**SECTION 33 30 00**

**SANITARY SEWERAGE UTILITIES**

**BASED ON DFD MASTER SPECIFICATION DATED 09/01/2015**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

Modify this document to account for project specific conditions.

***Note to the Designer: If project also includes plumbing coordinate this section with:***

* ***Section 22 13 00 – Facility Sanitary Sewerage***

 and clearly define party responsible for testing of the respective utility on the Drawings.

**PART 1 - GENERAL**

**SCOPE**

Confirm application limits for Sanitary Sewerage Utilities specifications. Coordinate with Division 22 Plumbing.

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide for the sanitary sewer work required in these specifications and on the drawings. The limits of the work, including the responsible party for testing purposes, shall be clearly defined on the Drawings. Included are the following topics:

PART 1 - GENERAL

Scope

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Reference Standards

Submittals

Provisions for Future Work

As-Built Drawings

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Manholes

Castings

Manhole Chimney Seal

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PART 3 - EXECUTION

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Diversion Plan

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Casting Installation

Connections to Existing Structures

Sewer Laterals

Pipe Insulation

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Locator Tape

Deflection Testing

Leakage Testing

Sewer Televising

Abandon Sewer

**RELATED WORK**

 ***Note to the designer: Determine if this work will impact other related work and revise these specifications accordingly to only include those Sections that apply to the project.***

Applicable provisions of Division1 govern work under this section.

Related work specified elsewhere:

Section 02 32 00 – Geo Technical Investigation

Section 22 11 00 – Facility Water Distribution

Section 22 13 00 – Facility Sanitary Sewerage

Section 22 14 00 – Facility Storm Drainage

Section 30 05 00 – Common Work Results for All Exterior Work

Section 31 23 16.13 – Trenching

Section 31 25 00 – Erosion Control

**REFERENCE DOCUMENTS**

Where reference is made to the “SSSWC”, it shall mean pertinent sections of the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition. Method of measurement and basis of payment sections in referenced documents shall not apply.

Where these specifications do not cover portions of the work to be undertaken, the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition, shall govern the work.

**REFERENCE STANDARDS**

American Society for Testing and Materials (ASTM) International:

C425 Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings

C700 Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated

D1784 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

D2235 Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings

D2564 Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

D2680 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping

D3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

D4673 Standard Classification System for Acrylonitrile-Butadiene-Styrene (ABS) Plastics and Alloys Molding and Extrusion Materials

F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679 Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

American Water Works Association (AWWA):

C104/ANSI A21.4 Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

C151/ANSI A21.53 Standard for Ductile Iron Pipe, Centrifugally Cast

C153/A21.53 Standard for Ductile Iron Compact Fittings

**SUBMITTALS**

Provide manufacturer’s product information (cut sheets), shop drawings and O&M information for sewer materials including:

* Pipe
* Fittings
* Pre-Cast and Cast-in-Place Structures
* Castings and Covers

Provide wastewater diversion and pumping plan.

Provide reports documenting all required testing and televising. testing results for the project to the DFD Project Representative and the AE within 48 hours of completing the individual tests.

**PROVISIONS FOR FUTURE WORK**

***Note to the designer: Describe any specific provisions required to accommodate future sanitary sewer work.***

Construct sanitary sewer system in a manner that will facilitate future extension or connection.

When drawings indicate future connection at a manhole or other structure, install a full length of pipe beyond the structure, providing plugged bell at terminal end of pipe. Provide marker board at terminal end of stubbed pipe.

**AS-Built drawings**

Show the actual locations of sanitary sewer pipes and service lines, manholes and cleanouts on drawings. Show changes to proposed sanitary sewer pipe, alignment, or grades. Show the actual locations, sizes and types of underground utilities and other features encountered during construction.

**PART 2 - MATERIALS**

***Note to the designer: Edit material requirements to account for agency/institution and local utility requirements, or variations in material availability. Edit pipe requirements to account for depth of bury, traffic and other load conditions for this project.***

**PVC PIPE**

Conform to ASTM D-3034 with solvent weld or elastomeric joints. Pipe shall be SDR-35, unless otherwise noted. Pipe over 15 inches in diameter shall meet the requirements of ASTM F679-03. Do not mix different manufacturer's products, or fittings.

PVC fittings shall be same joint type and SDR as connecting PVC sanitary sewer pipe.

**HDPE PIPE**

***Note to the designer: Verify the necessary Dimension Ratio (DR) based on site specific conditions including pipe diameter, depth and soil type.***

Polyethylene Resin

Polyethylene resin used for manufacturing piping and fittings shall meet ASTM D1248 for Type III, Class C, Grade P34, Category 5, with a PPI recommended designation of PE3408 and a minimum cell classification of PE 345434C in accordance with ASTM D3350. The polyethylene compound shall be combined with carbon black to provide protection against degradation by ultraviolet light. Pipe shall be made from virgin material with no rework compound, except that obtained from the manufacturer’s own production of the same formulation.

Polyethylene Piping

High density polyethylene (HDPE) piping, shall meet the requirements of AWWA C906, current version. Pipe dimensions and workmanship shall be in accordance with ASTM F714 and ASTM D2122. Pipe shall be of diameter shown on the drawings, with dimension ratio (DR) of DR11, unless otherwise noted.

Pipe, fittings, and joints shall meet or exceed the following physical properties:

|  |  |  |
| --- | --- | --- |
| Property | ASTMTest method | Value |
| Density, gm/cc | D1505 | 0.955 |
| Melt Index, gm/10 min | d1238-e | 0.10 |
| High Load Melt Index, gm/10 min | D1238-F | 12.0 |
| Tensile Strength @ Break, psi | d638 | 4,500 |
| Tensile Strength @ Yield, psi | d638 | >3,200 |
| Elongation, % | d638 | >800 |
| Flexural Modulus, psi | d790 | 136,000 |
| Environmental Stress Cracking Resistance F20’ Hours (100°c) | d1693 (Cond. C) | >5,000 |
| Brittleness Temperature, °f | d746 | <-180 |
| Melting Point, °f | d789 | 261 |
| Vicat Softening Temperature, °f | d1525 | 255 |
| Hardness, Shore D | D2240 | 66 |
| Volume Resistivity, ohm-cm | D991 | 2.6 1016 |
| Recommended Hydrostatic Design Stress: |  | 1600 psi @ 73.4°F800 psi @ 140°F |

Pipe Marking

Each length of straight and special HDPE pipe and each HDPE fitting shall be plainly marked on the outside to identify the design pressure or class of pipe, proper location of the pipe or fitting in the pipeline, and the date of manufacture.

**Ductile iron watermain**

Ductile watermain shall be Class 52, ANSI/AWWA C151/A21.51centrifugally cast, cement mortar lined meeting the requirements of ANSI/AWWA C104/A21.4.

Ductile iron watermain joints shall be rubber gasket push-on joint or mechanical joint meeting the requirements of ANSI/AWWA C111/A21.11.

Pipe shall be provided with conductive bonding straps to provide electrical continuity.

Pipe shall be manufactured in the United States.

**CONNECTIONS FOR DISSIMILAR PIPE MATERIALS**

Where new sewer connects to and existing dissimilar pipe, the connection shall be made with a no hub type coupling meeting the requirements of CISPI 310.

Couplings shall have neoprene gaskets with stainless steel shield, and multiple stainless steel clamps with worm gear tightening device. The couplings shall be made specifically for the type and size of pipe materials being connected.

Couplings shall be Fernco, Husky, or approved equal.

**MANHOLES**

General

Provide precast concrete manholes. Cast-in-place manholes may only be used after receiving written approval by the DFD Project Representative and the A/E for customized manhole sizes and shapes.

Submit manufacturer's preproduction (shop) drawings for approval prior to the start of manufacturing.

Contractor shall verify existing pipe locations, sizes, orientation and elevation prior to ordering new manholes.

Precast Manhole Sections

Note to the designer: Determine manhole sizes based on pipe size, location, orientation and other project specific requirements.

Precast concrete manhole sections, including bottom and top shall meet the requirements of ASTM C478.

If conditions require a larger structure than shown on drawings, contact the DFD Project Representative and the A/E.

Provide eccentric cone top sections with a minimum clear opening of 24 inches. Flat top slabs may be used on manholes greater than 6-foot inside diameter.

Manhole wall thickness shall be a minimum of 5 inches for 4-foot inside diameter manholes, 6 inches for 5-foot inside diameter manholes, and 7 inches for 6-foot and 7-foot inside diameter manholes.

Manhole bottom section shall be pre-cast with integral base having a minimum thickness of 8 inches unless otherwise noted.

Joints

Provide manhole riser and barrel sections, cones, and flat tops, with standard pipe section tongue and groove joints.

Seal joints watertight with prefabricated rubber or plastic gaskets or formed in place butyl rubber seal.

Joint sealers: Hamilton Kent, ConSeal, MultiSeal Butyl-Tite, or approved equal.

Connections

Openings for connections shall be cast-in-place or cored and appropriately sized for the type and size of pipe being connected.

Provide flexible, watertight, pipe-to-manhole connections (or "boots") for sanitary sewers; Kor-N-Seal, Hamilton Kent, A-Lok, or an approved equal.

Manhole Steps

Provide steps at 16” O.C. and project approximately 6” from wall.

Manhole steps shall be located in a straight, vertical line from the top of the manhole to the bottom. If the orientation of pipe openings prohibits this, locate manhole steps over the downstream pipe opening.

Manhole steps shall be steel reinforced polypropylene with ½-inch diameter deformed reinforcing bar. Steps shall be permanently secured in the manhole wall.

Manhole steps shall be American Step Company, M.A. Industries, or approved equal.

Bench and Flowline

Provide precast or cast-in-place bench and flowline.

Unless otherwise indicated on the drawings, bench height shall be ¾ the diameter of the downstream pipe. Slope bench towards flowlines at a minimum ½” per foot. Provide light broom finish on bench.

Flowlines shall be formed with gradual, uniform sweeps directed towards the downstream pipe. Provide smooth, troweled finish for flowlines.

When cast-in-place benches and flowline are used, lay the sewer pipe through the manhole.

Adjusting Rings

Fiber-reinforced pre-cast concrete adjusting rings meeting the requirements of ASTM C-478. Provide rings of 2 inches or 4 inches thickness.

Pre-compressed butyl gasket, 3/8”x3½” shall be used between the top of the manhole and first adjustment ring, and between all subsequent rings. Butyl material shall be E-Z Stick, or equal.

**CASTINGS**

Note to the designer: Determine casting type, size and load rating. Consult with the Owner Agency to address and specific casting requirements. Determine if any existing castings are able to be salvaged.

General

All manhole castings shall be heavy duty iron conforming to ASTM A48, Class 20 and rated for AASHTO H-20 loading. Provide water-tight, gasketed, self-sealing, non-rocking lids with concealed pickhole.

Standard Manhole Frame and Casting

Neenah Foundry R-1550, with Type B lid; or approved equal.

Low Profile Manhole Frame and Casting

Neenah Foundry R-1689, with Type B lid; or approved equal.

Standard Security Manhole Frame and Casting (Solid Lid)

Neenah Foundry Company R-1916-C with bolt down type B lid; or approved equal. Lid shall be water tight, gasketed, self-sealing, with concealed pick-hole.

Low Profile Security Manhole Frame and Casting (Solid Lid)

Neenah Foundry R-1689, with Type B lid having 4 Type “E” countersunk flathead pent socket screws; or approved equal. Lid shall be water tight, gasketed, self-sealing, with concealed pick-hole.

Manhole Chimney Seal

When indicated on the drawings, provide an internal frame/cone seal meeting requirements of Sections 8.42.3-8.42.5 of the SSSWC.

**DROP MANHOLES**

Note to Designer: Determine drop manhole configuration and manufacturing methods.

Provide outside drop sanitary manholes where shown on the drawings or where the elevation difference between the incoming invert and the springline of the outgoing pipe is greater than 2 feet.

Provide drop manhole bases with integral 1-foot minimum overhanging base.

Pre-cast outside drops will be considered on a case-by-case basis.

Provide outside drop with the same size and type of pipe as the sewer, with a wye or tee into the manhole at the top on the line and grade of the sewer and a one-quarter bend with its invert into the manhole at the elevation of theoutlet pipe springline.

**BOARD INSULATION**

Insulation shall be rigid, closed-cell extruded polystyrene insulation suitable for buried insulation. Individual boards shall have dimensions of 8’x4’x2”.

Owens Corning, Dow Styrofoam, or approved equal.

**tracer wire**

Tracer wire shall be #10 solid copper wire with green insulated jacket.

**locator tape**

Tape shall be detectable metallic locator tape, specifically manufactured for marking utilities with a minimum width of 6 inches and detectable at a depth of 18”.

Tape shall be marked “SEWER” and green colored.

**PART 3 - EXECUTION**

**General**

Complete exploratory excavations at utility crossings as shown on the drawings and as necessary to complete the work.

Maintain clearances between existing or proposed sewer lines and watermains as follows:

* 8’ horizontal separation (measured center to center) between existing or proposed sanitary or storm sewers and watermains.
* 12” vertical separation (measured from outsides of pipes) where watermains cross over sanitary or storm sewers.
* 18” vertical separation (measured from outsides of pipes) where watermains cross under sanitary or storm sewers.

Notify the A/E and DFD Project Representative of utility conflicts as soon as they are encountered.

Store and handle pipe in accordance with manufacturers’ recommendations. Keep pipes clean of soil, debris and animals.

**DIVERTING SEWAGE**

***Note to the designer: Verify occupancy of tributary buildings with Agency/Owner. Modify for project conditions noting known periods of low or high flow.***

Tributary buildings and services will remain occupied during construction. Wastewater will continue to be discharged to the sanitary sewers during construction. Contractor shall provide, operate and maintain all diversion and pumping equipment necessary to carry out the work and allow wastewater to continue to be discharged to the sanitary sewer system. Provide all necessary generators or other power source necessary to operate pumps on a continuous basis. Extra pumping and power equipment shall be staged onsite to maintain sewage diversion in the event of failure of the primary pumping equipment. The Contractor is solely responsible for sewage diversion.

**DIVERSION PLAN**

Contractor shall provide a wastewater diversion and pumping plan indicating the order and schedule for completion of the work and associated diversion provisions. The plan shall indicate the location of proposed diversion, pipe size and type, discharge locations, and the type and size of pumping equipment to be used. The plan shall describe contingencies to be used in the event of failure of the primary pumps. Contractor’s diversion plan is subject to Owner’s approval prior to implementation.

**LAYING PIPE**

Install pipe in accordance with the SSSWC and ASTM specifications that pertain to the specified type of pipe material and the installation situation.

Do not use pipe or fittings that are cracked or contain defects.

Clean all pipe of any dirt and/or debris both inside and outside prior to placing in the trench.

Make joints in accordance with manufacturer's directions with due care to avoid damaging pipe and/or disturbing previously laid pipe.

Cut pipe only according to manufacturer's directions.

Lay all sewer pipes to horizontal alignment and grade shown on the drawings with bell ends up hill. Establish and maintain horizontal alignment. Discrepancies from the required horizontal alignment or grade at any location shall not be greater than 0.10’ or 0.05’, respectively.

**Bedding/utility Cover**

Note to the designer: Determine the materials to be used for bedding and utility cover based on the project specifics. Coordinate the materials to be used with those defined in Part 2 of Section 31 23 16.13 – Trenching.

Provide *[Crushed Stone Bedding]* shall be used for both bedding and utility cover in accordance with the applicable requirements of Section 31 23 16.13 – Trenching.

Where excavation extends below the bottom of the structure's base or the trench, bring the excavation to the required elevation by the use of compacted *[Crushed Stone Bedding]*.

A minimum of 8” of compacted *[Crushed Stone Bedding]* shall be placed below manhole base.

A minimum of 6” of compacted *[Crushed Stone Bedding]* shall be placed below the sanitary sewer pipe and 12” of cover material shall be placed over the sanitary sewer pipe (both measured at the bell of the pipe).

**MANHOLES**

Manholes having improper location and/or orientation of the pipe connections will be rejected. Field repairs or adjustments of connection points are not permitted.

Do not connect abandoned pipes to new manholes.

Limit the excavation for manholes so as to provide only the necessary amount of space to sufficiently prepare the subgrade, set the base, set the manhole or structure, and lay pipe. Provide adequate clearance for compaction equipment and operator between structure and trench soil retention for adequate backfilling and compaction.

Set manhole base in accordance with elevation and location as indicated on the drawings. Install base plumb and level. Install subsequent pre-cast manhole sections in accordance with shop drawing layout. Provide watertight gaskets between each manhole section.

Pour inverts with smooth surface draining to downstream pipe. Where two or more lines meet at an angle, provide curved channel. Slope manhole bench at 2 inches/foot towards flow channel.

Manholes shall be provided with between 4 inches and 8 inches of adjusting rings, with the top adjusting ring being 2” thick. Provide butyl sealant material between rings. Once rings are in place, tuck point the exterior joint and provide the entire exterior surface of the adjusting ring riser with a coating of mortar.

When indicated on the drawings, the manhole frame shall be set with a Type I frame/chimney joint as specified in the Standard Specifications for Sewer and Water Construction in Wisconsin, latest edition. The frame and adjusting rings shall be sealed with an internal rubber sleeve as detailed in File 12A of the Standard Specifications.

Drop manholes shall be constructed in accordance with the SSSWC.

**CASTING INSTALLATION**

***Note to the designer:* *Correctional and mental health facilities shall be provided with Security Castings. Verify casting models and locking or fastening features to be incorporated into manhole covers. If welded covers are required specify whether contractor or institution staff will weld manhole covers.***

Install casting type as indicated on the drawings or in the specifications. *[Correctional and mental health facilities shall be provided with Security Castings.*]

Provide butyl sealant material between last adjusting ring and casting base. Adjust casting elevation and slope to match adjacent proposed grades.

**CONNECTIONS TO EXISTING STRUCTURES**

Make all necessary openings into existing structures or sewers including the reconstruction of existing inverts or benches, as necessary. Patch all openings permanently watertight with hydraulic cement and flexible watertight boots.

**SEWER LATERALS**

***Note to the designer: If connecting lateral to sewer main owned by municipality or sewer district, verify connection requirements and modify this specification accordingly. A manhole may be required at the connection of a lateral greater than 6-inches in diameter to the sewer main.***

Connect existing sewer laterals in accordance with all of the requirements of the sewer mains, including bedding, backfill, compaction, and jointing of the pipe. Connect sewer laterals to the sewer main by means of an approved "wye" fitting. Connect the new pipe to the existing lateral material using a no-hub coupling or approved transition fitting. Coupling/fitting shall be selected for the specific pipe material being connected.

Subject to local municipality requirements, cut-in type saddle wyes are permitted on existing sanitary sewers where service laterals are to be connected to the sewer. Unless otherwise indicated, the saddle fitting shall be gasketed PVC, with stainless steel bands and hardware.

**PIPE INSULATION**

Provide board insulation where indicated on drawings or where depth of cover is less than 6 feet.

Install insulation on compacted utility cover material, 6” above the top of the pipe. Stagger joints where more than one layer of insulation is required. Provide insulation with a minimum of 1’ of utility cover material. Place cover and backfill material in manner that does not damage insulation; replace any damaged insulation.

**TRACER WIRE**

Note to the designer: Coordinate with the current version of Safety and Professional Services (SPS) 382 Locating Requirements.

Provide tracer wire for buried non-metallic sewer piping. Tracer wire shall be installed directly above the top of pipe and within six inches of the pipe.

Splices in tracer wire shall be made with split-bolt or compression-type connectors.

Access points are required every 400 feet or closer. At access points the tracer wire shall be brought to grade with manholes or other covered access devices.

**LOCATOR TAPE**

Install locator tape directly above new non-metallic sanitary sewer pipe approximately 15 inches below finished grade. Bring tape to surface and terminate in valve box or other structure.

**DEFLECTION TESTING**

Test all PVC sewer pipe in the presence of the DFD Project Representative by a "go-no-go" deflection test mandrel furnished by the Contractor. Do not perform deflection testing any sooner than 30 days following the installation of the PVC pipe. Pull the mandrel by hand, or hand operated winch so as to avoid any damages to the pipe that may be caused by mechanized pulling equipment.

Size the mandrel to test the pipeline for a maximum allowable internal deflection of the pipe (in any direction) of not to exceed five (5) percent of the original internal diameter for the pipelines tested, regardless of how long after installation the testing takes place.

Deflection testing may be done concurrently with any necessary televising of the sewers. When done concurrently with sewer televising, the mandrel may be pulled by mechanized equipment, provided the mandrel is visible in the television picture during the testing and the operation of the mandrel can bequickly halted before damage to the pipe occurs.

Where poor trench soils conditions require the pipe excavation to be undercut and/or over excavated, the DFD Construction Representative reserves the right to require an additional deflection test prior to the expiration of the Contractor's one year performance guarantee.

Remove and replace all pipe that fails to pass the five (5) percent vertical deflection testing until the pipe passes the deflection test.

**LEAKAGE TESTING**

All new sanitary sewer lines shall be leakage tested in accordance with Chapter 3.7.0 of the SSSWC.

**SEWER TELEVISING**

Upon completion of the sewer construction all new sewers shall be televised to provide a record of the actual conditions inside the newly constructed sewers via closed circuit televising equipment. The DFD Project Representative may or may not be present during sewer inspections via this method.

Utilize televising equipment with a color camera specially designed and equipped for the conditions of the sewers to be televised, and with a monitor screen.

Transport the camera equipment through the sewers by means of mechanical or hand operated winches, coordinated to provide speed and directional control necessary to fully observe the sewer interior. Provide a light source for the necessary illumination.

Provide televising equipment equipped with an on-screen distance meter, capable of registering distances in the sewer from the starting manhole, and accurate to the nearest 0.5’ station, so as to facilitate in the locating of sewer features and/or defects from the ground surface.

Provide televising equipment with an on-screen date and time clock, so as to permit the verification of the date and time of the television inspection.

All video files of the sewer inspection shall contain audio notes describing the sewer location, direction of inspection, and a description of any pertinent features observed during the televised inspection (service locations, leaking or faulty joints, debris in the line, offset joints, etc.). In addition, record this information on a written log or record, in a format of the Contractor's choosing.

The Contractor shall provide to the DFD Project Representative with 2 DVD copies of the CCTV inspection videos and all inspection forms.

**ABANDON SEWER**

Existing sewer that is no longer in service, but is left in place shall be abandoned in accordance with Section 3.2.24 of the SSSWC. Sewer shall not be abandoned until existing services have been reconnected to the replacement sewer.

**END OF SECTION**