

**SECTION 22 13 13 - 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.

## 1.2 SUMMARY

- A. Section Includes:

1. PVC pipe and fittings.
2. Non-pressure-type transition couplings.
3. Pressure-type pipe couplings.
4. Expansion joints and deflection fittings.
5. Cleanouts.
6. Manholes.
7. Concrete.
8. Packaged Duplex Sanitary Grinder Pump Station

- B. As local authority having jurisdiction, all improvements shall be in compliance with the requirements of the Brunswick-Glynn County Joint Water and Sewer Commission, as well as all state and local requirements.

- C. All work performed under this Section shall be in complete conformance with the requirements of the Brunswick-Glynn County Joint Water and Sewer Commission, including, but not limited to,

1. BGJWSC Standards for Water & Wastewater Construction, by BGJWSC Planning & Construction Division, 1703 Gloucester Street, Brunswick, Georgia, 31520, dated January 2024 or later as amended, including:

- a. Section 1.0 Design Standards

- b. Section 2.0 Typical Details
- c. Section 3.0 Acceptable Products & Manufacturers
- d. Section 4.0 Technical Specifications

### 1.3 DEFINITIONS

- A. JWSC Brunswick-Glynn County Joint Water and Sewer Commission

### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Pipe and fittings.
  - 2. Non-pressure and pressure couplings
  - 3. Expansion joints and deflection fittings.
  - 4. Cleanouts.
- B. Shop Drawings:
  - 1. For manholes. Include plans, elevations, sections, details, and frames and covers.
  - 2. For pump stations. Include all products, installation methods, and manufacturers data, and all necessary and pertinent data.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of pipe and fitting.
- B. Field quality-control reports.

### 1.6 DELIVERY, STORAGE, AND HANDLING

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

## 1.7 FIELD CONDITIONS

- A. 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 Owner no fewer than seven days in advance of proposed interruption of service.
  2. Do not proceed with interruption of service without Owner's written permission.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Materials:
1. The type, class, grade, and alignment of sewer pipe may be changed only at manholes. The only exception to this being where a gravity sewer main crosses under a storm drain and the invert of the storm drain is less than 3 feet above the crown of the sewer main. In such cases, a full twenty (20) foot joint of ductile iron pipe shall be centered under the storm drain and joined to PVC or HDPE pipe with a mechanical joint or stress resistant coupling.
  2. Gravity sewer mains shall be ASTM 3034, SDR-26 heavy wall sewer pipe or DR-17 HDPE. Gravity sewer mains within steel casings or PVC DR18 casing pipes shall be ASTM 3034, SDR 26 heavy wall sewer pipe and shall be installed with approved skids or spacers to hold grade and prevent flotation in accordance with these specifications.
  3. Ductile iron pipe is only permitted for gravity sewer use where the mains or laterals are above ground as in ditch crossings. The only exception being storm drain crossings as cited above.
  4. All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified, shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.
  5. Pipe to be installed underground using open-cut methods shall be PVC push-on joint type as described in these specifications, or as accepted within these specifications for storm drain crossings. Pipe installed above ground shall be

Sewer-Safe restrained joint ductile iron pipe or flanged ductile iron pipe as described in these specifications.

6. Pipe bursting or horizontal boring construction: Not Used.

## 2.2 NON-PRESSURE PIPE AND FITTINGS

### A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Markings: Each length shall be clearly marked with the name of the manufacturer, location of the plant, pressure rating, nominal pipe diameter and length.
3. Fittings: ASTM D3034, PVC with bell ends.
4. Gaskets: ASTM F477, elastomeric seals.
5. Color: Green
6. Material storage and handling: AWWA Manual M23, Chapter 6

## 2.3 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

### A. Mechanical-Joint Piping, for use at utility crossings only:

1. Pipe: ANSI A21.50 (AWWA C150) and ANSI A21.51 (AWWA C151); pressure class 150 (minimum); ISO 9000 certified.
  - a. Markings: Each length shall be clearly marked with the name of the manufacturer, location of the foundry, pressure rating, thickness or pressure class, nominal pipe diameter, weight of pipe without lining, maximum depth of bury, and length.
  - b. Coating: Bituminous coating per ANSI A21.51. Coating shall be continuous and smooth, neither brittle when cold nor sticky when exposed to the sun and shall be strongly adherent. If installed in a corrosive soil, then all bolts, nuts, studs and other uncoated parts of joints for underground installation shall be coated with asphalt or coal-tar prior to backfilling.

- c. Lining: Sewer Safe internally lined with approved amine cured novalac epoxy coating containing at least 20% by volume of ceramic quartz pigment.
  - d. Color: Pipe shall be clearly marked with the name of the manufacturer, location of the foundry, pressure rating, thickness or pressure class, nominal pipe diameter, weight of pipe without lining, maximum depth of bury and length.
  - e. Manufacture: All pipe furnished shall be cast and machined at a single foundry location to assure quality control and provide satisfactory test data.
  - f.
2. Fittings: Compact; ANSI A21.10 (AWWA C110), A21.11 (AWWA C111), A21.15 (AWWA C115) and/or A21.53 (AWWA C153); ductile or gray iron; pressure class 350 (minimum); ISO 9000 certified. UL/FM approved. NSF Standard 61.
- a. Markings: Fittings shall be cast with the pressure rating, nominal diameter of openings, manufacturer's name, foundry location, plant code and degrees or fraction of the circle. Cast letters and figures shall be on the outside body of the fitting.
  - b. Coating: Bituminous coating per ANSI A21.51. Coating shall be continuous and smooth, neither brittle when cold nor sticky when exposed to the sun and shall be strongly adherent. If installed in a corrosive soil, then all bolts, nuts, studs and other uncoated parts of joints for underground installation shall be coated with asphalt or coal-tar prior to backfilling.
  - c. Lining: Sewer Safe internally lined with approved amine cured novalac epoxy coating containing at least 20% by volume of ceramic quartz pigment.
  - d. Manufacture: All fittings furnished shall be cast and machined at a single foundry location to assure quality control and provide satisfactory test data.
  - e.
3. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
4. Gaskets: AWWA C111/A21.11, rubber, of shape matching pipe, fittings, and glands.

## FORCE MAIN PIPE AND FITTINGS

## B. PVC Force Main

1. Pipe: ASTM D2241, SDR 21, Class 200 PVC
2. Joints: Elastomeric integral bell gasketed restrained joints, ASTM D2241
3. Size: Per plans, 1.25" to 1.5" diameter, IPS
4. Color: Green, marked: Forced Sewer
5. Comply with all requirements of JWSC.

## C. HDPE Force Main

1. Pipe: ASTM D3035, DR11 HDPE Pipe (High Density Polyethylene)
2. Joints: Butt fused joints
3. Size: Per plans, 1.25 to 2" diameter, IPS size
4. Color: Green
5. Comply with all requirements of JWSC

## 2.4 NON-PRESSURE-TYPE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground non-pressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  1. For Cast-Iron Soil Pipes: ASTM C564, rubber.
  2. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
  3. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

## 2.5 PRESSURE-TYPE PIPE COUPLINGS

- A. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.
- B. Metal, bolted, sleeve-type, reducing or transition coupling; for joining underground pressure piping. Include 200-psig minimum pressure rating and ends of same sizes as piping to be joined.
- C. Center-Sleeve Material: Stainless steel
- D. Gasket Material: Natural or synthetic rubber.
- E. Metal Component Finish: Corrosion-resistant coating or material.

## 2.6 CLEANOUTS

- A. Cast-Iron Cleanouts:
  - 1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
  - 2. Top-Loading Classification(s): Heavy Duty and Extra-Heavy Duty.
  - 3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

## 2.7 MANHOLES

- A. Standard Precast Concrete Manholes:
  - 1. Diameter: The minimum manhole inside diameters for gravity sewer lines shall be:
    - a. Lines six (6) inches through sixteen (16) inches: Four (4) feet .
    - b. Lines eighteen (18) inches through thirty (30) inches: Five (5) feet.
    - c. Lines thirty-six (36) inches through forty-eight (48) inches: Six (6) feet.
    - d. Lines greater than forty-eight (48) inches: Eight (8) feet.

- e. Where the depth of a manhole, (from finished grade to lowest pipe invert), is fifteen (15) feet or greater, the minimum manhole diameter shall be five (5) feet.
2. Precast Concrete Manholes:
    - a. Precast concrete manholes or calcium aluminate cement concrete manholes used shall conform to all requirements of ASTM Designation C478 at minimum and be provided with "O" ring gasket type joints, conforming to ASTM Designation C443-77, or flexible joint sealant roping of butyl rubber conforming to Federal Specification SS-S-210A, AASHTO M-198, Type B-Butyl Rubber with a minimum cross section of 1 ¼ inches, and shall be:
      - 1) Constructed using a top section cast monolithically and shaped as an eccentric cone, or for manhole depths five (5) feet or less be a concentric cone, joint systems must match associated riser or base sections; the clear opening for the manhole frame & cover shall not be less than twenty four (24) inches for main sewers six (6) inches through eighteen (18) inches in diameter, and not less than thirty two (32) for main sewers greater than eighteen (18) inches in diameter;
      - 2) constructed using riser sections cast monolithically having a minimum lay length of sixteen (16) inches and of joint systems matching associated base and cone sections;
      - 3) constructed using a base section cast monolithically having a minimum lay length of sixteen (16) inches and a joint system matching associated riser and cone sections;
      - 4) constructed, where depth permits, using a precast eccentric transition section to reduce base section diameters of six (6) foot or greater, to five (5) foot diameter at finish grade. Such transitions shall not be made less than four (4) vertical feet above the invert bench;
      - 5) constructed, where manhole depth will not permit a diameter transition section, using a precast flat slab top section with centered thirty-two (32) inch diameter hole for the manhole frame & cover opening;
      - 6) constructed using precast inverts providing clearance for pipe projecting a minimum of two (2) inch inside the manhole wall, troughs formed and finished to provide a minimum slope of 1.25% from the pipe outlet to the inlets, minimum concrete thickness from

the bottom of the lowest invert to the bottom of the base not less than eight (8) inches, invert benches with a uniform 2:1 slope from the high point at the manhole wall to the lip of the invert trough; trough depth from the lip of the invert trough to the invert of the pipe to be 50% of the main pipe diameter; inverts shall be free from depressions, high spots, voids, chips or fractures over one fourth (1/4) inch in diameter or depth;

- 7) hand-formed inverts, when approved for use, shall meet or exceed the durability, strength, configuration and hydraulic "smoothness" as required for precast inverts. Filler for inverts shall be holed burned brick;
  - 8) steps, on the vertical or straight wall of four (4) foot and five (5) foot diameter manholes shall be aligned vertically on sixteen (16) inch centers, secured to the wall with a compression fit in tapered holes or cast in place, coated with a copolymer polypropylene plastic coating, reinforced with one-half (1/2) inch diameter grade 60 bar with serrated treads and tall end lugs; step pullout strength shall be 2000 lbs. minimum when tested according to ASTM C497; steps shall begin no less than eighteen (18) inches from the manhole rim and end no closer than sixteen (16) inches above the manhole bench;
  - 9) Steps shall not be used on manholes greater than five (5) foot in diameter or where a concentric cone or flat-slab top is the final section;
  - 10) Lifting, devices for handling precast manhole section components shall comply with OSHA Standard 1926.704;
  - 11) Manhole entrance couplings with the entry pipes greater than eighteen (18) inch in diameter shall be fitted with pipe entrance connectors conforming to ASTM C923, and for eighteen (18) inch pipes and smaller to ASTM C-425 using neoprene boot inserts tightened to the pipe using a stainless steel adjustable band, ("A-Loc" or approved equal), rigid cement or synthetic type grout collars are not acceptable as a seal between the manhole and entry pipe in new construction.
3. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

4. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
  - a. Adjustments using clay or cement brick are not acceptable.
  - b. On new construction, an adjustment using metal riser rings to extend the manhole cover frame to grade is not permitted.
  - c. No adjustment using grade rings between the top cone section and the manhole cover frame shall exceed sixteen (16) inches.
  
5. Corrosion Protection
  - a. Manhole corrosion protection shall be provided for manholes in accordance with the following schedule based on detention time of sewer flow from the uppermost region of the contributing pipe reach using an average velocity of two (2) feet/seconds:

Vapor H2S	Corrosion Risk Level	Detention Time	Corrosion Protection
0-10 PPM	No or Low	<2 Hr	None
11-50 PPM	Moderate	2-4 Hr	Coal Tar Epoxies
>50 PPM	High	>4 Hr	Calcium Aluminates Epoxy Coatings Approved Lining Systems
FM Discharge MH	High	n/a	Calcium Aluminates Epoxy Coatings Approved Lining Systems

- 1) Corrosion protection for High Risk manholes shall be hydrogen sulfide resistant cementitious products containing calcium aluminates applied at a minimum of one-half (1/2) inch to three-fourths (3/4) inch in thickness or epoxy coatings applied a minimum of 150 mil thickness onto all interior manhole surfaces, excluding the trough, after proper substrate preparation; or precast manholes manufactured of calcium aluminate cement concrete; or manholes manufactured of fiberglass. Alternatives that provide equal or better protection may be approved.
  
- 2) Any manholes receiving the discharge from upstream lift stations shall be considered a High-Risk manhole and the 2nd and 3rd

manholes downstream shall be considered Moderate Risk manholes and protected per this standard.

B. Manhole Frames and Covers:

1. Description: Manhole frames and covers shall be Gray Cast Iron conforming to specification ASTM-A48 Class 35B. Castings shall be of uniform quality, and free from blowholes, porosity, hard spots, shrinkage distortion and other defects. Frames and covers shall be smooth, well-cleaned by shot blasting and shall remain unpainted. All castings shall be manufactured true to pattern, and component parts shall fit together in a satisfactory manner. The frame and cover shall be designed to withstand an AASHTO H-20 wheel loading. The frame and cover shall have an "O" Ring type rubber seal or neoprene gasket designed to eliminate or significantly reduce surface water infiltration, have two non-penetrating pick-holes in the cover and four one (1) inch diameter anchor holes in the frame flange. The cover shall read "Sanitary Sewer"
  - a. Manhole frames and covers on four (4) foot diameter manholes shall have a minimum inside opening diameter of not less than twenty-three (23) inches and no more than twenty-four (24) inches and considered a standard twenty-four (24) inch frame & cover;
  - b. Manhole frames and covers on five (5) foot diameter manholes and greater shall have a minimum inside opening diameter of not less than thirty (30) inches and not more than of thirty-one (31) inches and considered a standard thirty two (32) inch frame & cover;
  - c. Manhole frames and covers within easements and in areas where security is an issue shall be equipped with manhole locking devices or bolt down covers.

2.8 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350 (ACI 350M), and the following:
  1. Cement: ASTM C150/C150M, Type II.
  2. Fine Aggregate: ASTM C33/C33M, sand.
  3. Coarse Aggregate: ASTM C33/C33M, 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. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420-MPa) deformed steel.
- C. Manhole 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. Construct and form benches per JWSC standard details.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420-MPa) deformed steel.
- E. Sewer Manhole Drop Connection:
1. Construct where indicated on plan or required by JWSC.
  2. Construct per JWSC standard details.

## 2.9 PACKAGED SANITARY LIFT STATION

- A. Packaged Sanitary Lift Station (Private)
1. Packaged duplex grinder pump sanitary sewer pump station.
    - a. Designed for sanitary sewage use.
    - b. Removable, duplex grinder pumps, drywell access to pumps.
    - c. Check valves.
    - d. Wet well, minimum storage: Refer to plans. Provide integral venting system.
    - e. Discharge: Refer to plans for flow rate and operating conditions.
    - f. Power and controls package with audible and visual status/alarms.

- g. Remote Audible and Visual Alarms: Power loss, high level, trouble/malfunction, manual alarm silence.
- h. Status Indicators: Normal, pump running, high level. Hand/Off/Auto.
- i. Trouble Indicator: run dry, overpressure, brownout, voltage, extended run time.
- j. Indicator: runtime hours, cycle count.
- k. Control Enclosure: NEMA 4X enclosure assembly, lockable, UL listed.
- l. Basis of Design:
  - 1) Refer to plans for Basis of Design.
  - 2) Approved equal.
- 2. Provide anti-floatation ballast collar, sized as required.
- 3. Provide weatherproof emergency power receptacle.
- 4. Provide electrical service connection appropriate to equipment provided.
- 5. Install in complete conformance with manufacturer's requirements and instructions.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details to 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. Install gravity-flow, non-pressure, drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope as indicated on plans.
  2. Install piping NPS 4 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 36-inch minimum cover.
  4. Install ductile-iron, gravity sewer piping according to ASTM A746.
  5. Install PVC Type PSM sewer piping according to ASTM D2321 and ASTM F1668.
  6. Install PVC gravity sewer piping according to ASTM D2321 and ASTM F1668.
- F. Install force-main, pressure piping according to the following:
1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
  2. Install piping with 36-inch minimum cover in yard areas, 42" minimum cover in pavement areas.
  3. Install PVC pressure piping according to AWWA M23 or to ASTM D2774 and ASTM F1668.
- G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A674 or AWWA C105/A21.5:
1. Ductile-iron pipe and fittings.
- H. 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.

### 3.2 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, non-pressure, drainage piping according to the following:
  - 1. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
  - 2. Join PVC Type PSM sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.
  - 3. Join dissimilar pipe materials with non-pressure-type, flexible couplings.
- B. Join force-main, pressure piping according to the following:
  - 1. Join PVC pressure piping according to AWWA M23 for gasketed joints.
  - 2. Join PVC water-service piping according to ASTM D2855.
  - 3. Join dissimilar pipe materials with pressure-type couplings.
- C. 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 non-pressure flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.
  - 2. Use pressure pipe couplings for force-main joints.

### 3.3 PIPE TRENCH CONSTRUCTION, BEDDING, BACKFILL AND WORKMANSHIP

- 1. At no time shall the bedding, haunching, initial backfill or final backfill be less than, or in contradiction to the pipe manufacture's recommendations for the pipe materials being used.
- 2. Rigid Pipe: (Ductile Iron Pipe)
  - a. Rigid Pipe Materials (DIP) shall be laid in a Type 2 (flat bottomed) trench with a pipe bedding of Class I gravel or naturally occurring clean compacted sand, as necessary to provide a firm unyielding pipe foundation; or where the natural trench foundation is weak, on a Class I (#57 or #64 stone) gravel of sufficient depth to provide a firm and unyielding foundation, (in both cases, the compacted bedding shall extend across the entire width of the trench to undisturbed trench walls on either side of the pipe); initial backfill (from bedding to pipe crown) shall be hand tampered

gravel or sand material free from cinders, ashes, refuse, vegetable, or organic material, boulders, rocks, or stones, frozen soil or other materials that, in the opinion of the JWSC is unsuitable.

- b. Final backfill in non-traffic areas, (from pipe crown to final grade), shall be Class IV material or better and free of boulders, rocks and stones greater than three (3) inches in their greatest dimension, tree trunks or limbs, brush from clearing, refuse or trash, frozen soil or any organic materials which may decompose and create voids. Refer to specification Section P-152, Excavation, Subgrade and Embankment.
  - c. Final backfill in traffic areas shall be as specified in Section P-152, Excavation, Subgrade and Embankment to the bottom of proposed pavement structure. Final backfill on non-traffic areas shall be as specified in Section P-152, Excavation, Subgrade and Embankment.
3. Flexible Pipe (PVC, HDPE)
    - a. Flexible Pipe Materials (PVC, HDPE) shall be laid in a Type 2 trench with Class I gravel or naturally occurring clean compacted sand bedding material as necessary to provide a firm unyielding pipe foundation; or, where the naturally existing foundation is weak, on a Class I gravel bedding of sufficient depth to provide a firm and unyielding foundation; initial backfill (from bedding to crown of the pipe) shall be Class I material placed with shovel slicing (haunching) or clean naturally occurring hand-tamped sand along the sides of the pipe to insure firm side support and that no voids exist along the pipe barrel or between the pipe barrel and the undisturbed trench walls.
    - b. Final backfill for traffic areas and non-traffic areas shall be as specified in Section P-152, Excavation, Subgrade and Embankment.
4. Unsuitable Materials
    - a. Where rock or other unsuitable material is encountered at pipe grade, such rock or unsuitable material shall be removed to a minimum of six (6) inches below the proposed pipe grade line, refilled with Class I material to the correct pipe grade to protect the pipe from point loadings from below and provide base material for adjustment to grade and trench drainage; initial backfill and final backfill shall follow as per standards herein delineated.

### 3.4 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 1 inch above finished surface elsewhere unless otherwise indicated.

### 3.5 CONCRETE PLACEMENT

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

### 3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
  - 1. Use Heavy-Duty, top-loading classification cleanouts in paved foot-traffic and yard areas areas.
  - 2. Use Extra Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 8 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

### 3.7 CONNECTIONS

- A. Make connections to existing piping and underground manholes.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus **6-inch (150-mm)** overlap with not less than **6 inches (150 mm)** of concrete with 28-day compressive strength of **3000 psi (20.7 MPa)**.

2. Make branch connections from side into existing piping, **NPS 4 to NPS 20 (DN 100 to DN 500)**. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than **6 inches (150 mm)** of concrete with 28-day compressive strength of **3000 psi (20.7 MPa)**.
  3. Make branch connections from side into existing piping, **NPS 21 (DN 525)** or larger, or to underground manholes by cutting opening into existing unit large enough to allow **3 inches (76 mm)** 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 (150 mm)** of concrete for minimum length of **12 inches (300 mm)** to provide additional support of collar from connection to undisturbed ground.
    - a. Use concrete that will attain a minimum 28-day compressive strength of **3000 psi (20.7 MPa)** unless otherwise indicated.
    - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
  4. 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.
- B. Connect to grease, oil, and sand interceptors specified in contract drawings.

### 3.8 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8-inch dimension thick, brick masonry bulkheads.
  2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
1. Remove manhole and close open ends of remaining piping.

- C. Backfill to grade according to Section P-152, Excavation, Subgrade and Embankment.

### 3.9 IDENTIFICATION

- A. Comply with requirements in JWSC standards for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
  - 1. Use 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 (600 mm)** 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 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
    - f. Authorities having Jurisdiction: Rejection or corrections required by authorities having jurisdiction.
  - 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 48 hours' advance notice.
  4. Submit separate report for each test.
- C. Testing and Acceptance:
1. General: All gravity sanitary sewer lines up to thirty (30) inches in diameter, to include connected services and/or main stub-outs shall be low pressure air tested in accordance with ASTM F1417 and conducted in substantial conformance with the procedures below.
    - 1) air testing shall be performed as soon as possible after completing a reasonable length of gravity sewer installation, and before scheduling Preliminary Record Drawing Line Televising;
    - 2) the system installer shall furnish all equipment, material, and personnel to conduct the test using low pressure air;
    - 3) the test equipment shall be approved and the test conducted in the presence of a JWSC Construction Inspector;
    - 4) testing shall be conducted after backfilling has been completed but before finish grading or surface improvements;
    - 5) all wye's, tees, and lateral stubs or other fittings shall be suitably capped to withstand the internal test pressures;
    - 6) after a manhole-to-manhole section of line has been cleaned, it shall be plugged at each manhole with pneumatic plugs inflated to 25 psi internal pressure; plug bracing may be used as necessary to keep plugs from being blown out of lines;
    - 7) one of the test plugs shall have two factory equipped hole connections in addition to the hose connection used to inflate the plug. One connection shall be used to continuously monitor the

rising air pressure in the sealed line. The other connection shall be used only for introducing the low-pressure air into the sealed line;

- 8) three and one-half (3 ½) inch diameter, 0-30 psi air gauge shall be supplied for reading the internal pressure of the line being tested. Calibrations from the 0-10 psi range shall be in tenths;
- 9) low pressure air shall be introduced into the sealed line until the internal pressure reaches 3.5 psi greater than the average back pressure of any ground water that may be above the pipe, but not greater than 9.0 psi. At least two (2) minutes shall be allowed for the air pressure to stabilize. After this period the hose used to introduce the pressure shall be disconnected from the air source in such a manner as to retain the pressure in the sealed line and the compressor shut down;
- 10) the portion of the line being tested shall be accepted if it does not loose air at a rate greater than 0.0015 cfm per square foot of internal pipe surface when tested at an average pressure between 3.5 and 4.0 psi greater than any back pressure exerted by ground water that may be over the pipe at the time of the test;
- 11) time requirements for pressure drop of 1.0 psi or 0.5 psi 3.5 to 2.5 or 3.5-3.0 psi greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameter in the tables provided in the ASTM Standards;
- 12) where high ground water is known to exist, the height in feet of ground water above the invert of the sewer shall be divided by 2.31 and added to 3.5 psi to establish the amount of pressure to be used for the test;
- 13) if, the line fails to meet the requirements of the test, the source of leakage shall be identified and corrected and the line retested.

## 2. Infiltration Test

- a. Where gravity sewer lines cannot be low pressure air tested in accordance with this Standard, the system shall be subjected to an infiltration test to establish leakage less than 100 gallons per inch per day per mile (gal/in/day/mile) using a V-notch weir; however, where ground water conditions are not favorable for testing, (ground water levels less than eight (8) feet over the pipe invert for any individual line segment), the end of the

line to be checked shall be plugged at the downstream manhole, the upstream manhole partially filled to place a 3.5 psi head on the subject line at the lowest end, and the change in water depth noted during the test period converted to a volume; such volume and test time duration shall be compared against the 100 gal/in/day/mile Standard.

### 3. Vacuum Test

- a. All sanitary sewer manholes shall be vacuum tested in accordance with ASTM C 1244-93 and conducted in substantial conformance with the following procedures:
  - 1) The entire manhole structure, to include the joint between the cast iron frame & cover and the top cone or adjustment ring, shall be tested as a unit;
  - 2) All lift holes shall be plugged
  - 3) All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole
  - 4) Place vacuum test head on the top of the manhole structure, setting the sealing face so that the joint between the manhole frame & cover and the main structure is included in the area to be tested;
  - 5) Draw a vacuum of ten (10) inches of mercury on the manhole, shut the valve on the vacuum line of the test head and turn off the vacuum pump;
  - 6) Measure the time in seconds that it takes for the vacuum to drop to nine (9) inches of mercury;
  - 7) Compare the time of the pressure drop from ten (10) inches to nine (9) inches of mercury with the allowable time value for the manhole diameter and depth as shown on the table in the Section appendix;
  - 8) If the manhole fails the initial test, necessary repairs shall be made by an approved method and the manhole retested until a satisfactory test is obtained.

### 4. Visual Inspection

- a. All sanitary sewer mains will be visually inspected using color CCTV provided equipment by a PACP (Pipeline Assessment Certification Program)

certified operator using PACP certified software. This service will be provided by the JWSC upon demonstration by the installer that the sewer lines and manholes have passed air and vacuum tests, the lines have been hydraulically cleaned using a combination cleaner and presentation of a Preliminary Record Drawing of the sanitary sewer system as installed.

- b. The CCTV equipment shall include inclinometer capabilities that capture the line grade values in percent as the camera proceeds along the line and also provides a chart showing the average line grade from pipe start to pipe end for verification of Record Drawing slopes. The system installer is responsible for providing adequate trafficable access to the system components to perform this work.
- c. A CCTV re-inspection of any and all defects found in mains during any previous test shall be required prior to acceptance.

#### D. Deflection Testing

1. Deflection testing shall be performed on any flexible pipe reach installation where CCTV inspection observations indicate that the pipe may be deflected or ovalized in any dimension beyond allowable values. Where required, deflection testing shall be performed in substantial compliance with the following procedures:
  - a. Deflection testing shall be accomplished by pulling a five (5%) mandrel through the line if it has been installed for less than thirty days, or a seven and one-half (7 ½ %) mandrel on any line which has been installed longer than thirty days.
  - b. An approved mandrel, proving ring, pulling ropes and cables shall be provided by the installer for testing PVC pipe.
  - c. The mandrel shall be hand pulled through the pipe using no wenches or other mechanical devices except a pulley at the manhole invert. The pulley allows the mandrel to be pulled from ground level rather than from inside the manhole.
    - 1) If, at any point in the pipe one (1) man is unable to hand pull the mandrel through the pipe, then the pipe will be deemed unacceptable.
    - 2) The failed pipe shall be repaired by the installer, the mandrel re-pulled and the line re-televised at the Contractor's expense.

### 3.11 CLEANING

- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

## PART 4 - MEASUREMENT AND PAYMENT:

### 4.1 MEASUREMENT:

- A. Gravity Sanitary Sewers: The length of pipe to be paid for shall be the number of linear feet of sanitary sewer pipe in place, completed, and approved; measured along the centerline of the pipe from the inside face of the manhole to the inside face of the manhole. The measurement shall include any and all necessary appurtenances.
- B. Sanitary Sewage Force Mains: The length of pipe to be paid for shall be the number of linear feet of sanitary sewage force main pipe in place, completed, tested, and approved; measured along the centerline of the pipe, exclusive of separately paid work items. The measurement shall include any and all necessary appurtenances and connections.
- C. Duplex Grinder Pump Stations: Grinder pump stations will be measured as complete, fully operational units, as specified.
- D. Pavement Replacement: Pavement replaced in accordance with the plans and specifications and accepted by the Engineer, will be measured as separate payment items

### 4.2 PAYMENT

- A. Gravity Sewers and Force Mains: Gravity and force main sewer will be paid for at the unit price shown in the Proposal per linear foot for the various sizes, depths and types measured as described above. The price shall include all labor, equipment and materials, including excavation, bedding, backfill, pipe detection markings, and all necessary appurtenances for a complete installation as specified. No separate payment will be made for excavation, haunching material, bedding, backfill or compaction.
- B. Single and Dual Sanitary Service Assemblies: Payment for this item will be made at the Contract unit price bid for each item completed in accordance with the Contract Documents that is installed by the Contractor and accepted by the Engineer. This price shall include all wire, screws, tape, PVC pipe, restoration, etc., necessary for the complete installation of the item to the satisfaction of the Engineer. This price includes all lateral PVC pipe, regardless of length. This price shall be full compensation for furnishing all materials, and for all labor, equipment, tools and incidentals necessary to

complete the item. No separate payment will be made for excavation, haunching material, bedding, backfill or compaction.

- C. Duplex Grinder Pump Stations will be paid for as a lump sum item of work, to include a complete, fully operational system as specified on the Drawings and within this specification. Lump sum payment shall be full compensation for materials, equipment, installation, testing, and operation and maintenance training of Owner's maintenance staff. Installation shall include all necessary work items to provide a complete and operational system including, but not limited to: excavation, backfill, concrete ballast, pre-engineered pre-fabricated duplex grinder pump and basin system, piping installation, electric power supply, telephone/communications, stand-by power supply receptacle, and related necessary components.
- D. Surface restoration and pavement replacement within the limits required for the construction of the Work, will be paid for separately.
- E. Payment will be made under:

Item No. 22 13 13-1	Sanitary Sewer Service Lead, 4" Dia., PVC, SDR 26 – per Linear Foot
Item No. 22 13 13-2	Sanitary Sewer Main, 8" Dia., PVC, SDR 26 – per Linear Foot
Item No. 22 13 13-3	Sanitary Sewer Force Main, 1.25" Dia., HDPE, DR11 – per Linear Foot
Item No. 22 13 13-4	Sanitary Sewer Force Main, 2" Dia., HDPE, DR11 – per Linear Foot
Item No. 22 13 13-5	Sanitary Sewer Manhole, Standard – per Each
Item No. 22 13 13-6	Sanitary Sewer Manhole, High-Risk (Force Main) – per Each
Item No. 22 13 13-7	Connect to Existing Sanitary Manhole – per Each
Item No. 22 13 13-8	Remove Existing Sanitary Manhole – per Each
Item No. 22 13 13-9	Remove Existing Sanitary Sewer Main, Size Varies – per Linear Foot
Item No. 22 13 13-10	Remove Existing Sanitary Force Main, Size Varies – per Linear Foot

- Item No. 22 13 13-11 Adjust Sanitary Manhole to Grade – per Each
- Item No. 22 13 13-12 Sanitary Sewer Service, Restore or Reconnect to Existing System– per Each
- Item No. 22 13 13-13 Packaged Sanitary Grinder Pump Station, P-1, Complete – per Each.
- Item No. 22 13 13-14 Packaged Sanitary Grinder Pump Station, P-2, Complete – per Each.

**END OF SECTION 22 13 13**