

# TECHNICAL SPECIFICATIONS

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## SECTION 011000 – SUMMARY OF WORK

### PART 1 – GENERAL

#### 1.1 GENERAL

- A. The Work to be performed under this Contract shall consist of furnishing tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The Work shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents, which may be necessary for the complete and proper construction of the Work in good faith shall be provided by the Contractor as though originally so indicated, at no increase in cost to the Owner.
- B. The Contractor is responsible to follow the provisions of these Contract Documents, including, but not limited to: adhering to the Plans and Specifications; the timely, complete, and accurate submittal of shop drawings; the work of and correlation with his subcontractors and suppliers, timely performance of the Contract, and timely payment of suppliers and subcontractors. Nothing stated in the Contract Documents or Specifications shall be construed to relieve the Contractor of these basic responsibilities.
- C. Work under the Contract Documents, or under any Bid Item, allowance, or alternate, shall include all items necessary for the satisfactory completion of Work, whether or not expressly specified or indicated in the bid item descriptions below. All Work not specifically included in the bid item descriptions below shall be broken down as necessary for establishment of pay items.

#### 1.2 SUMMARY OF WORK – BASE BID

The work under the base bid items of this Contract consists of the following project elements:

##### Item 1 - Mobilization and Demobilization (LS)

Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project; temporary power, water, and sanitation facilities; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site. Mobilization includes the preparation of a Dewatering Plan for review and approval by the project engineer before proceeding with the work in accordance with the plans.

Demobilization shall consist of all preparatory work and operations to remove all the facilities and personnel included in Mobilization. Demobilization shall include cleanup of the entire construction area to pre-existing conditions after all the work indicated on the plans and specifications is completed and before final acceptance of the project.

Payment for mobilization and demobilization will be made as follows:

- a. Total bid price for this item shall not be more than five percent (5%) of the overall project construction cost.
- b. When 25% of the total original Contract amount is earned from other bid items, 75% of the amount of bid for mobilization and demobilization will be paid.
- c. Upon completion of all work on the project, including completion of punch list work and submittal of record drawings by the Contractor, 100% of the mobilization and demobilization item will be paid.

#### Item 2 - Erosion Control and Demolition

This bid item includes all labor, materials, tools, and equipment required to furnish, install, maintain, remove, and dispose of all erosion control measures for the duration of the project in accordance with the plans and specifications.

This bid item includes all labor, materials, tools, and equipment required for the removal and disposal of all items specified for demolition as shown on the plans and not required to be salvaged or relocated. This bid item includes salvaging items specified by the Owner and movement of items specified to be relocated. Off-site disposal of items specified for demolition will be the Contractor's responsibility and shall be made in conformance with all local, state and federally mandated disposal requirements at no additional cost to the Owner.

#### Item 3 - FM Crossing under SR-535

This bid item includes all labor, materials, tools, and equipment required to furnish and install the steel casings for the sanitary sewer force main crossing under SR-535 using trenchless installation methods as shown and specified on the plans. This bid item consists of, but is not limited to, bore and receiving pit excavations, sheeting and shoring, and other equipment and appurtenances as required to provide the crossing, complete and in place. This item also includes all dewatering as necessary required for the duration of the installation work. The HDPE force main piping material and installation is included in Bid Items 4 and 5.

#### Item 4 - FM Piping 6-inch HDPE DR21

This bid item includes all labor, materials, tools, and equipment required to furnish and install the new 6-inch HDPE sanitary sewer force main piping and fittings as shown and specified on the plans. This bid item consists of, but is not limited to, trench excavation, sheeting and shoring, bedding and backfill per specification, compaction testing, pipe and fittings, line location tape and wire placement, pressure and leakage testing, and other appurtenances as required to provide the item, complete and in place. This item also includes all dewatering as necessary required to construct the pipeline.

#### Item 5 - FM Piping 10-inch HDPE DR21

This bid item includes all labor, materials, tools, and equipment required to furnish and install the new 10-inch HDPE sanitary sewer force main piping and fittings as shown and specified on the plans. This bid item consists of, but is not limited to, trench excavation, sheeting and shoring, bedding and backfill per specification, compaction testing, pipe and fittings, line location tape and wire placement, pressure and leakage testing, and other appurtenances as required to provide the item, complete and in place. This item also includes all dewatering as necessary required to construct the pipeline.

#### Item 6 - FM Air Valve Manhole Assemblies

This bid item includes all labor, materials, tools, and equipment required to furnish and install the air valve assemblies along the sanitary sewer force mains as shown and specified on the plans including the manhole and base, concrete collars and lids, fittings, valves, pipe supports and bracing, located wire, and all associated appurtenances. This bid item consists of, but is not limited to, excavation, sheeting and shoring, bedding, backfill, and compaction per specification. This item also includes all dewatering as necessary to install the structures.

#### Item 7 - FM Termination and New Manhole

This bid item includes all labor, materials, tools, and equipment required to furnish and install the new manhole on the existing gravity sewer piping at the force main termination as shown and specified on the plans including the manhole and base with custom flow line, grade adjustment rings, cover, inside drop bowl assemblies, and all associated appurtenances. This bid item consists of, but is not limited to, excavation, sheeting and shoring, bedding, backfill, and compaction per specification, cutting of the existing gravity sewer. This item also includes all dewatering and bypass pumping as necessary to install the structure.

#### Item 8 - Water Main Relocation, Air Valve, and Flush Valve

This bid item includes all labor, materials, tools, and equipment required to furnish and install the water main relocation near the lift station site including the 8-inch C900 PVC piping, valves, fittings, air release valve assembly, flush valve assembly, and connections to existing piping as shown and specified on the plans. This bid item consists of, but is not limited to, trench excavation, sheeting and shoring, bedding and backfill per specification, compaction testing, line location tape and wire placement, pressure and leakage testing, disinfection, and other appurtenances as required to provide the item, complete and in place.

#### Item 9 - LS Site Excavation, Backfill, Compaction, and Finish Grading

This bid item includes all labor, materials, tools, and equipment required for clearing, grubbing, and disposal offsite of obstructions such as rocks, brush, vegetation, debris, and miscellaneous structures as necessary for preparation of the site. This bid item includes all labor, materials, tools, and equipment required for the removal and disposal of all items specified for demolition as shown on the plans and not required to be salvaged or relocated. This bid item includes salvaging items specified by the Owner and movement of items specified to be relocated. Off-site disposal of items specified for demolition will be the Contractor's responsibility and shall be made in conformance with

all local, state, and federally mandated disposal requirements at no additional cost to the Owner.

This bid item also includes all labor, materials, tools, and equipment required for the movement, cut, fill, placement, compaction of soils, and finish grading for the site and for the preparation of the subgrade for all structures, vaults, manholes, concrete pads and other improvements at the lift station site as required in the plans and specifications and not included in other bid items. This bid item also includes sheeting and shoring.

#### Item 10 - LS Site Dewatering

This bid item includes all labor, materials, tools, and equipment required to furnish, install, and maintain dewatering/pumping equipment as necessary to remove groundwater and install lift station site improvements. This bid item includes the Contractor's preparation of a dewatering plan for review and approval by the Engineer, obtaining discharge/pumping permits including associated permit fees, and the disposal of all groundwater in accordance with all local, state, and federally mandated disposal requirements at no additional cost to the Owner.

#### Item 11 - LS Approach Manhole

This bid item includes all labor, materials, tools, and equipment required to furnish and install the lift station approach manhole as shown and specified on the plans including the manhole and base with sump, concrete collars and lid, gravity pipeline connections, interior coating, and all associated appurtenances. Earthwork, subgrade preparation, sheeting and shoring, backfill, compaction, and dewatering are included in Bid Items 9 and 10.

#### Item 12 - LS Wet Well Structure

This bid item includes all labor, materials, tools, and equipment required to furnish and install the lift station wet well structure as shown and specified on the plans including the precast concrete structures, concrete grade rings and access covers, interior and exterior coatings, and piping penetrations. Earthwork, subgrade preparation, sheeting and shoring, backfill, compaction, and dewatering are included in Bid Items 9 and 10.

#### Item 13 - LS Dry Pit Structure

This bid item includes all labor, materials, tools, and equipment required to furnish and install the lift station dry pit structure as shown and specified on the plans including the precast concrete structures, concrete riser sections, access hatch and accessories, access ladder, exterior coatings, and piping penetrations. Earthwork, subgrade preparation, sheeting and shoring, backfill, compaction, and dewatering are included in Bid Items 9 and 10.

This bid item also includes all labor, materials, tools, and equipment required to furnish and install the concrete sump area with interior coatings and floor grate and the concrete pump pedestals.

#### Item 14 - LS Pumps and Motors

This bid item includes all labor, materials, tools, and equipment required to furnish and install the lift station pumps and motors, complete and in place. This item includes the

required anchorage of pumps, connections to suction and discharge piping, electrical connections, factory and field testing, and start-up in accordance with the plans and specifications.

#### Item 15 - LS Interior Piping and Equipment

This bid item includes all labor, materials, tools, and equipment required to furnish and install all suction and discharge piping and equipment interior to the lift station wet well and dry pit structures. This bid item consists of, but is not limited to, the 4-inch, 6-inch, and 8-inch suction and discharge piping, valve and valve operators, fittings, pipe supports and braces, application of paintings and coatings, pressure and leakage testing, and other appurtenances as required to provide the pumping system piping, as shown on the plans and as specified, complete and in place. This bid item also includes the drop bowl assembly, wet well mixer and accessories, dry pit sump pump and discharge piping, lifting chains for pumps and mixer, and all support brackets.

#### Item 16 - LS Meter and Air Valve Vault

This bid item includes all labor, materials, tools, and equipment required to furnish and install the meter and air valve vault as shown and specified on the plans. This bid item consists of, but is not limited to, the valve vault, access hatch, access ladder, all piping, fittings and valves interior to the vault, the flow meter, air valve assembly and pressure gauge, piping penetrations, exhaust fan and piping, application of paintings and coatings, pressure and leakage testing, and other appurtenances as required to provide the vault, complete and in place. Earthwork, subgrade preparation, sheeting and shoring, backfill, compaction, and dewatering are included in Bid Items 9 and 10.

#### Item 17 - LS Sewer Yard Piping, Valves, and Fittings

This bid item includes all labor, materials, tools, and equipment required to furnish and install the below-grade lift station site piping and fittings as shown and specified on the plans. This bid item consists of, but is not limited to the 24-inch gravity sewer PVC piping; the 6-inch, 8-inch, and 10-inch ductile iron sewer force main piping, fittings, and valves; 4-inch PVC drain piping and cleanouts from the valve vault; PVC vent piping from the air valve assembly to the wet well; the bypass pumping connection including the manhole frame, cover, and camlock connection; piping between the wet well and dry pit structure; valve boxes; line location tape and wire placement; all coatings, wax tape, and encasement required for corrosion protection; pressure and leakage testing; and all other piping appurtenances as required to provide the item, complete and in place. Earthwork, subgrade preparation, sheeting and shoring, backfill, compaction, and dewatering are included in Bid Items 9 and 10.

#### Item 18 - LS Pig Launching Stations with Stainless Steel Launch Barrels

This bid item includes all labor, materials, tools, and equipment required to furnish and install the above-grade piping and equipment for the pig launching stations as shown and specified on the plans. This bid item consists of, but is not limited to, the 6-inch and 10-inch piping, valves and fittings; the pig launch trap barrels; furnishing two foam pigs for each diameter; application of paintings and coatings; pressure and leakage testing; and other appurtenances as required to provide the pig launching stations, as shown on the plans and as specified, complete and in place.

The pig launch trap barrels included in this bid item are stainless steel. A bid alternate has been included in Section 1.3.

Item 19 - LS Water Connection, Meter, Backflow Preventer, and Yard Hydrant

This bid item includes all labor, materials, tools, and equipment required to furnish and install the water system connection and supply for the lift station site as shown and specified on the plans. This bid item consists of, but is not limited to, water supply piping, fittings, valves, connection to the existing water main, water meter and meter box assembly, backflow preventer assembly with hot box, yard hydrant assembly, and application of paintings and coatings. This bid item also includes trench excavation, bedding and backfill per specification, compaction testing, line location tape and wire placement, pressure and leakage testing, disinfection, and other appurtenances as required to provide the item, complete and in place.

This bid item also includes all labor, materials, tools, and equipment required to remove and replace the existing sidewalk improvements as needed for the water connection installation as specified on the plans.

Item 20 - LS Electrical, Power, Control, and Lighting

This bid item includes all labor, materials, tools and equipment required to furnish and complete the installation, activation, and testing for the new electrical systems associated with the lift station. This bid item consists of, but is not limited to, all conduits, wiring, receptacles, junction boxes, cabinets, control panels, electrical panels, light fixtures, and connections of all new equipment to the new electrical service. This bid item also includes all distribution switchboards, transfer switches, and motor control centers. Contractor shall work with City of Elko's systems integrator to provide I/O needed for the SCADA/radio telemetry system as specified in the plans and specifications and as needed to provide a complete and operable system.

This item also includes a new electrical service, providing and installing the service meter, installing electrical wiring and conduit for the new service, and coordination with the requirements of NV Energy.

Item 21 - LS Instrumentation

This bid item includes furnishing all labor, materials, tools and equipment required to complete the installation, activation, and testing of the instrumentation for the lift station. This bid item consists of, but is not limited to, float switches, pressure transmitters, and the flow meter transmitter.

Item 22 - LS Diesel Generator

This bid item includes furnishing all labor, materials, tools and equipment required to furnish and install the diesel generator including anchorage, electrical connections, and testing of the diesel generator per the plans and specifications and manufacturer's recommendations.

#### Item 23 - LS Ventilation Systems

This bid item includes furnishing all labor, materials, tools and equipment required to complete the installation, activation, and testing for the ventilation equipment. This bid item consists of, but is not limited to, the exhaust fan, vent piping and fittings to atmosphere, wall-mount support hardware, and application of paintings and coatings.

#### Item 24 - LS Site Fencing

This bid item includes all labor, materials, tools, and equipment required to furnish and install the site fencing as shown and specified on the plans including the access gates, fence and gate posts and railing, fencing hardware and accessories, concrete footings, and privacy slats.

#### Item 25 - LS Site Concrete Pads

This bid item includes all labor, materials, tools, and equipment required to furnish and install the concrete pads at the lift station site as shown on the plans. Construction of the pads shall include placement and compaction of aggregate base, furnishing concrete mix designs to meet contract document requirements, rebar placement as required, and furnishing and placing concrete, including forming and curing.

#### Item 26 - LS Site Bollards

This bid item includes all labor, materials, tools, and equipment required to furnish and install the bollards and safety chains as shown and specified on the plans. This bid item consists of, but is not limited to, excavation, backfill, and compaction, the furnishing and placing of concrete including forming and curing, and applications of paintings and coatings.

#### Item 27 - LS Site Aggregate Base Finish

This bid item includes all labor, materials, tools, and equipment required to furnish and place aggregate base surface finish at the lift station site and rip rap along the drainage swale to the existing infiltration basin as shown on the plans.

### **1.3 SUMMARY OF WORK – ALTERNATE BIDS**

Alternate bid items are as follows:

#### Item 18-ALT - LS Pig Launching Stations with Epoxy Coated Steel Launch Barrels

This bid item includes all labor, materials, tools, and equipment required to furnish and install the above-grade piping and equipment for the pig launching stations as shown and specified on the plans. This bid item consists of, but is not limited to, the 6-inch and 10-inch piping, valves and fittings; the pig launch trap barrels; furnishing two foam pigs for each diameter; application of paintings and coatings; pressure and leakage testing; and other appurtenances as required to provide the pig launching stations, as shown on the plans and as specified, complete and in place.

The pig launch trap barrels included in this alternate bid item are epoxy coated steel.

**— END SECTION 011000 —**

## **SECTION 011600 – CODES, PERMITS, AND PREVENTION OF ENVIRONMENTAL POLLUTION**

### **PART 1 – GENERAL**

#### **1.1 CITY, COUNTY, AND STATE LAWS**

- A. The CONTRACTOR shall comply with the requirements of all city, county, state and federal laws, whether or not stated herein, having specific control over this type of construction and operation.

#### **1.2 FEDERAL, STATE AND LOCAL POLLUTION CONTROL REGULATIONS**

- A. Meet all federal, state, and local pollution control regulations for all work performed under this contract. No lime, wet concrete, petroleum products, silt, organic material, or other deleterious materials are allowed to fall, flow, leach, or otherwise enter public waters.
- B. Observe all statues, ordinances, and regulations pertaining to the prevention of environmental pollution and the preservation of public natural resources. All such statutes, ordinances, regulations, or portions thereof pertaining to work performed under this contract are hereby incorporated with and made a part of this contract.
- C. The CONTRACTOR shall be aware of these provisions and coordinate with the specific controlling agencies.
- D. The CONTRACTOR shall furnish all bonds and insurance required by the controlling agencies and shall, if requested, pay for any inspections and testing accomplished or furnished by them.

#### **1.3 PERMITS**

- A. The CONTRACTOR shall obtain the following permits:
  - 1. All permits required by regulatory agencies, if any, including but not limited to:
    - a. Storm Water Pollution Prevention Plan (SWPPP)
    - b. Dust Control Plan
- B. The CONTRACTOR shall furnish all bonds and insurance required by the controlling agencies, and shall, if requested, pay for any inspection and testing accomplished or furnished by them.
- C. All work performed within the jurisdiction of the controlling agencies, such as river banks and public waters, including restoration of surfaces, opening and closing of excavations and other work which could affect the hydraulics or fish

life of the receiving waters, shall conform to the requirements and regulations of the various controlling agencies, and shall be subject to their approval. The CONTRACTOR shall coordinate all work with the controlling agencies.

#### **1.4 STATE AND FEDERAL SAFETY REQUIREMENTS**

- A. The CONTRACTOR shall include in the work all components and features required for both state and federal safety regulations. Such components and features shall include, but not be specifically limited to, any and all protective devices, guards, restraints, locks, latches, shoring, switches, and other safety provisions that may be required or necessitated by state and federal safety regulations. The CONTRACTOR shall determine the specific requirements for safety provisions and shall cause inspections and reports by the appropriate safety authorities to be conducted to ensure compliance with the intent of the regulations.
- B. The CONTRACTOR shall perform all work in accordance with state and federal safety regulations. Any and all safety procedures and equipment shall be followed and utilized as may be required. All costs for components and features required to meet state and federal safety regulations shall be incidental to performance of the work.
- C. The CONTRACTOR shall be required to comply with U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations, as outlined in the 29 CFR Parts 1910; "Permit-Required Confined Spaces for General Industry; Final Rule".

**— END SECTION 011600 —**

## **SECTION 012000 – MEASUREMENT AND PAYMENT**

### **PART 1 – APPLICATIONS FOR PAYMENT**

#### **1.1 SUMMARY**

- A. General work included in this Section:
  - 1. Measurement and Payment.

#### **1.2 GENERAL**

- A. Submit Applications for Payment to ENGINEER in accordance with the schedule established by conditions of the Contract and Agreement between Owner and CONTRACTOR.
- B. Additional requirements specified elsewhere.
  - 1. Progress payments, retainages, and final payment: Conditions of the Contract and Agreement.
  - 2. Schedule of Values: Bid Form.

#### **1.3 FORMAT AND DATA REQUIRED**

- A. Submit applications per EJCDC form C-620 "Contractor's Application for Payment." Electronic copy of form to be provided by ENGINEER to CONTRACTOR for use in submitting payments associated with this Contract.
- B. Provide itemized data on continuation sheet.
  - 1. Format, schedules, line items, and values: Those of the Schedule of Values.

#### **1.4 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT**

- A. Application form:
  - 1. Fill in required information, including that for Change Orders executed prior to the date of submittal application.
  - 2. Fill in summary of dollar values to agree with the respective totals indicated on the continuation sheets.
  - 3. Execute certification with the signature of a responsible officer of the CONTRACTOR's firm.
- B. Continuation Sheets:
  - 1. Fill in total list of all scheduled component items of work with item number and the scheduled dollar value for each item.
  - 2. Fill in the dollar value in each column for each scheduled line item when work has been performed or products stored.
    - a. Round off values to the nearest dollar.

- C. List each Change Order executed prior to the date of submission at the end of the continuation sheets.
  - 1. List by Change Order number and description, as for an original component item of work.

### **1.5 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS**

- A. When Owner or ENGINEER requires substantiating data, CONTRACTOR shall submit suitable information, with a cover letter identifying:
  - 1. Project.
  - 2. Application number and date.
  - 3. Detailed list of enclosures.
  - 4. For stored products:
    - a. Item number and identification as shown on application.
    - b. Description of specific material.
- B. Submit one copy of data and cover letter for each copy of the application.

### **1.6 PREPARATION OF APPLICATION FOR FINAL PAYMENT**

- A. Fill in application form as specified for progress payments.

### **1.7 SUBMITTAL PROCEDURE**

- A. Submit Application for Payment to ENGINEER as described in General Conditions.
- B. Number: One original plus two copies of each application.
- C. When ENGINEER finds the application properly completed and correct, the ENGINEER will transmit a Certificate of Payment to the Owner.

**— END SECTION 012000 —**

## **SECTION 013200 – CONSTRUCTION SCHEDULES**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. General work included in this Section:
  - 1. Construction schedules.

#### **1.2 CONSTRUCTION SCHEDULES: GENERAL**

- A. Prepare and submit to the ENGINEER estimated progress schedules for the Work, with sub-schedules of related activities that are essential to its progress.
- B. The CONTRACTOR shall submit revised progress schedules based upon revisions in the progress and/or scheduling of Work, or as required by the ENGINEER.
- C. Owner may require CONTRACTOR to add to his plant, equipment, or construction forces, as well as increase working hours if operations fall behind schedule at any time during the construction period.

#### **1.3 FORM OF SCHEDULES**

- A. Prepare schedules in the form of a horizontal bar chart:
  - 1. Provide separate horizontal bar for each trade or operation.
  - 2. Horizontal time scale: Identify the first work day of each week.
  - 3. Scale and spacing: To allow space for notations and future revisions.
  - 4. Minimum sheet size: 8.5" x 11".
- B. Format of listings:
  - 1. The chronological order of the start of each item of work.

#### **1.4 CONTENT OF SCHEDULES**

- A. Show on construction progress schedule:
  - 1. The complete sequence of construction by activity.
  - 2. The dates for the beginning and completion of each major element of construction.
  - 3. Submittal schedules for shop drawings and product data.
- B. Product delivery schedules:
  - 1. Show the delivery dates for all major items of materials and equipment.

## **1.5 PROGRESS REVISIONS**

- A. Indicate progress of each activity to date of submission.
- B. Show changes occurring since previous submission of schedule:
  - 1. Major changes in scope.
  - 2. Activities modified since previous submission.
  - 3. Revised projections of progress and completion.
  - 4. Other identifiable changes.
- C. Provide a narrative report as needed to define:
  - 1. Problem areas, anticipated delays, and the impact on the schedule.
  - 2. Corrective action recommended, and its effect.
  - 3. The effect upon the schedule of other activities.

## **1.6 SUBMISSIONS**

- A. Submit initial schedules by the time of the preconstruction meeting.
- B. Submit revised progress schedules with each Application of Payment, or as required by the ENGINEER.
- C. The CONTRACTOR shall provide four copies of the schedule with each submittal (the option of electronic submittal of the schedule is also available).
- D. The ENGINEER shall review and comment on the submittal within seven days. If required, the CONTRACTOR shall resubmit within seven days after return of the review copy.

**— END SECTION 013200 —**

## SECTION 013300 – SUBMITTALS

### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. All equipment and materials shall be submitted to the Engineer for approval prior to purchase. The information that is required to be submitted shall include, but not be limited to, drawings, specifications, descriptive data, certificates, and samples as required by the Engineer. This section also addresses submittal requirements for samples and operation and maintenance manuals.

#### 1.2 SUBMITTALS: GENERAL

- A. All submittals shall be transmitted to the Engineer.
- B. All submittals shall contain a cover sheet or cover letter clearly representing the purpose and the item(s) submitted.
- C. Submittal information defining equipment and materials shall be specific to the products proposed. Generalized product information that does not clearly define specific equipment or materials to be used will be rejected. Submittals shall contain the manufacturer's recommendations for installation, where applicable or required.
- D. All shop drawings and material and equipment submittals shall contain an approval stamp from the Contractor.
  - 1. The stamp shall state that "[*Contractor name*] has examined and verified all field dimensions and measurements, field construction criteria, materials, and similar data, and that the Contractor has checked with the requirements of the Work and Contract Documents."
  - 2. All transmittals shall be made by the Contractor. Transmittals received from subcontractors and suppliers will receive no action.
- E. The submittal of shop drawings and samples shall comply with Section 6.17 of the General Conditions.
- F. Each transmittal shall contain two copies of a transmittal cover sheet clearly indicating the following:
  - 1. The Project Name.
  - 2. The Owner.
  - 3. The Engineer.
  - 4. Date transmitted.
  - 5. The transmittal identification number for each item.

6. A description of each item.
  7. Action requested.
- G. The Contractor shall submit a sample of the proposed transmittal cover sheets to the Engineer for comment, prior to submittal proceedings.

### **1.3 SHOP DRAWINGS SUBMITTALS**

- A. The requirements for shop drawing transmittals are as follows:
1. Cover sheets shall contain the information depicted in Section 1.2F.
  2. Each item transmitted shall be numbered consecutively beginning with "1".
  3. Resubmittals shall retain the original transmittal number, but be accompanied with a suffix letter starting with letter "A".
  4. Each transmittal cover sheet shall contain items within only one Specification Section or construction detail.
  5. Submit four (4) copies of the submittal materials for the Engineer, plus the number of copies required by the Contractor – as an alternative submittals can be submitted electronically through Newforma Project Management. Electronic return of submittals will be the standard for all electronic version submittals. If no hard copies are submitted, no hard copies will be returned to the CONTRACTOR.
  6. The first page of each item's submittal materials shall contain a 2" x 3" clear space for the Engineer's stamp.
  7. The Contractor's marks shall be on each copy of the transmittal.
  8. The contents of transmittals shall be coordinated and identified so that all items can be easily verified by the Engineer.
  9. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item is in compliance with the Contract Documents.
  10. Wherever possible, submit product data information on 8½" x 11" sheets.
  11. Indicate exact item or model, and all proposed items on product information sheets.
  12. Submittal information shall include legible scale details, sizes, dimensions, performance characteristics, capacities, test data, installation instructions, storage and handling instructions, color charts, layout drawings, parts catalogs, rough-in diagrams, wiring diagrams, controls, weights, and other pertinent data.
  13. If proposed products deviate from the specifications or drawings in any way, clearly note and justify the deviation, in detail, in a supplemental letter to the submittal. If an explanation is not provided, the shop drawing will be returned without action.

### **1.4 SAMPLE SUBMITTALS**

- A. Identify the sample as to manufacturer, item, use, type, project designation, tag number, specification section or drawing detail, color, texture, finish, and other pertinent data.

- B. Include specific installation and application instructions.
- C. Provide the Contractor's stamp of approval on samples as an indication of his checking and verification of dimensions and coordination with interrelated work.

## **1.5 OPERATION AND MAINTENANCE MANUALS AND EQUIPMENT MAINTENANCE SUBMITTALS**

- A. Operation and Maintenance Manuals are required for:
  - 1. Major equipment.
  - 2. Equipment with electric motors.
  - 3. Specialized equipment including control valves, instrumentation, control systems, meters, recorders, variable frequency drives, transmitters, etc.
- B. Transmittals for Operation and Maintenance Manuals shall be identified with consecutive numbers, starting with "1". The prefix OM shall be provided for the transmittal of O&M Manuals (i.e. "OM - #").
- C. Submit three (3) hard copies and one electronic copy of the Operation and Maintenance Manual.
- D. An acceptable O&M submittal will be retained by the Engineer. The transmittal cover sheet will be returned with a request for three additional copies.
- E. Deficient submittals will be returned along with the transmittal sheet. The deficient areas will be noted.
- F. O&M Manuals shall include, but are not necessarily limited to the following:
  - 1. Equipment function, normal operating characteristic, and limiting operations.
  - 2. Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
  - 3. Operating instructions for start-up, routine and normal operations, regulation and control, shutdown, and emergency conditions.
  - 4. Lubrication and maintenance instructions.
  - 5. A guide to "troubleshooting".
  - 6. Parts list and predicted life of parts subject to wear.
  - 7. Outline, cross-section, and assembly drawings.
  - 8. Engineering data.
  - 9. Electrical diagrams, including elementary diagrams and interconnection diagrams.
  - 10. Test data and performance curves.
  - 11. A list of recommended spare parts.
  - 12. Copies of installation instructions, parts lists or other documents packed with equipment when it is delivered.
  - 13. Equipment record sheets recommended by the manufacturer.

## **PART 2 – EXECUTION**

### **2.1 SUBMITTALS: APPROVAL OR REJECTION**

- A. Submittals shall be reviewed for completeness and shall receive one of the following actions:
  - 1. "Reviewed"
  - 2. "Revise and Resubmit"
  - 3. "Rejected"
  - 4. "Furnish as Corrected"
- B. If the Engineer finds the submittal in substantial compliance with the Contract Documents, it will be marked "Reviewed". In this event, the CONTRACTOR may begin to implement the work method or incorporate the material or equipment covered by the submittal.
- C. If the Engineer marks the submittal as "Furnish As Corrected", the Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal with the noted corrections.
- D. If the Engineer finds the submittal is not within the requirements of the Contract Documents, it will be marked "Revise and Resubmit" or "Rejected" and annotated as to why it was not approved. The Contractor shall revise the submittal to be in compliance with the Contract Documents as resubmit for approval.
  - 1. Resubmittal shall be identified with the original identification number and shall include a suffix in accordance with Section 1.3A.
- E. Transmittals that are not stamped by the Contractor in accordance with Section 1.2 D will not be reviewed and will be returned with no action.
- F. Transmittals that are "Reviewed" or "Furnish as Corrected" will be distributed to the Owner's field personnel. If for any reason the Contractor resubmits an approved item, the Contractor shall assure that previously approved documents are superseded by the resubmittal.
- G. Transmittals that are "Rejected" or "Revise and Resubmit" will not be distributed. One copy of the transmittal will be marked up and returned to the Contractor.
- H. Allow seven working (7) days for the Engineer's initial review of each submittal. Where processing must be delayed to permit coordination with subsequent submittals, allow additional time. The Engineer will advise the CONTRACTOR promptly when a submittal being processed must be delayed for any reason.

**— END SECTION 013300 —**

## **SECTION 015500 – CONSTRUCTION TRAFFIC CONTROL**

### **PART 1 – GENERAL**

#### **1.1 DESCRIPTION OF WORK**

- A. The work to be performed in accordance with this section includes providing flagging services and pilot vehicles, furnishing, controlling, maintaining, moving, and removing barricades, warning signs, lights, signals, and pavement markings as required to provide safe and efficient vehicular and pedestrian passage through the work zone.
- B. This consists of all work related to traffic control, including but not limited to: 1) preparation and submittal of traffic control plans; 2) providing traffic control during the project for all operations within the project area; and, 3) notification of residents and businesses that will have limited access during the work.

#### **1.2 QUALITY ASSURANCE**

- A. Related Documents:
  - 1. MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION (MUTCD).
  - 2. Nevada Department of Transportation (NDOT) Standard Specifications for Road and Bridge Construction, latest edition.
  - 3. NDOT Signing and Marking Standard Drawings.
  - 4. NDOT Construction Standard Drawings.

#### **1.3 SUBMITTALS**

- A. Traffic control plan. A separate plan shall be submitted for each construction area. The CONTRACTOR shall comply with the approved traffic control plan at all times. If an alternate traffic control plan is requested by the CONTRACTOR, the CONTRACTOR must prepare the necessary plans, submit to the necessary agency or agencies for approval, receive approval in writing, and provide ENGINEER with a copy of the approval before working in areas associated with the modified traffic control plan.
- B. Schedule. Provide complete traffic control plan schedule showing dates and times for traffic control changes that will be performed in conjunction with the work schedule.
- C. Responsible Employee(s). Provide the name(s) and after hours phone number(s) for the employee(s) responsible for implementation and maintenance of the traffic control plan to the OWNER and local law enforcement agency. The employee(s) shall be available at all times to make necessary changes and/or

repairs to the traffic control facilities as required to maintain safe traffic control in and around construction areas.

## **PART 2 – MATERIALS**

### **2.1 GENERAL**

- A. All products, procedures and facilities shall be per MUTCD latest edition. All traffic control devices shall be high intensity.

### **2.2 SIGNS, BARRICADES, CHANNELIZING DEVICES AND LIGHTING DEVICES**

- A. MUTCD, part VI. Lighted barricades shall be properly maintained.

### **2.3 FLAGMEN**

- A. Competent, trained, and supplied with a combination STOP/SLOW sign, orange vest, and orange hard hat. Provide adjacent barricading devices where required. Flagmen shall be certified as required by State law and/or local codes and ordinances.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Provide adequate protection of all vehicular and pedestrian traffic and workmen through any and all portions of the construction zone where the construction operations interfere with, obstruct, or create a hazard to the normal movement of traffic.
  - 1. Where possible, two (2) lanes of traffic shall remain open at all times unless otherwise indicated.
  - 2. During Emergency situations, the OWNER may provide traffic control. The cost of any traffic control provided by the OWNER shall be borne by the CONTRACTOR.
  - 3. In the event that any employees of the OWNER are required to correct, repair, or modify any in-place traffic control by the CONTRACTOR, it shall be the responsibility of the CONTRACTOR to reimburse the OWNER for any incurred costs.
- B. The Contractor shall at all times during construction provide for public access by permitting traffic to pass through the construction area as specified herein. The Contractor shall refer to the appropriate sections of the MUTCD, the "Guidelines for Traffic Control in Work Zones", and the NDOT "Standard Specifications for

Road and Bridge Construction" for traffic control provisions and the installation of all traffic control devices (The most restrictive specification shall govern).

1. It is the intention of this section to set forth the basic provisions for traffic control in the work area and the Contractor shall note that nothing in these Conditions shall be construed as relieving the Contractor from its responsibility as provided in said NDOT Standard Specifications or as required by the NDOT Occupancy Permit, if needed.
  2. In addition, the Contractor shall, within or adjacent to the limits of the work, supplement additional warning and directional signs if requested by the Engineer.
  3. The Contractor, at its own expense, shall furnish and maintain all lights, signs, barricades or other devices necessary for the protection of public traffic. The Contractor shall install standard traffic control devices in accordance with the MUTCD and the "Guidelines for Traffic Control in Work Zones".
  4. In addition, the Contractor shall at all times during construction and non-construction hours be responsible for installation and maintenance of all traffic control devices necessary for the protection of public traffic, providing flaggers as necessary, scheduling and expediting the work to cause the least inconvenience to the public, and patrolling the work area as required to ensure that all devices are in place, clean and properly displayed at all times.
  5. Night flaggers shall wear reflectorized material and the flagger stations shall be illuminated so that the flaggers can be seen by the public traffic being controlled. Additionally, all traffic control devices shall be reflectorized.
  6. The Contractor's vehicles shall be parked as far off the edge of the pavement as possible to ensure the safe passage of public traffic.
  7. All costs associated with accommodating public traffic, furnishing flaggers, installing, maintaining and removing signs, barricades and other facilities for the safety and direction of public traffic through and around the Project site shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed.
  8. The Contractor shall erect and maintain temporary fences, bridges, railings, and barriers, and take all other necessary precautions and place proper guards for the prevention of accidents. The Contractor shall establish and maintain suitable and sufficient lights and other signals and shall indemnify and save harmless the Owner, Engineer, its officers, agents, and employees from all damages and costs to which they may be put by reason of injury to person or property resulting from the Contractor's negligence or carelessness in the performance of the work or in guarding the same, or from any improper materials, implements, or appliances used in its construction, or by or on account of any act of omission of the Contractor or his agents. Contractor shall be responsible for providing portable sanitation facilities at the project site.
- C. Closures of streets in order to facilitate construction will be permitted, in some cases, provided that:

1. The Contractor submits and receives approval from the Engineer for his traffic control plan.
2. The Contractor notifies the Owner in writing at least 10 days prior to the proposed closure of his intent to close the road.
3. The road closure shall only be permitted from the hours of 8 am – 5 pm.
4. The detour sign shall be covered when the road closure is not in effect.
5. The Contractor shall allow residents access to and from their driveways during road closures and shall minimize delays in accommodating the resident's needs.

### **3.2 PUBLIC NOTIFICATION**

- A. Contractor shall notify the following agencies of any traffic delays or road closures 48 hours in advance of the work:
1. Nevada Highway Patrol 775 687-5300
  2. Elko County Sheriff 775 738-3421
  3. Elko County School District 775 738-5196
  4. Elko Fire Department 775 777-7345
  5. Elko Public Works Department 775 738-4458

### **3.3 TRAFFIC CONTROL DEVICES**

- A. Place all necessary traffic control devices before any work is started. Move devices as necessary to keep up with the advancing operation. Place devices at the locations indicated on the traffic plan and in accordance with plan details and the MUTCD and as specified herein. Maintain devices; keep free from dirt, mud and roadway grime. Promptly replace all damaged devices.

### **3.4 FLAGMEN**

- A. Locate flagmen as indicated on the traffic control plan. Provide flagmen where traffic is required to stop and/or slow. Provide additional flagmen as required for site-specific traffic control conditions.

### **3.5 STOPPING TRAFFIC**

- A. Traffic shall not be stopped and held longer than absolutely necessary. Traffic shall not be stopped long enough to interrupt traffic at the nearest intersection or longer than 5 minutes unless otherwise approved by the OWNER.

### **3.6 ADJUSTMENT TO THE TRAFFIC CONTROL PLAN**

- A. At any time, the OWNER may request that adjustments be made to the traffic control plan layout or signage. The CONTRACTOR shall immediately make all adjustments and provide all signage required. No additional compensation or payments will be made for adjustments to the traffic control plan.

— **END SECTION 015500** —

## **SECTION 016100 - DELIVERY, STORAGE, AND HANDLING**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes:
  - 1. Scheduling of product delivery.
  - 2. Packaging of products for delivery.
  - 3. Protection of products from damage for:
    - a. Handling.
    - b. Exposure to element or harsh environments.
- B. Payment:
  - 1. No payment will be made to CONTRACTOR for equipment or materials not properly stored and insured or without approved shop drawings.
  - 2. Previous payments for items will be deducted from subsequent progress estimates if proper storage procedures are not observed.

#### **1.2 DELIVERY**

- A. Scheduling:
  - 1. Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.
- B. Packaging:
  - 1. Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.
- C. Identification:
  - 1. Clearly and fully mark and identify as to manufacturer, item, and installation location.
- D. Protection and Handling:
  - 1. Provide manufacturer's instructions for storage and handling.

### **PART 2 – EXECUTION**

#### **2.1 PROTECTION, STORAGE AND HANDLING**

- A. Manufacturer's instruction:
  - 1. Protect all products or equipment in accordance with manufacturer's written directions.

- a. Store products or equipment in location to avoid physical damage to items while in storage.
  - b. Handle products or equipment in accordance with manufacturer's recommendations and instructions.
2. Protect equipment from exposure to elements and keep thoroughly dry.

## **2.2 FIELD QUALITY CONTROL**

- A. Inspect deliveries:
  1. Inspect all products or equipment delivered to the site prior to unloading. Reject all products or equipment that are damaged, used, or in any other way unsatisfactory for use on the project.
- B. Provide temporary storage facilities, as required, for the protection of stored materials.
- C. Monitor storage area:
  1. Monitor storage area to ensure suitable temperature and moisture conditions are maintained.

**— END SECTION 016100 —**

## SECTION 017000 – MOBILIZATION AND DEMOBILIZATION

### PART 1 – GENERAL

#### 1.1 SCOPE

- A. Mobilization shall consist of preparatory work and operation, including but not limited to, those tasks necessary for the movement of personnel, equipment, supplies, and incidentals to and from the site, for the establishment of offices, buildings and other facilities necessary for work on the project; for premiums on bonds and insurance for the project and for all other work and operations which must be performed or costs incurred before beginning production work on the various contract items.

Demobilization at the finish of the job shall include the removal of all construction equipment, restoration of the site, and removal of all miscellaneous construction debris.

#### 1.2 SUBMITTALS

- A. The CONTRACTOR shall provide a notice to all affected residents and businesses. The CONTRACTOR shall submit a sample of the notice to the Owner for review and approval prior to, but no later than, the time of the preconstruction conference. It shall provide the following information:

PROJECT NAME:  
ENGINEER'S NAME:  
PROJECT ENGINEER's Contact:  
CONTRACTOR's Name:  
CONTRACTOR's Contact:  
CONTRACTOR's Phone#:

Brief description of work, and Tentative Schedule with estimated completion date.

The notice is to be distributed at least 48 hours prior to any construction activities.

The CONTRACTOR shall prepare and distribute revised notices to residents if there are revisions to the construction schedules.

- B. The CONTRACTOR shall provide one (1) copy to the ENGINEER of any written agreements with a property OWNER for the areas used for material and equipment storage or staging if located on private property.
- C. A copy of the approved Notice shall be provided to the Owner at their office.

- D. A copy of the approved Notice shall be provided to the ENGINEER.

## **PART 2 – PRODUCTS**

### **2.1 GENERAL**

- A. Materials shall consist of equipment, buildings, and tools necessary to move to the project site to perform work.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Setting up of offices, and the use of private property for storage or work area shall be executed in a legal manner in accordance with local and state codes and ordinances.
- B. Remove all equipment, offices, materials and facilities used for the construction of the PROJECT upon PROJECT completion. Leave areas used in a condition as good as or better than when encountered.

**END SECTION – 017000**

## **SECTION 017100 – CLEANING**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. Section includes:
  - 1. Intermediate and final cleaning of Work not including cleaning of systems specified elsewhere.

#### **1.2 STORAGE AND HANDLING**

- A. Store cleaning products and cleaning wastes in containers specifically designed for those materials.

#### **1.3 SCHEDULING**

- A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process will not fall on newly painted surfaces.

### **PART 2 – PRODUCTS**

#### **2.1 MATERIALS**

- A. Cleaning agents:
  - 1. Compatible with surface being cleaned.
  - 2. New and uncontaminated.
  - 3. For manufactured surfaces use cleaning materials recommended by the manufacturer.

### **PART 3 – EXECUTION**

#### **3.1 CLEANING – GENERAL**

- A. Prevent accumulation of wastes that create hazardous conditions.
- B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.
- C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains or sewers.

- D. Dispose of degradable debris and non-degradable debris at an approved solid waste disposal site.
- E. On completion of work, leave area in a clean, natural looking condition. Remove all signs of temporary construction activities incidental to construction of required permanent Work.
- F. Do not burn on-site.

### **3.2 INTERIOR CLEANING**

- A. Cleaning during construction:
  - 1. Keep work areas clean so as not to hinder health, safety or convenience of personnel at the project site.
  - 2. As a minimum, dispose of waste materials, debris, and rubbish on a weekly basis.
  - 3. Vacuum clean interior areas when ready to receive finish painting. Continue vacuum cleaning on an as-needed basis, until substantial completion.
- B. Final Cleaning:
  - 1. Remove grease, mastic, adhesives, dust, dirt, stains, labels, and other foreign materials from sight-exposed surfaces.
  - 2. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
  - 3. Polish glossy surfaces to a clear shine.
  - 4. Ventilation systems:
    - a. Clean permanent filters and replace disposable filters if units were operated during construction.
    - b. Clean ducts, blowers and coils if units were operated without filters during construction.
  - 5. Replace all burned out lamps.
  - 6. Broom clean and/or mop floor areas.

### **3.3 EXTERIOR CLEANING**

- A. Cleaning during construction:
  - 1. Construction debris:
    - a. Confine in strategically located container(s).
    - b. Cover containers to prevent blowing of debris.
    - c. Haul containers from site a minimum of once per week.
  - 2. Dispose debris to container(s) daily.
  - 3. Take special precautions to dispose of loose debris under windy or adverse weather conditions.
  - 4. Vegetation on the project site shall be maintained and trimmed as necessary.
  - 5. Soils, sand, and gravel shall be removed from paved and sidewalk areas, as necessary, to prevent muddy, dusty, or nuisance conditions. Materials shall not be flushed into storm sewer systems.

- B. Final cleaning:
  - 1. Remove trash and debris containers from site.
  - 2. Clean paved roadways.

### **3.4 FIELD QUALITY CONTROL**

- A. Routine monitoring of site conditions shall be conducted by the field representative. Deviations from requirements shall be promptly rectified by the Contractor.
- B. The project superintendent is expected to control conditions that may result in creating nuisance conditions to adjoining properties.

**— END SECTION 017100 —**

## **SECTION 033000 – CONCRETE**

### **PART 1 – GENERAL**

#### **1.1 DESCRIPTION**

- A. This Section covers all the work necessary for the cast-in-place non-reinforced and reinforced concrete work including, but not limited to: furnishing the materials; proportioning, mixing, transporting, placing, compacting, finishing, curing, and protecting the concrete; setting and fastening embedded items; and all incidental and related work.

The CONTRACTOR shall provide all laboratory and field testing of concrete and materials in accordance with this Specification.

- B. Applicable Additional Specifications: Standard Specifications for Public Works Construction (SSPWC) "Orange Book" Sections 311 – Concrete Structures and Masonry Construction.

#### **1.2 QUALITY ASSURANCE**

- A. Compliance sampling and testing during construction will be provided by the OWNER per SSPWC Section 336.00.

- B. Testing: The OWNER shall provide testing to determine compliance with the following criteria:

1. Consistency: Tested for slump in accordance with ASTM C143.
2. Air Content: Determine the percentage of air in accordance with ASTM C231.
3. Strength: All poured-in-place concrete shall develop a minimum 28-day compressive strength of 4,000 pounds per square inch (PSI) unless otherwise indicated. Take samples for this strength determination at the point of discharge from the ready-mix truck. Obtain a minimum of four (4) test cylinders for each fifty (50) cubic yards of concrete placed or fraction thereof. Test one (1) cylinder at 7 days, and two (2) cylinders at 28 days. Hold the fourth cylinder until the Notice of Completion is given. In the event that the 28-day test fails, the required minimum strength requirement, test the fourth cylinder for compressive strength when directed by the ENGINEER. The ENGINEER may waive concrete cylinder testing requirements for pours less than ten (10) C.Y. for non-structural installations (thrust blocks, etc.). Making and curing the test cylinders shall conform to ASTM C131, and testing shall conform to ASTM C39. Furnish two (2) copies of all test reports to the ENGINEER.

- C. Tolerances:

1. Tolerances for Formed Surfaces: Conform to ACI 301, Table 4.3.1. and Section 311.14 "Surface Finishes" of the SSPWC.
  2. Concrete Quality: Meet or exceed the minimum quality standards as specified.
    - a. Slump. The measured slump shall not exceed the specified design slump by more or less than one inch (1").
    - b. Air Content. The measured air content shall range between 4 and 7 percent.
    - c. Compressive Strength - Normal Concrete. The average of the two (2) 28-day compressive strength tests shall not be less than 4,000 PSI. No individual test shall be less than 3,800 PSI.
- D. Acceptance:
1. Plastic or hardened concrete not meeting acceptable tolerances will be rejected and immediately removed and replaced at the CONTRACTOR's expense.

## **1.2 SUBMITTALS**

The following submittals are required in accordance with SECTION 013300 SUBMITTALS:

- A. Certificates of Compliance:
  1. Admixtures
  2. Cement
  3. Fly Ash
  4. Pozzolan
  5. Water Stop
  6. Reinforcing Steel, or Mesh
  7. Fiber Reinforcement
- B. Materials Test Reports:
  1. Coarse Aggregates
  2. Fine Aggregates
- C. Evaporation Retardant
- D. Mix Designs:
  1. SSPWC, Section 202. ACI 211 normal weight concrete, including variations for admixtures. Include compressive strength test date and modulus of rupture test data obtained at the same concrete age which establishes a correlation between the flexural and compressive strength properties of concrete. Establish correlation with statistical procedures outlined by ACI.

## **PART 2 – PRODUCTS**

### **2.1 CONCRETE**

- A. Provide a minimum 28-day comprehensive strength of 4,000 PSI with entrained air ranging from 4 to 7 percent unless otherwise indicated. Use 3/4" inch maximum coarse aggregate, size 67. Provide minimum cement content of 517 pounds per cubic yard. Provide concrete with the minimum required slump to adequately place, densify, and finish. Do not exceed the mix design water cement ratio (W/C) or design slump. Per "Orange Book" concrete in freeze/thaw environments shall have a maximum slump of 4". Min. slump shall be greater than 1". Mix Design shall include fibers.

### **2.2 CEMENT**

- A. Conform to ASTM C150, Type II or V.

### **2.3 WATER**

- A. Use clear water free from objectionable quantities of organic matter, alkali, acids, oil, silt, and other deleterious substances. Maximum water/cement ratio shall be 0.45.

### **2.4 AGGREGATES**

- A. Coarse Aggregate: Conform to the requirements of ASTM C33, Class Designation 4S, grading size number 67.
- B. Fine Aggregate: Conform to ASTM C33.

### **2.5 ADMIXTURES**

- A. Air Entraining Agent: Comply with ASTM C260.
- B. Accelerating Agents: Comply with ASTM D98.
- C. Water Reducing Agents: Conform to ASTM C494, Type A, D, or E.
- D. Fly Ash and Pozzolan: Comply with ASTM C618, Class N or F. Pozzolan may be used to replace up to 15 percent of the weight of the required Portland cement. The replacement ration shall be 1.2 pounds of Pozzolan per pound of Portland cement.

## **2.6 CURING COMPOUND**

- A. The curing compound shall be transparent and not leave an objectionable discoloration or mottling of the concrete.

## **2.7 STEEL REINFORCEMENT**

- A. Conform to the requirements of ASTM A615, Grade 60, unless otherwise specified, and deformations shall conform to ASTM A615, A616, or A617 as applicable. All bars shall be round and deformed. Welded wire fabric or mesh shall conform to the requirements of ASTM A185.

## **2.8 FORMS**

- A. Forms shall be constructed of plywood or an approved equal. Plywood for forms shall be of the grade necessary to provide a neat concrete exterior. Forms shall be of the quality and strength required so that the finished concrete will conform to the plan dimensions. Forms shall be watertight and be filleted at all exposed outside corners.
- B. Form clamps or bolts shall be used. Use of tie wire to hold forms in place will not be permitted.
- C. Plywood form panels shall be placed in four (4) foot widths and eight (8) foot lengths where applicable. All form panels shall be placed in a neat symmetrical pattern.

## **2.9 NON-SHRINK GROUT**

- A. Use non-shrink grout where grout is called for on the Drawings. Provide 3,000 PSI non-metallic grout similar to "Embeco" manufactured by Master Builders Company, or an approved equal, and proportioned and placed in accordance with the manufacturer's recommendations.

## **2.10 CURING MATERIALS**

- A. Provide liquid curing compound in conformance with ASTM C309, type 1 D.

## **2.11 JOINT FILLERS**

- A. Comply with ASTM D1751.

## **2.12 EVAPORATION RETARDANT**

- A. Con-film or approved equal. ACI 302.

## **2.13 FIBER REINFORCEMENT**

- A. Comply with ASTM C1116, Type III, Shall be 100% virgin polypropylene fibrillated, MD Graded, fibers containing no reprocessed olefin materials and specifically manufactured to an optimum gradation for use as a concrete secondary reinforcement, and shall be Fibermesh, or other approved material. Application rate shall be a maximum of 1.5 lbs per cubic yard. The 28-day compressive strength of the mix, prior to adding the fibers, shall meet the required strength.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Match existing concrete where noted.

### **3.2 BASE PREPARATION**

- A. Subgrade shall be prepared in accordance with SECTION 310516, Aggregate Base Course.

### **3.3 FORM CONSTRUCTION/REMOVAL**

- A. Secure formwork to line and grade. Thoroughly clean forms before each use and apply a light coat of release agent which will not discolor the concrete.
- B. Do not remove front face form before the concrete has taken in initial set and has sufficient strength to carry its own weight. Do not remove rear forms until concrete has reached sufficient strength to prevent damage. Sawcut, remove and replace damaged sections.

### **3.4 STEEL REINFORCEMENT**

- A. Storage: Store steel reinforcement on blocking and under cover to prevent rusting.
- B. Cleaning: Remove all rust, oil, earth, and coatings before positioning the metal reinforcement. Reinspect and clean the reinforcement immediately before placing the concrete.
- C. Straightening and Rebending: Do not straighten or rebend metal reinforcement in a manner that will injure the material. Remove bars from the job site, which do not have kinks or bends conforming to the Drawings.

### **3.5 MEASURING, MIXING, TRANSPORTATION AND PLACING CONCRETE**

- A. Measure and mix concrete in accordance with ASTM C94. Additional water may be added to bring slump within the required limits provided the design water to cement ratio is not exceeded.
- B. Transportation: Transport concrete in accordance with ACI 301.
- C. Placing Concrete:
  - 1. Place concrete in conformance with ACI 301, except as modified herein. Do not exceed a free vertical drop of 6 feet from the point of discharge. The maximum allowable concrete temperature at the time of discharge shall be 90°F. The maximum allowable concrete age, measured from batch time to time of discharge, shall not exceed one (1) hour 30 minutes. Exceeding the maximum allowable concrete age, temperature, or slump shall be cause for immediate rejection. The minimum revolutions on a batch prior to placement is 30 to 70 revolutions and the maximum is 300 revolutions. Provide 30 revolutions after the addition of water.
  - 2. Retempering the mix after initial slump adjustment will not be allowed.
- D. Machine Formed: Machines shall be designed specifically for such work and approved by the ENGINEER. Machines shall be capable of producing results equal to or better than that produced with forms. If the results are not satisfactory to the ENGINEER, discontinue the use of the machine and make necessary repairs at no additional cost to the Agency. All applicable requirements of construction with forms shall apply to the use of machines.
- E. Densification: Thoroughly spade concrete away from the forms so there will be no rock pockets next to the forms. The concrete may be compacted by mechanical vibrators approved by the ENGINEER. Tamp or vibrate the concrete until the mortar rises to the surface and the coarse aggregate is not exposed.
- F. Cold Weather: Except with authorization, do not place concrete when the ambient temperature is below 40 degrees F or when the concrete is likely to be subjected to freezing temperatures within 24 hours. Cold weather concreting shall follow the recommended practices of ACI 3068, as approved by the ENGINEER.
- G. Hot Weather: Hot weather concreting shall follow the recommended practices of ACI 3058, as approved by the ENGINEER.

### **3.6 FINISHING**

- A. Finish all concrete surfaces smooth, straight and defect free. Provide a light broom finish as approved by the ENGINEER on all surfaces. Finish all exposed edges and joints with a 1/2-inch radius tool.

- B. Evaporation Retardant: Protect against loss of moisture from the surface of the concrete by applying an evaporation retardant. Apply per manufacturer's recommendation. Add during finish of concrete. CONTRACTOR is not permitted to use water in the finishing of the concrete.

### **3.7 CONCRETE CURING**

- A. A curing agent shall be applied to each section as it is finished.
- B. Inadvertently Cured Surfaces: Thoroughly clean advertently cured concrete by sandblasting prior to finishing or placing adjacent concrete.

### **3.8 JOINTS**

- A. Expansion Joints: Construct expansion joints in a straight line and vertical plane perpendicular to the longitudinal line of the structure, except in cases of curved alignment, when joints will be constructed along the radial lines of the curve. Construct to the full depth and width of the concrete. Expansion joints shall be constructed at all radius points and adjoining structures.
- B. Contraction Joints: Construct in a straight line and vertical plane perpendicular to the longitudinal line of the structure, except in cases of curved alignment when joints will be constructed along the radial lines of the curve.
- C. Edges: Shape with a suitable tool so formed as to round the edges to the radius indicated.

### **3.9 DELIVERY TICKETS**

- A. Provide a delivery ticket to the inspector for every load of concrete delivered to the job site. Include the following on the delivery ticket: date, batch time, mix I.D. number, specified strength, air content, job name, water content, and amount of concrete. The tickets are to have the actual batch weights of all aggregates, cement, water, admixtures, and batch plant moisture correction for aggregates. Provide allowance for drum moisture from previous batches. Include the reading of the truck revolution counter at the time of batching.

**— END SECTION 033000 —**

## **SECTION 09900 – PAINTING AND COATINGS**

### **PART 1 – GENERAL**

#### **1.1 WORK INCLUDED**

- A. Furnish all labor, materials and equipment as required for all painting and coatings as specified herein. All materials, equipment, piping and miscellaneous surfaces shall be coated except for those indicated under Part 1.7. Work includes, but is not to be limited to cleaning and preparation of surfaces, paint materials, and the application of all paint and other materials.

#### **1.2 DEFINITIONS**

- A. The term paint, coatings, or finishes as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.
- B. Dry Film Thickness (DFT): The minimum dry film thickness, without any negative tolerance.
- C. Submerged Metal: Steel or iron surfaces below tops of channel or structure walls which will contain water even when above expected water level.
- D. Exposed Surface: Any metal or concrete surface, indoors or outdoors that is exposed to view.
- E. Volatile Organic Compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon, as determined by EPA Method 24.
- F. Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.
- G. Where SSPC surface preparation standards are specified or implied for ductile iron pipe or fittings, the equivalent NAPF surface preparation standard shall be substituted for the SSPC standard.

#### **1.3 REFERENCE STANDARDS**

- A. Codes and Standards: In addition to the requirements of these Specifications, the work to be performed under this section is to comply with the following codes and regulations:
  - 1. The Society of Protective Coatings Specifications (SSPC):
    - a. SSPC SP-1 Solvent Cleaning

- b. SSPC SP-2 Hand Tool Cleaning
  - c. SSPC SP-3 Power Tool Cleaning
  - d. SSPC SP-5 White Metal Blast Cleaning
  - e. SSPC SP-6 Commercial Blast Cleaning
  - f. SSPC SP-7 Brush-Off Blast Cleaning
  - g. SSPC SP-10 Near-White Blast Cleaning
  - h. SSPC SP-11 Power Tool Cleaning to Bare Metal
  - i. SSPC-SP-12 High- and Ultrahigh-pressure Water Jetting
  - j. SSPC-SP-13 Surface Preparation of Concrete
  - k. SSPC-SP-16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
2. National Association of Pipe Fabricators (NAPF):
- a. NAPF 500-03 Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.

#### **1.4 QUALITY ASSURANCE**

- A. Painter's Qualifications: The work specified under this section shall be performed by or under the supervision of a qualified painter. The Contractor shall be required to document the painter's experience, competence and ability to comply with the requirements of these Specifications and to complete the work in a timely manner. The Painter or Applicator shall have the following qualifications:
- 1. Minimum of 5 years of experience applying specified type or types of coatings under conditions similar to those of the Work. Provide qualifications of applicator and references listing five similar projects completed in the past two years.
  - 2. Manufacturer approved applicator when manufacturer has approved applicator program.
- B. Standard Products: All paints in a paint system are to be the standard products. All products applied in any paint and coating system shall be from a single manufacturer.
- C. At a minimum of every four hours or more often when conditions change during surface preparation and coatings application, environmental conditions IE: Relative Humidity, dew-point, surface temperature and the dew-point/surface temperature depression must be measured and recorded. The use of a sling psychrometer and US weather bureau barometric chart or approved equal such as Defelsko or Elcometer test instruments shall be used to measure the environmental conditions.
- D. Warranty Inspection: A warranty inspection will be conducted at the end of the one-year warranty period from the substantial completion date. The Contractor and a representative of the coating material manufacturer may attend this inspection. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the Owner. The Owner may, by written

notice to the Contractor, reschedule the warranty inspection to another date within the warranty period.

## **1.5 SUBMITTALS**

- A. Before any paint materials are delivered to the job site, submit a complete list of all materials proposed to be furnished and applied under this Section. Include schedule of where and for what use coating materials are proposed in accordance with requirements for Product Data. Any coating or paint materials ordered by Contractor prior to receiving submittal response from Engineer indicating that the submitted material is accepted shall be at the risk of the Contractor.
- B. For each paint, provide a current chart of the manufacturer's available colors and sheen where applicable. Colors will be selected by the Owner from the color charts as part of the submittal review process.
- C. For each paint, furnish the paint manufacturer's specific application instructions and the following information:
  - 1. Paint manufacturer's data sheet for each product proposed, including statements on the suitability of the materials for the intended use.
  - 2. Surface preparation recommendations
  - 3. Type of primer, if required
  - 4. Maximum dry and wet mil thickness per coat
  - 5. Minimum and maximum curing time between coats, including atmospheric conditions for each
  - 6. Curing time before submergence in water
  - 7. Thinner to be used with each paint
  - 8. General ventilation requirements
  - 9. Atmospheric conditions during which the paint is not to be applied
  - 10. Allowable methods of application
  - 11. Maximum allowable moisture content and minimum age of plaster, concrete and wood surfaces at time of paint application
  - 12. Compatibility of shop and field applied coatings (where applicable)

## **1.6 DELIVERY AND STORAGE**

- A. Deliver, store, and handle products in accordance with manufacturer's requirements. All materials are to be delivered to the job site in their original, unopened containers bearing the manufacturer's name, brand, batch number, date of manufacture, and any special directions.
- B. Only the approved material shall be stored at the job site and stored only in designated areas restricted to the storage of paint materials and related equipment. All paint is to be stored in enclosed structures and protected from weather and excessive heat or cold. Store coatings in well-ventilated facility that provides protection from the sun, weather, and fire hazards. Maintain ambient

storage temperature between 45 and 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.

- C. Store flammable materials to conform with State and local safety codes. Protect emulsion type paints from freezing. Take precautions to prevent fire and spontaneous combustion.
- D. Materials exceeding storage life recommended by the manufacturer will be subject to rejection.
- E. Remove unspecified and unapproved paints from Project site immediately.

### **1.7 SURFACES NOT REQUIRING PAINTING**

- A. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, aluminum, chromium plate, and weathering steel, except where (1) required for electrical insulation between dissimilar metals, (2) aluminum is in contact with concrete or masonry, and (3) color coding of equipment and piping is required.
- B. Copper, bronze, aluminum, weathering steel, and stainless steel,
- C. Glass, porcelain, and plastics do not require painting.
- D. Prefinished architectural finishes such as acoustical tile, cabinets, and wall panels do not require painting.
- E. Prefinished electrical items such as motor control centers, switchboards, switchgear, panelboards, transformers, and disconnect switches do not require painting.
- F. Exposed electrical conduits shall be painted to match the color of the adjacent wall or equipment to which they are attached, except that non-submerged conduits attached to unpainted masonry and concrete surfaces need not be painted.
- G. Exterior concrete slabs, exterior sidewalks, exterior concrete stairs and exterior concrete curbs.
- H. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.

### **1.8 MAINTENANCE**

- A. Extra Materials: Include minimum 1 gallon of each type and color of coating applied. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type and color.

## PART 2 – PRODUCTS

### 2.1 PAINT AND COATING SYSTEM APPLICATIONS

- A. Prepare surfaces and apply paint and coating systems in accordance with the following schedules for all surfaces.

Surface Preparation	Description
SSPC SP-1	Solvent Cleaning
SSPC SP-2	Hand Tool Cleaning
SSPC SP-3	Power Tool Cleaning
SSPC SP-5	White Metal Blast Cleaning
SSPC SP-6	Commercial Blast Cleaning
SSPC SP-7	Brush off Blast Cleaning
SSPC SP-10	Near White Blast Cleaning
SSPC SP-11	Power Tool Cleaning to Bare Metal
SSPC SP-12	High- and Ultrahigh-Pressure Water Jetting
SSPC SP-13	Surface Preparation of Concrete
SSPC SP-16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

Paint and Coating Application Schedule			
Surface to be Painted or Coated	Surface Preparation	Paint/Coating System Description	System No.
Ferrous Metal (Ungalvanized), Exposed	SSPC – SP-6	Alkyd primer (or polyamide epoxy) and alkyd enamel gloss finish	System 1
Ferrous Metal (galvanized)	SSPC – SP-1	Pretreatment for galvanized metal, alkyd primer (or polyamide epoxy), and alkyd enamel gloss finish	System 2
Ferrous Metal, Submerged or Buried; Ferrous Metal, Exposed Inside Wet Well	SSPC – SP-10	High Solids Amine Epoxy	System 3
Concrete, Exterior Waterproofing, Wet Well and Dry Pit (per plans)	Per Manufacturer's Instructions	Coal-Tar Free Epoxy	System 4

Paint and Coating Application Schedule			
Surface to be Painted or Coated	Surface Preparation	Paint/Coating System Description	System No.
Concrete, Interior of Wet Well and Approach Manhole (per plans)	Per Manufacturer's Instructions	Epoxy or Polymer Lining System	System 5

## 2.2 PAINT AND COATING SYSTEMS

- A. Furnish primers and finish coatings as shown on the following coating table schedule. If manufacturers have changed their coating products and the products shown below are no longer available, provide the product that the manufacturer recommends as the improved version of the product shown.
- B. Where dry film thicknesses are not shown, the DFT shall be as recommended by the manufacturer for the product and service shown in the Application Schedules above.
- C. Paint and Coating Systems:

System	Ameron Coatings	ICI Devoe Coatings	Tnemec Company
1	Amercoat 5105 primer Amercoat 5405 finish 2 coats, 3.0 mils each	Devguard 4160 primer Devguard 4308 finish (4550) finish 2 coats, 3.0 mils each	Tnemec 66 primer Tnemec 2H finish 2 coats, 3.0 mils each
2	Same as system 1 but pretreat galvanizing	Same as System 1 but for Devoe Coatings but use Devguard 4120 primer	Same as System 1 but pretreat galvanizing
3	Amercoat 78HB 16 mils total	-	Tnemec N69 primer, 8.0 mils Tnemec HS Epoxy 104 finish, 10 mils
4	-	Devtar 5A-HS, 2 coats, 12 mils each (or approved equal)	-

System	Raven	Sauereisen
5	Raven 405 125 mils total	Sauereisen SewerGard 210 125 mils total

## 2.3 OTHER COATINGS

- A. Factory Applied Coatings and Touchup: Field touchup shall consist of touching up the shop prime coat to achieve the film thickness, continuity and coating

specified in accordance with the paint system data sheets. Badly damaged shop coatings shall be removed and the surfaces recoated in accordance with the specified system requirements.

- B. Aluminum Metal Insulation: Where aluminum surfaces come in contact with concrete or with metals not compatible with aluminum, paint the dissimilar materials with a prime coat of zinc-chromate primer or a coating of heavy-bodied bituminous paint.

## **PART 3 – EXECUTION**

### **3.1 SURFACE PREPARATION**

- A. Prepare all surfaces prior to application of paint or coatings. Comply with surface preparation requirements of the Society for Protective Coatings (SSPC). If the paint or coating manufacturer recommends a surface preparation different than that shown, follow the more stringent surface preparation requirement.
- B. ASTM D4259 – Wet Abrasive Blasting, Vacuum Assisted Dry Abrasive Blasting or Centrifugal Shot Abrasive Blasting
  - 1. Shot Blasting – Before blasting fill defects and holes with filler recommended by the coating manufacturer. Blast with dustless steel shot to remove laitance, residue and loose material to roughen the surface to a texture of No. 40 to 60 grit sandpaper.
- C. Surface preparation requirements of the Society for Protective Coatings (SSPC) are as follows:
  - 1. SSPC SP-1 Solvent Cleaning
  - 2. SSPC SP-2 Hand Tool Cleaning
  - 3. SSPC SP-3 Power Tool Cleaning
  - 4. SSPC SP-5 White Metal Blast Cleaning
  - 5. SSPC SP-6 Commercial Blast Cleaning
  - 6. SSPC SP-7 Brush-Off Blast Cleaning
  - 7. SSPC SP-10 Near-White Blast Cleaning
  - 8. SSPC SP-11 Power Tool Cleaning to Bare Metal
  - 9. SSPC-SP-12 High- and Ultrahigh-pressure Water Jetting
  - 10. SSPC-SP-13 Surface Preparation of Concrete
  - 11. SSPC-SP-16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals
- D. Preparation of Concrete and Masonry Surfaces: Unless otherwise specified, concrete surfaces which are to receive any paint coating shall be allowed to age for a minimum of 28 days. Moisture content shall be tested with a Delmhorst Instrument Company moisture detector prior to application of paint or coating.

The moisture content of the concrete shall be within the limits recommended by the manufacturer of the paint or coating before any paint or coating is applied.

### **3.2 APPLICATION**

- A. Workmanship: All work shall be done in a workmanlike manner so that the finished surface will be free from runs, drips, ridges, waves, laps and unnecessary brush marks. All coats shall be applied in such a manner as to produce an even film of uniform thickness, completely coating all corners and crevices.
- B. The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in a first-class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Spray equipment shall be equipped with mechanical agitators, pressure gauges, and pressure regulators. Spray nozzles shall be of the proper sizes.
- C. Each coat of paint shall be applied evenly and sharply cut to line. Care shall be exercised to avoid overspraying or spattering paint on surfaces not to be coated. Glass, hardware, floors, roofs and other adjacent areas and installation shall be protected by taping, drop cloths or other suitable measures.
- D. Paint Properties, Mixing and Thinning. All paint, when applied, shall provide a satisfactory film and smooth, even surface. Glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application, adhesion and subsequent coats. Paints shall be thoroughly stirred, strained and kept at a uniform consistency during application. Coatings consisting of two (2) or more components shall be mixed in accordance with manufacturer's instructions. Where necessary to suit conditions of the surface, temperature, weather and method of application, and with the Engineer's approval, the paint may be thinned immediately prior to use by the addition of not more than one pint per gallon of the proper thinner; provided that in no case shall the paint be reduced more than necessary to obtain the proper application characteristics. Where specifically permitted by the Specifications, certain paints may be thinned more than the maximum indicated above. Paint thinner shall be as recommended by the paint manufacturer.
- E. Atmospheric Conditions: Except as specified or required for certain water-thinned paints, paints shall be applied only to surfaces that are thoroughly dry and only under such combination of humidity and temperatures of the atmosphere and surfaces to be painted as will cause evaporation rather than condensation.
  - 1. In no case shall any paint be applied during rainy, misty weather, or to surfaces upon which there is frost or moisture condensation without suitable protection, as accepted by the Engineer. Where painting is permitted during damp weather or when the temperature is at or below 40 degrees F, the surfaces shall be heated to prevent moisture condensation thereof.

2. Bar metal surfaces, except those which may be warped by heat, may be dehydrated by flame-heating devices immediately prior to paint application.
  3. While any painting is being done and for a period of at least eight (8) hours after the paint has been applied, the temperature of the surfaces to be painted, the painted surfaces and the atmosphere in contact therewith shall be maintained at or above 40 degrees F and 5 degrees above the dew point.
  4. All paint, when applied, shall be approximately the same temperature as that of the surface on which it is applied. The use of fans or heaters shall be required in enclosed areas where conditions causing condensation are severe.
- F. Method of Paint Application: Where two (2) or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors. Color additives shall not contain lead or any lead compound which may be destroyed or affected by hydrogen sulfide or any gas likely to be found in wastewater facilities.
- G. Electrical and mechanical equipment, on which the manufacturer's coating is found, shall be touch-up primed and painted with two (2) coats of the specified paint system to match the color scheduled.
- H. No paint shall be applied to any surface until it has been prepared as specified and approved by the Engineer. Unless otherwise specified, the primer or first coat of paint shall be applied by brush to ferrous surfaces. All subsequent coats for all ferrous surfaces may be either brush or spray applied. Unless stated otherwise, prime and finish coats shall be applied at the rate recommended by the manufacturer for the services involved. After prime coat is dry, all suction spots shall be touched up before succeeding coats are sprayed. All coats for concrete and masonry shall be brushed or rolled unless otherwise specified. Before painting or repainting existing surfaces, the Contractor shall test-paint a small area on the actual surface to show that the color matches the existing surfaces.
- I. Unless otherwise specified, do not apply finish coats until all other work in the area is done and until the prime and intermediate coats have been inspected by the Engineer.
- J. Film Thickness and Continuity: The actual surface area covered per gallon of oil and varnish vehicle paint for various types of surfaces shall not exceed those recommended by the manufacturer. All paint and coating thickness stated in this specification are dry film thickness. The first coat on metal surfaces refers to the first full paint coat and not to conditioning or other pretreatment applications. All coatings shall be applied to the thickness in accordance with these Specifications. The minimum thickness at any point shall not deviate more than 25 percent from the required average. Except as specified, no less than two (2) coats shall be applied.

- K. Special Requirements: Hangers shall be painted, except for the final coat, prior to installation. Paint underside of all ungalvanized equipment bases and supports with at least two (2) coats of rust inhibiting primer prior to setting the equipment in place. Paint bolt and bolt holes in flanges, such as those used with couplings or wayer type valves, where hold and bolt as finally installed will be exposed to weather or moisture, prior to assembly to prevent rusting of the unprotected metal.

### **3.3 FIELD INSPECTION AND TESTING**

- A. Where two (2) or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors.
- B. Film Thickness: All paint and coating thickness stated in this specification are dry film thickness. The first coat on metal surfaces refers to the first full paint coat and not to conditioning or other pretreatment applications. All coatings shall be applied to the thickness in accordance with these Specifications and the Manufacturer's recommendations as stated in the product data sheets. The dry film thickness of each coating application will be measured using the SSPA-2 standard. The minimum/maximum thickness requirements shall meet the perimeters outlined in this standard. Where the minimums and maximums do not meet the requirements of this standard, corrections must be made.

### **3.4 PROTECTION OF PAINT SURFACES**

- A. Where protection is provided for painted surfaces, such protection shall be preserved in place until the paint film has properly dried and the removal is authorized. Items which have been painted shall not be handled, worked on, or otherwise disturbed until the paint coat is completely dry and hard.
- B. After delivery at the site of materials for permanent erection or installation, all shop-coated metalwork shall be repainted or retouched from time to time, which specified paint, whenever, in the opinion of the Engineer, it becomes necessary to maintain the integrity of the film.

### **3.5 CLEANUP**

- A. Upon completion of all painting, remove all surplus materials, protective coverings and accumulated rubbish and thoroughly clean all surfaces and repair any overspray or other paint-related damage.

**— END SECTION 099000 —**

## SECTION 220529 – PIPE SUPPORTS AND HANGERS

### PART 1 – GENERAL

#### 1.1 WORK INCLUDED

- A. Furnish labor, materials, and equipment as required for the installation of all pipe hangers, sleeves, supports, brackets, and other related items required to support the piping systems as required.
- B. No attempt has been made to indicate all required pipe supports on the plans. The absence of pipe supports and details on any drawings shall not relieve the Contractor of the responsibility for providing a satisfactory piping support system in conformance with the functional and specific support spacing requirements of these specifications.
- C. Contractor shall verify that supporting structures including precast concrete can support the applied loads from floor, wall, or ceiling-mount pipe supports and hangers.
- D. Contractor shall test all piping support systems and correct any problems found to exist.

#### 1.2 REFERENCE STANDARDS

- A. All mechanical piping systems shall conform to requirements under the latest revision of International Mechanical Code, ASA Code for Pressure Piping, and International Building Code.
  - 1. ASA Codes as sponsored by ASME
  - 2. ASME B31.1            Power Piping
  - 3. ASME B31.2            Fuel Gas Piping
  - 4. ASME B31.3            Process Piping
  - 5. ASTM A123            Zinc (Hot-Dip Galvanized) Coatings on Iron & Steel Products
  - 6. Piping Handbook      Nayyar, Mohinder L. (2000). Piping Handbook (7th Edition). McGraw-Hill.
  - 7. International Building Code (IBC), latest edition
  - 8. American Society of Civil Engineers (ASCE) 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures, latest edition

- B. Install work in accordance with applicable provisions of codes, rules, regulations, statutes, and ordinances of governing bodies having jurisdiction. Such codes, rules, regulations, statutes, and ordinances are hereby incorporated into these specifications. Comply with specification requirements which are in excess of code requirements and not in conflict therewith.

### **1.3 SUBMITTALS**

- A. Submit shop drawings in accordance with SECTION 013300 SUBMITTALS. Shop Drawings shall include the following information:
  - 1. Detail drawings indicating type of supports and their location.
  - 2. Catalog cut sheets of pipe supports, hangers, anchors, guides, and appurtenances for piping support systems.
  - 3. Seismic calculations stamped and signed by a professional engineer.

## **PART 2 – PRODUCTS**

### **2.1 PIPE HANGERS AND SUPPORTS**

- A. Pipe hangers and support system components shall be designed to withstand the dead loads imposed by the weight of pipes filled with water and shall have a minimum factor of safety of 5. In addition, all piping 2-1/2 inch inside diameter and larger shall be designed and braced for seismic forces. Upon application of seismic forces, piping shall remain fully connected into operable systems and shall not be displaced sufficiently to damage adjacent or connecting equipment and structures. Seismic design and bracing shall be in accordance with the International Building Code (IBC) and ASCE 7 – Minimum Design Loads for Buildings and Other Structures (latest editions).
- B. Pipe hangers shall be capable of supporting the pipe in all conditions of operation, allowing free expansion and contraction of the piping, and preventing excessive stress on equipment. All hangers shall have a means of vertical adjustment after erection. Hangers shall be designed to prevent becoming disengaged by any movement of the supported pipe. Hangers subject to shock, seismic disturbances, or thrust imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading only.
- C. Unless shown otherwise, provide vertical piping supports for all pipe except copper:
  - 1. Support vertical piping with wrought steel riser clamps. Make adequate provision for expansion, contraction, and lateral stability.

2. Use steel extension pipe clamps for vertical pipe supports similar to Anvil Figure 261, refer to manufacturer's rated maximum loading for each size pipe. Bolt clamp securely to pipe rest, clamp end extension on structure.
  3. Where pipe sleeves extend above floor, place pipe clamps at ceiling below, support clamp end extension from inserts.
  4. Use beam clamps that are of malleable iron, Anvil Figure 86 for 3/8-inch hanger rods; forged steel beam clamp, Anvil Figure 228 for hanger rod up to 1-1/2 inch.
- D. Supports for piping with the longitudinal axis in approximately a horizontal position shall be spaced to prevent excessive sag, bending, and shear stresses in the piping, with special consideration given where components such as flanges and valves impose concentrated loads. For temperatures other than ambient temperatures, or those listed, and for other piping materials or wall thicknesses, the pipe support spacing shall be modified in accordance with the pipe manufacturer's recommendations. Vertical supports shall be provided to prevent the pipe from being overstressed from the combination of all loading effects. Use one of the following means of supporting horizontal piping from a wall.
1. Steel J-Hook for pipe located close to wall, up to 3-inch pipe.
  2. For hanger suspension with 750 lbs. maximum loading, use light welded steel bracket with hole for one rod, 3/4-inch diameter.
  3. For pipe-roll stand support use welded-steel bracket, light for 700 lbs. maximum loading; medium for 1,500 lbs. maximum loading; and heavy for 3,000 lbs. maximum loading.
- E. Unless otherwise specified, support spacing for Steel and Copper shall conform to the following:

Nominal Pipe Diameter (inches)	Maximum Span (feet)
1 - 1/4" and smaller	6' - 0" on center
1 - 1/2" thru 3"	8' - 0" on center
4" thru 8"	12' - 0" on center
10" and larger	20' - 0" on center

- F. Unless otherwise specified, support spacing for Ductile-Iron Pipe shall conform to the following:

Nominal Pipe Diameter (inches)	Maximum Span (feet)
All Diameters	Two supports per pipe length or 10 feet (one of the 2 supports located at joint)

- G. Unless otherwise specified, support spacing for PVC, CPVC, and ABS shall conform to the following:

Nominal Pipe Diameter (inches)	Maximum Span (feet)
1" and smaller	4' - 0" on center
1 - 1/4" thru 2"	5' - 0" on center
2 - 1/2" thru 4"	6' - 0" on center
5" and larger	7' - 6" on center

- H. Thermal Expansion: Wherever expansion and contraction of piping is expected, a sufficient number of expansion loops or expansion joints shall be provided, together with the necessary rolling or sliding supports, anchors, guides, pivots, and restraints permitting the piping to expand and contract freely in directions away from the anchored points. All components shall be structurally suitable to withstand all loads imposed.
- I. Heat Transmission: Supports, hangers, anchors, and guides shall be so designed and insulated, that excessive heat will not be transmitted to the structure or to other equipment. Support insulated piping with pipe saddles and hangers that fit on the outside of the insulation. Do not compress or damage pipe insulation with hangers or supports.
- J. Point Loads: Any meters, valves, heavy equipment, and other point loads on PVC, FRP, and other plastic pipes, shall be supported on both sides, according to manufacturer's recommendations to avoid undue pipe stresses and failures. To avoid point loads, all supports on PVC, FRP, and other plastic piping shall be equipped with extra wide pipe saddles or galvanized steel shields.
- K. Materials of Construction: All pipe support assemblies, including framing, hardware, and anchors, shall be steel construction, galvanized after fabrication, unless otherwise indicated on the plans or listed below:
1. All submerged piping, as well as piping, conduits, and equipment in hydraulic structures below the top of wall shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel, unless otherwise indicated.
  2. All piping in chemical and corrosive areas shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel or FRP, unless otherwise indicated.
  3. All stainless steel piping shall be supported with support assemblies, including framing, hardware, and anchors, constructed of Type 316 stainless steel, unless otherwise indicated.
- L. Manufactured Supports

1. Stock Parts: Where not specifically indicated, designs that are generally accepted as exemplifying good engineering practice and that use stock or production parts, shall be utilized wherever possible. Such parts shall be locally available, new, of best commercial quality, and designed and rated for the intended purpose.
  2. Manufacturers:
    - a. Cooper B-Line (Eaton);
    - b. Anvil International, Inc.;
    - c. Bergen-Paterson Pipesupport Corp.;
    - d. Or approved equal.
- M. Galvanizing: Unless otherwise indicated, all fabricated pipe supports other than stainless steel or non-ferrous supports shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

## **2.2 INSERTS**

- A. Furnish and set inserts in concrete forms; provide reinforcing rods for pipe sizes over 3 inches or equivalent.
- B. Furnish concrete inserts as follows: Black, malleable iron, Universal type for threaded connections with lateral adjustment, Anvil Figure 279 for pipe sizes up to 3-1/2 inches; Anvil Figure 282 for pipe sizes up to 8 inches.

## **2.3 SHIELDS**

- A. Provide shields to protect insulation in all areas. Provide approved galvanized form shields to protect insulation at areas of contact with hangers and supports. Size in accordance with shield manufacturer's recommendations.

## **2.4 SLEEVES**

- A. Where pipes pass through floors, footings, foundations, walls, or ceilings, furnish and install pipe sleeves. Sleeves for concealed piping shall be of galvanized iron, and I.P.S. black steel pipe for exposed piping installed so as to be completely covered by escutcheons, hereinafter specified. Extend sleeves through floors 1/2 inch above finish floor.

## **2.5 ESCUTCHEONS**

- A. Fit pipe passing through walls, floors, or ceilings with escutcheons with set screws as shown on the plans. Use prime painted escutcheons where surface is to receive a paint finish; otherwise, use escutcheons that are nickel or chromium plated. Where piping is insulated, use escutcheon outside the insulation.

## **2.6 JOINTS**

- A. For screwed pipe make ends with sharp, clean tapered threads using pipe compound on male thread only. Do not use mill cut threads. Ream cut pipe to full inside diameter.
- B. Welding may be done by either the arc or acetylene process conforming to the requirements of the ASME B31.1.
- C. For solder joints use fittings specifically made for soldering. Clean all burrs and roughen pipe to clean; solder complete around joint.
- D. For grooved pipe jointing systems use Victaulic couplers or equal.
- E. For no-hub cast iron pipe use double screw joint neoprene coupler.

## **2.7 UNIONS**

- A. Furnish and install unions necessary for installation and necessary to permit removal of equipment.
- B. For unions in steel pipe 1-1/2 inch and smaller use malleable iron ground joint unions with brass to iron seat, galvanized or black as required.
- C. For larger unions in steel pipe, use standard weight cast iron flange unions with 1/16- inch thick gaskets, galvanized or black as required.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Prior to installation of piping, verify that it will not interfere with clearances required for the erection and finish of structural members, architectural members, electrical, or mechanical items.
- B. Code Compliance: All piping systems and pipe connections to equipment shall be properly anchored and supported to prevent undue deflection, vibration, dislocation due to seismic events and line pressures, and stresses on piping, equipment, and structures. All supports and parts thereof shall conform to the requirements of ANSI/ASME 831.1, except as supplemented or modified below. Supports for plumbing piping shall be in accordance with the latest edition of the applicable plumbing code or local administration requirements.
- C. Structural Members: Wherever possible, pipes shall be supported from structural members. Where it is necessary to frame structural members between existing members, such supplementary members shall be provided by the Contractor. All supplementary members shall be in accordance with the requirements of the building code and the American Institute of Steel Construction and shall be acceptable to the Engineer.

- D. Do not cut any structural members for installation of piping.
- E. All pipe supports, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions and ASME B31.1. All concrete inserts for pipe hangers and supports shall be coordinated with the formwork.

### **3.2 INSERTS**

- A. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
- B. Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 3 inches in diameter.
- C. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
- D. Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

### **3.3 SLEEVES**

- A. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
- B. Extend sleeves through potentially wet floors one inch above finished floor level. Caulk sleeves full depth and provide floor plate.
- C. Where piping passes through floor, ceiling, or wall, close-off space between pipe and construction with noncombustible insulation. Provide tight-fitting metal caps on both sides and caulk.

### **3.4 PIPE HANGERS AND SUPPORTS**

- A. Appearance: Pipe supports and hangers shall be positioned to produce an orderly, neat piping system. All hanger rods shall be vertical, without offsets. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, without interference with other work.
- B. Support all piping and make adequate provisions for expansion, contraction, slope, and anchorage.
- C. The use of wire, chains, or straps for pipe supports will not be permitted.
- D. Suspend all piping in the building and/or structures as shown on the plans.
  - 1. Install hangers to provide minimum ½-inch clear space between finished covering and adjacent work.
- E. Place a hanger within one foot of each horizontal elbow.

- F. Use hangers which are vertically adjustable 1-1/2 inch minimum after piping is erected.
- G. No pipe shall be supported from the pipe below it or hung from the pipe above it unless approved in writing by the Engineer.
- H. Support horizontal soil pipe near each hub, with five feet maximum spacing between hangers.
- I. Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.
- J. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- K. Where practical, support riser piping independently of connected horizontal piping.

### **3.5 FINISHING**

- A. Paint exposed piping and supports in accordance with SECTION 099000 PAINTING AND COATINGS.

**— END OF SECTION 220529 —**

## **SECTION 221300 – SANITARY SEWER PIPING AND APPURTENANCES**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes piping and specialties for sanitary sewer service.

#### **1.2 DEFINITIONS**

- A. The following are industry abbreviations for plastic and rubber materials:
  - 1. DI: Ductile Iron.
  - 2. HDPE: High Density Polyethylene.
  - 3. PVC: Polyvinyl chloride.

#### **1.3 SYSTEM PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressures: The following are minimum pressure requirements for piping and specialties, unless otherwise indicated:
  - 1. Sanitary Sewer Force Main: 100 psi
- B. Test Pressures: The following are minimum test pressure requirements for piping and specialties, unless otherwise indicated:
  - 1. Sanitary Sewer Force Main: 75 psi (based on operating pressure of 50 psi)

#### **1.4 SUBMITTALS**

- A. The Contractor shall submit information in accordance with Section 013300, SUBMITTALS, to substantiate compliance with this specification. In addition, the following specific information shall be provided:
  - 1. Product Data: For the following:
    - a. Pipe and fittings
    - b. Drop Bowl
    - c. Check Valves
    - d. Air Release Valves
    - e. Restraint materials
    - f. Valves
    - g. Aboveground protective enclosures and accessories
    - h. Valve Boxes
    - i. Vaults
    - j. Taps
    - k. Saddles
    - l. Other Miscellaneous Appurtenances

2. Shop Drawings: For precast concrete vaults and valve boxes. Include frames and covers and drains.
3. Operation and maintenance data in accordance with Section 013300, SUBMITTALS for the following:
  - a. Valves

## **1.5 QUALITY ASSURANCE**

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of sanitary sewer piping specialties and are based on specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered.
- B. Comply with requirements of the sanitary sewer utility.
- C. Comply with standards of authorities having jurisdiction for sanitary sewer piping. Include materials, installation, and testing.
- D. Comply with Sections 305 and 306 of the Standard Specifications for Public Work Construction (SSPWC).
- E. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated devices.
- F. Provide listing/approval stamp, label, or other marking on piping and specialties made to specified standards.
- G. Listing and Labeling: Provide electrically operated specialties and devices specified in this Section that are listed and labeled.
  1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
  2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Preparation for Transport: Prepare valves according to the following:
  1. Ensure that valves are dry and internally protected against rust and corrosion.
  2. Protect valves against damage to threaded ends and flange faces.
  3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves according to the following:
  1. Do not remove end protectors, unless necessary for inspection; then reinstall for storage.

2. Protect from weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- B. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use hand wheels or stems as lifting or rigging points.
  - C. Deliver piping with any factory-applied end-caps or seals that may typically be provided. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
  - D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
  - E. Protect flanges, fittings, and specialties from moisture and dirt.
  - F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

## **1.7 PROJECT CONDITIONS**

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Verify that sanitary sewer piping may be installed to comply with original design and referenced standards.

## **1.8 SEQUENCING AND SCHEDULING**

- A. Coordinate connection to sewer mains with Engineer, utility company, and/or Owner.
- B. Coordinate piping materials, sizes, entry locations, and pressure requirements with sewer system piping.
- C. Coordinate with other utility work.

## **PART 2 – PRODUCTS**

### **2.1 PIPE**

- A. PVC Plastic Pipe for Gravity Sewer: SDR 35 Solid Wall Pipe shall be made of compounds conforming to ASTM D1784 with a cell classification of 12454B. PVC

pipe shall meet all the dimensional, chemical, and physical requirements as outlined in ASTM D3034. Joints shall meet the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477.

- B. Pressure PVC Plastic Pipe: C900 PVC Water Pipe shall be made of compounds conforming to ASTM D1784 with a cell classification of 12454 and dimension ratio as noted on the plans. C900 & C905 shall meet all the dimensional, chemical, and physical requirements as outlined in AWWA C900 & C905 and will be supplied in 20 foot laying lengths. Joints shall meet the requirements of ASTM 3139 and shall be formed using Rieber Technology. Gaskets shall meet the requirements of ASTM F477. Potable water pipe shall be manufactured from National Sanitation Foundation (NSF) approved compounds.
1. Laying Lengths: Pipe-laying lengths shall be provided in 20-foot nominal lengths with allowable trim-pipe lengths in accordance with AWWA C900 (905).
- C. Ductile Iron Pipe: Ductile iron pipe shall conform to AWWA C150/C151. The pipe shall be of the diameter and class specified on the plans (Pressure Class 350 for pipe diameters 12-inch and less) and shall be furnished complete with gaskets and all specialties and fittings as specified. The ductile iron pipe shall be Tyton Joint Pipe (push-on type connection) as manufactured by U.S. Pipe, or approved equal, for unrestrained pipeline sections. The ductile iron pipe shall be TR Flex, or HP Lok, as manufactured by U.S. Pipe, or approved equal, for restrained pipeline sections. Gaskets shall be Tyton Gaskets, or approved equal, conforming to AWWA C111. Pipeline joint deflection shall be 5-degrees maximum and in accordance with manufacturer's recommendations.
1. Linings and Coatings: Per Section 2.3.
  2. Laying Lengths: Pipe-laying lengths shall be provided in 18-20-foot nominal lengths with allowable trim-pipe lengths in accordance with AWWA C151. Special shorter lengths shall be provided as needed.
- D. High Density Polyethylene Pipe (HDPE): HDPE pipe shall conform to AWWA C906 (IPS pipe sizes), ASTM F714, and ASTM D3035. Pipe compound shall be PE 4710. Dimension ratio shall be as specified on the plans. Polyethylene fabricated fittings shall be manufactured from polyethylene pipe, sheet stock, or molded fittings meeting the material requirements of this specification and all appropriate requirements of AWWA C906. The pipe shall be pressure-rated HDPE (IPS) pipe by JM Eagle, or approved equal.
- E. Steel Pipe: Galvanized Standard Schedule 40 Steel Pipe.
- F. Schedule 40/80 PVC: All PVC Schedule 40/80 pipe shall be manufactured from a Type I, Grade I, PVC compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM D1785 and D2665 (where applicable), consistently meeting and/or exceeding the Quality Assurance test requirements of these standards with regard to material, workmanship, burst pressure, flattening, and extrusion quality. Standard lengths

of pipe sizes 6" and larger shall be beveled each end by the pipe manufacturer. All pipe shall be stored indoors after production at the manufacturing site until shipped from factory.

## **2.2 FITTINGS**

- A. General: All fittings shall be Ductile Iron and shall be furnished with push-on joints, mechanical joints, or flanged joints, as required.
- B. Push-on Joints: Push-on joints shall conform to AWWA C110 or C153, C104, and C105. Unless otherwise specified, gasket material shall be standard Tyton gasket. Push-on joints shall be TR Flex or HP Lok, as manufactured by U.S. Pipe, or approved equal. The pressure rating for push-on joints shall be a minimum of 250 psi or the specified pressure rating of the pipe, whichever is less.
- C. Flanged Joints: Flange fittings shall be ductile iron in accordance with AWWA C110 or AWWA C153, and C104, and C105. Bolt circle and bolt holes match those of ANSI B16.1 class 125 and ANSI B16.5 class 150 flanges. The flanges shall be rated for at least 250 psi working pressure. Bolts, gaskets, and installation shall be in accordance with AWWA C110 or AWWA C115, Appendix A requirements. Flanged gaskets shall be Full Face Flange-Tyte gaskets, as manufactured by U.S. Pipe, or approved equal. Gaskets for flanged ductile iron pipe must not have the larger inside diameters provided by the requirements of ANSI B16.21. Flange facing shall be smooth or with shallow serrations per AWWA C110 or AWWA C153.
- D. Commentary: As noted in the appendices of various ANSI/AWWA standards and AWWA Manual M41, the use of flanged joints underground is generally not recommended because of the rigidity of the joint.
- E. Mechanical Joints: Mechanical joints shall conform to AWWA C111. Bolts shall be per AWWA C111 and shall be Type 304 Stainless Steel. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR) per this standard.
- F. Polyethylene fittings, including custom fabrications, shall have the same internal pressure rating as the mating pipe. At the point of fusion, the wall thickness and outside diameter of the fitting shall be in accordance with AWWA C-901 or AWWA C-906 for the same pipe size.
- G. Small Diameter <2" Steel Fittings: Galvanized Standard Schedule 40 Steel Fittings, Unions, Etc.
- H. Small Diameter <2" PVC Fittings: Sch. 40/80 fittings matching pipe requirements.

## **2.3 LININGS AND COATINGS (DUCTILE IRON PIPE/FITTINGS)**

- A. Interior Lining:

1. The interior of all ductile iron pipe and fittings shall be lined with a ceramic-epoxy internal lining. All ductile pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface.
2. Internal lining shall be Protecto 401 Ceramic Epoxy, or approved equal. The material shall be an amine cured novolac epoxy containing at least 20% by volume of ceramic quartz pigment.
3. Any request for substitution must be accompanied by a successful history of lining pipe and fittings for sewer service, a test report verifying the following properties, and a certification of the test results.
  - a. A permeability rating of 0.00 when tested according to Method A of ASTM E-96-66, Procedure A with a test duration of 30 days.
  - b. The following test must be run on coupons from factory lined ductile iron pipe:
    - (i) ASTM B-117 Salt Spray (scribed panel) - Results to equal 0.0 undercutting after two years.
    - (ii) ASTM G-95 Cathodic Disbondment 1.5 volts @ 77°F. Results to equal no more than 0.5 mm undercutting after 30 days.
    - (iii) Immersion testing rated using ASTM D-714-87.
      - 20% Sulfuric acid: No effect after two years.
      - 140°F 25% Sodium Hydroxide: No effect after two years.
      - 160°F Distilled Water: No effect after two years.
      - 120°F Tap Water (scribed panel): 0.0 undercutting after two years with no effect.
    - (iv) ASTM G-22 90 Standard practice for determining resistance of Synthetic Polymeric materials to bacteria. The test should determine the resistance to growth of Acidithiobacillus Bacteria and should be conducted at 30 degrees centigrade for a period of 7 days on a minimum of 4 panels. The growth must be limited only to trace amounts of bacteria.
  - c. An abrasion resistance of no more than 3 mils (.075 mm) loss after one million cycles using European Standard EN 598: 1994 Section 7.8 Abrasion Resistance.

**B. Exterior Coating:**

1. Exposed Piping and Fittings (above-grade or within vaults/structures): The exterior of exposed ductile iron piping and fittings, including ferrous metal valves, flanges, appurtenances, etc., shall be epoxy coated in accordance with Section 099000, PAINTING AND COATINGS.
2. Buried Piping and Fittings: The exterior of buried ductile iron piping and fittings shall have a zinc coating with an asphaltic top coat in accordance with AWWA C151.

**C. Wax Tape Coating System:**

1. A wax tape coating system shall be applied to all buried fittings, valves, flanged coupling adapters, mechanical restraint glands, service saddles,

and any other exposed hardware prior to polyethylene encasement. Wax tape coating system requirements are as follows:

- a. Wax tape: Wax Tape #1 as manufactured by Trenton Corporation, or approved equal.
- b. Primer: Wax-tape primer (brown) as manufactured by Trenton Corporation, or approved equal.
- c. Protective outer wrap: Poly-Ply as manufactured by Trenton Corporation, or approved equal.
- d. Wax tape, primer, and protective outer wrap shall all be supplied by the same manufacturer. Mixing of product manufacturers will not be permitted.

D. Polyethylene Encasement:

1. All buried piping, fittings, valves, etc. shall be wrapped with an enhanced polyethylene encasement in accordance with AWWA C105.
2. The polyethylene encasement shall be V-Bio Enhanced Polyethylene Encasement (no known equal) infused with a blend of anti-microbial additive to mitigate microbiologically influenced corrosion (MIC) and a volatile corrosion inhibitor (VCI) to control galvanic corrosion.

## 2.4 JOINING MATERIALS

- A. As indicated on plans and in accordance with applicable codes and regulations.

## 2.5 VALVES

- A. All buried valves shall be rated for buried service with the appropriate actuators and extension stems for valve operation as specified on the plans or herein.
- B. Plug Valves, 3-Inch to 16-Inch: 100% port eccentric, resilient plug, AWWA C517, gray- or ductile-iron body. Include 175-psig (1200-kPa) minimum working-pressure design, epoxy coated interior/exterior, and flange or mechanical-joint ends (threaded for 2-inch). Buried plug valves shall have 2" actuator nut and extension stem with a buried service worm gear actuator. Above-grade or exposed plug valves shall have a hand-wheel operator with a worm gear actuator. All valve hardware, including shaft-to-nut pin shall be corrosion resistant (type 304 stainless steel). Plug valves shall be Valmatic Series 5000 or approved equal.
- C. Ball valves, 3-Inch to 16-Inch: Full port with floating ball, split-body, Class 150, carbon steel, with an epoxy coated interior/exterior. Buried ball valves shall have a 2" actuator nut and an extension stem for buried service. All valve hardware, including floating ball, shall be corrosion resistant type 316 stainless steel. Ball valves shall be by Kitz Corporation, Williams Valve Corporation, or approved equal.
- D. Gate Valves, 2-Inch NPS (DN80) to 16-Inch: Non-rising stem, resilient-seated, AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Include 200-psig

(1380-kPa) minimum working-pressure design, interior coating according to AWWA C550, and flange or mechanical-joint ends (threaded for 2-inch). Gate Valves shall be Mueller, or approved equal.

- E. Valve Boxes: Valve box with top section and cover with lettering "SEWER" or "SSFM".
  - 1. Description: Traffic valve boxes and accessory items as specified on plans.
- F. Valve Extensions shall be fabricated steel risers.

## **2.6 RESTRAINED JOINTS**

- A. Mechanical Joint Restraints for PVC pipe shall be EBAA Series 2000PV Megalug Mechanical Joint Restraint, ROMAC, or approved equal.
- B. Bell Joints Restraints for PVC pipe shall be EBAA Series 1500 Bell Restraint Harness for C900/C905 PVC pipe, ROMAC, or approved equal.
- C. Flange Adaptors shall be EBAA Series 2100 Megaflange Restrained Flange Adaptors, or approved equal, conforming to AWWA C600 & C110.
- D. Mechanical Joint Restraints for Ductile Iron Pipe shall be EBAA Series 1100 Megalug, or approved equal.
- E. Ductile Iron Pipe and Fitting restrained joints shall be TR Flex or HP Lok, as manufactured by US Pipe, or approved equal.

## **2.7 CORROSION PROTECTION**

- A. All underground bolt kits shall be corrosion resistant, Tripac 2000 Blue.
- B. All exposed bolt kits shall be corrosion resistant, Type 304 stainless steel.

## **2.8 SERVICE SADDLES**

- A. For mainlines 14" to 24", saddles shall be ROMAC 305 Stainless Steel Service Saddle for expanded pipe ranges, or approved equal. See plans for additional product information.
- B. For mainlines 30" and greater, saddles shall be Ford Triple Band Stainless Steel Saddle FS333-32-5-TAP, or approved equal
- C. For mainlines 2" to 12" and services ¾" and 1" in size, saddles shall be ROMAC 101NS or 202NS, or approved equal.

- D. For mainlines 2" to 12" and services 1.5" or 2" in size, saddles shall be ROMAC 202NS, or approved equal.

## **2.9 TAPPING SLEEVES**

- A. Shall be ROMAC "SST" Stainless Steel Tapping Sleeve, or approved equal. Tapping valves shall be Mueller A-2360 Resilient Wedge Gate Valve, FL x FL or FL x MJ. See plans for more product information.

## **2.10 COUPLINGS**

- A. For unrestrained connections: 3" and larger shall be ROMAC 501 couplings, or approved equal.
- B. For restrained connections: Use of MJxMJ sleeves with joint restraints is acceptable for connections between new pipe sections (not for use with connections to existing pipe as existing pipe may not be able to handle joint restraint mechanism).

## **2.11 THRUST BLOCKS**

- A. Concrete Reaction Backing (THRUST BLOCKS): Portland cement concrete mix, 4000 psi at 28 days when tested in accordance with ASTM C39.
- B. Thrust blocks shall be installed such that they bear against the pipe fitting (not the pipe) on one side and against undisturbed earth on the other side.
- C. Thrust block concrete shall not obstruct removal of flange bolts from fittings. Concrete shall be prevented from adhering to the fittings. Either a liquid bond breaker shall be applied to the fitting, or an impervious membrane (plastic, building paper, etc.) shall be used. The bearing area against the undisturbed soil shall be measured in a vertical plane, perpendicular to the axis of the pipe, or the line bisecting the extension of the pipes entering a fitting. The bearing area shall be as set forth in the thrust block table in the Plans.
  - 1. Cement: ASTM C 150, Type I.
  - 2. Fine Aggregate: ASTM C 33, sand.
  - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
  - 4. Water: Potable.

## **2.12 IDENTIFICATION**

- A. Arrange for installing warning tapes over piping and over edges of underground structures. Install tracer wire over all main line pipe and service laterals.
  - 1. Use detectable warning tape – width 12".
  - 2. Tracer wire - shall be #12 AWG HS-CCS HDPE 30 MIL Copper Head Tracer Wire, or approved equal. Snake Bike Copper Head connectors shall be utilized for connecting wires.

## **PART 3 – EXECUTION**

### **3.1 EARTHWORK**

- A. Refer to earthwork specifications for excavation, trenching, and backfilling.

### **3.2 JOINT CONSTRUCTION**

- A. Flanged Joints: Align flanges and install gaskets. Assemble joints by sequencing bolt tightening. Use lubricant on bolt threads.
- B. Threaded Joints: Thread pipes with tapered pipe threads according to ASME B1.20.1, apply tape or joint compound, and apply wrench to fitting and valve ends into which pipes are being threaded.
- C. PVC Piping, Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
- D. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, OD, and system working pressure. Refer to "Piping Systems - Common Requirements" Article below for joining piping of dissimilar metals.

### **3.3 PIPING SYSTEMS – COMMON REQUIREMENTS**

- A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved by Engineer.
- B. Install piping at indicated slope.
- C. Install components with pressure rating equal to or greater than system operating pressure.
- D. Install piping free of sags and bends.
- E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- F. Install fittings for changes in direction and branch connections.
- G. Piping Connections: Unless otherwise indicated, make piping connections as specified below:

1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

### **3.4 PIPING INSTALLATION**

- A. Installation shall conform to the manufacturer's recommendations except as modified by these specifications and as shown on the drawings.
- B. Bury piping with depth of cover over top at least 42 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration.

### **3.5 VALVE INSTALLATION**

- A. General Application: Use threaded- and flanged-end valves for installation in pits.
- B. AWWA-Type Gate Valves and Plug Valves: Comply with AWWA C600. Install underground valves with stem pointing up and valve box, or with hand wheel attachment and shown in the drawings.

### **3.6 IDENTIFICATION INSTALLATION**

- A. Install continuous detectable plastic underground warning tape during back-filling of trench for underground sewer piping.
- B. Tracer wire shall be taped directly to the sewer piping as shown on the plans.

### **3.7 WAX TAPE COATING SYSTEM APPLICATION**

- A. General:
  1. The intent of applying a wax tape coating system is to prevent water from contacting the metallic surface being coated.
  2. Apply the wax tape coating system to all identified metallic pipe, fittings, valves, and appurtenances.
- B. Surface Preparation:
  1. Wire brush and scrape the surface clean of loose mill scale, rust, paint, and other foreign matter.
- C. Primer Application:
  1. Apply primer to all surfaces to be coated with wax tape or profiling mastic.
  2. If the surface to be coated is wet, cold, or rusty, rub and press on primer firmly to displace the moisture and ensure adhesion.

- D. Wax Tape Application:
  - 1. Apply wax tape in accordance with manufacturer's application instructions. Wax tape shall be applied with a minimum 1-inch overlap.
  - 2. Wax tape shall be cut and contoured to provide a smooth, wrinkle-free surface without any bulges or edges protruding.
  - 3. While wrapping, press and mold the wrap into conformity, ensuring that there are no air pockets or voids, so the wrap is in intimate contact with the surface. Press and smooth out lap seams to ensure they are sealed.
  - 4. Unacceptable surface appearance shall result in the removal and complete reinstallation to the satisfaction of Owner or Owner's Representative.
  
- E. Protective Outer Wrap Application:
  - 1. After application of the wax tape, install the protective outer wrap over all surfaces.
  - 2. wrap securely to adhere to the wax tape without any loose material or bulges present.

### **3.8 ZINC COATING APPLICATION FOR DUCTILE IRON PIPE/FITTINGS**

- A. The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m<sup>2</sup> of pipe surface area. A finishing layer asphaltic topcoat shall be applied to the zinc. The coating system shall conform to ISO 8179-1 "Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01."

### **3.9 FIELD QUALITY CONTROL**

- A. Force Main Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system.
  
- B. Hydrostatic Tests: Ductile Iron pipe shall be tested in accordance with AWWA C600. Other materials shall be tested per requirements in the Standard Specifications for Public Works Construction (SSPWC) Section 336.
  - 1. Meet requirements of the local regulatory authority for testing/reporting.
  
- C. Prepare reports for testing activities.

### **3.10 CLEANING**

- A. Clean and sanitary sewer piping as follows:
  - 1. Purge sanitary sewer piping and parts of existing piping that have been altered, extended, or repaired before use.

— END SECTION 221300 —

## SECTION 221343 – WASTEWATER PUMPING STATIONS

### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. This section covers requirements for the site assembled precast wastewater utility pumping station, including:
1. Precast concrete wet well and dry pit
  2. Hatches, ring, and covers
  3. Pumps and mountings
  4. Other pumping station components including wet well mixer, dry pit heater, dry pit exhaust fan, dry pit sump pump, and pig launch stations

#### 1.2 SUBMITTALS

- A. The Contractor shall submit information in accordance with Section 013300, SUBMITTALS, to substantiate compliance with this specification. In addition, the following specific information shall be provided:
1. Product Data: Provide manufacturer's technical data for each component with detailed specifications and data covering performance, materials of construction, parts, devices, and other accessories forming a part of the equipment furnished.
  2. Pump Performance Curves:
    - a. Performance curves shall include total dynamic head, certified flow rate, brake horsepower, shutoff head, net positive suction head, and efficiency over the entire operating range of the pump from shutoff to maximum capacity.
    - b. Pump curves shall be certified as confirmed by factory testing.
    - c. Performance requirements shall be as defined in the Hydraulics Institute Standards.
  3. Shop Drawings: Show fabrication, assembly, dimensional information, and installation drawings.
  4. Equipment Warranty (per Section 1.4).
  5. Operation and Maintenance Manuals: In accordance with Section 013300, SUBMITTALS.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: NPCA certified with experience and demonstrated capability to produce work specified in this Section.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## **1.4 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of pumping stations that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures including precast concrete structures, hatches, and other accessories.
    - b. Faulty operation of pumps and pump accessories.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  2. Warranty period for pump station components (concrete and pumps): One (1) year from date of Substantial Completion.

## **PART 2 – PRODUCTS**

### **2.1 MANUFACTURER**

- A. Basis of Design: Provide site assembled precast wastewater utility pumping station, including specified pumps, precast concrete wet well, and precast concrete dry pit vault to be manufactured and furnished by:
1. Jensen Precast, (855) 468-5600, PumpStations@jensenprecast.com, www.JensenEngineeredSystems.com.

### **2.2 PRECAST PUMPING STATIONS DESIGN CRITERIA**

- A. Description: Site assembled precast wastewater utility pumping station including pumps, precast concrete wet well, and precast concrete dry pit vault.
1. Pump Station Peak Design Flow Initial: 400 gpm
  2. Pump Station Peak Design Flow Build-out: 1,500 gpm (buildout/future pumps not in contract but included for reference)
  3. Gravity Sewer Inlet Size & Elevations: Per plans
  4. Force Main Size(s) & Elevations: Per plans
  5. Wet Well and Dry Pit Material: Precast concrete
    - a. Capacities and Characteristics: Provide box culvert, risers, and flat top precast sections to correspond to height of precast structures as shown on plans

### **2.3 PRECAST CONCRETE STRUCTURES**

- A. General: Size indicated, with provision for sealant at joints, meeting ASTM C 913, designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy traffic, structural loading.

- B. Round Precast Concrete Wells: ASTM C 478, precast, reinforced concrete.
  - 1. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  - 2. Flexible Resilient Pipe Connectors: ASTM C 923
- C. Precast Concrete Vaults: ASTM C 858, precast, reinforced concrete.
  - 1. Resilient Pipe Connectors: ASTM C 890, cast or fitted into manhole walls, for each pipe connection.
- D. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
- E. Wet Well and Dry Pit Exterior Waterproofing: Per plans and Section 099000, PAINTING AND COATING.
- F. Wet Well Interior Coating: Per plans and Section 099000, PAINTING AND COATING.

## **2.4 PRECAST CONCRETE MATERIALS AND MIX DESIGN**

- A. General: Precast concrete according to ACI 318/318R.
- B. Concrete Design Mix: 4,000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

## **2.5 ACCESS DOORS AND FRAMES**

- A. Dry Pit Access Hatch:
  - 1. Dimensions: Per plans, double-leaf opening.
  - 2. Materials:
    - a. Hatch: aluminum, angle frame
    - b. Nuts, Bolts, Hinges: 316 stainless steel
  - 3. Features: Lift assist, bituminous paint, flush lifting handle, watertight slamlock, 13-inch skirt, hold-open arms with locking pins, drainable rain to prevent against rainwater intrusion  
Safety Accessories: Aluminum safety grate with safety orange powder coat or safety net
  - 4. Loading Capacity: Pedestrian-rated
  - 5. Lift Assist: Lift assist is required in the form of horizontal springs or gas shocks with a maximum lifting force of 15 lbs per access hatch leaf.
  - 6. Manufacturer: Jensen MetalTech or USF Fabrication
- B. Wet Well Manhole Access Covers:
  - 1. Dimensions: Per plans
  - 2. Materials: Fiberglass or composite (light-weight)
  - 3. Loading Capacity: Pedestrian-rated

## 2.6 PUMPS

- A. Basis of Design: Furnish and install three (3) variable speed, dry pit, vertically mounted, non-clog type centrifugal pumps with submersible motors.
- B. Pump Manufacturer:
1. Homa or comparable product approved by Engineer prior to bid.
- C. General Conditions:
1. As this pump will be utilized for solids handling, it must be capable of repeatedly passing spherical solids up to 3 inch in diameter.
  2. Pumps shall be designed to handle raw, unscreened sewage, stormwater, sludge, or similar contaminated liquid, with induction type electric motor assembled in a single body, watertight NEMA Type B chamber.
  3. The pumps shall be capable of maintaining their watertight integrity submerged under 80 feet of water.
  4. For all sewage pump stations, the pumps must comply with NEC Class 1, Division 1, Group C & D hazardous locations.
- D. Materials of Construction:
1. Major Castings: ASTM A48 Class 40B Cast Iron
  2. Wear Ring: ASTM B505 Bronze
  3. Shaft: AISI 430F Stainless Steel
  4. Fasteners: AISI 304 Stainless Steel
  5. O-Rings: Nitrile Rubber
  6. Shaft Seals: Silicon Carbide (impeller and motor side)
  7. Motor Jacket: Stainless Steel
  8. Cable Entry: Elastomer grommet, stainless steel washers
  9. Protective Coating: High Solids Epoxy
- E. Pump System Characteristics (Initial): As required to meet performance requirements.
1. Construction Phase: Initial
  2. Number of Pumps: (3) Three – (2) duty + (1) standby
  3. Design Capacity: 400 gpm
  4. Total Dynamic Head: 46 feet
  5. Shut-off Head: 92 feet
  6. Minimum Hydraulic Efficiency: 75% at design capacity
  7. Motor Size: 15 HP
  8. Speed: 1,750 rpm
- F. Pump System Characteristics (Buildout): Pumps not in contract but included for reference.
1. Construction Phase: Buildout (Future)
  2. Number of Pumps: (3) Three – (2) duty + (1) standby
  3. Design Capacity: 1,500 gpm
  4. Total Dynamic Head: 131 feet

5. Shut-off Head: 180 feet
  6. Minimum Hydraulic Efficiency: 65% at design capacity
  7. Motor Size: 75 HP
  8. Speed: 1,750 rpm
- G. Pumping Station Electrical Characteristics:
1. Electrical Service:
    - a. Volts: 480V
    - b. Phases: 3 (Three)
    - c. Frequency: 60Hz
  2. Full-Load Amperes: 162 A (pumping system only, excludes other loads shown on plans)

## **2.7 WET WELL MIXER**

- A. Submersible wet pit mixer shall be heavy duty, direct drive mixer, type 316 stainless steel, with two-bladed propeller and 15-degree blade angles. Mixer shall be installed in horizontal mount, type 316 stainless steel porta-cleanse stand. Mixer shall be provided with vortex suppressor and jet ring. Motor shall be 460 volts, 3 phase, 60 Hz, 2.3 HP, explosion proof, w/thermal overload switch and leakage detector. Mixer shall be provided with lifting cable and stainless steel bracket/hook. The wet pit mixer shall be Model SR-4620 by Flygt, or an approved equal.

## **2.8 DRY PIT HEATER**

- A. The electric heater shall be QMark Model MUH074 with a remote thermostat and B10 mounting bracket, 7.5 kW, 9.0 amps, 480 Volts, 3 phase, or an approved equal.

## **2.9 DRY PIT EXHAUST FAN**

- A. Exhaust fan shall be a cast aluminum blower with 6-inch diameter outlet and shall be mounted to the interior dry pit wall as shown on the plans. The fan intake and vent discharge piping shall be 6-inch diameter steel with fusion epoxy lining and coating and flanged connections. The pipe discharge to atmosphere shall have ¼-inch stainless steel mesh screen. All bolts shall be type 304 stainless steel. The exhaust fan shall be Model CAB-04-2 by CFM or approved equal.

## **2.10 DRY PIT SUMP PUMP**

- A. The sump pump shall have a 2-inch discharge and automatic float switch for operation based on dry pit sump water levels. The sump pump shall have an epoxy coated cast iron pump housing, a non-clog impeller, and stainless steel nuts, bolts, and fasteners. The sump pump should be capable of pumping at a capacity of 20 gpm and a total dynamic head of 8 feet.

## **2.11 PIG LAUNCH STATIONS**

- A. Contractor shall provide and install pig launching stations per the plans along with all gauges, instrumentation, and/or accessories to ensure a functioning system. Pig launch barrels shall be of the material shown on the plans and shall conform to ANSI B31.3, B31.4, and B31.8. Pig launcher barrels shall be by Jamison Products, or approved equal.
- B. The Contract shall furnish (1) 6" and (1) 10" coated 5-7 lb foam pig with tracking cavity to the Owner. Each pig shall be equipped with a rope loop on the front and back end for retrieval purposes (two rope loops for each pig). Pigs shall be by Pipeline Pigging Products, Incorporated, or an approved equal.
- C. Pig launching stations vary in length, accessories, and port locations between manufacturers. Contractor assumes the responsibility for the size, layout, accessories, and geometry of the pig launching stations.

## **2.12 PUMPING STATION ELECTRICAL AND CONTROLS**

- A. See electrical plans and specifications.

## **2.13 FABRICATION**

- A. Precast Concrete Structures:
  - 1. ASTM C 478 for precast wells/vaults.
  - 2. Fabricate structures with continuous joints to provide watertight construction.

## **PART 3 – EXECUTION**

### **3.1 PAINTING**

- A. The pumps and all other ferrous metal (except stainless steel) shall be factory primed and field finish painted, as specified in Section 099000, PAINTING AND COATING.
- B. The concrete wet well interior/exterior and concrete dry pit exterior shall be coated as specified in Section 099000, PAINTING AND COATING.

### **3.2 PREPARATION FOR SHIPMENT**

- A. Insofar as is practical, the equipment specified herein shall be factory assembled. The pump, parts, and assemblies that are of necessity shipped unassembled shall be packaged and tagged in such a manner that will protect the equipment from

damage and facilitate the final assembly in the field. Generally, machined and unpainted parts shall be protected from damage by the elements with the application of strippable, protective coatings. Provide all lubricant required for initial lubrication.

### **3.3 PRECAST CONCRETE STRUCTURES**

- A. Install precast concrete structure sections with sealants per ASTM C 891.

### **3.4 PUMP INSTALLATION**

- A. The pumps shall be installed in strict accordance with the manufacturer's recommendations and as shown on the plans. All appurtenances required for a complete and operating pumping system shall be provided including such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundation, anchors, grouting, pumps, drivers, power supply, and control.
- B. The pump base shall be installed in strict accordance with the manufacturer's requirements as shown on the plans and as specified herein.
- C. The pumps and motor alignment shall be checked according to the Standards of the Hydraulic Institute.
- D. All strain from attached piping shall be eliminated from the pumps and any evidence of pump misalignment, noisy operation, or other signs of improper setting shall be corrected by the Contractor.
- E. Install equipment such that they are properly aligned, plumb, and level. Flexible couplings shall not be considered to compensate for misalignment.

### **3.5 FACTORY TEST**

- A. The pumps shall be factory tested prior to shipment. Factory test shall be a non-witnessed certified performance test.

### **3.6 FIELD TESTS**

- A. Installation of the pumps and electrical connections shall be complete and the units shall be serviced, tested, adjusted and ready for use before the field tests are scheduled.
- B. Field testing shall demonstrate proper operation of the equipment at the specified design parameters and compliance with the plans, these specifications, and the Standards of the Hydraulic Institute. All equipment that fails any test shall be rejected, and complete retesting shall be required at the Contractor's expense after

the Contractor makes corrections or modifications to equipment which previously has failed any test. All field tests shall be witnessed by the Engineer.

- C. Written notice of the scheduled dates for the field tests shall be given to the Engineer at least 10 days prior to the field test dates. The notice shall include a written test schedule listing the tests, the test procedure, the criteria for a satisfactory test, and special measurement equipment to be employed.
- D. Minor repairs and adjustments shall be made by the Contractor as required to achieve satisfactory performance of the pump drive units. If minor repairs or adjustments are made during the tests, additional testing shall be performed as required by the Engineer.

### **3.7 MANUFACTURER'S REPRESENTATIVE SERVICES**

- A. The manufacturer's representative shall inspect the installation of the equipment prior to startup and shall make the necessary adjustments to the equipment for satisfactory operation. The manufacturer shall also be responsible for instructing the Owner's personnel in the operation and maintenance of the equipment.
- B. The manufacturer's representative shall certify the correctness of the installation.

**— END SECTION 221343 —**

## **SECTION 260000 – GENERAL ELECTRICAL REQUIREMENTS**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. It is the intent of this part of the Contract Documents to cover the work and materials necessary for erecting a complete electrical system, tested and ready for continuous use. The system shall be constructed in accordance with the Contract Documents, and Federal, State, and Local codes and regulations.

#### **1.2 GENERAL PROVISIONS**

- A. Minimum sizes of equipment, and electrical devices, are indicated but it is not intended to show every offset and fitting, nor every structural or mechanical difficulty that will be encountered during the installation of the work.
- B. Work indicated on the Plans is approximately to scale, but actual dimensions and detailed plans should be followed as closely as field conditions permit. Field verification of scale dimensions on Plans is governed by field conditions. Installation of systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination.
- C. Discrepancies indicated on different Plans, between Plans and actual field conditions, or between Plans and Contract Documents shall be promptly brought to the attention of the Engineer for clarification, prior to purchasing and installing equipment.
- D. The alignment of equipment and conduit shall be adjusted to accommodate architectural changes, or to avoid work of other trades, without extra expense to the Owner.
- E. The Contractor shall furnish and install the parts and pieces necessary to the installation of equipment, in accordance with the best practice of the trade, and in conformance with the requirements of these Contract Documents.
- F. The Contractor shall furnish and install inserts and hangers required to support conduits and other electrical equipment. If the inserts, hangers, sleeves, or other mounting hardware are improperly placed, or installed, the Contractor shall do necessary work, at their own expense, to rectify the errors.

- G. The Contractor shall perform necessary saw cutting, core drilling, excavating, removal, shoring, backfilling, and other work required for the proper installation of conduits, whether inside, or outside of the structures. The Contractor shall repair and patch where demolition has taken place in a manner to match existing original structure.

### **1.3 REGULATIONS, CODES, AND STANDARDS**

- A. Electrical work, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the latest published regulations, codes, and standards, of the following:
  - 1. National Electrical Code (NEC)
  - 2. State and local codes
  - 3. Institute of Electrical and Electronic Engineers (IEEE)
  - 4. American National Standards Institute (ANSI)
  - 5. American Society for Testing and Materials (ASTM)
  - 6. Insulated Cable Engineers Association (ICEA)
  - 7. National Electrical Manufacturers Association (NEMA) Standards
  - 8. Federal Occupational Safety and Health Act (OSHA)
  - 9. National Fire Protection Association (NFPA)

## **PART 2 – PRODUCTS**

### **2.1 GENERAL MATERIALS AND METHODS**

- A. Materials, equipment, and parts comprising any unit, or part thereof, specified or indicated on the Plans, shall be new and unused, of current manufacture, and of highest grade consistent with the state of the art. Damaged or dirty materials, equipment, and parts, are not considered to be new and unused, and will not be accepted.
- B. Field verification of scale dimensions on Plans is directed, since actual locations, distances, and levels will be governed by actual field conditions. The Contractor shall also review architectural, structural, yard, mechanical, and other Plans, and the accepted electrical and mechanical shop drawings, and shall adjust their work to conform to the conditions indicated therein.
- C. The fabricator of major components, such as distribution panelboards, switchgear, and motor control centers, shall also be the manufacturer of the major devices therein. Where possible, the major components shall be manufactured and supplied by the same fabricator.

- D. Refer to various Division sections for individual equipment manufacturers. Indicated manufacturers are subject to strict compliance with the specifications and complete project documents. The reference to a particular manufacturer does not relieve the Contractor from conforming to the specified requirements.

## **2.2 NAMEPLATES**

- A. Where indicated elsewhere in these specifications, or on the Plans, the Contractor shall furnish and install nameplates, which shall be white laminate with black letters. The nameplates shall be fastened to the various devices with round head stainless steel screws. Each disconnecting means for service, feeder, branch, or equipment conductors shall have nameplates indicating its purpose.

## **PART 3 – EXECUTION**

### **3.1 UTILITY SERVICE AND EQUIPMENT**

- A. The Contractor shall be responsible for contacting and coordinating the electrical utility work with the electrical utility company. The Contractor shall be responsible for furnishing and installing equipment and material required to bring electrical power service to the service location in conformance with the electrical utility requirements.

### **3.2 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper. Stranded for all sizes.
- B. Branch Circuits: Copper. Stranded for all sizes.

### **3.3 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Service Entrance: Type XHHW-2, single conductors in raceway
- B. Exposed Feeders and Branch Circuits: Type THWN-2 or XHHW-2 based on wire size requirements described in PART 2, single conductors in raceway. Multiconductor Tray Cable type TC shall be used where runs are to be in cable trays as shown on the drawings.
- C. Feeders and Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground:
  - 1. Type THWN-2 or XHHW-2 based on wire size requirements described in PART 2, single conductors in raceway.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
    - a. All conductors with voltages at 277V or higher and corresponding neutrals and grounds.
    - b. All conductors #8 and larger.
    - c. All motor leads and corresponding grounds.

**— END SECTION 260000 —**

## **SECTION 260519 – CONTROL-VOLTAGE ELECTRICAL POWER CABLES**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements for control-voltage electrical power cables.

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 INSTRUMENT CABLES**

- A. Instrument cable shall be Type TC, and have the number of individually shielded twisted pairs indicated on the Plans and shall be insulated for not less than 600 volts. Unless otherwise indicated, conductor size shall be No. 18 AWG minimum. Shielded, grounded instrumentation cable shall be used for all analog and low voltage digital signals.

**— END SECTION 260519 —**

## **SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **PART 1 – GENERAL**

#### **1.1 SCOPE OF WORK**

- A. Types of supports, anchors, sleeves and seals specified in this section include the following:
  - 1. Round Stainless Steel Rods
  - 2. Stainless Steel Drop-in Anchors
  - 3. Stainless Steel Wedge Type Anchor Bolts
  - 4. Stainless Steel U-Channel Strut System

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 STAINLESS STEEL U-CHANNEL STRUT SYSTEM & CONDUIT SUPPORTS**

- A. Provide Stainless Steel U-channel strut system for supporting electrical equipment, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with all stainless steel hardware, and the following stainless steel fittings that mate and match with Stainless Steel U-Channel:
  - 1. Fixture hangers
  - 2. Channel hangers
  - 3. End caps
  - 4. Beam clamps
  - 5. Post bases
  - 6. Rigid conduit clamps
  - 7. U-bolts
- B. Approved for use with the following types of conduit:
  - 1. PVC Coated GRS
  - 2. PVC

**— END SECTION 260529 —**

## **SECTION 260543 – CONDUITS AND RACEWAYS**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements for conduits and raceways.

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 CONDUITS AND RACEWAYS**

- A. Furnish and install conduits as required, and as shown on the Plans. Underground conduits shall be PVC.
- B. All exposed conduits and fittings shall be PVC coated galvanized rigid steel (GRS).

**— END SECTION 260543 —**

## **SECTION 260800 – TESTING AND COMMISSIONING OF ELECTRICAL SYSTEMS**

### **PART 1 – GENERAL**

#### **1.1 REQUIREMENTS**

- A. The Contractor shall fully commission and test the entire electrical, instrumentation, and control system.
- B. Factory Functional and operational testing shall be a collaborative effort between the Contractor and the Owner's Systems Integrator.
- C. The Contractor shall assign a project manager to the commissioning process for the coordination and scheduling of all testing and report submittals.

#### **1.2 Coordination**

- A. The Contractor shall coordinate all testing with the Owner's System Integrator and construction manager to verify operations between all systems.

#### **1.3 Submittals**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification. Testing and quality control submittals shall be specific for the project and shall include the following:
  - 1. Switchgear busing torque reports
  - 2. Cable megger reports
  - 3. Motor voltage, current, and rotation reports
  - 4. Control functionality reports
  - 5. I/O checklist
- B. The Contractor shall develop and submit to Engineer for approval, a commissioning test plan which describes detailed test procedures, checklists and blank forms that data will be reported on, and test equipment to be used.

**— END SECTION 260800 —**

## **SECTION 262419 – MOTOR CONTROL CENTERS**

### **PART 1 – GENERAL**

#### **1.1 SCOPE OF WORK**

- A. The Contractor shall furnish and install, ready to use, motor control centers for use as indicated on the Plans and specified herein.
- B. Circuit breaker ratings, and modifications, shall be as indicated on the Plans.
- C. MCP ratings, and modification, shall be as indicated on the Plans.

#### **1.2 SUBMITTALS**

- A. The motor control centers shall meet the requirements of the latest edition of Standards for Industrial Control No. ICS published by the National Electrical Manufacturers Association. The following minimum information and drawings shall be submitted for review:
  - 1. Plan, front, side views and overall dimension of each motor control center.
  - 2. Weight.
  - 3. Internal wiring diagram of each plug-in unit.
  - 4. Internal wiring diagram of the motor control centers.
  - 5. External connection diagram showing the wiring to the external controls and devices associated with the motor control center.
  - 6. One-line and schematic diagram for each motor control center.
  - 7. Bill of material list and Manufacturer's Product Data.
  - 8. Installation instructions including seismic installation.
  - 9. Manufacturer's certification that the following items are capable of interrupting and/or withstanding the specified short circuit condition:
    - a. Bus bar bracing
    - b. Feeder tap units
    - c. Starter units
- B. Product information shall be submitted In accordance with SECTION 260000 General Electrical Requirements, and elsewhere in the Contract Documents.

### **PART 2 – PRODUCTS**

#### **2.1 MOTOR CONTROL CENTERS (MCC)**

- A. The motor control center fabricator shall be the manufacturer of the major components therein, such as circuit breakers, VFD's and starters. Engineered motor control centers shall be by the component and housing manufacturer. The manufacturer shall comply with equipment specifications contained elsewhere in these Contract Documents.
- B. Each component, as well as the complete assembly, shall be constructed and tested in accordance with latest NEMA Standards for Industrial Control. The type of construction of the control centers shall be NEMA Class II, Type B. Lifting eyes shall be provided on each section to facilitate handling.
- C. Unit doors shall be mounted on the stationary structure and hinged on the side away from the vertical wireway. They shall be held closed with slotted thumbscrews.
- D. Unit doors shall have positive action linkage with disconnect operating mechanism. Mechanism shall be designed so that it can be locked in the OFF position with up to 3 padlocks. When the handle is not padlocked, it shall be possible to open the door by releasing the door interlock with a small screwdriver. The control units shall be of the plug-in type. When doors are closed, the operating mechanism shall clearly indicate the ON or OFF position of the disconnect, and the door interlock mechanism shall engage. The disconnect operating mechanism shall be designed against inadvertent operation when the door is open. Each plug-in unit door shall be provided with a nameplate, specified elsewhere herein, that indicates the circuit number and circuit name. The nameplate shall be attached to the door with brass or stainless steel screws. Each motor starter door shall be provided with an externally operated manual reset pushbutton for the overload relay.
- E. Units shall be completely enclosed with sheet steel. A small wireway shall be provided inside the unit, so all wiring can be laid in place without removing barriers or plates. Each vertical section that holds the units shall be rigidly formed of minimum 12 gauge, cold-rolled sheet steel. The vertical front-of-board-construction shall be supplied with minimum 20-inch depth.
- F. Continuous horizontal wiring troughs shall be provided at both top and bottom of each section. These troughs shall line up to form a continuous wireway for the full length of the MCC. A large continuous, full-height vertical wiring trough shall be provided in the right side of each section.
- G. All starter wiring, control, and power shall be terminated in terminal strips in this trough for size 2 and smaller starters. Size 3 and larger starters shall have control leads terminating on the terminal strips in the trough. Terminal strips shall be split-type to facilitate wiring connections without disconnecting factory or field conductors. Terminal strips shall be rated to accept conductor sizes as indicated on the Plans.

- H. All bus bars shall be tin plated copper, and shall be of the ampacity indicated on the Plans. Unit bus bar stabs shall insure high contact pressure. The vertical bus bars shall be effectively isolated from accidental contact by plastic insulating medium.
- I. Bus bar supports shall be of high impact strength non-carbonizing insulating material mounted on padded steel brackets and shall provide adequate dielectric strength and creepage distance. The bus structure shall be capable of withstanding short circuit current in accordance with NEMA standards, and as indicated on the Plans.
- J. Each section shall be equipped with horizontal ground bus that shall be continuous across the MCC.
- K. The MCCs shall be supplied as indicated on the Plans, and as specified herein and in accordance with NEMA Standard Pub. IS 1.1, latest edition. The MCCs shall be enclosed in NEMA Type 3R gasketed industrial use enclosures, unless otherwise shown. NEMA 3R enclosures shall provide sufficient depth for air conditioning units to be mounted on the end of the structures. If the MCCs contain VFDs or Solid State Starters that require cooling, their respective sections shall be louvered top and bottom, and fans shall remove heat from within the sections. MCC will have internal cabinet LED lighting.
- L. All metal surfaces and structural parts shall be given a phosphatizing, or equal, treatment prior to painting. The control centers shall then be given a gun-metal gray undercoat which is equal to zinc chromate. The exterior of the enclosure shall be finished in standard ANSI Grey.
- M. Spaces for future combination starters shall have all the hardware necessary so that a future plug-in control unit can be installed without having to modify the vertical sections. The number of spaces for future control units shall be as indicated on the Plans.
- N. Devices, such as, but not limited to, starters, circuit breaker, relays, timers, conductors, shall conform to other sections of these Contract Documents.
- O. Provide customer metering instruments, as indicated on the Plans. Unless otherwise indicated on the Plans, metering units shall be electronic, capable of displaying volts line-to-line and line-to-neutral, and amps per phase.
- P. Each section shall be equipped with horizontal neutral bus that shall be continuous across the MCC if the MCC is designated as 277/480 volt 4 wire.
- Q. MCCs shall be as manufactured by Rockwell or equal.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. The MCCs shall be erected in accordance with the recommendations of the manufacturer and with the details specified herein.
- B. Cables larger than No. 6 A WG, which hang from their vertical connections, shall be supported within 2 feet of the connection.
- C. The motor overload relays shall be provided and sized based on the actual full load amperes of the motor connected to the starter.
- D. The motor circuit protectors shall be adjusted to the lowest settings that do not cause false tripping.
- E. Motor control centers shall be installed for seismic requirements as required in SECTION 260000 General Electrical Requirements.
- F. Motor Control Centers shall be provided in accordance with all applicable sections of SECTION 260000 General Electrical Requirements.

### **3.2 FIELD TESTS**

- A. MCCs shall be tested in accordance with SECTION 260000 General Electrical Requirements.

**— END SECTION 262419 —**

## **SECTION 262713 – METERING SWITCHBOARD**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements for the metering switchboard.

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 METERING SWITCHBOARD**

- A. 600 amp main breaker, 600 amp AL main structure, 600 amp utility metering section-NV Energy (NEPCO), Utility meter socket, (Service Entrance) horizontal isolated barrier, (incoming pull section) 600 amp AL bussed, Nema 3R enclosed (nonwalk-in).

**— END SECTION 262713 —**

## **SECTION 263200 – GENERATOR PACKAGE**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements for the standby diesel engine generator system.

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. The Contractor shall submit concrete pad anchorage details, anchoring requirements, and seismic anchorage calculations signed and stamped and signed by a civil engineer.
- C. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. The standby diesel engine generator shall be a 230 KW, 480 volt, 3 phase, Kohler Model 230-275REOZJE, or approved equal.

#### **2.2 GENERATOR**

- A. Requirements for the generator are as follows:
  - 1. Weather enclosure with sub base fuel tank
  - 2. Internal mounted silencer and flexible exhaust
  - 3. Enclosure capable of handling up to 150 MPH winds, tank mounted, steel construction, lockable flush mounted door latches
  - 4. Fuel tank capable of handling 24 hours of operation
  - 5. Controls capable of handling an automatic transfer switch start up signal

**— END SECTION 263200 —**

## **SECTION 265613 – LIGHT POLES**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements for light poles.

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 LIGHT POLES**

- A. Light poles shall be 20-foot square steel poles with welded Tenon RAB PS-4-11-20WT, or approved equal.
- B. Provide RAB Bull 2 bull horn, or approved equal.

**— END SECTION 265613 —**

## **SECTION 265619 – LED LIGHTING FIXTURES**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements for LED lighting fixtures.

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 LIGHTING FIXTURES**

- A. Lighting shall be placed at the locations shown on the plans. Lighting fixture requirements are as follows:
  - 1. Site Lighting (Pole Mounted): FXLED125SF/D10 125.00 Watts, 5000 K color and 18,317 Lumens floodlight or equivalent.
  - 2. Dry Pit Interior Lighting: RAB WP2LED24 24.00 watt, 5000 K color, and 2998 Lumens wall pack or equivalent.

**— END SECTION 265619 —**

## **SECTION 310000 - EARTHWORK**

### **PART 1 – GENERAL**

#### **1.1 WORK RELATED**

- A. Work included in this section shall include furnishing of all materials and labor necessary to complete Earthwork as indicated, specified herein or on the Plans. The work of this section includes, but is not necessarily limited to, the following:
1. Stripping and clearing.
  2. Scarifying and re-compaction of native soils.
  3. Excavation for footings.
  4. Structural fill and backfill.
  5. Base fill under slabs on grade.
  6. Finish site grading.
  7. Temporary site drainage.
  8. Dust control.
  9. Quality control.

#### **1.2 CONTRACTOR'S RESPONSIBILITY**

- A. The CONTRACTOR shall attentively examine the site to confirm existing surface conditions and to confirm that the quality and quantity of exposed materials and subsurface soil or rock deposits have been satisfactorily represented by the plans. Any discrepancy that may be of prior knowledge to the CONTRACTOR or that is revealed through site investigations shall be made available to the OWNER. The selection of equipment for use of the project and the order of work will similarly be the CONTRACTOR's responsibility such that the requirements included in the following sections have been met.

#### **1.3 REFERENCE STANDARDS**

- A. Standard Specifications: Standard Specifications for Public Works Construction (SSPWC) "Orange Book" most recent edition.
- B. American Society for Testing and Materials (ASTM):
1. ASTM D2922 – Compaction Testing in Place by Nuclear Methods
  2. ASTM D1557 – Moisture Density Relationship of Compacted Soils
- C. Where referred to herein, relative compaction shall mean the in-place dry density of soil expressed as a percentage of maximum dry density of the same material, as determined by ASTM D1557 Moisture Density Relationship Test Procedure. Optimum moisture content shall mean the moisture content corresponding to maximum dry density as determined above.

#### **1.4 QUALITY CONTROL**

- A. CONTRACTOR shall retain and pay a qualified testing laboratory to test all fill or backfill materials to be used by the CONTRACTOR during construction.
- B. CONTRACTOR shall retain and pay a qualified testing technician to test compaction of sub-grade and fill materials as directed by the OWNER's representative. Frequency of testing shall be in conformance with Orange Book requirements.
- C. When compacted soils and materials fail to meet the requirements of the specifications, the CONTRACTOR shall pay for any and all retesting of said compacted soils and materials.
- D. If, during the progress of work, tests indicate that compacted materials do not meet specified requirements, or if materials display any adverse conditions, i.e. pumping, excessive or insufficient water content, excessive debris, poor or improper gradation etc. or if materials are determined by the ENGINEER or Technician to be different than those specified, CONTRACTOR shall remove, replace and retest materials and work at no cost to the OWNER.
- E. Materials used for the project must comply with the project-specific geotechnical investigation as referenced in the Contract Documents.

#### **1.5 SUBMITTALS**

- A. Test Reports: CONTRACTOR shall submit current test reports on all fill or backfill materials for approval, at least 14 days prior to the start of work.

#### **1.6 SITE CONDITIONS**

- A. Information presented in the Contract Documents regarding existing site conditions is believed to be correct, but is not guaranteed. CONTRACTOR shall visit the site for the necessary information and data regarding present ground levels, conditions of the property, location and size of obstructions, and location of adjacent streets, utilities, etc.
- B. CONTRACTOR shall assume all responsibility for damage to buildings, utilities, streets, etc., that may be caused by his work. CONTRACTOR shall refer to plans and confer with OWNER for the location of existing utilities, etc.

#### **1.7 PROTECTION**

- A. CONTRACTOR shall protect existing streets, utilities, benchmarks, buildings and other features or facilities on or adjacent to the site from damage from the work of this section where such items are to remain. Any damage to the above shall be immediately repaired by the CONTRACTOR in a manner approved by the OWNER's representative.

- B. The CONTRACTOR shall provide, install, and maintain all barricades, shoring, bracing, etc., as required by Federal and State and local codes.

## **1.8 UTILITY SERVICES**

- A. When encountered in the work, the CONTRACTOR shall perform the following:
  - 1. Protect existing active sewer, water, electric, gas, telephone or other utility services or underground improvements. If existing active services are not indicated, but are encountered, request instructions from the OWNER's representative. Do not proceed until instructions are obtained.

## **1.9 DUST ABATEMENT**

- A. CONTRACTOR shall take adequate measures at all times during construction to abate dust on the site. Provide watering from trucks, sprinklers, hoses or the like at sufficiently frequent intervals to preclude dust.

## **1.10 EXCAVATION VARIATIONS**

- A. CONTRACTOR shall notify the OWNER's representative immediately if abnormal or questionable soil conditions are encountered, and shall not proceed with the work until so directed by the OWNER's representative. Procedures are as follows:
  - 1. Additional Excavation: When soil nature is such that good bearing cannot be found at sub-grade levels indicated, additional excavation to good bearing soil may be necessary. Should additional excavation be required, it will be ordered in writing. Additional excavation will be paid for at a price negotiated prior to the start of work.
  - 2. Unauthorized Excavation: Where excess or unauthorized excavation takes place beyond indicated lines, CONTRACTOR shall grade and fill to indicated sub-grades in accordance with the provisions of this section at no extra cost to the OWNER or OWNER's representative.

## **PART 2 – PRODUCTS**

### **2.1 CLASS A**

- A. Class A Bedding shall meet requirements of Section 200.03.02 of the Standard Specifications for Public Works Construction.

### **2.2 CLASS C**

- A. Class C Backfill shall meet requirements of Section 200.03.04 of the Standard Specifications for Public Works Construction.

## **2.3 AGGREGATE BASE**

- A. Aggregate Base shall meet requirements of Section 200.03.01 of the Standard Specifications for Public Works Construction for Type II, Class B, Aggregate Base.

## **2.4 NATIVE BACKFILL**

- A. On-site materials free of organics and debris are allowed for backfill if the material meets the requirements of the project-specific geotechnical investigation as referenced in the Contract Documents. All rocks and cobbles with a diameter greater than 4 inches shall be removed prior to placement of backfill.

## **2.5 STRUCTURAL FILL**

- A. Structural fill shall conform to the project-specific geotechnical investigation as referenced in the Contract Documents.

# **PART 3 – EXECUTION**

## **3.1 SITE PREPARATION**

- A. CONTRACTOR shall locate all utilities and improvements to remain.

## **3.2 SUB-GRADE SOIL PREPARATION**

- A. Prior to the placement of any compacted backfill, structural fill, compacted base material, etc., CONTRACTOR shall scarify and moisture condition to within 2% of optimum moisture content, then compact subgrade soils to at least 90% relative density as determined by ASTM D1557.

## **3.3 EXCAVATION**

- A. CONTRACTOR shall excavate to lines, grades and dimensions indicated or otherwise required to accommodate the work.
- B. Excavation shall extend a sufficient distance from the walls to allow for placing and removal of forms, placing reinforcing, installation of services, and for inspection. Sides of footings must be formed. Remove all loose material immediately before the concrete is placed.

### **3.4 STRUCTURAL FILL AND BACKFILL**

- A. CONTRACTOR shall remove water from areas to receive structural fill and backfill before commencing work and keep areas free of water during filling and compaction. Fill and back-filling operations shall be carried out as follows:
  - 1. Placement of fill, backfilling or compacting of soils during freezing weather shall not occur except by permission of the ENGINEER or his representative. No backfill or fill materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill. Provide protection as necessary during freezing weather.
  - 2. Place all fill material in lifts of not more than 8 inches loose material thickness, moisture condition material to within 2% of optimum moisture content and compact by approved means to 90% relative density as determined by ASTM D1557.

### **3.5 SLAB BASE**

- A. CONTRACTOR shall provide aggregate base compacted to a depth of no less than 6 inches under all concrete slabs-on-grade, vaults, manholes, and concrete site work. Before placing the fill, smooth and level the surface of the existing soil and thoroughly compact as required for structural fill. Place base material in one lift, moisture condition to within 2% of optimum moisture content and compact to not less than 95% relative density as determined by ASTM D1557, unless indicated otherwise on the Plans.

### **3.6 COMPACTION**

- A. Compaction as specified shall be obtained using suitable equipment designed for the work specified. The CONTRACTOR shall be responsible for selecting the type of equipment to be used.
- B. Compaction of each layer shall be continuous over the entire area of the fill. Compaction shall be carried out on lifts placed as level as possible. In areas where finished grade exceeds 5:1 slope lifts shall be "staircased" to ensure a level compacting surface.

### **3.7 FINISH GRADING**

- A. The areas within the grading limits shall be graded to the lines and levels shown on the Plans. Finish grade shall be uniform, smooth, and well compacted, free from trash, debris and rocks over two inches in diameter. Finish grades shall not vary more than one inch from indicated elevations.

### **3.8 CLEANUP**

- A. During the progress of the work, the CONTRACTOR shall keep the entire job site in a clean and orderly condition. Excess or unsuitable backfill material, broken pipe, or other waste material shall be removed from the job site within one week. Spillage resulting from hauling operations along or across existing streets or roads shall be removed immediately by the CONTRACTOR. All gutters and roadside ditches shall be kept clean and free from obstructions. Any deviation from this practice shall have prior approval from the OWNER. In area where excessive dust is a nuisance, the CONTRACTOR shall as often as necessary wet down the area to prevent dusty conditions as specified in the Special Conditions. This includes weekends and holidays.
- B. Before final acceptance of the work, the CONTRACTOR shall carefully clean up the work and the premises, remove all temporary structures, such as portable berms, built by or for the CONTRACTOR, remove all surplus construction materials and rubbish of all kinds from the grounds which the CONTRACTOR has occupied, and leave them in a neat condition. All drainage ditches shall be restored to their original condition, free of backfill and excavation material, and fully capable of passing storm runoff as in original condition.
- C. Daily cleanup of trash, paper, and small debris subject to movement with winds will be required.

**— END SECTION 310000 —**

## **SECTION 310516 - AGGREGATE BASE COURSE**

### **PART 1 – GENERAL**

#### **1.1 DESCRIPTION**

- A. Description of Work: The work to be performed in accordance with this section includes furnishing, placing, and compacting an aggregate base course to plan grades and cross sections. This work shall include the furnishing of all labor, tools, equipment, materials and performing all operations required to provide a complete item in accordance with the Contract Documents.
- B. Applicable Additional Specifications: Standard Specifications for Public Works Construction (SSPWC) "Orange Book" Sections 308 – Untreated Base Courses and 302 – Subgrade Preparation.

#### **1.2 QUALITY ASSURANCE**

- A. Reference Test Standards and Specifications: The publication listed in SSPWC "Orange Book" form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Compliance sampling and testing during construction will be provided by the Owner per SSPWC Section 336.00.
- B. Frequency of Testing
  - 1. Maximum Dry Density and Optimum Moisture Content, ASTM 1557.
    - a. CONTRACTOR shall provide documentation that one test for each different class or type of material has been performed, and
    - b. CONTRACTOR shall have one test performed when previous test is suspect, due to subtle changes in the material, as determined by the Engineer.
  - 2. Density of Soil In-Place by Sand Cone or by Nuclear Methods, ASTM D1556 or D2922 by Owner.
    - a. The Engineer requests a minimum of one test per 500 linear feet of embankment or fill.
    - b. The Engineer may test more frequently.
- C. Testing Tolerances
  - 1. Percent Compaction. Not less than as specified in the Contract Documents or the SSPWC.
  - 2. In-Place Moisture Content. As required to achieve minimum compaction.
  - 3. Soft or Yielding Surfaces. Regardless of the percent compaction obtained by test, areas which are soft and yield under the load of construction equipment are to be removed and replaced at no additional cost.

### **1.3 SUBMITTALS**

- A. Materials Test Report. Report on maximum dry density, optimum moisture content, gradation, and R-value prior to beginning of construction.

## **PART 2 – MATERIALS**

### **2.1 AGGREGATE BASE**

- A. Aggregate Base shall be free from organic matter and other deleterious substances, and shall be of such nature that it can be compacted readily under watering and rolling to form a firm stable base.
- B. Aggregate shall conform to the grading and quality requirements found in Section 200.01.03 Type 2, Class B Aggregate Base.

## **PART 3 – EXECUTION**

### **3.1 PRELIMINARY INVESTIGATION OF THE WORK**

- A. The CONTRACTOR is to satisfy himself/herself that all preliminary work including, but not limited to, clearing, grubbing, subgrade preparation and staking has been performed in accordance with these Specifications prior to subgrade preparation.

### **3.2 AGGREGATE BASE PREPARATIONS**

- A. All work shall conform to the following subsections of Section 308 – Untreated Base Course, of the SSPWC.
- B. During moisture conditioning of the base material take care so as not to damage the subgrade below. CONTRACTOR shall be responsible for over watering of grade during operations.
- C. Deficiencies. Remove and replace deficiencies prior to placement of the pavement. Deficiencies in the base course, covered by asphalt paving or concrete will be removed and replaced at no additional cost to the Owner.
- D. Aggregate base shall be placed to the thickness shown on the plans.

**— END SECTION 310516 —**

## **SECTION 312310 - TRENCH EXCAVATION, BACKFILLING AND COMPACTION**

### **PART 1 – GENERAL**

#### **1.1 DESCRIPTION**

- A. this section provides addition specifications for materials and work involved in trench excavation, backfilling and compaction.
- B. Trench excavation shall include the removal of all materials or obstructions of any nature, the installation and removal of all sheeting and bracing and the control of water necessary to construct the work as shown. Unless otherwise indicated on the Plans or permitted by the ENGINEER or his representative, excavation shall be by open cut. Trenching machines may be used, except where their use will result in damage to existing facilities.
- C. Trench excavation work shall be performed in a safe and proper manner with suitable precautions being taken against hazards of every kind. Trench excavations shall provide adequate working space and clearances for the work to be performed therein, and for installation and removal of sheeting and shoring that may be required.
- D. Prior to commencing excavation, the CONTRACTOR shall have materials, labor and equipment on the job site suitable for making emergency repairs to the existing system, should the existing facilities be damaged by the CONTRACTOR's operations.

#### **1.2 RELATED SECTIONS SPECIFIED ELSEWHERE**

- A. SECTION 311000 – EARTHWORK

#### **1.3 SUBMITTALS**

- A. The CONTRACTOR shall submit testing reports, prepared by a qualified testing laboratory, for all bedding and aggregate base materials, prior to commencement of work, including information on location of the source of material.

### **PART 2 – MATERIALS**

#### **2.1 BEDDING**

- A. The pipe bedding material, within the pipe zone, shall be clean, granular material conforming to Class A Bedding requirements of Section 200.03.02 of the Standard Specifications for Public Works Construction.

- B. Sieve analysis and a moisture-density curve of bedding material shall be paid for by the CONTRACTOR and a copy of the results provided to the ENGINEER/OWNER before placement commences. In the absence of such excavated select backfill material, suitable bedding material (sand) shall be imported. Sand shall be free from foreign materials such as dirt, clay, rocks, sticks or vegetation.

## **2.2 TRENCH BACKFILL**

- A. The trench backfill material, above the pipe zone, shall be structural fill conforming to the project-specific geotechnical investigation as referenced in the Contract Documents.
- B. All trenches shall be backfilled after pipe fittings and appurtenances have been installed, inspected and approved for backfill.
- C. All wood, debris and waste material shall be removed from excavation preparatory to backfilling. Backfill material shall be approved in all cases by the ENGINEER and shall be free of trash, wood, rocks greater than 4 inches and any other objectionable debris.
- D. Backfilling shall include the refilling and compacting of the fill in trenches or excavations up to the subgrade of the roadway or to the existing ground surface. All backfill above the pipe zone shall not exceed 8-inch maximum lifts of loose material and shall be compacted throughout to a minimum of 90% relative density. Backfill under roadways shall be compacted to 95% relative density except where noted in the plans.

## **PART 3 – EXECUTION**

### **3.1 TRENCH CONFIGURATION AND ALIGNMENT**

- A. Trenches and other excavations shall have the minimum width which the CONTRACTOR can effectively excavate and install the improvements. Excessive widths will not be permitted. Trenches shall have a recommended width between twelve (12) and twenty-four (24) inches greater than the outside diameter of the pipe to be installed. Deviations from this recommended width must be submitted to the ENGINEER in writing for approval.

### **3.2 PIPE BEDDING**

- A. Prior to placement of bedding material, the Contractor shall proof-roll to detect the presence of soft or pumping subgrade soils. The Contractor shall stabilize the subgrade with drain rock or crushed rock in accordance with the Plans, or as directed by the Engineer.

- B. The pipe bedding shall be brought to optimum moisture content and compacted to 95% density. The OWNER shall pay for initial compaction tests. All test reports shall be submitted to the OWNER prior to acceptance of the project.

### **3.3 PROCEDURE AT PIPE ZONE**

- A. After center loading the pipe to prevent lateral movement, select granular excavated material, specified under Paragraph 2.1 - Bedding, shall be placed in the trench simultaneously on each side of the pipe for the full width of the trench in layers not to exceed the spring line of the pipe. Each layer or lift shall be compacted to at least 95% of maximum density evenly, on each side of the pipe throughout the pipe zone. The pipe zone is to extend from bottom of the excavation to 12 inches above the top of the pipe and shall be backfilled with select material as specified herein.

### **3.4 PROCEDURE ABOVE PIPE ZONE**

- A. From 12 inches above the top of pipe to the top of the trench or pavement structure, pipe backfill shall consist of suitable material to meet structural backfill requirements as identified in the project-specific geotechnical investigation. Material of perishable, spongy or otherwise improper nature shall not be used in backfilling and no material greater than 2 inches in any dimension shall be placed within 1 foot of any pipe, manhole or structure.
- B. Backfill above the pipe zone and within street rights-of-way, except State Highways, shall be compacted in accordance with Section 305.14 of the Standard Specifications for Public Works Construction and the Details provided in the plans.

### **3.5 SHEETING AND SHORING**

- A. Excavation for trenches shall be properly and substantially sheeted, braced, and shored as required by OSHA and State Standards. Sheeting, bracing, and shoring shall be designed and built to OSHA standards to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances.
- B. During backfilling, any shoring shall be carefully removed by the CONTRACTOR in such a manner as will result in a minimum of caving, lateral movement, or flowing of the soil. On approval of the ENGINEER, the CONTRACTOR may leave shoring in place, but in such an event, no payment will be made by the OWNER for such materials left in place. Where trench shoring is left in place, it shall not be braced against the pipe.

### **3.6 DISPOSAL OF EXCESS EXCAVATED MATERIALS**

- A. Disposal of excess excavated material shall be the responsibility of the CONTRACTOR.

### **3.7 BLASTING**

- A. No blasting will be permitted without the approval of the ENGINEER. When blasting is permitted, it shall be done only by skilled operators and under the direction of a competent, properly licensed foreman. Blasting will be permitted only when proper precautions are taken for the protection of persons, the work, and existing structures. Any damage done to persons, private property, the work, or existing structures shall be the responsibility of the CONTRACTOR.
- B. Blasting shall be done with explosives of such power and in such quantities and positions as not to make the excavation unduly large, or to shatter the faces of cuts which are to remain open. Excessive blasting or "overshooting" will not be permitted, and any material outside the authorized cross-section which may be shattered or loosened by blasting shall be removed and replaced with earth as herein specified, at the CONTRACTOR's expense. The ENGINEER shall have authority to require the CONTRACTOR to discontinue any method of blasting which leads to overshooting or is dangerous to the public or destructive to property or to natural features.
- C. Permits for blasting shall be obtained and paid for by the CONTRACTOR.

### **3.8 MAXIMUM LENGTH OF OPEN TRENCH**

- A. Open trench at any one time shall be limited to 300 feet in areas readily accessible to the public; any exception to this requirement shall require the ENGINEER's approval with the strict understanding that no trench will remain uncovered at the end of each working day.
- B. Trenching or excavation shall not be allowed to remain open during the hours of darkness or on weekends, holidays or other periods when work is not in progress. During such periods, trenching or excavations shall be backfilled to the surrounding grade or completely covered with steel plating or other suitable material, such as cold road-mix asphalt pavement. With prior concurrence of the ENGINEER that such measures are impracticable, the CONTRACTOR may erect sound and substantial fencing or barricades completely around the periphery of such trenching or excavations to the satisfaction of the ENGINEER, or install adequate trench plates over all open trenching with the approval of the ENGINEER.

### **3.9 CONTROL OF WATER**

- A. When water is encountered, the CONTRACTOR shall furnish, install, maintain and operate all necessary machinery, appliances, and equipment to keep excavations free from water until the placing of the bedding material, laying and jointing of the pipe, pouring of concrete, and placing of the backfill material has been completed, inspected, and approved and all danger of flotation and other damages are removed. Groundwater pumped from the trench shall be disposed of in such a manner as will not cause injury to public or private property, or constitute a

nuisance or menace to the public, and shall be subject to the approval of the ENGINEER.

### **3.10 REPAIRS REQUIRED BY TRENCH SETTLEMENT**

- A. If, at any time during a period of one (1) year dating from the date of final acceptance of the project, there shall be any settlement of the trenches requiring repairs to be made, or should any other defect appear in the system due to negligence or carelessness on the part of the CONTRACTOR, the OWNER will notify the CONTRACTOR to immediately make such repairs as may be deemed necessary at the CONTRACTOR's expense.

### **3.11 SPECIAL FOUNDATION TREATMENT**

- A. Whenever the bottom of the trench is soft, yielding, or in the opinion of the ENGINEER otherwise unsuitable as a foundation for the pipe, the unsuitable material shall be removed and replaced with suitable excavated material or crusher run gravel. Payment of this work will be made only if the bottom of the trench has become unstable due to circumstances beyond the control of the CONTRACTOR.

### **3.12 EROSION CONTROL AND DEWATERING**

- A. Sediment barriers shall be installed across the entire construction right of way at all ditch/drainage crossings where necessary to prevent sediment flow into the flow-way. Removable sediment barriers can be removed during actual construction, but must be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent.
- B. Trench dewatering shall be conducted in a manner that does not cause erosion and does not result in heavily silt-laden water flowing into any wetland. Remove the dewatering structures as soon as possible after the completion of dewatering activities.
- C. The Contractor shall conduct activities in accordance with permitting associated with construction dewatering.
- D. The Contractor shall submit a plan outlining proposed dewatering and erosion control prior to construction/implementation of said activities.
- E. A SWPPP will be prepared in coordination with the low bidder and the ENGINEER. The Contractor shall be the responsible party and shall be responsible for adhering to the requirements of the SWPPP and erosion control plans.

**— END SECTION 312310 —**

## **SECTION 407000 – INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. General requirements, which apply to the SCADA Control System (hereafter referred to as I&C).
  
- B. Complete I&C System
  - 1. The I&C control panel shall be supplied by the Owner.
  - 2. The Contractor and the OSI, (Owners System Integrator), shall be responsible to the Owner for the implementation of a complete I&C System. The Contractor shall provide all necessary coordination, material and labor such that the entire system be complete and functional. This includes but is not limited to the proper operation and monitoring of electrical power systems, process systems, mechanical equipment, instrumentation, control panels, programmable controllers, and the I&C system.
  - 3. It is the Contractor's responsibility to include in the bid and installation all labor and material to provide a complete system based upon actual information from equipment being supplied for the project. Any changes or additions due to non-certified manufacturer or vendor information shall be provided at no additional cost to the Owner.

#### **1.2 CONTROL NARRATIVE**

- A. Level Control
  - 1. The wet well level is controlled by pressure transmitters located at the bottom of the wet well. There is a primary pressure transmitter and a redundant pressure transmitter. The redundant transmitter will be transferred to the primary level control if the primary pressure transmitter fails.
  - 2. Lead and lag start and stop set points will be programmed by using the HMI panel located in the SCADA panel. The pumps, if available, will rotate from lead to lag on each level cycle.
  - 3. If either of the pressure transmitters fails, an alarm signal will be sent to the main SCADA computer and the alarm dialer located in the supervisors office for logging. An alarm call will then be placed to the "ON CALL" person to address the issue.
  
- B. Extreme High Level Alarm
  - 1. A ball float switch (LSH100) is utilized for monitoring the wet well Extreme High Level Alarm. If the wet well level trips the float switch, all of the

available pumps will be called to run and will run until the wet well reaches the low level set point. At this time, the alarm signal will be sent to the main SCADA computer and the alarm dialer located in the supervisors office for logging. An alarm call will then be placed to the "ON CALL" person to address the issue.

- C. Mixer Control
  - 1. The mixer will be called to run for a preset time, HMI adjustable, before the sewage pumps will be called to run. This function can be adjusted on the HMI panel.
  
- D. Pump Monitoring
  - 1. The sewage pumps and the mixer will have "RUNNING" status inputs to the SCADA PLC. This will allow for recording "RUN" times for each motor and to monitor for "FAIL TO START OR FAIL TO RUN" alarming. If one of the pumps or the mixer goes into alarm, that alarm signal will be sent to the main SCADA computer for logging. An alarm call will then be placed to the "ON CALL" person to address the issue.
  
- E. Dry Pit Water Alarm
  - 1. A float switch is used to monitor water accumulation in the DRY PIT. If the water level in the DRY PIT reaches and trips the float switch (LSH200), that alarm signal will be sent to the main SCADA computer for logging. An alarm call will then be placed to the "ON CALL" person to address the issue.
  
- F. Generator and ATS Status
  - 1. The generator will have RUNNING, FAULT ALARM, and LOW FUEL ALARM status inputs. These alarms will be sent to the main SCADA computer for logging. An alarm call will then be placed to the "ON CALL" person to address the issue.
  - 2. There will be a "GENERATOR RUNNING FOR 1 HR" alarm that will be sent to the "ON CALL" person to address the issue.
  - 3. ATS position status will also be logged on the main SCADA computer.
  
- G. Sewage Flow Alarm
  - 1. Pumping flow will be monitored and will be alarmed if flow rate falls below set point entered in the HMI. If pumping flow rate is below set point for a preset time, alarm signal will be sent to the main SCADA computer for logging. An alarm call will then be placed to the "ON CALL" person to address the issue.
  
- H. Pump Control
  - 1. Each sewage pump will have a HAND-OFF-AUTO selector switch. AUTO will allow level control, HAND will allow local running of pumps for maintenance.

— END SECTION 407000 —

## **SECTION 407113 – MAGNETIC FLOW METER**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements for the magnetic flow meter.

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. The magnetic flow meter shall be SITRANS F M MAG 5000 Model 7ME6580-4PJ14-2AA2 by Siemens, or approved equal.
- B. The flow transmitter shall be matched to the flow tube and provided as a complete assembly by the same manufacturer (including cable kit and enclosure). The flow transmitter shall be MAG 5000 Model 7ME6910-2CA10-1AA0 by Siemens, or approved equal.

#### **2.2 FLOW METER**

- A. The magnetic flow meter shall meet the following requirements:
  - 1. Diameter: DN 200 (8")
  - 2. Flanges: ANSI B16.5, Class 150
  - 3. Flange materials and coating: Carbon steel flanges, ASTM A 105 corrosion-resistant coating of category C4-medium
  - 4. Liner materials: Ebonite Hard Rubber
  - 5. Electrode materials: Hastelloy
  - 6. Electrical connection: ½ NPT
  - 7. Provide one spare spool piece with flanged ends having the same diameter, pressure rating, and laying length as the flowmeter

## **2.3 FLOW TRANSMITTER**

- A. The flow transmitter shall meet the following requirements:
  - 1. Accuracy: Maximum measuring error  $\pm 0.4\% \pm 1 \text{ mm/s}$
  - 2. Cable kit: 15 m minimum (or as required), Model No. A5E02296464 by Siemens or approved equal
  - 3. Enclosure: Panel mounting enclosure in aluminum, NEMA 1, Model No. FDK: 083F5032 by Siemens or approved equal.

## **PART 3 – EXECUTION**

### **3.1 FIELD QUALITY CONTROL**

- A. Provide manufacturer's services to perform start-up and calibration or verification.
- B. Verify factory calibration of all instruments in accordance with the manufacturer's instructions. Submit testing and calibration forms.
- C. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

### **3.2 INSTALLATION**

- A. Install instruments at the location shown on the plans or approved by the Owner. Instruments shall be NEMA rated for the installed location.
- B. Install level and plumb. All instruments shall be provided with floor stands or wall brackets as shown or required.
- C. Mounting hardware, stands, channels, and spacers shall be either galvanized steel, stainless steel, or non-metallic to match the NEMA rated location.
- D. All screws and bolts shall be stainless steel.

**— END SECTION 407113 —**

## **SECTION 407243 – LEVEL PRESSURE TRANSMITTER**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements for the level pressure transmitters.

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. The submersible level pressure transmitter shall be Dwyer/Mercoid Model PBLT2-5-40-PU, or approved equal.

#### **2.2 LEVEL PRESSURE TRANSMITTER**

- A. The submersible level pressure transmitter shall meet the following requirements:
  - 1. Wetted Materials: Type 316 stainless steel (housing), Polyurethane (cable)
  - 2. Accuracy: +0.25% FS
  - 3. Temperature limit: 0-180 degrees F
  - 4. Power requirement: 13-30VDC
  - 5. Output signal: 4-20MA two wire
  - 6. Electrical connection: Wire pigtail
  - 7. Mounting orientation: suspended in tank below level being measured

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION**

- A. Install and calibrate transmitter and connect to elements per manufacturer's recommendations. Install at the location shown on the plans or approved by the Owner.

- B. Install instrument level and plumb. All instruments shall be provided with wall brackets as shown or required. Mounting hardware, including all screws and bolts, shall be stainless steel.

**— END SECTION 407243 —**

## **SECTION 407276 – LEVEL SWITCH**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements for the level switch.

#### **1.2 SUBMITTALS**

- A. The Contractor shall provide submittal information in accordance with Section 013300 SUBMITTALS to substantiate compliance with this specification.
- B. Operation and maintenance manuals shall be furnished for the equipment herein specified in accordance with Section 013300 SUBMITTALS.

### **PART 2 – PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. The level switch shall be a self counter-weighted floating switch, Mercoïd Model FSW2-ONPN-20, or approved equal.

#### **2.2 LEVEL SWITCH**

- A. The level switch shall meet the following requirements:
  1. Wetted materials: Polypropylene (enclosure), PVC (cable)
  2. Operating temperature: 32 to 122 degrees F
  3. Enclosure rating: IP68
  4. Switch type: SPST NO
  5. Electrical rating: 8A @250 VAC
  6. Cable length: 20 feet

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION**

- A. Install and connect to elements per manufacturer's recommendations. Install at the location shown on the plans or approved by the Owner.

- B. Install instrument level and plumb. All instruments shall be provided with wall brackets as shown or required. Mounting hardware, including all screws and bolts, shall be stainless steel.

**— END SECTION 407276 —**

## **SECTION 409249 – VARIABLE FREQUENCY DRIVES**

### **PART 1 – GENERAL**

#### **1.1 REQUIREMENTS**

- A. This section provides specification requirements for packaged Variable Frequency Drives (VFD) as a complete motor control center unit for use with NEMA B design AC motors.
- B. The VFD unit manufacturer shall furnish, field test, adjust and certify all installed VFD units for satisfactory operation. The VFD shall be integral component of the MCC and provided by the MCC manufacturer as a complete system contained within the MCC structure.
- C. Installation shall include providing housekeeping pads, setting in place, anchoring and installing all conduit and wire as required to provide for a completed system. Contractor shall make all final terminations per the interconnection drawings furnished.

#### **1.2 DEFINITIONS**

- A. Definitions: Definitions of terms and other electrical considerations as set forth in the:
  - 1. National Electrical Code.
  - 2. Institute of Electrical and Electronic Engineers, standard 519-1992.
  - 3. Instrument Society of America.
  - 4. National Fire Protection Association.

#### **1.3 SYSTEM DESCRIPTION**

- A. Power Source
  - 1. Standard commercial utility secondary power.
    - a. Voltage Levels
      - 1) As indicated on the electrical plans.
    - b. Available fault current: to be consistent with the rating of the devices in the panelboards and/or MCC feeding the VFDs.
- B. Equipment:
  - 1. As indicated on the Drawings.
- C. Manufacturer coordination requirements:
  - 1. It is the responsibility of the Manufacturer to coordinate the drive with the motor and the installed cable length to ensure that no damage can occur to the motor as a result of standing waves, high carrier frequency, high levels of dv/dt, etc. Any changes that may need to be made in order

to protect the equipment shall be made by the Manufacturer at no additional costs to the OWNER.

2. It is the responsibility of the Manufacturer to coordinate the drive with the motor and the installed cable length to ensure that the drive can charge the cable capacitance. Any changes that may need to be made in order to protect the equipment shall be made by the Manufacturer at no additional costs to the OWNER.
3. The manufacturer shall coordinate the connection requirements and equipment ratings between the pump supplier, motor supplier and contractor to insure a complete and operable VFD system compatible with the equipment being controlled.
4. The VFD supplier shall certify that all equipment and materials have been coordinated prior to installation and operation of the VFD.

#### **1.4 SUBMITTALS**

- A. Furnish complete submittals in accordance with Section 013300.
  1. Submittals shall be custom prepared by the VFD manufacturer for this specific application.
- B. Submittal information shall include, but not be limited to:
  1. Equipment dimensions.
  2. Catalog cuts of major components.
  3. Spare parts list, per paragraph 1.11 of this Section.
  4. Certifications, including:
    - a. Certification statement stating that the VFD, Motor, and Driven equipment constitute a fully and completely matched system for the application and the installed conditions.
  5. Complete wiring and interconnection drawings.
  6. Confirmation that the drive is sized for the full motor horsepower at the installed altitude.
- C. Operations and maintenance manual
  1. Complete English language narrative describing operation, set-up, start-up, and trouble shooting of drive.
  2. Complete wiring diagrams.
  3. Complete parts list.

#### **1.5 QUALITY ASSURANCE**

- A. Regulatory Requirements
  1. Local Laws and Ordinances.
  2. State and Federal Laws.
  3. NFPA-70, National Electric Code.
  4. American National Standards (ANSI).
  5. National Electrical Manufacturers Association (NEMA).
  6. Institute of Electrical and Electronics Engineers (IEEE).
  7. Listings and labeling:

- a. When incorporated into a motor control center, all portions of the motor control center, vertical bays, VFD, and components shall bear UL or other nationally recognized independent test laboratory labels.
  - b. VFD shall bear a UL or other nationally recognized independent testing laboratory label.
- B. The entire VFD system shall be factory assembled and system tested to assure a properly coordinated system.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Variable Frequency Drives shall be protected from the elements during storage, and must be stored indoors in dry heated areas.

## **1.7 WARRANTY**

- A. Variable Frequency Drive.
  - 1. Provide a full two-year warranty that shall cover all parts and labor needed to replace any and all components in the variable frequency drive for a period of two years from complete and final acceptance of the total project.
    - a. Warranty shall not require the return of parts or OWNER removal or installation of parts.

## **PART 2 – PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable drive manufacturers:
  - 1. Cutler-Hammer.
  - 2. Siemens
  - 3. Square D
  - 4. Allen Bradley

### **2.2 EQUIPMENT**

- A. The VFD system, in order to meet the requirements of these specifications, shall consist of: converter section, output inverter, and control logic section. All components listed shall be integral to the VFD, factory wired and tested as a complete system.
- B. Input circuit breaker will be located within the motor control center that is supplying power to the VFD as indicated on the plans.
- C. Maximum input voltage unbalance shall be 0.5% as defined in NEMA MG1.14.35.2.

- D. VFD system shall maintain a 0.95 minimum true power factor throughout the entire speed range.

## 2.3 COMPONENTS

- A. Variable Frequency Drives
  - 1. General:
    - a. IGBT Drive.
    - b. Voltage or Current input signal control.
    - c. Ground fault protection.
  - 2. Operator interface.
    - a. Drive/door mounted.
    - b. 2-line x 16- character backlit LCD display.
    - c. Scalable units of measure.
  - 3. Minimum integral protection furnished with the drive:
    - a. Under and overvoltage protection.
    - b. Output phase-to-phase short circuit.
    - c. Output phase to ground.
    - d. I2T motor overload protection.
    - e. Drive thermal protection.
  - 4. Control outputs:
    - a. Minimum of two programmable discrete dry contact outputs.
      - 1) Drive running.
      - 2) Drive failed.
    - b. Minimum of two programmable analog isolated 4-20 mA output.
      - 1) Drive output speed.
      - 2) Drive output speed.
  - 5. Control Inputs:
    - a. Minimum of eight programmable inputs
      - 1) Drive Start/Stop Input Source A
      - 2) Drive Start/Stop Input Source B
      - 3) Speed Source A or B Select
      - 4) Drive Shutdown/Stop
      - 5) Drive Reset
      - 6) Auxiliary Input
      - 7) Drive Hand Control (Local Panel Operator Speed Select)
    - b. Minimum of two analog 4-20 mA analog inputs
      - 1) Speed Source A Control
      - 2) Speed Source B Control
  - 6. Input specifications, unless otherwise indicated on the Drawings:
    - a. Three Phase 480 VAC.
    - b. Frequency: 60 Hz.
    - c. Power ride through: 15 msec.
  - 7. Output specifications:
    - a. Voltage: Fully programmable from 0 to nominal input voltage.
    - b. Frequency range: 0-400 Hz.
    - c. Frequency resolution: 0.01 Hz.
    - d. Continuous current: 100% of rated current.

- e. Intermittent Current: 150% of rated current for 60 seconds.
- f. Current trip: 200% of rated current.
- 8. Drive adjustments
  - a. Accel/Decel Time: 0.0-3600 Seconds in 0.1 second Increments.
  - b. Accel/Decel Type: Linear or S-ramp.
  - c. Minimum frequency: 0 to 120 Hz.
  - d. Maximum frequency: 40 to 400 Hz.
  - e. Stop mode: Coast/ramp/DC Brake to Stop.
  - f. Current Limit: 20 to 150%.
  - g. Motor overload: 20 to 115%.
  - h. DC Boost: 0-25% of input voltage.
  - i. Adjustable Start Delay
- 9. Audible Noise
  - a. Adjustable carrier for quiet operation.
- 10. Ambient operating temperatures
  - a. NEMA 1 enclosure: 0-50°C.
  - b. NEMA 12 enclosure: 0-40°C.
- 11. Control Scheme:
  - a. As indicated on the control drawings.
- 12. Manufacturer coordination requirements:
  - a. It is the responsibility of the Manufacturer to coordinate the drive with the motor and the installed cable length to ensure that no damage can occur to the motor as a result of standing waves, high carrier frequency, high levels of dv/dt, etc. Any changes that may need to be made in order to protect the equipment shall be made by the Manufacturer at no additional costs to the OWNER.

## **2.4 COMMUNINCATIONS**

- A. None

## **2.5 ACCESSORIES**

- A. As required to meet the operation as defined by the P&IDs, control wiring schematics, electrical single lines and loop descriptions.

## **2.6 SPARE PARTS**

- A. Provide one spare 15 HP drive system complete.

## **PART 3 – EXECUTION**

### **3.1 CONFIGURATION**

- A. The drive controller shall be programmed and configured to meet the project requirements prior to factory testing. The VFD inputs and outputs shall be

programmed to perform the desired functions as indicated on the control wiring diagrams and referenced in the sequence of operation.

- B. The drive shall be programmed to operate the motor at the indicated load for the type of drive unit utilized.
- C. The drive shall be programmed such that when it is switched to manual control via a panel H-O-A switch, the drive speed is controlled by the local operator interface panel.

### **3.2 SOURCE QUALITY CONTROL**

- A. Variable Frequency Drives, Factory Testing.
  - 1. Component tests.
    - a. Incoming inspection of components and raw materials based on strategic supplier base and experience. Sampling plans based on MIL STD 105E.
    - b. MIL STD 45662 calibration system.
    - c. All products subject to 100% testing and final inspection; no sampling plans permitted.
- B. Variable Frequency Drives, Factory Testing.
  - 1. Component tests.
    - a. All components shall be 100 percent tested.
    - b. All printed circuit boards shall be burned-in continuously for 50 hours at 50 °C.
    - c. The printed circuit boards shall be tested after burn-in to insure proper performance, with specified tolerances.
    - d. Control power shall be applied to microprocessors, printed circuit boards, diagnostic boards, and similar devices including software to test for proper operation, sequencing, logic and diagnostics.
    - e. All wiring shall be checked for continuity and for compliance with the wiring diagrams.
- C. Furnish all cables, conduit, lugs, bolts, expansion anchors, sealants, and other accessories needed to completely install the VFD for the line, load and control connections.
- D. Assemble and install the VFD in the locations and with the layouts shown on the Drawings and in complete conformance with the manufacturer's recommended procedures.
- E. Furnish all components, drills, tools, etc., as required to complete the installation.
- F. Replace any hardware lost or damaged by the installation or handling to provide a complete installation.
- G. Provide openings in top or bottom of the VFD for conduit only, no additional openings will be allowed.

1. Mis-cut holes will require that the entire vertical bay or removable panel be replaced. No hole closers or patches will be allowed.
- H. Bundle circuits together and terminate in each unit.
  1. Tie with nylon wire ties.
  2. Label all wires at each end with wire numbers shown on the approved control drawings.
  3. All connections to and from the VFD enclosure must be made via dedicated field terminal blocks.
- I. Furnish all mounting brackets, stands, etc. that may be required to physically mount the VFD.
- J. Tolerances
  1. Install the VFD so that it is plumb and level to within  $\pm 1/16$  inch across its entire dimension.

### **3.3 FIELD QUALITY CONTROL**

- A. Manufacturer shall provide the services of a factory technician for installation coordination, start-up, technical assistance and training.
  1. Testing, checkout, and startup of the variable frequency drive equipment in the field shall be performed under the technical direction of the Manufacturer's Service Engineer.
  2. Adjust program and modify the drive as required based on the actual load and operational requirements in the field.
  3. Under no circumstances are any portions of the drive system to be energized without authorization from the Manufacturer's Representative.

### **3.4 ADJUSTING**

- A. Make all adjustments as necessary and recommended by the manufacturer, ENGINEER, or testing firm.
- B. Adjust circuit breakers and program drive in accordance with the time-current coordination study.

### **3.5 CLEANING**

- A. Clean and vacuum all enclosures to remove all metal filings, surplus insulation, and visible dirt, dust, and other matter before starting system or energization of equipment.
- B. Do not use compressors or air blowers for cleaning.

### **3.6 DEMONSTRATION**

- A. Demonstrate the operation to the ENGINEER's and OWNER's satisfaction.

### **3.7 PROTECTION**

- A. Protect all equipment from damage or degradation after testing is complete until the Project is substantially completed and accepted by the ENGINEER and OWNER.

**— END OF SECTION 409249 —**