

SECTION 33 3400 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

- A. Provide all labor, materials and equipment as necessary to complete all work as indicated on the Drawings and specified herein. Review specific project requirements with NU during the design phase.
- B. This Section includes:
 - 1. Storm drainage piping.
- C. Related Sections:
 - 1. Section 22 0000 “Common Work Results for Plumbing”

1.3 DEFINITIONS:

- A. PVC: Polyvinyl chloride plastic
- B. HDPE: High Density Polyethylene.
- C. RCP: Reinforce Concrete Sewer Pipe
- D. CSP: Non-reinforced Concrete Sewer Pipe

1.4 PERFORMANCE REQUIREMENTS – GRAVITY-FLOW, NONPRESSURE, DRAINAGE-PIPING
PRESSURE RATINGS:

- A. At least equal to system test pressure.

1.5 REFERENCES

- A. Except as herein specified or as indicated on the Drawings the work of this section shall comply with the following:
 - 1. AASHTO Standards M36 – Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
 - 2. M218 – Sheet Steel, Zinc-Coated (Galvanized) for Corrugated Steel Pipe.
 - 3. IDOT:

- a. IDOT Standard Plans.

1.6 SUBMITTALS

- A. Before commencing work, the Contractor shall provide an affidavit from the material manufacturers, that their materials meet the Specifications.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS:

- A. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings: ASTM A 74, gray iron, for gasketed joints.
 - 1. Gaskets: ASTM C 564, rubber, compression type, thickness to match class of pipe.
- B. Ductile Iron Pipe and Fittings: AWWA C151, for push-on joints.
 - 1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
 - 2. Gaskets: AWWA C111, rubber.
- C. Corrugated-Steel Pipe: Not permitted.
- D. Corrugated HDPE Drainage Tubing and Fittings: AASHTO M 252, Type S, with smooth waterway for coupling joints.
 - 1. Soiltight Couplings: AASHTO M 252, corrugated, matching tube and fittings to form soiltight joints.
- E. Corrugated HDPE Pipe and Fittings: AASHTO M 294, Type S, with smooth waterway for coupling joints.
 - 1. Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings to form soiltight joints.
 - 2. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings to form silttight joints.
- F. PVC Pressure Pipe: AWWA C900/C905, Class 150, for gasketed joints.
 - 1. PVC Pressure Fittings: AWWA C907, for gasketed joints.
 - 2. Gaskets for PVC Piping: ASTM F 477, elastomeric seals.
- G. PVC Sewer Pipe and Fittings:
 - 1. PVC Sewer Pipe and Fittings, 15" and Smaller: ASTM D 3034, SDR 26, gasketed joints.
 - 2. Gaskets: ASTM F 477, elastomeric seals.
- H. PVC Sewer Pipe and Fittings, 18" and Larger: ASTM F 679, T-1 wall thickness, bell and spigot for gasketed joints.
 - 1. Gaskets: ASTM F 477, elastomeric seals.

- I. Nonreinforced-Concrete Sewer (CSP) Pipe and Fittings: Not permitted.
- J. Reinforced-Concrete (RCP) Sewer Pipe and Fittings: ASTM C 76, Class III, with gasketed joints.
 - 1. Gaskets: ASTM C 443, rubber.
- K. Reinforced-Concrete Arch Pipe: ASTM C 506, Class IV, for banded joints.
 - 1. Sealing Bands: ASTM C 877, Type I.
- L. Reinforced-Concrete Elliptical Pipe: ASTM C 507, Class III, for banded joints.
 - 1. Pattern: Type HE, horizontal.
 - 2. Pattern: Type VE, vertical.
 - 3. Sealing Bands: ASTM C 877, Type I.

2.2 SPECIAL PIPE COUPLINGS AND FITTINGS:

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for nonpressure joints.
 - 1. Sleeve Material for Concrete Pipe: ASTM C 443, rubber.
 - 2. Sleeve Material for Cast-Iron Soil Pipe: ASTM C 564, rubber.
 - 3. Sleeve Material for Plastic Pipe: ASTM F 477, elastomeric seal.
 - 4. Sleeve Material for Dissimilar Pipe: Compatible with pipe materials being joined.
 - 5. Bands: Stainless steel, at least one at each pipe insert.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Heavy-Duty, Shielded, Stainless-Steel Couplings, 10-inch and Smaller: With ASTM A 666, Type 301 or Type 304, stainless-steel shield; 2 or more stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings, 12-inch and 15-inch: With ASTM A 666, Type 301 or Type 304, stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
- D. Unshielded Flexible Couplings: Elastomeric sleeve with stainless steel tension band and tightening mechanism on each end.

2.3 NORMAL-TRAFFIC PRECAST CONCRETE MANHOLES: ASTM C 478, PRECAST, REINFORCED CONCRETE, OF DEPTH INDICATED, WITH PROVISION FOR RUBBER GASKETED JOINTS.

- A. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
- B. Steps: Steel Reinforced Plastic or Cast Iron, individual steps. Wide enough to allow worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor

steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

- C. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include indented top design with lettering "STORM SEWER" cast into cover.
 - D. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 - E. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
 - F. Protective Coating: Plant-applied, Bitumastic Coal Tar SSPC-Paint 16, 10-mil minimum thickness applied to exterior surface.
- 2.4 NORMAL-TRAFFIC, PRECAST CONCRETE CATCH BASINS: ASTM C 478, PRECAST, REINFORCED CONCRETE, OF DEPTH INDICATED, WITH PROVISION FOR RUBBER GASKETED JOINTS.
- A. Gaskets: ASTM C 443, rubber.
 - B. Steps: Provide one of the following:
 - 1. Fiberglass, individual steps or ladder of a width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step.
 - 2. Steel Reinforced Plastic or Cast Iron individual steps. Wide enough to allow worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from invert to finished grade is less than 60 inches.
 - C. Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service.
 - D. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
 - E. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
 - F. Protective Coating: Plant-applied, Bitumastic Coal Tar SSPC-Paint 1610-mil minimum thickness applied to exterior surface.
- 2.5 STORMWATER INLETS:
- A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.
 - B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.
 - C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

2.6 CLEANOUTS:

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
1. Light Duty: In earth or grass foot-traffic areas.
 2. Medium Duty: In paved foot-traffic areas.
 3. Heavy Duty: In vehicle-traffic service areas.
 4. Extra-Heavy Duty: In roads.
 5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.
1. Light Duty: In earth or grass foot-traffic areas.
 2. Medium Duty: In paved foot-traffic areas.
 3. Heavy Duty: In vehicle-traffic service areas.
 4. Extra-Heavy Duty: In roads.
- C. Gray-Iron Area Drains: ASME A112.21.1M, round, gray-iron body with anchor flange and round, secured, gray-iron grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated. Use units with top-loading classifications according to the following applications:
1. Medium Duty: In paved foot-traffic areas.
 2. Heavy Duty: In vehicle-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
 3. Ballast: Increase thickness of concrete, as required to prevent flotation.

2.7 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS: MODULAR SYSTEM OF PRECAST, POLYMER-CONCRETE CHANNEL SECTIONS, GRATES, AND APPURTENANCES; DESIGNED SO GRATES FIT INTO CHANNEL RECESSES WITHOUT ROCKING OR RATTLING. INCLUDE NUMBER OF UNITS REQUIRED TO FORM TOTAL LENGTHS INDICATED.

- A. Sloped-Invert, Polymer-Concrete Systems: Include the following components:
1. Channel Sections: Interlocking-joint, precast, modular units with end caps, rounded bottom, with built-in invert slope of 0.6 percent minimum and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.
 - a. Frame: Include gray-iron or steel frame for grate.
 2. Grates with manufacturer's designation "Heavy Duty," with slots or perforations that fit recesses in channels.
 - a. a. Material: Provide fiberglass, galvanized steel, or stainless steel.
 3. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

- 2.8 PLASTIC, CHANNEL DRAINAGE SYSTEMS: MODULAR SYSTEM OF PLASTIC CHANNEL SECTIONS, GRATES, AND APPURTENANCES; DESIGNED SO GRATES FIT INTO FRAMES WITHOUT ROCKING OR RATTLING. INCLUDE NUMBER OF UNITS REQUIRED TO FORM TOTAL LENGTHS INDICATED.
- A. Fiberglass Systems: Include the following components:
1. Channel Sections: Interlocking-joint, fiberglass modular units, with built-in invert slope of approximately 1 percent and with end caps. Include rounded or inclined inside bottom surface, with outlets in number, sizes, and locations indicated.
 2. Factory- or field-attached frames that fit channel sections and grates.
 - a. Material: Galvanized steel Stainless steel Bronze
 3. Grates with slots or perforations that fit frames.
 - a. Material: Fiberglass Galvanized steel Gray iron Stainless steel Bronze.
 4. Drainage Specialties: Include the following plastic components:
 - a. Large Catch Basins: 24-inch- square plastic body, with outlets in number and sizes indicated. Include gray-iron frame and slotted grate.
 - b. Small Catch Basins: 12-by-24-inch plastic body, with outlets in number and sizes indicated. Include gray-iron frame and slotted grate.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 UTILITY LOCATION

- A. Prior to any utility installation work commencing, Contractor shall call JULIE / one-call Illinois locate.

3.3 INSTALLATION

- A. Connections and changes in direction or grade shall be made in manholes.
- B. Structure bases shall be cast-in-place concrete, transit mixed with minimum compressive strength of 3000 psi at 28 days, formed and finished level. Precast bases may be used with written approval of the Project Representative and where required by extremely difficult site conditions. Base slab shall be fully cured before precast portions are set.
- C. Precast concrete shall be used to construct structures. Only when precast sections are not manufactured in the size and shape required will block constructed structures be permitted. The Project Representative shall be notified prior to construction of block structures. Set precast sections in full mortar bed.

- D. Trench drains shall be constructed so that they sit on a foundation of a minimum depth of 42 inches, measured from finish grade to bottom of structure.
- E. Adjustment to Casting Elevations:
1. Concrete rings shall be used wherever possible to adjust casting elevations. Rings shall be set in full mortar bed. Use a maximum of 3 rings.
- F. Tile shall be laid through the manhole and 3000 psi concrete shall be placed around the tile up to half of the diameter. The concrete shall slope from the walls of the manhole to the sewer. When there is a change in grade, direction, or pipe size, the flow channel shall be built from bricks and 3000 psi concrete to make a uniform, smooth change in grade, direction or pipe size.
- G. Vertical elevation of the invert shall be within plus or minus 0.04 foot (1/2-inch) of required elevation. Horizontal alignment must meet the same tolerance.
- H. Pipe Connections to Structures:
1. Connections with existing sewers shall be made at points and in a manner indicated on the Drawings and approved by the Project Representative.
 2. Sewers being disconnected shall be sealed off with concrete.
 3. If PVC pipe connects to an existing or new structure, the pipe shall connect with an appropriately sized rubber boot.
- I. Catch basin sump shall extend 2 feet below the pipe outlet invert.
- J. Construct a peripheral sub-drainage system for catch basins.
1. Install 4-inch diameter perforated polyethylene corrugated drain pipe with a heavy duty sock covering around each new structure and existing structure, if at least 4 vertical feet is exposed or the outlet pipe is exposed.
 2. Pipe shall enter catch basin with a tee connector, 2 inches above and directly opposite the outlet invert.
 3. The peripheral drain pipe shall be positioned at 1/4-inch to provide positive drainage to the catch basin. The peripheral drain pipe shall be placed over the outlet pipe. Do not cut and cap the drain pipe at the outlet pipe.
 4. Backfill the drain pipe with properly compacted Class II sand to the finish subgrade.
- K. Connection method for culvert pipe:
1. Put coupling band into position at the end of pipe last laid with band open to receive next section.
 2. Bring next section into position within approximately 1-inch of last section laid.
 3. Clean the interior of band and exterior of pipe of all dirt, stone and debris.
 4. Pipes shall cleanly meet to allow for proper band pipe connections.
 5. Insert bolts and tighten, positioning the coupling band joint on the top half of pipe.
- L. Treatment of field welds and damaged galvanized steel surfaces of culvert pipe:
1. Clean with wire brush.
 2. Two coats of zinc-rich paint, conforming to Federal Specifications ML-P-21035.
- M. Install Tracer Wire per 22 0000 "Common Work Results for Plumbing".

3.4 TESTING AND INSPECTION

A. Inspections

1. Contractor shall inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - a. Submit separate reports for each system inspection.
 - b. Defects requiring correction include the following:
 - 1) Alignment: Less than full diameter of inside of pipe is visible between structures.
 - 2) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - 3) Crushed, broken, cracked, or otherwise damaged piping.
 - 4) Infiltration: Water leakage into piping.
 - 5) Exfiltration: Water leakage from or around piping.
 - c. Contractor shall replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - d. Contractor shall reinspect and repeat procedure until results are satisfactory.

B. Internal Television Inspection of Storm Sewers:

1. General:
 - a. Inspect sanitary sewers using a closed-circuit color television camera.
 - b. Provide Engineer with videos DVD format and written logs to document the internal television inspection:
 - 1) Written logs shall note the location of sewer laterals and pipe deficiencies by distance from the upstream manhole.
 - 2) The video tape shall include audio commentary regarding the sewer condition.
 - c. Engineer will review the videos and written logs to verify that the storm sewers were constructed in accordance with the Contract Documents.
 - d. The videos shall verify that the storm sewers are clean and free of sediment and debris to the satisfaction of Engineer. Storm sewers not satisfactorily cleaned shall be promptly cleaned and reinspected by closed-circuit color television camera.
 - e. Television inspection shall be completed, documentation of television inspection shall be provided and Engineer shall determine that the sewers were constructed in accordance with the Contract Documents before payment for completed sections of sanitary sewer will be recommended to Owner.
2. Performance Requirements:
 - a. Inspection procedures and equipment shall meet the applicable standards as presented in the National Association of Sewer Service Companies (NASSCO) Recommended Specifications for Sewer Collection System Rehabilitation.
 - b. Each section of sanitary sewer between manholes shall be television inspected separately utilizing a video camera and related equipment specifically designed for the purpose of internal sewer inspection.

- c. The camera speed shall not exceed 30 feet per minute.
- d. The camera shall be stopped for no less than 10 seconds at the entrance manhole, each service lateral, exit manhole, and at points where the sewer is damaged or deficient.
- e. Lighting for the camera shall be adequate to allow a clear picture of the entire periphery of the sewer and shall be varied as required to be effective for all pipe diameters inspected.
- f. Cables and equipment used to propel the camera shall not obstruct the camera view or interfere with the documentation of the sewer conditions.
- g. The video recording shall be continuous video file.
- h. The mobile recording studio shall have adequate space to accommodate up to 3 persons for the purpose of viewing the video monitor while the inspection is in progress.
- i. Whenever possible, the camera shall move in a downstream direction.
- j. The location of the camera in the sewer shall be monitored by an accurate measuring system which records the distance traveled from the upstream manhole on the video.
- k. Video DVDs and written logs shall be clearly labeled with the Project name and location identification.
- l. If sewer has dirt and debris which prohibits video inspection, the sewer shall be cleaned and re-televised at no expense to Owner.

C. Testing

- 1. Contractor shall test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - a. Contractor shall not enclose, cover, or put into service before inspection and approval.
 - b. Contractor shall test completed piping systems according to authorities having jurisdiction.
 - c. Contractor shall schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - d. Contractor shall submit separate reports for each test.
 - e. Contractor shall replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 33 4000

NORTHWESTERN UNIVERSITY
PROJECT NAME _____
JOB # _____

FOR: _____
ISSUED: 11/06/2018

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