SECTION 33 41 01

HIGH-DENSITY POLYETHYLENE PIPE (HDPE)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes construction of high-density polyethylene pipe for storm drainage culverts including appurtenances normally installed as a part of these systems. Construction may include surface preparation, trench excavation, shoring, dewatering, lay, align, and join pipe, installation of appurtenances, bedding and backfilling, surface restoration, and other related work.

1.02 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS, which may be related to this section:

1. Section 01 57 19, Temporary Environmental Controls
2. Section 31 11 00, Clearing and Grubbing.
3. Section 31 14 13, Topsoil Stripping and Stockpiling.
4. Section 31 23 00, Excavation and Fill.
5. Section 31 23 19, Dewatering.
6. Section 31 23 33, Trenching and Backfilling.
7. Section 31 25 00, Erosion and Sedimentation Controls

1.03 REFERENCES

A. The following is a list of standards, which may be referenced in this section.

1. American Association of State Highway and Transportation Officials (AASHTO):
    a. M252, Standard Specification for Corrugated Polyethylene Drainage Tubing.
    b. M294, Standard Specification for Corrugated Polyethylene Pipe.
    c. Section 18, Soil Thermoplastic Pipe Interaction Systems.
2. ASTM International (ASTM):
    a. D638, Standard Test Method for Tensile Properties of Plastic.

b. D1056, Specification for Flexible Cellular Materials - Sponge and Expanded Rubber.

c. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

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

e. D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Material.

f. D4976, Specification for Polyethylene Plastics Molding and Extrusion Materials.

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

h. F667, Standard Specification for Large Diameter Corrugated Polyethylene Tubing and Fittings.

i. F894, Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

j. F2306, Standard Specification for 12 to 60 in. Annular Corrugated Profile-Wall Polyethylene Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.

k. F2562, Specifications for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage.

l. F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and fittings.

3. Plastic Pipe Institute (PPI):

a. Handbook of Polyethylene Pipe.

b. TR-33, Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.

1.04 SUBMITTALS

A. Details of fittings and specials shall be furnished for approval by ENGINEER.

B. Unless otherwise specified, CONTRACTOR shall submit to ENGINEER for approval SHOP DRAWINGS showing the exact dimension of the joints including the permissible tolerances for each size of pipe being furnished and the size, type and locations of gasket materials. Approval of the joint detail DRAWINGS shall not relieve CONTRACTOR of any responsibilities to meet all of the requirements of these SPECIFICATIONS, or of the responsibility for correctness of CONTRACTOR’s details.

C. CONTRACTOR shall submit certified laboratory test certificates for all items required in this section.

D. CONTRACTOR shall cooperate with ENGINEER in obtaining and providing samples of all specified materials.

1.05 QUALITY ASSURANCE

A. Manufacturer:

1. Experienced in the design, manufacture, and commercial supplying of the specific material for a minimum period of five (5) years.

2. Experienced in the design, manufacture, and commercial supplying of the specific size of pipe for a period of one (1) year.

3. Certify to above minimum experience requirements.

B. All HDPE pipe and fittings shall be from a single manufacturer. All HDPE pipe to be installed may be inspected at the factory for compliance with these SPECIFICATIONS by an independent testing laboratory provided by the OWNER. The CONTRACTOR shall require the manufacturer's cooperation in these inspections. The cost of these plant inspections of all pipe approved, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the OWNER.

C. Inspection of the pipe shall also be made by the ENGINEER or other representatives of the OWNER after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the SPECIFICATION requirements, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Responsibility for Material:

1. Shipping: Material shall be shipped so to not cut, kink, or otherwise damage pipe during transport.

2. CONTRACTOR shall be responsible for all materials intended for the WORK that are delivered to the construction site and accepted by CONTRACTOR. Payment shall not be made for materials found to be defective or damaged in handling after delivery and acceptance. Defective or damaged materials shall be removed and replaced with acceptable materials at CONTRACTOR's expense.

3. CONTRACTOR shall be responsible for the safe and proper storage of such materials.

a. Limit stacking of pipe to a height that will not cause excessive deformation of bottom layers of pipes under anticipated temperature conditions.

b. Where necessary, because of ground conditions, store pipe on wooden sleepers, spaced suitably and of such widths as not to allow deformation of pipe at point of contact with sleeper or between supports.

c. Keep pipe shaded from direct sunlight prior to installation in the trench.

B. Pipe Acceptance:

1. In addition to any deficiencies not covered by the applicable ASTM Specifications, pipe, which has any of the following visual defects, will not be accepted.

a. Cracks, bubbles, pinholes, inclusions or occlusions, which, because of their nature, degree, or extent, detrimentally affect the strength and serviceability of the pipe.

C. Pipe Handling:

1. Pipe and accessories furnished by CONTRACTOR shall be delivered to, unloaded, and distributed at the site by CONTRACTOR. Each pipe shall be unloaded adjacent to or near the intended laying location.

2. Pipe fittings, specials, valves, and appurtenances shall be unloaded and stored in a manner that precludes shock or damage. Such materials shall not be dropped.

3. Pipe shall be handled to prevent damage to the pipe ends or to any coating or lining. Pipe shall not be skidded or rolled against adjacent pipe. Damaged coatings or lining shall be repaired or replaced by CONTRACTOR, at CONTRACTOR's expense in accordance with the recommendations of the manufacturer and in a manner satisfactory to Engineer. Physical damage to the pipe or accessory shall be repaired or replaced by CONTRACTOR at CONTRACTOR's expense, and in a manner satisfactory to ENGINEER.

D. Gasket Storage: All gaskets shall be stored in a cool place, preferably at a temperature of less than seventy degrees Fahrenheit (70°F.), and in no case shall the gaskets be stored in the open, or exposed to the direct rays of the sun.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: HDPE pipe, which does not conform to ASTM D3350, ASTM D 4976, ASTM F667, ASTM F894, ASTM F2306, or ASTM F2562 or to any other requirement specified herein, shall not be approved for storm sewer, culvert, or sanitary sewer installations.

B. Allowable Pipe diameters for this specification shall be between eighteen (18) inches to thirty-six (36) inches unless approved by ENGINEER and OWNER.

C. Allowable ASTM Specifications: All material, manufacturing operations, testing, inspection, and making of HDPE pipe shall conform to the requirements of the appropriate allowable ASTM Standard Specifications, latest revision thereof, listed in Article References.

D. Marking:

1. The following shall be clearly marked on both the interior and exterior surface of the pipe:

   a. Class and size.

   b. Date of manufacture.

   c. Name or trademark of manufacturer.

   d. Deflection angle for bends.

E. Diameter of Pipe: The diameter indicated on the DRAWINGS shall mean the inside diameter of the pipe.

F. Wall Thickness and Class of Pipe:

1. The wall thickness shall comply with the appropriate ASTM Specification and the class of pipe designated on the DRAWINGS.

2. HDPE pipe and fittings shall have a smooth interior and corrugated exterior. 18-inch through 36-inch pipe shall meet the requirements of AASHTO M294 Type S. The pipe shall have a full circular cross-section with annular corrugations. Pipe shall be produced to constant internal diameters.

3. Pipe and fittings shall be made of high-density, high-molecular weight polyethylene material meeting the requirements of cell classification 324420C or higher in accordance with ASTM D3350. Clean rework material generated by the manufacturer's own production may be used so long as the pipe or fittings produced meet all the requirements of this SPECIFICATION.

G. Fittings and Specials:

1. Elbows and fittings shall be mitered from pipe sections welded together on the interior and exterior at all junctions.

2. The pipe sections forming the miters shall be cut to fit with no gap.

3. Tolerances on the angle of all elbows shall be plus or minus 1 degree.

4. The standard turning radius of elbows shall be 1.5 times the inside diameter. Special turning radii shall be used for special applications.

5. Elbows shall conform to the following requirements:

Angle of Elbow (Degrees)	**Number of Miters**
0 to 45	1
45 to 90	2

6. Elbows shall be designed to prevent joint rupture resulting from dynamic forces or application of a test pressure of 25 psi.

H. Joints:

1. Watertight joints shall be accomplished by rubber gasket, in accordance with ASTM D3212.

2. Gaskets shall be closed-cell synthetic, expanded rubber meeting the requirements of ASTM D1056, Grade 2A2 or made of polyisoprene meeting ASTM F477. Gaskets shall be installed on the connection by the pipe manufacturer.

3. Lubricant shall have no detrimental effect on the gasket of on the pipe.

4. Integral bell and spigot gasketed joints shall be designed so that when assembled, the elastomeric gasket, contained in a machined groove on the pipe spigot, is compressed radially in the pipe bell to form a positive seal. The joint shall be designed to avoid displacement of the gasket when installed in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.01 GENERAL

A. The pipe and pipe coatings shall be inspected by ENGINEER for damage or defects before being placed in the trench. Damaged or defective pipe shall not be installed.

B. All pipes, which do not meet the requirements of PART 2 of this section, will be rejected and replaced at CONTRACTOR's expense.

C. CONTRACTOR shall install storm sewer pipe of the type, diameter, load class, wall thickness, and protective coating that is shown on the DRAWINGS.

D. Proper equipment, implements, tools, and facilities shall be provided and used by CONTRACTOR for safe and convenient installation of the type of pipe being installed.

3.02 SURFACE PREPARATION

A. Within Easement, Cultivated, Landscaped, or Agricultural Area:

1. All vegetation, such as brush, sod, heavy growth of grass or weeds, decayed vegetable matter, rubbish and other unsuitable material within the area of excavation and trench side storage shall be stripped and disposed of in accordance with the requirements of Section 31 11 00, Clearing and Grubbing.

2. Topsoil shall be removed to a depth of eight (8) inches or the full depth of the topsoil, whichever is less. Topsoil shall be removed from the area to be excavated and stockpiled, or, CONTRACTOR may elect to import topsoil to replace that lost during excavation.

B. Within Unpaved Roadway Areas: CONTRACTOR shall strip the cover material from graveled roadways or other developed, but unpaved traffic surfaces to the full depth of the existing surfacing. The surfacing shall be stockpiled to the extent that it is acceptable and useable for restoration purposes.

C. Within Paved Areas:

1. The removal of pavement, sidewalks, driveways, or curb and gutter shall be performed in a neat and workmanlike manner. Concrete pavement, asphalt, sidewalks, driveways, or curb and gutter shall be cut with a power saw to a depth of two (2) inches prior to breaking. The concrete shall be cut vertically in straight lines and avoiding acute angles.

2. Bituminous pavement, sidewalks, driveways, or curb and gutter shall be cut with a power saw, pavement breaker, or other approved method of scoring the mat prior to breaking or excavation. The bituminous mat shall be cut vertically, in straight lines and avoiding acute angles.

3. Any overbreak, separation, or other damage to the existing bituminous or concrete outside the designated cut lines shall be replaced at CONTRACTOR's expense.

4. Excavated paving materials shall be removed from the job site and shall not be used as fill or backfill.

3.03 DEWATERING

A. All pipe trenches and excavation for structures and appurtenances shall be kept free of water during pipe laying and other related work. The method of dewatering shall provide for a dry foundation at the final grades of excavation in accordance with Section 31 23 19, Dewatering. Water shall be disposed of in a manner that does not inconvenience the public or result in a menace to public health. Pipe trenches shall contain enough backfill to prevent pipe flotation before dewatering is discontinued. Dewatering shall continue until such time as it is safe to allow the water to rise in the excavation.

3.04 INSTALLATION

A. General: Precautions shall be taken to prevent foreign material from entering the pipe before or while it is being placed in the line. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe. The open ends of pipe shall be closed with a watertight plug, or with other devices approved by ENGINEER, at times when pipe laying is not in progress.

B. Pipe:

1. Pipe shall be installed in accordance with the manufacturer's recommendations for installing the type of pipe used, unless otherwise shown on the DRAWINGS.

2. Pipelines shall be laid to the grades and alignment shown on the DRAWINGS or staked by ENGINEER. Variation from the prescribed grade and alignment shall not exceed one-tenth (0.10) foot, and the rate of departure from, or return to, the established grade or alignment shall be not more than one (1) inch in ten (10) feet, unless approved by ENGINEER. No deviation from grade shall cause a

depression in the sewer invert that could retain fluids or solids. Any pipe which is not in true alignment or which shows undue settlement after laying shall be taken up and re-laid at CONTRACTOR'S expense.

3. Lift or roll pipe to protect coating. Do not drag over gravel or rock. Avoid striking rocks or hard objects when lowering into trench.

    a. Pipe on which coatings have been damaged may be rejected at the site of the Work regardless of previous approvals.

C. Pipe Fittings:

1. Pipe fittings shall be laid so as to form a close concentric joint with the adjoining pipe to avoid sudden offsets of the flowline. Pipe sections shall be joined together in accordance with the manufacturer's recommendations.

2. Pipe fittings and appurtenances shall be carefully lowered into the trench with suitable tools or equipment to prevent damage to the pipe and protective coatings and linings; pipe and accessory materials shall not be dropped or dumped into the trench.

D. Gaskets: No gaskets that show signs of deterioration, such as surface cracking or checking, shall be installed in a pipe joint. The neoprene gaskets used, when the air temperature is ten degrees Fahrenheit (10°F) or lower shall be warmed to temperature of sixty degrees Fahrenheit (60°F) for a period of thirty (30) minutes before being placed on the pipe.

E. Obstructions not shown on the DRAWINGS may be encountered during the progress of the WORK. Should such an obstruction require an alteration to the pipe alignment or grade, ENGINEER will have authority to order a deviation from the DRAWINGS, or ENGINEER may arrange for the removal, relocation, or reconstruction of any structure which obstructs the pipeline.

3.05 BEDDING AND BACKFILL FILLING

A. Select bedding and backfill material may be required and shall be so shown on the DRAWINGS. Select bedding materials shall conform to the designated gradation requirements in Section 31 23 33, Trenching and Backfilling.

B. Bedding material shall be placed under and around all pipes as shown on the DRAWINGS. Bedding shall be placed in a manner that will minimize separation or change in its uniform gradation. Bedding shall be distributed in six-inch (6") maximum layers over the full width of the trench and simultaneously on both sides of the pipe. Special care shall be taken to ensure full compaction under the haunches and joints of the pipe.

C. Backfill compaction shall not be attained by inundation or jetting, unless approved in writing by ENGINEER. Backfill material shall be uniformly compacted the full depth of the trench.

3.06 CONCRETE CUTOFF COLLARS

A. Concrete shall meet the requirements of Section 03 31 00, Structural Concrete.

3.07 FIELD TESTING

A. Acceptance Tests for Gravity and Low-Pressure Pipelines:

1. Alignment:

a. Sewer shall be inspected by flashing a light between manholes or by physical passage where space permits.

b. Contractor shall clean pipe of joint sealant, other dirt, and debris prior to inspection.

c. Determine from Illumination or Physical Inspection:

1) Presence of any misaligned, displaced, or broken pipe.
2) Presence of visible infiltration or other defects.

B. Deflection Testing:

1. Maximum installed deflections of flexible pipe shall be five percent (5%) of mean internal diameter.

2. At the ENGINEER's discretion, CONTRACTOR shall test flexible pipe after backfill has been in place 30 days. Deflection is defined per ASTM D2321.

a. CONTRACTOR shall provide rigid ball or mandrel deflection testing equipment and labor.

b. Obtain approval of equipment and acceptance of method proposed for use in testing deflection of the pipe. Test shall be performed without mechanical pulling devices.

c. Pipe exceeding deflection limits, as defined in ASTM D2321, shall be replaced or re-compacted at CONTRACTOR's expense.

3.08 SURFACE RESTORATION

A. All streets, alleys, driveways, sidewalks, curbs, or other surfaces broken, cut or damaged by CONTRACTOR shall be replaced in kind or as shown on the DRAWINGS.

3.09 CLEAN UP

A. All rubbish, unused materials, and other non-native materials shall be removed from the job site. All excess excavation shall be disposed of as specified, and the right-of-way shall be left in a state of order and cleanliness.

END OF SECTION

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