SECTION 330513
MANHOLES

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SECTION 330513
MANHOLES

PART 1 - GENERAL

1.1 SCOPE

A. This section of the Specifications shall govern the construction of standard sanitary sewer manholes, including manhole rings and covers, to be incorporated as detailed on the Drawings. The Contractor shall furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

1.2 REFERENCE STANDARDS

A. American Concrete Institute (ACI) 308 - Standard Specification for Curing Concrete

B. ACI 318 - Building Code Requirements for Structural Concrete

C. American Society for Testing and Materials (ASTM) A48/A48M - Standard Specification for Gray Iron Castings

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

E. ASTM C150 - Standard Specification for Portland Cement

F. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

G. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections

H. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile

I. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals

J. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures

K. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill

1.3 GENERAL

A. Unless otherwise shown on the plans and details or approved by the Engineer, standard sanitary sewer manholes shall be constructed on influent or effluent pipes 24-inches in diameter or smaller with precast reinforced concrete manhole sections or be monolithically poured concrete manholes.

1. A standard sanitary sewer manhole shall be a single maintenance entrance cylindrical structure having a uniform internal diameter of 4, 5 or 6 feet structure to the bottom of the diameter adjustment section or cone.
2. The base of the structure shall include the load-bearing portion beneath and exterior of the structure, invert channels, and the fill or bench portions adjacent to the lower sewer pipes within the structure.
3. The maximum vertical height of the diameter adjustment section or cone shall be 36 inches. Adjustment or throat rings may be used for elevation adjustment of the manhole ring and cover.
4. Manhole ring concrete encasement as shown on the plan details shall be provided to attach the ring and cover to the diameter adjustment section or cone.
5. Equipment, products, and materials shall be shipped, handled, stored, and installed in ways which will prevent damage to the items.
6. Damaged items will not be permitted as part of the work except in cases of minor damage that have been satisfactorily repaired and are acceptable to the Engineer.

B. For pipe penetrations through manholes, core through, install gasket around pipe, grout penetration on both sides, and install a minimum of 6 inches (thickness and distance) around collar outside of the manhole or inlet structure penetration. Connections shall be A-lok for ductile iron pipe, Kor-n-seal for PVC pipe, or equal. Manholes are expected to be watertight and have zero infiltration and inflow (I&I).

C. The intention of these specifications is to produce the best system for the Owner. If the Contractor suggests that an alternate material, equipment, or procedures will improve the results at no additional cost, the Engineer and the Owner will examine the suggestion and if it is accepted, it may be used. The basis upon which acceptance of an alternate will be given is its value to the Owner, and not for the convenience of the Contractor.

D. All measurements, including inverts and depths, shall be to the nearest 0.1 feet.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pre-cast manhole barrel, base and cone sections shall be of the dimensions indicated on the Drawings or required and shall meet the latest requirements of ASTM C-478. Barrels shall be 48-inch, machine made, tongue and groove indicated. Joints shall be jointed by an approved preformed plastic gasket meeting the requirements of federal specifications SS-S-00210, "Sealing Compound, Preformed Plastic for Pipe Joints," Type 1, rope form (Kent Seal or approved equal).

B. Add grout inside joints.

C. All riser joints shall be sealed on the outside with a 6” to 9” EPDM rubber seal wrap (Infi-Shield Gator Wrap, Seal Wrap, or approved equal).

D. Grade ring and cover shall be sealed on the outside with a molded EPDM rubber seal (Infi-Shield Uni-Band or approved equal).

E. Riser sections to be sealed with single offset gasket per ASTM C-443.

F. Manhole bases shall have inside diameters based on the size and type of pipe being connected to the manhole as shown in the drawings or as approved by the Engineer. Where 5'-0" diameter and larger bases are used, a flat top reducer section shall be used to transition to a 4'-0" diameter riser section. See detail drawings.

G. Manhole wall thickness shall be in accordance with the following schedule:

Manhole (ft)	Wall thickness (in)
4’ diameter	5"
5’ diameter	6"
6’ diameter	7"
7’ diameter	8"
8’ diameter	9"

H. Concrete bases shall be of the size and minimum thickness, as indicated on the Drawings. Bases shall be pre-cast, cast-in-place bases if approved by the Engineer shall be 4,000 psi conforming to the requirements of Section 033000. Bases shall be placed and leveled on a twelve-inch (12-inch) bed of crushed stone.

I. Suitable provision shall be made to assure a watertight connection of the sewer to the manhole. Holes in pre-cast bases to receive sewer pipes shall be provided with flexible manhole boots of high quality synthetic rubber, equal to Kor-N-Seal flexible connectors manufactured by NPC Systems, Inc. or pre-approved equal. The outer end of the boot shall fit around the outside of the pipe and shall be secured to the pipe by means of a stainless steel strap clamp. The synthetic rubber shall be suitable for use in sewage service.

J. Holes in pre-cast bases to receive sewer pipes shall be pre-cast at the factory at the required locations and heights or cored if approved by FCDWS. Knocking out of holes in the field will not be permitted. Holes will not be acceptable across riser seams.

Minimum Manhole Inside Diameter

Pipe Size Deflection Min M.H. Diameter

Pipe Size	Deflection (degrees)	Min. MH Diameter
8" Through 12"	0˚ - 90˚	4'-0"
15"	0˚ - 60˚	4'-0"
15"	60˚ - 90˚	4'-0"
18"	0˚ - 60˚	4'-0"
18"	60˚ - 90˚	5'-0"
20"	0˚ - 60˚	5'-0"
20"	60˚ - 90˚	5'-0"
24"	0˚ - 60˚	5'-0"
24"	60˚ - 90˚	6'-0"
27"	0˚ - 60˚	5'-0"
27"	60˚ - 90˚	6'-0"
30"	0˚ - 60˚	5'-0"
30"	60˚ - 90˚	6'-0"
≥36"		per FCDWS

K. Transition bases shall be accepted as equal to the bases specified above and for manholes with pipes greater than 30".

L. Manhole barrels shall be constructed of pre-cast reinforced concrete unless otherwise indicated on the Drawings.

M. Manhole cones shall be constructed of pre-cast concrete. Pre-cast Grade Rings shall be used to adjust ring and cover to finish grade. No more than 10 vertical inches of grade rings will be allowed per manhole. Grade Rings shall conform to ASTM C478 and shall be no less than 4" in height.

N. Brick shall not be used to adjust ring and cover to grade. Pre-cast concrete riser rings with a flexible rubber seal are required to adjust rings and covers to grade. A cast in place riser collar using methods and equipment as specified by the Whirlygig Company is considered as an acceptable alternative.

O. Inverts and tables may be constructed of rowlock brick if pre-cast inverts are not specified on the Drawings, and shall have the same radius as the outflow pipe. Invert walls shall be constructed to a height corresponding to the spring line of the influent and effluent pipes with smooth rounded walls. Inverts shall be appropriately channeled for all stub connections to the manhole.

P. The flow channel though manholes should be made to conform in shape and slope to that of the sewers. Minimum drop though manhole shall be 0.2 feet, or as specified on the Drawings to prevent solids deposition. Tables are to be gently sloped and troweled smooth from manhole wall to invert wall height and constructed of aggregate-mix cement with smooth, veneer finish.

Q. Manhole drops shall be provided at all locations where difference in invert elevations of the sewer pipes is two (2) feet or greater, or at such other locations as may be directed or indicated.

All drop connections shall be constructed using ductile iron pipe and fittings with mechanical joints. The slope of a sewer pipe entering an outside drop shall be no more than 5% (the maximum deflection for a mechanical joint).

R. All aluminum in contact with concrete shall have been painted with coal tar pitch paint.

S. Manhole steps shall be equal to M. A. Industries #PS-1. The manhole step shall be designed to be cast in place. The legs shall be at least 10" on center and overall width of the step shall be 12". Manhole Steps shall meet ASTM C-478, ASTM D-4104, ASTM A-615, and AASHTO No. M-199-811.

T. Manhole Safety platforms shall not be used as they interfere with a tripod and tether evacuation system.

U. A cast iron frame and cover shall be furnished for each manhole as follows:

1. Type A – For street and areas not subject to flooding. Provide heavy duty U.S. Foundry & Mfg. Corp. Model USF 229 & CU Cover, East Jordan Iron Works V1357, or approved equal. Areas not subject to flooding include those manholes whose cover resides at or above the 100-year flood plain shown on the drawings.

2. Type B – For areas subject to flooding. Provide East Jordan Iron Works V2358 watertight, U.S. Foundry & Mfg. Corp. Model 152-BV-BWT or approved equal. Areas subject to flooding include those manholes whose cover resides below the 100-year flood plain shown on the drawings.

3. Type C – For areas requiring venting. Provide, where shown on drawings, Neenah Foundry Co., Catalog R, 9th Edition, No. R-1659 or approved equal.

4. Type D – For elevated manholes, particularly on sanitary sewer trunk and outfall lines, the manholes should be installed with a ring and cover casting that allows the cover to rotate on a shaft recessed into the cast iron ring. The cover shall be of a watertight and bolt down configuration equal to U.S. Foundry & Mfg. Corp. Model USF 275 Ring & RO Cover or East Jordan Iron Works "Revolution" ring and cover. Both cover and frame shall be Class 35 B and meet the latest requirements of ASTM A48.

   NOTE: The following shall be cast into all sanitary sewer manhole covers in 1-1/2" (min) Sharp Face Gothic print:

"FORSYTH COUNTY SEWER" or "FORSYTH COUNTY SANITARY SEWER"

5. Type A frames and covers shall be properly set in place in full bed of mortar and adjusted so as to make the top of the frame conform to the finished surfaces when located in street and public highways. In other locations, they shall be so adjusted as to conform to such elevations as are indicated on the Drawings or as required.

6. Type B, Type C and Type D frames and covers shall be cast into the pre-cast manhole cones or slab tops at the place of manufacture of the manholes, unless drawings indicate that an adjustment to exact elevation is required. In that case Type B ,Type C and Type D frames and covers will be set as described for Type A frames and covers.

V. Low profile ring and cover shall not be used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of manhole structures shall conform to ASTM C478 and ASTM C891.

B. Excavation and backfill for manholes shall conform to the applicable provisions of Section 312316, Excavation, and Section 312316.13, Trenching

C. Place concrete base pad, trowel top surface level. Set precast manhole base unit level on 12" of crushed stone (#57) as specified herein for a cast-in-place base.

D. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad. Place manhole cylinder plumb and level, to correct dimensions and elevations.

E. Cut and fit for pipe.

F. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

G. Set cover frames and cover level without tipping, to correct elevations.

3.2 INSPECTION

A. All manholes installed will be visually inspected for any leaks or seepage from groundwater. Should a leak or seepage be discovered, the Contractor will take appropriate measures to repair the manhole and stop the leak or seepage.

B. Precast, reinforced, concrete manhole bases, risers, and covers shall be subject to rejection for failure to conform to any of the Specification requirements. In addition, individual sections of manhole risers and covers may be rejected for any of the following reasons:

1. Fracture or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
2. Defects that indicate imperfect proportioning, mixing, or molding.
3. Surface defects indicating honeycombed or open texture.
4. Damaged ends, where such damage would prevent making a satisfactory joint as determined by the Engineer or Owner.

5. The internal diameter of the manhole section varying more than 1 percent from the nominal diameter.

6. Any continuous crack having a surface width of 0.01 inch or more and extending for a length of 12 inches or more, regardless of the position in the section wall.

3.3 VACUUM TESTING OF MANHOLES

A. Vacuum testing of manholes for water tightness is required to demonstrate the integrity of the installed materials and the construction procedure. Vacuum testing shall be performed by the Contractor and witnessed by the Engineer or Owner

B. Testing shall be in accordance with ASTM C 1244.

C. If the manhole fails the initial test, the Contractor shall make all necessary repairs, then retest until a satisfactory test is obtained.

D. All manholes shall pass the vacuum test prior to final payment.

3.4 NOTICE OF CONNECTION TO EXISTING SYSTEMS

A. Prior to connection, the Owner shall have approved all construction of the sewer system.

B. The FCDWS shall be notified at least 24-hours in advance of connecting to the existing sewer system.

3.5 RECORD DATA

A. It will be required of the Contractor to keep accurate, legible records of the location of any deviations from the construction drawings, any additional items or structures to the construction drawings and all utilities encountered which are not shown on the construction drawings. These records will be made available to the Engineer before his inspection for incorporation into the Engineer' record drawings. The record drawings shall include: inverts with direction of flow, rim elevations, and manhole depths.

B. The Contractor shall provide photographic or video evidence of the installed manholes. One CD/DVD/other electronic format of the photos will be provided to each the Engineer and the Owner. Each manhole will have a wide-shot location picture, a picture of the rim and a picture of the interior of the manhole. The interior photo shall be taken from above, as clear as possible, facing downstream flows and be labeled as follows:
   1. "Project Name"
   2. "Manhole No. ___" (as identified in the Drawings)
   3. Date of installation (Year-Month-Day)

END OF SECTION 330513