

SECTION 221313 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Site Wide Materials Management Plan to be provided by the Selected Bidder

1.2 SUMMARY

- A. Section Includes sanitary sewer system outside of the building, such as:
 - 1. Pipe and fittings.
 - 2. Nonpressure and pressure couplings.
 - 3. Expansion joints and deflection fittings.
 - 4. Cleanouts.
 - 5. Encasement for piping.
 - 6. Manholes.
- B. Related Sections include the following:
 - 1. Division 01 Section, "Construction Waste Management"
 - 2. Site Wide Materials Management Plan to be provided by Selected Bidder

1.3 DEFINITIONS

- A. DIP: Ductile Iron Pipe

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity Flow, nonpressure – piping pressure ratings: At least equal to system test pressure.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Ductile Iron or PVC sanitary sewer piping
 - 2. Manhole Structures
 - 3. Connections to existing sanitary sewer system
- B. Shop Drawings: For piping material, cleanouts, connection to existing sewer pipe and pipe testing methodology. Include plans, elevations, sections, details, frames and covers.

- C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- D. Field quality-control reports and testing results

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic cleanouts, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle piping and cleanouts according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Site information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Engineer and Owner no fewer than three days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Engineer and Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings: According to the following:
 - 1. PVC Gravity Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D-3034, SDR 35, for solvent-cemented or gasketed joints.
 - a. ASTM F477, elastomeric seals.
 - b. Joints shall be push-on type in accordance with ASTM D-3212.
 - c. Rubber ring gaskets in accordance with ATM D-1869.
- B. DIP – Ductile Iron Sewer Pipe and Fittings: According to the following:
 - 1. Ductile Iron Pipe shall be centrifugally cast, cement lined pipe with approved rubber ring push on joints to latest ANSI/AWWA Designation A21.51-198 (AWWA C151-86) specifications. Pipe may be furnished in 18 or 20 foot nominal laying lengths.

2. The joint shall be rubber gasket conforming to latest ANSI/AWWA Designation A21.11/C-111. Joints shall be of the bell and spigot type with rubber ring. Where a ductile iron pipe is to be joined to PVC-SDR-35 pipe, transition couplings shall be furnished and installed. Transition couplings shall be iron as manufactured by Ford (style C62), Dresser (style 162) or approved equal.
3. Pipe shall be furnished with flanges where connections to flange fittings are required and conform to latest ANSI/AWWA Designation C115/A21.15. Flanged pipe shall be Class 52 (minimum).
4. The outside of the ductile iron pipe shall be coated with a uniform thickness of hot applied coal tar coating in accordance with ANSI/AWWA C150/A21.50 and the inside shall be lined with cement in accordance with latest ANSI/AWWA Designation A21.4/C-104.

2.2 MANHOLES

- A. Normal-Traffic Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
 1. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.
 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 5-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 4. Riser Sections: 5-inch (100-mm) minimum thickness, and lengths to provide depth indicated.
 5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 6. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
 7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 229-mm) total thickness that matches frame and cover.
 8. Steps: Fiberglass or Aluminum, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12-inch intervals. Steps: ASTM C 478 (ASTM C 478M), individual steps or ladder.
 9. Pipe Connectors: Flexible rubber manhole sleeves or boot secured to pipe with stainless steel strapping or equal. PVC pipe to manhole seal shall be A-lok gasket or equal.
- B. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
 1. Ballast: Increase thickness of concrete, as required to prevent flotation.
 2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 229-mm) total thickness that matches diameter of frame and cover.
 3. Steps: Fiberglass or aluminum, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12-inch intervals.

4. Steps: Manufactured from deformed, 1/2-inch (13-mm) steel reinforcement rod complying with ASTM A 615/A 615M and encased in polypropylene complying with ASTM D 4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12-inch intervals.
- C. Manhole Frames and Covers: ASTM A 48, Class 30B, Graycast-iron castings designed for heavy-duty service. Include indented top design with lettering as shown on the detail.

2.5 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.
- C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio. Include channels and benches in manholes.
 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 2. Benches: Concrete, sloped to drain into channel.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.

2.6 PROTECTIVE COATINGS

- A. Description: One- or two-coat, coal-tar epoxy; 15-mil (0.38-mm) minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:
 1. Concrete Manholes: On exterior and interior surfaces.

2. Manhole Frames and Covers: On entire surfaces.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Site Wide Management Plan".

3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe- jacking process of microtunneling.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of 2 percent unless otherwise indicated.
 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 3. Install piping with minimum cover. As indicated on construction plans.
- G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.4 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Join dissimilar pipe materials with nonpressure-type, flexible couplings.
- B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
 - 1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Shielded flexible couplings for pipes of same or slightly different OD.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 - d. Use pressure pipe couplings for force-main joints.

3.5 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Install FRP manholes according to manufacturer's written instructions.
- D. Form continuous concrete channels and benches between inlets and outlet.
- E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
- F. Install manhole-cover inserts in frame and immediately below cover.

3.6 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.7 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use ductile Iron pipe fittings in sewer pipes at branches for cleanouts, and use ductile Iron pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 6 inches deep. Set with tops 1 inch above surrounding grade except within athletic field where cleanouts cover shall be set 12" below grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.8 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."
- B. Make connections to existing piping and underground manholes.
 1. Use commercially manufactured wye fittings or saddle connection for piping branch connections as indicated on the plans.
 2. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3500 psi unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- C. Connect to grease oil and sand interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

3.9 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
 1. Use warning tape or detectable warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of

underground manholes.

3.10 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate report for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 93 percent of piping diameter. Deflection testing shall not be conducted earlier than seven (7) days after placement and compaction of backfill.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Low Pressure Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Clean and flush all lines, and all debris flushed out shall be removed at each downstream manhole. All test plugs, gauges, an air compressor, and personnel for conducting the acceptance testing shall be provided by the Contractor. The test shall be conducted under the supervision of the Owner and the Authority having Jurisdiction.
 - b. Securely plug each manhole in the section being tested. All stoppers shall be adequately braced.
 - c. Air shall be slowly supplied to the plugged section of pipe to be tested until the internal air pressure reaches 4.0 psi greater than the average backpressure of any groundwater that may submerge the pipe. At least two (2) minutes shall be allowed for temperature stabilization before proceeding further. The back pressure of any groundwater caused by water head above the invert of the pipe must be determined by a method approved by the Owner or its representative. This back pressure must be added to the

- standard test pressures to compensate for groundwater effect on the air test.
 - d. The rate of air loss shall be determined by measuring the time interval required for any internal pressure decrease from 3.5 psi to 2.5 psi greater than the average backpressure of any groundwater that may submerge the pipe.
 - e. The pipeline shall be considered acceptable when the 1.0 psi pressure drop is not less than the holding time acceptable to the Authority having jurisdiction.
 - C. Leaks and loss in test pressure constitute defects that must be repaired.
 - D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.
 - E. The contractor must televise all sanitary sewer improvements after the pavement base course has been installed. The televised tape shall be submitted to City of Elizabeth Engineering and Sewer Department for their review and approval.
 - F. The contractor shall be responsible to coordinate, schedule and perform all testing as required by the City of Elizabeth Engineering and Sewer Department, architect and the plumbing code official. In addition, the contractor shall be responsible to coordinate and schedule all required inspections by the authority having jurisdiction.
- 3.11 CLEANING
- A. Clean dirt and superfluous material from interior of piping.

END OF SECTION 221313