

**SECTION 33 30 00**  
**SANITARY SEWERAGE UTILITIES**

SPEC WRITER NOTES:

1. Use this section only for NCA projects.
2. Delete between // // if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs.
3. References to pressure in this section are gage pressure unless otherwise noted.

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Outside, underground sanitary sewer system, complete, ready for operation, including all gravity flow lines //pressure (force) lines// manholes, cleanouts, frames, covers, structures, appurtenances, and connections to new building and structure, service lines, existing sanitary sewer lines, and existing sanitary structures, and all other incidentals.

**1.2 RELATED WORK**

SPEC WRITER NOTE: Retain one of two paragraphs below.

- A. //Section 01 00 01, GENERAL REQUIREMENTS (Major NCA Projects).//
- B. //Section 01 00 02, GENERAL REQUIREMENTS (Minor NCA Projects).//
- C. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- D. Section 01 42 19, REFERENCE STANDARDS.
- E. Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS.
- F. //Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- G. //Section 03 30 53, (SHORT FORM) CAST-IN-PLACE CONCRETE.//
- H. Section 05 50 00, METAL FABRICATIONS: Fabrication of Steel Ladders.
- I. //Section 22 13 29, SANITARY SEWERAGE PUMPS.//
- J. //Section 31 20 00, EARTH MOVING:// //Section 31 20 11, (SHORT FORM) EARTH MOVING:// //Section 31 23 19, DEWATERING:// Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing.
- K. Section 32 90 00, PLANTING: Seeding, Topsoil.
- L. Section 33 10 00, WATER UTILITIES.

### 1.3 APPLICABLE PUBLICATIONS

SPEC WRITER NOTE: Make material requirements agree with requirements specified in the referenced Applicable Publications. Verify and update the publication list to that which applies to the project, unless the reference applies to all mechanical systems. Publications that apply to all mechanical systems may not be specifically referenced in the body of the specification, but, shall form a part of this specification.

- 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):
- A48/A48M-2003 (R2012)...Standard Specification for Gray Iron Castings
  - A536-1984 (R2014).....Standard Specification for Ductile Iron Castings
  - A615/A615M-2015a.....Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - A746-2009 (R2014).....Standard Specification for Ductile Iron Gravity Sewer Pipe
  - C76-2015a.....Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
  - C139-2014.....Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
  - C150/C150M-2015.....Standard Specification for Portland Cement
  - C478-2015.....Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
  - C857-2014.....Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
  - C990-2009 (R2014).....Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
  - D698-2012e2.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))

- D2321-2014e1.....Standard Practice for Underground Installation  
of Thermoplastic Pipes for Sewers and Other  
Gravity-Flow Applications
  - D2412-2011.....Standard Test Method for Determination of  
External Loading Characteristics of Plastic  
Pipe by Parallel-Plate Loading
  - D3034-2014a.....Standard Specification for Type PSM Poly (Vinyl  
Chloride) (PVC) Sewer Pipe and Fittings
  - D3212-2007 (R2013).....Standard Specification for Joints for Drain and  
Sewer Plastic Pipes Using Flexible Elastomeric  
Seals
  - D3261-2012e1.....Standard Specification for Butt Heat Fusion  
Polyethylene (PE) Plastic Fittings for  
Polyethylene (PE) Plastic Pipe and Tubing
  - D3350-2014.....Standard Specification for Polyethylene  
Plastics Pipe and Fittings Materials
  - D4101-2014.....Standard Specification for Polypropylene  
Injection and Extrusion Materials
  - F477-2014.....Standard Specification for Elastomeric Seals  
(Gaskets) for Joining Plastic Pipe
  - F679-2015.....Standard Specification for Poly (Vinyl  
Chloride) (PVC) Large-Diameter Plastic Gravity  
Sewer Pipe and Fittings
  - F714-2013.....Standard Specification for Polyethylene (PE)  
Plastic Pipe (DR-PR) Based on Outside Diameter
  - F794-2003 (R2014).....Standard Specification for Poly (Vinyl  
Chloride) (PVC) Profile Gravity Sewer Pipe and  
Fittings Based on Controlled Inside Diameter
  - F894-2013.....Standard Specification for Polyethylene (PE)  
Large Diameter Profile Wall Sewer and Drain  
Pipe
  - F949-2015.....Standard Specification for Poly (Vinyl  
Chloride) (PVC) Corrugated Sewer Pipe with a  
Smooth Interior and Fittings
- C. American Water Works Association (AWWA):
- C110-2012.....Ductile-Iron and Gray-Iron Fittings
  - C153-2011.....Ductile-Iron Compact Fittings

- C508-2009.....Swing Check Valves for Waterworks Service, 2 inches Through 24 inches (50 mm Through 600 mm) NPS
- C509-2009.....Resilient-Seated Gate Valves for Water Supply Service
- C512-2015.....Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
- C515-2009.....Reduced-Wall, Resilient-Seated Gate Valves For Water Supply Service
- C550-2013.....Protective Interior Coatings for Valves and Hydrants
- C605-2013.....Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
- C900-2007.....Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 100 mm Through 300 mm (4 inches Through 12 inches) for Water Transmission and Distribution
- C905-2010.....Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 350 mm through 1,200 mm (14 Inches through 48 Inches), for Water Transmission and Distribution
- C906-2015.....Polyethylene (PE) Pressure Pipe and Fittings, 100 mm through 1650 mm (4 Inches through 65 Inches), for Waterworks

D. Uni-Bell PVC Pipe Association:

- Uni-B-6-1998.....Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

**1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 33 30 00, SANITARY SEWERAGE UTILITIES", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights,

materials, applications, standard compliance, model numbers, size, and capacity.

- D. Submit the following as one package:
1. Pipe, Fittings, and, Appurtenances.
  2. Jointing Material.
  3. Manhole and Structure Material.
  4. Frames and Covers.
  5. Steps and Ladders.
  6. //Gate Valves.//
  7. //Valve Boxes.//
  8. //Check Valves.//
  9. //Air Release Valves.//
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
  2. Include complete diagrams of the internal wiring for each item of equipment.
  3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- F. //Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- G. //Submit training plans and instructor qualifications in accordance with the requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//

#### **1.5 QUALITY ASSURANCE**

- A. Products Criteria:
1. Multiple Units: 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. Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, including model number, securely affixed in a conspicuous place on equipment, or name or trademark, including model number cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection, extension, and modification to Public Sanitary Sewer lines and Public Utility Systems as applicable.

#### 1.6 AS-BUILT DOCUMENTATION

SPEC WRITER NOTE: Coordinate O&M Manual requirements with Section 01 00 01, GENERAL REQUIREMENTS (Major NCA Projects) or Section 01 00 02, GENERAL REQUIREMENTS (Minor NCA Projects). O&M manuals shall be submitted for content review as part of the close-out documents.

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be //in electronic version on CD or DVD// inserted into a three ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version //\_\_\_\_// provided on CD or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures

followed for all tests, and certification that all results of tests were within limits specified.

## **PART 2 - PRODUCTS**

### **2.1 PIPING**

#### **A. Gravity Flow Lines (Pipe and Fittings):**

##### **1. Polyvinyl Chloride (PVC):**

- a. Pipe and Fittings, 100 mm to 381 mm (4 inches to 15 inches) in diameter, shall conform to ASTM D3034, Type PSM, //SDR 35// //SDR 26//. Pipe and fittings shall have elastomeric gasket joints providing a watertight seal when tested in accordance with ASTM D3212. Gaskets shall conform to ASTM F477. Solvent welded joints are prohibited.
- b. Pipe and fittings, 450 mm to 900 mm (18 inches to 36 inches) in diameter, shall be solid wall or have a corrugated or ribbed exterior profile and a smooth interior. Pipe shall conform to the following:
  - 1) Pipe and fittings shall conform to ASTM F949 corrugated sewer pipe with a smooth interior. The corrugated outer wall shall be fused to the smooth innerwall at the corrugation valley. Pipe and fitting shall have a smooth bell, elastomeric joints conforming to ASTM D3212, and shall have a minimum pipe stiffness of 345 kPa (50 psi) at 5 percent deflection when tested in accordance with ASTM D2412. Corrugation shall be perpendicular to the axis of the pipe to allow gaskets to be installed on field cut sections of pipe without the requirement for special fittings.
  - 2) Ribbed wall PVC pipe and fittings shall conform to ASTM F794 ribbed sewer pipe with smooth interior pipe. Fittings shall have a smooth bell, elastomeric joints conforming to ASTM D3212, and shall have a minimum pipe stiffness of 320 kPa (46 psi) when tested in accordance with ASTM D 2412 at 5 percent vertical deflection. Joints shall not leak at 7.6 m (25 feet) of head under 5 percent deflection.
  - 3) Solid wall pipe and fittings shall conform to ASTM F679, //SDR 35// //SDR 26// pipe. Fittings shall have gaskets conforming to ASTM F477 and shall be able to withstand a hydrostatic pressure of 345 kPa (50 psi).

2. High density polyethylene (HDPE) pipe and fittings 450 mm to 900 mm (18 inches to 36 inches) shall conform to ASTM F894. Pipe and fittings shall have a smooth interwall and profile exterior, and be Class //40// //63// //100// //160// //as noted on the drawings//. Joints shall be water tight elastomeric gaskets in accordance with ASTM D3212, or thermal welded joints.

SPEC WRITER NOTE: Use fiberglass pipe for secondary containment for acid waste if required by local code.

B. Pressure (Force) Lines (Pipe and Fittings):

1. All pipe and fittings used in the construction of force mains shall be rated for a minimum of //1035 kPa (150 psi)// // // kPa (// // psi).
2. Polyvinyl Chloride (PVC): PVC pipe 100 mm to 300 mm (4 inches to 12 inches) shall conform to AWWA C900, //Class 150 (DR 18)// //Class 200 (DR 14)//. PVC pipe greater than 300 mm (12 inches) shall conform to AWWA C905, //Class 165 (DR 25)// //Class 200 (DR 21)//. Fittings for PVC pipe shall be ductile iron conforming to AWWA C153 or AWWA C110.
3. High Density Polyethylene (HDPE) pipe and fittings shall be manufactured from PE 3608, high density, extra high molecular weight polyethylene meeting the requirements of ASTM D3350. Pipe shall be manufactured in accordance with ASTM F714, and shall be //Class 160 (DR 11)// //Class 200 (DR 9)//. Molded fittings shall be manufactured in accordance with ASTM D3261 and subject to the test required under ASTM D3261. Fabricated fittings shall be made by heat fusion jointing of machined shapes cut from pipe, sheet stock, or molded fittings. Molded and fabricated fittings shall be rated for a minimum working pressure equivalent to the pipe. Joints shall be heat fusion butt joints, flange adapters, or mechanical couplings.
  - a. Flange adapters shall have adequate through-bore length to be clamped in a butt fusion jointing machine without the use of a stub-end holder. The sealing surface of the flanged shall be machined with a series of V-shaped grooves to restrain the gasket against blow out. Back-up rings and flange bolts shall be rated equal to or greater than the mating pipe. All flange adapters shall be equipped with a stainless steel internal pipe stiffener.
  - b. Mechanical couplings shall be sleeve style, restrained coupling.



## 2.2 JOINTING MATERIAL

### A. Gravity Flow Lines:

1. Polyvinyl Chloride (PVC) Pipe (Gravity Use): Joints, ASTM D3212. Elastomeric gasket, ASTM F477.
2. High Density Polyethylene (HDPE) pipe and fitting joints, ASTM D3212, elastomeric gaskets, ASTM F477.

### B. Pressure (Force) Main:

1. Polyvinyl Chloride (PVC) Pipe (Pressure Use): Conform to AWWA C900.
  - a. Push-on joints shall conform to AWWA C900 and AWWA C905.
  - b. Push-on gaskets for pipe, ASTM F477.
  - c. Restrained joints shall comply with the following:
    - 1) Push-on bell and spigot joints shall be retained with retaining rings and thrust rods. The rings shall be ductile iron conforming to ASTM A536.
2. High Density Polyethylene (HDPE) pipe and fittings shall be fusion butt welded, flanged, or mechanical couplings as recommended by the manufacturer. Restrained joints shall be limited to fusion welded and flanged.

## 2.3 MANHOLES AND VAULTS

A. Manholes and vaults shall be constructed of precast concrete segmental blocks, precast reinforced concrete rings, precast reinforced sections, or cast-in-place concrete. The manholes and vaults shall be in accordance with State Department of Transportation or State Roads Commission standard details, and the following:

1. Precast Concrete Segmental Blocks: Blocks shall conform to ASTM C139 and shall not be less than 150 mm (6 inches) thick for manholes to a depth of 3.6 m (12 feet); not less than 200 mm (8 inches) thick for manholes deeper than 3.6m (12 feet) deep. Blocks shall be not less than 200 mm (8 inches) in length. Blocks shall be shaped so that joints seal and bond effectively with cement mortar. Cover structure interior and exterior with 15 mm (1/2 inch) of cement mortar applied with a trowel and finished to an even glazed surface.
2. Precast Reinforced Concrete Rings: Rings or sections shall have an inside diameter as indicated on the drawings, and shall be not less than 1219 mm (48 inches) in diameter. Wall thickness shall conform to requirements of ASTM C478, except that lengths of the sections may be shorter as conditions require. Tops shall conform to ASTM C478. Top section shall be eccentric cone type. Steps on inside wall

- shall be in the same plane from bottom of structure to manhole cover.
3. Precast Reinforced Concrete Manhole Risers and Tops: Design, material and installation shall conform to requirements of ASTM C478. Top sections shall be eccentric. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
  4. Flat top manhole tops shall be reinforced concrete as detailed on the drawings.
  5. Vaults: Reinforced concrete, as indicated on the plans, or precast reinforced concrete. Concrete for precast sections shall have a minimum compressive strength of 35 MPa (5,000 psi) at 28 days, ASTM A615/A615M, Grade 60 reinforcing steel, rated for AASHTO HS20-44 loading with 30 percent impact, and conform to ASTM C857.
  6. Mortar:
    - a. Precast Concrete Segmental Block Structures: By volume, 1 part of Portland cement, 1/4 part lime hydrate, and 3 parts sand.
    - b. Precast Reinforced Concrete Ring and Riser Structures: By volume, 1 part of Portland cement and 2 parts sand. Water in mixture shall produce a stiff, workable mortar, but shall not exceed 21 L (5-1/2 gallons) per sack of cement.
  7. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet ASTM C990.
  8. Frames and covers shall be gray cast iron conforming to ASTM A48/A48M. The frame and cover shall be rated for AASHTO HS20-44 loading, have a studded pattern on the cover, and the words "sanitary sewer". The studs and the lettering shall be raised 8 mm (5/16 inch). The cover shall be a minimum of 600 mm (24 inches) in diameter and shall have four 20 mm (3/4 inch) vent holes and two lifting slots. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.
  9. Manhole steps shall be polypropylene plastic coated on a No. 4 deformed rebar conforming to ASTM C478, Polypropylene shall conform to ASTM D4101. Steps shall be a minimum of 400 mm (16 inches) wide and project a minimum of 175 mm (7 inches) away from the wall. The

top surface of the step shall have a studded non-slip surface. Steps shall be placed at 300 mm (12 inch) centers.

10. Ladders, brackets and hardware shall be constructed of welded aluminum, rails shall be 10 mm (3/8 inch) by 65 mm (2-1/2 inches) spaced a minimum of 400 mm (16 inches) apart. Rungs shall be 35 mm (1-3/8 inches) in diameter and have a non-slip surface. Standoffs shall offset the ladder 175 mm (7 inches) from the wall. The ladder assembly shall be rated for a minimum of 2200 N (500 pounds).

#### **2.4 CONCRETE**

- A. Concrete shall have a minimum compressive strength of 21 MPa (3000 psi) at 28 days. The cement shall be Type III conforming to ASTM C150/C150M. Concrete shall conform with the provisions of Division 03, CONCRETE.

#### **2.5 REINFORCING STEEL**

- A. Reinforcing steel shall be deformed bars, ASTM A615/A615M, Grade 60 unless otherwise noted.

#### **2.6 //SEWAGE WET WELL (LARGER THAN 300 GALLONS WORKING VOLUME)**

- A. Wet well shall be a rectangular precast vault conforming to ASTM C857. The vault shall have a precast bottom, walls, and top structure. The vault shall be constructed of 35 MPa (5000 psi) concrete at 28 days and ASTM A615/A615M, Grade 60 reinforcement. The vault shall be rated for AASHTO HS20-44 loading and 30 percent impact loads.
- B. All joints in the precast structure shall be tongue and groove. Flexible sealing compound, conforming to ASTM C990, shall be placed in all joints to form a watertight structure.//

#### **2.7 CONCRETE PROTECTIVE COATING**

- A. Concrete coating for the interior of wet wells shall consist of an epoxy blended filler sealer, and a cross linked epoxy phenolic cured, resistant protective coating.

#### **2.8 GATE VALVES**

- A. AWWA C509, resilient seated gate valves rated for 1380 kPa (200 psi) WSP, reduced-wall resilient seated gates valves may be supplied in accordance with AWWA C515. Asbestos packing is prohibited. The interior and exterior of the valve shall be epoxy coated for AWWA C550.
- B. Operation:
- C. Shall turn counterclockwise to open.
- D. Underground: 50 mm (2 inch) nut for socket wrench operation.
- E. Above Ground and In Pits: Handwheels.

- F. Joints: End of valve shall accommodate, or be adapted to, pipe furnished.

## 2.9 VALVE BOXES

- A. Cast iron extension box with screw or slide-type adjustment and flared base. Minimum thickness of metal shall be 5 mm (3/16 inch). Box shall be of such length as will be adapted, without full extension, to depth of cover required over pipe at valve location. The least diameter of the shaft of the box shall be 133 mm (5-1/4 inches). Cast iron box shall have a heavy coat of bituminous paint.

- B. Cast the word "SEWER" on the cover.

SPEC WRITER NOTE: Indicate how many "T" handles are to be provided by the Contractor.

- C. Provide // // "T" handle socket wrenches, of 18 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box.

## 2.10 CHECK VALVES

- A. Check valves shall be swing-check valves conforming to AWWA C508. The interior and exterior of the valve shall be epoxy coated per AWWA C550. The check valve shall be rated for minimum of 861 kPa (125 psi) working pressure.

## 2.11 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT

- A. Shall be constructed of reinforced precast concrete or cast-in-place concrete of the shape and configuration indicated on the plans. Precast vaults shall be constructed in accordance with ASTM C857 and be rated for AASHTO HS20-44 loading. The concrete shall have a minimum compressive strength of 35 MPa (5,000 psi) at 28 days, and reinforcement shall comply with ASTM A615/A615M, Grade 60. Access to the trap shall be through 600 mm (24 inches) diameter manhole frame and cover or through hinged aluminum access manways.
- B. Baffles shall be constructed of 6 mm (1/4 inch) mild carbon steel with 6 mm (1/4 inch) thermoplastic coating.

## 2.12 AIR RELEASE VALVE

- A. Valves shall be combination air release and vacuum valve with a single body. The valves shall be rated for 1035 kPa (150 psi) working pressure, and conform to AWWA C512. Valve shall be provided with threaded connections, and be mounted on a full opening ball valve which shall isolate the valve from the system.

**2.13 CLEANOUT FRAMES AND COVERS**

- A. Frames and covers shall be gray iron casting conforming to ASTM A48/A48M. The frame and cover shall be rated for AASHTO HS20-44 wheel loading, have a studded pattern on its cover, vent holes, and lifting slots. The cover shall fit firmly on the frame without movement when subject to vehicular traffic. The word "SEWER" shall be cast on the cover.

SPEC WRITER NOTE: Use non-detectable type at cemeteries only.

**2.14 WARNING TAPE**

- A. Standard, 0.10 mm (4 mils) polyethylene 75 mm (3 inch) wide tape detectable type, green with black letters and imprinted with "CAUTION BURIED SEWER LINE BELOW".

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

**3.2 BUILDING SERVICE LINES**

- A. Install sanitary sewer service lines to point of connection within approximately 1500 mm (5 feet) outside of buildings where service is required and make connections. Coordinate the invert and location of the service line with the contractor installing the building lines.
- B. Connections of service line to building piping shall be made after the new sanitary sewer system has been constructed, tested, and accepted for operation by the COR. Install all temporary caps or plugs required for testing.
- C. When building services have not been installed at the time when the sanitary sewer system is complete, provide temporary plugs or caps at the ends of all service lines. Mark the location and depth of the service lines with continuous warning tape placed 300 mm (12 inches) above service lines.

**3.3 ABANDONED MANHOLES STRUCTURES AND PIPING**

- A. Manholes and Structures Outside of Building Areas: Remove frame and cover, cut, and remove the top to an elevation of 600 mm (2 feet) below finished grade. Fill the remaining portion with compacted gravel or crushed rock or concrete.

- B. Manholes and Structures within Building Areas: Remove frame and cover and //remove the entire structure and the base// //cut and remove the top to an elevation of 600 mm (2 feet) below the finish floor elevation, and completely fill the structure with 21 MPa (3,000 psi) concrete//.
- C. Piping under and within 1500 mm (5 feet) of building areas shall be //completely removed// //abandoned in place and completely filled with 21 MPa (3000 psi) concrete//.
- D. Piping outside of building areas shall //be completely removed// //have all ends of the piping at the limit of the abandonment and within structures and manholes, plugged with concrete, and abandoned in-place//.
- E. Comply with all OSHA confined space requirements while working within existing manholes and structures.
- F. When the limit of the abandonment terminates in an existing manhole to remain, the flow line in the bench of the manhole to the abandoned line shall be filled with concrete and shaped to maintain the flowline of the lines to remain.

#### 3.4 REGRADING

- A. Raise or lower existing manholes and structures frames and covers, cleanout frames and covers and valve boxes 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. Adjust the elevation of the cleanout pipe riser, and reinstall the cap or plug. 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, 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.
- C. Comply with all OSHA confined space requirements when working within existing structures.

SPEC WRITER NOTE: If the project includes connections to existing VA owned manholes, retain the first optional paragraph 3.4. If the project includes connections to existing public utility

manholes, retain the second optional paragraph 3.5.

### 3.5 //CONNECTIONS TO EXISTING VA OWNED MANHOLES

- A. During construction of new connections to existing manholes, maintain continued sanitary sewer service to all buildings and users upstream. Provide, install, and maintain all pumping, conveyance system, dams, weirs, etc. required to maintain the continuous flow of sewage. All temporary measures required to meet this requirement shall be subject to the review of the COR.
- B. Core existing structure, install pipe at the design invert. Install an elastomeric gasket around the pipe, and grout the interstitial space between the pipe and the core.
- C. The bench of the manhole shall be cleaned and reshaped to provide a smooth flowline for all pipes connected to the manhole.
- D. Connections and alterations to existing manholes shall be constructed so that finished work conforms as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting and shaping. //

### 3.6 //CONNECTIONS TO EXISTING PUBLIC UTILITY COMPANY MANHOLES

- A. Comply with all rules and regulations of the public utility.
- B. The connection to the existing utility shall comply with the standard details and specifications of the public utility company, except as specifically modified on the plans and specifications.//

SPEC WRITER NOTE: Include Section 33 10 00, WATER UTILITIES, if water mains are to be reconstructed.

### 3.7 PIPE SEPARATION

- A. Horizontal Separation -Water Mains and Sewers:
  - 1. Existing and proposed water mains shall be at least 3 meters (10 feet) horizontally from any proposed gravity flow and pressure (force main) sanitary sewer or sewer service connection.
  - 2. Gravity flow mains and pressure (force) mains may be located closer than 3 meters (10 feet) but not closer than 1.8 m (6 feet) to a water main when:
    - a. Local conditions prevent a lateral separation of ten feet; and
    - b. The water main invert is at least 450 mm (18 inches) above the crown of the gravity sewer or 600 mm (24 inches) above the crown of the pressure (force) main; and

- c. The water main is in a separate trench separated by undisturbed earth.
  3. When it is impossible to meet (1) or (2) above, both the water main and sanitary sewer main shall be constructed of push-on or mechanical joint ductile iron pipe. The pipe for the sanitary sewer main shall comply with the specifications for pressure (force) mains, and the water main material shall comply with Section 33 10 00, WATER UTILITIES. The sewer shall be pressure tested as specified for pressure (force) mains before backfilling.
- B. Vertical Separation - Water Mains and Sewers at Crossings:
1. Water mains shall be separated from sewer mains so that the invert of the water main is a minimum of 600 mm (24 inches) above the crown of gravity flow sewer or 1219 mm (48 inches) above the crown of pressure (force) mains. The vertical separation shall be maintained within 3 meters (10 feet) horizontally of the sewer and water crossing. When these vertical separations are met, no additional protection is required.
  2. In no case shall pressure (force) sanitary main cross above, or within 600 mm (24 inches) of water lines.
  3. When it is impossible to meet (1) above, the gravity flow sewer may be installed 450 mm (18 inches) above or 300 mm (12 inches) below the water main, provided that both the water main and sewer shall be constructed of push-on or mechanical ductile pipe. Pressure (Force) sewers may be installed 600 mm (24 inches) below the water line provided both the water line and sewer line are constructed of ductile iron pipe. The pipe for the sewer shall conform to the requirements for pressure sewers specified herein. Piping for the water main shall conform to Section 33 10 00, WATER UTILITIES.
  4. The required vertical separation between the sewer and the water main shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer line is at least 3 meters (10 feet).

### **3.8 GENERAL PIPING INSTALLATION**

- A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade. Pressure (force) mains shall have the bells facing the direction of flow.
- B. Do not lay pipe on unstable material, in wet trench, or when trench and weather conditions are unsuitable for the work.



- C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- D. 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.
- E. 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.
- F. 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, and excess jointing materials.
- G. Do not lay sewer pipe in same trench with another pipe or other utility. Sanitary sewers shall cross at least 600 mm (2 feet) below water lines.
- H. Do not walk on pipe in trenches until covered by layers of bedding or backfill material to a depth of 300 mm (12 inches) over the crown of the pipe.
- I. Warning tape shall be continuously placed 300 mm (12 inches) above sewer pipe.
- J. Install gravity sewer line in accordance with the provisions of these specifications and the following standards:
  - 1. Polyvinyl Chloride (PVC) Piping: ASTM D2321.
  - 2. High Density Polyethylene (HDPE) Piping: Comply with ASTM D2321 and manufacturer's recommendations with //gasketed joints// //gaskets with fused joints//.
- K. Installation of Pressure (Force) Mains
  - 1. Sections of piping listed on the drawings shall be fully restrained using approved joint restraint devices. Joint restraint devices shall be installed in accordance with the manufacturer's recommendations. For devices with twist of nuts, the twist of nuts shall be placed on top of the fitting for the Engineer's inspection. Torque test all bolts, set screws, identified by the COR.
  - 2. Thrust blocks are prohibited.
  - 3. Install pressure (force) mains in accordance with the provisions of these specifications and the following standards:
    - a. Polyvinyl Chloride (PVC) Piping: AWWA C605.
    - b. High Density Polyethylene (HDPE) Piping: Per manufacturer's recommendations.

### 3.9 MANHOLES AND VAULTS

#### A. General:

##### 1. Circular Structures:

- a. Precast concrete segmental blocks shall lay true and plumb. All horizontal and vertical joints shall be completely filled with mortar. Cover interior and exterior of structure with 15 mm (1/2 inch) of cement mortar applied with a trowel and finished to an even glazed surface.
- b. 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.
- c. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

##### 2. Rectangular Structures:

- a. Reinforced concrete structures shall be installed in accordance with Division 03, CONCRETE.
  - b. Precast concrete structures shall be placed on a 200 mm (8 inch) reinforced concrete pad, or be provided with a precast concrete base section. Structures provided with a base section shall be set on 200 mm (8 inches) 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 preformed flexible gasket material.
3. Do not build structures when air temperature is 0 degrees C (32 degrees F), or below.
  4. 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.

5. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1:12 (1 inch per foot) nor more than 1:6 (2 inches per foot). Bottom slab and benches shall be concrete.
6. The wall that supports access rungs or ladder shall be 90 degrees vertical from the floor of structure to manhole cover.
7. 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.
8. 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 50 mm (2 inches) above the adjacent finish grade. Install a 200 mm (8 inches) thick, by 300 mm (12 inches) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

### **3.10 SEWER AND MANHOLE SUPPORTS, CONCRETE CRADLES**

- A. Reinforced concrete as detailed on the drawings. The concrete shall not restrict access for future maintenance of the joints within the piping system.

SPEC WRITER NOTE: Select the first optional paragraph 3.10 for Wet Wells or the second optional paragraph 3.11 for Dry Wells and Vaults.

### **3.11 //WET WELLS (PRECAST CONCRETE)**

- A. Install the wet well on a 200 mm (8 inches) compacted aggregate base course.
- B. Set precast units level and plumb. Install sealant between all precast.
- C. Core openings for pipe penetrations and seal with a modular seal. Seal shall be "link-seal" or approved equal.
- D. Grout all joints and depressions in the vault. Install concrete protective coating per the manufacturer's recommendations. The final coating shall be applied in two coats, providing a minimum thickness of 0.15 to 0.20 mm (6 to 8 mils) dry film thickness per coat.
- E. Set top of wet well 300 mm (12 inches) above finish grade.
- F. Pipe and fittings entering and within the wet well shall be poly lined ductile iron pipe.

- G. All pipe penetrations through the walls of the wet well shall be sealed water tight.//

### 3.12 //DRY WELL AND VAULTS

- A. Install //precast// //reinforced// concrete vaults on a 200 mm (8 inches) compacted aggregate base course. The floor, walls, and top shall be level and plumb.
- B. Vaults shall be sized as indicated on the drawings. Orientate vault and internal piping, valves, and appurtenances to provide access to all valves and appurtenances for operation and maintenance of the equipment.
- C. Paint interior of dry well and vaults with 2 coats of alkyd enamel masonry paint.//

### 3.13 OIL AND GREASE INTERCEPTOR AND GREASE REMOVAL PIT

- A. //Construct reinforced concrete as shown on the drawing, and in accordance with Division 03, CONCRETE.// //Install precast units as specified above.//
- B. Pipe and Fittings: Ductile iron, polylined, piping shall be used inside of trap, between trap and buildings, and between trap and manhole.
- C. Manways and access manholes shall be set to finish grade providing adequate access to the unit. Slope pavement around the access-way to prevent stormwater from entering the unit.
- D. Install baffles as indicated on the drawings.

### 3.14 CLEANOUTS

- A. 150 mm (6 inches) in diameter and consisting of a ductile iron 45 degree fitting on end of run, or combination Y fitting and 1/8 bend in the run with ductile iron pipe extension, water tight plug, or cap and cast frame and cover flush with finished grade. Center-set cleanouts, located in unpaved areas, in a 300 mm by 300 mm by 150 mm (12 inches by 12 inches by 6 inches) thick concrete slab set flush with adjacent finished grade. Where cleanout is in force main, provide a blind flange top connection. The center of the flange shall be equipped with a 50 mm (2 inches) base valve to allow the pressure in the line to be relieved prior to removal of the blind flange. Frames and covers for pressure (force) mains shall be 600 mm (24 inches) in diameter.
- B. The top of the cleanout assembly shall be 50 mm (2 inches) below the bottom of the cover to prevent loads being transferred from the frame and cover to the piping.

**3.15 SETTING OF GATE VALVES**

- A. Avoid setting valves under pavement except where shown on the drawings.
- B. Clean valve interior before installation.
- C. Set valve plumb, restrain ends of valves when indicated on the drawing.
- D. Set valve box cover flush with the finished grade. Valve box shall be centered over the operating nut.

**3.16 SETTING OF CHECK VALVES**

- A. Check valves shall be installed in a vault. Direct burial of check valves are prohibited.
- B. Check valves shall be set in the horizontal position, with adequate clearance to the structure to allow for movement of the lever and maintenance of the valve.
- C. Clean the interior of the valve and check its operation prior to installation.
- D. After installation, adjust the weight on the lever to provide proper operation in accordance with the manufacturer's recommendations.

**3.17 SETTING OF AIR RELEASE VALVES**

- A. Set valves in vault with adequate space for maintenance of the valve. The vault shall have a solid floor to prevent all sanitary blowoff from being absorbed into the soils.
- B. Valves shall be set plumb and supported to the vault. Maintain accessibility to the isolation valve on the air valve line.
- C. Install the valve after the completion of testing of the pressure (force) main.

**3.18 INSPECTION OF SEWERS**

- A. Inspect and obtain the COR's approval. Thoroughly flush out before inspection. Lamp test between structures and show full bore indicating sewer is true to line and grade. Lip at joints, on the inside of gravity sewer lines are not acceptable.

**3.19 STARTUP AND TESTING**

- A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

- C. //The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and Commissioning Agent. Provide a minimum notice of 10 working days prior to startup and testing.//

### 3.20 TESTING OF SANITARY SEWERS

- A. Gravity Sewers and Manholes (Select one of the following):

1. Air Test: PVC Pipe, Uni-Bell Uni-B-6. Clean and isolate the section of sewer line to be tested. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. The line shall be pressurized to 28 kPa (4 psi) and allowed to stabilize. After pressure stabilization, the pressure shall be dropped to 24 kPa (3.5 psi) greater than the average back-pressure of any groundwater above the sewer. The minimum test time shall be as specified in Uni-Bell Uni-B-6.
2. Exfiltration Test:
  - a. Subject pipe to hydrostatic pressure produced by head of water at depth of 900 mm (3 feet) above invert of sewer at upper manhole under test. In areas where ground water exists, head of water shall be 900 mm (3 feet) above existing water table. Maintain head of water for one hour for full absorption by pipe body before testing. During one hour test period, measured maximum allowable rate of exfiltration for any section of sewer shall be 11 L (3.0 gallons) per hour per 30 m (100 feet).
  - b. If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.
3. Infiltration Test: If ground water level is greater than 900 mm (3 feet) above invert of the upper manhole, infiltration tests are acceptable. Allowable leakage for this test will be the same as for the exfiltration test.

- B. Pressure (Force) Mains: Test at 690 kPa (100 psi) for two hours. Leakage shall be per the following:

$$L=J*D*\sqrt{P}/4500$$

Where:

- L = Maximum Allowable Leakage in Gallons per Hour
- J = Number of Joints in Test Area
- D = Diameter of Pipe in Inches
- P = Average Test Pressure (Psi)

- C. Testing of Concrete Wet Well: No leakage with the wet well completely filled with water for a duration of 4 hours.

**3.21 //COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.
- B. Components provided under this section of the specification will be tested as part of a larger system.//

**3.22 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for //four// // // hour//s// to instruct each VA personnel responsible in the operation and maintenance of units.
- B. //Submit training plans and instructor qualifications in accordance with the requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//

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