



WATER – SEWER DISTRICT

SOUTH COUNTY WATER RECLAMATION FACILITY PRELIMINARY TREATMENT INFLUENT SCREENS REPLACEMENT

TECHNICAL SPECIFICATIONS ISSUED FOR BIDDING

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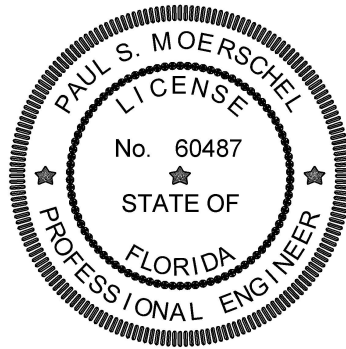
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COLLIER COUNTY WATER SEWER DISTRICT

**SOUTH COUNTY WATER RECLAMATION FACILITY PRELIMINARY TREATMENT
INFLUENT SCREENS REPLACEMENT
SUPPLEMENTAL PROJECT REQUIREMENTS**

The following Supplemental Project Requirements have been provided for the South County Water Reclamation Facility Preliminary Treatment Influent Screens Replacement Project. These Project Requirements are intended to supplement the existing Collier County Water-Sewer District Utilities Standards Manual Technical Specifications. These technical specifications can be obtained from the Collier County Government website.

COLLIER COUNTY WATER-SEWER DISTRICT
SOUTH COUNTY WATER RECLAMATION FACILITY
PRELIMINARY TREATMENT INFLUENT SCREENS REPLACEMENT

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SECTION 01110

SUMMARY AND SEQUENCE OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

General description of the Work at the South County Water Reclamation Facility (SCWRF) required under this Contract. Awarded Contractor must replace existing screens with only Multi-Rake Bar Screens RakeMax-CF and replacement of compactor/washer units only with Wash and Press (WAPs), both manufactured by Huber Technologies.

In addition, replacement of four (4) motor operated channel gates and (2) manual channel gates that fully satisfy current fit, form and function. The removal and reinstallation of manual bar screen. The isolation and bypassing of flows for project work. Miscellaneous piping and piping modifications; cleaning, repair and coating of concrete channels. Replacement of existing decking and miscellaneous electrical work.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work in this Contract consists of:

1. All locate work including underground and above ground piping and conduit and embedded conduits.
2. Demolition of existing Influent Screens and compactor/washer units including anchor bolts removal and patching in the channels.
3. Installation of temporary gates, stainless steel plates, and bulkheads as required to assist in equipment and channel isolation.
4. Installation of new screen system, including wash press and sluice, drop chutes, anchor bolts, supports, piping, etc.
5. Repair and coating the channels with a waterproofing membrane or coating (By Others).
6. Removal of existing gates including chipping out and removing any abandoned existing gate rails
7. Installation of new gates, gate rails, actuators, level sensors, aluminum decking, electrical control panels, conduit, etc.
8. Temporary measures as required, including temporary stairs, handrails, bypass pumps and piping with supports.
9. Aluminum deck removal including aluminum beams and installation of new aluminum deck system and new aluminum beams.

10. Removal and replacement of existing electrical and I/C equipment.
11. All equipment and system startups, testing as described in the Contract Documents.
12. All operation and maintenance manuals as described in the Contract Documents.
13. Project record documents as described in the Contract Documents.
14. All Work with scheduling and coordination requirements as noted in the Contract Documents.
15. Complete final cleaning and restoration.

The Contractor shall refer to the entire Contract Documents for a more complete description of the Work.

- B. The Contractor shall organize, coordinate, schedule and execute the various phases or sites of the Contract Work so as to be in strict compliance with the following:
 1. Special Project Requirements and Sequence of Work as noted on Contract Drawings Sheet G-3 and G-4.
 2. The requirements for written shut-down plans as per Contract Drawings.
- C. The Contract Work includes handling and disposal of residual liquid, grit and solids in the existing tanks and equipment systems. The Work also includes temporary measures as may be required to shut-off or control the flows affecting execution of the Work. Before proceeding with such temporary measures, the Contractor shall submit written details for approval. Refer to Section 01140 for additional information and requirements.
- D. The Contractor shall provide factory certified start-up of the new screens and appurtenances.
- E. Execution of the Work will require coordination and planning with the SCWRF Manager, the County's Project Manager and Engineer. The Work shall be presented in a manner and schedule that does not interfere with the on-going normal operations of the SCWRF.
- F. The SCWRF will have other construction projects ongoing. As a result, the Contractor shall coordinate his work with these other projects. This coordination shall include submitting weekly schedules and cooperating with other contractors.
- G. Contractor staff shall use the gate at 5600 Warren Street for access/egress. Large truck deliveries will be made through the rear door of the SCWRF. This is subject to change. The Contractor shall coordinate and regulate all site access/egress with the SCWRF Manager and the County Project Manager.
- H. Construct the Work under a single contract. Certain materials as described in the Contract Documents may be furnished by the Owner for unloading, storing, installation, start-up and testing assistance by the Contractor. The Contractor shall provide coordination and technical support associated with Owner furnished material.

END OF SECTION

SECTION 01130

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. Payment for the various items in the Schedule of Payment as further specified herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, taxes, materials, commissions, transportation and handling, bonds, permit fees, insurance, overhead and profit, and incidentals appurtenant to the items of Work being described, as necessary to complete the various items of the Work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). Such compensation shall also include payment for any loss or damages arising directly or indirectly from the Work.
- B. The Contractor's attention is called to the fact that the quotations for the various items of Work are intended to establish a total price for completing the Work in its entirety. Should the Contractor feel that the cost for any item of Work has not been established by the Schedule of Payment items or this Section, it shall include the cost for that Work in some other applicable bid item, so that its proposal for the project does reflect its total price for completing the Work in its entirety.

1.02 PAYMENT ITEMS

- A. The Contractor shall submit a Schedule of Payment Values for review with the return of the executed Agreement to the Owner. The schedule shall contain the installed value of the component parts of Work broken down into labor and material categories for the purpose of making progress payments during the construction period. No progress payments will be made until the Schedule of Payment Values is approved.
- B. The schedule shall be given in sufficient detail for proper identification of Work accomplished. The Schedule of Payment Values shall coincide with the activities of work detailed in the construction progress schedule in order to accurately relate construction progress to the requested payment. Each item shall include its proportional share of all costs including the Contractor's overhead, contingencies and profit. The sum of all scheduled items shall equal the total value of the Contract.
- C. If the Contractor anticipates the need for payment for materials stored on the project site, it shall also submit a separate list covering the cost of materials, delivered and unloaded with taxes paid. This list shall also include the installed value of the item with coded reference to the Work items in the Schedule of Payment Values. Similar procedures shall be employed for undelivered specifically manufactured equipment and materials as specified herein.
- D. Payment will not be made for materials stored off-site.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

- A. Make payment on the basis of work actually completing each item in the Bid, such work including, but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, cleanup, and all other appurtenances to complete the construction and installation of the work to the configuration and extent as shown on the Contract Drawings and described in the Specifications. Payment for each item includes compensation for cleanup and restorations. Cost of cleanup and surface restorations will be considered as the percentage retained in accordance with the Contract Documents, and complete payment will not be made until cleanup restorations and as-builts are completed.
1. Mobilization/Demobilization: Measurement and Payment for mobilization/demobilization shall be by Lump Sum for each portion of the project. The work shall include, but not be limited to, those operations necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site and for the establishment of temporary offices, buildings, safety equipment and first aid supplies, sanitary and other facilities. The cost of bonds and insurance and any other pre-construction expenses necessary for the start of the work, excluding the cost of construction materials, shall be included. Mobilization shall not exceed 60% of the Lump Sum for this item.
 2. Preconstruction Audio/Video Recording: Measurement and Payment shall be by Lump Sum. The work includes all necessary recordings to document existing conditions on the SCWRF headworks structure preliminary treatment. The Audio/Video Recording shall be supplemented by still photos, as necessary. The Contractor may be required to restore facilities to conditions better than existing, at no additional cost to County, if the Contractor fails to sufficiently document existing conditions.
 3. Survey Layout and Record Survey: Measurement and Payment shall be by Lump Sum. This item includes materials, labor, and certification to prepare the "As-Builts," field verification of existing facilities, construction stakeout of the proposed project and to survey the finished project. Prior to acceptance of the project by County, the Contractor shall submit two prints, and one set of electronic copies of AutoCAD formatted drawings marked as "Survey As-Builts" for review and approval. The As-Builts shall include vertical and horizontal alignment of all project installations. As-Builts shall be certified by a Professional Land Surveyor licensed in the State of Florida. All elevations to be based on NAVD 88 vertical datum and all horizontal coordinates in Florida State Plane East coordinates.
 4. Flow Bypass: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to all labor, materials, and equipment necessary to furnish and install temporary bulkheads, temporary stainless steel plates, and any other items necessary to reroute channel flow to perform all project material installations. The bypassing of flows shall be in accordance with the details identified in the contract documents.

5. Existing Influent Screen Demolition: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, removal of the existing influent screens at the site. This item includes all labor and materials for disposal, abandonment, and relocation of contents in accordance with the details in the Construction Plans. This item includes any coordination with the SCWRF Plant Manager and County Project Manager to minimize outage time of the existing facility.
6. Existing Electrical Component Demolition: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, removal of the existing influent screens, electrical/control panels, level sensors at the site. This item includes all labor and materials for disposal, abandonment, and relocation of contents, panels, plugs, or caps and remove the existing wiring (including structures, fittings, restraints, and other in-line devices) in accordance with the details in the Construction Plans. This item includes any coordination with the SCWRF Plant Manager and County Project Manager to minimize outage time of the existing facility.
7. Existing Slide Gate and Actuator Demolition: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, removal of the six existing gates and four actuators identified on the Contract Plans. This item includes all labor and electrical panels materials for disposal, abandonment, guide rail removal and patching, and relocation of contents in accordance with the details in the Construction Plans. This item includes any coordination with the SCWRF Plant Manager and County Project Manager to minimize outage time of the existing facility.
8. Existing Aluminum Decking Demolition: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, removal of the existing aluminum decking, supports, and anchor bolts at the site. This item includes all labor and materials for disposal, abandonment, and relocation of contents in accordance with the details in the Construction Plans. This item includes any coordination with SCWRF Plant Manager and County Project Manager to maintain access at the existing facility.
9. Furnish and Install Influent Screens and Wash Presses: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to all labor, materials, and equipment to complete the installation of the influent screens, electrical panels, wash presses, and related equipment in accordance with the project plans and specifications. This item also includes, but is not limited to, the installation of valves, piping and modification of existing piping, connections, and anchoring. The Contractor is responsible for providing any and all other hardware, parts and/or pieces required to complete the proper installation of the influent screens, electrical panels, wash press, and sluice.
10. Furnish and Install Drop Chutes: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, all labor, materials, and equipment to complete the installation of the drop chutes and related equipment in accordance with the project plans and specifications. This item also includes, but is not limited to, the installation of mounting equipment. The Contractor is responsible for providing any and all other hardware, parts and/or pieces required to complete the proper installation of the rubber drop chutes.

11. Furnish and Install Level Sensors: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, all labor, materials, and equipment to complete the installation of the level sensors, backup float systems, and related equipment in accordance with the project plans and specifications. This item also includes, but is not limited to, the installation of mounting equipment. The Contractor is responsible for providing any and all other hardware, parts and/or pieces required to complete the proper installation of the level sensors and backup float systems.
12. Furnish and Install New Electrical Components: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, all labor and materials to install the electrical components in accordance with the plans and specifications. This item includes all electrical components that may include but not be limited to electrical/control panel, disconnects, meter boxes, panel boards, wires, conduits, conductors, junction boxes, hardware, and other electrical components, parts, and pieces required for a complete installation and functioning system. All electrical equipment shall be installed per National Electric Code (NEC) latest edition.
13. Screens Startup and Testing: Measurement and Payment shall be by Lump Sum. This item shall include all labor, material, and equipment to complete the startup of the screens. This shall include coordination with Collier County and any of their vendors.
14. Screens Electrical and Telemetry Startup and Testing: Measurement and Payment shall be by Lump Sum. This item shall include all labor, material, and equipment to complete the startup of the electrical and telemetry. This shall include coordination with Collier County and any of their vendors.
15. Furnish and Install New Channel Mounted Slide Gates: Measurement and Payment shall be by Lump Sum. This includes all labor, materials, and equipment to complete the installation of the new channel mounted slide gates and related equipment in accordance with the project plans and specifications. This item also includes, but is not limited to, the installation of connections and anchoring. The Contractor is responsible for providing any and all other hardware, parts and/or pieces required to complete the proper installation of the slide gates.
16. Furnish and Install New Actuators: Measurement and Payment shall be by Lump Sum. This includes all labor, materials, and equipment to complete the installation of the new actuators and related equipment in accordance with the project plans and specifications. This item also includes, but is not limited to, the installation of connections and anchoring. The Contractor is responsible for providing any and all other hardware, parts and/or pieces required to complete the proper installation of the actuators.
17. Gate and Actuator Startup and Testing: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, all labor, material, and equipment to complete the startup of the new slide gates and actuators. This shall include coordination with Collier County and any of their vendors.
18. Furnish and Install New Stainless Steel Stop Logs: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, all labor, material, and equipment to complete the installation of the new channel, mounted stop logs and related equipment in accordance with the project plans and specifications. This item also includes, but is not limited to, the installation of connections and anchoring. The Contractor is responsible for

providing any and all other hardware, parts and/or pieces required to complete the proper installation of the stop logs.

19. Furnish and Install New Aluminum Decking and Modifications: Measurement and Payment shall be by Lump Sum. The work shall include, but not be limited to, all labor, materials, and equipment to complete the installation of the aluminum decking and related modifications in accordance with the project plans and specifications. This item also includes, but is not limited to, the installation of anchoring. The Contractor is responsible for providing any and all other hardware, parts and/or pieces required to complete the proper installation of the Aluminum Decking.
20. Allowance Fund for Owner's Use: See Specification Section 01135 - Allowance Fund. Allowance for Unforeseen Work general conditions will be made at the appropriate contract price for time and materials. Use of allowance must be approved by Collier County prior to execution of the work. There is no guarantee the Contractor may use these funds or a portion of these funds.

END OF SECTION

SECTION 01135

ALLOWANCE FUND

PART 1 – GENERAL

1.01 CONTRACT ALLOWANCE

- A. The Contractor shall include in its Contract Price an allowance equal to Allowance Fund shown in the Bid Schedule for additional work required due to unforeseen conditions.
- B. Proposals for allowance work shall be submitted to Engineer for approval prior to initiating work. Any work under this pay item and associated payment shall be based on a time and material basis as agreed upon by the Contractor and County. Final invoices and other supporting documentation shall be submitted for final payment of work.
- C. The provisions for the Allowance Fund are not a guarantee the Contractor will be paid any portion or the full amount of such Allowance Fund.

1.02 ALLOWANCE FUND

- A. Refer to Bid Schedule for Allowance Fund amount.
- B. Allowance for Owner's used as directed for unforeseen work and costs associated with existing conditions piping, electrical and conduits and other miscellaneous items.

END OF SECTION

SECTION 01140

MAINTENANCE OF UTILITY OPERATIONS

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. The existing plant will be maintained in continuous operation by the Owner during the entire construction period of the Contract as hereinafter specified.
- B. Work shall be scheduled and conducted by the Contractor so as not to impede any treatment process, reduce the quality of the plant effluent or cause odor or other nuisance except as explicitly permitted hereinafter. In performing the work shown and specified, the Contractor shall plan and schedule work to meet the plant and collection system operating requirements, and the constraints and construction requirements as outlined in this Section. No discharge of raw or inadequately treated wastewater shall be allowed. The Contractor shall pay all civil penalties, costs, assessments, etc., associated with any discharge of raw or inadequately treated wastewater associated with the Contractor's work.
- C. The General Contractor shall be responsible for coordinating the general construction and the schedules of electrical, plumbing and related trades and for ensuring that permanent or temporary power and controls are available for all existing, proposed, and temporary facilities that are required to be online at any given time.
- D. The Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done without cost to the Owner and provided that all requirements of these Specifications are fulfilled. Work not specifically covered in the following paragraphs may, in general, be done at any time during the contract period, subject to the operating requirements and constraints and construction requirements outlined hereinafter. All references to days in this Section shall be consecutive calendar days.

1.02 GENERAL CONSTRAINTS

- A. The Contractor shall schedule the Work so that the plant is maintained in continuous operation. All treatment processes shall be maintained in continuous operation during the construction period. Several items of work require connections of new piping and/or utilities to existing piping, utilities, or modifications to existing piping, utilities or facilities. The County will not allow shutdowns of the South County Water Reclamation Facility (SCWRF), any of its processes, or its collection system (in part or in its entirety) to facilitate these connections and/or modifications unless specified herein contract documents. The Contractor shall submit a written plan to the Owner and Engineer describing the process shutdown and a detailed schedule along with all planned resources. The plan for each process shutdown must be submitted at least ten working days prior to the scheduled shutdown.

- B. The Contractor shall comply with the scheduling and coordination requirements and restrictions identified in the Special Project Requirements noted in the Contract Drawings. Refer to Section 01110 for additional information and requirements.
- C. The Contractor shall review all bidding documents and shall be responsible to determine all such connections or modifications, and the scope and cost of all temporary measures required to isolate the work area without the need for a shutdown of the affected facility, process area, piping or utility.
- D. The Contractor shall furnish any temporary work, facilities, roads, walks, protection of existing structures, piping, pipe stops, blind flanges, valves, equipment, electrical work, power supply, controls, etc. that may be required to maintain continuous and dependable operation of the entire SCWRF facilities at no extra cost to the Owner.
- E. The Owner shall have the authority to order Work postponed, stopped or prohibited that would, in his opinion, unreasonably result in interrupting the necessary functions of the plant operations.
- F. If the Contractor impairs performance or operation of the plant as a result of not complying with specified provisions for maintaining plant operations, then the Contractor shall immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of the Owner and the Engineer. Such work shall progress continuously to completion on a 24-hours per day, seven workdays per week basis.
- G. The Contractor shall provide the services of emergency repair crews on call 24-hours per day at no additional cost to the Owner.

1.03 GENERAL OPERATING REQUIREMENTS, CONSTRAINTS, AND CONSTRUCTION REQUIREMENTS

- A. Access to Plant Site, Roadways, and Parking Areas
 - 1. An unobstructed traffic route through the 5600 Warren Street gate shall be maintained at all times for the Owner's operations personnel and maintenance equipment. The General Contractor shall be responsible for providing access to and for preparing and maintaining approved parking areas.
 - 2. An unobstructed traffic route around the plant site shall be maintained at all times for the Owner's operations personnel and maintenance equipment. Vehicular access to the treatment units and buildings for Owner personnel shall be maintained at all times by the Contractor.
 - 3. When vehicles are leaving the site, a wash down pit shall be provided and utilized to remove all mud and other contaminants before entering a public roadway.
 - 4. The Contractor shall provide temporary measures to protect the existing pavement by filling over with earthen material or supplying other measures acceptable to the Engineer, and he shall repair any damage to existing paved surfaces that occurs during the construction period. Any areas disturbed along the shoulders of the access road and

interior roads and elsewhere inside and outside of the plant shall be repaired, graded, seeded, etc. as necessary to match pre-existing conditions.

5. The General Contractor shall not undertake the restoration/construction of new roadway (paved, gravel, or asphalt overlay) shown on the Contract Drawings, until all other work on the plant improvements has been completed.
6. It shall be the responsibility of the General Contractor to obtain any permits required from the Florida Department of Transportation and pay all associated fees.

B. Personnel Access

Treatment plant personnel shall have access to all areas which remain in operation throughout the construction period. The Contractor shall locate stored material, dispose of construction debris and trash, provide temporary walkways, provide temporary lighting, and other such work as directed by the Engineer to maintain personnel access to areas in operation. Access and adequate parking areas for plant personnel must be maintained throughout construction.

C. Plumbing Facilities

Unless otherwise allowed by the Engineer, sanitary facilities in the existing structures shall be operational at all times for plant operating personnel. All other building plumbing systems such as roof and floor drains, pumping, etc., shall be maintained for all structures.

D. Power, Light and Communications Systems (General)

Electric power, lighting service and communications systems shall be maintained in uninterrupted operation in all areas which remain in operation. Individual units may be disconnected as required for replacement, but service shall be available at all times including periods when plant elements are out of service. The Owner may allow outages under conditions determined by the Owner by making use of the existing and/or the proposed engine-generator at the plant. All costs associated with operation of the engine-generators shall be paid by the Contractor. The Contractor shall coordinate shutdowns required by subcontractors to minimize the total number of shutdowns required to complete construction. Owner's phone service to the plant shall be maintained in continuous operation during construction.

E. Draining Process Pipes and Conduits (General)

The contents of all pipes and conduits to be removed, replaced or relocated (or dewatered for a specific purpose) shall be transferred to a suitable facility in a manner approved by the Owner through hoses or piping, or by using pumps if hydraulic conditions so require them. The Contractor shall provide the pumps, piping and hoses at no additional cost to the Owner. No uncontrolled spillage of a pipe or conduit shall be permitted. Any spillage, other than potable water, shall be immediately washed down and flushed into the appropriate process flow train.

F. Potable Water System

Potable water service shall be maintained in continuous service at all times during construction except for short term interruptions required for tie-ins. Shutdown of the potable water system shall be fully planned and coordinated with the Plant Manager or their designee and shall be limited to not more than two (2) hours. Existing fire hydrants within the plant site shall be operational at all times, unless otherwise approved by the Owner.

G. Non-potable Water System – Plant Service Water Only

The existing non-potable plant service water (IQ/reuse water) service shall be maintained in continuous operation during construction except for short term tie-ins of new or temporary facilities to existing facilities. Temporary non-potable plant service for the water systems shall be provided by the Contractor as necessary to insure continuous, uninterrupted service of these critical systems. The Contractor shall furnish any required temporary non-potable plant service water systems at no additional cost to the Owner. The Contractor may require temporary support or relocation or demolition of existing non-potable plant service water facilities to proceed with construction. The Contractor shall provide all temporary supports, relocation of existing piping, or demolition of existing non-potable plant service water piping including placement with temporary or permanent non-potable water piping as required at no additional cost to the Owner.

H. Sump Pumps and Sumps

All existing sumps shall be maintained in an operable condition with either existing pumps or temporary pumps. Interim piping, power and controls shall be provided as required by the staged construction sequence.

I. Seal Water and Service Water Piping

A supply of service and seal water and the necessary connections to existing equipment shall be maintained during construction. Interim piping shall be provided as required.

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION

SECTION 01150

PROTECTION OF EXISTING FACILITIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

Requirements for protection of existing facilities, structures and completed construction

1.02 GENERAL

- A. The Contractor shall protect all existing utilities, structures and improvements not designated for removal and shall restore damaged or temporarily relocated utilities, structures and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements of the Contract Documents.
- B. The Contractor shall verify all existing conduit and piping in the work area. Existing facilities shall remain in service unless identified for removal. Where conflict exist with the proposed work, the Contractor shall notify the Engineer.
- C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

1.03 RIGHTS-OF-WAY

- A. The Contractor shall not do any Work that would affect any oil, gas, sewer or water pipeline, any telephone, telegraph or electric transmission line, any fence or any other structure nor shall the Contractor enter upon the rights-of-way involved until notified by the Engineer that the Owner has secured authority therefor from the proper party. After authority has been obtained, the Contractor shall give said party due notice of its intention to begin Work.
- B. When two or more contracts are being executed at one time on the same or adjacent land in such manner that Work on one contract may interfere with that of another, the Owner shall determine the sequence and order of the Work.
- C. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the Owner to the Contractor so desiring, to the extent, amount, in the manner, and at the times permitted.
- D. No such decision as to the method or time of conducting the Work or the use of territory shall be made the basis of any claim for delay or damage.
- E. The Owner's Right of Access is reserved to the Owner and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property.

1.04 PROTECTION OF SURVEY STREET OR ROADWAY MARKERS

- A. The Contractor shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration. It shall be the Contractor's responsibility to notify the Owner of the time and location that Work will be done. Such notification shall be sufficiently in advance of construction so that there will be no delay due to waiting for survey points to be satisfactorily referenced for restoration.

1.05 EXISTING UTILITIES AND IMPROVEMENTS

- A. Maintaining in Service: All oil and gasoline pipelines, power, and telephone or other communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the Engineer are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, wire or cable.
- B. The Contractor shall protect all underground utilities, structures and other improvements which may be impaired during construction operations. It shall be the Contractor's responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The Contractor shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.
- C. Where the proper completion of the Work requires the temporary or permanent removal, or relocation of an existing utility or other improvement which is shown, the Contractor shall contact the utility owner and proceed as specified in the Contract Documents.
- D. Unrecorded Underground Utilities or Improvements
 - 1. Plans show features of topography and underground utilities, but do not purport to show in complete detail all such lines or obstructions.
 - 2. Existing utilities shown on Drawings are based upon available records. Data regarding existing utilities is presented for Contractor's convenience only and shall not be used as a basis for claims of extra compensation.
 - 3. Examine available records and make exploratory excavations whenever necessary to determine locations of existing pipes, valves, or other underground improvements.
 - 4. Take prudent precautions not to damage unrecorded underground utilities and improvements.

5. If unrecorded underground utilities or other improvements are encountered, immediately notify the Engineer and inform the Engineer of the conditions encountered. Include written report of conditions encountered with Progress Schedule covering period in which unrecorded underground utilities or improvements were encountered. Provide unscheduled impact on CPM schedule for each occurrence. If unrecorded underground utilities or improvements conflict with Work, changes shall be made under the terms of the Agreement. Changes to the Work shall be as approved by the Owner.
6. The Contractor shall contact the affected utility owner and proceed as specified in the Contract Documents.

1.07 TREES WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

- A. The Contractor shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or owner.
- B. All existing trees and shrubs which are damaged during construction shall be repaired or replaced by the Contractor as specified in the Contract Documents.

1.08 NOTIFICATION BY THE CONTRACTOR

- A. Prior to any excavation in the vicinity of any existing underground facilities including all water, sewer, storm drain, gas, petroleum products or other pipelines; all buried electric power, communications or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than three (3) days nor more than seven (7) days prior to excavation so that a representative of said owners or agencies can locate their facilities or be present during such work if they so desire.

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION

SECTION 01160

ALTERATION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for alterations and restoration.

1.02 SITE AND BUILDINGS

A. Site Visit

1. Prior to submission of Bids, the Contractor shall have visited the site and attended mandatory pre-bid conference to thoroughly acquaint himself with the exact nature of the work indicated on the Drawings and the Specifications requirements. Failure to comply with the aforementioned requirements shall not constitute a basis for claims for additional compensation.

B. Measurements and Notice

1. Prior to ordering any materials or doing any work, the Contractor shall verify all measurements, dimensions and other conditions of each building scheduled for work as may be necessary or required in connection with his work. The Contractor shall be responsible for the correctness of same. Provide three (3) working days' notice to the Owner prior to commencing cutting or alterations.

1.03 SUBMITTALS

A. General: as specified in Section 01330 – Submittals.

B. In addition, submit the following:

1. Written request for authorization to perform cutting or alteration.
 - a. Submit written request in advance of cutting, restoration, or alteration which affects:
 - (1) Structural integrity of any element of Project.
 - (2) Integrity of weather-exposed or moisture-resistant element.
 - (3) Efficiency, maintenance, or safety of any operational element.
 - (4) Visual qualities of sight-exposed elements.
 - (5) Work of Owner or separate contractor.
 - b. Include in request:
 - (1) Identification of Project.

- (2) Location and description of affected work.
 - (3) Necessity for cutting, restoration, or alteration.
 - (4) Description of proposed work, and products to be used.
 - (5) Alternatives to cutting, restoration, or alteration.
 - (6) Effect on work of Owner or separate contractor.
 - (7) Written permission of affected separate contractor.
 - (8) Date and time that work will be executed.
- 2. Shop drawings for fabricated items to be used in alterations and restoration.
 - 3. Product data for items and materials to be used in alterations and restoration.
 - 4. Request for substitution as specified in Section 01600 – Material and Equipment

1.04 SHORING, UNDERPINNING AND BRACING

- A. When necessary and required, the Contractor shall provide underpinning and temporary shoring and bracings, all in accordance with code requirements, and as approved by the Engineer. The underpinning, shoring and bracing shall be based on calculations and drawings provided by a Florida licensed Professional Engineer. Submit calculations and drawings for the Engineer for review prior to commencing work.
- B. Shoring and bracing shall be of such form and so installed as to safely support the work and interfere as little as possible with the progress of the work. Suitable means shall be provided to adjust any settlement in the shoring supports. Temporary shoring shall consist of sound timbers or rolled shapes of required dimensions which shall be removed after necessity for same ceases to exist. All work removed or damaged through installation of temporary shoring or through improper shoring shall be replaced or repaired after the shoring is removed, at no additional cost to the Owner.

1.05 WORK PREPARATION AND TEMPORARY ACCESS

- A. The Contractor, before commencing work, shall prepare and submit for approval a progress schedule in accordance with the requirements of Section 01330, "Submittals", in order to coordinate the work of all trades and to insure completion on or before the completion date. The Owner and the Engineer reserve the right to revise or modify such schedules as required to expedite each phase of work and to coordinate such work with the partial use of the building for purposes as directed.
- B. No facility such as toilets, corridors, etc., shall be barricaded or access restricted without providing other temporary or interim means of access. It is further required that no work specified hereinafter shall disturb or interfere with the operation of the existing mechanical installation until proposed new work has been completed or satisfactorily installed. Exception may be made to this requirement only by written approval from the Owner and Engineer.
- C. Detailed sequence of availability of areas within the present buildings where work is to be performed under each Contract shall be in accordance with Section 01140, Maintenance of

Utility Operations, but may be modified by the Contractor, upon authorization by the Owner and Engineer as the work progresses.

- D. Existing built-in equipment to remain in the final work but requiring temporary removal for the installation of new construction, alterations, repairs and/or renovations, shall be disconnected by the Contractor and removed to temporary storage areas designated by the Owner. Resetting of existing equipment under this heading shall be performed by the Contractor including connecting to electric service lines.
- E. The Contractor shall furnish and install all temporary fire exists, fire extinguishers, hose and safety devices as may be required by authorities having jurisdiction.
- F. Work within existing buildings to be performed, once started, shall be completed as quickly as practicable and each trade shall determine before work is started that all required materials are at hand or readily obtainable to avoid delays.
- G. Shutdowns of existing services within existing buildings which may be occupied during construction will be permitted only upon written approval by the Owner subject to at least three (3) weeks notice in writing to the Owner in each case. Shutdowns will be limited to times which will result in the least interference with normal operations.

1.06 EXISTING UTILITIES AND IMPROVEMENTS

A. General

- 1. Ascertain the actual location of existing utilities and improvements that will be encountered.
- 2. Protect existing utilities and improvements.
- 3. Supervise and observe excavation operations.

B. Public Utilities and Franchise Utilities (Utilities)

- 1. General: Do not interrupt service of any utility without notification and approval of applicable utility.
- 2. Work in Public Right-of-Way and Utility Easements: The Contractor shall inform affected utilities as specified in Section 01150 – Protection of Existing Facilities.
- 3. Work on Owner's Property
 - a. Notify the Engineer prior to performing excavations in areas where existing utilities may be encountered.
 - b. Do not perform excavations until underground utilities have been located by utilities having property in the area to be excavated.

4. Relocation of Utility Property

- a. If is necessary to relocate the property of any utility, the utility property will be relocated by the applicable utility unless otherwise shown or specified.
- b. If utility property is shown or specified to be relocated by the Contractor, relocate utility property in accordance with the written instructions or recommendations of the applicable utility.
- c. Notify Engineer and applicable utility a sufficient time in advance of relocation for the following:
 - (1) Measures to be taken which prevent, or minimize, interruption of service.
 - (2) Scheduling of personnel to perform, observe, or perform and observe relocation.
- d. Provide access to applicable utility personnel, vehicles, and equipment required to perform, observe, or perform and observe relocation of utility property.

5. Repair of Utility Property

- a. If service of utility is interrupted or property of utility is damaged without notification and approval of applicable utility, immediately notify Engineer, Owner, and affected utility.
- b. Service interruption and property damage shall be corrected and repaired by affected utility, unless otherwise approved by Engineer and affected utility.
- c. Repairs by Contractor shall be done in accordance with instructions of the affected utility. All repairs shall be subject to inspection and approved by an authorized representative of the utility before being concealed by backfill or other work.
- d. Repairs and fines related to unscheduled interruptions, or damage shall be paid by the Contractor with no additional cost to the Owner.

C. Owner's Utilities, Process Piping, and Improvements

1. General

- a. Do not interrupt service of Owner's existing utilities, process piping, or other improvements without seven (7) days prior notification and written approval of Engineer.
- b. Interruptions of Owner's utilities, process piping, and other improvements shall be minimized and shall meet the requirements of Sections 01110 and 01140.

2. Repair of Owner's Utilities and Improvements

- a. If Owner's utilities, process piping, or other improvements are interrupted or damaged without notification and approval, immediately notify Engineer and Owner.
- b. Unscheduled service interruption damage shall be repaired as follows:
 - (1) Contractor shall take immediate actions to shut off flows, shut off pumps, shut off equipment, and contain spills as applicable to the event.
 - (2) Engineer shall direct Contractor to make repairs, assist Owner in making repairs, or provide access to event site for Owner to make repairs.
- c. Repair work by Contractor shall meet the requirements of the Owner.
- d. Repairs and fines related to unscheduled interruptions, or damage shall be paid by the Contractor with no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 PRODUCTS FOR ALTERATIONS AND RESTORATION

- A. Type and Quality of Existing Products: Determine by inspecting and testing existing products where necessary, referring to existing work as a standard.
- B. Products for Restoration: Products identical to, or equal to, products used in existing work when new.
- C. Products for Alterations: As specified in individual product specification Sections applicable to products.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspect existing conditions, including elements subject to damage or movement during alteration, restoration, or alteration and restoration.
- B. Remove debris and abandoned items from areas of alteration and renovation work and from concealed spaces.
- C. Verify that demolition is complete.
- D. Verify that areas are ready for installation of new work.
- E. Beginning of restoration work or alteration work means acceptance of existing conditions.

3.02 PREPARATION

- A. Provide supports to assure structural integrity of surroundings. If supports are provided for structural members, details and calculations must be prepared by a Florida licensed Professional Engineer and submitted for review prior to commencing installation of such supports.
- B. Close openings in exterior surfaces so that existing work and salvage items are protected from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.
- C. Maintain excavations free of water.
- D. Provide barriers, covers, and other protection required to prevent structural elements, equipment, piping, conduit, paving, finishes, and other adjacent improvements from being damaged.
- E. Cut, move, or remove items as necessary for access to alterations and renovation work. Replace and restore at completion.
- F. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete.
- G. Remove and cut work so that damage is minimized. Remove and cut work to provide a means of restoring products and finishes as follows:
 - 1. If products, finishes, or products and finishes are specified, restore work to specified condition.
 - 2. If products, finishes, or products and finishes are not specified, restore work to original condition.
- H. Remove surface finishes and prepare surfaces to provide for proper installation of new work and finishes.

3.03 OPENINGS IN CONCRETE AND MASONRY

- A. General: As specified in Section 003312-Concrete Repair Work.
- B. Rectangular Openings
 - 1. Where new rectangular openings are to be made in concrete or masonry walls or floors, score edges of each opening. Score both sides of exposed walls and elevated slabs. Score concrete and masonry by saw cutting clean, straight lines to a minimum depth of one inch. After scoring concrete and masonry, chip out concrete and masonry, or saw cut completely through slab or wall to remove concrete and masonry. Do not allow saw cuts deeper than one inch, or the depth of cover over existing reinforcing steel, whichever is less, to extend beyond limits of new opening. Make corners square and true by combination of core drilling, chipping, or grinding. Do not leave any rough edges.

2. Repair saw cuts beyond new opening by filling saw cut with non-shrink grout.
 3. Chip back concrete around reinforcing steel exposed by cutting and repair as per Section 02220, 3.04. Cut exposed steel, coat ends with corrosion inhibitor, and bonding agent in accordance with manufacturer's recommendations.
- C. Circular Openings (Unless noted otherwise on the drawings)
1. Where circular openings are required in existing concrete walls and slabs for the installation of pipe, make openings by core drilling and chipping.
 2. Cut exposed reinforcing steel and repair as per Section 02220, 3.04. Coat reinforcing steel with corrosion inhibitor, and bonding agent in accordance with manufacturer's recommendations.
 3. Fill void between interior face of opening and exterior of pipe with an approved non-shrink grout so that there are no leaks around pipe or opening.

3.04 PLUGGING OPENINGS

Plug openings in wall, floors, and ceilings resulting from removal of existing equipment, piping, and conduit. Plug openings in a manner that will result in a structurally suitable seal and a neat and presentable appearance.

3.05 CUTTING PIPE AND CONDUIT

- A. Where new piping is to be connected to existing piping, cut existing piping square. Properly prepare ends of pipe for connection indicated on the drawings. Repair damage to lining and coating of existing piping resulting from cutting.
- B. Where existing piping or conduit is to be removed or abandoned in place, cut existing piping or conduit square or disconnect piping or conduit at an existing joint. Seal exposed ends of abandoned connections with plugs, caps, or blind flanges suited for material, type, and service of pipe or conduit.

3.06 REPAIR OF STRUCTURAL STEEL

- A. Where existing structural steel members are removed or modified, repair remaining steel members which are damaged by construction activities or corrosion.
- B. Prepare surfaces of repaired members and coat repaired members as specified in Section 09960 – High Performance Coatings.

3.07 DOORS, PASSAGEWAYS, AND WINDOWS

- A. Dress jambs, sills, and heads of new doors, passageways, windows, or other openings cut into existing walls and slabs. Dress jambs, sills, and heads of new doors, passageways, windows, or other openings with new masonry, concrete, or metal.
- B. Finish jambs, sills, and heads so that only finished edges and surface are exposed. Provide a smooth finished appearance.

3.08 TRANSITIONS

- A. Where new work abuts or aligns with existing, perform a smooth and even transition. Patch work to match existing adjacent work in texture and appearance.
- B. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.
- C. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer for transition from existing surface to new surface.

3.09 REPAIR OF DAMAGED SURFACES

- A. Repair surfaces of walls or floors which are exposed by removals or demolition, and which have holes, scars, chipped, or other damage revealed by removal or demolition.
- B. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.
- C. Repair substrate prior to patching finish.

3.10 FINISHES

- A. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.
- B. Finish patches to product uniform finish and texture over entire area.
- C. When finish cannot be matched, refinish entire surface to nearest intersections.
- D. Finish surfaces as specified in individual Product Sections.

3.11 PAVEMENT RESTORATION

- A. Restore pavement removed, cut, or damaged during construction.
- B. If edges of pavement surface remaining are jagged or broken, saw cut surface course so that the pavement edge is clean, sound, and vertical.
- C. Restore pavement as follows:
 - 1. If pavement restoration detail is shown on the Drawings, restore pavement as shown in detail.
 - 2. If no restoration details are shown on the Drawings, replace pavement with similar materials and of equal thickness to match existing undisturbed pavement.

3. Restoration of pavement to comply with Collier County DOT Standards and Utilities Standards Manual, latest editions with revisions.
- D. Following restoration or pavement cuts, overlay pavement.
1. If extent of overlay is shown on the Drawings, provide overlay as shown on Drawings.
 2. If extent of overlay is not shown on the Drawings, provide continuous surface course overlay over all of the pavement cuts with 10' minimum overlap of existing pavement at each end of overlay.
 3. Restoration of pavement to comply with Collier County DOT Standards and Utilities Standards Manual, latest editions with revisions.

3.12 SIDEWALK RESTORATION

- A. Restore sidewalks removed, cut, or damaged during construction.
- B. Saw cut sidewalk at existing joint. If there are no existing joints, saw cut sidewalk perpendicular to the side of the sidewalk. Saw cut sidewalk so that the sidewalk edge is clean, sound, and vertical.
- C. Replace sidewalk with similar materials and of equal thickness to match existing undisturbed sidewalk.
- D. Sidewalk restoration shall comply with Collier County DOT Standards and Utilities Standards Manual, latest editions with revisions.

3.13 REPLACEMENT AND REPAIR OF TREES AND SHRUBS

- A. Replace damaged trees and shrubs if damaged trees and shrubs if damaged plants cannot be repaired without destroying the value of the plants as screening or landscaping.
- B. Replacement of Trees and Shrubs
1. Replacement plants for native varieties shall be same variety as plants removed.
 2. Replacement plants for exotic varieties shall be native varieties.
 3. Replacement plants shall be equal in size to plants removed or 1.5 times total diameter of removed plants if replacement plants are smaller than plants removed.
- C. Repair of Trees and Shrubs.
1. Preserve symmetry of trees and shrubs.
 2. Do not leave stubs, splits, or torn branches.
 3. Make clean cuts close to trunk or large branch.
 4. Coat cuts over 1-1/2" in diameter with asphaltic emulsion material.

3.14 DUST-PROOF PARTITIONS

- A. The Contractor shall furnish and erect all necessary temporary dust-proof partitions where required to protect unaltered portions of existing buildings and structures or as directed by the Owner or Engineer.
- B. Partitions shall be constructed of wood studs with plywood on both sides. Partitions shall extend from floor to ceiling with a closure plate at floor and ceiling. The Contractor shall furnish and install one (1) door in each enclosure complete with hardware attached and keyed as directed. Such enclosures will be required in areas of major demolition work and for protection of existing equipment.

3.15 WEATHER PROTECTION

- A. Where exterior walls or roofs are being altered, or disturbed for any adjacent alteration, the Contractor shall provide temporary weather protection in those areas to keep interior of buildings absolutely dry and unaffected by the weather. The Contractor will be held responsible for any damage caused by improper protection against weather.
- B. Where existing exterior walls or roofs are disturbed due to alterations, disturbances shall be kept to a minimum and walls or roofs shall be repaired and patched in such a manner that the buildings will be absolutely watertight and meet the conditions of the existing roofing flashing and waterproofing bonds and guarantees.

3.16 CUTTING, PATCHING, REPAIRING, AND REFINISHING – GENERAL

- A. The Contractor shall be responsible for cutting all openings in walls, floors and ceilings (indicated to remain) to accommodate alteration work under their Contract in accordance with the requirements of the General Conditions, Supplemental Conditions, and as hereinafter specified. Rough patching and all finish patching shall be by the Contractor.
 - 1. Where new openings are to occur in existing exterior and interior concrete and masonry bearing walls and structural concrete floor, the Contractor will be required to notify the Owner and Engineer in writing at least five (5) full work days prior to commencing the cutting and shall obtain approval prior to cutting operations. The Engineer will determine whether such openings affect the structural stability or load bearing capacities of walls and floors.
 - 2. All holes and openings to be cut in existing walls, floors and ceilings of any nature shall be geometrically correct and no larger than necessary to accommodate the new work.
 - 3. No cutting of finished or structural work may be done without the approval of the Engineer.
- B. Major demolition and removal work such as demolition of buildings and structures, complete or nearly complete removal of floors, walls and ceilings indicated on the Drawings, shall be performed by the Contractor. The Contractor shall also be responsible for all finish patching operations of holes and openings in existing floors, walls, ceilings and roofs to accommodate the alteration work under the Plumbing, and Electrical Sections as well as that required for the Contractor's work hereinafter specified.

- C. Each Contractor and/or their Subcontractors shall provide sleeves, forms and inserts for installation by the General Contractor as specified in Section 01010.

3.17 EXISTING EQUIPMENT AND FURNISHINGS

- A. Existing built-in equipment to remain in the final work and requiring temporary removal shall be as specified under this Section.
- B. All unsalvageable equipment shall become the property of the Contractor in accordance with the requirements of Section 02220 and shall be removed from each building and away from the site. Equipment to be retained, or relocated, shall be as shown on the Drawings or as specified.

3.18 SCHEDULE OF INTERIOR FINISHES FOR EXISTING BUILDINGS

- A. Unless otherwise specified, all materials required for the work in the existing buildings shall be new, and where required shall match existing adjacent finishes.
- B. As indicated on the Drawings, specified or otherwise required to complete the work, the Contractor shall cut new openings and block up existing openings in floors, walls, partitions and ceilings; remove existing floors; remove, relocate existing and/or install new windows, doors, frames, transoms, access doors, partition sash and trim.
- C. The Contractor shall remove window sash, frame, sill, stool and trim at exterior door openings to be blocked up; remove door, frame and trim and, unless otherwise hereinafter specified or indicated on the Drawings to be blocked up with other materials, window and door openings shall be blocked up with brick and/or masonry block.
 - 1. At door, sash and other openings in interior partitions and wall to be closed, block up such openings with same materials and construction as adjacent, unless otherwise indicated on the Drawings. Plaster and finishes applied at blocked up openings shall finish even and straight, flush with and of the same texture or other surface characteristics of existing adjacent finishes.
- D. Existing finishes or subfloor surfaces which are scheduled to receive new floor finishes shall be repaired, patched with concrete, asphalt latex type emulsion and underlayment as required to suit existing surfaces or the new floor surfacing material to be applied.
- E. Concrete and floors disturbed by alterations shall be patched to finish even, straight and flush with adjacent surfaces.
- F. Existing partitions to be removed shall be removed for their entire height.
- G. Where existing bases and other trim are removed and grounds are exposed and will not be covered by new finishing materials such as resilient base, new trim, or wall covering, grounds shall be removed and wall surfaces patched with plaster to finished even, straight and flush with adjacent existing plaster surfaces. Where existing plaster ceilings are scheduled to be removed, the ceilings shall be replaced with new metal furring, lathing and plaster finish or acoustical ceilings or other ceiling system as indicated on the Drawings.

- H. Where partitions or walls are removed and existing ceiling on each side of the partition or wall is to remain, the gap shall be patched; a vertical break shall be provided if the ceilings are at different levels. Where the ceiling on one side is to remain and a new ceiling is scheduled for the area on the other side, the new ceiling shall be constructed so that the new and existing finished ceiling areas will be at the same level.
- I. Existing floors, walls and ceilings shall be cut as required for removal of existing services and for installation of new plumbing, heating, ventilating and air conditioning, and electrical work and related piping, duct work, conduits, fixtures and equipment.
- J. In addition to work specifically called for in the finish schedule on the Drawings, all finishes disturbed in the performance of any alterations or new work by a Contractor shall be patched or repaired to match existing surfaces or finishes. Holes, slots, chases, etc., in floors, walls and ceilings left by the removal of existing, or installation of new piping, plumbing fixtures, radiators, duct work, registers, grills, conduit, receptacles, switches, lighting fixtures and other items of the other Contracts shall also be patched or repaired by the Contractor.
- K. Existing spaces not listed on the finish schedule on the Drawings may require no work other than complete painting and patching by the Contractor of surfaces damaged in performance or any work included under this Contract.

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.01 PRECONSTRUCTION MEETING

- A. A preconstruction meeting will be held after Award of Contract, but prior to starting work at the site. The Engineer shall prepare and distribute the meeting agenda and shall preside at the meeting. The Engineer shall record and distribute minutes of the proceedings and decisions.
- B. Attendance:
 - 1. Owner
 - 2. Engineer
 - 3. Contractor
 - 4. Major subcontractors
- C. Minimum Agenda:
 - 1. Tentative construction and submittal schedules
 - 2. Critical work sequencing
 - 3. Designation of responsible personnel
 - 4. Processing of Field Decisions and Change Orders
 - 5. Adequacy of distribution of Contract Documents
 - 6. Submittal of Shop Drawings and samples
 - 7. Procedures for maintaining record documents
 - 8. Use of site and Owner's requirements
 - 9. Major equipment deliveries and priorities
 - 10. Safety and first aid procedures
 - 11. Security procedures
 - 12. Housekeeping procedures

13. Processing of Partial Payment Requests

14. General regard for community relations

1.02 PROGRESS MEETING

- A. Progress meetings will be held biweekly at the South County Water Reclamation Facility during the performance of the field work of this Contract. Additional meetings may be called as progress of work dictates.
- B. Engineer will prepare and distribute agenda, preside at meetings and record minutes of proceedings and decisions. Engineer will distribute copies of minutes to participants.
- C. Attendance:
 - 1. Owner
 - 2. Engineer
 - 3. Contractor
 - 4. Subcontractors and manufacturer representatives, only with Engineer's approval or request, as pertinent to the agenda
- D. Minimum Agenda:
 - 1. Review and approve minutes of previous meetings.
 - 2. Review progress of Work since last meeting.
 - 3. Review proposed 30-60 day construction schedule.
 - 4. Note and identify problems which impede planned progress.
 - 5. Develop corrective measures and procedures to regain planned schedule.
 - 6. Revise construction schedule as indicated and plan progress during next work period.
 - 7. Maintaining of quality and work standards.
 - 8. Complete other current business.
 - 9. Schedule next progress meeting.

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION

SECTION 01315

COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for structural, mechanical and electrical coordination to ensure proper selection, installation, fit and operation of all mechanical, electrical and control devices as well as building components.

1.02 COORDINATOR

Contractor shall employ an individual or a firm, technically qualified and experienced in field coordination for the type of work required for this Project for the duration of the Work.

1.03 SUBMITTALS

- A. General: As specified in Section 01330 – Submittals.
- B. Submit name, address, and telephone number of Coordinator and, if a firm, the name of its principal officer, to Engineer for approval.
- C. Submit necessary coordination drawings and schedules prior to submitting shop drawings, product data, and samples.

1.04 COORDINATION REQUIRED

- A. Coordinate submittals for structural, architectural, mechanical and electrical products.
- B. Conduct conferences with Subcontractors and others concerned with the Work, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
- C. Participate in progress meetings. Report on progress of Work to be adjusted under coordination requirements, and any required changes in schedules. Transmit official minutes of meetings and reports to concerned parties.

1.05 DOCUMENTS FOR COORDINATION

- A. Prepare necessary coordination drawings to organize installation of products for efficient use of available space, to meet requirements of Work sequence, for proper sequence of installation, and to identify potential conflicts.
- B. Prepare a master schedule to identify responsibilities under each section of Divisions 1 through 16 of the Specifications for activities that directly relate to mechanical and electrical coordination, including submittals and temporary utilities.

- C. Maintain documents for the duration of the Work, recording changes due to site restrictions, modifications or adjustments.
- D. After Engineer review of original and revised documents, reproduce and distribute copies to concerned parties.

1.06 COORDINATION OF SUBMITTALS

- A. Coordinate shop drawings, product data, and samples.
 - 1. Check field dimensions and clearances and relationship to available space and anchors.
 - 2. Check compatibility of products with products furnished or installed under other sections.
 - 3. Check electrical characteristics, and operational control requirements.
 - 4. Check motor voltages, speed, and control characteristics.
 - 5. Coordinate controls, interlocks, power wiring, control wiring, and instrument wiring.
 - 6. Coordinate wiring and control diagrams.
 - 7. Review the effect of any changes on work of other sections.
- B. Verify and coordinate maintenance of Record Documents.

1.07 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS

- A. Submit requests for substitutions as specified in Section 01600 – Materials and Equipment.
- B. Review proposals and requests from subcontractors.
- C. Verify compatibility of substitutes with other products. Identify modifications required to make other products compatible with substitutes.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 OBSERVATION OF WORK

- A. Observe Work for structural, architectural, mechanical and electrical coordination.
- B. Maintain a list of observed deficiencies and defects and promptly report observed deficiencies and defects to appropriate parties.

3.02 EQUIPMENT START-UP

- A. Verify utilities, connections and controls are complete and equipment is in operable condition prior to equipment start-up.

- B. Observe start-up of equipment and demonstrations to Owner.
- C. Coordinate adjustments or modifications required to provide equipment and systems that operate properly, both mechanically and electrically.

3.03 INSPECTION AND ACCEPTANCE OF EQUIPMENT

Prior to inspection, verify that equipment and systems are tested and operating properly.

END OF SECTION

SECTION 01330

SUBMITTALS

PART 1 – GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for submittals.

1.02 SCHEDULE

- A. Transmit submittals in accordance with approved Progress Schedule, and in such sequence to avoid delay in the work or work of other contracts.
- B. Do not fabricate products or begin work that requires submittals until return of submittal with Engineer acceptance.
- C. Identify the appropriate specification sections and parts on each submittal.

1.03 CONTRACTOR REVIEW

- A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.
- B. Sign each sheet of shop drawings and product data, and each sample; label to certify compliance with requirements of Contract Documents. **Notify Engineer of any deviations from requirements of Contract Documents in writing at time of submittal.**
- C. Identify the relevant specification sections and parts on each submittal.
- D. For each submittal, the Contractor must submit a statement letter that they have met all contract requirements.

1.04 SUBMITTAL REQUIREMENTS

- A. Apply Contractor's stamp, signed certifying to review and approval, verification of products, field dimensions and field construction criteria, and coordination of information with requirements of Work and Contract Documents.
- B. Number each submittal sequentially beginning with 001. **Each submittal shall describe only one product or equipment.** Re-submittals shall use the same number identifier with a letter suffix, e.g. 001A.
- C. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
 - 1. Finishes that involve Engineer selection of colors, textures, or patterns.
 - 2. Associated items that require correlation for efficient function or for installation.

- D. Submit under transmittal letter. Identify Project by title and number.
- E. Provide table of contents for multi-page submittals.
- F. If any submittal requires more than three (3) reviews (normally an original and two (2) re-submittals), the Engineer may charge the Contractor for additional review time based on their actual incurred time and expenses. These charges shall be summarized for the Contractor and deducted from the Contractor's next pay request.
- G. The Contractor may expect most submittals to be reviewed within twenty-one (21) calendar days following receipt of the submittal. Certain submittals such as Owner color selection or instrumentation may require a longer review time.
- H. The submission of submittals will be by email subject to the requirements noted below. Before the first electronic submittal, the Contractor must meet with the Engineer to review the format and protocols for such submittals.
- I. Any digital file submittal or re-submittal must be complete in every respect. Any digital file submittal must include only one (1) piece of material or equipment. Each digital file submission must have the documents arranged in logical sequential order as described in that submittal's table of contents.
- J. Provide submittals on the following items and as required by the Contract Documents:
 - 1. Screens, controls and appurtenances, mounting hardware and installation procedures.
 - 2. Screenings Washer Compactor, drop chute and anchor bolts.
 - 3. Slide Gates
 - 4. Gate rails
 - 5. Gate actuators
 - 6. Stop Logs
 - 7. Level sensors
 - 8. Aluminum decking system.
 - 9. Wiring, conduit, electrical devices, grounding and all electrical appurtenances.
 - 10. Structural repair materials and procedures.
 - 11. Piping, fittings, valves, and appurtenances.
 - 12. Pre-construction video recording of existing conditions.
 - 13. Sheeting and dewatering plans.
 - 14. Test results.
 - 15. Operational and Maintenance Manuals
 - 16. Temporary measures, Bypass plans and shutdown plans; refer to Section 01110 and Contract drawings.

1.05 PROGRESS SCHEDULES

Submit progress schedules in accordance with Contract documents

1.06 SHOP DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with Project name and number. Transmittal letter shall reference item as listed on Submittal Schedule.

- B. Identify each element of drawings by reference to sheet number and specification section of Contract Documents.
- C. Identify field dimensions; show relation to adjacent or critical features or Work or products.

1.07 PRODUCT DATA

- A. Submit only pages that are pertinent. Mark or highlight each copy of standard printed data to identify pertinent products. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.
- B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.

1.08 SAMPLES

- A. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures, and patterns, for Owner selection.
- B. Submit samples to illustrate functional characteristics of products, including parts and attachments.
- C. Approved samples that may be used in the Work are indicated in the Specification section.
- D. Label each sample with identification required for transmittal letter.
- E. Provide field samples of finishes at Project, at location acceptable to Engineer, as required by individual Specifications section. Install each sample complete and finished. Acceptable finishes in place may be retained in completed work.
- F. Accepted samples shall establish the standards by which the completed Work will be judged.

1.09 MANUFACTURER'S CERTIFICATES

- A. Prior to delivery at project site, furnish an Affidavit of Compliance certified by the equipment manufacturer that the equipment and appurtenances furnished comply with all applicable provisions of applicable referenced standards and these Specifications.
- B. Do not deliver equipment to job site until Affidavit of Compliance has been submitted and accepted by the Consultant.

1.10 REQUESTS

If there are any questions about interpretations of plans, specifications or Contract Documents, the Contractor may submit a written request for information or a request for clarification to the Engineer.

1.11 RESUBMITTAL

- A. Make resubmittals under procedures specified for initial submittals; identify changes made since previous submittal.
- B. Identify resubmittal as a resubmittal and reference previous submittal.
- C. Identify changes made since previous submittal.

1.12 DISTRIBUTION

- A. Distribute reproductions of shop drawings, copies of product data, samples, substitutions and other submittals which bear Engineer's review stamp, to job site file, Record Documents file, subcontractors, suppliers, and other entities requiring information.
- B. Instruct recipients to promptly report any inability to comply with provisions.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION

SECTION 01410
REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for obtaining permits and complying with permits.

1.02 PERMITS

- A. Contractor will obtain County, State and Federal permits not obtained by County, including but not limited to building permits, South Florida Water Management District dewatering permits, right-of-way permits, burning permits, tree removal permits, excavation permits, demolition permits and Florida Department of Environmental Protection (FDEP) NPDES Stormwater Pollution Prevention Plan.
- B. The Contractor must file a minimum of forty-eight (48) hours prior to start of construction a Notice of Intent with the FDEP.
- C. Contractor shall schedule and document all inspections and re-inspections (if needed) required by permitting agencies.
- D. County will obtain the FDEP and Department of Health Water/Sewer Construction Permit, and County utilities and engineering approvals.
- E. Documents:
 - 1. County will furnish signed and sealed sets of Contract Documents for permit applications.
 - 2. County will furnish copies of permits obtained by County and required to be posted on the job site. Copies of permits will be forwarded to Contractor prior to start of construction.
 - 3. Contractor shall furnish copies of permits obtained by the Contractor. Forward copies of permits to the County prior to commencement of work requiring permits.

1.03 CODES AND ORDINANCES

- A. Codes applicable to this project include but are not necessarily limited to the following:
 - 1. Standard building codes as applicable.
 - 2. Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.
 - 3. Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

4. Accessibility Requirements Manual, Department of Community Affairs, Florida Board of Building Codes and Standards.
 5. The Americans with Disabilities Act (ADA) 1990 36 CFR Part 1191 Architectural and Transportation Barriers Compliance Requirements.
 6. NFPA 101 Life Safety Code, Latest Edition.
 7. Standard Fire Prevention Code, Latest Edition.
 8. State Fire Marshal's Uniform Fire Safety Rules.
- B. All materials and workmanship shall confirm to local city or county ordinances.
- C. If there is a conflict in regulations, codes, or regulations and codes, the more stringent requirements shall govern.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 VERIFICATION AND CONFORMANCE

- A. Conform to all requirements of all permits.

END OF SECTION

SECTION 01420

REFERENCE STANDARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements to ensure that the products and installation meet industry standards, manufacturers requirements and government regulations and ordinances.

1.02 GENERAL QUALITY CONTROL

- A. The Contractor shall maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Public Inspection: The Contractor shall inform the Engineer and local authorities, such as building and plumbing inspectors, Fire Marshall, OSHA inspectors, and others, in order that they may approve all required work and witness all required tests for foundations, piping, plumbing, fire protection systems, pressure vessels, safety systems, electrical systems and other systems requiring regulatory authority inspections to obtain all required permits and certificates.
- C. Site Inspection: The Contractor shall verify all dimensions in the field and shall continuously check field conditions during construction.
- D. Sampling and Testing: The Engineer reserves the right to take samples and make independent tests to verify that the Work meets the requirements of the specifications.

1.03 RIGHT OF REJECTION

- A. Engineer shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after installation. If the Engineer or its representative, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be subsequently rejected.
- B. The Contractor shall promptly remove rejected articles or materials from the site of the Work after notification of rejection.

PART 2 – PRODUCTS

2.01 MANUFACTURERS' CERTIFICATES

Submit manufacturer's certificate that product meets or exceeds specified requirements as specified in Section 01600 – Material and Equipment and Section 01750 – Testing and Startup.

2.02 MATERIALS TESTING

The Contractor shall employ the services of an independent, testing laboratory to perform inspections, tests, and other services as specified in Section 01430 – Materials Testing. The Contractor's responsibilities are described in Section 01430.

PART 3 – EXECUTION

3.01 MANUFACTURERS' INSTRUCTIONS

Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

3.02 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Comply with all local, state, and federal regulations and ordinances.
- C. Perform work by persons qualified to produce workmanship of specified quality.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration and rocking.

3.03 MANUFACTURERS' FIELD SERVICES

- A. When specified in the individual product section, require manufacturer or manufacturer's representative to provide qualified personnel to observe field conditions; conditions of surfaces and installation; quality of workmanship; startup, testing, adjustment, and balance of equipment as applicable; and to make appropriate recommendations.
- B. The extent of the manufacturer's field services shall be as specified in the individual product specification sections.

END OF SECTION

SECTION 01430
MATERIALS TESTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for testing laboratory services for concrete, soils compaction and other testing as may be required by the Contract Documents.

1.02 REFERENCES

- A. General: as specified in Section 01420 - Reference Standards.
- B. ANSI/ASTM Standards
 - 1. ANSI/ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
 - 2. ANSI/ASTM E329 - Practice for Inspection and Testing Agencies for Concrete, Steel, Bituminous Materials as Used in Construction

1.03 SELECTION AND PAYMENT

- A. The Contractor shall employ services of one or more independent testing laboratories to perform specified inspection and testing. The cost for all testing services shall be included within the Contractor's Bid Price.
- B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.04 QUALITY ASSURANCE

- A. Standards: Comply with requirements of ANSI/ASTM E329 and ANSI/ASTM D3740.
- B. Laboratory: Authorized to operate in State in which Project is located.
- C. Laboratory Staff: Maintain a full time Registered Professional Engineer on staff to review services.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards (NBS) or accepted values of natural physical constants.

1.05 LABORATORY RESPONSIBILITIES

- A. Test samples submitted by Contractor.
- B. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.

- C. Perform specified inspection, sampling, and testing of Products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or Products.
- F. Perform additional inspections and tests required by Engineer.
- G. Attend preconstruction conferences and progress meetings as appropriate.

1.06 LABORATORY REPORTS

- A. After each inspection and test, the laboratory shall promptly submit three (3) copies of laboratory report to Engineer, Contractor and County.
- B. Report shall include:
 - 1. Date issued,
 - 2. Project title and number,
 - 3. Name of inspector or technician,
 - 4. Date and time of sampling or inspection,
 - 5. Identification of product and Specifications section,
 - 6. Location in the Project,
 - 7. Type of inspection or test, Date of test,
 - 8. Results of tests,
 - 9. Conformance with Contract Documents.
- C. When requested by Engineer, provide interpretation of test results.

1.08 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor.
- D. Laboratory has no authority to stop the Work.

1.09 CONTRACTOR RESPONSIBILITIES

- A. Deliver to laboratory, at designated location, adequate samples of proposed materials that require testing, along with proposed design data as required.
- B. Cooperate with laboratory personnel and provide access to the Work.
- C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at source of Products to be tested, to facilitate tests and inspections, storage and curing of test samples.
- D. Notify Engineer and laboratory twenty-four (24) hours prior to expected time for operations requiring inspection and testing services.
- E. Payment for testing and laboratory services.

1.10 SCHEDULE OF INSPECTIONS AND TESTS

As specified in individual Product Specification sections.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION

SECTION 01450

QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements to ensure that the products and installation meet industry standards, manufacturers requirements and government regulations and ordinances.

1.02 GENERAL QUALITY CONTROL

- A. The Contractor shall maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Public Inspection: The Contractor shall inform the Engineer and local authorities, such as building and plumbing inspectors, Fire Marshall, OSHA inspectors, and others, in order that they may approve all required work and witness all required tests for foundations, piping, plumbing, fire protection systems, pressure vessels, safety systems, electrical systems and other systems requiring regulatory authority inspections to obtain all required permits and certificates.
- C. Site Inspection: The Contractor shall verify all dimensions in the field and shall continuously check field conditions during construction.
- D. Sampling and Testing: The Engineer reserves the right to take samples and make independent tests to verify that the Work meets the requirements of the specifications.

1.03 RIGHT OF REJECTION

- A. Engineer shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after installation. If the Engineer or its representative, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be subsequently rejected.
- B. The Contractor shall promptly remove rejected articles or materials from the site of the Work after notification of rejection.

PART 2 – PRODUCTS

2.01 MANUFACTURERS' CERTIFICATES

Submit manufacturer's certificate that product meets or exceeds specified requirements as specified in Section 01600 – Material and Equipment and Section 01750 – Testing and Startup.

2.02 MATERIALS TESTING

The Contractor shall employ the services of an independent, testing laboratory to perform inspections, tests, and other services as specified in Section 01430 – Materials Testing. The Contractor's responsibilities are described in Section 01430.

PART 3 – EXECUTION

3.01 MANUFACTURERS' INSTRUCTIONS

Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

3.02 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Comply with all local, state and federal regulations and ordinances.
- C. Perform work by persons qualified to produce workmanship of specified quality.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration and rocking.

3.03 MANUFACTURERS' FIELD SERVICES

- A. When specified in the individual product section, require manufacturer or manufacturer's representative to provide qualified personnel to observe field conditions; conditions of surfaces and installation; quality of workmanship; startup, testing, adjustment, and balance of equipment as applicable; and to make appropriate recommendations.
- B. The extent of the manufacturer's field services shall be as specified in the individual product specification sections.

END OF SECTION

SECTION 01470

COLOR AUDIO-VIDEO PRECONSTRUCTION RECORD

PART 1 - GENERAL

1.01 SCOPE

Prior to commencing work, the Contractor shall take a continuous color audio-video digital recording of Project site to serve as a record of pre-construction conditions.

1.02 APPROVAL

No construction shall begin prior to review and approval by Engineer of the video recording covering construction area. The Engineer shall have authority to reject all or any portion of the recording not conforming to specifications and order that it be done again at no additional charge. The Contractor shall reschedule unacceptable coverage within five days after being notified. The Engineer shall designate those areas, if any, to be omitted from or added to the audio-video coverage. Recordings shall not be made more than 60 days prior to construction in any area. All recordings and written records shall become property of the County. Prior to video recording, there will be a meeting between Engineer, Contractor and digital photographer.

1.03 PROFESSIONAL DIGITAL PHOTOGRAPHER

Engage the services of a professional digital photographer. The color audio-video recording shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of preconstruction color audio-video documentation. The digital photographer shall furnish to Engineer a list of names and addresses of two references that digital photographer has performed color audio-video recording for projects of a similar nature.

PART 2 - PRODUCTS

2.01 AUDIO-VIDEO

Audio-video recording shall be electronically transmitted. The Contractor shall submit the recording for review and approval.

2.02 EQUIPMENT

- A. Furnish all equipment, accessories, materials and labor to perform this service. The total audio-video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume, clarity and be free from distortion and interruptions.
- B. The color video camera used in the recording system shall have a horizontal resolution of 300 lines at center, a luminance signal to noise ratio of 45 dB and a minimum illumination requirement of 25 foot-candles.

PART 3 - EXECUTION

3.01 SCHEDULING

No recording shall be done during precipitation, mist or fog. Recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.

3.02 RECORDED INFORMATION – AUDIO

Each recording shall begin with current date, project name and Owner and followed by general location, i.e., viewing side and direction of progress. Audio track shall consist of an original live recording. Recording shall contain the narrative commentary of digital photographer, recorded simultaneously with his fixed elevation video record of the zone of influence of construction.

3.03 RECORDED INFORMATION - VIDEO

All video recordings must, by electronic means, display continuously and simultaneously generated with the actual taping transparent digital information to include the date and time of recording, and station numbers as shown on the Drawings. Date information shall contain the month, day and year. Time information shall contain the hour, minutes and seconds. Additional information shall be displayed periodically. Such information shall include but not be limited to project name, contract number, name of street or structure, direction of travel and view. This transparent information shall appear on the extreme upper left hand third of the screen.

3.04 AREA OF COVERAGE

- A. Recorded coverage shall include all surface features located within the zone of construction including the construction entrance area and laydown areas supported by appropriate audio coverage. Such coverage shall include special attention to existing driveways, sidewalks, curbs, pavements, structures, exposed piping, electrical and control devices, landscaping, culverts, fences, signs and headwalls within the area covered.
- B. When a conventional wheeled vehicle is appropriate for use, distance from the camera lens to the ground shall not be less than twelve feet. Rate of speed in the general direction of travel of the vehicle used during recording shall not exceed 15 feet per minute. Panning, zoom-in and zoom-out rates shall be sufficiently controlled to maintain a clear view of the object. Tape coverage may be required in areas not accessible by vehicles. Such coverage shall be obtained by walking or special conveyance approved by the Engineer.

END OF SECTION

SECTION 01510
TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for temporary utilities.

1.02 TEMPORARY SERVICES

- A. Each temporary service shall meet the requirements of the utility having authority over the temporary service. Provide metering and isolation to meet requirements of utility authority over temporary service.
- B. Obtain permission of utility having authority over temporary service prior to connecting temporary service.
- C. Remove temporary services after temporary services are no longer needed for construction operations, site security, field offices, or testing. Restore to pre-construction condition.
- D. The cost for all temporary utilities shall be part of the Bid Price.

1.03 APPLICATION AND PAYMENT FOR TEMPORARY SERVICES

- A. Make applications and arrangements and pay all fees and charges for temporary electrical, potable water, non-potable water, sanitary and telephone services.
- B. Provide and pay for temporary generators, pumps, wiring, switches, piping, connections, meters, and appurtenances for temporary utilities.
- C. The following permanent utility services and services relative to temporary utilities shall be provided by the Owner.
 - 1. Electricity for facilities that are occupied and operated by the Owner.
 - 2. Potable water for facilities that are occupied and operated by the Owner.
 - 3. Telephone service for facilities that are occupied and operated by the Owner.

1.04 ELECTRICITY, LIGHTING

- A. For facilities connected to permanent electrical services, the Contractor shall pay the Owner by deductive cost Change Order for all electrical power used in new facilities until facility is accepted, occupied, and operated by the Owner.
- B. Provide temporary electrical service, or services, for the following:
 - 1. Power tools for construction operations.

2. Construction lighting.
 3. Security lighting.
 4. Field offices and sheds.
 5. Testing specified in individual Sections.
- C. Provide construction lighting as required for the following:
1. Prosecution of Work;
 2. Observation of Work by Engineer, Owner, and regulatory authorities;
 3. Access to facilities occupied by Owner within project site.
- D. Wiring for Temporary Electrical Services
1. Properly install and maintain wiring for temporary lighting and power.
 2. Provide separate circuits for temporary lighting and for temporary power.
 3. Provide branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords.
 4. Securely fasten wiring and electrical devices.
 5. Temporary lighting and power facilities shall meet the requirements of OSHA Safety and Health Standards for Construction.

1.05 WATER

- A. Provide temporary water services for the following:
1. Potable water or non-potable water for construction operations.
 2. Potable water for consumption by Contractor's and subcontractors' personnel.
 3. Potable water for field offices.
 4. Potable water or non-potable water for fire protection on the construction site.
- B. Piping for Temporary Water Services
1. Provide pipe, fittings, valves, and hydrants for temporary water service, or services.
 2. Provide temporary pumps, storage tanks, and controls if available water volume, pressure, or volume and pressure are not sufficient for construction operations.
 3. Extend branch piping with outlets located so that water is available by use of hoses.
 4. Securely anchor and support temporary water piping.
 5. Provide warning signs at each temporary non-potable water outlet.

1.06 SANITARY FACILITIES

- A. Provide sanitary facilities (fixed toilets or portable chemical toilets) for Contractor and Subcontractor Personnel.
- B. Sanitary Facilities for Contractor's and Subcontractor Personnel shall meet the requirements of OSHA Safety and Health Standards for Construction.
- C. Seclude sanitary facilities from public observation as follows:
 - 1. Locate sanitary facilities so that sanitary facilities cannot be observed by public, or
 - 2. Provide screening around sanitary facilities so that public cannot observe sanitary facilities.
- D. Maintain sanitary facilities so that sanitary facilities are clean and dry at all times.
- E. Enforce use of sanitary facilities. Do not commit nuisances on the project site.

1.07 HEAT, VENTILATION, AND AIR CONDITIONING

- A. Provide temporary heat, ventilation, and air conditioning for the following:
 - 1. Construction operations.
 - 2. Protection, drying, and curing of materials and finishes.
 - 3. Field offices and sheds.
- B. Temporary heat and ventilation for construction operations shall meet the requirements of OSHA Safety and Health Standards for Construction.

1.08 TELEPHONE SERVICE

- A. Provide temporary, land line telephone service for the following:
 - 1. Communications regarding construction operations.
 - 2. Emergency services.
 - 3. Field offices.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION

SECTION 01520

OCCUPANCY

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for site occupancy.

1.02 CONTRACTOR USE OF PROJECT SITE

- A. Contractor's use of project site shall be limited to the Contractor's construction operations, including on-site storage of materials, and field offices.
- B. The Contractor shall prepare shop drawing submittal showing the location of trailers, utilities, storage parking, and staging area. No occupancy of the existing facility will be allowed until this submittal has been approved by the Engineer.
- C. **The Contractor shall not operate any valve, flow control device, electrical device, instrument or control system associated with the existing facility.** If such operation is required for prosecution of the Work, the Contractor shall notify the Owner. Only the Owner's representatives or staff shall operate such devices.
- D. Residential occupancy on the project site by the Contractor's or subcontractor's employees, including owners and supervisors, is not permitted.

1.03 OWNER USE OF PROJECT SITE

- A. Owner may utilize all or part of the existing facilities during the entire construction period for the conduct of the Owner's normal operations.
- B. Schedule and coordinate the Work to minimize interference between construction operations and Owner's operation and maintenance of facilities in service.

1.04 OPERATION AND MAINTENANCE OF TREATMENT FACILITIES

A. Operation

- 1. Owner shall operate the treatment facilities that are in service as part of the treatment process.
- 2. Contractor shall operate or assist in the operation of new facilities and modified facilities during testing and prior to Owner's acceptance of new facilities and modified facilities.

B. Maintenance

1. Owner shall maintain existing facilities that have not been removed from service for modification or demolition.
2. Owner shall maintain new facilities and modified facilities that have been accepted following Substantial Completion certification of these facilities by the Engineer.
3. New or modified facilities shall be placed in service prior to acceptance if required to meet regulatory requirements for treatment quality. New or modified facilities may be placed in service prior to acceptance if required to complete Work on schedule. **If new facilities or modified facilities are in service prior to acceptance of new or modified facilities, Contractor shall maintain new or modified facilities until such facilities are accepted for Substantial Completion. Contractor shall provide maintenance and operation at no additional cost to the Owner.**

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION

SECTION 01540

SECURITY

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for project site security.

1.02 SITE SECURITY

- A. Facilities Partially Occupied by Owner: Site security of partially occupied sites shall be joint responsibility of Contractor and Owner.

1. Contractor shall provide security for the following:

- a. Contractor's and subcontractors' staging areas and storage areas.
- b. Field offices and sheds.
- c. New facilities under construction.
- d. Existing facilities being renovated.

2. Owner shall provide security for the following:

- a. Facilities occupied by Owner.
- b. Site areas solely occupied by Owner.

3. Site Entrance

- a. Site access shall be through the entrance gate on 5600 Warren Street unless otherwise directed by the Owner.
- b. Contractor shall provide security for site entrance for Contractor's and subcontractors' use.

- B. All field workers associated with execution of the Contract Work must obtain security badges from the Facilities Department of Collier County.

1. Each worker must go to the Facilities Department at the Government Center on Tamiami Trail East for fingerprinting, photographing and completion of security application. Workers that fail the security clearance requirements shall not be allowed on the project.
2. The Contractor shall be responsible for payment to the County of the fee associated with each security badge.
3. The Contractor is responsible for renewal of the security badges and for maintaining a current badge for each worker.

- C. The Contractor shall be fully responsible for security of construction equipment, products, small tools, and other items related to the construction.

1.03 SECURITY PROGRAM

- A. Protect Work from theft, vandalism, and unauthorized entry.
- B. Maintain program throughout construction period until Owner acceptance precludes the need for Contractor security.

1.04 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into construction site.
- B. Owner will control entrance of persons and vehicles related to Owner's operations.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION

SECTION 01550

ACCESS ROADS AND PARKING AREAS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for project access roads, haul routes, and parking areas.

1.02 CONSTRUCTION ACCESS AND HAUL ROUTES

- A. The Contractor shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work. It shall be the Contractor's responsibility to construct and maintain any haul roads required for its construction operations.
- B. Traffic Control: For the protection of traffic in public or private streets and ways, the Contractor shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the Florida and County Departments of Transportation. The Contractor shall take all necessary precautions for the protection of the Work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. The Contractor shall station police officers, guards and flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.
- C. Site access shall be through the entrance gate on Wild Flower Way unless otherwise directed by the Owner.

1.03 ON-SITE ACCESS ROADS

- A. Provide access roads for the following:
 - 1. Construction operations.
 - 2. Material and equipment delivery for construction.
 - 3. Emergency access.
- B. Construct temporary access roads as required on route, or routes, approved by Engineer.
- C. Provide 20-foot driveway width along approved access routes.
- D. Access drives shall have load bearing capacity to provide unimpeded traffic for construction operations, Owner access for operation and maintenance of facilities in service, and emergency vehicles.

- E. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.
- F. Extend and relocate access drives as Work progress requires.
- G. Provide detours as necessary for unimpeded traffic flow.
- H. Provide turning space between and around combustible materials.
- I. Provide and maintain access to the following:
 - 1. Fire hydrants.
 - 2. Facilities in service.
 - 3. Valves, switches, and controls for facilities in service.

1.04 PARKING

- A. Provide temporary parking facilities for use by construction supervisory personnel, Owner's representative, and Engineer.
 - 1. Provide parking on job site in areas designated and approved by Owner.
 - 2. Provide additional off-site parking for construction personnel. Provide transportation to and from site from off-site parking.
- B. Do not use temporary parking areas for storage of material or equipment to be incorporated in the Work, construction material, or construction equipment.

1.05 PERMANENT PAVEMENTS AND PARKING FACILITIES

- A. Do not allow traffic loading beyond paving design capacity.
- B. Do not allow tracked vehicles on surface or base for permanent roads.

1.06 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with the following:
 - 1. Public traffic and parking.
 - 2. Access by emergency vehicles.
 - 3. Owner's operations.
- B. Monitor parking of construction personnel's vehicles.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.
- D. Do not operate tracked vehicles beyond the limits of the construction site.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Temporary Surface: Granular surface may be used unless asphaltic concrete surface is required for dust control.
- B. Temporary Surface Over Permanent Base: Equal to permanent surface.
- C. Permanent Construction: As shown on the Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clear areas to be used for temporary access roads and parking.
- B. Provide drainage facilities, including retention areas and sediment control, for temporary access roads and parking.

3.02 MAINTENANCE OF CONSTRUCTION ACCESS AND HAUL ROUTES

- A. Clean haul vehicles prior to leaving job site if required to prevent dirt from being deposited on either access routes or haul routes.
- B. Immediately remove dirt, debris, or dirt and debris deposited or spilled on access routes, haul routes, or access and haul routes.
- C. Repair or replace pavement damaged by construction operations or movement of construction equipment or material.

3.03 MAINTENANCE OF ON-SITE ACCESS ROADS AND PARKING AREAS

- A. Maintain traffic routes so that emergency vehicles can access the project site, operating facilities, and Owner-occupied facilities at all times.
- B. Maintain traffic routes and parking areas so that traffic routes and parking areas can be used for their intended purpose by passenger cars.

3.04 REMOVAL AND RESTORATION

- A. Remove temporary access drives and parking that are not part of permanent Work.
- B. Replace removed surface, base, and subgrade as appropriate to completed Work.

END OF SECTION

SECTION 01570

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for temporary environmental controls of water, dust, noise, erosion, pollution and pests.

1.02 WATER CONTROL

A. Surface Water Control

1. Protect site from puddling or running water.
2. Grade construction areas so that storm water drains to storm water system or to dewatering systems.

B. Disposal of Discharge Water

1. Do not contaminate or disturb the environment of properties adjacent to the Work.
2. Do not contaminate streams or other surface waters.
3. Do not use sanitary sewers for disposal of water from water control systems.

1.03 DUST CONTROL

A. Provide continuous dust control systems, construction methods, or both which control dust generation and disbursement.

B. Control dust from construction operations, construction traffic, and other traffic on the job site so that:

1. Visibility is not reduced below safe limits for construction operations and traffic.
2. Adjacent property does not receive dust from the project site.
3. Persons, animals, or persons and animals are not injured by dust from the project site.
4. Dust from the project does not cause a nuisance to the Owner or persons in the vicinity of the project site.

1.04 EROSION AND SEDIMENT CONTROL

Shall conform to Section 02310 - Erosion and Sediment Control

1.05 NOISE CONTROL

- A. Provide systems, measures, or both so that noise from construction operations, equipment and traffic does not exceed levels permitted by local ordinances.
- B. Control noise from construction operations, equipment and traffic so that:
 - 1. Noise does not impede the performance of Owner's personnel at the project site.
 - 2. Persons, animals, or persons and animals are not injured by noise from the project site.
 - 3. Noise from the project does not cause a nuisance to the Owner or persons in the vicinity of the project site.
- C. Provide hearing protection within the project site for Contractor's personnel, Owner's personnel, and Engineer wherever noise levels exceed occupational exposure limits.

1.06 PEST CONTROL

- A. Provide insect and rodent control for construction areas, staging area, storage area, field offices, and sheds.
- B. Keep storage areas clean and neat.
- C. Provide routine cutting of grass and weeds.
- D. Instruct construction personnel on the prevention of bites from poisonous snakes and spiders when picking up materials and performing other tasks.

1.07 POLLUTION CONTROL

Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious substances, toxic substances, and pollutants produced by construction operations.

1.09 ACCESS AND HAUL ROUTE

Contractor shall maintain public access roadways, right-of-way, and haul route free from mud, debris, trash and dust created by the Contractor's activities. Contractor shall provide all services necessary to accomplish this Contract requirement, including continuous crews and equipment, if necessary.

PART 2 - PRODUCTS

2.01 CHEMICALS

Chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either EPA or USDA.

PART 3 - EXECUTION

3.01 USE OF CHEMICALS

Use of chemicals and disposal of residues shall be in strict conformance with manufacturer's instructions, government regulations, or both, as applicable.

END OF SECTION

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

General requirements for materials and equipment and requirements for procurement, handling, and storage of materials and equipment.

1.02 GENERAL

A. Furnish and Install

1. Where the words “furnish”, “provide”, “supply”, “replace”, or “install” are used, whether singularly or in combination, they shall mean to furnish and install, unless specifically stated otherwise.
2. In the interest of brevity, the explicit direction “to furnish and install” has sometimes been omitted in specifying materials and/or equipment herein. Unless specifically noted otherwise, it shall be understood that all equipment and/or materials specified or shown on the Drawings shall be furnished and installed under the Contract as designated on the Drawings.
3. The associated cost for all field testing, laboratory testing, O&M manuals, spare parts, startup services, commissioning services, and owner training services as required in this contract shall also be included in the cost.

1.03 REFERENCES

A. General

B. ANSI Standards

ANSI B46.1 Surface Texture

C. ASTM Standards

- i. ASTM A48
- ii. ASTM A108

1.04 SUBMITTALS

- A. General:** As specified in Section 01330 – Submittals
- B. Lubricant Test Report:** as specified in this Section
- C. Substitutions:** as specified in this Section.

- D. **Manufacturer Certificate of Completion:** The Contractor shall obtain written certification from the equipment manufacturer, stating that the equipment will efficiently and thoroughly perform the required functions in accordance with the Specifications and as indicated on the Drawings. Contractor shall have responsibility for coordination of all equipment, including motors, variable speed drives, controls, and services required for proper installation and operation of the completely assembled and installed equipment. The Contractor shall submit all such certificates to the Engineer with the shop drawings.

1.05 INFORMATION REGARDING BUY AMERICAN PROVISION

- A. The Buy American Provision of Public Law 95-217 (Section 215 of Public Law 92-500 as amended) as implemented by EPA regulations and guidance, generally requires that preference be given to the use of domestic construction material in the performance of this Contract.
- B. **Products manufactured outside of the United States will not be considered acceptable for the Work unless the Manufacturer and the manufacturing facility (IES) are certified as ISO/9001 compliant. The ISO certification must come from a firm having itself been certified by the International Accreditation Forum (IAF). Submission of this secondary certification by the IAF or approved equal is required.**
- C. Refer to part 2.02 of this Section.

1.06 QUALITY ASSURANCE

- A. General: As specified in Section 01450 – Quality Control
- B. Inspection, Field Adjustment, and Startup: Demonstrate that all equipment meets the specified performance requirement.
- C. Tolerances: Tolerances and clearances shall be shown on the shop drawings. Adhere to approved tolerances and clearances. Machine work shall be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1/16 of an inch for members 30 feet or less in length, and not greater than 1/8 of an inch for members over 30 feet in length.
- D. Machine Finish: The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1. The following finishes shall be used:
- E. Manufacturer's Experience: Unless otherwise directed by the ENGINEER, all equipment furnished shall have a record of at least five (5) years of successful, trouble-free operation in similar applications, from the same manufacturer.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Products include material, equipment, and systems.
- B. Comply with Specifications and referenced standards as minimum requirements.
- C. All products shall be new and of the very best quality.
- D. Components that are supplied in quantity within a Specification section shall be the same and shall be interchangeable.
- E. All parts of the equipment furnished shall be amply designed and constructed for the maximum stresses occurring during fabrication, erection and continuous operation.

2.02 STAINLESS STEEL

- A. All stainless steel fasteners shall be polished during the manufacturing process to provide a bright surface finish.
- B. The submittal data on stainless steel fasteners manufactured outside the United States shall include documentation of alloy elemental analysis performed as routine and ongoing quality control measures associated with the manufacture of the specific products for this project.

2.03 PRODUCT OPTIONS

- A. Products specified by reference standards or by descriptions only: Any product meeting these requirements can be submitted for approval.
- B. Products specified by naming one or more manufacturers with a provision for substitutions: Submit a request for substitution for any manufacturer not specifically named.
- C. Products specified by naming one or more manufacturers with no provision for substitutions: No substitutions will be allowed.

2.04 SUBSTITUTIONS

- A. A request for substitution should be made enough time in advance of procurement to allow time for review by the Engineer. A substitution may not be accepted if it delays the project schedule.
- B. Document each request for substitution with complete data substantiating compliance of proposed substitution with material or product specifications.
- C. Request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
 - 2. Will provide the same warranty for substitution as for specified product.
 - 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.
- D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.
- E. Engineer will determine acceptability of proposed substitution and will notify Contractor of acceptance or rejection in writing within a reasonable time.

2.05 MANUFACTURER'S CERTIFICATIONS

- A. Prior to delivery at project site, furnish an Affidavit of Compliance certified by the equipment manufacturer that the equipment and appurtenances furnished comply with all applicable provisions of applicable referenced standards and these Specifications.
- B. Do not deliver equipment to job site until Affidavit of Compliance has been submitted and accepted by the Engineer.

2.06 NOISE AND VIBRATION

- A. When in operation, no single piece of equipment shall exceed the OSHA noise level requirements for a one-hour exposure.
- B. Equipment that transmits vibration to structures, piping, conduit, or other items connected to the equipment, shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations.
- C. Equipment that can be damaged by vibration generated by the equipment or by vibration transmitted through piping or other connecting items, shall be provided with vibration damping per manufacturer's written recommendations.

2.07 WELDING OF EQUIPMENT AND PIPE

- A. Shop Welding: Unless otherwise specified or shown, shop welding shall conform to the following:
 1. Applicable Standards of the American Welding Society and AWWA for the material and type of item being welded.
 2. All composite fabricated steel assemblies, which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.
 3. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.
 4. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions.

Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

- B. Field Welding: Field welding shall be as specified in individual specification sections. Qualification of welders shall be in accordance with the AWS standards. Prior to commencement of any field welding, the Contractor shall furnish the Engineer a copy of each welder's current certification for the alloy, position and type of welding to be performed.

2.08 PROTECTIVE COATINGS FOR EQUIPMENT

- A. Equipment shall be painted or coated in accordance with Section 11331 and Section 09960 unless otherwise approved by the Engineer. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

2.09 SHOP FABRICATION

- A. Perform shop fabrication in accordance with the final reviewed and processed shop drawings.

2.10 NAMEPLATES

- A. Equipment nameplates shall be stainless steel. Nameplates shall be engraved or stamped. Fasten nameplates to equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins.
- B. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.11 WARRANTIES

- A. Furnish warranties as specified in respective equipment specification.

2.12 SPARE PARTS

- A. Provide for approval the manufacturer's recommended spare parts list by the Engineer and immediately prior to Substantial Completion.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall be responsible for the delivery, storage, and handling of products.
- B. Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry.

- C. Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number shown or specified for the particular item.
- D. Transport products by methods that prevent product damage. Deliver products dry and in undamaged condition in manufacturer's unopened containers or packaging. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Load and unload equipment and appurtenances by hoists or skidding and in accordance with the manufacturer's recommendations. Do not drop products. Do not skid or roll products on or against other products. Pad slings and hooks in a manner that prevents damage to products.
- F. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions. Store products that will be deteriorated by sunlight in a cool location out of direct sunlight. Rubber products shall not come in contact with petroleum products.
- G. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering and as recommended by manufacturer; provide ventilation that avoids condensation.
- H. Deliver pipe, fittings, valves, and accessories in a clean and undamaged condition. Store pipe, fittings, valves, and accessories off the ground and in accordance with manufacturer's instructions. Do not stack ductile iron pipe higher than the limits shown in ANSI/AWWA C600. Stacking of pipe shall meet the requirements of the pipe manufacturer. Do not stack fittings, valves, valve boxes, or valve stands.
- I. Keep stored products safe from damage or deterioration. Keep the interior of pipe, fittings, valves, and appurtenances free from dirt or foreign matter. Drain and store valves in a manner that will protect valves from damage. Store gaskets, plastic pipe and fittings, and other products that will be deteriorated by sunlight in a cool location out of direct sunlight.
- J. Equipment having moving parts such as gears, bearings, and electric motors; instruments; control panels; motor control centers; and switchgear shall be stored in a temperature and humidity controlled area until equipment is installed.
- K. Stored electric motors and actuators with space heaters shall have the space heaters energized. When electric motors and actuators with space heaters are installed, the space heaters shall be connected and energized. Space heaters shall remain energized until equipment is accepted and placed in service.
- L. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged and are maintained under required conditions.
- M. Promptly remove damaged products from the job site. Replace damaged products with undamaged products at no expense to Owner.

3.02 MANUFACTURE'S REPRESENTATIVES

- A. Provide the services of experienced, competent, and authorized service representative of the manufacturer of the items of equipment when specified in the individual Product Section.
- B. Manufacturers' representatives shall visit the site of Work, and shall perform the following tasks:
 - 1. Assist Contractor in installation of equipment.
 - 2. Inspect, check, adjust equipment, and approve equipment installation.
 - 3. Start-up and field-test equipment for proper operation, efficiency, and capacity. Perform necessary field adjustments during the test period until equipment installation and operation are satisfactory to the Engineer.
 - 4. Supervise functional test as specified in Section 01750 – Testing and Start-Up
 - 5. Instruct Owner's personnel in operation and maintenance of equipment as specified in this Section.
- C. The times specified in the individual product sections for the Manufacturer's Representative to provide services are exclusive of travel time to and from the facility. The times specified shall not be construed as to relieve the manufacturer of any additional visits to provide sufficient service to place the equipment in satisfactory operation.

3.03 INSTALLATION - GENERAL

- A. Install equipment in accordance with acceptable procedures submitted with the shop drawings and as indicated on the Drawings, unless otherwise accepted by the Engineer.
- B. Measure drive shafts just prior to assembly to ensure correct alignment without forcing.
- C. Support pipe, fittings, valves, conduit, and other items connected to equipment so that there are no excess stresses and loads on equipment.
- D. Equipment shall be secure in position and neat in appearance.

3.04 INSTALLATION OF EQUIPMENT

- A. Equipment and materials shall be installed in accordance with the requirements of the General Conditions, Supplemental Conditions and the respective Specification Sections.
- B. Concrete foundations for equipment shall be of approved design and shall be adequate in size, suitable for the equipment erected thereon, properly reinforced, and tied into floor slabs by means of reinforcing bars or dowels. Foundations shall be built, and bolts installed in accordance with the manufacturer's certified drawings and Section 03312.

- C. Before mounting equipment on a foundation, the Contractor shall prepare the surface as specified in Section 03312, 3.02.
- D. Equipment shall be set, aligned and assembled in conformance with manufacturer's drawings or instructions. Run out tolerances by dial indicator method of alignment shall be plus or minus .002 inches, unless otherwise directed by the Engineer.
- E. All blocking and wedging required for the proper support and leveling of equipment during installation shall be furnished by the Contractor. All temporary supports shall be removed, except stainless steel wedges and shims, which may be left in place with the approval of the Engineer.
- F. Each piece of equipment or supporting base, bearing on concrete foundations, shall be bedded in grout. The Contractor shall provide a minimum of 1-1/2 inch thick grouting under the entire baseplate supporting each pump, motor drive unit and other equipment. Grout shall be non-shrink, epoxy, non-metallic grout. Submit grout data for approval.
- G. When motors are shipped separately from driven equipment, the motors shall be received, stored, megger once a month, and the reports submitted to the Engineer. After driven equipment is set, the motors shall be set, mounted, shimmed, mill righted, coupled and connected complete. Motors shall then be turned once per month and documented by the Contractor to the Owner/Engineer.

3.05 CONNECTIONS TO EQUIPMENT

- A. Connections to equipment shall follow manufacturer's recommendations as to size and arrangement of connections and/or as shown in detail on the Drawings or approved Shop Drawings. Piping connections shall be made to permit ready disconnection of equipment with minimum disturbance of adjoining piping and equipment.

3.06 LUBRICANTS

- A. Furnish and install lubricants required for initial operation.
- B. Maintain lubricants at proper levels until equipment is accepted.
- C. Change lubricants in each piece of equipment following equipment initial run-in. The manufacturer shall test removed lubricants for metal particles and lubricant breakdown. Submit lubricant test report to the Engineer. If the equipment manufacturer requires the first lubricant change prior to Final Completion, the Contractor shall remove lubricant and furnish and install the necessary lubricants.

3.07 FIELD TESTS

- A. Field test equipment in accordance with Section 01750 - Testing and Start-up.
- B. Field test equipment as specified in individual Specification Sections.

3.08 FUNCTIONAL TEST

Prior to placing systems in service, perform functional test of each system as specified in Section 01750 - Testing and Start-up. Submit a field report to summarize the completed testing and results.

3.09 TRAINING

- A. Manufacturer's representative, responsible subcontractor, or both shall instruct Owner's designated operating and maintenance personnel in correct operation and maintenance procedures for equipment and systems when specified in individual product specification sections. Qualified persons who have been made familiar in advance with equipment and systems at Owner's facility shall give on-site instruction.
- B. Submit to Engineer not less than 14 calendar days prior to each training session an outline of the training program and the qualifications of the trainer(s).
- C. Coordinate training with the Owner. Notify Owner not less than 14 calendar days in advance of each training session.
- D. Provide training while equipment is fully operational. All training shall be digitally recorded with color video and audio and submitted to the Owner and Engineer subsequent to each training session.
- E. Provide training between 12:00 P.M. and 4:00 P.M. on Wednesday only to accommodate Owner's personnel schedule. Duration of each training session shall be not less than two hours or more than four (4) hours.
- F. **Operation and Maintenance Data as specified in Section 01830 shall be submitted and accepted prior to commencement of training. Use accepted Operation and Maintenance manuals as the basis of instruction.**
 - 1. Review contents of manual with personnel in full detail.
 - 2. Explain all aspects of operation and maintenance.
 - 3. Demonstrate start-up, operation, control, adjustment, calibration, troubleshooting, servicing, maintenance, and shutdown of equipment.

END OF SECTION

SECTION 01740

CONSTRUCTION CLEANING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for cleaning project site and disposal of waste materials, debris, and rubbish during construction.

1.02 SITE AND FACILITIES CLEANING

- A. Site Not Occupied by Owner: The Contractor shall be fully responsible for cleaning until site is partially or fully occupied by Owner after attaining Substantial Completion.
- B. Facilities Partially Occupied by Owner: Cleaning of partially occupied sites shall be responsibility of the Contractor.
 - 1. Contractor shall clean the following:
 - a. Contractors and subcontractors' staging areas and storage areas.
 - b. Field offices and sheds.
 - c. New facilities under construction.
 - d. Existing facilities being renovated.
 - 2. Owner shall be responsible for cleaning the following:
 - a. Facilities occupied solely by Owner.
 - b. Site areas solely occupied by Owner.

PART 2 - PRODUCTS

2.01 EQUIPMENT

Provide covered containers for deposit of waste materials, debris, and rubbish.

PART 3 - EXECUTION

3.01 CLEANING - GENERAL

- A. Maintain areas under Contractor's control free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, crawl spaces, and other closed or remote spaces, prior to closing the space.
- C. Periodically clean interior areas to provide suitable conditions for work.

- D. Broom clean interior areas prior to start of surface finishing and continue cleaning on an as-needed basis.
- E. Control cleaning operations so that dust and other particulates will not adhere to wet or newly coated surfaces.

3.02 CLEANING OF NEW WORK

- A. The Contractor shall be fully responsible for cleaning related to new Work including, but not necessarily limited to, the following:
 - 1. Cleaning of cured, or partially cured, concrete surfaces prior to placement of additional concrete.
 - 2. Cleaning of joint surfaces prior to making joints.
 - 3. Cleaning of surfaces prior to application of finish.
 - 4. Cleaning of equipment and enclosures prior to Substantial Completion.
 - 5. Cleaning of new buildings and renovated buildings prior to Substantial Completion.
- B. Cleaning relative to new Work shall be as specified in individual specifications sections.

3.03 DISPOSAL

- A. Remove waste materials, debris, and rubbish from site periodically.
- B. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.

3.04 REPAIR AND RESTORATION

- A. Clean and repair damage caused by installation or use of temporary facilities.
- B. Restore existing facilities used during construction to condition prior to construction.

END OF SECTION

SECTION 01750
TESTING AND STARTUP

PART 1 - GENERAL

1.01 SECTION INCLUDES

Procedures for starting of mechanical, electrical, control systems, and monitoring systems.

1.02 GENERAL

- A. Do not place new facilities and modified facilities in service until:
 - 1. Equipment and controls have been successfully started up and tested.
 - 2. Draft O&M manuals have been provided.
 - 3. Training of Owner's personnel has been satisfactorily completed with approved Operation and Maintenance manuals.

1.03 QUALITY CONTROL

- A. When specified in individual Product Specification Sections, require manufacturer to provide authorized representative to be present at site at time of startup, testing, and training.
- B. Manufacturer's representative shall perform services as described in Section 01600 – Material and Equipment.

1.04 SUBMITTALS

- A. General: as specified in Section 01330 - Submittals.
- B. In addition, submit the following to the Engineer:
 - 1. Preliminary schedule listing times, dates and sequence for start-up of each item of equipment fourteen (14) calendar days prior to proposed dates.
 - 2. Each manufacturer shall prepare and submit a completed document, which is contained at the end of this Section, certifying the installation is acceptable and meets their standards and the equipment or device is functioning properly. The Contractor shall submit these certifications to the Engineer prior to either Substantial Completion or placing the equipment in service. A sample of the required certification document is appended to this Section 01750.

PART 2 - PRODUCTS (not used)

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify that project conditions comply with requirements.
- B. Verify that status of work meets requirements for starting of equipment and systems.

3.02 PREPARATION AND CONTRACTOR'S INITIAL START-UP AND INITIAL FUNCTIONAL TEST

- A. Coordinate sequence for initial start-up of various items of equipment.
- B. Notify Engineer fourteen (14) calendar days prior to initial start-up of each item of equipment.
- C. Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during entire start-up process.
- D. Provide control diagrams that show actual control components and wiring.
- E. Verify that each piece of equipment has been checked for proper lubrication, drive rotation, belt tension, control sequence, noise, vibration and other conditions that may cause damage.
- F. Verify control systems are fully operational in automatic and alternate modes of operation.
- G. Verify that tests, meter readings, and specific electrical characteristics agree with those specified by electrical equipment manufacturer.
- H. Verify that instruments, meters, and gages have been calibrated. Perform three-point calibration on continuous elements and systems. Provide calibration records.
- I. Conduct start-up and initial functional testing.
- J. Provide temporary flow meters and other measurement devices as required for testing of equipment and systems.

3.03 START-UP AND FUNCTIONAL TEST – DEMONSTRATION FOR OWNER AND ENGINEER

- A. Perform satisfactory Contractor's initial start-up and functional test prior to demonstration for Owner and Engineer.
 - 1. Perform pre-start-up inspection of installation.
 - 2. Perform start-up under no-load conditions, if possible. Observe noise, vibration and operation.
 - 3. If all operating characteristics are normal, proceed with start-up.

4. Operate equipment and system under all load conditions and confirm all operating characteristics are normal. If normal operation is observed, proceed with witnessed functional test and performance test as required.
- B. Perform functional and performance tests.
1. Perform functional and performance tests under supervision of responsible manufacturers' representatives, instrumentation and control subcontractor, and Contractor personnel.
 2. Representatives of Owner and Engineer shall witness functional test.
 3. Perform functional and performance tests on each piece of equipment and operational system as specified in the individual product sections.
 4. If system is to be placed in service in phases, perform functional and performance tests on each part of system prior to placing each part of system in service.
- C. Demonstrate that equipment operates and complies with specified performance requirements.
- D. Demonstrate that control panel functions, including failures and alarms, operate and comply with specified performance requirements.
- E. Functional test shall be non-destructive.
- F. If approved by the Engineer, simulate failures and alarm conditions by jumping failure input terminals.
- G. Provide signal generators that simulate control conditions if it is not feasible to create actual conditions.
- H. Use actual as-built control diagrams in demonstration of functions.
- I. Use Operation and Maintenance manuals to demonstrate operation of equipment.
- J. If functional test or performance test does not meet requirements specified in this Section, Contractor shall compensate Engineer for additional time required to observe functional testing until system successfully completes functional testing.

3.04 TRAINING

- A. Training shall not occur until after completion of successful functional testing, performance testing and the Interim O&M manual has been approved.
- B. Comply with Section 01600 – Material and Equipment.
- C. Comply with Section 01830 – Operation and Maintenance Data.

3.05 PLACING SYSTEMS IN SERVICE

- A. Complete functional and performance testing prior to placing system in service.

- B. Execute start-up under supervision of responsible manufacturer's representative and Contractor personnel.
- C. Place equipment in operation in proper sequence.

END OF SECTION

**MANUFACTURER'S CERTIFICATE OF
PROPER INSTALLATION AND OPERATION**

SCWRF Influent Screens Replacement

Date_____

PRODUCT: _____

SERIAL NO.: _____

SPECIFICATION SECTION: _____

As an authorized representative of the manufacturer, the undersigned certifies the product identified above has been inspected and is installed in accordance with the manufacturer's recommended standards, except as noted below.

The undersigned further certifies that the product identified above has been placed into satisfactory operation and that all controls, safety devices and product systems are functional, except as noted below.

Exceptions and comments:

Signature: _____

Printed Name: _____

A copy of this executed Certificate must be included in the Operation and Maintenance Data. A copy must be forwarded to the Engineer upon completion of start-up and testing.

SECTION 01770
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for contract closeout.

1.02 CLOSEOUT PROCEDURES

- A. Comply with procedures stated in General Conditions of the Contract for issuance of Certificate of Substantial Completion.
- B. When Contractor considers work has reached final completion, submit written certification that Contract Documents have been reviewed, work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.
- C. In addition to submittals required by the conditions of the Contract, provide submittals required by governing authorities, and submit a final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.
- D. If appropriate, Engineer will issue a final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Order.

1.03 PROJECT RECORD DOCUMENTS

- A. Project Record Documents shall be as specified in Section 01781 – Project Record Documents.
- B. Prior to Contract closeout, submit Record Documents to Engineer with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

1.04 WARRANTIES AND BONDS

Contractor shall ensure that all warranties and bonds have been received and submitted to Owner as specified in the Contract Documents.

1.05 SPARE PARTS

- A. Contractor shall ensure that all spare parts have been provided as specified in individual Product Sections. Spare parts shall be packaged and labeled as specified in Section 01600 – Material and Equipment.
- B. Contractor delivers the spare parts to the Owner at one time. The delivery shall include an itemized list to be signed and dated by the receiving party for the SCWRF.

1.06 OPERATION AND MAINTENANCE MANUALS

Contractor shall ensure that Operation and Maintenance manuals have been provided to the Owner as specified in Section 01830 – Operation and Maintenance Data.

1.07 CERTIFICATES OF PROPER INSTALLATION AND OPERATION

Contractor shall provide complete Certificates of Proper Installation and Operation as specified in the Contract documents.

PART 2 - PRODUCTS (not used)

PART 3 – EXECUTION

3.01 FINAL CLEANING

- A. Execute prior to final inspection.
- B. 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. Clean equipment and fixtures to a sanitary condition. Clean roofs, gutters, downspouts, and drainage systems.
- C. Clean site, sweep paved areas, and rake clean other surfaces.
- D. Remove waste, surplus materials, rubbish and temporary construction facilities from the site.

END OF SECTION

SECTION 01781
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

Requirements for preparation, maintenance and submittal of project record documents.

1.02 SUBMITTALS

- A. General: as specified in Section 1330 - Submittals
- B. At Contract close out, deliver copy of record documents to Engineer as specified in Section 01770 – Contract Closeout.

1.03 REQUIREMENTS

Contractor shall maintain at the site for the Owner one record copy of:

- A. Drawings
- B. Specifications
- C. Addenda
- D. Change orders and other modifications to the Contract
- E. Engineer's field orders or written instructions
- F. Approved shop drawings, working drawings and samples
- G. Field test records
- H. Construction photographs
- I. Detailed Progress Schedule

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION

3.01 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Project record documents shall be stored in Contractor's field office or other location approved by the OWNER apart from documents used for construction.
- B. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

- C. Make documents and samples available at all times for inspection by the Engineer and/or Owner.

3.02 RECORDING

A. General

1. Label each document "PROJECT RECORD" in neat, large, printed letters.
2. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.
3. Record information in red ink.

B. Record Drawings

1. Drawings shall indicate all deviations from Contract Drawings including:
 - a) Field changes of dimension and detail
 - b) Changes made by Change Order
 - c) Details, utilities, piping or structures not on original Contract Drawings.
 - d) Equipment and piping relocations.

C. Specifications and Addenda

Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
2. Changes made by Field Order or Change Order.

D. Shop Drawings

1. Keep one copy of the final, approved shop drawing with the Record Documents. Do not keep previously rejected submittals unless they are necessary to complete the submittal.
2. Record documents should include all shop drawing information submitted. Additional information submitted during the Engineer's review process should be filed with the appropriate submittal.

END OF SECTION

SECTION 01830

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for content and submittal of manufacturers' operation and maintenance data and content and submittal of Facility's Operation and Maintenance manual.

1.02 SUBMITTALS: MANUFACTURERS' O&M DATA

- A. Submittals shall be as specified in Section 01330 – Submittals.
- B. Draft: Submit one electronic copy of manufacturer's O&M Data not later than shipment of product. The Engineer will review and return with comments.
- C. Final: Revise the manufacturer's O&M Data based upon the Engineer's comments as well as the completed installation and any deficiencies noted during instruction of Owner's personnel. Submit electronically the complete, final O&M Data. Electronic submittals to be in PDF and all sections of the manual for each piece of equipment consolidated into one electronic file. Submit final O&M Data not more than 30 days after final inspection and startup.

1.03 CONTENTS, EACH VOLUME OF MANUFACTURER O&M DATA

- A. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Engineer, subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
- B. For Each Product or System: List names, addresses, facsimile and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- E. Instructions: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- F. Each manual shall comply with Parts 2.01. D through 2.01. G and 2.02 of this Section.
- G. Warranties and Bonds: Bind in copy of each.
- H. Additional Requirements: As specified in individual Product specification sections.

1.04 DATA FOR MATERIALS AND FINISHES

- A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. (Provide information for re-ordering custom manufactured Products.)
- B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

1.05 DATA FOR EQUIPMENT AND SYSTEMS

- A. Each Item of Equipment and Each System: Provide the following:
 - 1. Product Description
 - 2. Operating Procedures
 - 3. Maintenance Procedures
 - 4. Parts
 - 5. Lubricants
 - 6. Procedures and requirements for short term (less than 3 months) storage and for long term storage
 - 7. Other Specified Data.
- B. Manufacturer's Printed Operation and Maintenance Instructions: Provide manufacturer's printed operation and maintenance instructions.
- C. Control Data: Provide the following:
 - 1. Include sequence of operation by controls manufacturer.
 - 2. Control diagrams by controls manufacturer as installed.
- D. Panelboard Circuit Directories: Provide electrical service characteristics, controls and communications.
- E. Drawings, Diagrams, and Charts: Provide the following:
 - 1. Color coded wiring diagrams as installed
 - 2. Contractor's coordination drawings, with color-coded piping diagrams as installed
 - 3. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams
- F. Tests and Reports: Include tests and reports as specified in the following Sections:

1. Section 01430 – Material Testing
2. Section 01450 – Quality Control
3. Section 01750 – Testing and Startup
4. Division 02 through Division 16 – Individual Product specification sections.

1.06 OPERATION AND MAINTENANCE DATA REQUIREMENTS

A. Product Description

1. Identify each system and system component. Use identification numbers presented in the Contract Drawings and Specifications. Describe function, physical characteristics, normal operating characteristics, and alternate operating procedure.
2. Present performance curves, engineering data, and test results.
3. Describe operating limitations, environmental limitations, and any other limitations.

B. Operating Procedures

1. Provide instructions, including required sequences, for the following operations:
 - a. Startup following installation.
 - b. Break-in.
 - c. Routine
 - d. Preventative maintenance.
 - e. Calibration.
 - f. Emergency shutdown.
 - g. Startup following emergency shutdown.
2. Provide operating procedures for variations in sunlight, temperature, and humidity.
3. Provide operating procedures for variations in demand, flow, and loading.
4. Provide special operating procedures vital to the product.

C. Maintenance Procedures

1. Provide instructions for preventative, routine, and periodic maintenance including the following:
 - a. Servicing and lubricating schedule and sequences.
 - b. Wearing parts replacement schedule, including part numbers.
 - c. Product disassembly and assembly.
 - d. Alignment, adjustment, and testing.
 - e. Product re-calibration.
2. Provide a "trouble shooting" guide and repair instructions.

D. Parts

1. Provide complete nomenclature for all product parts including manufacturer's part number for replacement parts.
 2. Provide a list of recommended spare parts with instructions for storage of recommended spare parts.
 3. Provide a list of local sources of supply for parts.
- E. Lubricants
1. Provide a list of lubricants required. Identify the parts to be lubricated with each listed lubricant.
 2. Submit separate lubrication schedule for each piece of equipment.
 3. Other Data: Provide other Operation and Maintenance Data as specified in the individual Product specification sections.
- F. Other Data: Provide other operation and maintenance data as specified in the individual product specification sections.

PART 2 – PRODUCTS

2.01 GENERAL DESCRIPTION: FACILITY OPERATION AND MAINTENANCE MANUAL

- A. General: The Contractor shall submit a Facility Operation and Maintenance Manual, which shall be a compilation of all manufacturer's O&M data. This data shall include the data provided by the Contractor for the project known as South County Water Reclamation Facility Preliminary Treatment Influent Screens Replacement.
- B. Table of Contents: Provide a detailed Table of Contents in each Binder.
- C. Index of Tabs
1. Provide a tabbed index sheet for each equipment item, component, or subject. Index tabs shall provide quick reference points, which assist the Owner's personnel in the use of the manual.
 2. Indexes shall be 90-lb. stock, minimum. Tabs and binding strips shall be reinforced.
- D. Text
1. Text shall be legible and written in English. Each letter in the text shall be identifiable. Text shall be technically and grammatically correct.
 2. Prepare the text so that operation and maintenance personnel can easily read, understand, and properly apply the instructions contained in the text. Arrange the text in a logical format. Use headings to identify each set of procedures.
 3. Prepare text specific to this project. Preprinted text and brochures may be used to supplement text specific to this project if the text specific to this project contains reference, or references, to the preprinted material and if the preprinted material has been annotated to clearly show the part, or parts of the preprinted material that are applicable to this project.
 4. Text character height shall not be less than 8 points or more than 12 points. Larger size letters may be used for headings. Pitch shall be between 10 characters per inch and 16.66 characters per inch. The pitch may be less than 10 characters per inch in headings. Select character point and pitch to produce text, which is easy to read. Select a font style which is easy to read.

E. Illustrations

1. Provide illustrations as required to clearly present instructions, clarify the text, or both. Place illustrations so that the illustrations are in a logical relationship to the text.
2. Pages of the O&M Data may contain text, illustration, or text and illustrations. Preprinted illustrations and brochures containing illustrations may be used if the preprinted illustrations are applicable to this project or the preprinted illustrations are annotated to clearly show the illustrations or parts of illustrations that are applicable to this project.

F. Drawings

1. Provide drawings for each system in the O&M Data. Drawings shall show the relationship between the various components in each system and the equipment installed in each system. If there is fluid flow within a system, the drawings for the system shall include a flow diagram. If there is electrical power, control wiring, or both in a system, the drawings for the system shall include a wiring diagram, a control diagram, or both as applicable.
2. Identify systems, components, and enclosures on the O&M Data drawings. Present definitions of all abbreviations and symbols used on the O&M Data drawings.
3. Identify wire and terminal numbers on all wiring diagrams.
4. Drawings shall be specific to this project. Standard drawings may be used in the O&M data if the drawings are revised for this project.

G. Quality Assurance

1. Personnel who assemble the O&M Data and the Facility Manual shall be familiar with requirements of this Section.
2. O&M Data shall be written by, edited by, or written and edited by personnel skilled in technical writing to the extent required to communicate essential data.
3. Drawings, diagrams, figures, and illustrations shall be prepared by skilled draftsmen or CADD operators competent to prepare required. Drawings.

2.02 REPRODUCTION

- A. Text and drawings, sketches and diagrams used for illustrations shall be on 8-½" x 11" paper, 20-lb. minimum. Do not use sensitized paper.
- B. Photo prints shall be securely mounted on 8-½ x 11" backing or shall be mounted in sheet protectors. Photo print backing shall be heavy paper, 90-lb. minimum, card stock, or equal. Sheet protectors shall be non-glare, clear vinyl.
- C. Drawings shall be 8-½" x 11", 11" x 17", or larger. Drawings 8-½" x 11" and 11" x 17" shall be bound together with text and shall have reinforced holes. Drawings larger than 11" x 17" shall be folded and placed in pockets which are bound together with text or inside the back cover of the binder.
- D. Text and illustrations shall be originals, offset printed, photo prints, or first quality machine copies. Text and illustrations shall be crisp with a uniform background. If originals have characters, lines, or shading which are a color, or colors, other than black or the medium is a color, or colors other than white, provide machine color copies.

- E. Drawings shall be offset printed, blue line prints, black line prints, or first generation machine copies. Drawings shall be crisp with a uniform background. If originals have lines, characters, symbols, or shading which are a color, or colors, other than black, provide offset prints of drawings.

PART 3 – EXECUTION

3.01 TRAINING OF OWNER'S PERSONNEL

- A. Fully instruct Owner's designated operating and maintenance personnel in the operations, maintenance, adjustment, and calibration of products, equipment, and systems if specified in the applicable Section of the Specifications. The requirements for the training are described in Section 01600 – Material and Equipment.
- B. Use the O&M Data as the basis of instruction.
 - 1. Review contents of manual with personnel in full detail.
 - 2. Explain all aspects of operation and maintenance.

END OF SECTION

SECTION 02220

DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Removal of structures, equipment, piping, wiring, and other existing materials, wholly or in part, as required to complete Work as shown on the Drawings and specified in this Section.
- B. Removal and salvaging of designated equipment, materials, and piping. Disposal of rubble, debris, equipment, piping, wiring, and other materials removed.
- C. Special requirements to locate embedded conduit in concrete structures receiving partial or spot demolitions.

1.02 SUBMITTALS

- A. General: as specified in Section 01330 - Submittals
- B. Submit the following:
 - 1. Proposed methods for demolition;
 - 2. Equipment proposed to be used to do demolition work;
 - 3. Demolition schedule/sequence.

1.03 PROJECT/SITE CONDITIONS

- A. General
 - 1. Execute demolition so that there is no injury to persons or damage to adjacent buildings, structures, equipment, materials, piping, wiring, pavement, fences, guardrails, and other adjacent improvements. Execute demolition so that access to facilities that are in operation is free and safe.
 - 2. Execute demolition so that interference to vehicular traffic and personnel traffic does not exceed scheduled interference. Do not place rubble, debris, equipment, piping, wiring, pavement, fencing, or other materials removed on roadways, drives, or sidewalks that are to remain in service.
- B. Dust Control
 - 1. Control dust resulting from demolition so that dust does not spread to occupied portions of buildings and to facilities in service.
 - 2. Control dust resulting from demolition so that no nuisance is created in areas surrounding the project site.

PART 2 - PRODUCTS

2.01 TEMPORARY MATERIALS

- A. Provide temporary fencing, barricades, barriers, and enclosures to meet the requirements of this Section.
- B. Temporary fencing, barricades, barriers, and enclosures shall be suitable to the purpose intended.

2.02 REPAIR AND REPLACEMENT MATERIALS

For repair or replacement of existing work to remain, use materials identical to, or equal to, materials used in existing work when new.

PART 3 - EXECUTION

3.01 GENERAL

- A. Conduct demolition as shown and specified in the Contract Documents.
- B. Conduct demolition so that existing equipment, piping, wiring, structures, and other improvements to remain are not damaged. Repair or replace equipment, piping, wiring, structures, and other improvements damaged at no additional cost to the Owner.
- C. Do not remove equipment, piping, wiring, structures, or other improvements not shown or specified to be removed. If equipment, piping, wiring, structures, or other improvements not shown or specified to be removed is removed, replace equipment, piping, wiring, structures, or other improvements at no additional cost to the Owner.

3.02 PROTECTION OF CONDUIT AND CONDUCTORS

- A. It is the Contractor's responsibility in existing structures that receive partial or spot demolition, to protect embedded conduit and conductors. The Contractor shall use non-destructive imaging methods (radar, x-ray, etc.) to locate embedded conduit in concrete prior to demolition, saw cutting and core drilling. Relocate, repair and reconstruct functional conduits and conductors affected by the demolition.

3.03 DISCONNECTIONS

- A. Prior to starting demolition, check underground and exposed existing utilities, piping, and equipment within the limits of demolition. Prior to starting demolition, check underground and exposed existing utilities, piping, wiring, and equipment connected to and associated with buildings, structures, equipment, materials, piping, wiring, pavement, fences, guardrails, and other existing improvements to be removed. Verify the following:
 - 1. Piping is inactive (abandoned);
 - 2. Electrical power to equipment, lighting, controls, and other facilities has been permanently or temporarily disconnected, if required:

3. Utilities have been permanently disconnected or temporarily if required:
- B. Do not proceed with salvage or demolition if piping is active, electrical power has not been disconnected, or utilities have not been disconnected.

3.04 EMBEDDED ANCHORS, REBAR AND FASTENERS

- A. Remove all anchors, fasteners, reinforcing steel or similar devices embedded in concrete and associated with equipment, piping and materials to be removed or demolished.
- B. Chip around each anchor, fasteners, reinforcing steel or similar device to allow removal of the embedded material 0.5 inches from the surface for concrete not in continuous contact with water or earth and 1.0 inches from the surface for submerged or buried concrete surfaces or as directed by the Engineer. Unless noted otherwise, repair concrete with Sikatop 122 plus or approved equal. Provide exposed finish surface to match adjacent surface texture and color.

3.05 SALVAGE OF EQUIPMENT, PIPING, AND MATERIALS

- A. Remove items identified on the drawings, or specified, to remain the property of the Owner. Do not damage equipment, piping, and materials to be salvaged.
- B. Following removal of equipment, piping, and materials to be salvaged, place equipment, piping, and materials in a location designated by the Owner.

3.06 REPAIRS

Repair structural elements, equipment, piping, conduit, and other improvements to remain that are damaged during demolition. Use workers specifically qualified in trade, or trades, involved to repair damaged work.

3.07 DISPOSAL

- A. Remove equipment, piping, and materials not specifically designated to be retained by the Owner from the project site as Contractor's property.
- B. Contractor shall not accumulate or store debris from demolition on the project site.

3.08 FILLING

- A. Backfill excavations, trenches, craters, holes, and pits resulting from demolition and below ground, abandoned remains of partially demolished structures. Do not use debris in backfill.

3.09 CLEANUP

- A. Following demolition, clean-up areas where other work is to be done as specified in this Section, or Sections applicable to work to be done.
- B. Following demolition, clean-up areas where no other work is to be done under this Contract. Remove debris and rubbish, temporary facilities, and equipment. Level

surface irregularities to eliminate depressions. Leave work in a neat and presentable condition.

END OF SECTION

SECTION 02310

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for erosion and sedimentation control.

1.02 SUBMITTALS

- A. General: As specified in Section 01330 – Submittals and Section 01410 – Regulatory Requirements
- B. Submit copy of approved Erosion Control Plan (Storm Water Pollution Prevention Plan) to the Engineer prior to installing erosion and sedimentation control measures.

1.03 EROSION CONTROL PLAN

- A. Contractor shall be responsible for erosion and sedimentation control.
- B. The Contractor shall prepare an Erosion Control Plan that will include structures, locations, maintenance schedules, operational requirements and other measures that will be taken to control erosion.
- C. The Erosion Control Plan shall include management of all anticipated non-stormwater discharges such as dewatering and line flushing.
- D. The Erosion Control Plan shall include all phases of construction anticipated.
- E. Drawings showing locations and details of structures shall be included as necessary to show the proposed measures.

PART 2 - PRODUCTS

2.01 MATERIALS FOR EROSION AND SEDIMENT CONTROL

All materials shall comply with Section 104-6 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction and local regulations.

PART 3 – EXECUTION

- 3.01 All construction, maintenance, and removal of erosion control structures shall comply with Sections 104-6 to 104-8 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction and local regulations.

END OF SECTION

SECTION 05313
ALUMINUM WALKWAY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes reinforced aluminum plate walkway system.

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Clips and anchorage devices for gratings.
 - 2. Lift devices for removable grating
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For gratings, including analysis data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.06 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.07 FIELD CONDITIONS

Field Measurements: Verify actual locations of walls and other construction contiguous with floor support and systems by field measurements before submission of shop drawings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, licensed in Florida, to design the walkway system including slip resistant diamond aluminum floor plates, aluminum floor plate stiffeners, supports, lift mechanisms, hinged access doors, etc which shall be engineered to match existing in form and function.
- B. Structural Performance: Floor system shall be designed and anchored to concrete to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Floors: Uniform load of 125 lbf/sq. ft. (6.00 kN/sq. m) or concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.
 - 2. Limit deflection to $L/360$ or 1/2 inch (6.4 mm), whichever is less.

2.02 ALUMINUM

- A. General: Provide alloy and temper recommended by aluminum producer for type of use indicated, with not less than the strength and durability properties of alloy, and temper designated below for each aluminum form required.
- B. Extruded Bars and Shapes: ASTM B221 (ASTM B221M), alloys as follows:
 - 1. 6061-T6 or 6063-T6 for all flat plates and aluminum shapes

2.03 FASTENERS

- A. General: Provide **Type 316** stainless-steel fasteners
- B. Post-Installed Anchors: Torque-controlled expansion or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

2.04 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.

2.05 ALUMINUM FINISHES

- A. Clear anodized finish

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing floor system to concrete walls of channels. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing floor plate system. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Delete first paragraph below if no toeplates or if they are attached in shop.
- F. Attach toeplates to gratings by welding at locations indicated.
- G. Field Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- H. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 11292

SLIDE GATES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install, ready for operation and field test stainless steel gates and appurtenances as shown on the Contract Drawings and as specified herein.
- B. The gates and appurtenances shall be supplied in accordance with the latest edition of AWWA C561 Standard for Fabricated Stainless Steel Slide Gates as modified herein. The allowable leakage rate for the stainless-steel gates in this specification shall be 1/2 the allowable leakage listed in the latest revision of AWWA C561.

1.02 REFERENCES

AWWA C561	Fabricated Stainless Steel Slide Gates
ASTM A240	Stainless and Heat Resisting Plate
ASTM A312	Austenitic Stainless-Steel Pipe
ASTM A276	Stainless and Heat Resisting Steel Bars and Shapes
ASTM A564	Age Hardening Bars and Shapes
ASTM B584	Copper Alloy Sand Castings
ASTM D2000	Rubber Products in Automotive Applications
ASTM D4020	Ultra High Molecular Weight Polyethylene
ASTM F593	Stainless Steel Bolts, Hex Cap Screws and Studs
ASTM F594	Stainless Steel Nuts
AWS D1.6	Structural Welding Code – Stainless Steel

1.03 SUBMITTALS

- A. General: As specified in Section 01600 – Materials and Equipment and Section 01330 – Submittals.
- B. In addition, prior to equipment manufacture, submit the design calculations showing that gate plates will withstand design pressures to the Engineer for approval.
- C. Furnish operations and maintenance manuals in accordance with Section 01830 – Operation and Maintenance Data.
- D. Furnish manufacturer's Certificate of Proper Installation and Operation on all gates.

1.04 QUALITY ASSURANCE/QUALIFICATIONS

- A. All of the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 20 years' experience designing and manufacturing water control gates. The manufacturer shall have manufactured water control gates for a minimum of 100 projects.
- B. The manufacturer's shop welds, welding procedures, and welders shall be qualified and certified in accordance with the requirement of the latest edition of ASME, Section IX or AWS D1.6 Structural Welding Stainless Steel.
- C. The specification is based on the stainless-steel Gate as manufactured by Rodney Hunt, Inc of Orange, MA. or Engineer Pre-Approved Equal seven (7) days prior to bid.
- D. Contamination Prevention
 - 1. In order to avoid contamination and maintain surface purity, the principal manufacturing facility must have a dedicated stainless-steel facility segregated and isolated from the facility where products of other materials such as carbon steel or cast iron are manufactured. The stainless -steel material must be kept separated from other materials beginning from acquisition and storage through handling, fabrication, assembly, and dispatch.
 - 2. Mechanical removal of free iron particle, oil, dirt, paint, welding flux, slag, heat tint and scales of oxides must be supplemented with glass bead blasting followed by in house chemical bath pickling and passivation. Spray passivation or pickling and passivation performed by a third party is strictly not permitted.
- E. Corrosion Prevention
 - 1. To prevent crevice corrosion and advocate long life of stainless-steel fabricated products, the principal manufacturer must only use continuous welding practices performed in house by the principal manufacturer. To verify the quality of the welds, a dye penetration test shall be conducted on all weld joints and approved by a quality control inspector.
- F. Material Property Assurance
 - 1. Heatless cutting of stainless steel by a CNC water jet capable of 35,000 psi must be utilized to ensure there is no change in corrosion resistance properties of the stainless steel. Cutting methods utilizing heat will not be accepted.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Gates shall be used to control flow from the headworks to screen and from screens to grit chambers.
- B. The type, location, and dimensions of gates shall be as shown on the Contract Drawings.

2.02 MANUFACTURERS

- A. General: All gates shall be furnished by a single manufacturer. Gates shall be designed to allow a maximum leakage of 0.05 gpm per foot of wetted seal perimeter at design seating or unseating head conditions.
- B. The gate manufacturer shall be Whipps, Inc., Rodney Hunt Company or an approved equal manufactured in the United States.

2.03 GATES, GENERAL

- A. Each slide gate will be manufactured as detailed here and will be supplied fully tested as per requirements. To the maximum extent possible, the gate assembly comprising of frame, guides and slide will be supplied as a factory assembled unit and shipped to site ready to install on the wall thimble or wall.
- B. The slide gates will be manufactured in accordance with AWWA C-561.
- C. Gates shall be as specified herein and have the characteristics and dimensions shown on the Contract Drawings.
- D. The slide gates will be designed for water tightness for both seating and un-seating differential head per the actual site requirement as detailed in the Stainless-Steel Slide Gate Table.
- E. The slide gates will be shop tested to verify the leakage performance at operating head in the un-seating direction. Where sealing configuration permits, hydrostatic testing will be conducted at 1.5 times operating head, to demonstrate structural integrity. Testing for opening load at the unseating operating head to verify actuating mechanism sizing will also be conducted.
- F. The slide gates will be of rising stem type unless site geometry prohibits it. Operation will be by means of a manual hoist, electric actuator or hydraulic cylinder as detailed in the Stainless-Steel Slide Gate Table.
- G. The slide gate will be supplied complete with all accessories such as: gate assembly, gasket, studs and nuts for mounting, stem, thrust nut, stem couplings, stem guides, pedestal, operating mechanism as required, gate opening indicating arrangement and as required anchor bolts and fasteners for stem guides and pedestal.
- H. The allowable leakage rate for the slide gates in this specification shall be 1/2 the allowable leakage listed in the latest revision of AWWA C561, 0.05 gpm/ft of wetted seal perimeter in seating head and unseating head conditions.
- I. The gates shall utilize self-adjusting seals. Due to the difficulty of accessing gates when they are in service - gates that utilize adjustable wedges, wedging devices or pressure pads are not acceptable.
- J. All structural components of the frame and slide shall be fabricated of stainless steel having a minimum thickness of 1/4" and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.
- K. All welds shall be performed by welders with AWS certification for the material grades used in fabrication.

- L. All welds shall be full and continuous performed by welders with AWS certification for the material grades used in fabrication.
- M. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale accompanied by passivation. All iron and steel components shall be properly prepared, and shop coated with a primer.

2.04 GATE FRAMES, SLIDES, PLATES, SEALS, WALL THIMBLES, STEMS AND STEM GUIDES

A. General

1. Slide gates shall open when gate is raised.
2. Slide gates shall be surface mounted as indicated in Contract Drawings.
3. When fully closed, the slide gates shall be sealed on either four (4) or three (3) sides as shown in the Contract Drawings.

B. Gate Frames

1. The frame assembly, including the guide members, invert member and yoke members, shall be constructed of formed stainless steel plate with a minimum thickness of 1/4".
2. Frame design shall allow mounting directly to a wall with stainless steel anchor bolts and grout or mounting to a wall thimble with stainless steel mounting studs and a mastic gasket material. Mounting style shall be as shown on the Contract Drawings.
3. All wall mounted gates shall have a flange frame. Flat frame gates are not acceptable.
4. The structural portion of the frame that incorporates the seats/seals shall be formed into a one-piece shape for rigidity. Guide members design where water loads are transferred through the assembly bolts are specifically not acceptable.
5. Gussets shall be provided as necessary to support the guide members in an unseating head condition.
6. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening gates or downward opening weir gates.
7. On self-contained gates, a yoke shall be provided across the top of the frame. The yoke shall be formed by a structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The yoke shall be designed to allow removal of the slide.
8. A rigid stainless steel invert member shall be provided across the bottom of the opening. The invert member shall be of the flush bottom type on upward opening gates.
9. A rigid stainless steel top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.
10. A rigid stainless-steel member shall be provided across the invert of the opening or downward opening weir gates.

C. Slides

1. The slide and reinforcing stiffeners shall be constructed of stainless-steel plate. All structural components shall have a minimum thickness of 1/4".
 - a. The slide shall not deflect more than 1/360 of the span or 1/16", whichever is smaller, under the maximum design head.
 - b. When the width of the gate opening multiplied by the maximum design head is 80 square feet or greater, the portion of the slide that engages the guide members shall be of a "thick edge" design. The thick edge portion of the slide shall have a minimum thickness of 3".
 - c. Reinforcing stiffeners shall be continuously welded (stitch welding will not be acceptable) to the slide and mounted horizontally. Vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement.
 - d. The stem connector shall be constructed of two (2) angles or plates. The stem connector shall be continuously welded to the slide. A minimum of two (2) bolts shall connect the stem to the stem connector.

D. Seals

1. All gates shall be provided with a self-adjusting seal system to restrict leakage in accordance with the requirements listed in this specification. Provide UHMW-PE seals on the sides, top and invert of gates. As shown in the Contract Drawings.
 - a. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
 - b. The seat/seals shall extend to accommodate the 1-1/2 x the height of the slide when the slide is in the fully closed or fully opened position.
 - c. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member, or the bottom of the slide and it shall be held in place with stainless steel attachment hardware.
 - d. All downward opening weir gates shall be provided with UHMW polyethylene seats/seals across the invert member.
 - e. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.
 - f. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.
 - g. The seals shall be mounted so as not to obstruct the water way opening.
 - h. Gates that utilize rubber "J" seals or "P" seals are not acceptable.
 - i. The seal system shall have been factory tested to confirm negligible wear (less than 0.01") and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

E. Wall Thimbles

1. Wall Thimbles shall be provided when shown on the Contract Drawings.
 - a. The wall thimble depth shall be equal to the thickness of the concrete wall in which the thimble is to be mounted.
 - b. Wall thimbles shall be fabricated stainless steel construction of adequate section to withstand all operational and reasonable installation stresses.
 - c. Wall thimbles shall be constructed of ¼" minimum thickness stainless steel and the front face shall have a minimum thickness of ¼".
 - d. The fabrication process shall ensure that the wall thimble is square and plumb, and the front face is sufficiently flat to provide a proper mounting surface for the gate frame.
 - e. The face of the wall thimble shall only be machined if recommended by the gate manufacturer. If the wall thimble is to be machined, the front face shall have a minimum thickness of ¼" after machining.
 - f. A water stop shall be welded around the periphery of the thimble. Wall thimbles shall be designed to allow thorough and uniform concrete placement during installation.
 - g. Studs and nuts shall be stainless steel. Water stop may be stitch welded.
 - h. A suitable gasket or mastic shall be provided to seal between the gate frame and the wall thimble.

F. Stems

1. The slide gates will be supplied with rising type operating stems unless non-rising stems are required by installation geometry.
 - a. The stem will be supplied with ACME full or stub threading. The stem will be designed to allow for elevation deviations of up to 2".
 - b. The stem shall be constructed of solid stainless-steel bar for the entire length, the metal having a tensile strength of not less than 90,000 psi for stems that are 3" or less in diameter. Stems that are in excess of 3" in diameter shall have a tensile strength of 85,000 psi.
 - c. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2". Stem extension pipes are not acceptable.
 - d. The design of stem will be per the provision in AWWA C-561.
 - e. The L/r ratio will not exceed 200.
 - f. For buckling, Euler's formula will be used with an end condition of 2.0. For threaded sections, the radius of gyration will be based on the minor diameter. At the stem design load as follows, the yield strength of the material will not be exceeded.

- g. As a minimum for manual hoists, the stem design load is the load produced with a 100-pound effort on the crank or handwheel.
- h. For electric actuators, the stem design load is the greater of the load produced with a 100-pound effort handwheel effort and 1.50 times the load produced at a locked rotor condition.
- i. For hydraulic actuation, the stem design load will be 1.25 times the thrust produced at system relief pressure.
- j. Stems of more than one section shall be joined by stainless steel or bronze couplings. The coupling shall be threaded and bolted to the stems.
- k. Stems shall be provided with adjustable stop collars to prevent over closing of the slide.

G. Stem Guides

- 1. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
 - a. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.
 - b. Wall mounted stem guides will be adjustable in two directions, providing at least 0.50" of adjustment in both directions. Wall brackets will be stainless steel.
 - c. Wall mounted stem guides will have machine bored, split bushings to facilitate erection. Bushings will be bronze or UHMWPE. Stem guides mounting at the base of the pedestal do not require adjustment.

2.05 ELECTRIC ACTUATOR OPERATORS

Electric actuator shall be provided per Specification 15116 - Gate Actuators and as shown on the Contract Drawings.

2.06 MANUAL OPERATORS

- A. Unless otherwise shown on the Drawings, gates shall be operated by a manual handwheel gearbox. The operator shall be mounted on the yoke of self-contained gates or on the pedestal of non-self- contained gates.
 - 1. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb. effort when the gate is in the closed position and experiencing the maximum operating head.
 - 2. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.
 - 3. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
 - a. Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - b. Handwheel operators shall be equipped with roller bearings above and below the operating nut.

- c. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - d. The handwheel shall be removable and shall have a minimum diameter of 15".
 - e. Crank operated gearboxes shall be fully enclosed and shall have a cast aluminum or shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - f. Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.
 - g. Gears shall be steel with machined cut teeth designed for smooth operation.
 - h. The pinion shaft shall be stainless steel and shall be supported on ball or tapered roller bearings.
 - i. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - j. The crank shall be cast aluminum or cast iron with a revolving nylon grip.
 - k. The crank shall be removable.
4. Ductile iron housing.
- a. Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
 - b. Gearboxes
5. All gates having widths in excess of 72" and widths greater than twice their height shall be provided with two gearboxes connected by an interconnecting shaft for simultaneous operation.
- a. Interconnecting shafting shall be constructed of aluminum or stainless steel.
 - b. Flexible couplings shall be provided at each end of the interconnecting shaft.
 - c. One crank shall be provided to mount on the pinion shaft of one of the gearboxes.
6. An extended operator system (remote access) utilizing stainless steel chain and stainless-steel sprockets shall be furnished by the manufacturer when the centerline of the handwheel, on a non-gear operator, is located over 48" above the operating floor and as shown on the Contract Drawings. Chain wheels are not acceptable.
- a. A removable stainless-steel cover shall be provided to enclose chain and sprockets.
 - b. The extended operator system shall lower the centerline of the pinion shaft to 36" above the operating floor.

- c. A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60" or less above the operating floor.
- 7. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
 - a. The pedestal height shall be such that the handwheel or pinion shaft on the crank-operated gearbox is located approximately 36" above the operating floor.
 - b. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel.
 - c. Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb. effort on the handwheel.
 - d. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the Engineer. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.
 - e. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly as needed.
- 8. Operators shall be equipped with fracture-resistant clear butyrate or Lexan plastic stem covers.
 - a. The top of the stem cover shall be closed and vented. Gate opening indication will be provided on the stem cover for all non-rising stem gates. A full height scale will be mounted on the side of the stem cover and an indicator nut mounted on the rising stem to show gate position. The scale graduation will be 1".
 - b. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
 - c. Stem covers shall be complete with indicator markings to indicate gate position.
- 9. When shown on the Contract Drawings, provide a stainless steel 2" square nut, mounted in a floor box, with a non-rising stem shall be provided.
 - a. The floor box shall be constructed of stainless steel or cast iron and shall be set in the concrete floor above the gate as shown.
 - b. Provide one aluminum or stainless-steel T-handle wrench for operation.

2.07 ANCHOR BOLTS

- A. Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances.
 - 1. Quantity and location shall be determined by the gate manufacturer.
 - 2. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts.

3. Anchor bolts shall have a minimum diameter of 1/2".

PART 3 – MATERIAL OF CONSTRUCTION

The gates shall be manufactured using the materials in the table below.

Frame Assembly and Retainers:	Stainless Steel, ASTM A240Type 304L or ASTM A240 Type or 316L
Slide and Stiffeners:	Stainless Steel, ASTM A240Type 304L or ASTM A240 Type or 316L
Stem:	Stainless Steel, ASTM A276Type 304, or ASTM A240 Type or 316L
Fasteners, Nuts and Bolts:	Stainless Steel, ASTM A276Type 304 ASTM F593 and F594
Invert Seal Neoprene or EPDM (Upward Opening Gates Only):	GR1 for type 304 and GR2 for type ASTM D-2000
Seats/Seals and Facing:	Ultra-High Molecular Weight Polyethylene ASTM D4020
Lift Nuts:	Bronze ASTM B584
Pedestals and Wall Brackets:	Stainless Steel, ASTM A276 Type 304L, or ASTM A240 Type or 316L
Operator Housing:	Cast Aluminum or Ductile Iron

PART 4 - EXECUTION

4.01 INSTALLATION

- A. Installation of the gates and appurtenances shall be done in a workmanlike manner. It shall be the responsibility of the Contractor to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.
- B. The Contractor shall review the installation drawings and installation instruction prior to installing the gates.
- C. The gate assemblies shall be installed in a true vertical plane, square and plumb.
- D. The Contractor shall fill the void in between the gate frame and the wall with non- shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.
- E. The Contractor shall add a mastic gasket between the gate frame and wall thimble (when applicable) in accordance with the manufacturer's recommendations.

4.02 TESTING

- A. After installation, all gates shall be field tested in the presence of the Engineer and Owner to ensure that all items of equipment are in full compliance with this Section. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting. The effort to open and close manual operators shall be measured and shall not exceed the maximum operating effort specified above. Electric motor actuators shall function smoothly and without interruption. Each gate shall be water tested by the Contractor, at the discretion of the Engineer and Owner, to confirm that leakage does not exceed the specified allowable leakage.

4.03 MANUFACTURER'S REPRESENTATIVE

- G. As specified in Section 01600 – Material and Equipment and Section 01750 – Testing and Startup.
- H. The gate manufacturer shall provide a minimum of two days of installation inspection and testing.
- I. Each manufacturer shall issue a certificate approving the installation and operation of each gate.

END OF SECTION

**MANUFACTURER'S CERTIFICATE OF
PROPER INSTALLATION AND OPERATION**

PROJECT: SCWRF INFLUENT SCREENS REPLACEMENT

Date: _____

PRODUCT: _____

SERIAL NO.: _____

SPECIFICATION SECTION: _____

As an authorized representative of the manufacturer, the undersigned certifies the product identified above has been inspected and is installed in accordance with the manufacturer's recommended standards, except as noted below.

The undersigned further certifies that the product identified above has been placed into satisfactory operation, except as noted below.

Exceptions and comments:

Signature: _____

Printed Name: _____

A copy of this executed Certificate must be included in the Operation and Maintenance Data. A copy must be forwarded to the Engineer upon completion of startup and testing.

SECTION 11293

STAINLESS STEEL STOP LOGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall furnish and install stainless steel stop logs, guides and stop log pullers in accordance with the details shown on the Contract Drawings, specified in the Detailed Specifications and the requirements specified herein.
- B. Following successful completion of field tests, the CONTRACTOR shall store the stop logs and stop log pullers at the locations designated by the County Project Manager.

1.02 REFERENCES

ASTM A240 Stainless and Heat Resisting Plate
ASTM A276 Stainless and Heat Resisting Steel Bars and Shapes.
ASTM D2000 Rubber Products in Automotive Applications
ASTM D4020 Ultra-High Molecular Weight Polyethylene
ASTM F593 Stainless Steel Bolts, Hex Cap Screws and Studs
ASTM F594 Stainless Steel Nuts
AWS D1.6 Structural Welding Code – Stainless Steel

1.03 SUBMITTALS

- A. Provide the following information to confirm compliance with the specification in addition to the submittal requirements specified in Section 01330.
 - 1. Complete description of all materials including the material thickness of all structural components of the logs and the frame and guides.
 - 2. General assembly drawings showing all details of construction, details required for installation, dimensions, and anchor bolt locations.
 - 3. Maximum bending stress and deflection of the log under the maximum design head.

1.04 QUALITY ASSURANCE

A. Qualifications

- 1. All the equipment specified under this Section shall be furnished by a single manufacturer with a minimum of 20 years experience designing and manufacturing water control gates. The manufacturer shall have manufactured water control gates for a minimum of 100 projects.
- 2. The manufacturer's shop welds, welding procedures, and welders shall be qualified and certified in accordance with the requirement of the latest edition of ASME, Section IX or AWS D1.6 Structural Welding Stainless Steel.
- 3. The specification is based on the stainless steel stop logs as manufactured by Rodney Hunt, Inc of Orange, MA.

PART 2 - EQUIPMENT

2.01 GENERAL

- A. Stop logs, stop log frames and stop log lifters shall be manufactured as detailed here and shall be supplied fully tested per requirements.
- B. The gate manufacturer will be Rodney Hunt, Inc. or prior approved equal.
- C. The number, size and location of stop logs, guides, lifting devices and storage racks shall be provided as shown on the Contract Drawings or called for in the Detailed Specifications.
- D. The stop logs shall not deflect more than $1/360$ of the span of the log under the design head shown on the Contract Drawings or specified in the Detailed Specifications.
- E. The stop logs shall be designed for flow in either direction and seals shall be provided for this condition.
- F. Manufacturer maximum guaranteed leakage shall be 0.1 gallons per minute per linear foot of seal length.

2.02 STOP LOGS

- A. Stop logs shall be fabricated of stainless-steel plate reinforced with stainless steel plate or rolled structural horizontal and vertical members.
- B. End caps will not be allowed on the stop logs will be of sufficient weight to be submerged under their own weight.
- C. Two lifting lugs shall be provided for each stop log. Lifting lugs shall be capable of withstanding the lifting load necessary to remove the stop log under a differential head equal to the height of one log.

2.03 LOG TYPE SEALS

- A. Each stop log shall be provided with non-continuous interrupted seals along the bottom of the log and up both sides. The bottom seals shall be attached to the log with Type 316 stainless steel bars and fasteners. Seals shall be replaceable without resorting to plant shutdown.
- B. The shape of the seal shall provide a seating surface having a sufficient width to provide effective sealing.
- C. As indicated on the Contract Drawings, the bottom of the log shall seal flush with the invert of the finished concrete channel.

2.04 GUIDES (FRAME)

- A. As shown on the Contract Drawings, the guides for the stop logs shall be either head wall, channel surface mounted or embedded in the concrete.
- B. Guides shall be flared at the top to facilitate installation and prevent seal damage during insertion.
- C. Guides and all necessary attaching bolts and anchor bolts shall be furnished by the stop log manufacturer.

2.05 LIFTING DEVICE

- A. Lifting device shall be provided to remove and install the stop log as specified herein and shown on the Contract Drawings. The lifters shall be extendible so that they will function with different stop log lengths when stop logs of approximately the same overall width are supplied. Different length lifters shall be provided where stop logs differ in length by more than 2.5 feet.
- B. The lifting device shall be equipped with a suitable eye bolt for portable crane operation. The device shall be oriented in its position by the stop log guides and shall be capable of securing and releasing the stop logs with the use of a lanyard from the operating floor. The safe lifting capacity shall be shown on the lifter.

2.06 STOP LOG STORAGE

- A. Storage racks shall be provided by the manufacturer. Racks shall not require rotating the logs from vertical to horizontal. The design of the rack shall prevent the logs from resting on the seal. Individual logs shall be separated by vertical dividers to protect side seals. One storage rack shall include space for the lifter.
- B. Storage racks shall be designed for both lifting by a crane with a four-leg spreader and for handling with a fork truck. **Optional inclusion**, The storage racks shall be equipped with non-metallic casters sized for the loaded weight of the storage rack.

2.07 EXISTING SITES ONLY EXAMINATION OF STOP LOG LOCATIONS

- A. The Contractor shall examine the locations of the stop logs to verify all pertinent dimensions prior to fabrication of the stop logs.
- B. The Contractor shall have full responsibility for the proper fit of the furnished stop logs at the locations designated on the Contract Drawings.

PART 3 - MATERIALS OF CONSTRUCTION

Frame Assembly: Stainless Steel, ASTM A 240 /A276 Type 304

Logs and Stiffeners

Lifter: Stainless Steel, ASTM A 240 /A276 Type 316

Storage Rack: Stainless Steel, ASTM A 240 /A276 Type 304

Fasteners, Nuts and Bolts: Stainless Steel, ASTM A276 Type 316
ASTM F593 and F594 GR2, Type 316

Lip and Invert Seals Neoprene or EPDM ASTM D-2000

Bearing bars Ultra-High Molecular Weight Polyethylene

PART 4 - EXECUTION

4.01 INSTALLATION

- A. Installation of the guides shall be done in a workmanlike manner. It shall be the responsibility of the CONTRACTOR to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.
- B. The CONTRACTOR shall review the installation drawings and installation instruction prior to installing the guides.
- C. The guide assemblies shall be installed in a true vertical plane, square and plumb.
- D. The CONTRACTOR shall fill the void in between the guide and the wall with non-shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.

4.02 FIELD TESTING OF STOP LOGS

- A. The Contractor shall demonstrate, using a stop log puller and lifting device, the ease of installation, removal and the proper fit of the stop logs at their locations of use in the presence of and to the satisfaction of the Engineer.
- B. Where operating protocol permits, stop logs shall be tested for conformance to manufacturer's maximum guaranteed leakage.
- C. Any stop logs that do not fit or bind, or do not meet leakage requirements shall be repaired and retested all at no additional cost to the owner.

SECTION 11330

SCREENINGS WASHER COMPACTOR

PART 1 - GENERAL

1.01 SCOPE

- A. Contractor shall furnish and install screenings wash and press(es) (WAP) for washing, dewatering, compacting and conveying screenings material as shown on the drawings and described in the specifications. Each WAP shall be manufactured from stainless steel shapes. Fabrication and assembly shall be in conformance with these specifications and drawings.
- B. Each WAP shall include a cylindrical body, shafted auger, gear motor, wash water manifold with solenoid valve(s), anchor bolts, controls and all accessories and appurtenances specified or otherwise required for a complete and properly operating installation.
- C. The contractor shall coordinate all details of the equipment with other related parts of the work. And shall verify that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alterations required to accommodate equipment differing in dimensions, weight, or other characteristics from these specifications and drawings.
- D. The contractor shall install the equipment according to instructions and recommendations of the equipment manufacturer.
- E. The main power supply is 480 V, 60 Hz, 3-phase.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications
- B. ISO 281:2007 Calculation Method for Fatigue Life for Roller Bearings
- C. American Institute of Steel Construction (AISC) Publications
- D. American Welding Society (AWS), European Welding Federation (EWF), and International Institute of Welding (IIW) Publications
- E. American Structures Painting Council (ASPC) Publications
- F. International Organization for Standardization (ISO) Publications

1.03 SUBMITTALS

The manufacturer shall provide an electronic submittal for review by the engineer in accordance with Section 01300.

- A. Product Data: Include the following:
 - 1. Descriptive literature, brochures, catalogs, cut-sheets and supplementary material to define the equipment.
 - 2. Motor characteristics and performance information.
 - 3. Gear reducer data including service factor, efficiency, torque rating, and materials.
 - 4. Parts list including a list of recommended spare parts.
- B. Shop Drawings: Include the following:
 - 1. Manufacturer's installation drawings.
 - 2. Wiring and schematic diagrams.
- C. Operations and maintenance manual.
- D. Detailed mechanical and electrical installation instructions and procedures.
- E. Equipment weights and lifting points.
- F. Recommendations for short and long-term storage.
- G. A copy of the manufacturer's warranty.
- H. A copy of documents proving certification of the Manufacturer's Quality Management System according to ISO 9001 and Environmental Protection Management System according to ISO 14001.
- I. Failure to include all drawings applicable to the equipment specified in this section will result in rejection of the entire submittal with no further review.

1.04 QUALITY ASSURANCE

- A. To ensure quality, conformance, reliability, and environmental practices with regard to the manufacturing and production of the machinery described in this section, the equipment manufacturer shall meet the requirements listed in this section.
- B. Manufacturer shall have established an ISO 9001 certified quality management system. Manufacturers without an ISO 9001 certified quality management program must provide complete documentation of their existing quality management system with supplemental information clarifying why areas do not meet ISO 9001 standards. Meeting national quality management standards alone shall not be considered an acceptable substitute because ISO standards exceed national quality management standards.
- C. Manufacturer shall have established an ISO 14001 certified environmental protection management system. Manufacturers without an ISO 14001 certified environmental protection management system must provide complete documentation of their existing environmental

protection management system with supplemental information clarifying why areas do not meet ISO 14001 standards. Meeting national or local environmental protection management standards alone shall not be considered an acceptable substitute because ISO standards exceed national and local environmental protection management standards.

- D. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid (pickling bath) to remove any residues that may be present on the material because of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer, which is critical to the long life of the stainless steel.
- E. No stainless steel components may be fabricated or assembled in a factory where carbon steel products are fabricated, in order to prevent contamination by rust.
- F. Manufacturer shall have a minimum of twenty (20) years' experience producing equipment substantially similar to that required and shall be able to submit documentation of at least fifty (50) independent installations using the same type of equipment as detailed below. Each installation must have been in satisfactory operation for at least five (5) years.
- G. OEM: Manufacturer shall provide evidence of Original Equipment Manufacturer (OEM) of the specified wash and press design and manufacturing. Licensed wash and press designs shall not be accepted.
- H. All welding is performed in accordance with American Welding Society (AWS), European Welding Federation (EWF), International Institute of Welding (IIW), or equivalent.
- I. Manufacturer shall provide screen, motors, gear reducers, controls, control panels, and lifting attachments as a complete integrated package to ensure proper coordination, compatibility, and operation of the system.
- J. Manufacturer shall provide services by a factory-trained service technician, specifically trained on the type of equipment specified. Service technician requirements include, but are not limited to the following:
 - 1. Manufacturer shall have a minimum of ten (10) service technicians based in the United States for field service of the equipment. Manufacturer shall have multiple service locations with a minimum of one dedicated service location for both the eastern and western regions of the US.
 - 2. Service technician shall be present during initial energizing of equipment to determine directional testing.
 - 3. Service technician shall inspect and verify location of anchor bolts, placement, leveling, alignment and field erection of equipment, as well as control panel operation and electrical connections.
 - 4. Service technician shall provide classroom and/or field training on the operation and maintenance of the equipment to operator personnel.
 - 5. Manufacturer shall state field service rates for a service technician to owner and contractor. In the event that the field service time required by this section should not be sufficient to properly place the equipment into operation, additional time shall be

purchased by contractor to correct deficiencies in installation, equipment, or material without additional cost to owner.

- K. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or installation, defective workmanship or materials, and breakage or other failure. Materials shall be suitable for service conditions.
- L. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service prior to delivery, except as required by testing.
- M. Each major component of equipment shall have the manufacturer's name, address and product identification on a nameplate securely affixed to the equipment.

1.05 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT

- A. Equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.
- B. Contractor shall be responsible for unloading and shall have equipment on-site at the time of delivery permitting proper hoisting of the equipment.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. WAP Size 4 from HUBER Technology, Inc.
- B. Screening Wash and Press from pre-approved alternate manufacturer(s), as per section 1.06 above.
- C. Equipment of all manufacturers must be in accordance with these specifications and plans. Being named as a manufacturer does not eliminate their responsibility of providing equipment in compliance with the following specification section. Any deviations without sufficient evidence proving equal or superior quality shall be rejected without further review or comment.

2.02 PERFORMANCE REQUIREMENTS

Parameter	Value
Number of Units	2
Feed Type	Screen
Equipment Location [Indoor/Outdoor]	Outdoor
Installation Area Classification	Class 1 Division 1
Maximum Screenings Capacity [ft ³ /hr]	140
Optimal Screenings Throughput [ft ³ /hr]*	53-88
Maximum Moisture Content of Dewatered Screenings	65%
Wash Water Demand [gpm]	16
Wash Water Pressure [psi]	30-75
Minimum Drive Motor Rating [HP]	5.0

*For best performance and final product

- A. The equipment specified herein shall be standard equipment manufactured for use in a municipal wastewater treatment plant, specifically to reduce and separate fecal matter from raw sewage screenings.
- B. The screening equipment shall produce dewatered screenings capable of passing the EPA Paint Filter Test as described in method 9095 of EPA Publication SW-486.
- C. To minimize odors and nuisance, the conveyance, dewatering and compaction zones shall be completely enclosed.
- D. The spray wash system shall be enclosed such that spray water, aerosols or leakage do not escape from the housing enclosure.
- E. The control system shall be designed such that the cleaning characteristics of the wash and press system can be changed via the programmable controller. Systems which do not offer this feature will not be acceptable for this project.

2.03 PRODUCT DESIGN SPECIFICATIONS

A. MATERIALS

Washer/Compactor Body	316 Stainless Steel
Shafted Screw Auger	316 Stainless Steel
Inlet Hopper	316 Stainless Steel
Discharge Pipe	316 Stainless Steel
Guide Bars	Hardox 400 Plate
Flight Brushes	Nylon
Solenoid Valve(s)	Brass Bodied

B. SCREENINGS WASHER BODY

1. The WAP 4 screenings washer body shall be fabricated from 1/8" (3 mm) thick stainless steel. The 10-3/4" (273 mm) diameter screenings washer body shall include an extended trough opening for screenings deposit. A level mounting flange shall be provided around the trough for the transitional hopper that directs the screenings into the trough of the screenings washer. The hopper shall be fabricated from 3/32" (2.5 mm) thick stainless steel.
2. The screenings washer body shall house the shafted screw and shall include one (1) 3/4" diameter wash water connections in the compaction zone, one (1) 3/8" diameter connection in the screenings trough, and shall include one (1) connection to the drain pan to flush any debris from the drainage pan.
3. The screenings washer body shall include 3/16" (5 mm) diameter perforations spaced 13/32" (10 mm) center-to-center in a vertical alignment in the washing and compaction zones to drain the excess wash water and filtrate water pressed from the screenings to the drain pan. Designs utilizing larger openings or wedge wire drains shall not be acceptable.
4. The screenings washer body shall be equipped with not less than six (6) guide bars. The guide bars shall be bolted from the outside of the tube for easy access and removal. The guide bars shall be at least 14-1/2" (370 mm) long and the thickness shall be not less than 1/4" (6mm). Welded guide bars shall be not allowed.

C. SHAFTED SCREW

1. The shafted screw shall transport the screenings from the trough area (washing zone) into the compaction zone and shall force the compacted screenings out the discharge pipe. The shafted screw for the WAP 4 shall be fabricated from 3/16" (5 mm) thick stainless steel.

2. The screw flights shall have a minimum a thickness of 13/32" (10 mm) in the trough and perforated washing zones, and a thickness of 25/32" (20 mm) in the compression zone. The outside diameter of the screw shall be 10-3/16" (259 mm) and shall include a 6" (150 mm) flight pitch in the trough area and washing zone, and a 4-3/4" (120 mm) pitch in the compaction zone.
3. Screw flights in the compaction zone shall have a Hardox 400 abrasion resistant plate welded to the stainless steel flights. The last flight of the screw shall have Tubrodur hard metal seams welded around the external surface of the flight.
4. A stainless steel backed brush shall be attached to the shafted screw with set screws for the full length of the perforated washing zone. Brush segments fit in manufactured groove on the trailing edge of the flights. Designs that do not utilize brushes to clean the sieve or mount the brushes on the leading edge or top of the flights shall not be acceptable.

D. PLANT WATER MANIFOLD

1. The screenings washer shall be equipped with a manifold to provide plant water to the different washing inlet locations. The manifold shall be mounted directly to the top discharge end of the washer body. The screenings washer shall be provided with not less than two (2) separate connections for injecting wash water into the screenings and one (1) connection to the drain pan underneath the wash and press body. The unit shall be designed to accept wash water from the facility's non-potable water system, which is sourced from final plant effluent.
2. The main wash water supply line to the wash and press unit shall be provided with two (2) 1" diameter Burkert normally-closed solenoid valves with maximum operating pressure of 140psi. The solenoid valves shall be independently controlled by the PLC in the control panel. One solenoid valve shall supply wash water directed against the rotation of the screw flights in the inlet hopper and into the compaction zone of the WAP. The second solenoid valve shall direct wash water to the drain pan beneath the screening's washer body.

E. DRAIN PAN

1. The drain pan shall collect the spent wash water and filtrate water squeezed from the screenings. The drain pan shall be fabricated from 1/8" thick (3 mm) stainless steel and shall connect to the screening's washer body with stainless steel clasps for easy removal.
2. The drain pan shall include one (1) 3/4" threaded inlet connection for wash water from the manifold to flush the trough for cleaning purposes. A 3-1/2" (89 mm) diameter drain connection shall be provided to discharge the drained water back into the channel on the downstream side of the screen.

F. DISCHARGE PIPE

1. The wash and press discharge pipe shall be made of stainless steel and shall be connected to the screening's washer body by a 10" (250 mm) diameter flange. The diameter of the straight section of the discharge pipe shall increase in size to ease the transport of the screenings. The diameter of the discharge pipe straight section shall increase from 10-1/2" to 13-3/4" (267 mm to 350 mm). The bend fittings on the unit's discharge pipe shall have a radius that is three times (3x) larger than the pipe diameter.

G. GEAR MOTOR DRIVE MECHANISM

1. The drive unit shall be a gear motor rated for continuous duty and shall be selected to match the requirements of the particular wash press. The drive motor shall be totally enclosed designed for application in a C1D1, C1D2 or non-classified area. The motor shall be a constant speed unit rotating at 1760 rpm, and shall be powered by 230/460 VAC, 60 Hz, 3 phase power.
2. The drive unit shall be direct coupled to the screening wash and press drive shaft through the gear box. The gear box housing shall be constructed from ASTM A-48, Class 30 cast iron.
3. The gear box shall be designed for AGMA Class II, 24 hour duty.
4. The motor and gearbox paint treatment is designed to meet the requirements of the ISO 12944-2 Standard. The paint system shall consist of one coat of primer of the MG1500 series, autophoretic, e-coat, or powder coat per 004824-007BY, and a final coat of two-component, solvent based epoxy paint in the MG1025 series. Motors painted under this spec shall receive a coating with a total DFT in the range of 3.0 to 5.5 mils, (80 to 140 microns). Other paint specifications described in the sections covered by this proposal shall be superseded by this above described paint specification.

2.04 CONTROLS AND INSTRUMENTATION

A. GENERAL

The control system shall be provided by the screen supplier.

B. LOCAL CONTROLS ON EACH SCREEN

One (1) NEMA7, Class 1 Division 1 approved Cast Aluminum local control station per screen.

C. CONTROL PANEL (EACH UNIT)

1. A single main control panel shall be furnished with a lockable NEMA 4X corrosion-resistant stainless steel enclosure together with a single local push button station rated for a NEMA 7, Class 1 Division 1 environment.
2. Controls panel shall be made by a U.L. listed company and shall bear a U.L. label.
3. Control panel wiring shall be color coded, neatly cabled and supported in non-flammable wiring tracks. Wiring shall be minimum 14 gauge MTW stranded wire.

4. Control panel shall contain all power and control devices necessary for the proper function of the screen and shall include the following:
 - a. 600-Volt rated main circuit breaker disconnect with lockable handle
 - b. 480 – 120 Volt control power transformer
 - c. Reversible Screen VFD, Square D Altivar 31 or equal
 - d. HAND-OFF-AUTO selector switch for the operation of the bar screen drive
 - e. FORWARD-OFF-REVERSE selector switch for HAND operation. Switch shall spring return from REVERSE to OFF
 - f. Red pilot light for “Screen Run” indication
 - g. Amber pilot light for “Fault” indication
 - h. Amber pilot light for “High Water Level” indication
 - i. White pilot light for “Control Power” indication
 - j. Alarm silence and reset push buttons
 - k. Push-to-Stop/Pull-to Run emergency stop maintained push button with lockout
 - l. Dry contacts for remote indication of “Fault”, “Screen Running”, and “High Level”
 - m. Control relays, wiring and circuitry required to implement the control logic
 - n. High Level Float switch
 - o. Programmable controller (PLC) Allen Bradley Micro 800.
 - p. Operator interface Allen Bradley PanelView 800 4” color touchscreen to provide following:
 1. Display of current fault
 2. Alarm History
 3. Motor Hour Meter
 4. Operator access to user adjustable setpoints

D. SEQUENCE OF OPERATION

1. In AUTO position the screen shall be controlled by the water level sensors. Screen operation shall be started when the water level sensors monitor a certain water level difference, when the radar level sensor detects high water level, or when a certain time has passed since the last operation of the screen. Screen operation shall be stopped with an adjustable delay time after the water difference is below a certain value and after the radar level sensor ceases to indicate high water alarm, or after a certain run time has expired (if operation was started by timer).
2. If VFD registers high current, motor to enter a self-clearing mode. The self-clearing mode with attempt to reverse the direction of travel of the rakes for a set period before resuming forward operation. This cycle will be attempted up to three (3) times; if the self-clearing mode should prove unsuccessful then the system shall initiate an alarm signal.
3. Reset is manually performed after correction of any cause for a trip-out.
4. In HAND position the operator shall be able to run the rake assembly selecting the respective FORWARD or REVERSE direction from the FORWARD-OFF-REVERSE selector switch.

2.05 SPARE PARTS

A. The following Spare Parts shall be included and supplied together with the equipment:

1. Six (6) Guide bars
2. One (1) Cleaning brush
3. One (1) Solenoid valve rebuild kit

PART 3 - EXECUTION

3.01 INSTALLATION, START-UP AND OPERATOR TRAINING

- A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify engineer of significant deviations.
- B. Installation of the equipment shall be in strict accordance with the contract documents and the manufacturer's instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. Contractors shall install the anchor bolts in accordance with the manufacturer's recommendations.
- C. Contractor shall provide all couplings, transitions and adapters required to connect proposed piping to existing portions of the water supply and drain system as required for a complete and fully functional installation.
- D. After installation, touch-up paint shall be applied to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting. Contractor shall passivate all field welds.

- E. Supplier shall furnish the services of a factory-trained service technician for one (1) trip including a total two (2) workdays to inspect the installation, observe start up, and provide operator training.
1. Equipment shall not be energized, or “bumped” to check the electrical connection for motor rotation without the service technician present.
 2. The service technician shall make all necessary adjustments and settings to the controls.
 3. The service technician shall demonstrate proper and sequential operation of the dewatering system. The dewatering system shall be able to operate fully automatically.
 4. The technician shall demonstrate for a minimum of 5 business days of successful operation of the first installed WAP and Screen System before putting in-service prior to construction of the second WAP and Screen System.

3.02 WARRANTY

The manufacturer shall warrant against any defects in material or workmanship to the screw press and framework. This warranty shall commence upon delivery of the products and shall expire on the earlier to occur of one (1) year from initial operation of the product or 18 months from delivery thereof (the “Warranty Period”).

END OF SECTION

SECTION 11331

MECHANICALLY CLEANED CENTER FLOW BAR SCREEN

PART 1 - GENERAL

1.01 SCOPE

- A. The contractor shall furnish and install center flow type, multiple rake bar screens as indicated on the drawings. Each screen shall be manufactured from AISI 316L stainless steel shapes. Fabrication and assembly shall be in conformance with these specifications and drawings.
- B. Each screen shall be furnished complete with bar rack, dead plate, discharge chute, side frames, covers, rake blades, drive chains, sprockets and bearings, scraper assembly, drive motor, gear reducer, anchor bolts, controls and all accessories and appurtenances specified or otherwise required for a complete and properly operating installation.
- C. The contractor shall coordinate all details of the equipment with other related parts of the work. He shall verify that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alterations required to accommodate equipment differing in dimensions, weight, or other characteristics from these specifications and drawings.
- D. The contractor shall install the equipment according to instructions and recommendations of the equipment manufacturer.
- E. The main power supply is 480 V, 60 Hz, 3-phase.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications:
- B. ISO 281:2007 Calculation Method for Fatigue Life for Roller Bearings.
- C. American Institute of Steel Construction (AISC) Publications
- D. American Welding Society (AWS), European Welding Federation (EWF), and International Institute of Welding (IIW) Publications
- E. American Structures Painting Council (ASPC) Publications
- F. International Organization for Standardization (ISO) Publications.

1.03 SUBMITTALS

The manufacturer shall provide an electronic submittal for review by the engineer in accordance with Section 01300.

- A. Product Data: Include the following:
 - 1. Descriptive literature, brochures, catalogs, cut sheets and supplementary material to define the equipment.
 - 2. Motor characteristics and performance information.
 - 3. Gear reducer data including service factor, efficiency, torque rating, and materials.
 - 4. Parts list including a list of recommended spare parts.
- B. Shop Drawings: Include the following:
 - 1. Manufacturer's installation drawings.
 - 2. Wiring and schematic diagrams.
- C. Operations and maintenance manual.
- D. Detailed mechanical and electrical installation instructions and procedures.
- E. Equipment weights and lifting points.
- F. Recommendations for short and long-term storage.
- G. A copy of the manufacturer's warranty.
- H. A copy of documents proving certification of the Manufacturer's Quality Management System according to ISO 9001 and Environmental Protection Management System according to ISO 14001.
- I. Failure to include all drawings applicable to the equipment specified in this section will result in rejection of the entire submittal with no further review.

1.04 QUALITY ASSURANCE

- A. To ensure quality, conformance, reliability, and environmental practices with regard to the manufacturing and production of the machinery described in this section, the equipment manufacturer shall meet the requirements listed in this section.
- B. Manufacturer shall have established an ISO 9001 certified quality management system. Manufacturers without an ISO 9001 certified quality management program must provide complete documentation of their existing quality management system with supplemental information clarifying why areas do not meet ISO 9001 standards. Meeting national quality management standards alone shall not be considered an acceptable substitute because ISO standards exceed national quality management standards.
- C. Manufacturer shall have established an ISO 14001 certified environmental protection management system. Manufacturers without an ISO 14001 certified environmental protection management system must provide complete documentation of their existing environmental protection management system with supplemental information clarifying why areas do not meet ISO 14001 standards. Meeting national or local environmental protection management

standards alone shall not be considered an acceptable substitute because ISO standards exceed national and local environmental protection management standards.

- D. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid (pickling bath) to remove any residues that may be present on the material because of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer, which is critical to the long life of the stainless steel.
- E. No stainless steel components may be fabricated or assembled in a factory where carbon steel products are fabricated, in order to prevent contamination by rust.
- F. The manufacturer shall have a minimum of twenty (20) years' experience producing multi-rake screens and upon request shall submit to the engineer documentation of fifteen (15) installations similar or larger than specified herein, that have been in operation for at least five (5) years
- G. All welding is performed in accordance with American Welding Society (AWS), European Welding Federation (EWF), International Institute of Welding (IIW), or equivalent.
- H. Manufacturer shall provide screen, motors, gear reducers, controls, control panels, and lifting attachments as a complete integrated package to ensure proper coordination, compatibility, and operation of the system.
- I. Manufacturer shall provide services by a factory-trained service technician, specifically trained on the type of equipment specified. Service technician requirements include, but are not limited to the following:
 - 1. Manufacturer shall have a minimum of ten (10) service technicians based in the United States for field service of the equipment. Manufacturer shall have multiple service locations with a minimum of one dedicated service location for both the eastern and western regions of the US.
 - 2. Service technician shall be present during initial energizing of equipment to determine directional testing.
 - 3. Service technician shall inspect and verify location of anchor bolts, placement, leveling, alignment and field erection of equipment, as well as control panel operation and electrical connections.
 - 4. Service technician shall provide classroom and/or field training on the operation and maintenance of the equipment to operator personnel.
 - 5. Manufacturer shall state field service rates for a service technician to owner and contractor. In the event that the field service time required by this section should not be sufficient to properly place the equipment into operation, additional time shall be purchased by contractor to correct deficiencies in installation, equipment, or material without additional cost to owner.

- J. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or installation, defective workmanship or materials, and breakage or other failure. Materials shall be suitable for service conditions.
- K. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service prior to delivery, except as required by testing.
- L. Each major component of equipment shall have the manufacturer's name, address and product identification on a nameplate securely affixed to the equipment.

1.05 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT

- A. Equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.
- B. Contractor shall be responsible for unloading and shall have equipment on-site at the time of delivery permitting proper hoisting of the equipment.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. RakeMax-CF Model 2849X500X625/4 from Huber Technology, Inc.

Alternates shall not be acceptable.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

Parameter	Value
Location in Facility	-
Number of Units	2
Approach Channel Width [ft]	4
Channel Width at Screen Location [ft]	4
Channel Depth [ft]	5.67
Channel Invert to Operating Deck [ft]	5.67
Equipment Location [Indoor/Outdoor]	Outdoor
Installation Area Classification	Class 1 Division 1
Peak Hourly Flow (per Screen) [MGD]	16
Average Daily Flow (per Screen) [MGD]	-
Downstream Water Level During PHF [in]	40
Downstream Water Level During ADF [in]	-
Maximum Upstream Water Level [in]	55
Maximum Headloss During PHF* [in]	16
Minimum Freeboard [in]	-
Chamber Opening [in]	15.75 (400mm)
Bar Grid Depth (Parallel with Channel) [in]	-
Clear Spacing Between Screening Bars [in]	0.157 (4mm)
Minimum Bar Dimensions (Rectangular Profile) [in]	0.16 x 0.75
Inclination from Horizontal within Channel [degrees]	90
Discharge Height Above Channel Invert [ft]	-
Minimum Motor Rating [HP]	1.5

*Based on 30% blinding of the screen field.

1. The travel speed of the rakes shall be between 26 and 39 feet per minute (8 to 12 m/min).
2. All parts shall be designed and manufactured to handle the forces that may be exerted on the screen during fabrication, shipping, erection, and proper operation according to the O&M

manual.

3. All components shall be so designed that jamming at any point will not result in structural failure but will cause the drive motor to stall. All components, including the gear reducer, shall be designed to withstand, without damage or permanent distortion, the full stalling torque of the drive motor and/or the maximum differential head at any channel water depth.

2.03 BAR SCREEN DESIGN SPECIFICATIONS

A. MATERIALS

Frame, Deadplate, Chain Guides & Discharge Chute	316L Stainless Steel
Screening Bars & Rakes	316L Stainless Steel
Screen Covers	316L Stainless Steel
Drive Chain Links	316L Stainless Steel
Drive Chain Pins & Bushings	AISI-431 Stainless Steel
Drive Chain Rollers	Polyamide
Drive Shaft & Sprockets	316L Stainless Steel
Wiper Blade	Polyethylene
Channel Seals	EPDM

1. Screen shall be manufactured from shapes (rods, angles, and channels), pipes, and sheets from stainless steel material as noted in the table above.
2. Screen shall be manufactured in a stainless steel only factory to prevent contamination of the stainless steel with rusty dust.
3. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid (pickling bath) to remove any residues that may be present on the material as a result of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel. Sand blasting, bead blasting, spray pickling or hand pickling of stainless steel surfaces shall not be acceptable.
4. Upper sprocket bearings shall have a paint coated cast iron casing and include ball bearings with grease nipples that are double sealed with Nilos rings.

B. CONSTRUCTION

1. The fine screen shall be the center flow type. The flow enters the inside of the screen's chamber opening and exits through both vertical sides and the bottom of the stationary screening bars. Screen designs that are not center flow type or screens utilizing rotating, continuous belts of plates, links or other screening media will not be acceptable for this project.

2. The bar screen shall remove debris (screenings) from the incoming wastewater by means of a positively cleaned, U-shaped bar rack that is installed within a concrete channel. The screen shall retain debris at the bar rack. A multitude of rake blades shall remove and lift the debris to a discharge mechanism. The bar rack shall be cleaned by a series of rakes engaging the bar rack starting above the maximum upstream water level and continuously engaging within the screening bars while moving along the entire bar rack length. The debris shall be lifted vertically above the operating deck elevation, transferred to a 70° screen section before dropped on a discharge chute to the side of the screen (parallel to influent flow).
3. Screens with single rakes shall not be approved. Screens employing brushes and spray water for screenings removal shall not be approved. Screens centrally discharging within the chamber opening width (above the channel) to an internal sluice, conveyor or press shall not be approved. Screens that engage the rakes into the screening bars below the water level shall not be approved as they are susceptible to jams and/or damaged rake teeth.
4. The bar rack shall consist of equally spaced bars that are formed from a continuous length of stainless steel. The bar rack shall have a “U” shaped profile to accommodate the center flow screen design over the entire bar grid depth as specified herein. Individual bars shall have a rectangular cross section with a width of 5/32” (4 mm), a depth of minimum 0.75” (20 mm). Round, tear-shape or trapezoidal bar shapes will not be acceptable. The bar rack shall be made up of equally sized sections securely fastened to the frame of the screen and be readily removable. Screens without the ability to replace bar screen sections will not be acceptable for this project.
5. A frame shall be provided supporting all required loads. Front and rear shell frames shall be made of 10/64 inch (4 mm) thick stainless steel plates with a minimum of four axial edges. The shell frames shall be connected with each other through channels having a minimum thickness of 10/64 inch (4 mm) and a minimum cross section of 4-1/4 inch x 2 inch (108 x 49 mm). The shell frames shall be connected to extended support brackets to reach the side channel walls. The support brackets shall be securely anchored onto the operating floor.
6. The bar screen shall be provided with a dead plate extending from the bar rack to the discharge chute, positioned parallel with the incoming flow. The dead plate shall be made of 10/64 inch or 4 mm thick stainless steel plate and shall be stiffened by structural members so that it is flat without undulation so that the tips of the rake’s teeth ride at a distance between 1 to 2 mm over the dead plate. Upper portion of the dead plate shall incorporate a rounded transition from 90° to 70° prior to the discharge point. The dead plate shall be securely fastened to the front and rear shell frames.
7. The back-plate of the screen shall be furnished with modular overflow weir plates that provide a stationary overflow weir for emergencies. The upper plates shall be bolted to the shell frames and set just above the maximum upstream water level. Screen designs that do not incorporate a fixed emergency overflow option will not be acceptable for this project.
8. A discharge chute shall be provided that fully encloses the discharge section of the screen. An access hatch with hinges and a handle shall be provided in the chute permitting easy access. The discharge chute shall be mounted to direct screenings into the appropriate receiving washer/compactor, sluice, conveyor or screenings bin. The

chute shall have a slope of minimum 60 degrees. The discharge chute shall be made of a minimum 10/64 inch or 4 mm thick stainless steel plate.

9. The screen shall be provided with easily removable, sufficiently stiffened covers made of 3/64 inch (1.5 mm) thick stainless steel plates with edges on all sides. The covers shall be provided with turn locks and handles.
10. If influent channel width is greater than the chamber opening, two (2) stainless steel baffle plates shall be included and bolted to the front of the screen and anchored to the concrete channel to direct the influent flow into the chamber opening. The baffle plates shall be formed from minimum 13 gauge material and set at minimum 45° to reduce headloss through the reduction and shall match the height of the overflow weir plate within the screen to provide additional weir length for emergencies.
11. Each shell frame shall include separate roller tracks to guide the rakes. The roller tracks shall be bolted to the frame so that they can easily be replaced. The roller tracks shall be made of minimum 10/64 inch (4 mm) thick L-profiles.
12. Drive chains for the rakes shall be roller type. Each chain shall be rated for a maximum load of 56,000N (12,589lbs.f). Drive chains, chain guides, sprockets and their bearings shall be replaceable without the need for removing the screen from the channel. Chain pitch shall be no less than 6-5/16 inch (160mm). Screens utilizing drive chains constructed from alternative materials will not be acceptable for this project due to the corrosive nature of wastewater.
13. Chain rollers shall have a diameter of 2-3/8 inch (60 mm) and shall be a minimum of 1-1/4 inch (32 mm) wide.
14. Each screen shall be provided with two upper sprockets with a reference diameter of 17-3/8 inch (442 mm). The sprockets shall be split to facilitate maintenance. The sprockets shall be made of minimum 1-1/8 inch (29 mm) thick stainless steel plates. Screen designs that utilize sprockets constructed of differing materials will not be acceptable for this project. Screens that utilize submerged bottom sprockets or guide discs will not be acceptable for this project.
15. Upper bearings shall be flange bearings and shall be provided with grease nipples for easy lubrication. The bearings shall be designed for use with biodegradable grease. Their diameter shall be a minimum of 2 inch (50mm). The casing shall be made of paint coated cast iron.
16. Rakes shall include rake bars made of 1/4 inch (6 mm) thick channel profile having a cross section of 8-1/4 inch x 3 3/8 inch (210 x 85 mm). Curved rake blades with a thickness of 13/64 inch (5 mm) and a depth of minimum 5-1/2 inch (140 mm) shall be bolted on the rake bars. Rake blades shall be set at an obtuse angle to that of the screening bar face to prevent screenings push-through or jams. The rake blades and reinforcing rake shall have teeth matching and engaging the bars of the bar rack. Reinforcing rake blade teeth shall be formed from minimum 3/8" (10 mm) thick stainless steel and welded to the underside of each rake blade. Individual rake blade teeth shall have a minimum depth of 3/4 inch (20 mm) to ensure full engagement with a tolerance width of 1 mm between the screening bars to provide optimal cleaning. Reinforcing rake teeth shall have a minimum 1.5 mm tolerance width.
17. A pivoting scraper mechanism shall be positioned at the point of discharge and shall be

- attached to the shell frames. The scraper shall clean the rake on each pass and return to its rest position with minimal shock. The scraper shall be designed such that screenings do not wrap around the rake or scraper. The scraper shall be provided with a scraper bar made 10/64 inch (4 mm) thick channel profile with a minimum cross section of 1-1/2 inch x 2-11/16 inch (39 x 68 mm) and an adjustable 3/8 inch (10 mm) thick blade. The scraper shall be connected with the frame through a pair of minimum 20 inch (500 mm) long scraper arms that shall be made of 10/64 inch (4 mm) thick channel profile with a minimum cross section of 2-3/4 inch x 2-3/8 inch (68 x 59 mm). A pair of shock absorber elements made of EPDM shall be provided.
18. The drive shaft shall be hollow and have a diameter of minimum 3-1/8 inch (80mm) and a wall thickness of minimum 13/64 inch (5 mm). Solid drive shafts shall not be accepted.

C. GEAR MOTOR DRIVE MECHANISM

1. The drive unit shall be designed for continuous service and intermittent spray water contact.
2. The bevel gear reducer shall be a totally enclosed unit. Gear reducer shall have ball or roller bearings throughout with all moving parts immersed in oil. Gear reducers which require periodic disassembly of the unit and manual re-greasing of bearings are not acceptable. The nominal input power rating of the gear reducer shall be at least equal to the nominal horsepower of the drive motor. Gear reducer shall be designed and manufactured in compliance with applicable AGMA or equivalent standards. During continuous operation the oil temperature shall not exceed 200 degrees F (95 degrees C).
3. The rake assembly shall be driven by an electric motor. The motor shall be UL rated for operation in Class 1 Division 1 environment. The motor shall be inverter duty rated, 460 Volts, 60 Hz, 3-phase. The motor shall be rated for operation in a 104 degree F (40 degree C) environment.
4. The motor and gearbox paint treatment is designed to meet the requirements of the ISO 12944-2 Standard. The paint system shall consist of one coat of primer of the MG1500 series, autophoretic, e-coat, or powder coat per 004824-007BY, and a final coat of two-component, solvent based epoxy paint in the MG1025 series. Motors painted under this spec shall receive a coating with a total DFT in the range of 3.0 to 5.5 mils, (80 to 140 microns). Other paint specifications described in the sections covered by this proposal shall be superseded by this above described paint specification.

2.04 CONTROLS AND INSTRUMENTATION

A. GENERAL

The control system shall be provided by the screen supplier.

B. LOCAL CONTROLS ON EACH SCREEN

One (1) NEMA7, Class 1 Division 1 approved Cast Aluminum local control station per screen.

C. WATER LEVEL SENSORS

- i. Bar screen manufacturer shall provide two (2) HydroRanger 200 ultrasonic differential

sensors for continuously monitoring of the upstream and downstream water levels for control of screen operation. The sensors shall be rated for Class 1 Division 1 hazardous locations and shall be intrinsically safe without the use of additional barriers. Contractor shall install the sensors and provide wiring to the control panel.

- ii. Screen manufacturer shall provide a float switch with intrinsically safe relays and submersible cable for emergency high flow and backup situations and alarm. Contractor shall install the float switch and provide wiring to the control panel.

D. CONTROL PANEL (EACH UNIT)

1. A single main control panel shall be furnished with a lockable NEMA 4X corrosion-resistant stainless steel enclosure together with a single local push button station rated for a NEMA 7, Class 1 Division 1 environment.
2. Controls panel shall be made by a U.L. listed company and shall bear a U.L. label.
3. Control panel wiring shall be color coded, neatly cabled and supported in non-flammable wiring tracks. Wiring shall be minimum 14 gauge MTW stranded wire.
4. Control panel shall contain all power and control devices necessary for the proper function of the screen and shall include the following:
 - a. 600-Volt rated main circuit breaker disconnect with lockable handle
 - b. 480 – 120 Volt control power transformer
 - c. Reversible Screen VFD, Square D Altivar 31 or equal
 - d. HAND-OFF-AUTO selector switch for the operation of the bar screen drive
 - e. FORWARD-OFF-REVERSE selector switch for HAND operation. Switch shall spring return from REVERSE to OFF
 - f. Red pilot light for “Screen Run” indication
 - g. Amber pilot light for “Fault” indication
 - h. Amber pilot light for “High Water Level” indication
 - i. White pilot light for “Control Power” indication
 - j. Alarm silence and reset push buttons
 - k. Push-to-Stop/Pull-to Run emergency stop maintained push button with lockout
 - l. Dry contacts for remote indication of “Fault”, “Screen Running”, and “High Level”
 - m. Control relays, wiring and circuitry required to implement the control logic
 - n. High Level Float switch
 - o. Programmable controller (PLC) Allen Bradley Micro 800.
 - p. Operator interface Allen Bradley PanelView 800 4” color touchscreen to provide following:
 1. Display of current fault
 2. Alarm History

3. Motor Hour Meter
4. Operator access to user adjustable setpoints

E. SEQUENCE OF OPERATION

1. In AUTO position the screen shall be controlled by the water level sensors. Screen operation shall be started when the water level sensors monitor a certain water level difference, when the radar level sensor detects high water level, or when a certain time has passed since the last operation of the screen. Screen operation shall be stopped with an adjustable delay time after the water difference is below a certain value and after the radar level sensor ceases to indicate high water alarm, or after a certain run time has expired (if operation was started by timer).
2. If VFD registers high current, motor to enter a self-clearing mode. The self-clearing mode with attempt to reverse the direction of travel of the rakes for a set period before resuming forward operation. This cycle will be attempted up to three (3) times; if the self-clearing mode should prove unsuccessful then the system shall initiate an alarm signal.
3. Reset is manually performed after correction of any cause for a trip-out.
4. In HAND position the operator shall be able to run the rake assembly selecting the respective FORWARD or REVERSE direction from the FORWARD-OFF-REVERSE selector switch.

2.05 SPARE PARTS

- A. The following spare parts shall be included and supplied with the equipment:
1. Two (2) wipers for scraper
 2. Two (2) proximity switches
- B. Spare parts shall be packaged with labels including a description of the contents.

PART 3 - EXECUTION

3.01 INSTALLATION, START-UP AND OPERATOR TRAINING

- A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify engineer of significant deviations.
- B. Installation of the equipment shall be in strict accordance with the contract documents and the manufacturer's instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. Contractors shall install the anchor bolts in accordance with the manufacturer's recommendations.
- C. After installation, touch-up paint shall be applied to all scratched, abraded and damaged shop painted surfaces. Coating type and color shall match shop painting. Contractor shall passivate all field welds.
- D. Supplier shall furnish the services of a factory-trained service technician for one (1) trip including a total of two (2) workdays to inspect the installation, observe start up, and provide operator training. Operator training should be in accordance with Section 01600, 3.09.
 - 1. Equipment shall not be energized, or "bumped" to check the electrical connection for motor rotation without the service technician present.
 - 2. The service technician shall make all necessary adjustments and settings to the controls.
 - 3. The service technician shall demonstrate proper and sequential operation of the screening system. The screen shall be able to operate fully automatically.

3.02 WARRANTY

- A. The manufacturer shall warrant against any defects in material or workmanship to the screen and framework. This warranty shall commence upon delivery of the products and shall expire on the earlier to occur of one (1) year from initial operation of the product or 18 months from delivery thereof (the "Warranty Period").

END OF SECTION

SECTION 15060

SUPPORTS AND ANCHORS FOR EXPOSED PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for furnishing and installation of supports, anchors, and appurtenances for exposed piping as shown on the Drawings and specified in this Section.

1.02 REFERENCES

A. ANSI/ASME Standards

ANSI/ASME B31.1 Power Piping

B. ASTM Standards

ASTM E84 Test Method for Surface Burning Characteristics of Building Materials

1.03 DEFINITIONS

References to pipe, fittings, and valve sizes on the Drawings and in the Specifications are intended to be nominal size and shall be interpreted as nominal size.

1.04 SUBMITTALS

A. General: As specified in Section 01600 – Material and Equipment and Section 01330 – Submittals.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Furnish and install supports and anchors as required for complete and properly supported and restrained piping systems.
- B. Support and anchor system shall prevent undue deflection, vibration, and stresses on piping, equipment, and structures.
- C. Support and anchors systems shall meet the requirements of ANSI/ASME B31.1, except as supplemented, modified, or supplemented and modified in this Section.

2.02 MANUFACTURERS

- A. Manufacturer for pipe hangers, supports and rods shall be Elcen Metal Products Company; B-line Systems, Inc.; Grinnell Supply Sales Company; or equal.
- B. Manufacturers for stainless steel channel framing system shall be B-Line Systems Inc.; Kin-Line, Inc.; Uni-strut Building Systems; or equal.
- C. Manufacturers for inserts shall be B-line Systems, Inc.; Grinnell Supply Sales Company; or equal.

2.03 PIPE HANGERS AND SUPPORTS

A. General

1. Hangers shall be capable of supporting piping in all conditions of intended operation. Hanger shall allow for free expansion and contraction of the piping system. Hangers shall prevent excess stress on equipment.
2. Provide hangers with 1-1/2" minimum vertical adjustment.
3. Hangers shall be designed so that they cannot become disengaged by movement of the supported piping.
4. Hangers subject to shock or thrust imposed by the action of safety valves, shall include hydraulic shock suppressers.
5. Hanger rods shall be subject to tensile loading only.
6. At hanger locations where lateral or axial movement is anticipated, provide linkage that permits lateral and axial movement. Where horizontal pipe movement is greater than 1/2", or where hanger rod deflection from the vertical is greater than 4 degrees from the cold to the hot position of the pipe, offset hanger rod and structural attachment so that the rod is vertical in the hot position.
7. Provide spring-type hangers for piping subject to vibration or vertical expansion and contraction, such as engine exhausts and similar piping. Spring-type hangers shall be sized to the manufacturers written recommendations and the loading conditions encountered. Provide variable spring supports with means to limit misalignment, buckling, and eccentric loading. Provide variable spring supports with means to prevent overstressing of the spring. Provide variable spring supports with means to indicate spring compression. Spring-type hangers shall be designed for a maximum variation in supporting effort of 25% of total travel resulting from thermal movement.
8. Wherever expansion and contraction of piping is expected, provide a sufficient number of expansion loops or joints, together with necessary rolling or sliding supports, anchors, guides, pivots, and restraints, that allow expansion and contraction without damaging piping, equipment, or structures. Provisions for expansion and contraction shall permit piping to expand and contract freely in directions away from anchored points for total travel resulting from thermal movement.
9. Supports, hangers, anchors, and guides shall be designed and insulated so that excess heat will not be transmitted to the structure or other equipment.

B. Materials for Hangers, Fasteners, Supports, and Hanger Rods

1. Hangers, Fasteners, Supports, and Hanger Rods for AISI Type 316 Stainless Steel Piping: AISI Type 316, Type 316L, or Type 316N stainless steel.
2. Anchor Bolts and Assembly Bolts, Nuts, and Washers for All Hangers and Supports: AISI Type 316, Type 316L, or Type 316N stainless steel.

2.04 STAINLESS STEEL CHANNEL FRAMING SYSTEM

A. Channel Framing

1. Stainless steel channel framing system channels shall be cold formed from 12 gauge AISI Type 316 or Type 316L stainless steel.
2. Channels shall be 1-5/8" x 1-5/8" profile.

B. Channel Fittings

1. Stainless steel channel frame support racks shall be assembled with channel fittings supplied by the stainless steel channel framing system manufacturer.
2. Channel fittings shall be AISI Type 316 or Type 316L stainless steel.

C. Channel Post Bases

1. Stainless steel channel frame support rack posts shall be anchored to floor with post bases supplied by the stainless steel channel framing system manufacturer.
2. Post bases shall be AISI Type 316 or Type 316L stainless steel.

D. Pipe and Tubing Clamps: Pipe and tubing clamps used with stainless steel channel framing system shall be AISI Type 316, Type 316L, or Type 316N stainless steel.

1. Fasteners: Nuts, including channel nuts, bolts, and washers used with stainless steel channel.

PART 3 - EXECUTION

3.01 PIPE HANGERS AND SUPPORTS

- A. Whenever possible, support pipes from structural members. Provide piping support framing between structural members as required to support piping as specified in this Section and as required to meet requirements of applicable building code and the American Institute of Steel Construction.
- B. Arrange piping supports systems so that piping is neat and orderly.
1. Adjust height of hangers and supports to align pipes to the proper grade for drainage and venting.
 2. Hanger rods and support pipes shall be vertical without offsets.
- C. Support piping as follows:

Table 15020-1 Pipe Support Spacing Requirements		
Nominal Pipe Size (inch)	Metallic Piping (feet)	Plastic, Fiberglass and Copper Piping (feet)
1/2	5	3
3/4 to 1-1/2	6	3
2 to 3	6	4
4	10	5
6 and larger	10	5

- D. Support piping independent of connected equipment. Space supports for piping to prevent sag, bending, and shear stresses in the piping. Reduce support spacing where components, such as flanges and valves, impose concentrated loads. Provide supports on both sides of meters, valves, strainers, and other items that impose heavy point loads on piping system.

- E. Place a hanger within 12" of each horizontal elbow.
- F. Supports for plastic pipe and fiberglass pipe shall be provided with extra wide pipe saddles or stainless steel shields that reduce stress on pipe at supports to acceptable limits.
- G. Install hangers to provide minimum 1/2" space between finished covering and adjacent work.
- H. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

END OF SECTION

SECTION 15110

VALVES AND ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for furnishing and installing valves, valve operators and accessories as specified in this Section and shown on the Drawings.

1.02 REFERENCES

A. ANSI Standards

1. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 125
2. ANSI B16.3 Malleable Iron Threaded Fitting, Class 125 and 300
3. ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys

B. ANSI/AWWA Standards

1. ANSI/AWWA C111/A21.1 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
2. ANSI/AWWA C500 Gate Valves
3. ANSI/AWWA C504 Rubber Seated Butterfly Valves
4. ANSI/AWWA C508 Swing Check Valves for Waterworks Service, 2" (50 mm) Through 24" (600 mm) NPS.
5. ANSI/AWWA C509 Resilient-Seated Gate Valves 3" through 12" NPS, for Water and Sewage Systems

C. ASTM Standards

1. ASTM A126 Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
2. ASTM A276 Specification for Stainless Steel and Heat-Resisting Steel Bars and Shapes
3. ASTM A351 Specification for Steel Castings, Austenitic, for High-Temperature Services
4. ASTM A743 Specifications for Castings, Iron-Chromium, Iron-Chromium-Nickel and Nickel-Base Corrosion Resistant for General Applications

D. MSS Standards

E. ANSI/NSF Standards

ANSI/NSF 61 Drinking Water System Components-Health Effects

F. Collier County Utilities Standards, latest edition with latest revisions.

1.03 DEFINITIONS

- A. Exposed Valves: Valves that are not buried. Exposed valves include valves outdoors aboveground, valves in buildings, valves on the interior of tanks, valves in the interior of vaults and valves in the interior of pits.
- B. Size: References to valve sizes on the Drawings and in the Specifications are intended to be nominal size and shall be interpreted as nominal size.

1.04 SUBMITTALS

- A. General: As specified in Section 01600 - Material and Equipment and Section 01330 – Submittals
- B. Manuals as specified in Section 01830 – Operation and Maintenance Data

1.05 WARRANTIES

- A. General: As specified in Section 01600 - Material and Equipment.
- B. The Contractor shall warranty all valves, valve operators and appurtenances to be free from defects in material and workmanship for a minimum period of one year as noted in the Contract requirements and furnish and install any such items found to be defective within the warranty period.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide valves suitable to the intended service as defined in Section 15120 – Piping, General and to meet the standards of the Owner.
- B. Provide valves with joints suitable to connect to adjoining piping.
- C. Exposed Valves
 - 1. Exposed valves shall be provided with valve operators, levers, handwheels, chainwheels and chains, extension stems, bonnet extensions, floor stands, and other accessories as shown or specified.
 - 2. If distance from operating floor or platform to valve operating wheel is less than six feet, valve or valve operator shall be furnished with a handwheel. If the distance from the operating floor or platform to valve operating wheel is 60 inches or more, the valve or valve operator shall be furnished with a chainwheel and chain. Chains shall terminate four feet above operating floor or platform.
 - 3. Effort required to operate valve lever shall not exceed 40 pounds applied at the extreme grip position of the lever. Effort required to operate valve handwheel shall not exceed 40 pounds applied at the extremity of the handwheel. Effort required to operate valve chainwheel shall not exceed 40 pounds applied to the chain.
 - 4. Handwheels on valves 14" and smaller shall not be less than 8" in diameter. Handwheels on valves larger than 14" shall not be less than 12" in diameter. Handwheels shall be cast iron or stainless steel. Aluminum handwheels are not acceptable.
 - 5. Operators shall have open direction clearly and permanently marked. Operators for shut-off valves shall have position indicators.
 - 6. Exposed valves shall have integrally cast flanged joints that meet the dimension requirements of ANSI B16.1.

D. Buried Valves

1. Buried valves shall be provided with operators, valve boxes, bonnet extensions, floor stands, and other accessories as shown or specified.
2. Buried valves with valve boxes shall be provide with extension stems.
3. Buried shut-off valves shall have position indicators. Buried valves with exposed operators shall have position indicator on valve operators. Buried valves with valve boxes shall have position indicator on extension stem beneath valve box lid.
4. Buried valves shall have mechanical joints that meet the requirements of ANSI/AWWA C111/A21.1 and these specifications.

E. Operators, General

1. Unless otherwise shown or specified, valves 6" and smaller shall have lever operators. Valves 8" and larger shall have gear-assisted operators.
2. The valve manufacturer shall also provide valve operators. Valve operators shall be installed, adjusted, and tested by the valve manufacturer at the valve manufacturer's plant.
3. Operators, unless otherwise specified, shall turn counterclockwise to open.

2.02 CHAINWHEEL OPERATORS

- A. Chainwheel operator shall be fabricated of malleable iron and pocketed type chainwheels with chain guards and guides.
- B. Operators shall have galvanized smooth welded link type chain. Chain that is crimped or has links with exposed ends shall not be acceptable.
- C. Chainwheel operators shall be marked with an arrow and the word OPEN indicating direction to open.

2.03 VALVE BOXES

- A. Valve boxes shall be adjustable telescope type, adjustable to grade. Valve boxes shall be asphalt varnished cast iron, or enameled cast iron, suitable to withstand heavy traffic. Bases shall be the round type.
- B. All buried valves shall have cast-iron two-piece valve boxes (see County Approved Product List, Appendix F), valve boxes shall be provided with suitable heavy bonnets to extend to such elevation at the finished grade surface as directed by the Engineer. The barrel shall be two-piece, screw type. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling, shall be designed to prevent the transmission of surface loads directly to the valve or piping, and shall be complete with cast iron covers. The covers shall be so constructed as to prevent tipping or rattling. All valve boxes located in paved roadways or sidewalks shall have locking covers.
- C. The name of the manufacturer and foundry of origin shall be cast into each of the components of the assembly in legible form. The assembly shall be suitable for highway traffic wheel loads of 16,000 pounds and shall withstand a proof load test of 25,000 pounds without failure or permanent deflection. The valve box shall be cast, machined, assembled, and packaged within the United States and shall fully comply with the Buy American provisions of Public Law 102-240, enacted 12/18/91.
- D. Valve box covers shall be marked either "WATER", "REUSE" or "SEWER", depending on service.

2.04 VALVE LABELING

- A. Label all exposed valves exclusive of hose bibs.
- B. Labels shall be square or rectangular, 2" across the flats, minimum and shall be permanently attached to the valve or on a wall adjacent to the valve.
- C. Labels for exterior valves shall be 1/16" stainless steel. Labels for interior valves shall be 1/16" stainless steel or plastic. Text as provided by the Engineer shall be permanently engraved on the label.
- D. Label all underground valves as shown in the Drawings.

2.05 BALL VALVES

- A. Manufacturers
 - 1. Stainless steel ball valves shall be manufactured by Jamesbury Corporation, Jenkins Bros., Lunkenheimer Flow Control, WM Powell Company or Worchester Controls.
- B. Stainless Steel Ball Valves
 - 1. Stainless steel ball valves shall be Class 300, three-piece type, with lever operators unless noted otherwise.
 - 2. The valve bodies, end pieces, balls and stems shall be constructed of AISI 316 stainless steel. The seats shall be constructed of Teflon and the seals constructed of reinforced Teflon.
 - 3. The valves shall have flanged ends, rated 150 psi.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. **Verify operator orientation with Engineer prior to valve installation.**
- B. Install valves, operators, extension stems, valve boxes, and other accessories in accordance with the manufacturer's written instructions and as shown and specified. Support valves so that there are no undue stresses on pipe.
- C. Install valves with easy access for operation, removal, and maintenance. Install valves so that there are no conflicts between valve operators and structural members or handrails.
- D. Install valves, sensors, switches, and controls so that all systems are compatible and operate properly.
- E. Install valve boxes perpendicular, centered around and covering the upper portions of the valve or valve operator, or the pipe. The top of each valve box shall be flush with finish grade unless otherwise indicated on the Drawings.

3.02 TESTING

- A. While testing the appurtenant pipeline and system of which the valve is a part, operate the valve or test the valve function to ensure proper operation.
- B. Operate each valve through the range of operation.

3.03 MANUFACTURERS' REPRESENTATIVE

- A. General: As specified in Section 01600 – Materials and Equipment
- B. Provide services of valve manufacturer's representative as required to obtain correct installation of valves and accessories.

END OF SECTION

SECTION 15116
GATE ACTUATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements for furnishing and installing electric gate actuators and appurtenances as shown on the Drawings.

1.02 SUBMITTALS

- A. General: As specified in Section 01330 – Submittals.
- B. Affidavit of Compliance.
- C. Manuals as specified in Section 01830 – Operation and Maintenance Data.
- D. Manufacturer's Certificate of Proper Installation and Operation. Refer to Certificate at the end of this Section.
- E. Written Warranty.

1.03 WARRANTIES

- A. General: As specified in the Contract Documents.
- B. The manufacturer shall provide a written, two-year full warranty on all materials and workmanship from the date of Substantial Completion and shall replace and install any such items found to be defective within the Warranty period.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Furnish and install gate actuators for the following new gates as shown on the Drawings. The gates shall be in compliance with Section 11292 and the Contract Drawings. The gate manufacturer shall provide all necessary information for sizing the actuator. The actuators manufacturer's approved representative/supplier shall provide and install actuator, and its assembly as required in Section 11292, 2.05. The Contractor shall connect to the electrical and I&C. Gate actuator assembly shall include all adaptation brackets, mounting hardware, plates, and associated hardware shall be constructed from Type 316 stainless steel.

2.02 MANUFACTURERS

- A. Rotork is the only acceptable manufacturer due to Collier County's standardization. Alternate manufacturers will not be accepted.
- B. Gate actuators manufacturer's approved representative/supplier shall coordinate with manufacturers of the proposed gates, to ensure that the actuator assembly provides for properly operating valves.

2.03 ELECTRIC ACTUATORS

A. General

1. The actuators shall be suitable for use on existing power supply nominal 460/3/60 and incorporate motor, integral reversing starter, local control facilities and terminals for remote control and indication connections housed within a self-contained, sealed enclosure. The actuator shall be Ethernet IP native card compatible.
2. In order to maintain the integrity of the enclosure, setting of the torque levels, position limits and configuration of the indication contacts etc. shall be carried out without the removal of any actuator covers and without mains power providing the option of Infra-red or *Bluetooth*® wireless interface. Sufficient commissioning tools shall be provided with the actuators and must meet the enclosure protection and certification levels of the actuators. Commissioning tools shall not form an integral part of the actuator and must be removable for secure storage / authorized release. In addition, provision shall be made for the protection of configured actuator settings by a means independent of access to the commissioning tool. Provision shall be made to disable *Bluetooth*® communications or only allow a *Bluetooth*® connection initiated by an Infra-Red command for maximum security.
3. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel irrespective of the connection sequence of the power supply.

B. Actuator sizing

The actuator shall be sized to guarantee valve closure at the specified differential pressure and temperature. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. For linear operating valves, the operating speed shall be such as to give valve closing and opening at approximately 10"-12" per minute unless otherwise stated in the data sheet. For 90° valve types of the operating time will be specified.

C. Environmental

1. Actuators shall be suitable for indoor and outdoor use. The actuator shall be capable of functioning in an ambient temperature ranging from -33°C (22°F) to 70°C (140°F), up to 100% relative humidity.
2. Actuators for hazardous area applications shall meet the area classification, gas group and surface temperature requirements specified in data sheet.

D. Enclosure

1. Actuators shall be O-ring sealed, watertight to IP66/IP68 21feet for 72hrs, NEMA 4, 6. The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the

terminal cover is removed for site for cabling, the terminal compartment having the same ingress protection rating as the actuator with the terminal cover removed.

2. Enclosure must allow for temporary site storage without the need for electrical supply connection.
3. All external fasteners shall be plated stainless steel. The use of un-plated stainless steel or steel fasteners is not permitted.

E. Motor

1. The motor shall an integral part of the actuator, designed specifically for valve actuator applications. It shall be a low inertia high torque design, class F insulated with a class B temperature rise giving a time rating of 15 minutes at 40°C (104°F) at an average load of at least 33% of maximum valve torque. Temperature shall be limited by two (2) thermostats embedded in the motor end windings and integrated into its control.
2. Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gearcase. Plugs and sockets are not acceptable as a means of electrical connection for the motor.
3. Protection shall be provided for the motor as follows:
 - a. Stall – The motor shall be de-energized within 8 seconds in the event of stall when attempting to unseat a jammed valve
 - b. Over temperature – Thermostat will cause tripping of the motor. Auto-reset on cooling.
 - c. Single phasing – lost phasing protection.
 - d. Direction – phase rotation correction

F. Gearing

1. The actuator gearing shall be totally enclosed in an oil-filled gearcase suitable for operation at any angle. Grease lubrication is not permissible. All drive gearing and components must be of metal construction and incorporate a lost motion hammer blow feature. For rising spindle valves the output shaft shall be hollow to accept a rising stem and incorporate thrust bearings of the ball or roller type at the base of the actuator. The design should be such as to permit the opening of the gearcase for inspection or disassembled without releasing the stem thrust or taking the valve out of service.
2. For 90° operating type of valves drive gearing shall be self-locking to prevent the valve back driving the actuator. Butterfly Valves 16" and larger shall incorporate the use of a secondary worm gear box. Worm Gears shall be constructed in accordance AWWA C517 and shall be IP68 rated.
3. Actuators shall be enclosed in a ductile iron housing with outboard seals to protect the bearings and other internal components. The actuator shaft and the quadrant shall be supported on permanently angular contact bearings.

Input shaft and fasteners shall be made of stainless steel. Gears shall be efficiency optimized 3 stage gear reduction type.

4. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuators shall be 90% grease filled. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals.
5. Gears shall incorporate the use of a Rotorlok Device for backwinding protection to prevent undesired reverse rotation of the gear train at the extents (i.e. fully closed position) of travel when holding a residual applied torque.
6. Gears shall have a two-year warranty from date of shipment and shall have a metal tag containing a serial number, ratio; number of turns shall be riveted to the gear for future identification. Gears shall be Rotork Model IW-RL-RAW.

G. Handwheel Operation

1. A handwheel shall be provided for emergency operation, engaged when the motor is declutched by a lever or similar means, the drive being restored to electrical operation automatically by starting the motor. The handwheel or selection lever shall not move on restoration of motor drive. Provision shall be made for the hand/auto selection lever to be locked in both hand and auto positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in hand without damage to the drive train.
2. Clockwise operation of the handwheel shall give closing movement of the valve unless otherwise stated in the data sheet. For linear valve types of the actuator handwheel drive must be mechanically independent of the motor drive and should be such as to permit valve operation in a reasonable time with a manual force not exceeding 400N through stroke and 800N for seating/unseating of the valve.

H. Drive Interface

The actuator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. The drive bush shall be positioned in a detachable base of the actuator. Thrust bearings shall be sealed for life and the base shall be capable of withstanding five times the rated thrust of the actuator.

I. Local Controls

1. The actuator shall incorporate local controls for Open, Close and Stop and a Local/Stop/Remote mode selector switch lockable in any one of the following three positions: local control only, stop (no electrical operation),

remote control plus local stop only. It shall be possible to select maintained or non-maintained local control.

2. The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.
3. The local controls and display shall be rotatable through increments of 90° to suit valve and actuator orientation.

J. Torque and Limits

1. Torque and turns limitation to be adjustable as follows:
 - a. Position setting range – multi-turn: 2.5 to 8,000 turns, with resolution to 7.5 deg. of actuator output.
 - b. Position setting range – direct drive part turn actuators: 90° +/-10°, with resolution to 0.1 deg. of actuator output.
 - c. Torque setting: 40% to 100% rated torque.
2. Position measurement – Absolute position measurement should be incorporated within the actuator. The technology must be capable of reliably measuring position even in the case of a single fault. The design must be simple with the minimum amount of moving parts (no more than 5). Technologies such as LEDs or potentiometers for position measurement are considered unreliable and therefore not preferred.
3. Measurement of torque shall be from direct measurement of force at the output of the actuator. Methods of determining torque-using data derived from the motor such as motor speed, current, flux etc. are not acceptable.
4. A means for automatic “torque switch bypass” to inhibit torque off during valve unseating and “latching” to prevent torque switch hammer under maintained or repeated control signals shall be provided.
5. The electrical circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit.

K. Remote Valve Position and Status Indication

1. Four contacts shall be provided which can be selected to indicate any position of the valve; Provision shall be made for the selection of a normally closed or open contact form. Contacts shall maintain and update position indication during handwheel operation when all external power to the actuator is isolated.
2. The contacts shall be rated for 5mA to 5A, 120V AC, 30V DC.

3. As an alternative to providing valve position indication any of the four above contacts shall be selectable to signal one of the following:
 - a. Valve opening, closing or moving
 - b. Thermostat tripped, lost phase
 - c. Motor tripped on torque in mid travel, motor stalled
 - d. Remote selected
 - e. Actuator being operated by handwheel
 - f. Actuator fault
4. Provision shall be made in the design for an additional eight contacts having the same functionality.
5. A configurable monitor relay shall be provided as standard, which can be used to indicate either Availability or Fault. The relay should be a spring return type with a Normally Open / Normally Closed contact pre-wired to the terminal bung.
6. The Monitor (availability or fault) relay, being energized from the control transformer will de-energize under any one or more the following conditions:
Available Mode
 - a. Loss of main or customer 24V DC power supply
 - b. Actuator controls selected to local or stop
 - c. Motor thermostat tripped
 - d. Actuator internal fault
7. Provision shall be made in the design for the addition of a contactless transmitter to give a 4-20mA analogue signal corresponding to valve travel and / or torque for remote indication when required. The transmitter will auto range to the set limit.

L. Local Position Indication

1. The actuator display shall include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully close in 0.1% increments. Valve closed and open positions shall be indicated by symbols showing valve position in relation to the pipework to ensure that valve status is clearly interpreted. With mains power connected, the display shall be backlit to enhance contrast at all ambient light levels and shall be legible from a distance of at least 5m (16ft).

2. Red, green, and yellow LEDs corresponding to open, closed and intermediate valve positions shall be included on the actuator display when power is switched on. The yellow LED should also be fully programmable for on/off, blinker and fault indication. The digital display shall be maintained and updated during handwheel operation when mains power to the actuator is isolated. In the event of a (main) power (supply) loss or failure, the position contacts must continue to be able to supply remote position feedback and maintain interlock capabilities. If batteries are required to maintain contact functionality the actuator vendor shall provide a supply sufficient for forty-five (45) continuous days of un-powered operation with one complete valve cycle every hour.
3. The actuator display shall include a fully configurable dot-matrix display element with a minimum pixel resolution of 168 x 132 to display operational, alarm, configuration and graphical datalogger information. The text display shall be selectable between English and other languages such as: Spanish, German, French, and Italian. Provision shall be made to upload a different language without removal of any covers or using specialized tools not provided as standard with the actuator.
4. Datalogger graphical displays should as a minimum be able to display log and trend graphs on the local LCD for the following:
 - a. Torque versus Position
 - b. Number of Starts versus Position
 - c. Number of starts per hour
 - d. Dwell Time
 - e. Average temperature
5. The main display shall be capable of indicating 4 different home-screens of the following configuration:
 - a. Position and status
 - b. Position and torque (analogue)
 - c. Position and torque (digital)
 - d. Position and demand (positioning)
6. Provision shall be made for the addition of an optional environmental cover to protect the display from high levels of UV radiation or abrasive materials.
7. The local controls and display shall be rotatable through increments of 90° to suit valve and actuator orientation.

8. Actuators that are not accessible shall have the capability of a “mirror image” of the face of the actuator Remote Hand Station. (RHS) shall be suitable for remote connection to an electric actuator up to 100m distance, include local control facilities, a backlit LCD display and terminals for communication highway connection to the host actuator housed within a self-contained, double-sealed enclosure. In order to maintain the integrity of the enclosure, setting of the actuator torque levels, position limits and configuration of the indication contacts etc. shall be carried out without the removal of any covers via a Bluetooth® wireless interface.

M. Integral Starter and Transformer

1. The reversing starter, control transformer and local controls shall be integral with the valve actuator, suitably housed to prevent breathing and condensation. The starter shall be suitable for 60 starts per hour and of rating appropriate to motor size. The controls supply transformer shall be fed from two of the incoming three phases and incorporate overload protection. It shall have the necessary tapping and be adequately rated to provide power for the following functions:
 - a. Energizing of the contactor coils.
 - b. 24V DC or 110V AC output for remote controls (maximum 5W/VA)
 - c. Supply for all the internal electrical circuits.

N. Remote Control Facilities

1. The necessary control, wiring and terminals shall be provided integral to the actuator enclosure. Open and close external interlocks shall be made available to inhibit local and remote valve opening / closing control. It shall be possible to configure the interlocks to be active in remote control only.
2. Remote control signals fed from an internal 24V DC (or 110VAC) supply and/or from an external supply between 20V and 60 VDC or 40V and 120VAC, to be suitable for any one or more of the following methods of control:
 - a. Open, Close and Stop control.
 - b. Open and Close maintained or “push to run” (inching) control.
 - c. Overriding Emergency Shutdown to close (or open) valve from a normally closed or open contact.
 - d. Two-wire control, energize to close (or open), de-energize to open (or close).
3. Additionally, provision shall be made for a separate ‘drive enable’ input to prevent any unwanted electrical operation.

4. It shall be possible to reverse valve travel without the necessity of stopping the actuator. The motor starter shall be protected from excessive current surges during rapid travel reversal. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 2kV.
5. Provision shall be made for operation by distributed control system utilizing the following network system:

Collier County Version of Hart.

O. Local Position Indication

1. The actuator must provide a local LCD display of the position of the valve, even when the power supply is not present for a minimum of 30 days of un-powered operation. This requirement necessary for possible extended outages. The display shall be able to be rotated in 90-degree increments so as to provide easy viewing regardless of mounting position.
2. The actuator shall include a digital LCD position indicator with a numeric display from fully open to fully closed in 1% increments. Red, green, and yellow lights corresponding to Open, Closed, and Intermediate positions shall be included on the actuator, including, configurable multilingual text capability. The digital display shall be maintained even when the power to the actuator is isolated. The local display should be large enough to be viewed from a distance of six feet (6') when the actuator is powered up.
3. Provide mechanical-type gate position indicator. Gate position indicator shall show gate position at all times. Indicator shall be part of an intermediate gear head or electric motor actuator.

P. Monitoring Facilities

Facilities shall be provided for monitoring actuator operation and availability as follows:

1. Actuator text display indication of the following status/alarms:
 - a. Closed Limit, open limit, moving open, moving closed, stopped
 - b. Torque trip closing, torque trip opening, stalled
 - c. ESD active, interlock active
 - d. Thermostat trip, phase lost, 24V supply lost, Local control failure
 - e. Configuration error, Position sensor failure, Torque sensor failure
 - f. Battery low, power loss inhibit
2. Integral datalogger to record and store the following operational data:

- a. Opening last /average torque against position.
 - b. Closing last /average torque against position.
 - c. Opening motor starts against position.
 - d. Closing motor starts against position.
 - e. Total open/closed operations.
 - f. Maximum recorded opening and closing torque values.
 - g. Event recorder logging operational conditions (gate, control and actuator)
3. The datalogger shall record relevant time and date information for stored data.
- a. Datalogger data shall be accessed via non-intrusive Bluetooth® communication and data displayed on the local LCD.
 - b. Sufficient standard intrinsically safe tools shall be provided for downloading datalogger and actuator configuration files from the actuators and subsequent uploading to a PC.
 - c. The actuator manufacturer shall supply PC software to enable datalogger files to be viewed and analyzed

Q. Wiring and Terminals

- 1. Internal wiring shall be of tropical grade PVC insulated stranded cable of appropriate size for the control and three- phase power. Each wire shall be clearly identified at each end. The terminals shall be embedded in a terminal block of high tracking resistance compound.
- 2. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal and shall be provided with a minimum of three (3) threaded cable entries with provision for an additional 5 extra conduit entries.
- 3. All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable.
- 4. A durable terminal identification card showing plan of terminals shall be provided attached to the inside of the terminal box cover indicating:
 - a. Serial Number
 - b. External Voltage Values
 - c. Wiring Diagram Number

d. Terminal Layout

5. The code card shall be suitable for the contractor to inscribe cable core identification alongside terminal numbers.

R. Commissioning Kit

Each actuator shall be supplied with a start-up kit comprising installation instruction manual, electrical wiring diagram and cover seals to make good any site losses during the commissioning period. In addition, sufficient actuator commissioning tools shall be supplied to enable actuator set up and adjustment during valve/actuator testing and site installation commissioning.

S. Performance and Test Certificate

1. Each actuator must be performance tested and individual test certificates shall be supplied free of charge. The test equipment should simulate a typical valve load, and the following parameters should be recorded.
 - a. Current at maximum torque setting
 - b. Torque at max. torque setting
 - c. Flash test voltage
 - d. Actuator output speed or operating time.
2. In addition, the test certificate should record details of specification such as gear ratios for both manual and automatic and second stage gearing if provided, drive closing direction, wiring diagram number.

T. On Site Start Up Assistance:

Prior to start up, contractor shall inform service techs of all requirements of the certificate of proper installation. All forms and documentation required for the certificate of proper installation shall be given to service tech prior to start up. Minimum of 1 day per two actuators.

U. Warranty:

Each actuator shall be warranted for a minimum of 12 months of operation up to a maximum of 18 months from shipment.

V. Acceptable Electric Motor Actuator Manufacturer:
Rotork Controls IQ Series (Open/Close) and IQM (Modulating).

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Actuator manufacturer shall install the actuator on each new gate, and test and certify operation at the site.
 - 1. Gate actuator adaptation brackets, mounting hardware, plates, and all associated hardware shall be the sole responsibility of the actuator manufacturer.
 - 2. Contractor shall install gate and actuator manufacturer shall install actuators. The Contractor shall connect to the power and controls. Refer to the Contract Drawings for additional information and requirements.
- B. Each actuator must be performance tested and individual test certificates shall be supplied. The test equipment should simulate a typical gate load, and the following parameters should be recorded:
 - 1. Current at maximum torque setting
 - 2. Torque at maximum torque setting
 - 3. Flash Test Voltage
 - 4. Actuator Output Speed or Operating Time

In addition, the test certificate should record details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.

3.02 FIELD TESTS

- A. As specified in Section 01750 - Testing and Startup
- B. Hydrostatic Test: Test actuators with gates.
- C. Functional Test
 - 1. Following installation and inspection of the actuators operate valve actuators.
 - 2. After adjustments have been made and the actuator is properly lubricated, do the following:
 - a. Operate actuator with selector switch in “LOCAL” position.
 - (1) Run actuator through one complete cycle from full-closed to full-open to full-closed.
 - (2) Run actuator through modulating cycle based a set flow to EQ Basins. Using the downstream EQ Flow Meter and other device per County requirements.
 - (3) Verify that “STOP” push-button stops valve motion.
 - b. (Not Required) Operate actuator with selector switch in “REMOTE” position and test actuator operation from actuator terminal strip.
 - (1) Run actuator through one complete cycle from full-closed to full-open to full-closed.
 - (2) Verify that remote stop signal stops gate motion.

- c. Verify that contacts for remote monitoring of gate position and operation are functioning properly.
- d. Verify that indicator lights are functioning properly.
- e. Verify that limit switches are functioning properly.

3.03 MANUFACTURERS' REPRESENTATIVE

- A. General: As specified in Section 01600 – Materials and Equipment.
- B. A manufacturer's representative shall be present onsite for a minimum of two (2) full days for installation inspection, startup and testing and one day for operation and maintenance training.
- C. Provide manufacturer's written Certificate of Proper Installation and Operation of each gate actuator.

END OF SECTION

**MANUFACTURER'S CERTIFICATE OF
PROPER INSTALLATION AND OPERATION**

SCWRF Influent Screens Replacement

Date _____

PRODUCT: _____

SERIAL NO.: _____

SPECIFICATION SECTION: _____

As an authorized representative of the manufacturer, the undersigned certifies the product identified above has been inspected and is installed in accordance with the manufacturer's recommended standards, except as noted below.

The undersigned further certifies that the product identified above has been placed into satisfactory operation, except as noted below.

Exceptions and comments:

Signature: _____

Printed Name: _____

A copy of this executed Certificate must be included in the Operation and Maintenance Data. A copy must be forwarded to the Engineer upon completion of startup and testing.

SECTION 15120

PIPING - GENERAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

System of nomenclature for piping shown on the Drawings and general requirements for piping systems.

1.02 DEFINITIONS

- A. Exposed Piping: Piping that is not buried. Exposed piping includes piping outdoors aboveground, piping in buildings, piping on the interior of tanks, piping on the interior of vaults, and piping on the interior of pits.
- B. Size: Pipe, fittings, and accessory sizes and references to pipe diameter on the Drawings and in the Specifications are intended to be nominal size or diameter and shall be interpreted as nominal size or diameter.

1.03 SUBMITTALS

- A. General – As specified in Section 01330 – Submittals.
- B. Manuals as specified in Section 01830 – Operation and Maintenance Data.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Pipe, fittings, valves, and appurtenances furnished as part of the Work shall be in accordance with Section 01600 – Materials and Equipment.
- B. The general requirements, materials, and installation for the pipe in this Contract are listed in the following Sections and Standards:
 - 1. Collier County Utilities Standards Manual, latest edition with latest revisions.
- C. Piping materials shall be as described in this Section unless noted otherwise on the Drawings.
- D. All PVC or CPVC pipe used for reuse water shall be Federal Safety purple. All PVC or CPVC pipe used for potable water shall be blue or white in color. All PVC or CPVC pipe used for wastewater shall be green in color.

2.02 SLEEVE-TYPE COUPLINGS, STAINLESS STEEL

- A. Manufacturers
 - 1. Straight Couplings:
 - a. Rockwell (Smith-Blair), Style 411;
 - b. Dresser, Style 38;
 - c. or equal straight sleeve type couplings by US manufacturer.

2. Reducing Couplings:
 - a. Rockwell (Smith-Blair), Style 415;
 - b. Dresser, Style 62;
 - c. Ford Meter Box Co., Inc., Style FC1 or FC3;
 - d. or equal sleeve type reducing couplings by US manufacturer.
3. Transition Couplings:
 - a. Rockwell (Smith-Blair), Style 413;
 - b. Dresser, Style 162;
 - c. Ford Meter Box Co., Inc., Style FC1 or FC3;
 - d. or equal sleeve type transition couplings by US manufacturer.
- B. Coupling Description: One 316 stainless steel middle ring, two 316 stainless steel follower flanges, two gaskets, and sufficient bolts and nuts to properly compress the gaskets.
- C. Coupling Size: Nominal size to fit outside diameter of pipe and fittings to be coupled.
- D. Middle Rings
 1. Interior of Rings: Smooth without pipe stop.
 2. Minimum Thickness: Not less than 1/4"
 3. Length
 - a. Standard Couplings: 5" or 7":
 - b. Long Sleeve Couplings: 16"
 4. Tests: Cold-expansion, a minimum of one percent beyond the yield point and air test for porosity.
 5. Followers
 - a. Type: Single-piece contoured mill section welded and cold-expanded as required for the middle rings.
 - b. Strength: As required to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling.
 - c. Shape: As required provide positive confinement of the gasket.
- E. Gaskets: As described in the Piping Systems sections.
- F. Bolts and Nuts
 1. Bolts for Sleeve-type Couplings
 - a. Type: Track headed.
 - b. Material: AISI 316 stainless steel.
 - c. Standard: ASTM A193, Grade B8M

- d. Threads: Rolled thread.
- 2. Nuts for Sleeve-type Couplings
 - a. Type: Hexagon head
 - b. Material: AISI 316 stainless steel
 - c. Standard: ASTM A194, Grade 8M.
 - d. Threads: To match bolts.

G. Restrained Joint Sleeve-Type Couplings

- 1. Restraint Type: Harness.
- 2. Standard: Meet the requirements as described in this section.

2.03 FLANGE ADAPTERS

- A. Flanged adapters shall be furnished as required and as shown on the Drawings.
- B. All flanged adapters, 12" in diameter and smaller, except as shown on the Drawings or directed by the Engineer, shall be locking type flanged adapters with joint restraint.
- C. Pressure and service shall be the same as connected piping.
- D. Materials shall be high strength steel with fusion bonded epoxy coating inside and out.
- E. Flanged adapters shall receive a field coating as specified in the Contract Documents.
- F. Bolts and nuts shall be Type 316 stainless steel.
- G. Flanged coupling adapters larger than 12" in diameter shall be harnessed by tying the adapter to the nearest pipe joint flange or bell using Type 316 stainless steel threaded rods and rod tabs. The threaded rods and rod tabs shall be as shown on the Drawings.
- H. Flanged adapters shall be as manufactured by Smith Blair Corporation, Model 911, Ford Type FCA, or approved equal from a U.S. manufacturing facility.

2.04 MODULAR CASING SEALS

- A. Manufacturer
 - 1. Thunderline Corporation Link-Seal;
 - 2. or equal modular casing seals by US manufacturer.
- B. Type: Modular mechanical.
- C. Seal Description: Continuous belt of interlocking synthetic rubber links shaped to fill annular space between pipe and wall sleeve, or cored opening, and bolted together with pressure plate under each bolt and nut.

D. Link Assembly

1. Assemble seal with bolts loose.
2. Position seal between pipe and wall sleeve, or between pipe and cored opening.
3. Tighten bolts. When bolts are tightened rubber sealing elements shall expand and provide water-tight seal between pipe and wall sleeve, or cored opening.

E. Seal Element Material: Ethylene-propylene diene terpolymer (EPDM) rubber.

F. Pressure Plate Material: Glass reinforced nylon plastic.

G. Bolts and Nuts: AISI 316 stainless steel.

2.05 REINFORCED FLEXIBLE PIPE COUPLING/EXPANSION JOINT

A. Manufacturers

1. Red Valve Company Type J-1, single arch, or approved equal.

B. Rated Working Pressure: 150 psig.

C. Reinforced Flexible Couplings for Water and Wastewater Service

1. Material: Buna-N elastomer with 1/8" Hypalon cover.
2. Maximum Temperature Rating: 180°F.

D. Couplings Flanges

1. Type: Integrally molded.
2. Retaining Rings
 - a. Type: Split and beveled
 - b. Material: AISI 316 stainless steel.
3. Accessories: AISI 316 stainless steel washers at point where retaining rings are split.
4. Flange Bolt Holes and Bolt Circle: Conform to mating flange patterns of connecting piping.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Quality of materials, process of manufacture, and finished products shall be subject to inspection and approval by Engineer. Such inspection may be made at place of manufacture or at project site after delivery, or at both places. Products shall be subject to rejection at any time on account of failure to meet any of the specified requirements even though sample products have been accepted as satisfactory at place of manufacture.

- B. Inspect pipe, fittings, valves, hydrants, and piping appurtenances prior to installation. Reject and promptly remove pipe, fittings, valves, hydrants, and piping appurtenances that do not meet the Specifications. Remove rejected products from the job site.

3.02 GENERAL

- A. Install all piping in conformance with Section 02317 – Trenching, Bedding and Backfilling for Pipe, Section 02503 – Cleaning and Flushing of Piping Systems and the Collier County Utilities Standards Manual.
- B. Install piping to lines, grades, elevations, or lines, grades and elevations shown on Drawings. Install piping with continuous grade between elevations shown on Drawings. Provide additional grade changes as required to avoid interferences and as required to provide separation distances specified in this Section. Make changes in directions or elevations with fittings and by deflecting pipe joints. Do not exceed deflections specified in this Section or recommended by the joint manufacturer, whichever is more stringent.
- C. Clean pipe, fittings, valves, and piping appurtenances before installation. Keep pipe, fittings, valves, and piping appurtenances clean during installation.
- D. Before setting wall sleeves, pipes, castings and pipes to be cast in place, check the Drawings and equipment manufacturer's drawings which may have a direct bearing on pipe locations. Properly locate pipe, fittings, valves, and appurtenances during construction of and renovation of tanks and structures.
- E. Attach piping to pumps and other equipment in accordance with respective manufacturers' recommendations. Use flexible connectors where required to prevent excess load, vibration, or load and vibration on pumps and other equipment.
- F. Provide and locate unions for piping assembled with threaded, solvent-cement, welded or solder joints, so that piping can be disassembled and disconnected from pumps and equipment without cutting pipe.
- G. Support pipe, fittings, valves, and piping appurtenances in accordance with manufacturer's requirements and Section 15060- Supports and Anchors for Exposed Piping, whichever is more stringent.
- H. Do not damage pipe, fittings, or piping appurtenances, including linings, coatings and encasement, during installation. Remove and replace damaged pipe, fitting, valves, hydrants, or piping appurtenances. Remove damaged products from job site. Repair damaged linings, coatings and encasement according to the manufacturer's requirements.

3.03 CUTTING PIPE

- A. Do not cut pipe by burning.
- B. Cut pipe with a saw, cutter, or abrasion tool. Use the proper tool, machine, or tool and machine for each pipe material.
- C. Examine cut ends for damage caused by cutting.
- D. Finish cut ends of pipe.
 - 1. Plain End Pipe: Bevel cut ends of pipe.

2. Threaded Pipe: Square pipe ends and remove burrs.
3. Butt Welded Pipe: Bevel cut ends of pipe.
4. Solvent Socket Weld Pipe: square and smooth pipe ends.

3.04 CONNECTING TO EXISTING PIPE

A. General

1. Locate existing pipe horizontally and vertically and verify exact size of existing pipe.
2. Locate existing pipe sufficiently in advance of making connections to allow ample time for making changes in connection location and size.

B. Wet Connections

1. Make each wet connection with a tapping valve and tapping sleeve.
2. Install tapping sleeves and valves in accordance with manufacturer's written instructions.
3. Hydrostatically test each tapping valve and tapping sleeve assembly prior to tapping existing pipe.
4. Open and close tapping valves.
5. Inspect tapping valves in opened and closed positions. Make certain valves are in working condition.
6. Inspect each tapping valve immediately before connection tapping machine, and verify that tapping valve is open.
7. Install watertight plug on tapping valve outlet and backfill excavation if existing pipe is not tapped within 48 hours after installing tapping valve and tapping sleeve or tapping saddle assembly.
8. Install watertight plug on valve outlet and backfill excavation if new piping is not connected to tapping valve within 48 hours after making tap in existing pipe.

C. Dry Connections

1. Make each dry connection with fittings and valves indicated on Drawings.
2. Provide sleeves required to complete connections.
3. Required pipe, fittings, valves, tools, and equipment shall be at connection site prior to starting connection.
4. Make connections at night and on weekends when existing piping can only be removed from service during minimum flow periods or when requested by the Owner.
5. Owner will operate existing valves.
6. Install sufficient pipe, restrained joints, thrust blocking, or pipe, restrained joints and thrust blocking so that existing pipe can be put in service immediately after connection is completed.
7. Inspect joints and eliminate leaks immediately after connection is completed and existing pipe is put in service.
8. Install watertight plugs on open ends of pipe and valves and backfill excavation if existing pipe is not tapped or if new piping is not connected to dry connection within 48 hours after completing dry connection.

3.05 THRUST RESTRAINT FOR BURIED PIPING

A. Restraint for Pipe and Fittings

1. **Restrain all underground pipe joints in all locations.**

B. Restraint for Valves, Couplings, Adapters, and Other Piping Appurtenances

1. General

- a. Restrain valves, couplings, adapters, and other piping appurtenances.
- b. Restrain valves so that unbalanced force developed during opening and closing of valves are supported independent of the piping system.

C. Thrust restraint shall be as specified in AWWA C110 and AWWA C153.

D. Pipe Anchors

1. Pipe anchors may be used in lieu of restrained joints only upon approval of the Engineer. Contractor shall demonstrate that pipe anchors will provide restraint equivalent to restraint shown on the Drawings.
2. Space pipe anchors so that pipe is divided into equal ($\pm 10\%$) sections. Locate anchors at valves, changes in direction of piping, and major branch connections.
3. Anchors shall be of type recommended by pipe manufacturer and accepted by the Engineer.

END OF SECTION

SECTION 15123

POLYVINYL CHLORIDE (PVC) AND CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for materials and installation of Polyvinyl chloride (PVC) and Chlorinated polyvinyl chloride (CPVC) pipes and fittings as shown on the Drawings.

1.02 REFERENCES

A. ANSI Standards

1. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 125
2. ANSI B16.3 Malleable Iron Threaded Fittings, Class 150 and 300

B. ANSI/NSF

1. ANSI/NSF 61 Drinking Water System Components-Health Effects

C. ANSI/AWWA Standards

1. ANSI/AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe 4 In. Through 12 In. for Water Distribution
2. ANSI/AWWA C905 Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.

D. ASTM Standards

1. ASTM A193 Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
2. ASTM A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and
3. ASTM D1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
4. ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
5. ASTM D2464 Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
6. ASTM D2467 Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
7. ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

8. ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
9. ASTM D4024 Specification for Reinforced Thermosetting Resin (RTR) Flanges
10. ASTM F437 Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
11. ASTM F439 Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
12. ASTM F441 Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
13. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
14. ASTM F493 Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

E. AWWA Standards

1. AWWA Manual PVC Pipe - Design and Installation

1.03 SUBMITTALS

General: As specified in Section 01600 - Materials and Equipment and Section 01330 – Submittals.

PART 2 - PRODUCTS

2.01 GENERAL

Pipe materials furnished shall follow the requirements of Section 01600 – Materials and Equipment.

2.02 MANUFACTURERS OF PVC PIPING

A. PVC (C900 and C905) pipe and fittings shall be manufactured by:

1. Certain Teed Corporation
2. The Harrington Corporation
3. Or equal US manufacturer of C900 and C905 PVC pipe and fittings.

B. PVC and CPVC (Schedule 80) pipe and fittings shall be manufactured by:

1. Eslon Thermoplastics
2. Harvel Plastics, Inc.
3. NIBCO Inc.
4. Or equal US manufacturer of Schedule 80 PVC pipe and fittings.

2.03 PVC PIPE, FITTINGS AND APPURTENANCES, 4" THROUGH 36"

- A. PVC Pipe 4" through 36" shall conform to ANSI/AWWA C905 and have a pressure rating of 200 psi.
- B. Fittings for pipe 4" through 36" shall be ductile iron fittings as specified in Section 15140 – Ductile Iron Pipe.
- C. Pipe and Fitting Joints for Buried PVC Piping, 4" through 36"
 - 1. Joints for buried pipe and fittings, 4" through 36" shall be restrained.
 - 2. Restrained joints for buried pipe and fittings, 4" through 36" shall be as follows:
 - a. Restrained push-on joint, or push-on joint with restraining device.
 - b. Restrained mechanical joint.

2.04 PVC AND CPVC PIPE, FITTINGS, AND APPURTENANCES, 3" AND SMALLER

- A. PVC and CPVC Pipe, 3" and Smaller
 - 1. PVC pipe shall conform to the pipe standards in ASTM D1785, Schedule 80 and to the material standards in ASTM D1784, Class 12454-B.
 - 2. CPVC pipe shall conform to the pipe standards in ASTM F441, Schedule 80 and the material standards in ASTM D1784, Class 23447.
- B. PVC and CPVC Fittings, 3" and Smaller
 - 1. PVC fittings shall conform to ASTM D1784, Class 12454-B and the following fitting standards:
 - a. Socket Solvent Weld Fittings: ASTM D2467.
 - b. Threaded Joint Fittings: ASTM D2464.
 - 2. CPVC fittings shall conform to ASTM D1784, Class 23447 and the following fitting standards:
 - a. Socket Solvent Weld Fittings: ASTM F439
 - b. Threaded Joint Fittings: ASTM F437
- C. PVC and CPVC Pipe and Fitting Joints, 3" and Smaller
 - 1. Joints for buried and above ground pipe and fittings, 3" and smaller shall be solvent socket weld, threaded or flange joint.
 - 2. Flanges for PVC and CPVC Pipe and Fittings, 3" and Smaller
 - a. Flanges shall be of like material that conforms to ASTM D4024
 - b. All flanges shall have flat faces that conform to the dimension standards in ANSI B16.5, Class 150.

3. Primer for PVC and CPVC solvent socket weld pipe and fittings shall be stabilized tetrahydrofuran, or equal supplied by the pipe and fitting manufacturer.
4. Solvent Joint Cement
 - a. Solvent cement for PVC shall conform to ASTM D2564
 - b. Solvent cement for CPVC shall conform to ASTM F493
 - c. Cement for pipe and fittings in bleach service shall be specifically approved by the manufacturer for use in sodium hypochlorite solution.
 - d. Solvent cement shall be provided in containers no larger than one pint and equipped with a dauber secured to the lid.
- D. Coatings for exposed PVC and CPVC Pipe and Fittings, 3" and Smaller: Coat exposed PVC pipe and fittings as specified in Section 09900 – Paint and Coatings.

2.05 JOINT ACCESSORIES

A. Gaskets

1. Flange joint gaskets shall be full face.
2. Gasket Material
 - a. Joints Outside of Buildings: 1/8" neoprene.
 - b. Joints Inside of Enclosed Buildings: 1/8" neoprene or red rubber.
3. Union and Strainer Gaskets: Viton.

B. Bolts, Studs, and Nuts

1. Bolts, Studs, and Nuts for Flange Joints
 - a. Bolts for flange joints shall be semi-finished, regular hexagon head cap screws with UNC threads. The bolts shall be AISI 316 stainless steel that meets the requirements of ASTM A193, Grade B8M.
 - b. Studs for flange joints shall have UNC threads and extend through the nuts a minimum of 1/4". The studs shall be AISI 316 stainless steel that meets the requirements of ASTM A193, Grade B8M.
 - c. Nuts for flange joints shall be semi-finished regular hexagon nuts with UNC threads. The nuts shall be AISI 316 stainless steel that meets the requirements of ASTM A194, Grade 8M.
2. Bolts and Nuts for Mechanical Joints
 - a. Bolts for mechanical joints shall be tee-head type. The bolts shall be cast iron that meets the requirements of ANSI/AWWA C111/A21.11.
 - b. Nuts for mechanical joints shall be hexagon type. The nuts shall be cast iron that meets the requirements of ANSI/AWWA C111/A21.11.

- C. Threaded Joint Sealant – Sealant material for the threaded joints shall be Teflon tape, 1/2" wide. Tape thickness shall be as recommended by manufacturer of threaded fittings.

PART 3 - EXECUTION

3.01 INSTALLATION OF BURIED PVC PIPE

A. Laying Piping

1. Install pipe in accordance with AWWA –C605 and Section 02317 – Trenching, Bedding and Backfill for Pipe. Provide proper implements, tools, and facilities for safe and expeditious prosecution of Work.
2. Lay and maintain pipe to lines shown on the Drawings, except as specified in this Section. Lay and maintain pipe to grade shown on Drawings or to minimum depth specified in this Section. Install fittings and valves in locations shown on the Drawings.
3. Where piping is to be constructed parallel to and close to existing buried utilities, the exact location of which is unknown, adjust alignment of piping to least interfere with existing buried utilities, unless otherwise shown or specified.
4. Separation of utilities and minimum depth of cover shall be as specified by local ordinance.
5. Do not lay pipe in water or when trench or weather conditions are unsuitable for proper installation.
6. Lay each pipe section in a firm foundation of bedding material.
7. Bell Holes: Excavate bell holes in advance of pipe laying so that entire barrel will bear uniformly on bedding.
8. Lower pipe, fittings, and valves into trench by hand, by means of hoists or ropes, or by other suitable tools or equipment that will not damage products, coatings, or linings. Do not drop or dump pipe, fittings, or valves into the trench.
9. Use laser beam equipment, surveying instruments, or other proven techniques to maintain accurate alignment and grade.
10. Provide piping, 3" and larger, with two short lengths of pipe, not to exceed 4 feet, for first two joints outside a building or tank wall unless a greater number of joints is shown on the Drawings.
11. Provide thrust restraint at horizontal and vertical deflection fittings and at tees, plugs, tapping sleeves, and tapping saddles as specified in ASTM D3139.
12. Properly protect open excavations at all times. At the end of each day's work, protect the open ends of all pipes against entrance of animals, children, earth, or debris by bulkheads or stoppers. Perforate bulkheads or stoppers to allow passage of water into installed pipeline so that flotation of pipeline is prevented. Remove any earth or other material that gets into piping.

- B. Pipe Bedding and Haunching shall be as specified in Section 02317 – Trenching and Backfilling for Pipelines.

C. Joining

1. Clean ends of pipe before laying pipe, and make each joint in a satisfactory manner in accordance with the recommendations of the manufacturer of each particular type of joint and as specified in this Section. Joint work shall be done by experienced workmen.
2. Push or pull each length of pipe "home" into bell of previously installed pipe.
 - a. Push pipe by means of block and push bar. Do not use backhoe bucket, or other mechanically, electrically, or hydraulically powered excavating equipment, to join pipe or move pipe to grade.
 - b. Do not push pipe if pushing will damage pipe being installed or pipe previously installed. Where pushing will damage pipe or joint, use mechanical means consisting of cable placed inside pipe with winch, jack, or come-along to pull pipe "home".
 - c. Do not push pipe if joint gaskets are "rolled", cut, or otherwise damaged by pushing.
3. If a restrained mechanical joint or mechanical joint is required, install the joint.
4. Hold each length of pipe in place until trench and bedding are prepared for next pipe section.

D. Setting Valves and Valve Boxes

1. Clean interiors of valves of foreign matter before installation. Tighten stuffing boxes. Inspect valves in opened and closed positions to insure parts are in working condition.
2. Set buried valves and valve boxes plumb. Center valve boxes on valves, or valve operators. Tamp backfill around each valve box to a distance of four feet on all sides of box, or to undisturbed trench face if less than four feet.

E. Installation of Tracer Tape for Buried Piping: Install 3" wide labeled metalized tape in ditch, over piping, and 12" below finished grade. Install metallic tracer tape in the following locations:

1. Full length of pipe
2. End of stub outs for future connections, including, but not limited to, plugged branches of tees and wyes.
3. End of services not connected.

3.02 INSTALLATION OF EXPOSED PVC PIPING

A. Alignment

1. Install pipe to accurate lines and grades with fittings, valves and appurtenances at locations shown on Drawings and as specified.
2. Wherever possible, install piping parallel to walls and floors.

B. Installation

1. Clean debris, dirt, and other deleterious substances out of piping before installing piping. Keep piping clean until accepted at completion of work. Do not place debris, tools, clothing, lumber, or other materials in pipe during installation.
2. Inspect pipe, fittings, valves, and appurtenances for defects prior to installation.
3. Use proper implements, tools, and facilities. Do not damage piping or its linings and coating.
4. Install piping so no undue strain is placed upon piping joints, equipment, or structures.

C. Supports

1. Provide supports necessary to hold pipe and appurtenances at lines and grades shown on Drawings
2. Support piping so that there is no undue strain on piping joints, equipment, or structures.
3. Provide hangers and supports where required to support pipe and fittings in accordance with manufacturer's recommendations.

3.03 SETTING APPURTENANCES

- A. Install fittings, valves, hydrants, couplings, adapters, sleeves, saddles, and other piping appurtenances, in piping as indicated on the Drawings.

3.04 JOINT DEFLECTION

A. General

1. Deflect pipe and fittings as required to provide horizontal and vertical alignment as shown and specified.
2. Deflection of pipe and fitting joints shall not exceed limits specified in this Section. If alignment requires joint deflections in excess of allowable deflection joint, furnish and install fittings or a sufficient number of shorter lengths of pipe.

- B. Maximum Allowable Joint Deflection - maximum joint deflection shall be as specified maximum by the pipe manufacturer or the restrained joint manufacturer.

3.05 HYDROSTATIC TEST

Test PVC and CPVC piping as specified in Section 02505 - Pressure Testing of Piping Systems.

3.06 MANUFACTURERS' REPRESENTATIVE

- A. Provide services of pipe and fitting manufacturers' representatives as required to obtain correct piping installation, jointing, connections to structures, connections to existing piping systems, and piping supports.
- B. Provide assistance of pipe and fitting manufacturers' representatives at no additional cost to the Owner.

END OF SECTION

SECTION 16015

ELECTRICAL REFERENCE SYMBOLS

PART 1 - GENERAL

1.01 SYMBOLS

- A. In general the symbols used on the drawings conform to the Standard Symbols of the Institute of Electrical and Electronic Engineers with the exception of special systems or agencies as hereinafter noted or as shown in schedules or legends.

1.02 ABBREVIATION

- A. The following abbreviations or initials are used.
- | | |
|-------|--|
| A/C | Air Conditioning |
| A.C. | Alternating Current |
| AFF | Above Finished Floor |
| AFG | Above Finished grade |
| AHU | Air Handler Unit |
| AIC | Amps interrupting Capacity |
| AL | Aluminum |
| AMP | Ampere |
| ANSI | American National Standards Institute |
| ASA | American Standards Association |
| ATS | Automatic Transfer Switch |
| AUX | Auxiliary |
| AWG | American Wire Gauge |
| b.c. | Bare Copper |
| BIL | Basic Impulse Level |
| BKR | Breaker |
| °C | Degrees Centigrade |
| CAB | Cabinet |
| C. | Conduit or Conductor |
| C.B. | Circuit Breaker |
| CBM | Certified Ballast Manufacturers |
| CFM | Cubic Feet per Minute |
| CKT. | Circuit |
| Clg. | Ceiling |
| COND. | Conductor |
| Conn. | Connection |
| CPU | Central Processing Unit |
| CRT | Cathode Ray Terminal |
| CSP | Closed Standpipe (Sprinkler) |
| CSTC | Communications System Terminal Cabinet |
| C.T. | Current Transformer |
| CU. | Copper |
| C.W. | Cold Water |
| D.C. | Direct Current |
| Deg. | Degree |

Disc.	Disconnect
D.O.	Draw Out
DN.	Down
DPST	Double Pole Single Throw
E.C.	Electrical Contractor
EMT	Electric Metallic Tubing
E-Net	Ethernet Network
E.O.	Electrically Operated
ESIC	Elevator/Systems Interface Cabinet
°F	Degrees Fahrenheit
FFB	Foundation Field Bus Network
FLA	Full Load Amperes
FM	Factory Mutual
FPS	Feet per Second
FT.	Feet
FZ	Fire Protection Zone (Sprinkler)
GFI	Ground Fault Interrupting
gnd.	Ground
Horiz.	Horizontal
hp.	Horsepower
hr.	Hour
I/C	Intercom
ICU	Intensive Care Unit
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IMC	Intermediate Metallic Conduit
in.	Inches
IPCEA	Insulated Power Cable Engineers Association
J.B.	Junction Box
KV	Kilovolt
KVA	Kilo-Volt-Amps
KW	Kilowatts
LBS	Pounds
LED	Light Emitting Diode
lt.	Light
ltg.	Lighting
max.	Maximum
MCB	Main Circuit Breaker
MCP	Motor Circuit Protector
MIC	Microphone
min.	Minimum
M.L.O.	Main Lugs Only
MPH	Miles Per Hour
MTD	Mounted
MUX	Multiplex (Transponder) Panel
MVA	Mega Volt Amps
N.	Neutral
NEC	National Electric Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association

NIC.	Not in Contract
NF	Non Fused
No.	Number
OCU	Odor Control Unit
O.L.	Overload
OLS	Overloads
OSHA	Occupational Safety and Health Act
OS&Y	Outside Screw and Yoke (Sprinkler)
P.	Pole
PB	Pullbox
Ph or ϕ	Phase
PNL	Panel
PR	Pair
PWR	Power
PF	Power Factor
Pri.	Primary
psi	Pounds Per Square Inch
P.T.	Potential Transformer
PVC	Polyvinyl Chloride
RMS	Root-Means-Square
RPM	Revolutions Per Minute
Recept.	Receptacle
RTD	Resistance Temperature Device
SCA	Short Circuit Amps
Sec.	Secondary
S/N	Solid Neutral
SPKR	Speaker
SPST	Single Pole Single Throw
SW.	Switch
SWBD	Switchboard
TEL	Telephone
TSP	Twisted Shielded Pair
TTB	Telephone Terminal Board
TTC	Telephone Terminal Cabinet
TYP	Typical
temp.	Temperature
U.L.	Underwriters Laboratories
UNO (U.N.O.)	Unless Noted Otherwise
V	Volt
VFC	Variable Frequency Controller
VFD	Variable Frequency Drive
W	Wire
W.P.	Weatherproof

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16020

WORK INCLUDED

PART 1 – GENERAL

1.01 DESCRIPTION OF SYSTEM

- A. Furnish all labor, materials, equipment and incidentals required and install complete and make operational, electrical and process instrumentation systems for the Collier County Public Utilities Division as shown on the Drawings and as specified herein.
- B. The work shall include furnishing, installing and testing the equipment and materials specified in other Sections of the Specifications and shown on the Drawings. Provide all required coordination and supervision where work connects to or is affected by work of others, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings, indicated to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for roll-up doors, control panel installation, instrumentation and control installation, etc.
- C. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost. The work shall include but not be limited to furnishing and installing the following:
 - 1. Reuse, repair and extensions of existing distribution system for power where indicated on the contract plans. Including feeders and connections to motor disconnects, lighting and other power loads.
 - 2. Purchase, installation and manufacturer startup of (4) Motorized Gate Actuators.
 - 3. Modifications to existing Panelboard PP14A, including installation of new circuit breakers.
 - 4. Demo existing Weather station complete.
 - 5. Refeed the existing manual bar screen level transmitter from Screen 1 control panel.
 - 6. Modifications and additions to existing Lightning Protection, Bonding and Grounding Systems.
 - 7. Power, instrumentation and control Surge Suppression systems.
 - 8. Power conduit and wiring systems.
 - 9. Installation stands for power and I&C equipment.
 - 10. Installation of (2) Screen Control panels provided by the screen vendor, including Level transmitter, floats and appurtenances.
 - 11. Modifications to existing plant HMI Interface system. Including integration of Ethernet based monitoring, hardwiring and screen modifications.
 - 12. Partial demolition of electrical and control conduits, cables and equipment.
 - 13. Partial demolition of all hard-wired connections and programmed logic related to (2) Screen units and actuators.
 - 14. Furnish and install fiber optic cable including installation and termination of fiber optic cable. Fiber optic switches and patch panels supplied by the contractor in the allotted space in the Screen vendor control panels.
 - 15. Onsite Commissioning and Training for proposed screen system.

16. Arc Flash evaluation, short circuit and coordination study and electrical testing of equipment including SKM file of approved studies.
17. Electronic and hard copy project record drawings, vendor operation and maintenance manuals.

PART 2 – PRODUCTS (NOT USED)
PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16025

CODES, FEES, AND STANDARDS

PART 1 - GENERAL

1.01 CODES AND FEES

- A. Install in accordance with latest edition of the National Electric Code and the regulations of governing local, State, County and other applicable codes, including the Utilities Company. All articles, products, materials, fixtures, forms or types of construction covered in the specifications will be required to meet or exceed all applicable standards of manufacturer, testing, performance, capabilities, procedures and installation according to the requirements of ANSI, NEMA, IEEE, and NEC referenced documents where indicated and the manufacturer's recommended practices. Requirements indicated on the contract documents, which exceed but are not contrary to governing codes shall be followed.
- B. Compliance and Certification: The installation shall comply with the governing state and local codes or ordinances.
- C. All work and equipment under this Division shall be in strict compliance with the latest edition of the following codes and standards:
 - 1. National Electrical Safety Code (NESC)
 - 2. Occupational Safety and Health Administration (OSHA)
 - 3. National Fire Protection Association (NFPA)
 - 4. National Electrical Manufacturers Association (NEMA)
 - 5. American National Standards Institute (ANSI)
 - 6. Insulated Cable Engineers Association (ICEA)
 - 7. Instrument Society of America (ISA)
 - 8. Underwriters Laboratories (UL)
 - 9. Factory Mutual (FM)
 - 10. International Electrical Testing Association (NETA)
 - 11. Institute of Electrical and Electronic Engineers (IEEE)
 - 12. American Society for Testing and Materials (ASTM)
 - 13. Electrical Safety in the Workplace (NFPA70E-2012)
 - 14. Florida Building Code
 - 15. Local Codes and Ordinances

1.02 STANDARDS

- A. All electrical equipment and materials shall be listed by Underwriter's Laboratories, Inc., or a nationally recognized Electrical Testing Agency and shall bear the appropriate UL listing mark or classification marking. Equipment, materials, etc. utilized not bearing a UL certification shall be field or factory UL certified prior to equipment acceptance and use. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
- B. All materials shall be new and free of defects, and shall be U.L. listed, bear the U.L. label or

be labeled or listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16037

SHORT CIRCUIT AND COORDINATION STUDY AND ARC

FAULT HAZARD ANALYSIS

PART 1--GENERAL

1.01 GENERAL SCOPE

- A. Provide the services of a recognized corporately and financially independent firm for the purpose of performing electrical studies and reports on all new electrical equipment supplied in this project. It is the intent of these Specifications that the study firm work in direct communication with the engineer of record with frequent updates as the work progresses. The study firm shall provide all material, equipment, labor and technical supervision required to perform the studies and reports.
- B. Provide a short circuit, coordination and arc-flash study for entire electrical system. Provide a single final electrical study report incorporating the short circuit, coordination and arc flash study. The final document shall become part of the operation and maintenance manuals for the facility. The report shall be submitted on 8.5-inch by 11-inch paper bound with all field data in appendix form. Drawings within the testing report shall be on 11-inch by 17-inch paper folded to 8.5-inch by 11-inch and drawn with a computer aided design (CAD) package. The computer aided design package shall be Autocad or converted to Autocad. All adjustable breakers shall be fitted with a sticker indicating the coordination values for the equipment.
- C. Provide a short circuit, coordination and arc-flash study from the MCC14 OCP to all points downstream. Provide system studies in latest release of SKM Power Systems software, using 2018 IEEE 1584 Calculation methodology. Provide CD-Rom electronic version of SKM Power Systems software data files bound in study report for future use by Owner. The electrical system studies shall be signed and sealed by a Florida registered electrical engineer. All documentation and Record Drawings shall be verified by the signing engineer. The signing engineer shall meet at the Site with the electrical design Engineer during the information gathering phase and after system evaluation to discuss remedial changes necessary for code compliance. The remedial work study changes shall be incorporated within the electrical studies at no additional cost to the Owner.

1.02 APPLICABLE CODES, STANDARDS, AND REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.
 - 2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
 - 3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.
 - 4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings.
 - 5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

6. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations.
- B. American National Standards Institute (ANSI):
1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
 2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.
 3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
 4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
 5. ANSI C37.5 – Methods for Determining the RMS Value of a Sinusoidal Current Wave and Normal-Frequency Recovery Voltage, and for Simplified Calculation of Fault Currents.
- C. The National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code, latest edition adopted by Florida Building Code.
 2. NFPA 70E – Standard for Electrical Safety in the Workplace, latest edition.

1.3 QUALIFICATIONS

- A. The study firm shall be regularly engaged in the study of electrical equipment devices, installations, and systems. The lead, technical person shall be an electrical professional engineer in the state of Florida. The study firm shall provide in house electrical studies and reports as specified. The study firm shall submit proof of 5 similar studies with the above qualifications when requested. At least two of the similar project examples shall include arc flash studies with variable frequency drives.
- B. Pre-qualified study firms are:
1. Emerson Electrical Reliability Services, Inc. (239)-693-7100.
 2. Industrial Electrical Testing, Inc. (904) 260-8378.
 3. Expert Power Solutions, (239) 789-5458.
- C. Other firms will be considered by the engineer on submittal of qualifications on or before 20 days prior to Bid.

PART 2--PRODUCT

2.1 SHORT-CIRCUIT ANALYSIS AND COORDINATION STUDY FOR ALL NEW ELECTRICAL EQUIPMENT

- A. Provide an integrated complete study for the total electrical system.
1. Data Collection: Study Firm shall furnish all field data as required by the power system studies. All data shall be verified on site by the signing engineer. The study firm shall expedite collection of the data to eliminate unnecessary delays and assure completion of the studies as required for final approval of

- the distribution equipment Shop Drawings and/or prior to the release of the equipment for manufacturing.
2. Data may require combination to include present and future utility supplies, motors, and generators.
 3. Load data utilized may include existing and proposed loads obtained from Contract Documents and site visits.
 4. Include fault contribution of existing motors in the study, with motors less than 10 hp grouped together. The testing firm shall obtain required existing equipment data, if necessary, to satisfy the study requirements.
- B. Provide a current and complete short-circuit study, equipment interrupting or withstand evaluation, and a protective device coordination study for the electrical distribution system.
1. The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly covered in the study.
 2. The studies shall be submitted to the project electrical engineer prior to granting final approval of the distribution equipment Shop Drawings and/or prior to release of equipment for manufacture.
 3. The study shall be in accordance with applicable ANSI and IEEE Standards. The study input shall include the utility company's short circuit single and three phase contribution, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.
 4. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.
 5. An equipment evaluation study shall be performed to determine the adequacy of new and existing circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents. Any problem areas or inadequacies in the existing equipment shall be documented back to the project engineer with recommended remedial actions. The study firm shall coordinate with the supplier of the new equipment to assure all Specifications of the new equipment meet or exceed the ratings required by the study at no additional cost to the owner.
 6. A protective device coordination study shall be performed to select or to check the selections of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and settings. The coordination study shall include all voltage classes of equipment from the utility's incoming line protective device down to and including each motor control center and/or panelboard. The phase and ground overcurrent protection shall be included, as well as settings for all other adjustable protective devices.

7. The time current characteristics of the specified protective devices shall be plotted on appropriate log-log paper. The plots shall include complete titles, representative one-line diagram and legends, associated power company's relays of fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves, and fuse curves. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, ANSI transformer magnetizing inrush and withstand curves per ANSI C37.91, cable damage curves, symmetrical and asymmetrical fault currents. All requirements of the current National Electric Code shall be adhered to. Reasonable coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a complete system basis. Sufficient curves shall be used to clearly indicate the coordination achieved to each utility main breaker, primary feeder breaker, unit substation primary protective device rated or more. There shall be a maximum of four protective devices per plot.
 8. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system. Discrepancies, problem areas, or inadequacies shall be coordinated with the equipment suppliers and resolved within the scope of the Project and at no additional cost to the Owner.
- C. The results of the power system study shall be summarized in a final report and made part of the operation and maintenance manuals. The report shall include the following sections:
1. Description, purpose, basis written scope, and a single line diagram of the portion of the power system which is included within the scope of study.
 2. Tabulations of circuit breaker, fuse and other equipment ratings versus calculated short circuit duties, and commentary regarding same.
 3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection and commentary regarding same.
 4. Fault current tabulations including a definition of terms and a guide for interpretation.
- D. The Contractor's certified study firm shall be responsible for setting the breakers. Each breaker shall be fitted with an engraved tag or permanent vinyl label indicating the breaker name and the settings listed:
1. Adjustable pickups and time delays (long time, short time, ground); Adjustable time-current characteristic; Adjustable instantaneous pickup; Recommendations shall incorporate revised settings to mitigate excessive arc flash hazard.

2.2 ARC FLASH EVALUATION

- A. Provide an investigation to quantify the arc-flash hazard to which workers could be exposed to throughout the facility. Establish arc-flash intensity data for all electrical equipment where there may be an occasion to open doors, remove covers or work on

the electrical equipment in such a way that workers are exposed to energized conductors.

- B. Provide a safety policy to include procedures and information regarding the arc flash data developed for the Site. Provide a written recommendation for PPE equipment. The Site safety manual to include procedures and methods related to energized work, PPE standards, and the arc-flash data developed in the analysis.
- C. Provide arc flash evaluations in conformance to IEEE Std. 1584-2018 *IEEE Guide for Performing Arc-Flash Hazard Calculations* and NFPA 70-2024 (NEC) and NFPA 70E-2018 *Standard for Electrical Safety in the Workplace*. The arc flash study shall be performed using computer software that uses methods based on IEEE Std. 1584-2018. The software used must be capable of modeling all protective devices at the Site and any mitigation devices used to limit the incident energy. The software used must have the capability of modeling user defined PPE descriptions and ATPV values as well as limiting the maximum clearing time where engineering judgment deems it prudent.
- D. The study firm shall collect all data required for the arc flash evaluation. The existing settings and equipment types and ratings shall be field verified. Any data that should be determined to be unverifiable (due to safety or operational concern) shall be identified to the engineer and alternate means to determine the data shall be used.
- E. Where the calculations determine that the breaker settings result in arc flash hazard with incident energy levels (greater than 40 cal/cm²), the study engineer shall provide recommended breaker settings or other mitigation recommendations to reduce the incident energy to the lowest level and where energized work is capable of being performed. The study firm shall document the recommended changes and provide time-current curves indicating the coordination that reflects the recommended settings. Where main switchgear incorporates fully compartmentalized breakers and insulated bus, analyze utility main and genset main breaker compartments separate from feeder breaker compartments.
- F. Provide color coded labels per ANSI Z535.4; Yellow=Caution, Orange=Warning, Red=Danger. Use orange "Warning" labels for incident energy levels below 1.2 cal/cm². Provide equipment with incident energy level equal to 1.2 cal/cm² up to 12cal/cm² with Orange "Warning" Labels. Provide Orange "Warning" labels for incident energy levels greater then 12 cal/cm² up to 40 cal/cm². Provide Red "Danger" labels with the words "Energized Work Prohibited" in areas of extreme hazard above 40 cal/cm². Provide labels as approved by the engineer consistent with utility standards.
- G. Provide permanent labels for each electrical enclosure or equipment where workers could be exposed to energized conductors and where required by NEC. Provide die-cut 4-inch by 6-inch labels with preprinted headers. Organize safety information in approved order to communicate quickly, clearly and accurately. Provide Die-cut labels made from industrial grade indoor/outdoor vinyl, providing a long label life. Labels shall not include study firm information. Label layout shall be approved by the Project Engineer. Provide yellow Caution; orange Warning and red Danger labels for category zero, 1-3, 4 and above incident energy categories. Study firm shall supervise installation of labels and provide a statement in the project report that the labels are approved as installed. These labels shall comply with the requirements of NFPA 70E-2018 and include at least the following information:

1. Voltage (phase to phase).
 2. Arc Flash Boundary (inches).
 3. Incident Energy at the working distance (cal/cm²) OR working distance and PPE Category and Description (Including glove rating) NOT BOTH.
 4. Restricted Approach Boundary (inches).
 5. Limited Shock Approach Boundary (inches).
 6. Location Identification.
- H. Provide a comprehensive report that includes the basis for and results of numerical assessments. The report shall include any significant conclusions and recommendations for corrective or mitigative action as appropriate. In addition, the report shall include the following:
1. Summary of Project.
 2. Description of system and equipment included in the assessment.
 3. Identification of the methods or software used.
 4. Date Work was performed.
 5. Identification of the person that performed the assessment.
 6. Tabular data indicating; the incident energy and required PPE for all locations evaluated.
 7. Detailed datasheets for each location studied.
 8. Tabular data of recommended settings changes.
 9. Time-current curves for the locations with recommended settings changes.
 10. A one-line diagram of the computer model.
- I. Provide all arc flash hazard tables within the report for all possible scenarios. Provide Arc Flash Labels for the worst case and highest hazard rating for each piece of equipment from any of the possible scenarios. Additionally provide the best case and lowest hazard rating informational CAUTION label adjacent to the worst case hazard label. Provide HRC tables for the following scenarios:
1. Utility main breaker closed in open transition; normal operation.
 2. Generator breakers closed in open transition; normal operation with two generators paralleled.
 3. Generator breaker closed in open transition; normal operation with one generator.
 4. During 100msec closed transition with Utility and Generator mains closed. Assume second genset paralleled with the other genset of like kind and with Utility.
 5. Utility main breaker closed in open transition with the generators locked out and the arc flash maintenance mode operational.
 6. Generator breaker closed in open transition with the utility main breaker locked out and the arc flash maintenance mode operational.
 7. Switchgear tie breaker closed and one bus utility and standby main breakers open and locked out.
 8. Provide additional scenarios as may become evident during the study report.

2.3 SAMPLE LABELS

A. Sample Arc Flash Label:

		DANGER	
NO SAFE PPE EXISTS			
QUALIFIED WORKERS ONLY - PPE REQUIRED			
168 in	Arc Flash Boundary		
42.5 cal/cm²	Incident Energy at 18 in		
480 VAC	Shock Risk when cover is removed		
00	Glove Class		
42 in	Limited Approach		
12 in	Restricted Approach		
Location:		MDP	
Prepared on:	04/28/21		
Warning: Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements			

		WARNING	
Arc Flash and Shock Hazard Appropriate PPE Required			
4.9 cal/cm² Incident Energy at 1 ft 6 in			
3 ft 6 in	Arc Flash Boundary		
480 VAC	Shock Risk	Glove Class	
		00	
3 ft 6 in	Limited Approach		
1 ft	Restricted Approach		
REFER TO NFPA 70E FOR SPECIFIC PPE REQUIREMENTS			
Rev 0		August 17, 2017	
Equip ID: SWBD2			

B. Sample Informational Labels:

CAUTION
Arc Flash Hazard is
Reduced to Category-X when Generator Source is locked out from operation.

CAUTION

Arc Flash Hazard is Reduced to Category-X when Generator Source is locked out and Switchgear
Arc Flash Maintenance Mode is Active.

END OF SECTION

SECTION 16040

IDENTIFICATION

PART 1 - GENERAL

1.01 GENERAL

- A. Provide materials and installation for the identification of electrical equipment, components, cables and wiring and safety signs.
- B. Related Work Specified in Other Sections Includes:
Section 16050-Special Requirements; Section 16120 Low Voltage Wires and Cables; Section 16850 PLC/HMI Control Integration

1.02 REFERENCES

- A. Codes and standards incorporated within this Section are:
 - 1. ANSIC2/NFPA70E National Electrical Safety Code (NESC)
 - 2. ANSI Z535.1 Safety Color Code
 - 3. ANSI Z535.2 Environmental and Facility Safety Signs
 - 4. ANSI Z535.3 Criteria for Safety Symbols
 - 5. OSHA Occupational Safety and Health Act: specification 1910.145, Standards for Accident Prevention, Signs and Tags

1.03 SUBMITTALS: Furnish all product submittals used.

- A. Product Data and Information: Furnish manufacturer's catalog data for safety signs, nameplates, labels and markers.
- B. Furnish manufacturer's instructions indicating application conditions and limitations of use; and storage, handling, protection, examination and installation of product.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.
 - 1. W. H. Brady Company
 - 2. Seton
 - 3. Thomas & Betts A.
 - 4. Approved Equal

2.02 MATERIALS

- A. General: Provide identification materials listed and classified by UL or tested by an acceptable Electrical Testing Company certifying the equivalence of the materials to UL listing requirements and OSHA approved.

- B. Laminated Plastic Nameplates: Provide engraved three layer laminated plastic nameplates with white letters on black background with lettering etched through the outer covering and fastened with corrosion resistant brass or stainless steel screws. Do not use mounting cement for fastening nameplates.
1. Provide nameplates with 1-inch high lettering for main breakers, automatic transfer switches, panelboards, transformers, VFD's, control panels and disconnect switches.
 2. Provide nameplates for each motor identifying service or function and lettering of an appropriate size to suit each motor. Submersible motor nameplates to be affixed to equipment disconnect.
 3. Provide approved directories of circuits with typewritten designations of each branch circuit in each panelboard.
 4. Provide smaller lettering for a neat, legible nameplate where the amount of lettering causes excessively large nameplates.

2.03 WIRE MARKERS: Identify wire bundles and each individual wire.

- A. Wire bundles: Provide a permanent waterproof brass or rigid fiber identifying tag attached with nylon self locking "Ty-Raps".
- B. Wire identification markers: Provide a printed white, self-laminating wrap labels with black bold lettering for wires size No. 10 AWG and smaller. Provide a printed self-laminating wrap labels, white, vinyl type with black bold lettering for wires No. 8 AWG and larger
- C. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Write-On Tags: Polyester tag, 0.015-inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable: Marker for Tags: Permanent, waterproof, black-ink marker recommended by tag manufacturer.

2.04 SAFETY SIGNS: Provide safety signs in accordance with OSHA standards meeting the requirements of ANSI C2, ANSI Z535.1, ANSI Z535.2 and ANSI Z535.3. Comply with NFPA 70 and 29 CFR 1910.145

- A. Provide safety signs manufactured from vinyl having a minimum thickness of 60 mils with red and black letters and graphics on a white background.
- B. Size: Provide 7-inch by 10-inch signs or smaller if larger size cannot be applied.
- C. Mount safety signs using corrosion-resistant screws. Do not use mounting cement.
- D. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- E. All receptacles and switches shall be identified on the inside of the cover plate by circuit

number and panelboard.

- F. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application and with 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- G. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing, and with colors, legend, and size required for application and with 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

2.05 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch. Identification plates shall be furnished for lighting and power panelboards, motor control centers, all line voltage heating and ventilating control panels, fire detector and sprinkler alarms, pilot lights, disconnect switches, manual starting switches, magnetic starters, and all miscellaneous controls, switches and enclosures.
- B. Process control devices and pilot lights shall have identification plates. Identification plates shall be furnished for all line-voltage enclosed-circuit breakers; the plates shall identify the equipment served, voltage, phase(s), and power source. Circuits 480 volts and above shall have conspicuously located warning signs in accordance with OSHA requirements.
- C. Identification plates shall be three-layer black-white-black, engraved to show black letters on a white background. Letters shall be uppercase. Identification plates 1-1/2 inches high and smaller shall be 1/16 inch thick with engraved lettering 1/8 inch high. Identification plates larger than 1-1/2 inches high shall be 1/8 inch thick with engraved lettering not less than 3/16 inch high. Identification plates having edges of 1-1/2 inches high and larger shall be beveled.
- D. Provide nameplates of minimum letter height as follows: Panelboards, switchboards, safety switches and motor control centers: 1/4-inch, identify panel name; 1/8-inch, identify voltage, phase, number of wires, and source.
- E. Safety color coding for identification of warning signs shall conform to NEMA Z 535. Red identification plates reading CAUTION: 480/277 VOLTS shall be provided in switch and outlet boxes containing 277-or 480-volt circuits. An identification plate marked DANGER: 480 VOLTS shall be provided on the outside of 480-volt enclosures. Identification plate shall use white lettering on a red laminated plastic.
- F. Any equipment with externally powered wiring shall be marked with a laminated plastic name plate having 3/16-inch-high white letters on a red background as follows: DANGER – EXTERNAL VOLTAGE SOURCE.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install nameplates on the front of equipment, parallel to the equipment lines and

secured with corrosion resistant screws. Labels to be consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual designations. Warning Labels for Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply metal-backed, butyrate warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

- B. Install laminated nameplates identifying, each electrical equipment enclosure and Individual equipment and devices. The following items shall be equipped with nameplates: All motors; motor starters, motor-control centers, pushbutton stations, control panels, time switches, disconnect switches panelboards, circuit breakers, contactors, recorders, transmitters, instruments or relays in separate enclosures, thermostats, photocells, power receptacles, switches controlling equipment or receptacles, switches controlling lighting fixtures where the fixtures are not located within the same space as the controlling switch, termination cabinets, manholes and pull boxes, instrumentation and control terminal cabinets, pull boxes manholes and cabinets. Special electrical systems shall be identified at junction and pull boxes, terminal cabinets and equipment racks.
- C. Electrical contractor is responsible for nameplates on electrical equipment supplied by other divisions and installed and wired by electrical including all instrumentation and controls equipment. A portion of existing equipment affected by this contract shall also receive nameplates as determined by the engineer.
- D. Surface Preparation: Degrease and clean surfaces to receive nameplates, labels and marking paint.
- E. Nameplates shall adequately describe the function of the particular equipment involved. Nameplates for panelboards and switchboards shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 277/480V, 3-phase, 4-wire". The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine. Equipment Requiring Workspace Clearance shall be labeled According to NFPA 70 applied to door or cover of equipment.
- F. Rework or reuse of existing equipment will require new identification tags for some existing equipment.
- G. Wire Markers: Identify each individual wire with identification tags as follows:
 - 1. Wire identification markers: Provide wire identification markers on each wire at all termination points.
 - a. On power and lighting circuits: The branch circuit or feeder number as indicated on drawings
 - b. On control circuits terminated in motor control centers, switchgears, control panels and alike: The field device and terminal number of the opposite end connection.
 - c. On control circuits at each field device: The panel or compartment number and terminal number of the opposite end connection.
 - 2. Provide oversize wire markers so that after heat shrinking the wire marker can be rotated on the wire. Rotate wire markers so that wire identification number is visible.

- H. Raceway Tags: Provide raceway tags to identify origin and destination of conduit. Install tags at each terminus and at midpoint of run. Provide tags at minimum intervals of every 50 feet of above grade raceway except where concealed in walls. Provide brass tags and nylon straps for attachment.
- I. Safety Signs: Provide safety signs as follows or as shown:
1. Wording: "DANGER -ELECTRICAL EQUIPMENT, AUTHORIZED PERSONNEL ONLY"
Location: On the outside door of all electrical equipment rooms or areas. On the outside door of all electrical equipment cabinets.
 2. Wording: "DANGER -POWERED FROM MORE THAN ONE SOURCE"
Location: Outside all equipment that operates from more than one power source; ATS, PLCs, Main Tie Main switchgear/MCCs, etc.
 3. Wording: "NOTICE -KEEP DOOR CLOSED" Location: On all doors with another safety sign installed.
 4. Wording: "CAUTION -CONTROLS & INTERLOCKS POWERED FROM MULTIPLE SOURCES". Location: On all control panel doors, MCCs I&C terminal cabinets, etc.

END OF SECTION

SECTION 16050

SPECIAL REQUIREMENTS

PART – 1 GENERAL

1.01 SUMMARY

- A. General requirements for providing basic electrical materials and methods.
- B. Related Work Specified in Other Sections Includes:
 - 1. Certain items of equipment, and various control devices including conduit and wiring which are indicated on electrical drawings to be connected, but are specified in other sections pertaining to plumbing, heating, ventilating, air conditioning, temperature control systems, process equipment, process control systems, and instrumentation. Install and connect these items to the electrical system as indicated or required in accordance with the Contract Documents.
 - 2. Excavation and backfilling, including gravel or sand bedding for underground electrical work is specified in other Divisions.
 - 3. Cast in place concrete work, including concrete encasements for electrical duct banks, equipment pads, and reinforcing steel, is specified in other Divisions.
- C. Overall Application of Specifications: This Section applies to all sections of Division 16 and to other sections that include electrical equipment requirements except when in these individual sections requirements are otherwise specified to provide and install all materials necessary for a complete operational system.
- D. Where the requirements of another Division, section, or part of these specifications exceed the requirements of this Division, those requirements shall govern.
- E. Temporary Requirements: This Section applies to any temporary circuits, overcurrent devices, conduit, wiring, and other equipment required during changeover from existing to a new electrical system. This Section also applies to temporary rewiring of lighting and power circuits, instruments and devices.

1.02 SCOPE OF WORK

- A. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing site and structures in which work under this Division is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that their representative has visited the site and structures and noted the locations and conditions under which the work will be performed and that the bidder takes full responsibility for a complete knowledge of all factors governing the work.
- B. Field verify all existing underground electrical and mechanical piping. Locate all openings required for work performed under this section.
- C. Provide sleeves, guards or other approved methods to allow passage of items installed under this section.

- D. The Contractor shall prepare and furnish electrical and instrumentation conduit layout shop drawings for yard electrical, within and under all roads, buildings and structures to the Engineer for approval prior to commencing work. Layouts shall include but not be limited to equipment, pull boxes, conduit routing, dimensioning, methods and locations of supports, reinforcing, encasement, materials, conduit sizing, equipment access, potential conflicts, building and yard lighting, and all other pertinent technical specifications for all electrical and instrumentation conduits and equipment to be furnished. All layouts shall be drawn to scale on 22 x 34 sheets.
- E. The work shall include complete testing of all equipment and wiring at the completion of work and making any minor correction changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.
- F. A single manufacturer shall provide panelboards, main breakers, transformers, disconnect switches, etc.
- G. Contractor shall provide their own temporary power for miscellaneous power (drills, pumps, etc.). No facility circuits shall be used unless approved by the engineer. Any temporary added shall be removed at job completion.
- H. Complete coordination with other contractors. Contractor shall coordinate with all other contractors equipment submittals and obtain all relevant submittals.
- I. Mount transmitters, process instruments, operator's stations, etc. furnished under other Divisions of these specifications.

1.03 DEFINITIONS

- A. Hazardous Areas: Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503. Hazardous areas as defined by the NEC as Class I, Division 1, Group D, or Class I, Division 2, Group D; hazardous areas as follows:
 - 1. Class 1, Division 1, Group D
 - a. Wet Wells
 - b. Pretreatment
 - i. Influent Channel(s)
 - 2. Class 1, Division 2, Group D
 - a. Pump Rooms and Dry Well
 - b. Odor control

1.04 QUALIFICATIONS

- A. The Florida licensed electrical contractor shall have regularly engaged in the installation of industrial electrical power systems for a minimum period of ten (10) years. When requested by the engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- B. Provide a field superintendent licensed in Florida, who has had a minimum of ten (10) years previous successful experience on projects of comparable size and complexity. Superintendent shall be present at all times that work under this Division is being installed or

affected. A resume of the Superintendent's experience shall be submitted to Engineer before starting work.

1.05 EXISTING CONDITIONS

- A. Investigate site thoroughly and reroute all conduit and wiring in area of new construction in order to maintain continuity of existing circuitry. Existing conduits shown on plans show approximate locations only. Contractor must verify and coordinate existing site conduits and pipes to any excavation on site. Bids to include hand digging and all required rerouting in areas of existing conduits and/or pipes.
- B. Special attention is called to the fact that work involved is in connection with existing facilities that must remain in operation while work is being performed. Work must be done in accordance with the owner's priority schedule as required. Schedule work for a minimum outage to Owner. Request written permission and receive written approval from Owner, reference section 01160 for shutdown notice time frames, in advance of any shutdown of existing system. Perform work required at other than standard working hours where owner cannot approve outages during regular working hours. Provide temporary power and temporary wiring as required to maintain operation as directed by the owner or engineer to facilitate construction. Protect existing buildings and equipment during construction as required.
- C. Special attention is called to the fact that there is conduit, wiring, fixtures and other electrical items in and between the existing facilities that must be removed or relocated in order to perform the work. Bid shall include all removal and relocation required for completion of the alterations and the new construction.

1.06 QUALITY ASSURANCE

- A. Codes: Provide all electrical Work in accordance with applicable local codes, regulations and ordinances. If there is a conflict between the requirements specified in the Contract Documents and the codes, follow the more stringent requirements as determined and approved.
- B. Testing: As a minimum, provide standard factory and field tests for each type of equipment. Other tests may be specified in the applicable equipment section.
- C. Labeling: Provide all electrical equipment and materials listed and approved by Underwriters Laboratories with the UL label or other OSHA recognized testing laboratories attached to it.
- D. Standard Products: Unless otherwise indicated, provide electrical materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these Specifications. When two or more units of the same class of material and equipment are required, provide the products of the same manufacturer.

1.07 ENCLOSURE TYPES

- A. Unless otherwise specified herein or shown on the Drawings, electrical enclosures shall have the following ratings:

1. NEMA 1 for dry, non-process indoor locations.
2. NEMA 12 for "DUST" locations.
3. NEMA 4X for all outdoor locations, rooms below grade (buried vaults), "DAMP" and "WET" locations.
4. NEMA 4X for "CORROSIVE" locations.
5. NEMA 7 (and listed for use in the area classifications shown) for "Class I Division 1 Group D", "Class I Division 2 Group D" and "Class II Division 1" hazardous locations shown on the Drawings.

1.08 CODES, INSPECTION AND FEES

- A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction. The installation shall comply with the governing state and local codes or ordinances. Completed electrical installation shall be inspected and certified by all applicable agencies that it is in compliance with all codes. Comply with latest utility company regulations.
- B. Obtain all necessary permits and pay all fees required for permits and inspections. It is the contractor's responsibility to contact the required Utility Company to determine if any fees, charges or costs will be due the Utility Company, as required by the Utility Company for temporary power, installations, hook-ups, etc. This fee, charge or cost shall be included in this contractor's bid price.

1.09 PHASE BALANCING

- A. The Drawings do not attempt to balance the electrical loads across the phases. Circuits on panelboards shall be field connected to result in evenly balanced loads across all phases.
- B. Field balancing of circuits shall not alter the conductor color coding requirements as specified herein.

1.10 SAFETY REQUIREMENTS

- A. The Contractor shall make every effort to keep all employees and/or subcontractors aware of the danger inherent in working in dangerous proximity to the existing power lines. The minimum recommended precautionary measures are as follows:
 1. Make sure that all persons responsible for operating cranes, draglines and other mobile equipment have a copy of, and are familiar with the State Department of Commerce Regulations for Use of Cranes, Draglines and Similar Equipment Near Power Lines, as well as the U.S. Department of Labor OSHA Regulations, before commencing operation of said equipment.
 2. Make sure that all cranes, draglines and other mobile equipment have attached to them the black and yellow Department of Commerce warning signs required by the said Regulations of State Department of Commerce.
 3. Warn all employees on the ground, new and old employees alike, of the danger of holding on to or touching a cable or other piece of equipment or machinery that is located or working close to any overhead power line.
 4. If, during the course of construction, it becomes necessary for the contractor, or subcontractor, and their employees, to operate cranes, draglines, or their mobile equipment, in dangerous proximity of any overhead power lines, or in such a manner that such equipment might come close to any overhead power lines, the

Contractor shall give the Power Company or overhead power line owner prior notice of such proposed operation.

1.11 PROJECT CONDITIONS

- A. The Drawings indicate the extent and general arrangement of the principal electrical elements, outlets and circuit layouts. Connect and install all electrical elements and devices to form a workable system as required by the Contract Documents whether the connections and installations are specifically stated in the Specifications or shown. Provide necessary materials and installation wherever required to conform to the specific requirements of the furnished equipment and for proper installation of the Work.
- B. Schematics: In general the runs of feeders are shown schematically and are not intended to show exact routing and locations of raceways. Verify actual and final arrangement, equipment locations, and prepare circuit and raceway layouts before ordering materials and equipment. Equipment locations are approximate and are subject to modifications as determined by equipment dimensions.
- C. Coordination of Work: Coordinate the Work so that the electrical equipment may be installed without altering building components, other equipment or installations.
- D. Coordinate arrangement, mounting, and support of electrical equipment to:
 - 1. Allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. Provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. Allow the right of way for piping and conduit installed at the required slope.
 - 4. Clear connecting raceways, cables, wireways, cable trays, and busways of obstructions and of the working and access space of other equipment.
- E. Coordinate the installation of required supporting devices and set sleeves in cast-in place concrete, masonry walls, and other structural components as they are constructed.
- F. Coordinate electrical testing of electrical, mechanical, and architectural items, so that functionally interdependent equipment and systems demonstrate successful interoperability.
- G. Departure from Design: If departures are deemed necessary due to structural conditions, obstructions or other problems, provide details of such departures and the reasons for requesting approval as soon as practicable but not later than the submittal of the raceway layout drawings. Do not make any departures without written approval.

1.12 MATERIALS

- A. Reference: "General Conditions of the Contract".
- B. Where several brand names, make or manufacture are listed as acceptable each shall be regarded as equally acceptable. Where a manufacturer's model number is listed, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to Engineer's review and acceptance.
- C. When a product is specified to be in accordance with a trade association or government

standard, at the request of Engineer, Contractor shall furnish a certificate that the product complies with the referenced standard. Upon request of Engineer, Contractor shall submit supporting test data to substantiate compliance.

1.13 SUBSTITUTIONS

- A. Each bidder represents that his bid is based upon the materials and equipment described in this division of the specifications.
- B. No substitutions will be considered unless written request has been submitted to the Engineer for approval at least ten days prior to the bid date. Submittal shall include the name of the material or equipment for which it is to be substituted, drawings, cuts, performance and test data and any other data or information necessary for the Engineer to determine that the equipment meets all specification and requirements. If the Engineer approves any proposed substitutions, such approval will be set forth in an addendum.
- C. Substituted equipment or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modifications of related systems as a result of substitutions shall be made at the Contractor's expense.

PART – 2 PRODUCTS (NOT USED)

PART – 3 EXECUTION

3.01 SUBMITTALS

- A. General: Provide submittals for all electrical material and devices. Including the following:
 - 1. Submit Technical Information Brochures at start of construction or within 30 days after Award of the Contract. Each brochure shall consists of an adequately sized, hard-cover, 3-ring binder for 8 1/2 inch by 11-inch sheets. Provide correct designation on outside cover and on end of brochure. When, in the judgment of the Engineer, one binder is not enough to adequately catalog all data, an additional binder will be required and data split as directed by the Engineer. Specific shop drawing submittals may be submitted separately after technical information brochures but before any equipment is purchased; provide index and schedule of shop drawings to be submitted within the technical information brochures.
 - 2. First sheet in the brochure shall be a photocopy of the Electrical Index pages in these specifications. Second sheet shall be prepared by the Contractor, and shall list Project Addresses and phone numbers with key personnel for this project.
 - 3. Provide reinforced separation sheets tabbed with the appropriate specification reference number.
 - 4. The General Contractor shall review the brochures before submitting to the Engineer. No request for payment will be considered until the brochure has been submitted and reviewed completely.
 - 5. Submit cost breakdown "Schedule of Values" for electrical work in the Technical Information Brochures. Cost of material and labor for each major item shall be shown.
 - 6. Acceptance: When returned to Contractor, submittals will be marked with Engineer's stamp. If box marked "returned for correction resubmit" is checked,

submittal is not approved and Contractor is to correct and resubmit as noted, otherwise submittal is approved and Contractor is to comply with notation making necessary corrections on submittal and resubmit for final record.

7. Note that the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Approval of shop drawings does not invalidate the plans and specifications if in conflict with the submittal. It is the contractor's responsibility to request in writing and seek written approval from the engineer for all deviations of the plans and specifications.

B. **Product Data and Information:** Provide complete list of electrical equipment and materials to be furnished showing manufacturer, catalog number, size, type, voltage rating and other pertinent information.

1. Provide catalog data on manufacturer's standard equipment and materials. Clearly indicate on catalog cuts the equipment and devices being proposed.
2. Identification: Provide complete schedule and listing of system and equipment identification labels with legends.
3. Material shall not be ordered or shipped until the shop drawings have been approved.
4. The Engineer's Shop Drawing review shall be for conformance with the design concept of the project and compliance with the Specifications and the Drawings. Errors and omissions on approved shop drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by the Specifications and the Drawings.
5. Shop Drawings shall be stamped with the date checked by the contractor and a statement indicating that the Shop Drawings conform to the Specifications and the Drawings. This statement shall also list all exceptions to the Specifications and the Drawings. Shop drawings not so checked and noted shall be returned.

C. **Contractor's Shop Drawings:** Provide shop drawings on items manufactured for the Contract.

1. Provide connection diagram and schematic for each piece of electrical equipment. A manufacturer's standard connection diagram or schematic showing more than one method of connection is not acceptable unless it is clearly marked to show the intended method of connection.
2. Provide diagrams showing connections to field equipment. Clearly differentiate between manufacturer's wiring and field wiring.
3. Provide raceway layout drawings showing conduits, boxes, and panels which contain the conductors to be provided. Include schedules listing conduit sizes and conductor content and identification.
4. Where additions and modifications are made to existing equipment, provide drawings which include both retained existing equipment and new Work.

D. **Coordination Drawings:** Prepare to scale coordination drawings (1/4"=1'-0"); detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:

1. Indicate the proposed locations of major raceway systems, equipment, and materials. All dimensions shall be field verified at the job site and coordinated with the work of all other trades. Include the following:
 - a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
 - b. Exterior wall and foundation penetrations.
 - c. Fire-rated wall and floor penetrations.
 - d. Equipment connections and support details.
 - e. Sizes and location of required concrete pads and bases.
- E. Record Documents: Prepare record documents, and in addition to the requirements specified in Division 1, General Requirements. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, (the "Record Drawings"). Indicate installed conditions for:
 1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 3. Approved substitutions, and actual equipment and materials installed.
 4. Record Drawings shall accurately show the installed condition of the following items: Power Riser Diagram(s). Equipment elevations (front views). Raceways and pullboxes. Conductor sizes and conduit fills. Control Wiring Diagram(s). Underground raceway and duct bank routing. Plan view, sizes and locations of distribution transformers and outdoor electrical equipment enclosure.
 5. Submit a schedule of control wiring raceways and wire numbers, including the following information: Circuit origin, destination and wire numbers. Field wiring terminal strip names and numbers.
 6. In addition to the schedule, provide point to point connection diagrams showing the same information submitted in the schedule of control wiring raceways including all designations and wire numbers. Comply with PLC tag designation on all instrumentation and control cabling in and out of PLC racks.
 7. The schedule of control wiring raceways and wire numbers and the point to point connection diagrams shall be in electronic Autocad and Word format (i.e. no hand-written or drawn schedules, drawings, or diagrams will be accepted).
- F. Operation and Maintenance Manuals: Prepare operation and maintenance manuals, and in addition to the requirements specified in other Divisions, include the following information for equipment items:
 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and catalog numbers of replacement parts. Complete parts list with stock numbers, including spare parts. A complete bill of material supplied, including serial numbers, ranges and pertinent data.
 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. A comprehensive index.
5. A complete "As Built" set of approved shop drawings.
6. A table listing of the "as left" settings for all timing relays and alarm and trip setpoints.
7. A complete listing of As left programmable parameters for all drives, soft-starters and other microprocessor controlled equipment.
8. System schematic drawings "As Built", illustrating all components, piping and electric connections of the systems supplied under this section.

3.02 ROUGH-IN

- A. Final Location: Verify final locations for rough-ins with field measurements, vendor shop drawings and with the requirements of the actual equipment to be connected.
- B. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.
- C. Install each 3 phase circuit in a separate conduit unless otherwise shown.
- D. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
- E. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
- F. All floor mounted electrical equipment shall be placed on 4-inch thick (3/4-inch, 45 degree chamfer at all exposed edges) concrete pads, provide reinforcement, anchors, etc.

3.03 SLEEVES AND FORMS FOR OPENINGS

- A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.
- B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.
- C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the Engineer may allow the installations of such conduit to be exposed. Requests for this deviation must be submitted in writing. No additional compensation for such change will be allowed.
- D. Seal all openings, sleeves, penetration and slots.

3.04 CONCRETE PADS

- A. Furnish and install reinforced concrete pads for transformers, switchgear, and motor control

centers, of size as shown on the drawings or required. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by three (3) inches on all sides, except when equipment is flush against a wall, then the side or sides against the wall shall be flush with the equipment. Chamfer top edges 1". Trowel all surfaces smooth. Reinforce pads with 6" X 6" X 6/6 welded wire fabric. Conduit stub up area within the pad area shall remain void. Coordinate with equipment shop drawings stub up areas.

3.05 CUTTING AND PATCHING

- A. Perform cutting and patching as specified in Division 1. In addition to the requirements specified in Division 1, the following requirements apply:
 - 1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Locate existing structural reinforcing where core drilled penetrations are required so as not to cut the steel reinforcing.
 - 2. Cut, remove, and properly dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work. Deliver all the existing removed to the OWNER as directed.
 - 3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
 - 4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
 - 6. Provide non-destructive imaging methods (radar, x-ray) to locate embedded conduit in concrete prior to demolition, saw cutting and core drilling. Relocate and reconstruct affected conduit and wire per electrical specifications.
 - 7. Patch finished surfaces and building components using new materials as specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
- B. Supplementary Requirements: Any cutting of work in place shall be patched and decorated by such mechanics and in such a manner that the quality of workmanship and finish shall be compatible with that of adjacent construction.

3.06 INSTALLATION

- A. Any work not installed according to the Drawings and this Division or without approval by the Engineer shall be subject to change as directed by the Engineer. No extra compensation will be allowed for making these changes.
- B. Electrical equipment shall at all times during construction be adequately protected against

mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If an apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it shall be replaced at no additional cost to the Owner, the damaged unit(s) or systems shall remain on site and returned to the manufacturer after the replacement unit(s) or systems have been delivered to the site. Under no circumstances will electrical equipment damaged by water be rehabilitated or repaired, new equipment shall be supplied and all cost associated with replacement shall be borne by the Contractor.

- C. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion.
- D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted at no additional cost to the Owner.
- E. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.
 - 3. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.
 - 4. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 - 5. Coordinate the installation of required supporting devices and sleeves to be set in cast-in-place concrete and other structural components, as they are constructed.
 - 6. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - 7. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 - 8. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - 9. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the ENGINEER for resolution.
 - 10. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - 11. Install electrical equipment to facilitate servicing, maintenance, and repair or

- replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
12. Install access panel or doors where units are concealed behind finished surfaces.
 13. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- F. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have finish or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of these specifications.

3.07 TESTS AND SETTINGS

- A. Test systems and equipment furnished under Division 16 and other divisions supplying electrical equipment. Repair or replace all defective work and equipment. Refer to Acceptance Testing section and the individual equipment sections for additional specific testing requirements.
- B. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.
- C. In addition to the specific testing requirements listed and the individual Sections, the following minimum tests and settings shall be performed. Submit test reports upon completion of testing.
1. Mechanical inspection, testing and settings of circuit breakers, disconnect switches, motor starters, overload relays, control circuits and equipment for proper operation.
 2. Check the full load current draw of each motor. Where power factor correction capacitors are provided the capacitor shall be in the circuit at the time of the measurement. Check ampere rating of thermal overloads for motors and submit a typed record to the Engineer of the same, including driven load designation, motor service factor, horsepower, and Code letter. If incorrect thermal overloads are installed replace same with the correct size overload.
 3. Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.
 4. Check settings of the motor circuit protectors. Adjust settings to lowest setting that will allow the motor to be started when under load conditions.
 5. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.
 6. Check rotation of motors prior to testing the driven load. Disconnect the driven equipment if damage could occur due to wrong rotation. If the rotation is incorrect for the driven equipment correct motor connections at the motor terminal box.
 7. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.
 8. Inspect each piece of equipment in areas designated as HAZARDOUS to ensure that equipment of proper rating is installed.
 9. Verify all terminations at transformers, equipment, panels and enclosures by producing a 1, 2, 3 rotation on a phase sequenced motor when connected to "A", "B" and "C" phases.
 10. Check all wire and cable terminations. Verify to the Engineer connections meet the equipments torque requirements.

11. Field set all transformer taps as required to obtain the proper secondary voltage.
12. Infra-red hot spot inspection shall be made of all electrical equipment including but not limited to switchgear, motor control centers, transformers, switches, power and control panels, etc. This shall be done under representative load conditions before the equipment is used by the Owner.

3.08 MANUFACTURERS SERVICE

- A. Provide manufacturer's services for testing and start-up of all major electrical equipment: VFDs, ATS, Gensets, MCCs, Switchboards, Switchgear, Actuators, Etc.
- B. Testing and startup shall not be combined with training. Testing and start-up time shall not be used for manufacturer's warranty repairs.
- C. The manufacturers of the above listed equipment shall provide experienced Field Service Engineer to accomplish the following tasks:
 1. The equipment shall be visually inspected upon completion of installation and prior to energization to assure that wiring is correct, interconnection complete and the installation is in compliance with the manufacturer's criteria. Documentation shall be reviewed to assure that all Drawings, operation and maintenance manuals, parts list and other data required to check out and sustain equipment operation is available on-site. Documentation shall be red-lined to reflect any changes or modifications made during the installation so that the "as-built" equipment configuration will be correctly defined. Spare parts shall be inventoried to assure correct type and quantity.
 2. The Field Service Engineers shall provide engineering support during the energization and check-out of each major equipment assembly. They shall perform any calibration or adjustment required for the equipment to meet the manufacturer's performance specifications.
 3. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with manufacturer's test specifications.
 4. A final report shall be written and submitted to the Contractor within fourteen days from completion of final system testing. The report shall document the inspection and test activity, define any open problems and recommend remedial action. The reports after review by the Contractor shall be submitted to the Engineer.

3.09 TRAINING

- A. The cost of training programs to be conducted with Owner's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.
- B. Provide digitally recorded color video with audio as directed by the Civil Engineer and Owner.
- C. Provide detailed O&M manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project. Reference section 01830 Operations and Maintenance Data for addition requirements.

- D. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance including trouble-shooting of each system.
- E. All training schedules shall be coordinated with and at the convenience of the Owner. Shift training may be required to correspond to the Owner's working schedule. The training shall be conducted with record "as-built" drawings sufficient for each class member.
- F. The Contractor shall submit an overview of the proposed training plan. This overview shall include, for each course proposed:
 - 1. An overview of the training plan.
 - 2. Course title and objectives.
 - 3. Recommended types of attendees.
 - 4. Course Content - A topical outline.
 - 5. Course Format - Lecture, laboratory demonstration, etc.
 - 6. Schedule of training courses including dates, duration and locations of each class.

3.10 WARRANTY

- A. The work under this Division shall include a two-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material that has been furnished under this Contract at no cost to the Owner for a period of two years from the date of substantial completion of the System. This guarantee shall not include light bulbs or batteries in service after six months from date of Substantial Completion of the System.

END OF SECTION

SECTION 16110

RACEWAYS AND CONDUIT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Description of System: This Section includes requirements for raceways, fittings, boxes, enclosures, and cabinets for electrical, instrumentation and control system wiring.
- B. Use threaded aluminum rigid conduit for all hazardous location areas. Only heavy wall PVC (Schedule 80) shall be used for all raceways trapped underground without concrete encasement protection. Above ground in areas subject to chemical degradation (chemical storage, chlorine rooms, odor control and scrubber area, etc) use Schedule 80-PVC. Use aluminum conduit for exposed above grade interior area. Electrical Metallic Tubing shall be used within air conditioned electrical rooms for power and for instrumentation and control conduits. Use rigid aluminum conduit above grade on exterior of buildings and in above grade interior wet locations. Where PVC conduit penetrates a floor from underground or in a slab; a PVC coated or black mastic coated rigid aluminum conduit elbow shall be used for all conduits.
- C. Minimum conduit size for all systems shall be 3/4". All conduits shall be U.L. listed and labeled. Conduit sizes shown on the drawings are to aid the contractor in bidding only; the contractor is responsible for conduit sizes as required by NEC fill tables but do not provide smaller conduits than indicated. The contractor is responsible to coordinate the required conduit sizes and conductor quantities for all control and instrumentation system conduit and wiring with the controls subcontractor prior to installation.
- D. Provide stainless steel or non-metallic conduit supports and 316 stainless steel hardware in all areas except air conditioned spaces.

1.02 SUBMITTALS

- A. Product Data:
 - 1. Product data shall be submitted on:
 - a. Conduit, raceways, wireways.
 - b. Conduit fittings, boxes, enclosures and cabinets.
 - c. Surface metal raceway

PART 2 - PRODUCTS

2.01 ELECTRIC METALLIC TUBING

- A. Electric metallic tubing (thin wall) shall meet Federal EMT Specifications WW-C-563 ANSI C80.3.

2.02 FLEXIBLE CONDUIT

- A. Flexible, Nonmetallic, Liquid-Tight Conduit:

1. Material: PVC core with fused flexible PVC jacket. UL 1660 listed for:
 - a. Dry Conditions: 80 degrees C insulated conductors.
 - b. Wet Conditions: 60 degrees C insulated conductors.
2. Manufacturers and Products:
 - a. Carlon; Carflex or X Flex.;
 - b. T & B; Xtraflex LTC or EFC.

2.03 PVC CONDUIT

- A. PVC conduit shall be composed of High Impact Virgin homopolymer, PVC (polyvinyl chloride C-200 Compound), and shall conform to industry standards, and be UL 651 listed in accordance with Article 347 of National Electrical Code for underground and exposed use and NEMA standard TC-2. Materials must have tensile strength of 55 PSI, at 70oF, flexural strength of 11,000 PSI, compression strength of 8600 PSI. Manufacturer shall have five years' extruding PVC experience. Consistent with requirements provide PVC conduit products by one of the following manufacturers:
 1. Carlon
 2. Cantex
 3. J.M. Plastics
 4. Queen City Plastics

2.04 RIGID ALUMINUM CONDUIT

- A. Provide Rigid Aluminum Conduit of 6063 alloy in temper designation T-1. The fittings are of the same alloy. Provide threaded Rigid Aluminum Conduit to Underwriters Laboratories U.L. 6A, "Standard for Electrical Rigid Metal Conduit and manufactured to ANSI C80.5.
- B. Provide threaded aluminum conduit fittings, of 6063 alloy, cast aluminum with integral insulated throat as manufactured by Allied, OZ Gedney, T&B, Crouse-Hinds, Killark or Appleton.
- C. Provide supplementary corrosion protection for aluminum conduit imbedded in concrete or in contact with soil. Where aluminum conduits are in contact with or penetrate concrete, coat conduit with asphaltic or bitumastic type coating.

2.05 CONDUIT FITTINGS

- A. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
- B. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
- C. Fittings for EMT: Steel compression type.
- D. Conduit locknuts shall be aluminum throughout except steel is acceptable within air conditioned spaces.
- E. Flexible, Nonmetallic, Liquid-Tight Conduit shall meet requirements of UL 514B with High strength plastic body, complete with lock nut, O-ring seal, threaded ferrule, sealing ring. Threaded ferrule designed to ensure high mechanical pullout strength and watertight seal.

Manufacturer, Carlon; Type LN or approved equal.

2.07 EXPANSION FITTINGS

- A. Conduit expansion fittings shall be malleable iron, and shall be hot dipped galvanized inside and outside. These fittings shall have a four-inch expansion chamber to allow approximately two-inch movement parallel to conduit run in either direction from normal. They shall have factory-installed packing and internal tinned copper braid packing to serve as an emergency bonding jumper. Unless the fitting used is listed by Underwriters' Laboratories for use "without external bonding jumpers", an external copper bonding jumper shall be installed with each expansion fitting with one end clamped on each conduit entering fitting.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All raceways shall be run in neat and workmanlike manner and shall be properly supported in accordance with latest edition of NEC with approved conduit clamps, hanger rods and structural fasteners except for PVC conduit installed in exterior locations. PVC conduit installed in exterior locations shall be supported at two foot intervals. Supporting conduit and boxes with wire is not approved. All raceways except those from surface-mounted switches, outlet boxes or panels shall be run concealed from view. Exposed raceways shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry. Rigid steel box connections shall be made with double locknuts and bushings. Where PVC penetrates a floor from underground or in slab, a PVC coated or black mastic coated aluminum conduit elbow shall be used on all conduits. All individual bare copper ground conductors (i.e. service, transformer, or lightning protection grounds) shall be installed in PVC conduit, not metal conduit. This does not apply to bare copper ground conductors run with feeders (as specified in this section). Conduits shall be run parallel to building walls wherever possible, exposed or concealed, and shall be grouped in workmanlike fashion. Crisscrossing of conduits shall be minimized.
- B. All raceways runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.
- C. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.
- D. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.
- E. All raceways shall be run from outlet to outlet exactly as shown on the drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of drawings as previously specified.
- F. All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with Section 300-5 of the NEC except that the minimum cover for

any conduit shall be two feet. Included under this Section shall be the responsibility for verifying finished lines in areas where raceways will be installed underground before the grading is complete.

- G. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by approved ground bushings.
- H. Insulated bushings shall be used on all rigid metallic conduits terminating in panels, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.
- I. Spare conduit stubs shall be capped and location and use marked with concrete marker set flush with finish grade or terminated in a manhole. Marker shall be 6" round X 6" deep with appropriate symbol embedded into top to indicate use. Also, tag conduits in panels where originating.
- J. All conduit stubbed above floor shall be separated with plastic interlocking spacers manufactured specifically for this purpose, or shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel.
- K. Raceways which do not have conductors furnished under this Division of the specifications shall be left with an approved nylon pullcord in raceway.
- L. Rigid Metallic Conduit electrical metallic tubing and PVC conduit shall be manufactured within the United States.
- M. All connections to motors or other vibrating equipment (except dry type transformers) or at other locations where required shall be made with not less than 12" nor more than 20" of flexible liquid-tight conduit, using special type of connectors with strain relief fittings at both terminations of conduit. Flex connectors shall have insulated throat and shall be T & B 3100 Series or approved substitution. Use angle connectors wherever necessary to relieve angle strain on flex conduit. Connections to dry type transformers shall be made with flexible conduit. Typical length of flex conduit shall be limited to 20" unless specifically approved by the engineer.
- N. PVC joints shall be solvent welded. Threads will not be permitted on PVC conduit and fittings, except for metallic to PVC couplings. Installation of PVC conduit shall be in accordance with manufacturer's recommendations. PVC conduit shall not be used to support fixture or equipment. Field bends shall be made with approved hotbox. Heating with flame and hand held heat guns are prohibited.
- O. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints; in each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit run above ground which is more than fifty feet long and

interval between expansion fittings in such a runs shall not be greater than 100 feet for metallic conduit and 50 feet for PVC conduit.

- P. Electric metallic tubing (thin wall) shall be installed inside buildings above ground floor slab where not subject to mechanical injury or wet areas. Tubing shall be joined with steel fittings and steel compression connectors.
- Q. Rigid metallic conduit installed underground shall be coated with waterproofing black mastic before installation, and all joints shall be recoated after installation.
- R. Conduit installations on roofs shall be kept to a bare minimum. Where required, conduit shall be rigid aluminum conduit, including couplings. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Supports to be fastened to roof using roofing adhesive as approved by roofing contractor.
- S. Underground cable identification: bury a continuous, pre-printed, bright colored metalized plastic (electronically traceable) ribbon cable marker with each underground conduit (or group of conduits), regardless of whether conduits are in ductbanks. Locate directly over conduits, 6" to 8" below finished grade. Delete this requirement under building slabs.
- T. Provide for separation of instrumentation, control and power conductors. Provide a minimum of 24" inch separation for parallel runs of power conduit to instrumentation or control conduit with either conduit being PVC or Aluminum. This separation can be reduced to 8" if metallic grounded separation is provided (metallic conduit).
- U. Duct seal all conduit entrances. Foam seal is not acceptable.
- V. All conduit penetration into enclosures & junction boxes shall be accomplished utilizing conduit hubs of equivalent NEMA rating to maintain enclosure NEMA rating.
- W. Conduit penetrations shall be installed along the bottom of enclosures only.

END OF SECTION

SECTION 16120

LOW VOLTAGE WIRES AND CABLES

PART 1 – GENERAL

1.01 REFERENCED STANDARDS

- A. Institute of Electrical and Electronics Engineers, Inc./American National Standards Institute (IEEE/ANSI)
- B. Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies.
- C. National Electrical Manufacturers Association (NEMA): ICS 4, Industrial Control and Systems: Terminal Blocks.
- D. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA): WC 57/S-73-532, Standard for Control Cables: WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
- E. National Fire Protection Association NFPA-70, National Electrical Code (NEC).
- F. Underwriters Laboratories, Inc. (UL44): Standard for Safety Thermoset-Insulated Wires and Cables; (UL83): Standard for Safety Thermoplastic-Insulated Wires and Cables; UL467 Standard for Safety Grounding and Bonding Equipment. UL486A Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors; UL 486C, Standard for Safety Splicing Wire Connections. UL510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.

1.02 DEFINITIONS

- A. Building Wire: Copper single conductor, cross link polyethylene insulated; type XHHW-2
- B. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- C. Instrumentation Cable (Analog signal cable): Multiple conductor, insulated, twisted Pair/Triad, with individual Pair/Triad shield and outer overall shield and outer sheath. Used for the transmission of low current (e.g., 4-20mA DC) using No. 16 AWG conductors. Common Types, TSP: Twisted shielded pair, TST: Twisted shielded triad.
- D. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, AWG. With overall shield where specified. Type SIS and MTW approved for use in the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers; otherwise type XHHW-2.
- E. Power Cable: Multi-conductor, insulated, with outer sheath containing building wire, No. 12 AWG and larger. Rated XHHW-2
- F. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc. Common Types: Ethernet UTP-unshielded twisted pair.

PART 2 – PRODUCTS

2.01 POWER CONDUCTORS

- A. Branch circuits and feeder conductors for all three phase electric power shall be stranded copper type XHHW-2 cross-link polyethylene (XLP) insulation and derated to 75 degrees Centigrade. No aluminum wiring shall be permitted. Wire shall be in accordance to NEC and minimum No. 12, except that branch "homeruns" over 50 ft. in length shall be minimum

No. 10 for 120/208V circuits. All branch lighting circuits serving HID and Fluorescent fixtures shall be minimum #10 with each circuit provided with a separate neutral. All wire shall be manufactured in the USA.

- B. Motor leads from variable frequency drives to driven motor shall be shielded VFD drive cable for all VFD motors. Provide flexible VFD shielded drive cables, 3 Class-I conductor cable plus 3 trisectional green insulated ground wires. Provide electrostatic shielding of tinned copper braided shield with aluminum-polyester laminated tape shielding system. Cross-linked polyolefin insulation system and neoprene outer jacket, type TC cable as manufactured by Rockbestos-Surprenant Cable Corp. or equal. Shielded VFD motor cables require increased conduit sizes over standard wire installations. Contractor to verify conduit sizes.
- C. Taps and Splices:
1. All power wiring taps and splices in No. 8 or smaller wire shall be fastened together by means of terminal strips except within lighting fixtures and wiring devices where conformance to NEC practices will be acceptable (Twist/screw on type connectors). All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire. Tape shall be heavy duty, flame retardant and weather resistant vinyl electrical tape, minimum 7 mil premium grade with an operating temperature of 0 degree F. to 220 degree F. Provide tape meeting UL 510 and CSA standard C22.2.
 2. All taps and splices in manholes or in ground pull boxes, etc. shall be approved by the engineer on a case by case basis; be made with high press long barrel double crimp compression type connectors and covered with Raychem heavy wall cable sleeves (type CTE or WCS) with type "S" sealant coating. Install sleeve kits as per manufacturer's installation instructions.
- D. Color Coding:
1. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel except for the wire markings.
 2. Unless otherwise approved, color-code shall be as follows: Neutrals to be white for 120/208V system, natural grey for 277/480V system; ground wire green, bare or green with yellow strips. Nominal Voltage: 120/208V, Phase A -black; Phase B - red; Phase C - blue. 480/277V, Phase A brown; Phase B - orange; Phase C -yellow. All switch legs, other voltage system wiring, control and interlock wiring shall be color-coded other than those above. In exiting or expansion projects, comply with existing color coding established within the facility.

2.02 INSTRUMENTATION AND CONTROL CABLE

- A. Multiconductor and Multi pair Process instrumentation cable shall be #16 AWG stranded, twisted pair, 600 V, (XLP) cross link polyethylene insulated, aluminum tape pair shielding, cross link polyethylene or chlorinated polyethylene (CPE) overall sheathed and shielded, type TC instrument cable as manufactured by the American Insulated Wire Co., Belden Wire Co. or equal.

- B. Multiconductor control cable shall be #14 AWG stranded, 600V, (XLP) cross link polyethylene insulated or polyolefin, with cross link polyethylene or chlorinated polyethylene (CPE or Hypalon) overall sheathed type TC control cable except for control cable into and out of VFD cabinets. Multiconductor control cable into and out of VFD cabinets shall be as indicated above and in addition include an aluminum polyester tape overall shield and drain wire. As a contractor alternate to shielded control cable into and out of VFD cabinets, provide twisted shielded instrument cable as specified above. Contractor to provide increased conduit size as required if instrument cable alternate is used into and out of VFD cabinets.
- C. Connections:
1. All conductor connections shall be on terminal strips including all spare conductors. Provide terminal strips in all cabinets; motor control centers; etc.
 2. All connections of stranded wire to screw terminals shall be by insulated spade lugs, crimp fastened to wire. Provide stranded wire crimp ferrules for all stranded wire connections not requiring spade lugs for screw type terminal blocks. The stranded wire ferrule is to be crimped to all stranded wire using a crimping tool specifically approved for crimping the size and type of ferrule.
 3. All conductors shall be marked with mylar wrap type "Brady" labels. Identification labels shall be permanent type and be machine printed. All terminal block terminations shall be labeled. The inside portion of the terminal cabinet doors shall display a protected terminal cabinet drawing with all connections shown and described as to color code, number assigned to connection function of conductor and destination.
 4. Wire shall be guided within terminal cabinets by cable supports. All conductors shall be neatly led to terminations.
 5. Instrumentation and control field cables on the unprotected side of SPD devices within the cabinet shall not run in parallel to the cables on the protected side of the SPD device. Separate cable supports (duct) will be provided.
 6. Cabinets: All cabinets shall be labeled with an engraved plastic laminate label riveted to the door.
 7. No splices shall be made within a conduit run or in manholes.

PART 3 - EXECUTION

3.01 CABLE LABELING AND SEPARATION

- A. All plant control system field wiring shall be labeled per the instrumentation and control contractor loop drawings from the field device, through the intermediate cabinets, to the PLC cabinet. The labeling system shall be consistent throughout the loop and follow the standard tag designation: System Code Identifier_ISA Identifier_Plant Location Code (example B_IBS_SCRN1_MOTOR_OVERLOAD).
- B. Provide for separation of Data, Instrumentation, Control Cables from power conductors. Provide a minimum of 24" inch separation for parallel run of power conduit and Data, Instrumentation or control conduit. This separation can be reduced to 8" if metallic grounded separation is provided.

3.02 SUBMITTALS

- A. Submit cut sheets on all major types of wires and cables including splicing tape, and terminating/splicing lugs, conductor identification systems and connectors and cable sleeves. Submit sample of all instrumentation and control cable. Sample shall be a minimum of 24" with exterior sheath clearly marked.
- B. Submit sample of all cable identification systems products.

END OF SECTION

SECTION 16170

DISCONNECTS

PART 1 – GENERAL (NOT USED)

1.01 SUBMITTALS

- A. Submit product data on all major types of disconnects.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All single throw disconnect switches and double throw manual transfer switches shall be heavy-duty horsepower rated type. Safety switches shall be rated for the available fault current where installed. Provide enclosed molded case switch type disconnects where required to meet high available fault current areas (above 10kaic). Switches shall be fusible only where required to meet equipment nameplate requirements.
- B. Switches shall be 240 volt rated on systems up to and including 120/208V and 600V rated on higher voltage systems. All switches for motors shall be horsepower rated. All switches shall be NEMA 4X stainless steel enclosure except switches mounted in air-conditioned spaces. As an alternate to NEMA 4X stainless steel enclosure provide NEMA 4X switches with aluminum enclosure as manufactured by Bryant. As an alternate to NEMA 4X stainless steel enclosures provide polyglass enclosures for 30amp (10hp) switches in the chemical areas equal to Hubbell Circuit-Lock. In classified hazardous locations utilize explosion proof rated NEMA7/9 disconnect enclosures to comply with NFPA820 requirements.
- C. Provide and install lugs on disconnect switch as required to accept conductors called for on drawings.
- D. Provide Switches with an externally operated handle; quick make quick break mechanism; the handle shall be interlocked with the switch cover by means of a defeatable interlock device. The switch shall be lockable in the "off" position with a padlock. Switches shall have arch suppressors, pin hinges and be horsepower rated at 600 volts.
- E. All disconnect switches shall be furnished from the manufacturer with (2) normally open and (2) normally closed interlock contacts. Motor space heater shall be wired through one set of contacts. The other contact shall be wired through the local off/remote motor switch at the disconnect location.
- F. Double throw non-fused safety switches may be used for manual power transfer where shown on the drawings and in areas up to 10,000A available short circuit current. In areas above 10k amps use double throw molded case manual transfer switches rated for the available fault currents.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16180
OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL(NOT USED)

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide Cutler Hammer JD series circuit breakers. Equal approved manufacturers will be considered. Manufacturers desiring approval are required to submit a complete arc flash hazard analysis for review.

2.02 MOLDED CASE CIRCUIT BREAKERS – 800A AND BELOW

- A. Protective devices shall be molded case circuit breakers with inverse time and instantaneous tripping characteristics and shall be Eaton or approved equal.
- B. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
- C. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.
- D. Circuit breakers 400ampere frame and below shall have thermal-magnetic trip units and inverse time-current characteristics.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 16190

SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SCOPE

- A. The work under this sections includes conduit and equipment supports, straps, clamps, steel channel, etc, and fastening hardware for supporting electrical work. Furnish and install all supports, hangers and inserts required to mount fixtures, conduit, cables, pull boxes and other equipment furnished under this Division. All supporting devices and hardware exterior of buildings or interior of structures except in air conditioned spaces shall be stainless steel. Aluminum and non metallic supports (fiberglass) and hardware will be reviewed by the Engineer on a case-by-case basis.
- B. All items shall be supported from the structural portion of the building. Supports and hangers shall be of a type approved by Underwriters' Laboratories. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels.
- C. The Contractor shall furnish and install all sleeves that may be required for openings through floors, wall etc. Where plans call for conduit to be run exposed, the Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If the Contractor does not properly install all sleeves and inserts required, contractor to provide cutting and patching to the satisfaction of the Engineer.

1.02 RELATED WORK: Applicable provisions of Division 1 govern work under this Section. Section 16110 – Conduit Systems

1.03 SUBMITTALS: Product Data: Provide data for support channel.

1.04 QUALITY ASSURANCE: Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Support Channel: Stainless steel throughout except galvanized steel in conditioned interior areas.
- B. Hardware: Stainless steel throughout
- C. Minimum sized threaded rod for supports shall be 3/8".
- D. Conduit clamps, straps, supports, etc., shall be stainless steel or aluminum. One-hole straps shall be heavy duty type.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All metal conduits shall be securely fastened in place on maximum of 6 foot intervals; all PVC conduits shall be securely fastened in place on maximum of 3 foot intervals vertically and 2 foot intervals horizontally. Hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by two-hole straps, clamp-backs, or other approved devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.
- B. On concrete or masonry construction, use "Tapcon" type fasteners. For brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. Steel members shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from stainless steel, or approved substitution.
- C. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using preset inserts, beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only). Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction.
- D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not drill structural steel members unless approved by the engineer.
- E. Fabricate supports from stainless steel or galvanized steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch (25 mm) off wall.
- F. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

END OF SECTION

SECTION 16450

GROUNDING AND BONDING

PART 1 - GENERAL

- 1.01 Description; the terms “connect”, “ground” and “bond” are used interchangeably in this specification and have the same meaning
- A. This section specifies general grounding and bonding requirements of electrical equipment operations and to provide a low impedance path for possible ground fault currents.
 - B. “Grounding electrode system” refers to all electrodes required by NEC, as well as including made, supplementary, perimeter counterpoise ground, lightning protection system grounding electrodes.
- 1.02 Related Work
- A. Section 16050, Special Requirements.
 - B. Section 16120, Low Voltage Wires & Cables
- 1.03 Submittals
- A. Submit in accordance with Section 16050
 - B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
 - C. Test Reports: Provide certified test reports of ground resistance.
 - D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Project Engineer:
 - 1. Certification, by the Contractor, that the complete installation has been properly installed and tested.
- 1.04 Applicable Publications
- A. American Society for Testing and Materials (ASTM):
 - B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
 - C. National Fire Protection Association (NFPA):
National Electrical Code (NEC)

- D. Underwriters Laboratories, Inc. (UL):
Thermoset-Insulated Wires and Cables
Thermoplastic-Insulated Wires and Cables
Grounding and Bonding Equipment
Wire Connectors

PART 2 – PRODUCTS

2.01 Grounding and Bonding Conductors

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 2 AWG and smaller may be solid copper unless otherwise noted on the drawings. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 4 AWG and larger shall be permitted to be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 2 AWG and smaller may be ASTM B1 solid bare copper wire.
- C. Electrical System Grounding: Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

2.02 Splices and Termination Components

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.03 Ground Connections

- A. Above Grade:
 - 1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lock washers.
 - 2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.

PART 3 – EXECUTION

3.01 General

- A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.
- B. System Grounding:
 - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.02 Grounding Connections

- A. Make grounding connections that are below grade by exothermic weld. Make grounding connections that are above grade but are otherwise normally inaccessible (poured columns, within walls) with exothermic weld.

3.03 Secondary Equipment and Connections

- A. Transformers:
 - 1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
 - 2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the ground bar at the service equipment.
- B. Conduit Systems:
 - 1. Ground all metallic conduit systems. All conduit systems shall contain an equipment grounding conductor (except service entrance with grounded neutral). Ground conductor shall be bonded to metallic conduit systems at the entrance and exit from the conduit.
- C. Boxes, Cabinets, Enclosures, and Panelboards:
 - 1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
 - 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
 - 3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- D. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
- E. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

3.04 Corrosion Inhibitors

- A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.05 Conductive Piping

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system.

3.06 Ground Resistance

- A. Grounding system resistance to ground shall not exceed 2 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the owner. Final tests shall assure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Below-grade connections shall be visually inspected by the Project Engineer prior to backfilling. Provide ground inspection wells at all ground rod locations.

3.07 Ground Rod Installation

- A. Drive each rod vertically in the earth, not less than 20 feet in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make above grade accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, drill rock then install rod. Backfill with flowable fill or concrete mix. Obtain the necessary permits if required for drilling.

END OF SECTION

SECTION 16610

LIGHTNING PROTECTION SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

A. Description of Systems:

1. A Lightning Protection System shall be placed on the structures by experienced installers in compliance with provisions of Code for Lightning Protection Systems as adopted by the National Fire Protection Association and Underwriters' Laboratories. Intent of the lightning protection systems shall be to protect the structures against damage by lightning. All equipment to that result shall be included whether or not specifically called for herein. Installers shall be Underwriters Laboratories certified as Master Label installers or of equal qualifications as approved by Engineer.
2. Provide complete and upgraded lightning protection systems as noted on the drawings. Provide bonding and grounding systems and interconnection to the site lightning protection and grounding systems as shown on the drawings and as specified. All systems shall be in conformance to NFPA-780, UL-96, UL96-A and as shown on the contract drawings.
3. Materials shall comply in weight, size and composition with the requirements of Underwriters' Laboratories and the National Fire Protection Code relating to this type of installation, and shall be U.L. labeled.
4. All installations shall be performed to meet Underwriters Laboratories Master Label standards. Provide a UL Master Label or Lightning Protection Institute (LPI) Certification for all protected structures to the extent the structures are eligible under the standards of UL 96A. If the structure is not eligible under the standards of UL 96A, provide a Letter of Findings for the installation at completion of work.

1.02 SUBMITTALS

A. Shop Drawings and Product Data:

1. Shop Drawings: Shop drawings shall be submitted before work is started. Drawings shall include full layout of cabling and points, and connections. The drawing shall show the type, size and location of all equipment, grounds and cable routing. The drawing shall show all grounds and air terminals that are shown on the contract drawings. See additional requirements for shop drawings in section 16050.
2. Product Data: Product Data shall be submitted on all equipment to show compliance with this section of the specifications and shall include manufacturer's written recommendations for installation. Provide a sample of the air terminal to be used with the shop drawing submittal.

1.03 SYSTEM DESIGN

- A. The system shall be an effective, aesthetically acceptable streamer-delaying lightning protection system to the standards of Underwriters Laboratories UL 96 & UL96A. The purpose of the system shall be to reduce the likelihood of a direct strike to the protected structure by delaying the formation of streamers from that structure. Secondly the system shall be designed in such a manner that it affords protection to the structure upon which it is installed in the event a direct lightning strike to the structure does occur.
- B. The system components shall not require mounting in a specific configuration or impose any other mounting limitations which may interfere with utility use of structure space or otherwise preclude or limit the intended use of the structure.
- C. All components shall be attached to the structure in such a manner as to reduce the possibility of corrosion between dissimilar metals. If installed on a metallic or otherwise electrically conductive structure, the system shall be electrically bonded to the structure upon which it is installed through mounting clamps and brackets, with additional bonding to grounded objects and to the structure, as required or as indicated on the drawings.
- D. The system shall be composed of components that meet the requirements of Underwriters Laboratories UL 96. Aluminum and Stainless Steel components shall be employed on structures and portions of structures subject to corrosive elements, where the use of copper components could be rendered ineffective, due to the surrounding environment. No dissimilar metals shall be allowed to be in contact.
- E. Air Terminals shall be mounted on all outside corners of each structure, around the perimeter of each structure at intervals not to exceed twenty (20) feet, and on the interior of each structure in such a manner that no two Air Terminals are separated by a distance of more than fifty (50) feet. In the event this is not practical, such as on a large open tank, Air Terminal spacing around the perimeter shall be decreased to not more than fifteen (15) feet, with a total number around the perimeter not less than the total of the normally required perimeter Air Terminals, plus the additional number of Air Terminals if Air Terminals had been installed on the interior at intervals not greater than fifty (50) feet.
- F. Each Air Terminal shall be provided with two (2) contiguous paths to ground. On structures with handrails, exposed structural members, or other conductors, provide a bond to structural conductors from the lightning protection system. Handrails shall not be used as a main lightning protection conductor. Provide a continuous lightning protection conductor parallel with handrails and bond from it to each handrail section and a minimum of 10' on center. In the case of a structure or a portion of the structure where the structure itself is electrically conductive, such as a light pole, tower, etc, that structure or portion of the structure itself may be employed as part of the lightning protection system, provided it meets the minimum requirements of UL 96 or UL 96A, and down conductors are specifically not required on such structures.

PART 2 - PRODUCTS AND INSTALLATION

2.01 AIR TERMINALS

- A. Air Terminals shall be of the streamer delaying type. Each air terminal shall have a minimum of five hundred dissipater electrode wires, none of which exceed ten thousands of an inch diameter. All air terminals shall complying with the weight and construction requirements

for Class II lightning protection systems. Electrode material shall be high quality 316 series stainless steel and shall have proper base support for surface on which they are attached, and shall be securely anchored to this surface. Terminals shall project a minimum of 18" above top of object to which attached and have a minimum 3/16" ball shaped tip.

- B. Streamer-delaying Air Terminals shall be manufactured by Alltec or equal.

2.02 CONDUCTORS

- A. Roof conductors shall consist of rope lay aluminum conductor complying with the weight and construction requirements for Class II lightning protection systems. Aluminum Conductor; IPC #A30, No. 4/0 Size, 200 pounds per 1000', 37 strand of .0756" diameter wire, 211,600 circular mils Conductors shall be coursed to interconnect with air terminals, and in general, provide a two-way minimum path to ground. The angle of any turn shall not exceed 90 degrees, and shall provide an approximately horizontal or downward course. Down conductors shall be copper, and shall be installed in sealed PVC conduit and hidden within the structure. Approved bi-metal transitions from aluminum conductors for bonding of aluminum roof structures (exhaust fans, etc.) to copper down conductors shall be provided.
- B. Provide copper grounding system below 18" AFG or AFF. Radius of bends shall not be less than 8 inches.
- C. Counterpoise loop ground conductors shall be tinned copper and be a minimum size equal to the main roof conductor size (115,000CM) or #2/0.

2.03 FASTENER

- A. Conductor fasteners shall be of the same material as the conductor, having ample strength to support conductor. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.
- B. All fasteners shall be of a heavy-duty bolted type typically used for Class II lightning protection systems. Conductor to conductor connections shall be through heavy-duty pressure type bolted fasteners. Splice and bimetal connections shall be through four bolt pressure type heavy-duty connectors. Crimp fasteners shall not be used.
- C. Dissimilar metals shall not be allowed to be in contact. Aluminum fittings shall be mounted on aluminum where necessary, and bonded to the main system using bi-metal connectors. Lead coating shall not be acceptable as a bi-metal transition.
- D. All mechanical termination points and lugs shall have an anti-corrosive coating applied. In areas subject to chemical corrosion (odor control, degasifiers, chem. Rooms, etc.) apply Glyptal 1201 red enamel coating after termination is made. In other less corrosive areas apply Permatex battery protector sealer (SA-9) or Glyptal 1201 or equal.
- E. Lugs for copper cable shall be high copper alloy terminals or stainless steel equal to Burndy type QDA Qiklug. Lugs of aluminum alloy are not acceptable.

2.04 GROUND CONNECTIONS

- A. Ground rods shall be installed in the quantities as indicated on the drawings and as required by NFPA-780. Ground rods shall be placed a minimum of two (2) feet from building foundations. In addition to above artificial grounds, one down conductor of each two-path

system shall be connected to water piping system with approved water pipe type strap connector. All ground rods shall be 5/8" X 20' minimum copperweld type. All connections made below grade shall be exothermically welded (cadweld) connection and placed in a ground rod inspection well as detailed.

- B. Soil type in the area is primarily sand with rock layer below. The rock layers on site will require drilling of ground rod holes. All ground rods shall be installed vertically. After drilling and installation of rod, back fill with sand and hydro compact around rod to provide low resistance to ground.

2.05 GROUND ROD & GROUND SYSTEM TESTING

- A. The contractor shall utilize a clamp on ground loop tester during construction to check the system for high resistance connections. The resistance at any point below the air terminal shall be less than 5 ohms. The resistance at grade level on the down conductors should be less than 2 ohms. The contractor shall investigate and correct high resistance readings within the system. Demonstrate to the engineer's satisfaction with witness testing, provision of a low resistance installation meeting this specification.
- B. Provide three point fall of potential ground testing on a minimum of one ground rod on each facility prior to connection to the counterpoise system. As an alternate provide ground rod selective method testing with appropriate ground testers. The complete ground system shall be three point fall of potential tested after completion of work. The system shall be tested at a minimum of three points spaced around the site using the "Tagg Slope" technique. Total grid system grounds should be less than one ohm.

2.06 INSTALLATION

- A. Installation shall be made in an inconspicuous manner with conductors coursed to conceal equipment as much as possible. Down conductors shall be concealed within structure, and shall be run in 1" PVC conduit. Surface mount down conductors to existing structures in a neat and workmanlike manner. All metallic equipment within 6 feet of any lightning conductor shall be bonded to conductor. System shall also be tied to the main service electrical ground and other ground systems in the area.

2.07 COORDINATION

- A. The installer shall coordinate the lightning protection work to insure a correct, neat, and unobtrusive installation. In normally accessible areas, catwalks, equipment platforms, etc., provide installation without trip hazard. Provide embedded conduit sleeves across access ways for ground conductors. In retrofit projects provide flat copper strap to ground or bond across access ways.
- B. Any electrical service grounding system and metallic water service piping to the structure shall be electrically bonded to the lightning protection system.
- C. The contractor shall coordinate his work in such a manner as to not interfere with the normal operation of the structure upon which the installation is performed.

2.08 MATERIAL MANUFACTURERS

- A. Equipment shall be as manufactured by Altec Global Lightning Protection or equal.

END OF SECTION

SECTION 16709

SURGE PROTECTIVE DEVICES (SPDs)

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection should be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers. Refer to related sections for surge requirements in:

1.02 RELATED SECTIONS

- A. Section 16180 - Disconnects

1.03 REFERENCES

- A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 4th Edition).
- B. ANSI/IEEE C62.41.1-2002 – Guide on surge environment in low-voltage (1000 V and less) AC power circuits.
- C. ANSI/IEEE C62.41.2-2002 – Recommended practice on characterization of surges in low-voltage (1000 V and less) AC power circuits.
- D. ANSI/IEEE C62.45-2002 – Recommended practice on surge testing for equipment connected low-voltage (1000 V and less) AC power circuits.

1.03 SUBMITTALS

- A. The following information shall be submitted to the Engineer:
 - 1. Provide verification that the SPD complies with the required ANSI/UL 1449 4th Edition listing by Underwriters Laboratories (UL).
 - 2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
- B. Where applicable the following additional information shall be submitted to the engineer:
 - 1. Descriptive bulletins

2. Product sheets

C. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed and shall incorporate all changes made during the manufacturing process

1.04 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.05 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be provided with each SPD shipped.

1.06 MANUFACTURERS

- A. Eaton / Cutler-Hammer products
- B. SquareD by Schneider Electric: Surgelogic
- C. EDCO
- D. Erico
- E. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

PART 2 – PRODUCTS

2.01 VOLTAGE SURGE SUPPRESSION – GENERAL

- A. Electrical Requirements
 1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

Configuration	Protection Modes			
	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

5. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.
6. SHORT CIRCUIT CURRENT RATING (SCCR): Per NEC 286.6, the short circuit current rating of the SPD shall be equal to or greater than the available short circuit current at the point where installed
7. ANSI/UL 1449 4th Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	2500

Modes	240D	480D	600D
L-L; L-G	1200	2000	2500

8. SPDs installed internal to the distribution equipment shall be of the same manufacturer as the equipment. The equipment shall be fully tested and certified to the following UL standards:

UL 67 = Panelboards
UL 845 = Motor Control Centers
UL 857 = Busway
UL 891 = Switchboards
UL 1558 = Low Voltage Switchgear

B. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
 - a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
 - i. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
 - b. Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location.
 - c. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed.

5. Remote Status Monitor: The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
6. Overcurrent Protection
 - a. The SPD shall be designed in a way that it will take itself off-line before any damaging external effects to the suppressor or surroundings will occur.

2.02 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies.
- B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	240kA	120 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120kA	60 kA

- C. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.03 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards.
 1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
 2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

3. The panelboard shall be capable of re-energizing upon removal of the SPD.
 4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
 5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
 6. The SPD shall be of the same manufacturer as the panelboard.
 7. The complete panelboard including the SPD shall be UL67 listed.
- B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)
1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.
- C. Switchgear, Switchboard, MCC and Busway Requirements
1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations.
 2. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway
 3. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
 4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
 5. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
 6. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
 7. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.04 ENCLOSURES

- A. All enclosed equipment mounted for indoor application shall be NEMA 1 general purpose enclosures. Provide NEMA 4X enclosures for all outdoor applications.
 - 1. NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
 - 2. NEMA 4X – Constructed of stainless steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, splashing water, and hose directed water).

2.05 POWER SUPPRESSORS FOR ELECTRONIC EQUIPMENT

- A. Each item of electronic equipment provided under this contract and connected by line cord or direct wired to the building electrical system shall be provided with a three-stage single or multi-phase hybrid suppressor. Fusing shall be provided which removes the protective elements from the circuit upon failure. Visual indication or loss of output power shall be used to notify the user of device failure.
- B. Suppressors shall be rated for a minimum of 125% of their continuous electrical load. Suppressors for cord connected equipment shall be equipped with standard NEMA cordsets one of which includes a molded grounding receptacle and the other, a molded grounding plug. Suppressor shall be installed in series with the power cord for the protected equipment. Where several items of equipment are grouped within the same cluster of equipment, one suppressor may be used in conjunction with properly sized grounding plugstrip to serve the equipment.
- C. Suppressors for direct wired equipment shall be identical in internal design to the unit described for cord connected applications, however, protected screw terminals suitable for termination of solid copper wire shall be used for wiring terminations. One suppressor may be used to support several equipment cabinets provided all cabinets are located within the same equipment cluster and the maximum connected load shall not exceed eighty percent of the rated suppressor capacity.
- D. Suppressors shall be constructed with a phenolic non-flammable exterior housing with provisions for mounting to the interior of equipment racks, cabinets, or to the exterior of free-standing equipment. Suppressors shall be constructed as three-stage devices. The first stage shall include a high-energy varistor clamp between line and neutral and from neutral to ground. The second stage shall consist of series air-core inductor installed in the line conductor(s) to properly coordinate the action of the first and third stages. The third, fast acting, hard clamping stage shall consist of a network of silicon avalanche bipolar surge suppression diodes between the neutral and line conductor(s).
- E. Minimum suppressor performance characteristics shall be as follows:

1. Maximum single impulse line-to-neutral current withstand: 15,000 Amperes (8 x 20 us waveform)
2. Maximum single impulse neutral-to-ground current withstand: 10,000 Amperes (8 x 20 us waveform)
3. Pulse lifetime rating Category B worst case current waveform (8 x 20 us @ 3000 Amperes): 1200 occurrences
4. Pulse lifetime rating for 200 Ampere (8 x 20 us waveform): 10,000 occurrences
5. Worst case response time: Five Nanoseconds
6. Worst case (Maximum Single Impulse Current Conditions) clamping voltage: 400% of nominal phase-to-ground RMS voltage.
7. Initial breakdown voltage: 200% of nominal phase-to-ground RMS voltage.

2.06 SUPPRESSORS FOR CONDUCTOR PAIR PROTECTION

- A. Suppression devices for conductor pair protection shall be provided in single-circuit pluggable packages suitable for the circuitry to be protected. Units for protection of data circuits which utilize standard connector configurations shall be equipped with connectors which install in series with the data cable to the protected equipment. Units intended for use with multiple wiring pairs shall be equipped with accessory terminal blocks or strips suitable for the type of wiring being used. Single pair units shall be configured as encapsulated units with wire leads or screw-terminal wiring terminations. Suppressors installed outside of terminal or equipment cabinets (except at designated terminal boards) shall be provided with a housing to afford physical protection for the surge suppression modules.
- B. Suppression for each pair shall consist of a three-element gas tube first stage, an isolating element in series with each conductor of the pair, and a silicon avalanche second stage. Second stage clamping shall be provided across the pair for differential mode protection and from each side of the pair to ground for common mode protection. Resistive limiting elements may be used on low current circuits where the effect of voltage drop across the series resistance has no effect on circuit operation. Inductive series elements shall be used on higher current circuits to effectively pass direct or low frequency alternating currents while limiting passage of fast risetime surge waveforms. Silicon avalanche devices shall be designed for surge suppressor applications and shall be polarized or bipolar as appropriate for each circuit.
- C. Minimum performance criteria (each circuit) shall be as follows:
 1. Maximum single impulse conductor-to-ground or conductor to conductor current withstand: 10,000 Amperes (8 x 20 us waveform)
 2. Pulse lifetime rating Category B worst case current waveform (8 x 20 us @ 3000 Amperes): 10 occurrences

3. Pulse lifetime rating for 100 Ampere (10 x 1000 us waveform): 1,000 occurrences
4. Worst case response time: Five Nanoseconds
5. Worst case (Maximum Single Impulse Current) clamping voltage: 200% of normal operating voltage amplitude and polarized or bipolar as appropriate for each circuit type.
6. Initial breakdown voltage: 150 percent of normal operating voltage peak amplitude plus or minus five percent.
7. Capacitance: Capacitance for DC or low frequency lines shall not exceed 2000 picofarads measured line to line or line to ground at the rated diode breakdown voltage. Suppressors intended for use on high frequency or high baud rate circuits shall be designed for use on such lines. Capacitance of such units shall be equated to equivalent cable feet based on the type of cabling used for the particular circuit. The sum of equivalent cable feet for suppressors and actual cable footage shall not exceed manufacturers recommended maximum values for the system on which these devices are installed.
8. Circuit compensation: Any additional circuit compensation (gain or equalization) required to compensate for the insertion of surge suppression devices shall be provided as part of this contract.

PART 3 - EXECUTION

3.01 BONDING AND GROUNDING CONDUCTORS AND MATERIALS

- A. Conductors utilized for surge suppressor bonding shall be a minimum of #6 AWG solid insulated copper unless otherwise specified.
- B. Ground bus or strip material shall be copper, a minimum of 26 gauge in thickness and three inches wide unless otherwise specified. Bus materials may be secured to surfaces with an appropriate mastic material or mechanical fasteners. Bus connections shall be bolted or brazed and reinforced as necessary on thin bus material to provide a permanent and secure connection.
- C. Unless otherwise specified, all surge suppression grounding electrodes shall be 5/8" diameter copperweld rods, twenty feet in length.
- D. Connectors, splices, and other fittings used to interconnect grounding conductors, bond to equipment or ground bars, shall comply with requirements of the National Electric Code and be approved by Underwriters Laboratories for the purpose.
- E. Connectors and fittings for grounding and bonding conductors shall be of the compression or set-screw type in above grade locations. Connections below grade shall be exothermically welded or brazed.
- F. Bonding connections between electrically dissimilar metals shall be made using

exothermic welds or using bi-metal connectors designed to prevent galvanic corrosion.

3.02 SEGREGATION OF WIRING

- A. All system wiring shall be classified into protected and non-protected categories. Wiring on the exposed side of suppression devices shall be considered unprotected. Surge suppressor grounding and bonding conductors shall also fall into this category.
- B. All wiring between surge suppressors and protected equipment shall be considered protected. Isolated circuitry exempted from surge suppression requirements in part one of this section shall also be considered protected.
- C. A minimum of three inches of separation shall be provided between parallel runs of protected and unprotected wiring in control panels, terminal cabinets, terminal boards and other locations. In no case shall protected and unprotected wiring be bundled together or routed through the same conduit. Where bundles of protected and unprotected wiring cross, such crossings shall be made at right angles.

3.03 INSTALLATION OF SUPPRESSORS

- A. Suppressors shall be installed as close as practical to the equipment to be protected consistent with available space. Where space permits and no code restrictions apply, suppressors may be installed within the same cabinet as the protected equipment. Suppressors installed in this manner shall utilize the equipment chassis as a medium for bonding of their ground terminals. Bonding jumpers not exceeding two inches in length shall be installed between the chassis and suppressor ground terminals. Bolted connections with star washers shall be used to insure electrical and mechanical integrity of connections to the equipment chassis.
- B. Suppressors shall be installed in a neat, workmanlike manner. Lead dress shall be consistent with recommended industry practices for the system on which these devices are installed.
- C. Bonding between ground terminals for power and signal line suppressors serving a particular item or cluster of equipment shall be kept as short as possible. Where practical, suppressors shall be installed in a common location for the cluster with their ground terminals bonded closely together. For installations requiring separation between the various suppressor grounds and equipment chassis within an equipment cluster, the following table shall be used to determine bonding conductor requirements (distances are measured between most distant suppressor or chassis grounds):

BONDING DISTANCE MATERIAL

0 - 10 feet	#6 AWG Bare Copper (Solid)
10- 25 feet	1-1/2" Copper Strip 26ga. Min.
25- 50 feet	3" Copper Strip 26ga. Min.
Over 50 feet	6" Copper Strip 26ga. Min.

Care shall be exercised to avoid connection of incidental grounds to the bonding bus system.

- D. Where terminal cabinets are used to house surge suppressors, painted steel backboards shall be used to serve as a low impedance ground plane for bonding surge suppressor leads together. Terminal boards used for the same purpose shall be laminated with a single sheet of 14 ga. galvanized steel to serve as a ground plane for suppressors. Suppressors with ground terminals not inherently bonded to the ground plane through their mounting shall be bonded to this plane using a two-inch maximum length of #12AWG copper wire and suitable lug. Ground planes and backboards shall be drilled to accept self tapping screws, any paint in the area of the bond shall be removed and star washers shall be used.
- E. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG bare copper conductors and approved connections unless otherwise noted.

3.04 WARRANTY

- A. The manufacturer shall provide a full ten (10) year replacement warranty from the date of shipment against any SPD part failure in material or workmanship when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION

SCADA Integration Policy

Any project that has SCADA integration or deals, touches, impacts SCADA, PLC or any component or instrument tied to the SCADA systems at any Plant, collection or distribution system shall follow these guidelines.

Project SCOPE

In the project scope,

- All SCADA integration must be defined.
- All SCADA systems to be manipulated must be defined.
- All PLCs to be manipulated must be defined
- All logic and process change must be clearly written down and validated by SCADA integration team.

INTEGRATION SUBMITTAL PLAN

- **Must be submitted with every project or integration effort performed on County SCADA**
- **Upon completion of Integration work, the 'As Built' SCADA information must be finalized and the Integration Plan updated accordingly**
- **SCADA is comprised of three groupings of systems:**
 - **FIELD**
 - **NETWORK**
 - **HOST**
- **Each system must be specifically represented in the Integration Plan provided**

FIELD (PLC, Instrumentation, Wiring, Panels, UPS)

Instrumentation/Hardware to be added/replacing

- Process variable list for each instrument (spreadsheet form) must be provided including:
 - Point Tag name
 - Data type
 - Scale range

SCADA integrator must provide a complete list all PLCs that will be touched and changes made and documented with the following information (spreadsheet form):

- SCADA System
- PLC Name
- PLC tag names
 - Instrumentation Tags
 - Pseudo (Calculations) Tags
- PLC processes

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SCADA PLC Hardware Modifications

- PLC I/O Active – complete list of all active I/O
- PLC I/O Available – hardware address of all available I/O (chassis, slot, card, point)
- PLC Panel I/O requirements – PID Drawing from Design

SCADA Network (Communications Infrastructure, Switch, UPS)

- Network Hardware to be added/replaced
 - Provide configuration
 - Firmware revision level
 - Contact information
 - Service Provider
 - Contract Information
 - Licensing Information
 - Software required
- SCADA Network connectivity available
 - Fiber Optic
 - Switch Port Density
 - Radio frequency – azimuth required
- SCADA Network connectivity required
 - Fiber Optic
 - Switch Port Density
 - Radio frequency – azimuth required

SCADA Host (Server, Workstations, WebSpace, Hardware/Software, UPS)

Host Hardware to be added/replaced

- Hardware physical requirements
- Hardware technical requirements
- Hardware location

Host Software to be added/replacing

- Software technical requirements

SCADA integrator must provide a complete list of operator interface screens that will be touched and suggested changes made.

- SCADA Server Name
- SCADA machine name
- SCADA Historian

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- SCADA WebSpace name
- Touchscreen names

SCADA integrator must provide a list of anticipated HOST database points to be:

- Modified
- Added
- Deleted

SCADA integrator must provide a list of anticipated Historian database points to be:

- Modified
- Added
- Deleted

Before beginning work

SCADA integrator must review an Architectural Diagram of the SCADA system on which the work is to be performed.

SCADA integrator must receive a handbook of policies and procedures and Standards of how the specific SCADA system is networked, the application version that is running, the database structure and location of all files used to perform its normal operations.

SCADA integrator must have knowledge of existing CC PUD SCADA platforms (HOST, NETWORK, and FIELD).

SCADA integrator must receive a plant tour and pertinent contact sheets of persons who will allow access to the existing SCADA system, including login and password.

SCADA integrator must perform a complete system DB backup, PLC system backup, network infrastructure system backup,

SCADA integrator must provide a schedule of all integration services to be performed broken out by functionality in:

- FIELD
- NETWORK
- HOST

Onsite

SCADA integrator must perform a complete system DB backup, PLC system backup, network infrastructure system backup.

SCADA integration must be planned accordingly and provided on a detailed schedule.

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SCADA integrator must coordinate all work with SCADA integration team as well as system and plant operations personnel.

SCADA integration must **NOT** be completed on Fridays of any schedule.

SCADA integrator must provide a detailed scope of functionality to achieve each day, which supports a Roll Back Plan.

Testing

SCADA Integration test plans must be provided for all additions, deletions or modifications in each of the three specific groupings of functionality:

- FIELD
- NETWORK
- HOST

SCADA integration must be tested thoroughly before placed into a live Production environment in the control process.

SCADA integration test plans must be approved by the SCADA integration team or a designee thereof.

Close Out

SCADA Integrator must provide a complete list of database points added, modified, deleted to each system:

- SCADA
- HISTORIAN
- WebSpace
- PLC
 - Instrumentation PV
 - Pseudo (Calculation)

SCADA integrator must provide a complete list of operator interface screens that were touched and changes made.

SCADA integrator must prove to PUD PM, PUD SCADA Team and plant operations the documentation of each new point added, modified, deleted and its validation of accuracy and effectiveness in the integration.

SCADA integrator must provide a SOP type document of how the process was altered and how the operators will now manage the process.

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CCPUD INTEGRATION POLICY

Back Out (Roll Back) Plan

Operations must be able to control, in an automated fashion, the functionality of the station each night, unless other provisions are discussed, documented and confirmed with operations.

Each integration plan must be documented to support overnight automated functionality.

Each integration plan must have a roll back plan that ensures the existing system can be brought back on line and ensure original functionality in a reasonable amount of time.

Each day, in the midafternoon, operations and integration staff will confirm with integrator that the progress made is acceptable and whether or not the roll back plan will be implemented in support of regaining automated control.

SECTION 16850

PLC/HMI CONTROLS INTEGRATION

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and install, complete with all accessories, modifications to an existing programmable logic control based monitoring and control system as described herein and shown on the contract drawings.
- B. All system construction and programming will be the responsibility of the controls integrator (PLC/HMI) system supplier. All materials and labor shall be provided for a fully functional system including any items which are required for system operation but are not specifically addressed in this document or on the contract drawings.
- C. This specification is intended to be used in conjunction with all drawings supplied and is not intended to be complete without reference diagrams on system configurations, etc. All bidders must conform to all areas of the documentation. It is the intent of this specification that the system integrator have single source responsibility for the complete (PLC/HMI) system package for the project; PLC software and hardware modifications, HMI screen development modifications, HMI report generation and coordination with the field instrumentation and interconnecting conduit and control wiring for total system responsibility.
- D. The Effluent Screen Manufacturer will provide Allen Bradley MicroLogix PLC's with Ethernet/IP communications in the (2) Screen Control Cabinets (SCC's). Provide a fiber optic link from SCC-1 & SCC-2 back to the SCADA system. This contract includes the integration of the MicroLogix PLC's in the SCC's to the Plant SCADA system.
- E. Gate actuators G11101, G11102, G11111 and G11112 shall communicate via existing hardwired connections to PLC5.
- F. The contractor shall assume total systems responsibility for all aspects of this system including installation, commissioning and start-up of the system, training of operating personnel and coordinating interfaces between this system and equipment provided by others. This responsibility shall include all modifications to PLC5 including but not limited to, termination of field cables, terminal blocks, power supplies, surge suppression, fiber optic patch panels, switches, patch cables and other control devices as required for forming a complete system.

1.02 PLC/HMI SYSTEMS INTEGRATOR

- A. The contractor shall utilize the services of an experienced water and waste water PLC/HMI system integrator for this project. The PLC/HMI system integrator shall have a minimum of 5 years experience and demonstrate proficiency in Allen Bradley Logix 5000 programming software and I-Fix HMI systems.

1.03 SUBMITTALS

- A. Shop Drawings shall be submitted in accordance with Section 16050, Shop Drawings, Product Data and Samples. These drawings shall include:
1. A cover sheet consisting of a Bill of Material, purchase order number, manufacturer's job number, Owner's name, location, application and shipping address.
 2. Modifications to mechanical layout drawings detailing the overall external dimensions of all enclosures. Include all pertinent information such as location of door handles, windows, lifting lugs and enclosure mounted items such as pump controller chassis and I/O modules (show cable connections on modules), relays, cooling fans, etc.
 3. Details for mounting of the processor, I/O racks, relays, motor starters, disconnect switch, fuse blocks, wireways, etc. All materials shall be labeled to provide easy cross-reference to the Bill of Material listing.
 5. Electrical drawings detailing all hardwiring, done by the supplier, to devices such as relays, disconnect switches, fuse blocks, etc. Provide individual wire numbers and relay contact cross-reference designations.
 6. A description of all input and output modules by name, rack, module and terminal location.
 7. Modifications to the existing PLC input/output listing indicating, PLC number, drawing number, tag number, function description, I/O type, loop number and PLC address number.
- B. SHOP DRAWINGS:
1. Modifications to master wiring diagrams, elementary schematics and control schematics shall be submitted for approval before proceeding with manufacture. Shop drawings shall be on standard 11" X 17" media; drawn with a computer aided design package.
 2. A complete drawing indicating each point of interface with the process control system and the type of signal provided or accepted at each point. This drawing shall depict the actual interface terminal block including all circuit designations.
 3. Drawing modifications to be provided under this contract include but are not limited to Control Panel drawings for PLC5.
- C. SOFTWARE SUBMITTALS
1. The programmer of the software shall have a minimum of 5 years experience with software programming applications dealing with serial communication of the type to be used.

2. The system integrator shall submit modifications to the existing graphic screens and plant reports to be provided under this contract.
- D. O&M Manuals; Existing plant PLC/HMI O&M manuals shall be updated for the changes and modifications in this contract.
1. As-Built drawings of the Control Panel
 2. Bill of Material listing for all components provided within the PLC/termination cabinet (and any other panels provided) as well as provided external instrumentation devices, with cut sheets and operator's manual/user's reference books.
 3. Update documentation for the PLC and its programming. Include the RS Logix Report with: Processor Information listing, I/O configuration, channel configuration, program file list, data file list, complete ladder-logic printout, address assignment listings for all Data Files/Bits (digital input, digital output, S2 hex Status, B3 Binary, T4 Timer, C5 Counter, R6 Control, N7 Integer, F8 Float, others as utilized).
 4. Complete documentation of the I-Fix Screens and its database/address assignment, similar to that above for the operator interface. Include configuration/setup listings that were used for the SCADA programming.
 5. Complete electronic copy (disk or CD-ROM) of the PLC ladder logic program. The licensed copy of the programming software as specified. Complete electronic copy (CD-ROM) of the operator interface program. The licensed copy of the programming software for the operator interface if specified. Complete electronic copy (CD-ROM) of the I-Fix Screen files and any other configuration files that are specific to the configuration/setup.

PART 2 - PRODUCTS

2.01 PLC/HMI FIELD INPUTS/OUTPUTS

- A. The PLC/HMI controller (existing PLC5) shall be programmed to monitor & control the replacement Effluent Screen 1 & 2.
- B. The existing plant SCADA system shall be modified to communicate direct with Effluent Screens 1 & 2 SCC's through a fiber optic based Ethernet network. The system shall be programmed to provide all virtual I/O specified, some of the virtual I/O will be used for control, the remaining will be used locally for diagnostics

2.02 PLC/HMI HARDWARE

- A. Provide all necessary modification to the existing PLC5 controls cabinets to integrate the field I/O as indicated. Modifications include but are not limited to, termination of fiber optic cable, Stratix Switch, patch panels, terminal blocks, power supplies, surge suppression, interposing relays and other control devices as required to form a complete system. Hardware devices shall be identical to existing. Lightning and transient surge protection shall be provided for all copper circuitry entering or leaving the PLC cabinet.

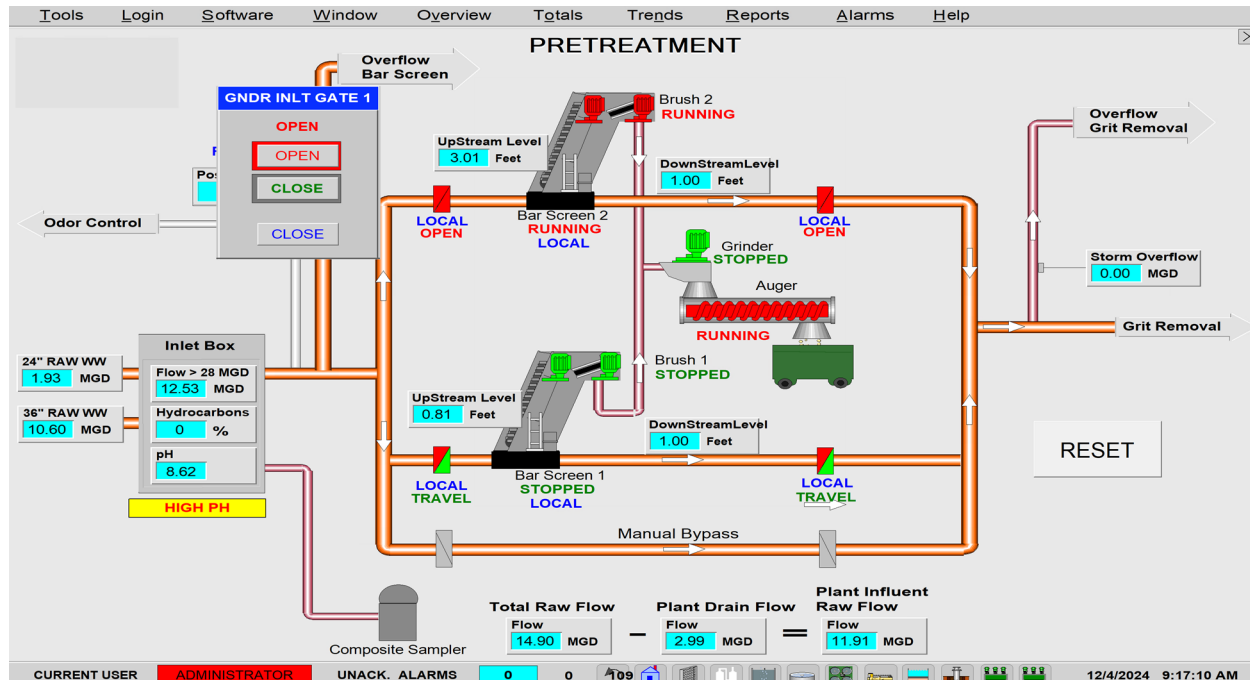
2.03 PLC/HMI SOFTWARE INTEGRATION

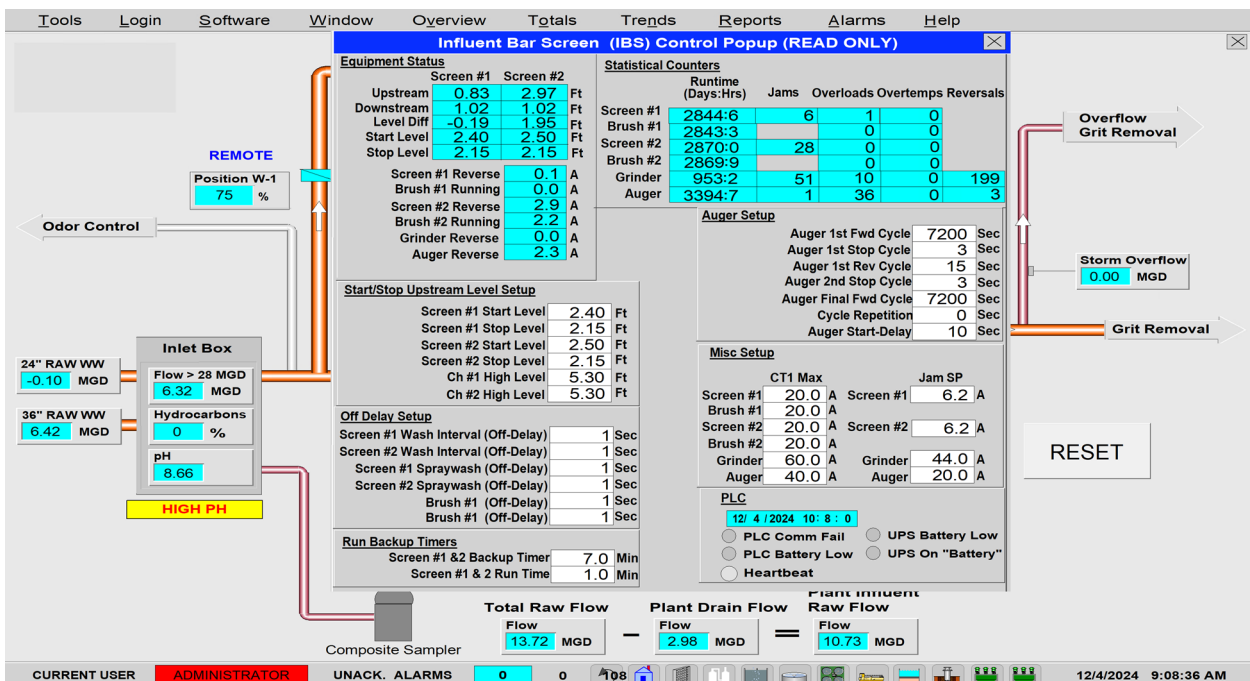
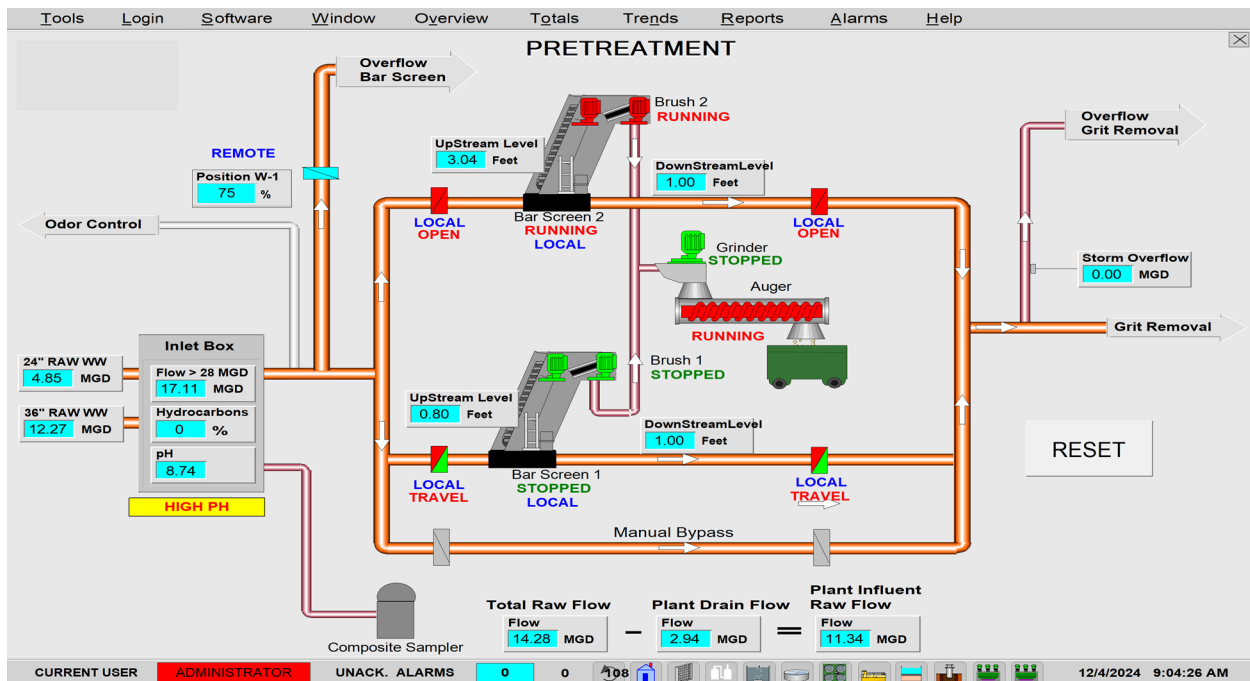
- A. The control system integrator will completely integrate the proposed field monitoring and control points into the existing SCADA system.
- B. Provide modifications and additions to the I-Fix computer software to support the proposed listed alarms, status and control signals associated with the project. Create internal registers and signals as required to link real signals to graphics for monitoring and keyboard for control. Each new signal shall be individually defined and assigned to a new device file.
- C. Screen modification presentation shall be minimal and comparable to the existing graphics screens with full use of dynamic colors, levels and numeric values and tied to real time data. All analog values shall be displayed in engineering units.
- D. Temporarily disable the instruments and field devices that are being demolished and replaced to prevent nuisance alarms during construction. Coordinate the phasing with the contractor and enable the devices again upon completion.
- E. Incorporate all required signals into the database and set limits and alarm values based on owner requests and operational testing. All modifications to the software shall be compatible with the existing format. Provide virtual high and low alarms for each analog parameter. Alarm levels as directed by the owner during operational testing. Provide an overall site analyzer graphic screen. Integrate analyzer trouble alarms into the alarm database.
- F. The HMI controller shall be programmed to monitor the proposed Effluent Screens through the proposed Ethernet network. The proposed network will be provided and configured with this project. influent screen Manufacturer shall provide Allen Bradley Stratix managed Ethernet switch & expansion module in the PLC control panel (SCC's) as the gateway between the HMI and the Effluent Screen PLC's. Note, analog and digital input signals from SCC panels indicated below are existing on the network unless indicated as **(NEW)**. Integrator shall modify network signal addresses as needed to provide a functioning system. As a minimum Ethernet signals to/from each screen will consist of the following:
 - 1. **Screen 1 Remote Start (NEW)**
 - 2. Screen 1 Motor Overload
 - 3. Screen 1 Motor Over Temperature
 - 4. Screen 1 Run Feedback Signal Loss
 - 5. Screen 1 Jammed
 - 6. **Screen 1 Control Cabinet UPS On Battery**
 - 7. **Screen 1 Control Cabinet UPS Battery Low**
 - 8. **Screen 1 Control Cabinet PLC Battery Low**
 - 9. Screen 1 ~~Brush~~ **Compactor 1 Overload**

10. Screen 1 ~~Brush 1~~ **Compactor 1** Motor Over Temperature
11. Screen 1 ~~Brush 1~~ **Compactor 1** Run Feedback Signal Loss
12. Screen 1 Upstream 4mA
13. Screen 1 Upstream 20mA
14. Screen 1 Upstream Level
15. Screen 1 Downstream 4mA
16. Screen 1 Downstream 20mA
17. Screen 1 Downstream Level
18. Screen 1 Start Differential
19. Screen 1 Stop Differential
20. Screen 1 Level Differential
21. Screen 1 Channel 1 High Level Setpoint
22. Screen 1 Channel 1 Upstream D1
23. Screen 1 Channel 1 Downstream D2
24. Screen 2 Remote Start
25. Screen 2 Motor Overload
26. Screen 2 Motor Over Temperature
27. Screen 2 Run Feedback Signal Loss
28. Screen 2 Jammed
29. **Screen 2 Control Cabinet UPS On Battery (NEW)**
30. **Screen 2 Control Cabinet UPS Battery Low (NEW)**
31. **Screen 2 Control Cabinet PLC Battery Low (NEW)**
32. Screen 2 ~~Brush 1~~ **Compactor 1** Overload
33. Screen 2 ~~Brush 1~~ **Compactor 1** Motor Over Temperature
34. Screen 2 ~~Brush 1~~ **Compactor 1** Run Feedback Signal Loss
35. Screen 2 Upstream 4mA
36. Screen 2 Upstream 20mA
37. Screen 2 Upstream Level
38. Screen 2 Downstream 4mA
39. Screen 2 Downstream 20mA
40. Screen 2 Downstream Level
41. Screen 2 Start Differential
42. Screen 2 Stop Differential
43. Screen 2 Level Differential
44. Screen 2 Channel 1 High Level Setpoint
45. Screen 2 Channel 1 Upstream D1
46. Screen 2 Channel 1 Downstream D2

Provide additional monitoring or control signals as directed by Collier County.

- G. Add values to existing reports as directed by the owner.
- H. Sample Screens: Remove Auger and Grinder Icons and tags. Update piping to resemble physical routing in the field on screens.





PART 3 - EXECUTION

3.01 INSTALLATION

- A. The work included in this section consists of furnishing, installing and placing in operation the instruments and appurtenances, including all conduit, wiring and circuitry, necessary to provide the Owner with a fully operable system properly calibrated and installed.
- B. Include the services of a factory trained, qualified service engineer of the equipment manufacturer to inspect the complete equipment installation to assure that it is installed in accordance with the manufacturer's recommendations, make all adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in the proper care and operation of the equipment furnished.
- C. All workmanship utilized in the manufacture and installation of this system shall be of the highest quality and performed in a manner which is consistent with all accepted practices for industrial controls.

3.02 START UP SUPERVISION

- A. The system supplier shall provide a qualified service technician to inspect all final connections and check the system prior to start-up of the system. The service technician shall coordinate with the owner's representative for functional check-out of the complete system.

3.03 WARRANTY AND TRAINING

- A. All products and systems herein must be warranted by the supplier for a period of Two (2) years from the date of final completion.
- B. The system supplier shall also provide (1) day of training instruction to the owner's personnel to include; operator training; and PLC and Controls system maintenance training including software maintenance training.

END OF SECTION

I/O LIST

Process #	DESCRIPTION	PLC	TY PE	STATUS
	Screen 1 Remote Start	PLC5	N	ALARM
	Screen 1 Motor Overload	PLC5	N	ALARM
	Screen 1 Motor Over Temperature	PLC5	N	ALARM
	Screen 1 Run Feedback Signal Loss	PLC5	N	ALARM
	Screen 1 Jammed	PLC5	N	ALARM
	Screen 1 Control Cabinet UPS On Battery	PLC5	N	ALARM
	Screen 1 Control Cabinet UPS Battery Low	PLC5	N	ALARM
	Screen 1 Control Cabinet PLC Battery Low	PLC5	N	ALARM
	Screen 1 Brush4 Compactor 1 Overload	PLC5	N	ALARM
	Screen 1 Brush4 Compactor 1 Motor Over Temperature	PLC5	N	ALARM
	Screen 1 Brush4 Compactor 1 Run Feedback Signal Loss	PLC5	N	ALARM
	Screen 1 Upstream 4mA	PLC5	N	AMPACITY
	Screen 1 Upstream 20mA	PLC5	N	AMPACITY
	Screen 1 Upstream Level	PLC5	N	Level
	Screen 1 Downstream 4mA	PLC5	N	AMPACITY
	Screen 1 Downstream 20mA	PLC5	N	AMPACITY
	Screen 1 Downstream Level	PLC5	N	Level
	Screen 1 Start Differential	PLC5	N	Feet
	Screen 1 Stop Differential	PLC5	N	Feet
	Screen 1 Level Differential	PLC5	N	Feet
	Screen 1 Channel 1 High Level Setpoint	PLC5	N	ALARM
	Screen 1 Channel 1 Upstream D1	PLC5	N	ALARM
	Screen 1 Channel 1 Downstream D2	PLC5	N	ALARM
	Screen 2 Remote Start	PLC5	N	ALARM
	Screen 2 Motor Overload	PLC5	N	ALARM
	Screen 2 Motor Over Temperature	PLC5	N	ALARM
	Screen 2 Run Feedback Signal Loss	PLC5	N	ALARM
	Screen 2 Jammed	PLC5	N	ALARM
	Screen 2 Control Cabinet UPS On Battery	PLC5	N	ALARM
	Screen 2 Control Cabinet UPS Battery Low	PLC5	N	ALARM
	Screen 2 Control Cabinet PLC Battery Low	PLC5	N	ALARM
	Screen 2 Brush4 Compactor 1 Overload	PLC5	N	ALARM
	Screen 2 Brush4 Compactor 1 Motor Over Temperature	PLC5	N	ALARM
	Screen 2 Brush4 Compactor 1 Run Feedback Signal Loss	PLC5	N	ALARM
	Screen 2 Upstream 4mA	PLC5	N	AMPACITY
	Screen 2 Upstream 20mA	PLC5	N	AMPACITY
	Screen 2 Upstream Level	PLC5	N	Level
	Screen 2 Downstream 4mA	PLC5	N	AMPACITY
	Screen 2 Downstream 20mA	PLC5	N	AMPACITY

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I/O LIST

[illegible]

SECTION 17100

FIBER OPTIC COMMUNICATION SYSTEM

PART 1 – GENERAL

1.01 REFERENCED STANDARDS

- A. The cable and installation shall meet all requirements stated in this specification as well as the latest edition of the following:
 - 1. Insulated Cables Engineers Association (ICEA); S-87-640 Standard for Fiber Optic Outside Plant Communication Cable
 - 2. United States Department of Agriculture Rural Development Utilities Program (RDUP); PE-90
 - 3. ISO/IEC:
 - a. 24702 Information technology -- Generic cabling -- Industrial premises OS2 Single-mode fiber type 0.4db/km attenuation
 - b. 11801 Information technology — Generic cabling for customer premises OM1 Multimode fiber type 62.5 μm core; minimum modal bandwidth of 200 MHz*km at 850 nm
 - 4. International Electrotechnical Commission (IEC):
 - a. 60793-2-50 Type B1.3 Product specifications - Sectional specification for class B single-mode fibres
 - b. 60793-2-10 Type A1b Product specifications - Sectional specification for category A1 multimode fibres
 - 5. International Telecommunication Union (ITU); T G.652.D Characteristics of a Single Mode Optical Fibre and Cable
 - 6. Telecommunications Industry Association/Electronics Industry Association (TIA/EIA) Standards:
 - a. 455-78-B Measurements Methods and Test Procedures-Attenuation
 - b. 492 CAAB Detail Specification for Class IVa Dispersion-Unshifted Single Mode Optical Fibers with low water peak
 - c. 492 AAAA-A Detail Specification for 62.5 micrometer Core Diameter/125 micrometer cladding diameter Class IVa Graded-Index Multimode
 - d. 568-C.3 Optical Fiber Cabling Component Standard
 - e. 598-B Optical Fiber Cable Color Coding
 - 7. Restriction of Hazardous Substance (RoHS) Compliant
 - 8. Telcordia; GR-20-CORE

1.02 QUALITY ASSURANCE

- A. Manufacturer
 - 1. The cable manufacturer shall be ISO 9001 or Quality Management System TL 9000 registered.
- B. Installer
 - 1. The fiber optic cable installer shall be certified by the cable manufacturer and adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning the

- Project
2. The Contractor directly responsible for this work shall be a Premise Distribution contractor who is, and who has been, regularly engaged in the providing and installation of commercial and industrial telecommunications wiring systems of this type and size for at least the immediate past five years.
 3. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and have personnel who are adequately trained in the use of such tools and equipment.

1.03 SUBMITTALS

- A. Submit in accordance with Section 16050 SPECIAL REQUIREMENTS.
- B. SHOP DRAWINGS shall include:
 1. Cable schedule showing cable identification, fiber counts for each cable and identification of used fiber pairs.
 2. Component Data:
 - a. Manufacturers and model number
 - b. Data sheets
 3. System Block Diagram
 4. Detailed Test Procedure to be implemented including all tests to be conducted and list of equipment to be used.
- C. OPERATION and MAINTENANCE submittal shall include:
 1. All shop drawing data revised for as built conditions
 2. Manufacturers user manuals and installation instructions
 3. Fiber Optic Cable Test Results

1.04 SYSTEM DESCRIPTION

- A. Furnish and install complete with all accessories a TIA/EIA fiber optic, Cabling System (FOCS). The FOCS system shall serve as a vehicle for transport of data and video signals connecting designated demarcation points and other locations as indicated on the contract drawings and described herein.
- B. The system shall utilize a network of fiber optic cabling. Cables and terminations shall be provided and located as shown and in the quantities indicated on the drawings. Cables shall terminate on rack mounted Fiber Distribution Centers (FDC's) located as shown on the drawings. All cables, and terminations shall be identified at all locations. All terminations shall comply with, and be tested to TIA/EIA and Gigabit Ethernet fiber optic standards.
- C. Major work items include but are not limited to:
 1. Fiber optic cable and patch cords
 2. Fiber Optic Patch Panels
 3. Installation of fiber optic cable
 4. Fiber optic terminations
 5. Testing of the fiber optic cable including:
 - a. On-the-reel fiber optic cable testing
 - b. OTDR testing on installed fiber optic cable.

- D. Electrical Contractor to furnish and install conduit for fiber optic cable. Coordinate fiber optic cable, conduit and innerduct requirements with electrical contractor.
- E. Provide fiber optic cable for installation based on lengths provided by the electrical contractor.
- F. Environmental Specifications:
 - 1. Outside Plant Fiber Optic Cable operation and storage -40 degrees C to +70 degrees C.
 - 2. Equipment Outside above ground -40 degrees C to +80 degrees C.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Multi-mode fiber optic cabling shall be provided between fiber racks as designated on the contract drawings. Cables placed below grade shall be certified by the manufacturer for that environment. Cables installed in vertical risers between floors shall be U.L. listed riser type cable. Cables installed in plenum spaces shall be listed for that environment.

2.02 MODE FIBER OPTIC CABLE

- A. Provide 62.5/125-micron OM1 Class IVa Graded-Index Multimode Optical Fiber for use in the backbone and horizontal distribution system.
- B. Fiber Characteristics:
 - 1. Reduced Water Peak
 - 2. Maximum Attenuation: 850/1300nm: 3.5/1.5dB/km
 - 3. Color coded buffer tube
 - 4. Color coded fiber
 - 5. Loose Tube
 - 6. Maximum Transmission: 1 Gbps Ethernet; 300m at 850nm and 600m at 1300nm
 - 7. Minimum Bend Radius 4.1” longterm, 8.2” during installation.
- C. Cable Characteristics:
 - 1. Fiber Count-6 fibers per cable or as otherwise noted on the drawings.
 - 2. Loose Tube Cable with PFM Gel filled buffer tubes
 - 3. Up to 12 fibers per buffer tube
 - 4. UV resistant Outer Jacket
 - 5. The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrinkback requirements.
 - 6. Buffer tubes shall be stranded around a dielectric central member using a reverse oscillating lay.
 - 7. Top and bottom ends of cable shall be available for testing.
 - 8. Both ends of cable shall be sealed during shipping to prevent ingress of moisture.
 - 9. The jacket shall be free of holes, splits and blisters. It shall also contain no metal elements and shall be of consistent thickness.
 - 10. Maximum Tensile Loading: 2700N(600lbf) during installation and 890N(200lbf) long term.

- D. Manufacturers:
 - 1. Superior Essex Series 11
 - 1. Corning
 - 2. Berk-Tek

2.03 FIBER OPTIC TERMINATION PANELS

- A. Control Panel Mounted Field Panels: Fiber optic cabling shall be terminated in wall mount fiber enclosures as described herein. Enclosures shall include swinging side doors with latching mechanism and routing guides. Provide blanking modules in all unused connection ports. FDC's shall be provided in quantities and configurations as required complete with SC style connectors. All FDC's shall be provided with mounting hardware allowing the unit to be mounted to a backplane.
- B. General: Provide blanking modules in all unused connection ports on the panels. All panels shall include strain relief points where fiber optic cable strength members shall be securely attached.
- C. Labels: Labeling for fiber cabling shall be by the color suffix designating which fiber is terminated. Die cut acetate labels or Kroy labels shall be considered acceptable the purpose
- D. Manufacturers:
 - 1. Lightwave
 - 2. Blackbox
 - 3. Corning

2.04 FIBER OPTIC CONNECTORS

- A. General: Provide field installable, multi mode SC type connectors. Connectors shall be Glass-in-Ceramic, with a maximum loss of .2 dB.
- B. Manufacturers:
 - 1. Blackbox
 - 2. Corning
 - 3. Siemon

2.05 FIBER OPTIC PATCH CORDS

- A. General: All patch cords shall be of the same manufacturer as provided with the FDU units and shall comply with manufacturers approved testing and warranty statements.

2.06 UNSPECIFIED EQUIPMENT AND MATERIAL

- A. Any item of equipment or material not specifically addressed on the contract drawings or in this document and required to provide a complete and functional SCS installation shall be provided in a level of quality consistent with other specified items.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Fiber Optic Cable
1. Install cable in accordance with cable manufacturer recommendations for bend radius and pulling tension. Do not exceed limits specified by the manufacturer.
 2. Utilize break away swivel set at 600lbs for straight pulls greater than 100' and all pulls which are not in a straight line.
 3. Identify cable on both ends, in pull boxes and at all terminations.
 4. Terminate all fibers in each cable to a connector.
 5. Provide slack fiber coiled neatly in cable management at all fiber termination centers, converters and switches.
 6. Terminate cables using manufacturer supplied break-out kits.
 7. Fan out fiber to allow direct connection with connectors. Provide strain relief with fan out collar.

3.02 TESTING

- A. Fibers in fiber optic cable shall be tested for correctness of termination and overall transmission loss using an approved fiber optic transmission loss test instrument (OLTS) and optical time domain reflectometer instrument (OTDR). System loss measurements shall be provided at 1310nm and 1550 nm for single mode fiber, at 850 and 1300 nanometers for multimode fiber. A certification report shall be provided listing both the calculated and measure loss for each fiber optic circuit and submitted with the close out documents.
- B. All cabled fibers greater than 1000 meters in length shall be 100% attenuation tested. The Attenuation of each fiber shall be provided with each cable reel.
- C. Perform OLTS testing in both directions of installed backbone and horizontal fiber.
1. Submit test report which includes:
 - a. Fiber Identification
 - b. Length of each fiber vs calculated length
 - c. Copy of the OTDR printouts
 - d. Pass or fail status of length under test.
- D. Provide OTDR on-the-reel tests for each fiber strand upon delivery to the project site.
1. Test each fiber optic strand for continuity and loss using an OTDR with disk storage capabilities.
 2. Submit test report for each reel which includes:
 - a. Reel Identification
 - b. Manufacturers product test data
 - c. Copy of the OTDR printouts
 - d. Pass or fail status of each fiber on the reel.
- E. Provide OTDR post installation tests for each installed fiber strand u
1. Test each installed fiber optic link for continuity and loss using an OTDR with disk storage capabilities.
 2. Submit test report for each cable which includes:
 - a. Cable Identification
 - b. ID of reel cable was taken from
 - c. Copy of the OTDR printouts
 - d. Pass or fail status of each fiber on the reel.

END OF SECTION