

SECTION 33 40 00

STORM SEWER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. 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.
- B. Contractor shall maintain flow in storm sewer systems during the project work. Pumps of sufficient capacity shall be provided to bypass work area.
- C. Work includes connecting/re-connecting existing drainage pipes that are discovered during the construction process and are not to be removed or abandoned.
- D. Work includes providing concrete anchors for steep slope pipe installation.
- E. Work includes providing a geotextile pipeline weight system to prevent flotation for the pipe segment(s) indicated on the drawings.
- F. Work includes providing water bars as indicated on drawings.
- G. Work includes providing work and materials as needed to conform to the requirements of the NYSDEC SPDES General Permit and the Stream Disturbance Permit.
- H. Contractor shall provide a temporary coffer dam to complete the work for Stormwater Outlet B at the location indicated on the drawings. Design of the temporary coffer dam is the responsibility of the Contractor. Design shall be stamped by a New York State licensed engineer.

1.2 RELATED WORK

- A. Trash Racks: Section 05 50 00 Metal Fabrications
- B. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing, Site Preparation: Section 31 20 00, EARTHWORK.
- C. Concrete Work: Section 32 05 23 Cement and Concrete for Exterior Improvements.

D. Materials and Testing Report Submittals: Section 01 33 23, SHOP
DRAWINGS, PRODUCT DATA AND SAMPLES.

E. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL
CONTROLS.

1.3 ABBREVIATIONS

A. CB: Catch Basin
B. COR: Contracting Officer's Representative
C. CPP: Corrugated Plastic Pipe (HDPE)
D. ELEV: Elevation
E. HDPE: High-density polyethylene
F. INV: Invert elevation
G. LF: Linear Feet
H. PE: Polyethylene
I. RIM: Rim or top of frame elevation
J. ST: Soil Tight
K. WT: Watertight

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, inline drains, pipe, and fittings in
direct sunlight.
B. Handle manholes, catch basins, and stormwater inlets according to
manufacturer's written rigging instructions.
C. Store and handle geotextile pipeline weights in according to
manufacturer's written instructions.

1.5 COORDINATION

A. Coordinate connection to storm sewer main with VA.
B. Coordinate delivery and filling of geotextile pipeline weights.

1.6 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.

1.7 SUBMITTALS

- A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, and other miscellaneous items.
- B. Provide shop drawings for all precast items.
- C. Provide buoyancy calculations for all drainage structures showing structure and concrete (when required) is adequate to prevent flotation.
- D. Provide manufactures literature and data for frames and covers and frames and grates.
- E. Provide manufactures literature and data for inline drains.
- F. Provide manufactures literature and data for trench drains.
- G. Provide manufactures literature and data for watertight drainage structure connection(s).
- H. Provide manufactures literature and data for inline check valve. Submit product literature that includes information on the performance and operation of the valve, materials of construction, dimensions and weights, elastomer characteristics, headloss, flow data and pressure ratings.
- I. Field quality control inspection report, including video recording.
- J. Provide items below for the geotextile pipeline weight system:
 - 1. Manufactures literature and data.
 - 2. Source and sieve analysis for fill materials.
 - 3. Filling and installation instructions.
 - 4. Certification from manufacturer on pipeline spacing requirement to meet the submerged downward force of at least 300 pounds per foot. Certification shall include the actual aggregate (fill material) utilized.
 - 5. Qualifications of skill person to be used for review and training.
- K. Stamped drawings (plan and sections) showing the design and installation of the temporary coffer dam.

1.8 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. The latest edition of the publication shall apply.
- 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

A760/A760M-10.....Corrugated Steel Pipe, Metallic-Coated for
Sewers and Drains

A798/A798M-07.....Installing Factory-Made Corrugated Steel Pipe
for Sewers and Other Applications

A849-10.....Post-Applied Coatings, Paving, and Linings for
Corrugated Steel Sewer and Drainage Pipe

A929/A929M-01 (2007)Steel Sheet, Metallic-Coated by the Hot-Dip
Process for Corrugated Steel Pipe

B745/B745M-97 (2005)Corrugated Aluminum Pipe for Sewers and Drains

B788/B788M-09.....Installing Factory-Made Corrugated Aluminum
Culverts and Storm Sewer Pipe

C14-07.....Non-reinforced Concrete Sewer, Storm Drain, and
Culvert Pipe

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

C76-11.....Reinforced Concrete Culvert, Storm Drain, and
Sewer Pipe

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

C506-10b.....Reinforced Concrete Arch Culvert, Storm Drain,
and Sewer Pipe

C507-10b.....Reinforced Concrete Elliptical Culvert, Storm
Drain, and Sewer Pipe

C655-09.....Reinforced Concrete D-Load Culvert, Storm
Drain, and Sewer Pipe

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/ft³ (600
kN-m/m³))

D1056-07.....Flexible Cellular Materials—Sponge or Expanded Rubber

D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2321-11.....Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2751-05.....Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

D2774-08.....Underground Installation of Thermoplastic Pressure Piping

D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3350-10.....Polyethylene Plastics Pipe and Fittings Materials

D3753-05e1.....Glass-Fiber-Reinforced Polyester Manholes and Wetwells

D4101-11.....Polypropylene Injection and Extrusion Materials

D5926-09.....Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679-08.....Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F714-10.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

F794-03(2009).....Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

F891-10.....Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

- F894-07.....Polyethylene (PE) Large Diameter Profile Wall
Sewer and Drain Pipe
- F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer
Pipe With a Smooth Interior and Fittings
- F1417-11.....Installation Acceptance of Plastic Gravity
Sewer Lines Using Low-Pressure Air
- F1668-08.....Construction Procedures for Buried Plastic Pipe
- C. American Association of State Highway and Transportation Officials
(AASHTO):
- M190-04.....Bituminous-Coated Corrugated Metal Culvert Pipe
and Pipe Arches
- M198-10.....Joints for Concrete Pipe, Manholes, and Precast
Box Sections Using Preformed Flexible Joint
Sealants
- M252-09.....Corrugated Polyethylene Drainage Pipe
- M294-10.....Corrugated Polyethylene Pipe, 12 to 60 In. (300
to 1500 mm) Diameter
- D. American Water Works Association(AWWA):
- C105/A21.5-10.....Polyethylene Encasement for Ductile iron Pipe
Systems
- C110-08.....Ductile-Iron and Gray-Iron Fittings
- C219-11.....Bolted, Sleeve-Type Couplings for Plain-End
Pipe
- C600-10.....Installation of Ductile iron Mains and Their
Appurtenances
- C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and
Fabricated Fittings, 4 In. Through 12 In. (100
mm Through 300 mm), for Water Transmission and
Distribution
- M23-2nd ed.....PVC Pipe "Design And Installation"
- E. American Society of Mechanical Engineers (ASME):

A112.6.3-2001.....Floor and Trench Drains

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991.....Cleanouts

F. American Concrete Institute (ACI):

318-05.....Structural Commentary and Commentary

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

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

1.9 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 two years 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 PE PIPE AND FITTINGS

A. Soil tight (ST) corrugated PE drainage pipe and fittings, NPS 4" to NPS 60" (DN 100 to DN 1500);

1. Pipe shall be dual wall HDPE pipe with smooth interior and a corrugated exterior. Manning's "n" value for use in design shall be 0.012.
2. Pipe and fittings shall be soil tight.
3. 4-through 10-inch (100 to 250 mm) pipe shall meet AASHTO M252, Type S
4. 12-through 60-inch (300 to 1500 mm) pipe shall meet AASHTO M294, Type S

5. Joint Performance: Pipe shall be joined using a bell & spigot joint meeting the requirements of AASHTO M252, AASHTO M294, or ASTM F2306. The joint shall be soil-tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
 6. Fittings shall conform to AASHTO M252, AASHTO M294, or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of AASHTO M252, AASHTO M294, or ASTM F2306. Fitting shall be designed specifically for the pipe furnished and manufactured by the pipe manufacturer.
 7. Shall be ADS N-12 ST or approved equal.
 8. Pipe size shall be as indicated on the drawings.
 9. HDPE piping system shall be specifically designed, constructed, and installed for the service intended
 10. Soil-tight Couplings: AASHTO M252 or AASHTO M294, corrugated, matching tube and fittings.
 11. Pipe shall be perforated only where indicated on the drawings.
 12. Pipe shall be adequate for depth of cover required.
- B. Watertight (WT) corrugated PE drainage pipe and fittings, NPS 12" to NPS 60" (DN 305 to DN 1500);
1. Pipe shall be dual wall HDPE pipe with smooth interior and a corrugated exterior. Manning's "n" value for use in design shall be 0.012.
 2. Pipe and fittings shall be watertight and shall be adequate for a pressure up to 10.8 psi.
 3. 12-inch through 60-inch (300 to 1500 mm) pipe shall meet ASTM F2881 or AASHTO M330.
 4. Joint Performance: Pipe shall be joined using a bell & spigot joint meeting the requirements of ASTM F2881 or AASHTO M330. The joint shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint

- lubricant available from the manufacturer shall be used on the gasket and bell during assembly. 12-inch through 60-inch (300 to 1500 mm) diameters shall have an exterior bell wrap installed by the manufacturer.
5. Fittings: Fittings shall conform to ASTM F2881 or AASHTO M330. Bell and spigot connections shall utilize a welded or integral bell and valley or inline gaskets meeting the watertight joint performance requirements of ASTM D3212.
 6. Material Properties: Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2881, Section 5 and AASHTO M330, Section 6.1.
 7. Pipe size shall be as indicated on the drawings.
 8. HDPE piping system shall be specifically designed, constructed, and installed for the service intended.
 9. Pipe shall be adequate for depth of cover required.
 10. Shall be ADS HP storm pipe and fittings or approved equal.

2.3 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 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.
- 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.
- F. Couplings used with watertight pipe shall meet the joint performance requirements of the pipe.

2.4 BACKWATER VALVES/INLINE CHECK VALVES

- A. Check Valves are to be all rubber and the flow operated check type with slip-in cuff or flange connection. The entire Valve shall be ply reinforced throughout the body, disc and bill, which is cured and vulcanized into a one-piece unibody construction. A separate valve body or pipe used as the housing is not acceptable. The valve shall be manufactured with no metal, mechanical hinges or fasteners, which would be used to secure the disc or bill to the valve housing. The port area of the disc shall contour down, which shall allow passage of flow in one direction while preventing reverse flow. The entire valve shall fit within the pipe I.D. Once installed, the valve shall not protrude beyond the face of the structure or end of the pipe.
- B. The downstream end of the valve must be circumferentially in contact with the pipe while in the closed positions.
- C. Slip-in style valves will be furnished with a set of stainless steel expansion clamps. The clamps, which will secure the valve in place, shall be installed inside the cuff portion of the valve, based on installation orientation, and shall expand outwards by means of a turnbuckle. Each clamp shall be predrilled allowing for the valve to be pinned and secured into position in accordance with the manufacturer's installation instructions. Flange style valves will be furnished with a stainless steel, ANSI 125/150 drilled, retaining ring unless specified otherwise.
- D. Valve shall be adequate for installation in the pipe specified in Section 2.2.
- E. Check valve shall be CheckMate™ as manufacturers by Tideflex Technologies®, A Division of Red Valve Company, Carnegie, PA 15106 or approved equal. All valves shall be manufactured in the U.S.A.

2.5 CLEANOUTS

- A. Cleanouts: As indicated on the drawings.
1. Top-Loading Classification: Heavy Duty
 2. Pipe riser shall be ductile iron.

2.6 DRAINS

- A. Inline drains shall be as indicated on the drawings.
- B. Cast-Iron Trench Drains: Provide trench drain as indicated on the drawings with an ADA compliant grate. Trench drain shall have a bottom outlet.

1. Top-Loading Classification(s): Heavy Duty

2.7 MANHOLES AND CATCH BASINS

A. Round Precast Concrete Manholes:

1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealed joints conforming to ASTM C443.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Base Section: 8 inch 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.
4. Riser Sections: 4 inch (102 mm) minimum thickness, and lengths to provide depth indicated.
5. Top Section: Flat-slab-top type unless eccentric-cone type or concentric-cone or is indicated, and top of cone of size that matches grade rings.
6. Joint Sealant: As recommended by manufacturer. Applied to inside and outside of structure.
7. Watertight (WT) Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection. All accessories for watertight connection shall be provided, such as, but not limited to corrugated pipe adapter gaskets or prefabricated manhole adapter.
8. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). 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.
9. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch (150 to 225 mm) total thickness, to match diameter of manhole frame and grate/cover, and height as required to adjust manhole frame and grate/cover to indicated elevation and slope.
10. Adequate for A-16 (AASHTO HS20-44), heavy-traffic, structural loading with 30% impact.
11. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation. Assume groundwater level at surface. When adding concrete provide concrete flange for manhole base.

B. Rectangle/Square Precast Concrete Manholes:

1. Description: ASTM C913; designed for A-16 (AASHTO HS20-44), heavy-traffic, structural loading with 30% impact; of depth, shape, and dimensions indicated, with provision for sealant joints (watertight).
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation. Assume groundwater level at surface. When adding concrete provide concrete flange for manhole base.
3. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
4. Watertight (WT) Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection. All accessories for watertight connection shall be provided, such as, but not limited to corrugated pipe adapter gaskets or prefabricated manhole adapter.
5. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches (1500 mm). ASTM A615 deformed, 1/2 inch (13 mm) steel reinforcing rods encased in ASTM D 4101, PP, width of 16 inches (400 mm) minimum, spaced at 12 to 16 inch (300 to 400 mm) intervals.

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

D. Manhole Frames and Covers:

1. Description: As indicated on the drawings. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile or ASTM A48/A48M, Class 35 gray iron unless otherwise indicated.
3. Shall be heavy duty (traffic rated).
4. Covers shall be provided with tamper proof bolts (locking). Provide four (4) keys/tools to VA for opening the tamper proof (locking) cover.
5. Provide watertight frame and cover anchored to manhole to resist surcharging where indicated on the drawings. Provide all items for

complete watertight frame and cover, including (but not limited to) gaskets and stainless steel anchors.

6. Cast frame into concrete top as where indicated on the drawings.

E. Precast Catch Basin:

1. Description: Precast, reinforced concrete, of depth and size indicated.
2. Adequate for A-16 (AASHTO HS20-44), heavy-traffic, structural loading with 30% impact.

F. Catch Basin or Manhole Frames and Grates:

1. Shall be as indicated on the drawings.
2. Shall be heavy duty (traffic rated).
3. Provide ADA compliant grates where indicated on the drawings.
4. Cast frame into concrete top where indicated on the drawings.

2.8 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.

2.9 PIPE OUTLETS

A. Outlet Structure: Cast in-place reinforced concrete structure as indicated on the drawings.

B. Riprap outlet protection: As indicated on the drawings.

2.10 INLET STRUCTURES

A. Reinforced pre-precast drainage manhole and/or reinforced cast in place concrete structure(s) as indicated on the drawings and specified herein.

B. Riprap protection: As indicated on the drawings.

C. Provide frame and grate or frame and cover as indicated on the drawings.

2.11 DRY WELLS

- A. Concrete Well: ASTM C478, precast, reinforced, perforated concrete rings. Include the following:
1. Concrete: 4000 psi (27.6 MPa) minimum 28 day compressive strength. 5%-9% Air.
 2. Top: Flat-slab-top with opening as indicated on the drawings. Provide frame and cover or frame and grate as indicated on the drawing.
 3. Wall Thickness: 5 inches minimum with 1 $\frac{3}{4}$ inch by 5 inch maximum slotted perforations arranged in rows parallel to axis of ring
 4. Total free area of perforations: Approximately 15 percent of ring interior surface
 5. Ring construction: Designed to be self-aligning.
 6. Adequate for A-16 (AASHTO HS20-44), heavy-traffic, structural loading with 30% impact.
- B. Filtering material: 1-1/2" to 3 inch washed, crushed stone or gravel. Encase filtering material within geotechnical filter fabric.
- C. Geotechnical filter fabric: Mirafi 160N or approved equal.
- D. Provide frame and grate or frame and cover as indicated on the drawings.
- E. Frame and cover shall be provided with tamperproof bolts. For cover, include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

2.12 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS

- A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets, and shall conform to ASTM C923.

2.13 WATER BARS

- A. Water bars shall be as indicated on the drawings.
- B. Geotechnical filter fabric: Mirafi 180N or approved equal.

2.14 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".

2.15 PIPE ANCHORS

- A. Pipe anchors for steep slope application shall be reinforced cast in place concrete as indicated on the drawings.

2.16 TRASH RACKS

- A. Trash racks shall be as indicated on the drawings and as specified with Section 05 50 00.

2.17 GEOTEXTILE PIPELINE WEIGHTS

- A. Provide non-biodegradable, geotextile fabric weights intended for use as pipeline anti-buoyancy devices when filled with local, natural aggregate ballast.

B. Design and Manufacturing:

1. Manufacturer should demonstrate a minimum of five years of continuous, successful experience in the manufacture of fabric-type weights for pipeline buoyancy control.
2. Manufacturer must be an ISO certified factory.
3. Design must incorporate multiple compartments.
4. Must be a top loading system.
5. An individual compartment safety factor of four times the rated capacity must be proven by a third party testing facility.
6. All material testing supplied by manufacturer should be as per American Society for Testing and Materials (ASTM) or equivalent standards.
7. Provide a submerged downward force of at least 300 pounds per foot to prevent the 36" diameter drainage pipe from floating. Weights shall be provided so that a HDPE pipe section (stick length) is anchored at the middle and both ends of the pipe section (stick length) as a minimum.
8. Geotextile pipeline weight shall be adequate for the installation conditions indicated on the drawings.
9. Resistant to commonly encounter soil chemicals, mildew, and insects.

C. Body Fabric

1. Woven polypropylene.
2. Geotextile rated.
3. Fabric (single layer) must be provided with a minimum weight of 200 GSM for individual compartment capacities not exceeding 500 lbs and a minimum of 400 GSM for individual compartment capacities not exceeding 2,500 lbs.

D. Webbing and Lift Strapping:

1. Manufactured from polypropylene or polyester only.

2. Minimum tensile strength of 10,000 lbs for individual compartment capacities in excess of 1,000 lbs.

3. All load-bearing thread must be polypropylene.

E. A UV protective cover or separate tarps must be used during delivery and storage. Until use, protective covers or separate tarps must be maintained to ensure proper protection from the elements (oil, dirt, sunlight, etc.).

F. Aggregate (Fill Material):

1. Local aggregate used to fill the geotextile pipeline weights shall be reviewed (sieve) by the manufacturer and utilized in the spacing and certification.

2. Screened stone graded from $\frac{3}{4}$ " to $\frac{1}{4}$ ". Stone shall be free of silt and clay.

2.18 CONCRETE DEADMAN

A. Provide precast concrete deadmen as indicated on the drawings.

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. 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 compacted Class IB or compacted Class II material.

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. If not indicated on drawings, use 24-inch minimum.

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 PE corrugated sewer piping according to ASTM D2321 with gasketed joints.
- H. Provide bypass pumping of stormwater during work to maintain flow in stormwater drainage system.

3.3 BACKWATER VALVES/INLINE CHECK VALVES

- A. Valve shall be installed in accordance with manufacturer's written Installation and Operation Manual and approved submittals.
- B. Valve shall be installed to prevent flow in the direction indicated on the drawings.
- C. Manufacturer's authorized representative shall be on-site during installation and start-up and shall verify proper installation.

3.4 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 water stream.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Use Heavy-Duty, top-loading classification cleanouts.
- C. Set cleanout frames and covers in earth in cast in-place concrete as indicated in the drawings.
- D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

- A. Install drains where indicated on the drawings as recommend by the manufacturer.
- B. Set drain frames and covers with tops flush with pavement surface.
- C. Assemble trench sections and embed trench sections in concrete around bottom and sides as indicated on drawings.
- D. Provide ADA compliant grate where indicated.

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 2 inches above finished surface elsewhere unless otherwise indicated.
- C. Circular Structures:
 - 1. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be watertight. Adjust the length of the rings so that the top section will be at the required elevation. Cutting the top or riser section is not acceptable.
 - 2. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.
- D. Square/Rectangular Structures:
 - 1. Precast concrete structures shall 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 D1557. Set precast section true and plumb. All joints shall be watertight.
- E. The wall that supports access rungs shall be 90 deg vertical from the floor of structure to manhole cover.
- F. Install steps per the manufacturer's recommendations. Steps shall not move or flex when used. All loose steps shall be replaced by the Contractor.
- G. Install manhole frames and covers or grate on a mortar bed, and flush with the finish pavement. Frames and covers or grate 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.
- C. Use brick and mortar to make a watertight pipe connection to catch basin.

3.9 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet and outlet structures as indicated on the drawings and as specified herein.
- B. Construct riprap of broken stone.
- C. Provide temporary coffer dam for the construction of Stormwater Outlet
 - B. Design of the temporary coffer dam shall be completed by a New York State licensed engineer who has at least 5 years of experience designing temporary coffer dams.
- D. Work for stormwater outlets A, B, and C shall occur during low water levels within the Cohocton River when there is no rain within the forecast for the estimated duration of the work.

3.10 DRY WELL INSTALLATION

- A. Excavate hole to diameter of at least 24 inches greater than outside of dry well. Do not extend excavation into ground-water table.
- B. Install precast, concrete dry wells according to the following:
 - 1. Set precast concrete base on 8" of leveling stone.
 - 2. Assemble rings to depth indicated, and extend rings to height where top of cover or grate will be at the elevation required.
 - 3. Install inlet pipe into rings.
 - 4. Install top and geotextile filter fabric and backfill around outside of rings with filtering material to top level of rings.
 - 5. Install frame and cover or frame and grate.
 - 6. Backfill to surface with select granular material unless otherwise specified.

3.11 CONNECTIONS

- A. Connect existing drainage piping discovered during construction that will remain to new storm water drainage system at no additional cost to the VA.
- B. Encase entire connection 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).
- C. 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.
- D. Pipe couplings and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Unshielded and Shielded flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.12 CLOSING ABANDONED STORM DRAINAGE 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 (203 mm) 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 and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Division 31 Section EARTHWORK.

3.13 IDENTIFICATION

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

3.14 PIPE ANCHORS

- A. Install pipe anchors as indicated on the drawing.

3.15 TRASH RACKS

- A. Install trash racks as indicated on the drawings.

3.16 GEOTEXTILE PIPELINE WEIGHTS

- A. Fill geotextile pipeline weights with aggregate material as recommended by the manufacturer. Filling shall only be completed by trained personnel.
- B. Protect filled geotextile pipeline weights as recommended by the manufacturer.
- C. Move and install geotextile pipeline weights as recommended by the manufacturer.
- D. Space geotextile pipe line weights as indicated in the manufacturer's certification.
- E. Manufacturer shall provide skilled person to review, instruct, and train the Contractor in the proper filling, hauling, and installation. Skill person shall review initial filling and installation. Skill person shall not be a sales representative, but technical representative who at least five (5) years of experience with geotextile pipeline weights.
- F. Any geotextile weights damaged during the filling or installation process shall be replaced at no additional charge to the VA.

3.17 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 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.
 - f. Failed testing.
 - 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.

3.18 TESTING OF STORM SEWERS:

- A. Submit separate report for each test.
- 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.
 - 3. Schedule tests and inspections with VA with at least 24 hours advance notice.
 - 4. Submit separate report for each test.
 - 5. Air test soil tight (ST) gravity sewers. Plastic Pipes air testing shall conform to ASTM F1417. When approved by COR, testing of individual joints shall conform to ASTM F3058.
 - 6. Infiltration/exfiltration testing shall be used to demonstrate the integrity of an installed watertight (WT) pipe line. Testing shall conform to ASTM F2487. Contact the manufacturer for recommended leakage rates.

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C. 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.

3.19 CLEANING

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

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