

Section 2570

Gravity Sewer Collection Systems

PART 1: General

- 1.1 *General Description of Work* – Furnish and install all sewer pipe, fittings, structures, and accessories required for sanitary sewer construction as indicated.
- 1.2 *Product Delivery, Storage, and Handling Guidelines* –
- 1.2.1 Store materials to prevent physical damage.
- 1.2.2 Protect materials during transportation and installation to avoid physical damage.
- 1.3 *Quality Assurance* –
- 1.3.1 *Compliance* – Comply with latest published editions of American Society of Testing and Materials (ASTM) Standards:

ASTM C478	Precast Reinforced Concrete Manhole Sections
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D2321	Practice for Underground Installation of Flexible Thermoplastic Sewers and Other Gravity-Flow Applications
ASTM D2564	Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3034	Type PSM – Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

PART 2: Materials and Equipment

- 2.1 *General Requirements* –
- 2.1.1 *Pipe Material* – Pipe shall meet the designations of the “ECUA Pipe Material Chart”, with standard pipe material for gravity sewer applications being that of PVC unless shown otherwise on plans or bid forms.
- 2.1.2 *Pipe Markings* – All pipes shall be marked in accordance with applicable standard specification under which pipe is manufactured unless otherwise specified.
- 2.2 *Delivery, Storage, and Handling* – Certificates of Compliance with the Specifications shall be required for all materials used on the Project. All materials shall be protected during transportation, storage, handling, and installation to avoid physical deterioration due to sun and

weather. The ECUA reserves the right to reject material, which in any way does not meet the requirements of these Specifications.

2.3 Sewer Mains –

2.3.1 Polyvinyl Chloride Pipe (PVC) –

2.3.1.1 See “ECUA Pipe Material Chart” for pipe requirements.

2.3.1.2 Use single elastomeric gasket push-on joints complying with ASTM D3212.

2.4 Structures and Pipe Accessories –

2.4.1 Fittings –

2.4.1.1 Fittings shall be allowed only on service laterals and drop manholes.

2.4.1.2 Fittings shall equal or exceed quality and strength of pipe.

2.4.2 Manholes & Sections –

2.4.2.1 Construction shall be precast reinforced concrete capable of sustaining an H-20 loading.

2.4.2.2 Manholes shall be constructed in accordance with ASTM C-478, using Type II or Type III Portland Cement with waterproofing additive (Xypex or approved equivalent) and anti-microbial additive (Conseal or approved equal).

2.4.2.3 Leakage shall not exceed 1 gallon per day per vertical foot of manhole.

2.4.2.4 Manholes shall have a minimum I.D. of 48 inches, unless otherwise noted on plans.

2.4.2.5 Base section shall be monolithic to a point 6 inches above the crown of the incoming pipe with minimum thick bottom section and 5-inch wall section and made in accordance with ASTM C-478. Doghouse manholes shall be used only with prior written approval of ECUA.

2.4.2.6 Pipe holes shall be properly located and either cast in place with appropriate boot or required shape, or core drilled after concrete has set. Minor field adjustments may be made with approval of ECUA. The invert of the lowest pipe shall be a minimum of 4 inches above the inside floor of the base section. The manhole base section shall include a preformed invert channel conforming to the shape and radius of the sewer pipe. The depth of the invert channel shall be no less than 2/3 of the pipe diameter.

2.4.2.7 Cone (top) sections shall be eccentric narrowing from 48 inches to 24 inches I.D., unless otherwise noted on plans.

2.4.2.8 Flat top sections shall be used in place of cone sections for manholes less than 5 feet deep. The access hole shall be offset to allow easy access and shall be reinforced to support an H-20 loading.

2.4.2.9 The joints between sections shall be one of the following:

- 2.4.2.9.1 Lap joint design with the upper lip inside and suitably shaped to accommodate a bitumastic joint sealer, ("Ram-Neck" or approved equivalent).
- 2.4.2.9.2 Rubber "O" ring gasket.
- 2.4.2.9.3 Completed joints shall be sealed inside and out with cement grout.
- 2.4.2.9.4 In addition, all joints shall be covered with a thermo-adhesive wrap as manufactured by Wrapid Seal or approved equal.

2.4.2.10 Pipe to manhole seals shall be made utilizing one of the following or approved equivalent:

- 2.4.2.10.1 Kore-N-Seal or Lock-Joint, with stainless steel bands and screws.
- 2.4.2.10.2 A-LOK.

2.4.2.11 Brick manholes shall only be used with consent of ECUA.

2.4.3 *Manhole Accessories –*

2.4.3.1 *Manhole Lid and Cover* – Refer to the following guidelines regarding manhole lid and cover:

- 2.4.3.1.1 Gray cast iron, with nominal opening of twenty-four (24) inches for standard four-foot diameter manholes. Manholes larger than four-foot diameter shall have a nominal opening no less than thirty-two (32) inches.
- 2.4.3.1.2 Cover shall be embossed with ECUA logo and marked "SANITARY SEWER" as shown on detail drawings.
- 2.4.3.1.3 The lifting holes shall not extend through cover.
- 2.4.3.1.4 Inflow protecting manhole inserts to be stainless steel

2.5 *Approved Rings and Covers –*

2.5.1 *Covers* – Refer to the following guidelines regarding covers:

Standard Non-Bolting Covers	
Within FDOT Right-Of-Way*	Outside FDOT Right-Of-Way
U. S. Foundry 170 Bj (200# Cover)	U.S Foundry 170 E (130 # Cover)
Approved Equivalent	Approved Equivalent

* Any cover for use within the FDOT right-of-way shall meet FDOT weight requirements (Min 195#).

Note: For non-standard applications requiring bolted covers or applications in flood prone areas, submit proposed ring and cover for review and approval by ECUA prior to installation.

- 2.5.2 *Manhole Coating* – Manholes receiving discharges from force mains, and at a minimum the next two manholes downstream of the receiving manhole, shall be lined with an ECUA approved epoxy/urethane coating (160 mil minimum thickness). Additional manholes shall be lined if required by ECUA. Other liners may be installed if approved by ECUA in writing. Manholes to be lined shall be noted on plans by Engineer.

PART 3: Execution

- 3.1 *General* – Provide all labor, equipment, and materials and install all pipe, fitting, specials, and appurtenances as indicated or specified.
- 3.2 *Pipe Installation* –
- 3.2.1 *Handling* – Handle and store pipe in a manner to insure installation in sound and undamaged condition, and in accordance with pipe Manufacturer's requirements.
- 3.2.1.1 Do not drop, bump, roll or drag.
- 3.2.1.2 Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.
- 3.2.1.3 Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.
- 3.2.1.4 Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.
- 3.2.2 *Installation* – Utilize equipment, methods, and materials insuring installation to lines and grades as indicated.
- 3.2.2.1 Do not lay on blocks unless pipe is to receive total concrete encasement.
- 3.2.2.2 Use calibrated laser for control of line and grade.
- 3.2.2.3 Install pipe of size, material, strength class, and joint type with embedment shown for plan location.
- 3.2.2.4 Insofar as possible, commence laying at downstream end of line and install pipe with bell ends in direction of laying (upstream). Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations there from.
- 3.2.2.5 Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.
- 3.2.2.5.1 Close open ends of pipe with watertight plugs at the end of each work day.
- 3.2.2.5.2 Do not let water enter trench. Pipe shall be laid in a dry trench. Include provisions to prevent pipe flotation and displacement should water control measures prove inadequate.

- 3.2.2.5.3 Remove water, sand, mud and other undesirable materials from trench before removal of end cap or plugs.
- 3.2.2.6 Inspect pipe prior to installation to determine if any pipe defects are present.
- 3.2.2.7 Brace or anchor as required to prevent displacement after establishing final position.
- 3.2.2.8 Perform only when weather and trench conditions are suitable.
- 3.2.2.9 Observe extra precaution when hazardous atmospheres might be encountered, especially when connecting to existing, active sanitary sewers.
- 3.2.2.10 Separation of sanitary sewer lines and potable water lines. See Detail D-64
 - 3.2.2.10.1 Except as provided in paragraph 3.2.2.10.5, sewers and force mains shall be laid at least ten feet (outside to outside) horizontally from water mains. Provided the applicant demonstrates there is no reasonable alternative, the ECUA may approve smaller horizontal separation distances for sewers if one of the following conditions is met:
 - 3.2.2.10.1.1 The top of the sewer is installed at least 18 inches below the bottom of the potable water line.
 - 3.2.2.10.1.2 The sewer is encased in watertight carrier pipe.
 - 3.2.2.10.1.3 Both the sewer and the water main are constructed of slip-on or mechanical joint pipe complying with public water supply design standards and pressure tested to 150 psi to assure water tightness.
 - 3.2.2.10.1.4 The applicant provides documentation accompanying the permit application showing that another alternative will result in an equivalent level of reliability and public health protection.
 - 3.2.2.10.2 Except as provided in paragraph 3.2.2.10.5, sewers and force mains shall be laid at least three feet (outside to outside) horizontally from any existing or proposed reclaimed water line. Smaller horizontal distances shall be approved in accordance with subsection 62-610.469(7), F.A.C.
 - 3.2.2.10.3 Except as provided in paragraph 3.2.2.10.5, sewer pipes and force mains shall cross under water mains, unless there is no alternative. Sewers and force mains crossing water mains or reclaimed water lines shall be laid to provide a minimum vertical distance of 18 inches between the invert of the upper pipe and the crown of the lower pipe. The minimum vertical separation shall be maintained whether the water main is above or below the sewer. For sewer crossings, the crossing shall be arranged so that the sewer pipe joints are equidistant and as far as possible from the water main joints. Adequate structural support shall be provided for the sewer or force main to maintain line and grade. For sewers, provided the applicant demonstrates there is no reasonable alternative, the ECUA may approve smaller vertical separation distances if one of the following conditions is met:

- 3.2.2.10.3.1 The sewer is encased in a watertight carrier pipe.
- 3.2.2.10.3.2 The sewer is designed and constructed equal to water pipe and pressure tested to 150 psi to assure water tightness.
- 3.2.2.10.3.3 The applicant provides documentation accompanying the permit application showing that another alternative will result in an equivalent level of reliability and public health protection.
- 3.2.2.10.4 The provisions of paragraphs 3.2.2.10 (1-3) above are applicable to in-ground crossings. No vertical or horizontal separation distances are required for aboveground crossings.
- 3.2.2.10.5 If there are conflicts in the separation requirements between collection systems and drinking water facilities established in this subsection and those established in Section 556-“Water Distribution Systems” design standards, then the requirements in Section 556-“Water Distribution Systems”, shall apply.
- 3.2.2.11 Auger or jack casing in place where shown on plans.
- 3.2.2.12 Maintain minimum of 36 inches of cover unless directed by Engineer.
- 3.2.2.13 Encase sewer pipe in steel, PVC, or HDPE casing or use ductile iron pipe when crossing under pipe, conduit, or structure of 24 inches in diameter or greater when a 6-inch separation distance cannot be maintained. This protection shall extend a minimum of 10 feet beyond crossed structure.
- 3.2.3 *Jointing* –
 - 3.2.3.1 Perform in accordance with Manufacturer's recommendations.
 - 3.2.3.2 Clean and lubricate all joint and gasket surfaces with lubricant recommended.
 - 3.2.3.3 Utilize methods and equipment capable of fully homing or making up joints without damage.
 - 3.2.3.4 Check joint opening and deflection for specification limits.
- 3.2.4 *Closure Pieces* –
 - 3.2.4.1 Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.
 - 3.2.4.2 Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.
- 3.2.5 *Temporary Plugs* –
 - 3.2.5.1 Furnish, install, and secure watertight temporary plugs at each end of work for removal by others when completed ahead of adjacent contract or where indicated.

- 3.2.5.2 Remove from pipe laid under separate or prior contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this Contract.

3.2.6 *Permanent Plugs –*

- 3.2.6.1 Use test plugs as manufactured by pipe supplier, or
- 3.2.6.2 Fabricate by Contractor of substantially same construction.
- 3.2.6.3 Must be watertight against heads up to 20 feet of water.
- 3.2.6.4 Secure in place in a manner to facilitate removal when required to connect pipe.

3.3 *Manhole Installation –*

3.3.1 *Precast Bases –*

- 3.3.1.1 Place on 12-inch layer of sand, gravel, or sandy material compacted to at least 98 percent of the maximum density as approved by Engineer. Subgrade preparation shall conform to ECUA Standard Detail D-10.
- 3.3.1.2 Base shall be leveled prior to installation of manhole sections.

3.3.2 *Cast-in-Place Bases –*

- 3.3.2.1 Cast on 12-inch layer of sand, gravel, or sandy material compacted to at least 98 percent of the maximum density as approved by Engineer. Subgrade preparation shall conform to ECUA Standard Detail D-10.
- 3.3.2.2 Manhole bases and channel inverts may be constructed integrally.

3.3.3 *Manhole Sections –*

- 3.3.3.1 Use precast sections unless cast-in-place manholes approved by Engineer.
- 3.3.3.2 Precast sections may be installed after base concrete has attained 75 percent of design strength.
- 3.3.3.3 Full circumference seals between manhole sections shall use one of the following or approved equivalent.

- 3.3.3.3.1 Bitumastic Seal (Kent No. 2, Ram Neck)

- 3.3.3.3.2 Rubber "O" ring gasket

- 3.3.3.3.3 Thermo-adhesive wrap (Wrapid Seal)

3.3.4 *Invert Channels –*

- 3.3.4.1 Form invert channel as indicated. Invert channel shall conform to the shape and radius of the pipe. The depth of the invert channel shall be no less than 2/3 of the pipe diameter.

- 3.3.4.2 Alternate invert and shelf may be constructed of mortar over concrete fill with approval of Engineer.
- 3.3.4.3 Make changes in direction of flow with smooth curves of as large a radius as size of manhole permits.
- 3.3.4.4 Make changes in size and grade smoothly and uniformly.
- 3.3.4.5 Slope shelf of manhole adjacent to channels, toward the channels, and rough broom finish to provide a non-slip surface.
- 3.3.4.6 Finish channel bottom smoothly without roughness, irregularity, or pockets. Irregularities greater than 1/8-inch shall not be allowed.
- 3.3.4.7 On straight through single pipe manholes, half sections of same pipe may be used with mortar and concrete with approval of Engineer.
- 3.3.4.8 Precast inverts in base sections are acceptable with approval from ECUA Engineering Department.

3.3.5 *Field Coatings* – Field applied coatings shall be applied after Engineer's approval of structure.

3.4 *Wastewater Services* –

- 3.4.1 *Laterals* – Service laterals shall be located in accordance with requirements in the ECUA Code. Refer to the Code for clarification of availability of facilities and responsibilities of customer for the installation of service laterals. Install service laterals to each residential lot or individual business lot or property, or as directed by Engineer.
- 3.4.2 *Services Wyes* – Install wyes, 4-inch branch diameter unless shown otherwise on plans. See ECUA standard detail, D-1 "Typical Service Connection".
- 3.4.3 *Risers* – Risers may be used with wyes for service connections where invert of sewer is 7 feet or more below ground surface or where shown on plans. Where risers are used, the minimum available depth of sewer shall be four feet. Terminate each connection as shown on plans or as directed by Engineer. Glued 45-degree bends shall be used.
- 3.4.4 *General* –
 - 3.4.4.1 Glue cap on end of stub out.
 - 3.4.4.2 Backfill trench only after recording exact location and depth of service connection.
 - 3.4.4.3 Street crossings shall have a minimum of 2 feet of cover to subgrade unless approved by Engineer.
 - 3.4.4.4 Drive a ½-inch metal rebar adjacent to each service lateral if lateral is buried prior to customer connection, with top of post 1 foot below ground surface. As-built drawings shall reflect horizontal location and depth of lateral at property line.

3.5 *Connection of Service Laterals and Sewer System Facilities –*

3.5.1 *Existing Service Laterals and New Sewer Main –* When a new sewer main is installed to replace an existing sewer main, extend new sewer laterals to property line. Connect new service lateral to existing sewer lateral at property line.

3.5.2 *New Service Lateral Connections to Existing Manholes –*

3.5.2.1 Unless otherwise directed by ECUA, insert new sewer lateral six (6) inches inside of manhole. Ensure that new pipe does not obstruct flow path in existing invert channel. Where possible, orient new service line consistently with direction of flow.

3.5.2.2 Connect new laterals to existing manholes. Seal new lateral in place to be watertight.

3.5.2.3 Reconstruct manhole channel and shelf to suit new connection.

3.5.2.4 All debris to be removed.

3.5.3 *Connections to Existing Sewer –*

3.5.3.1 Where no practicable alternative exists, build new manhole around existing sewer.

3.5.3.2 Break out existing sewer inside of manhole and construct channel and shelf to suit new connection.

PART 4: Acceptance

4.1 *Acceptance Tests for Sewer Pipelines and Manholes –*

4.1.1 *Infiltration Testing (Manholes) –*

4.1.1.1 *General –* Refer to the following general guidelines for infiltration testing:

4.1.1.1.1 Maximum infiltration for each section of sewer pipe shall not exceed 25 gpd/inch of pipe diameter/mile.

4.1.1.1.2 Manhole vacuum test in accordance with ASTM-C1244.

4.1.1.1.3 Acceptance of air test or exfiltration results will not preclude rejection of work if infiltration is measured and exceeds limitation.

4.1.1.1.4 Maximum infiltration for each manhole shall not exceed 1 gallon per vertical foot per 24 hours.

4.1.1.1.5 All tests to be witnessed by ECUA.

4.1.1.2 *Air Test (Manholes) –* Refer to the following guidelines for air testing: ASTM C969

4.1.1.2.1 Furnish all facilities required including:

4.1.1.2.1.1 Necessary piping connections.

- 4.1.1.2.1.2 Test pumping equipment.
- 4.1.1.2.1.3 Pressure gauges or manometers.
- 4.1.1.2.1.4 Bulkheads.
- 4.1.1.2.1.5 All miscellaneous items required.
- 4.1.1.2.2 Obtain approval from Engineer of equipment and methods proposed for use.
- 4.1.1.2.3 Test pipe in sections determined by Contractor and approved by Engineer.
- 4.1.1.2.4 Plug ends of line and cap or plug all connections to withstand internal test pressures.
- 4.1.1.2.5 Introduce low-pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe. (Add 0.43 psi for each vertical foot of ground water over the top of pipe.)
- 4.1.1.2.6 Allow two minutes for air pressure to stabilize.
- 4.1.1.2.7 Time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of any ground water above pipe shall not be less than time in following table for given diameters.

Manhole Air Testing Chart	
Pipe Diameter (Inches)	Minutes
6	3.0
8	4.0
10	5.0
12	5.5
15	7.0
18	8.5
21	10.0
24	11.5
27	12.75
30	14.0
36	17.0

- 4.1.1.2.8 Repeat test as necessary after all leaks and defects have been repaired.

4.1.2 *Exfiltration Test* –

- 4.1.2.1 Furnish all facilities required to plug pipe sections and fill with water to attain a minimum elevation of water in upstream manhole two feet higher than top of pipe in line being tested, or two feet above existing ground water in trench, whichever is higher elevation.
- 4.1.2.2 Maintain water level in manhole at start of test period for one hour.
- 4.1.2.3 Water added to maintain level (water lost) shall not exceed the following amounts:

Exfiltration Testing Chart	
Pipe Diameter (Inches)	Gallons/100 feet
8	0.63
10	0.79
12	0.95
15	1.19
18	1.42
21	1.66
24	1.90

Allowable leakage may be increased by 5 percent for each foot of head above water elevation indicated above.

4.1.3 Infiltration Test –

- 4.1.3.1 May be used in lieu of air test or exfiltration test if Contractor can prove that ground water conditions are such that crown of pipe is covered with not less than two feet of water at highest point in section being tested. The test head shall be maintained for not less than 24 hours before a weir measurement is made.
- 4.1.3.2 Infiltration shall be measured with weir at manhole and shall not exceed amounts stated in paragraph 4.1.2.3 of this section, Exfiltration Test.
- 4.1.3.3 Engineer will require exfiltration or air test if Contractor cannot prove to satisfaction of Engineer that ground water conditions are satisfactory.

PART 5: Measurement and Payment

5.1 Sewer Pipe –

- 5.1.1 Measure in lineal feet by specified pipe size along centerline of pipe with no deduction for manholes, wye connections, or riser connections.
- 5.1.2 Includes furnishing, handling, laying pipe materials and specified bedding materials; trench excavation, backfill and compaction; dewatering; sheeting, shoring and bracing; testing; utilities repair and relocation; providing all labor, tools, equipment and miscellaneous associated work necessary to complete item.
- 5.1.3 Payment: Unit price per linear foot.

5.2 (Standard) (Drop) (Shallow) Manholes –

- 5.2.1 Includes furnishing and placing all precast and cast in place materials; excavation, backfill and compaction; frame and lid; stub pipes; providing all labor, equipment, tools and miscellaneous associated work needed to complete item.
- 5.2.2 Payment: Unit price per each manhole.

5.3 Service Lateral Connections –

- 5.3.1 Lump sum price for long or short service lateral as indicated.

- 5.3.2 Includes furnishing, handling, laying pipe materials; trench excavation, backfill and compaction; dewatering; utilities repair; providing all labor, equipment and miscellaneous associated work needed to complete item.
- 5.3.3 Payment: Unit price per each.