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STORM SEWER

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SECTION 300

STORM SEWER

300 GENERAL

A. Storm sewer construction shall consist of all excavation, materials, installation, restoration, and related work as specified herein or shown on the drawings.

B. CONTRACTOR shall comply with requirements of Sections 200 and 600 for all storm sewer construction.

301 MATERIALS

A. General: all storm sewer pipe, fittings, and accessories shall be of reinforced concrete. Alternate pipe materials shall be provided as specified at locations shown on the drawings, or approved by ENGINEER.
   1. Minimum pipe size for storm mains shall be 15 inch diameter.
   2. Minimum pipe size for storm sewer laterals shall be 12 inch diameter.

B. Reinforced Concrete Pipe:
   1. Reinforced concrete sewer pipe shall be minimum Class III (ASTM C76) and reinforced concrete elliptical sewer pipe shall be minimum Class HE-III (ASTM C507).
   2. Rubber gaskets shall conform to the requirements of Specifications for Joints for Circular Concrete Sewer and Culvert Pipe, using Flexible, Watertight, Rubber Type Gaskets (ASTM C443).
   3. Bituminous mastic material shall be used for all elliptical concrete storm sewer pipe at the joints. The exterior of elliptical joints shall be sealed with Macwrap Exterior Joint Sealer as manufactured by Mar-Mac Manufacturing Company, installed according to manufacturer's recommendations. For pipe sizes up to 34-inch by 53-inch, the band shall be 9 inches wide. For larger pipes, the band shall be at least 12 inches wide.
   4. All exposed end sections shall be provided with precast concrete apron end walls.
   5. Pipe ties shall be provided for storm sewer lines discharging through apron end walls, to connect apron endwall and two adjacent sections of pipe. Pipe ties shall be provided in accordance with WisDOT Specifications.

C. Corrugated Metal Pipe and Pipe Arches:
   1. Corrugated metal pipe and pipe arches shall meet the requirements of AASHTO Designation M-36, and structural plate shall meet the requirements of AASHTO Designation M-167.
   2. Coupling bands shall be installed as recommended by the pipe manufacturer.
   3. All exposed end sections of corrugated metal pipe shall be provided with steel apron end walls.

D. Solid Wall PVC:
   1. Polyvinyl Chloride (PVC) sewer pipe shall meet the requirements of Standard Specifications for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings of ASTM D3034 for pipe sized 4 inches through 15 inches and ASTM F679 for pipe sizes 18 inches through 36 inches. All PVC sewer pipe shall have maximum standard dimension ratio (SDR) of 35. Pipe shall withstand flattening up to 60% without cracking, splitting or breaking and pass acetone immersion per ASTM D2152.

Acceptance of pipe materials shall be subject to tests conducted by an approved testing agency in accordance with ASTM D3034 and/or ASTM F679.

2. The wall thickness shall conform to requirements for a T-1 wall. PVC material shall have cell classification 12454-B or 12454-C as defined in ASTM D1784 with minimum modules of elasticity of 400,000 psi in tension. The pipe wall shall be homogeneous and contain no seams. Minimum pipe stiffness per ASTM D2412 shall be 60 psi for pipe sizes through 18-inch and 46 psi for 21-inch and larger pipe sizes. Pipe shall withstand impact of 210 foot-pounds for pipes sizes through 8-inch and 220 foot-pounds on larger sizes.
3. Pipe and fittings shall be the product of one manufacturer and the manufacturer shall have experience records substantiating acceptable performance of the pipe to be furnished.
4. Fittings shall be injection molded. Fittings such as saddles, elbows, tees, wyes and others shall be of material and construction corresponding to and have a joint design compatible with the adjacent pipe. Approved adapters shall be provided for transitions to other types of pipe.
5. Joints shall be of the elastomeric type. Elastomeric joints shall be a bell and spigot joint conforming to ASTM D3212 sealed by a rubber gasket conforming to ASTM F477 so that the assembly will remain watertight under all conditions of service, including the movements resulting from the expansion, contraction, settlement and deformation of the pipe. Bells shall be formed integrally with the pipe and shall contain a factory installed positively restrained gasket.
6. All exposed end sections shall be provided with steel apron end walls.

E. Open Profile Wall PVC (18-inch and Larger Pipe Only):

1. Open profile PVC sewer pipe and fittings shall meet the requirements of ASTM F794. Fittings shall conform to ASTM D3034 SDR 35. Pipe shall have smooth interior with a ribbed exterior. Exterior ribs shall be perpendicular to the axis of the pipe to allow placement of gaskets without additional cutting or matching. Pipe shall have solid cross section wall – no voids between inner and outer surfaces of pipe wall.
2. Acceptance of pipe materials shall be subject to tests conducted by an approved testing agency in accordance with ASTM F794. PVC materials shall have cell classification 12454-B or 12454-C as defined in ASTM D1784 with minimum modules of elasticity of 400,000 psi in tension. Pipe stiffness shall be minimum 46 psi when tested in accordance with ASTM D2412. Impact strength shall equal or exceed values given in ASTM D3034 or ASTM F679.
3. Pipe and fittings shall be the product of one manufacturer and the manufacturer shall have an experience record substantiating acceptable performance of the pipe to be furnished.
4. All joints shall be of the flexible elastomeric type with bells and spigots conforming to ASTM D3212. Gaskets shall conform to ASTM F477. All bells shall be formed integrally with the pipe. Elastomeric gasket shall be positively restrained in ribs on spigot of pipe.
5. Fittings shall be injection molded. Fittings such as saddles, elbows, tees, wyes and others shall be of material and construction corresponding to, and have a joint design compatible with the adjacent pipe. Approved adapters shall be provided for transitions to other types of pipe.
6. All exposed end sections shall be provided with steel apron end walls.

F. Corrugated High Density Polyethylene Pipe:
   1. Corrugated HDPE shall meet the requirements of AASHTO M294. All HDPE storm pipe used in the work shall be of adequate strength to support the trench loads and live construction loads applied.
   2. All exposed end sections shall be provided with steel apron end walls.

G. Inlets: Inlets shall be precast reinforced concrete conforming to the standard detail drawing.

H. Manholes and Catch Basins: Manholes and catch basins shall be precast reinforced concrete and shall conform to Specifications for Precast Reinforced Concrete Manhole Sections (ASTM C478) and the standard detail drawings. Joints shall be tongue and groove. Joint seal shall be circular O-ring conforming to ASTM C443, Ram Nek, Mas-Stik, butyl rubber gasket, or butyl rubber rope.

I. Castings: Castings for all inlets, manholes and catch basins shall conform with the standard detail drawings.

J. Apron Endwalls:
   1. Concrete apron endwalls for concrete pipe sewers shall be manufactured with reinforcement and concrete conforming to the pertinent requirements for Class III, Wall B, reinforced concrete pipe for circular pipe or Class HE III, reinforced concrete elliptical pipe for elliptical pipe. Steel apron end walls for CMP, PVC or HDPE pipe shall be provided in accordance with WisDOT Specifications.
   2. Apron endwalls shall be in accordance with the designs, dimensions, and details shown on the standard detail drawings.
   3. Pipe gates shall be provided on end walls where there is no line of sight through the pipe to another exposed end section, or where pipe length exceeds 100 feet. Pipe gates shall be provided in accordance with the standard detail.

K. Adjusting rings shall be injection molded high density polyethylene (HDPE), manufactured by Ladtech, IPEX, or equal. Joints shall be sealed with approved silicone or butyl sealant in accordance with manufacturer's recommendations. Materials shall conform to ASTM D-1248 using 100% recycled material. Rings shall be tested to assure compliance in meeting H-20 loading capacity per AASHTO Standards.

L. Where casting adjustment requirements cannot be met by the use of HDPE adjustment rings and upon ENGINEER's approval, CONTRACTOR shall provide precast concrete adjusting rings. Precast adjusting rings shall have at least one No. 2 reinforcing rod centered within ring and shall be sealed with 3.5-inch by 3/8-inch EZ-Stik, or equal, placed on each surface of the ring. Where EZ-Stik is not appropriate as determined by ENGINEER, CONTRACTOR shall seal rings with cement grout.

M. Riprap:
   1. This item of work shall consist of excavating areas as shown on the drawings or directed by ENGINEER; removing excess excavated material; installing geotextile fabric; and placing 18 inch deep riprap with the following graduation:

SIZE		% PASSING (by weight)
2.0 x d (50)	12 inch	100
1.5 x d (50)	9 inch	60-85
1.0 x d (50)	6 inch	25-50
0.5 x d (50)	3 inch	5-20
0.2 x d (50)	1 inch	0-5

2. Materials used shall be durable field or quarry stone of approved quality. Riprap shall be sound, hard, dense, resistant to the action of water, and free from seams, cracks, or other structural defects. At CONTRACTOR's option, waste concrete slabs may be substituted for the field or quarry stone, provided it is sound and free reinforcement. Height of freefall of riprap shall be as allowed by ENGINEER, but in no case shall this height exceed four feet. Hand work will be limited to the amount necessary to fill large voids or to correct segregated areas.
3. This item shall also include furnishing and installing geotextile fabric for subgrade separation beneath the riprap. CONTRACTOR shall install a Mirafi 600X woven geotextile fabric, or approved equal.
4. The storm sewer outfall areas shall be excavated and graded smooth and all stones, roots, sticks or other foreign material which would interfere with the fabric being completely in contact with the soil shall be removed prior to placing the fabric. The fabric shall be placed loosely and in the direction of the water movement. Separate pieces of fabric shall be joined by sewing or overlapping a minimum width of 12 inches. Damaged areas shall be covered with a patch of fabric providing a 3-foot overlap in all directions.

302 CONSTRUCTION PROCEDURES

A. All manholes, inlets, catch basins, headwalls, apron endwalls and pipe gates, shall be constructed according to the drawings and standard detail drawings.

B. All pipe and manhole lift holes shall be filled with a conical plug and sealed watertight with hydraulic cement applied to exterior surface.

C. Pipe connections at structures shall be grouted watertight.

303 TESTING

A. CONTRACTOR shall prepare all pipeline for testing and shall furnish all equipment, materials, tools, and labor necessary for performance of the tests.

B. All PVC and HDPE sewer pipe shall be tested for deflection. Maximum deflection after completion of backfilling shall be 5% of the inside pipe diameter. Deflection shall be measured by pulling a mandrel with a vertical diameter equal to 95% of the pipe inside diameter through the line, after thoroughly flushing the lines to be tested. The testing device shall be controlled using cables at both the upstream and downstream manholes. The testing device must be pulled manually and pass freely through the sewer. Any line which will not pass the mandrel will not be accepted until the faulty sections have been removed and replaced and the line retested.

C. Storm sewers may be videotaped by OWNER. If videotaping reveals a defect that requires repair, CONTRACTOR shall reimburse OWNER for cost of videotaping that section of pipe. All storm sewers with defects, including but not limited to cracked or deformed pipe, misaligned joints, unsealed lift holes, and incorrect gradelines, as identified through videotaping, shall be relaid or shall be paid for at 50% of the price bid. Relaying the pipe or reducing payment shall be at OWNER's discretion.

D. Installations which fail to meet the test limits shall be repaired in a manner acceptable to ENGINEER. In general, defective pipe installations should be uncovered and relaid, with new pipe if necessary, to repair the defect, at CONTRACTOR's cost. Under no circumstances shall defects be sealed from the interior of the pipe, and only where specifically allowed by ENGINEER shall defects be sealed from the exterior of the pipe.

304 ABANDONMENT OF EXISTING STORM SEWER FACILITIES

A. Where existing storm sewer facilities are required to be abandoned, or where existing abandoned facilities are discovered during construction, CONTRACTOR shall abandon these facilities as follows:
   1. Remove existing pipes or fill them with sand or grout and seal ends with a minimum 2-foot thick grout plug.
   2. Remove existing inlets, catch basins, and manholes to at least 2 feet below finished grade. Provide a minimum 6-inch hole in the bottom of the structure and fill the remaining portion with bedding stone.
   3. Salvage all castings and deliver them to OWNER at the City Water Utility yard behind the water tower at 3640 High Road.
   4. Cost for this work, as identified on the drawings, shall be paid for according to the lump sum bid.

305 MEASUREMENT AND PAYMENT

A. Cost for the work shall be paid for according to the various prices bid. Bid prices shall include all equipment, materials and labor to complete the work as specified herein including dewatering, excavation, bedding, material installation, cover, backfill (using excavated materials) and other miscellaneous items of work specified herein.

B. Storm Sewer Pipe: Storm sewers shall be measured by length in feet of each of the various types, classes and sizes of pipe installed, measured along the centerline of the pipe center-to-center of junctions and fittings. Construction through manholes, catch basins, inlets and other structures shall be included in the length measured for payment. The quantity measured for payment does not include the lengths of apron endwalls. There shall be no deductions from the measured lengths for the installations of wyes, tees, angle-sections and special sections required to join pipes of dissimilar sizes, shapes, and types.

C. Apron Endwalls: Apron endwalls shall be measured separately as units of each of the various types, classes, and sizes installed. The price bid shall always include pipe ties where specified and pipe gates only if noted in the bid.

D. Storm Sewer Manholes, Catch basins, and Inlets: Storm sewer manholes, catch basins, and inlets shall be measured separately as units of each of the various types and sizes installed including castings, steps, weeper holes, and adjusting rings.

E. Riprap: Measurement and payment for riprap shall be per square yard of 18 inch deep riprap placed. Excavation, disposal of excess materials, and geotextile fabric shall be incidental to the price bid for riprap.

END OF SECTION