

**SECTION 33 40 00**  
**STORM SEWER UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

**1.2 RELATED WORK**

- A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.
- B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 53, (SHORT FORM)CAST-IN-PLACE CONCRETE.
- C. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- D. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

**1.3 DEFINITIONS**

**1.4 ABBREVIATIONS**

- A. HDPE: High-density polyethylene
- B. PE: Polyethylene

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle manholes catch basins and stormwater inlets according to manufacturer's written rigging instructions.

**1.6 COORDINATION**

- A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.
- B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

**1.7 QUALITY ASSURANCE:**

- A. Products Criteria:
  - 1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
  - 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on

equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

#### 1.8 SUBMITTALS

A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

#### 1.9 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for  
Concrete

A242/A242M-04(2009).....High-Strength Low-Alloy Structural Steel

A536-84(2009).....Ductile Iron Castings

A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for  
Concrete Reinforcement

C33/C33M-08.....Concrete Aggregates

C139-10.....Concrete Masonry Units for Construction of  
Catch Basins and Manholes

C150/C150M-11.....Portland Cement

C443-10.....Joints for Concrete Pipe and Manholes, Using  
Rubber Gaskets

C478-09.....Precast Reinforced Concrete Manhole Sections

C857-07.....Minimum Structural Design Loading for  
Underground Precast Concrete Utility Structures

C891-09.....Installation of Underground Precast Concrete  
Utility Structures

C913-08.....Precast Concrete Water and Wastewater  
Structures

- C923-08.....Resilient Connectors Between Reinforced  
Concrete Manhole Structures, Pipes, and  
Laterals
- C924-02(2009).....Testing Concrete Pipe Sewer Lines by Low-  
Pressure Air Test Method
- C990-09.....Joints for Concrete Pipe, Manholes, and Precast  
Box Sections Using Preformed Flexible Joint  
Sealants
- C1103-03(2009).....Joint Acceptance Testing of Installed Precast  
Concrete Pipe Sewer Lines
- C1173-08.....Flexible Transition Couplings for Underground  
Piping Systems
- C1433-10.....Precast Reinforced Concrete Monolithic Box  
Sections for Culverts, Storm Drains, and Sewers
- C1479-10.....Installation of Precast Concrete Sewer, Storm  
Drain, and Culvert Pipe Using Standard  
Installations
- D448-08.....Sizes of Aggregate for Road and Bridge  
Construction
- D698-07e1.....Laboratory Compaction Characteristics of Soil  
Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600  
kN-m/m<sup>3</sup>))
- D1056-07.....Flexible Cellular Materials—Sponge or Expanded  
Rubber
- C. American Association of State Highway and Transportation Officials  
(AASHTO):
- M198-10.....Joints for Concrete Pipe, Manholes, and Precast  
Box Sections Using Preformed Flexible Joint  
Sealants
- D. American Concrete Institute (ACI):
- 318-05.....Structural Commentary and Commentary

350/350M-06.....Environmental Engineering Concrete Structures  
and Commentary

E. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for  
Erosion and Sediment Control

**1.10 WARRANTY**

The Contractor shall remedy any defect due to faulty material or  
workmanship and pay for any damage to other work resulting therefrom  
within a period of one year from final acceptance. Further, the  
Contractor will furnish all manufacturers' and suppliers' written  
guarantees and warranties covering materials and equipment furnished  
under this Contract.

**PART 2 - PRODUCTS**

**2.1 FACTORY-ASSEMBLED PRODUCTS**

A. Standardization of components shall be maximized to reduce spare part  
requirements. The Contractor shall guarantee performance of assemblies  
of components, and shall repair or replace elements of the assemblies as  
required to deliver specified performance of the complete assembly.

**2.2 STEEL PIPE AND FITTINGS (NOT USED)**

**2.3 ALUMINUM PIPE AND FITTINGS (NOT USED)**

**2.4 ABS PIPE AND FITTINGS (NOT USED)**

**2.5 PE PIPE AND FITTINGS (NOT USED)**

**2.6 CONCRETE PIPE AND FITTINGS**

A. Reinforced-Concrete sewer pipe and fittings shall be ASTM C76 or ASTM  
C655.

1. Bell-and-spigot or tongue-and-groove ends and sealant joints with  
ASTM C990, bitumen or butyl-rubber sealant.

2. Class II, Wall B

**2.7 NONPRESSURE 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 corrosion-resistant-metal tension  
band and tightening mechanism on each end.

B. Sleeve Materials

1. For concrete pipes: ASTM C443, rubber.

2. For dissimilar pipes: ASTM D5926, PVC or other material compatible  
with pipe materials being joined.

- C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

**2.8 PRESSURE PIPE COUPLINGS (NOT USED)**

**2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS (NOT USED)**

**2.10 BACKWATER VALVES (NOT USED)**

**2.11 CLEANOUTS (NOT USED)**

**2.12 DRAINS (NOT USED)**

**2.13 ENCASEMENT FOR PIPING (NOT USED)**

**2.14 MANHOLES AND CATCH BASINS**

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches(1200mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6 inch (150 mm) minimum thickness for floor slab and 4-inch (102 mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4 inch (102 mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). Individual FRP steps; FRP ladder; or ASTM A615, deformed, 1/2 inch (13 mm) steel reinforcing

rods encased in ASTM D4101, PP, width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.

10. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

**B. Manhole Frames and Covers:**

1. Description: Ferrous; 24 inch (610 mm) ID by 7 to 9 inch (175 to 225 mm) riser with 4 inch (102 mm) minimum width flange and 26-inch (600 mm) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A48/A48M, Class 35 gray iron unless otherwise indicated.

**2.15 CONCRETE FOR MANHOLES AND CATCH BASINS**

**A. General:** Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

**B. Concrete Design Mix:** 4000 psi (27.6 MPa) minimum, compressive strength in 28 days.

1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615, Grade 60 (420 MPa) deformed steel

**C. Manhole Channels and Benches:** Channels shall be the main line pipe material. Include benches in all manholes and catch basins.

1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel. Minimum of 6 inch slope from main line pipe to wall sides.

2.16 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS (NOT USED)

2.17 PLASTIC, CHANNEL DRAINAGE SYSTEMS (NOT USED)

2.18 PIPE OUTLETS (NOT USED)

2.19 DRY WELLS (NOT USED)

2.20 STORMWATER DISPOSAL SYSTEMS (NOT USED)

2.21 HEADWALLS (NOT USED)

2.22 FLARED END SECTIONS (NOT USED)

2.23 PRECAST REINFORCED CONCRETE BOX CULVERT (NOT USED)

2.24 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS (NOT USED)

2.25 WARNING TAPE

- A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

### **PART 3 - EXECUTION**

#### **3.1 PIPE BEDDING**

- A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

#### **3.2 PIPING INSTALLATION**

- A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping with minimum cover as shown on the Drawings.
- C. 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 use of lubricants, cements, and other installation requirements.

1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
  2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
  3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
  4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
  5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
  6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.
  7. Warning tape shall be continuously placed 12 inches (300 mm) above storm sewer piping.
- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. 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.
- F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- G. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow.
  2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.



3. Install reinforced concrete sewer piping according to ASTM C1479.

### **3.3 REGRADING**

- A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

### **3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES**

- A. Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping.

### **3.5 CONNECTIONS TO EXISTING PUBLIC UTILITY MANHOLES (NOT USED)**

### **3.6 DRAIN INSTALLATION (NOT USED)**

### **3.7 MANHOLE INSTALLATION**

- A. Install manholes, complete with appurtenances and accessories indicated. Install precast concrete manhole sections with sealants according to ASTM C891.
- B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
- C. Circular Structures:
  - 1. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Parge interior and exterior of structure with 1/2 inch (15 mm) or cement mortar applied with a trowel and finished to an even glazed surface.
  - 2. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible gasket material specifically manufactured for this type of application. Adjust the

length of the rings so that the eccentric conical top section will be at the required elevation. Cutting the conical top section is not acceptable.

3. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

D. Rectangular Structures:

1. Precast concrete structures shall be placed on a 8 inch (200 mm) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section shall be set on an 8 inch (200 mm) thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb. Seal all joints with preform flexible gasket material.
2. Do not build structures when air temperature is 32 deg F (0 deg C), or below.
3. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent sewer section. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by one of the listed methods:
  - a. Forming directly in concrete base of structure.
  - b. Building up with brick and mortar.
4. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1 to 12 or more than 1 to 6. Bottom slab and benches shall be concrete.
5. The wall that supports access rungs or ladder shall be 90 deg vertical from the floor of structure to manhole cover.
6. Install steps and ladders per the manufacturer's recommendations. Steps and ladders shall not move or flex when used. All loose steps and ladders shall be replaced by the Contractor.
7. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 2 inches (50 mm) above the adjacent finish grade. Install an 8 inch (203 mm)

thick, by 12 inch (300 mm) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

### **3.8 CATCH BASIN INSTALLATION**

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

### **3.9 STORMWATER INLET AND OUTLET INSTALLATION (NOT USED)**

### **3.10 DRY WELL INSTALLATION (NOT USED)**

### **3.11 CHANNEL DRAINAGE SYSTEM INSTALLATION (NOT USED)**

### **3.12 STORMWATER DISPOSAL SYSTEM INSTALLATION (NOT USED)**

### **3.13 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.
  - 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.
  - 3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening 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, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.
  - 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

### **3.14 CLOSING ABANDONED STORM DRAINAGE SYSTEMS (NOT USED)**

### **3.15 IDENTIFICATION**

- A. Install green warning tape directly over piping and at outside edge of underground structures.

### **3.16 FIELD QUALITY CONTROL**

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record

of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

1. Submit separate reports 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.
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.

### **3.17 TESTING OF STORM SEWERS:**

- A. Submit separate report for each test. 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. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.
- B. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### **3.18 CLEANING**

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

STRATTON VA MEDICAL CENTER  
RELOCATE VETERANS WAY  
VA PROJECT NO. 528A8-14-806  
10-11

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