SECTION 4000--STORM SEWERS

4001 SCOPE. This section covers all labor, materials and equipment required for the complete installation of storm sewers and appurtenances. The work shall consist of storm sewer construction in accordance with these specifications and in conformity with the lines and grades shown on the approved plans. The term "Storm Sewer" shall refer to pipes, box culverts, vegetated or rock lined channels, junction boxes and inlets.

Reinforced Concrete Pipe (RCP) shall be used within the Right-of-Way (ROW) and for all street crossings. The RCP shall extend to the inlet structures located on both sides of the street crossing.

High Density Polyethylene (HDPE) pipe shall be allowed only outside the Right-of-Way and may be used under residential driveways. Corrugated Metal Pipe (CMP) shall not be permitted for any public storm sewer improvements.

Polypropylene (PP) pipe shall be allowed for storm sewer applications within the Right-of-Way.

4002 MATERIALS.

Reinforced Concrete Pipe (RCP): Reinforced concrete pipe (RCP) shall conform to the following minimum requirements:

- Round Pipe: ASTM C 76, Class III, Wall B, with Single Off-Set Joint conforming to ASTM C 443. Type R4-Confined Groove Joint conforming to ASTM C 443 shall be used where required by the City Engineer.
- Elliptical Pipe: ASTM C 507, Class HE-III
- Arch Culvert Pipe: ASTM C 506, Class A-III

The Contractor may be required to supply pipe exceeding these minimum requirements as stipulated in the approved plans.

Flexible gaskets conforming to ASTM C 1619 shall be required for all round pipe.

Mastic joints shall be required on all pipe that is not round. The mastic joint compound shall be a homogeneous blend of bituminous material, inert filler, and suitable solvents or plasticizing compounds thoroughly mixed at the factory to a uniform consistency suitable for sealing joints of concrete pipe. The compound shall conform to the following:

Bitumen, soluble in CS_2, percent by weight, minimum.....45%
Ash, percent by weight.....15-50%
Penetration, standard cone, 150g, 5 seconds,
25° C trowel grade, bulk type.....110-250mm

High Density Polyethylene Pipe (HDPE): High density polyethylene (HDPE) corrugated pipe with an integrally-formed smooth interior wall shall conform to the requirements of AASHTO Designation M-294, Type S. Pipe. HDPE fittings shall be made of polyethylene compounds which meet or exceed the requirements of ASTM D 3350.

Polypropylene Pipe (PP): Polypropylene pipe (PP) corrugated pipe with an integrally formed smooth interior wall shall conform to the following requirements.

1. For 12-inch to 60-inch pipe, polypropylene pipe shall have a double wall with a smooth

interior and annular exterior corrugations and conform to ASTM F2881 and AASHTO M330. The pipe shall not be perforated unless otherwise specified by the City Engineer.

2. For 12-inch to 60-inch pipe, pipe shall be joined with a gasketed integral bell and spigot joint meeting the requirements of ASTM F2881.

3. Coupling bands shall cover at least two full corrugations on each section of pipe and shall prevent the infiltration of soil into the pipe.

4. Certification: All polypropylene (PP) pipe used for culvert and storm sewer applications shall be provided only by manufacturers that are certified through the National Transportation Product Evaluation Program (NTPEP) Third Party Certification program.

4003 INSTALLATION. This specification applies to the installation methods of both RCP and HDPE pipe.

Handling and Protection: All pipe shall be protected during installation against shock and free fall, and shall be installed without damage due to improper handling. Damaged pipe shall be removed from the site and replaced with new pipe at the Contractor's expense.

Grade Control: The alignment and elevation of the pipe shall conform to the requirements of the approved plans. The Contractor shall be responsible to remove and replace, at his cost, any pipe that does not meet the approval of the City Engineer.

Laying: The laying of pipe in graded trenches shall commence at the lowest point, with the bell end orientated upgrade. All pipe shall be laid with ends abutting in accordance with the line and grade indicated on the approved plans.

Pipes shall not be trimmed unless approved by the City Engineer. Pipes having defects may be utilized in areas where trimming is required, upon approval by the City Engineer.

Bedding: The pipe embedment shall conform to the requirements of the Technical Specifications and applicable Standard Details.

Jointing: Prior to making pipe joints, all surfaces shall be clean and dry. Lubricants, primers, adhesives and other substances shall be compatible with the jointing material recommended or specified.

All bell and spigot ends of RCP shall be primed prior to the application of the bitumastic material, if mastic joints are specified. A sufficient amount of bitumastic joint sealant shall be used to completely fill the annular space with some excess. The outside surface of the joint shall be wiped with additional bitumastic sealer to ensure a complete seal.

Flexible gaskets shall be placed around the spigot and rolled into place as the joint is assembled. O-ring gaskets shall be recessed in the groove on the spigot and confined by the bell after the joint is assembled. Lubrication shall be applied as recommended by the manufacturer.

Backfilling: Pipe backfilling shall conform to the requirements of the Technical Specifications.

4004 CATCH BASINS, INLETS, AND JUNCTION BOXES. Reinforced concrete storm sewer structures shall conform to the Standard Details. Concrete used in the structures shall have a minimum 28-day compressive strength of 4,000 psi and shall meet the requirements of the Technical Specifications. Concrete cover over steel reinforcement shall be not less than 1-1/2 inches for tops, walls and floors. The concrete shall be vibrated in a manner that prevents segregation. Small surface voids shall be grouted as directed by the City Engineer.

Inlet tops shall be cast-in-place construction. The elevation of curb inlet tops shall be established by the Contractor's surveyor placing fill marks on the installed storm sewer inlet box when the Contractor elects to pour the curb inlet tops prior to curb and gutter placement. Fill marks will not be required if curb inlet tops are poured after the curb and gutter has been completed. The concrete mix used for curb inlet tops shall conform to the requirements of the Technical Specifications. The inlet tops shall be broom finished and picture-framed. The inlet tops shall be doweled to the walls of the structure. Where sidewalks abut an inlet, tie bars shall be installed as shown on the applicable Standard Details. Variations may be made only with the approval of the City Engineer. Contractor shall install "No Dumping, Drains to Stream" markers per City requirements. The Contractor shall provide the markers per the Approved Materials List and supply the approved adhesive for installation. Wire brushing and cleaning of the concrete surface will be required prior to application of the adhesive.

The floors of all catch basins, inlets, and junction boxes shall have inverts. Inverts shall be constructed of concrete conforming to the requirements of the Technical Specifications, with the exception that the concrete shall have a minimum 28-day compressive strength of Class I 3000 psi.

The methods of excavation and backfilling for catch basins, inlets, and junction boxes shall conform to the requirements of the Technical Specifications and Standard Details of these specifications.

All catch basins, inlets, pipes, and junction boxes shall be free of any accumulation of silt, debris, or foreign matter of any kind at the time of final inspection.

4005 REINFORCED CONCRETE BOX CULVERTS. Construction and backfilling of reinforced concrete box culverts shall be done in conformance with the *KDOT Standard Specifications for State Road and Bridge Construction* unless otherwise specified or approved by the City Engineer.

Shop drawings for all precast box culverts shall be approved by the Design Engineer and provided to the City Engineer.

4006 PAVED DITCHES AND RIPRAP. Paving concrete for paved ditches shall conform to the applicable provisions of these Technical Specifications and shall conform to the standard drawings or approved equal.

The concrete shall be placed beginning at the lower end of the portion of the ditch to be lined and progressing toward the upper end. If required on the contract drawings, the concrete shall be reinforced with the type of reinforcement and in the manner indicated. Contraction or construction joints shall be spaced and formed as indicated on the contract drawings.

The surface shall be finished with a wooden float. A light brooming may be required for a more acceptable finish. Immediately after the finishing operations are completed, the concrete

shall be protected and cured in conformance with the requirements specified in the Technical Specifications.

Riprap shall be placed at the locations and to the dimensions shown on the contract drawings in accordance with the specified requirements.

Riprap shall be graded as necessary to form a dense blanket. The finished surface shall present an even surface conforming to the lines, grades, and sections given. Riprap shall be placed to a minimum depth of eighteen inches (18”). All riprap shall be placed on top of filter fabric.

Riprap shall be placed in such a manner that voids created by larger pieces are filled in by smaller pieces and no voids extend directly through the riprap to the surface below. The riprap shall be placed in rows transversely to the center line of the ditch and in the manner indicated on the drawings. The riprap shall be placed with ends and sides abutting and the joints between rows breaking with the joints in the preceding row.

Riprap shall consist of durable field or quarry stones. Riprap pieces shall range in weight from five (5) pounds to two hundred (200) pounds. Not less than 75 percent (75%) shall be within the range of one hundred (100) pounds to two hundred (200) pounds.

Stone for riprap shall be free from earth, soapstone, shale, shale-like or other easily disintegrated material that will tend to decrease the durability of the material after placement.

When grouted stone riprap is indicated the spaces between stones of grouted riprap shall be filled with grout consisting of one (1) part Portland Cement and three (3) parts of fine aggregate with sufficient water to form a plastic mix. The grout shall be poured and broomed into the spaces until they are completely filled.

4007 <u>HEADWALLS, WINGWALLS, ENDWALLS, AND END SECTIONS</u>. Construction and backfilling of headwalls, wingwalls, and endwalls shall be done in conformance with the *KDOT Standard Specifications for State Road and Bridge Construction*, unless otherwise specified or approved by the City Engineer.

End sections shall be installed according to all applicable Specifications, Standard Details and the approved plans. Precast concrete end sections may be used in place of cast-in-place concrete structures with the City Engineer's approval. RCP end sections shall be used for HDPE outfalls, unless otherwise approved by the City Engineer.

4008 <u>RESTORATION OF SURFACE CONSTRUCTION</u>. The restoration of concrete and asphalt pavement, gravel surfacing, walks, drives, curbs, and other surface construction removed or damaged during the progress of the work covered by this section shall conform to the applicable provisions of the Technical Specifications.