

SECTION 339100 - 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. All construction associated with this Contract shall comply with the requirements of the City of Salisbury Standard Utility Details and the *Uniform Construction Standards Manual 5th Ed.*, dated October 17, 2006 (Manual) or latest edition.
<http://www.salisburync.gov/constructionstandards>. Every effort has been made to conform these specifications to the Manual, however, in the event there is a conflict between these Specifications and the Manual, the Manual shall take precedence.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Encasement for piping
 - 3. Manholes.

1.3 SUBMITTALS

- A. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.4 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.

1.5 PROJECT 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 and Engineer no fewer than two 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 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

- A. Mechanical-Joint and/or Slip Joint, Ductile-Iron Pipe: Class 350, AWWA C151, (MJ pipe) with mechanical joint bell and plain spigot end or (Slip Joint) with bell and plain spigot end for gasketed joints unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. DIP Pressure Piping:
 - 1. Mechanical-Joint and/or Slip Joint, Ductile-Iron Pipe: Class 350, AWWA C151, (MJ pipe) with mechanical joint bell and plain spigot end or (Slip Joint) with bell and plain spigot end for gasketed joints unless grooved or flanged ends are indicated.
 - 2. Mechanical-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.
 - 3. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 - 4. Joint restraint shall be by mechanical joint or mega-lugs.
- C. DIP Laterals (Tap & Stub-out)
 - 1. 4" – 6" DIP: Mechanical-Joint and/or Slip Joint, Ductile Iron Pipe: Class 350, AWWA C151.
 - 2. Mechanical-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.
 - 3. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 - 4. Joint restraint shall be by mechanical joint or mega-lugs.

2.2 PVC PIPE AND FITTINGS

- A. PVC Gravity Sewer Piping (SDR- 35):
 - 1. Pipe: ASTM F 679 & ASTM D-3034, SDR-35 PVC pipe.
 - 2. Fittings: ASTM F 679, PVC pipe with bell-and-spigot ends.
 - 3. Gaskets: Integral ASTM F 477, elastometric seals.
- B. PVC Gravity Sewer Lateral (Tap & Stub-out) Piping (SCH 40)
 - 1. 4" – 6" Schedule 40 NSF-DW

2.3 ENCASUREMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105
- B. Install encasement for ductile iron piping where indicated on the drawings for cathodic protection.

- C. Material: high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.
- D. Form: Sheet of tube
- E. Color: Black

2.4 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum for manholes under 10' of depth and 60" minimum diameter for manholes with a depth 10' or greater. Manholes with inside drops shall have a minimum inside diameter of 60".
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum wall thickness for 4' diameter manholes and 6-inch minimum wall thickness for 5' diameter manholes; with separate base slab or base section with integral floor.
5. Riser Sections: 5-inch minimum thickness for 4' diameter manholes and 6-inch minimum wall thickness for 5' diameter manholes, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone ~~or flat slab top~~ type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals (maximum 26" to first step). Omit steps if total depth from floor of manhole to finished grade is less than 30 inches.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch 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 (maximum of 11½" of grade rings (including butyl mastic) – if more than 11½" is needed to reach indicated elevation and slope – a riser section shall be installed).
11. Sealed manholes shall have a vent pipe when indicated (see standard detail SS-4).

B. Manhole Frames and Covers (must be domestic manufactured):

1. (Vented) Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange with four 1" bolt holes and 26-inch- diameter cover with two 1" vent holes. (Sealed) Description: Ferrous; 24-inch ID by 7- to 9-inch riser threaded for four ½" bolts and include a minimum 1/8" thick gasket, with 4-inch- minimum-width flange with four 1" bolt holes and 26-inch- diameter non-vented cover with four bolt down holes for ½" bolts and non penetrating pickholes. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.5 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, 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 minimum, with 0.45 maximum water/cementitious materials ratio.
 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi 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.
 - a. Invert Slope: 0.2' drop through manhole unless otherwise indicated.
 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 RELATED DOCUMENTS

- A. All construction executed in associated with this Contract shall comply with the requirements of the City of Salisbury Standard Utility Details and the *Uniform Construction Standards Manual 5th Ed.*, dated October 17, 2006 (Manual) or latest edition.
<http://www.salisburync.gov/constructionstandards>. If there are any conflicts between these Specifications and the Manual, the Manual shall take precedence.

3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 33 Section "Trenching and Backfilling".

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 and when pipe material changes. Use fittings for branch connections (wye) (4' & 6") 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 bore and jacking.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow at the slope indicated on the drawings.
 - 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 36-inch minimum cover unless otherwise shown on the drawings.
 - 4. Install ductile-iron, gravity sewer piping according to ASTM A 746.
 - 5. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
- G. 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 (915-mm) minimum cover.
 - 3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
 - 4. Install ductile-iron special fittings according to AWWA C600.
- H. Install corrosion-protection piping encasement according to ASTM A 674 or AWWA C105 where indicated on the drawings.
- I. 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 ductile-iron, gravity sewer piping according to AWWA C600 for mechanical joints.
 - 2. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 - 3. Join dissimilar pipe materials with nonpressure-type, flexible couplings.
- B. Join force-main, pressure piping according to the following:
 - 1. Join ductile-iron pressure piping according to AWWA C600 or AWWA M41 for push-on joints.
 - 2. Join ductile-iron special fittings according to AWWA C600 or AWWA M41 for push-on joints.
 - 3. Join PVC pressure piping according to AWWA M23 for gasketed joints.
 - 4. 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 nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

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. 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 3 inches above finished surface elsewhere unless otherwise indicated (minimum 1' above grade for sewer outfall lines located outside of roads and residential yards).
- E. Manhole must be placed on a minimum of 8" compacted #67 washed stone.

3.6 CONCRETE PLACEMENT

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

3.7 CONNECTIONS

- A. Make connections to existing piping and underground manholes.

1. Sewer service connections shall be made on the sewer main. Service connections to manholes must be approved in advance by Utilities Management.
2. Where making a service connection directly to an existing main line, the following shall apply:
 - a. On VCP, cut hole in pipe using appropriate saw; use glue or 100% silicone adhesive/sealant and clamp wye-service saddle over hole.
 - b. On PVC & DIP, cut hole in pipe using appropriate saw; use glue or 100% silicone adhesive/sealant and clamp wye-service saddle over hole.
3. Sewer main to sewer main connections must be by a core with water-tight boot into an existing manhole or by installing a dog-house manhole on the existing sewer.
4. The lateral shall be installed from the main line to the edge of the right-of-way. Stub-outs shall be provided for every property abutting the line. The location of the end of the lateral shall be formed with a clean-out in accordance with the standard detail.
5. The service connections shall be located by distances from manhole to manhole. The distances shall be recorded on a reproducible medium and submitted to the City for their records.
6. Sewer laterals shall be a minimum of 4" (60' or longer shall be 6") diameter and be PVC (Schedule 40) or Ductile Iron Pipe. No material transitions of laterals between PVC and DIP will be allowed (including the clean-out/stack).
7. Stub-outs may be required on sanitary sewer outfalls on a case by case basis.
8. Tie-ins to the laterals shall be made at the existing tail piece section at the bottom of the stack. Tie-ins to the stack are not permitted unless approved in advance by a written waiver from Utilities Management.
9. 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.

3.8 IDENTIFICATION

- A. Materials and their installation are specified in Division 33 Section "Trenching and Backfilling". Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
 1. Use warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.9 FIELD QUALITY CONTROL

- A. Backfill
 1. Backfill shall be tested by an independent testing laboratory approved in advance by the City.
 2. Tests shall be performed in accordance with ASTM methods and be appropriate to the soil type.
 3. The backfill in pipeline trenches shall be tested at a minimum as follows:

- a. Pipelines within the road right-of-way, existing or proposed roads: Test density every 12-inches (2 lifts) of placed backfill at intervals of 200 feet, minimum one per day.
- b. Pipeline under lawns or cross-country: Test density every 12-inches (2 lifts) of placed backfill at intervals of 500 feet, minimum one per day.

B. Flushing

1. At completion of work, lines shall be thoroughly cleaned by flushing with water to remove all dirt and debris.
2. Pipeline shall be flushed at a rate of at least 2.5 feet per second for a duration suitable to the Engineer/Owner.
3. City water may be used (when available and a bulk water permit is purchased) to flush sewer lines or an approved source of non-potable water (must be free of any chemicals, silt, or debris) may be used to flush sewer lines.
4. All flush water must be collected in a plugged manhole and pumped out. Sewer flush water shall not be allowed to enter the City's sewer system.

C. Obstructions/Visual Inspection

1. The pipe shall be visually inspected from manhole to manhole using lights, mirrors, or other devices (CCTV) for visual inspection. All obstructions shall be removed, and the lines from one manhole to the next shall exhibit a fully circular pattern. Lines which do not exhibit a true line and grade or have structural defects shall be corrected to meet specifications.
2. The Engineer, Owner, or SRU inspector may require inspection by television camera (CCTV) of any sewer lines or laterals. The CCTV equipment must provide adequate light for the camera and be of high video quality (including the video tapes or DVD) to properly show the inside of the pipe. Each line and lateral must be marked with an identifying number and shown on the video tape or DVD and a log of any problems found, along with the line number and footage and/or lateral number must be included with the video tapes or DVD.

D. Leakage

1. Leakage tests shall be conducted on a schedule agreed upon by the Engineer and Owner.
2. Engineer and Owner's designated representative must be on site for all required testing.
3. Low pressure air testing shall be used to test for leakage in sewer lines and laterals. The test shall be in accordance with ASTM F 1417 as modified herein.
4. The pipeline is considered acceptable if when tested at a pressure of 4.0 psi (or greater than the average back pressure of any groundwater that may submerge the pipe) the section under test does not lose more than 0.5 psig within the allotted test time. Refer to Table: 1 for time specifications.

Table: 1 Minimum Time Required for a 0.5 psig Pressure Drop
for Size and Length of Pipe Indicated

Test Pressure for Start of Test 4.0 psig

Pipe Diameter (Inches)	Minimum Time (Minutes)	Specification Time for Length (L) Shown in Minutes and Seconds							
		100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	2:50	2:50	2:50	2:50	2:50	2:50	2:50	3:12
8	4:00	4:00	4:00	4:00	4:00	4:00	4:26	5:04	5:42
10	4:43	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	5:40	5:40	5:40	7:08	8:33	9:58	11:24	12:50
15	7:05	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:00
18	8:30	8:30	9:37	12:49	16:00	19:14	22:26	25:38	28:50
21	9:55	9:55	13:05	17:27	21:49	26:11	30:30	34:54	39:15
24	11:20	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:15
27	12:45	14:25	21:38	28:51	36:05	43:15	50:30	57:42	64:54
30	14:10	17:48	26:43	35:37	44:30	53:25	62:20	71:13	80:07
36*	17:00	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

* Consult with pipe manufacturer for maximum test pressure for pipe size greater than 36 in. in diameter.

5. This low pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, a line is over pressurized or plugs/caps are installed or restrained improperly. It is extremely important that the various plugs be properly installed to prevent the sudden expulsion of a poorly installed or partially inflated plug. Observe the following minimum safety precautions:
 - a. No one shall be allowed in the manhole during testing.
 - b. Contractor to install and retrain all caps and plugs securely.
 - c. When the lines are tested, it is mandatory that all caps and plugs be braced as an added safety factor.
 - d. Do no over pressurize the lines. Do not exceed 9.0 psig.
 - e. A regulator or relief valve set no higher than 9.0 psi shall be included on all pressurizing equipment.

E. Deflection Test (for PVC pipe)

1. No sooner than thirty (30) days after final backfill installation, each section of PVC pipe shall be checked for vertical deflection using an electronic deflectometer or a rigid "Go-No/Go" device.
2. Vertical deflection shall not exceed 5% of the inside pipe diameter.
3. Pipe exceeding the allowable limit shall be repaired and retested. Engineer or the engineer's designated representative must be on site for all required testing. City inspection of the test is required.

F. Manhole Vacuum Test

1. All testing shall be performed in the presence of the engineer or designated representative and SRU inspector.
2. Every manhole shall be checked for air tightness prior to setting of the manhole ring and cover. All manholes, whether with precast base sections or poured-in-place base, shall be vacuum tested. All lift holes shall be plugged with a non-shrink grout.
3. All pipes entering or leaving the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole during the test.
4. Notify the Engineer/Owner's representative and SRU inspector must be present for the test, notify Engineer/Owner 48 hours prior to conducting the test.
 - a. The vacuum equipment test head shall be placed at the inside of the top of the cone section, the seal inflated in accordance with the manufacture's recommendations.
 - b. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off.
 - c. With the valves closed, the time shall be measured for the vacuum to drop to 9-inches of mercury.
 - d. The test time shall be correlated to the manhole as follows:

<u>Manhole Diameter</u>	<u>Allowable Time:</u>
48"	60 seconds
60"	75 seconds

- e. If the manhole fails the initial test, necessary repairs shall be made at the contractor's expense with an approved non-shrink grout on the outside of the manhole while the vacuum is being drawn.
- f. The re-testing and repairing schedule cycle shall continue until the manhole passes the test.

G. Leaks and loss in test pressure constitute defects that must be repaired.

H. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

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

END OF SECTION 339100