SECTION 6000 – STORM SEWERS

6001 SCOPE. This section covers storm sewer pipe embedment, pipe installation, and other appurtenant work.

6002 REFERENCES. Trenching, backfill and flowable fill shall conform to the requirements of Section 1100 - *Grading*.

6003 MATERIALS.

A. Bedding. Granular bedding material shall meet the requirements for SB-2 or CA-5 aggregate as specified in Division 1100 of the KDOT specifications. Recycled concrete may be approved if material meets the required gradation and is free of debris.

B. Pipe. Changes in pipe material shall occur only at manhole and junction box structures.

1. Reinforced Concrete Pipe (RCP).
Reinforced concrete pipe shall conform to the following ASTM Standards and be of the minimum strength designated herein or such higher strength as may be required by the Contract Drawings or Special Provisions:

a. Shape.
i. Round Pipe. ASTM C 76, Class III, Wall B.
ii. Elliptical Pipe. ASTM C 507, Class HE-III.
iii. Arch Culvert Pipe. ASTM C 506, Class A-III.

b. Joints.
Flexible Gasket: Flexible gaskets may be either flat gaskets cemented to the pipe tongue or spigot, O-ring gaskets, or roll-on gaskets. All gaskets shall conform to ASTM C 443.

c. Plastic Compound. This compound shall be a homogeneous blend of bituminous material, inert filler and suitable solvents or plasticizing compounds roughly mixed at the factory to a uniform consistency suitable for sealing joints of concrete pipe. The compound shall conform to the following requirements:

Bitumen, soluble in CS,
Percent by weight, minimum 45%
Ash, percent by weight 15-50%
Penetration, standard cone, 15Og, 5 seconds, 2 5” C
Trowel grade, bulk type 11 O-250mm
Extruded rope or flat tape type 50-120mm

The above penetration ranges include test tolerances.

d. Preformed Plastic Compound. This compound shall be either rope form or flat tape form conforming to ASTM C 990. Primer, as recommended by the manufacturer, shall be used to maintain the material in position while pipe sections are being joined.

2. Polypropylene Pipe (PP).

a. PP pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330 for pipe diameters between fifteen (15) inches and sixty (60) inches.

b. Fittings shall conform to ASTM F2882 and AASTTO M330. Bell and spigot connections shall utilize a spun-on, welded or integral bell and spigots with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated coupling shall be split collar, engaging at least two (2) full corrugations.

3. High Density Polyethylene Pipe (HDPE).

a. High-density polyethylene pipe shall conform to AASHTO M294, type S (non-perforated circular cross section with corrugated outer surface and a smooth inner surface) for pipe diameters of 15 inches to 60 inches, inclusive.

b. Joints may be either bell and spigot, gasketed joints or made with external coupling bands. Joint integrity shall conform to the performance requirements of AASHTO M294.

c. Fittings and coupling bands shall be fabricated from the same material as the pipe and conform to AASHTO M294.

d. 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. Corrugated Metal Pipe (CMP). Pipe and coupling bands shall conform to the requirements of ASTM A 760/A 760M. Bituminous and/or other coatings shall be provided when required by the Special Provisions. All helical pipe shall have circumferential re-corrugated ends with a minimum of four (4) re-corrugations on each pipe.

Bituminous coating, if specified, shall conform to AASHTO M-190. Minimum thickness of the metal after galvanizing shall be as follows:

Circular Pipe					
2-2/3" x ½" corrugations			3" x 1" or 5" x 1" corrugations		
Diameter (in.)	Minimum Thickness (in.)	Gauge	Diameter (in.)	Minimum Thickness (in.)	Gauge
12-21"	0.079	14	36-54"	0.079	14
24-30"	0.079	14	60-84"	0.109	12
36-54"	0.109	12			
60-72"	0.138	10			
84"	0.168	8			

Arch Pipe 2-2/3" x ½" corrugations				
Equivalent Diameter (in.)	Minimum Thickness (in.)	Gauge	Span* (in.)	Rise* (in.)
15"	0.064	16	17"	13"
18"	0.064	16	21"	15"
21"	0.064	16	24"	18"
24"	0.079	14	28"	20"
30"	0.079	14	35"	24"
36"	0.109	12	42"	29"
42"	0.109	12	49"	33"
48"	0.109	12	57"	38"
54"	0.109	12	64"	43"
60"	0.138	10	71"	47"
* Subject to manufacturing tolerances				

C. Underdrain. Underdrains should be constructed in accordance with City of Lawrence Standard Detail 6000: Underdrain. Pipe shall be Contech A-2000, ADS N-12, or approved equal. The contractor shall not mix underdrain types of materials within any underdrain system.

6004 INSTALLATION.

A. Trenching. Excavation, grading, trenching, backfilling, compaction and density testing shall conform to requirements of Section 1100 of these Specifications.

B. Handling. All pipe and appurtenances shall be protected during installation from cracking, chipping, breaking, bending or other damage to pipe or coating materials. Damaged pipe materials shall be replaced with new materials unless otherwise approved by the Engineer.

C. Alignment And Grade. The alignment and grade or elevation of each pipe and appurtenant structure shall be maintained as shown on the drawings.

D. Laying. The laying of pipe in prepared trenches shall commence at the lowest point and continue upstream. Pipe shall be laid carefully centered to form a uniform flow line.

E. Pipe Bedding. Granular bedding material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints.

    1. Bedding shall be placed on each side of the pipe to the elevations indicated on the standard details. Bedding shall be compacted as necessary to provide firm uniform support for the pipe, and not subject the pipe to settlement or displacement.

F. Reinforced Concrete Pipe. Core holes and handling holes in concrete pipe shall be repaired by cementing a properly-shaped concrete plug in place with epoxy cement or by other methods acceptable to the Engineer.

G. Corrugated Metal Pipe. Before installing corrugated metal pipe, repair any damage to the metallic coating on the pipe. Clean the damaged area to bright metal by blast cleaning, power disk sanding or wire brushing. Apply zinc-rich paint over the cleaned area. Use zinc-rich paint to repair galvanized coatings.

H. PP Pipe. PP pipe shall be installed in accordance with ASTM D2321, “Standard Practice for Underground Installation of thermoplastic pipe for sewers and other gravity flow applications”, latest addition, with the exception that the initial backfill may extend to the crown of the pipe. Soil classifications are per the latest version of ASTM D2321. Class IVB materials (MH.CH) as defined in previous versions of ASTM D2321 are not appropriate backfill materials.

I. HDPE Pipe. HDPE pipe shall be installed in accordance with ASTM Recommended Practice D2321. Trench and backfill specification for HDPE pipe shall be as follows:

    1. No HDPE pipe shall be installed or backfilled without a City Engineering Inspector present. The inspector shall be notified of the installation schedule at least 48 hours prior to installation.

2. The minimum trench width = (1½ times the pipe diameter) + 12 inches.

3. The space between the pipe and the trench wall shall be wider that the compaction equipment used in the pipe zone.

4. The trench width in unsupported, unstable soils will depend on the size of the pipe, the stiffness of the backfill and in-situ soil, and the depth of cover.

5. Granular embedment shall be placed 6 inches minimum below the pipe and shall be shaped to fit the pipe to a depth of 0.25 time the pipe diameter. Where rock exist, the embedment shall be increased to 12 inches minimum below the pipe.

6. Where flowable mortar is required, granular backfill shall be placed to the spring line of the pipe. Where flowable mortar is not required, granular backfill shall be placed to a depth of 12" above the top of the pipe.

7. If the fill to the top of the subgrade is 3 feet or less, backfill with granular material to the top of the subgrade.

8. If the fill to the top of the subgrade is greater than 3 feet, backfill with granular material to a point 12 inches above the top of the pipe.

9. Granular embedment and backfill material shall comply with current City specifications.

10. The contractor shall not deform or damage the pipe during the placement of backfill.

11. The contractor shall be responsible to prevent floating the pipe during the backfilling operations. Do not deform or damage the pipe while compacting the granular backfill. Hand tamping may be necessary adjacent to the pipe to prevent distortion.

12. The maximum barrel deflection of all PE pipe (reduction of the barrel nominal base inside diameter) shall not exceed 5%. The contractor shall use a mandrel to measure the barrel deflection of the pipe. Take the measurement at least 30 days after the installation and backfilling. If oversized diameter pipes are installed, actual inside pipe diameters may need to be considered. The contractor shall remove, reinstall or replace any pipes deformed more than 5%.

J. Structure Connections. Pipes connected to structures shall be cut parallel with the inside face of the structure for plane walls and parallel with the spring line of the pipe for curved walls. Projection of the pipe beyond the inside face shall not exceed six (6) inches (measured at the spring line for curved walls).

K. Structure Steps: Steps may be used in structures for construction. All Steps inside structures shall be removed prior to final acceptance.

L. Drainage Maintenance. Backfilling shall be performed so that water will not accumulate in unfilled or partially filled trenches. Surface drainage shall not be obstructed longer than necessary.

M. Protection Of Trench Backfill. Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion. Erosion control methods shall comply with the approved Stormwater Pollution Prevention Plan (SWP3) or as approved by the Engineer.

6005 ABANDONMENT.

A. Scope – This section applies to the construction methods and procedures for the abandonment of storm sewer piping.
B. Removal of Storm Sewer Piping – the preferred method of storm sewer piping system abandonment is complete removal. Details of abandonment of stormwater piping including plans and profiles showing the limits of excavation and backfill details (such as backfill material and compaction), and existing soil stratum at the pipe abandonment location should be provided in plans and approved by the Engineer.
C. Grouting of Existing Pipes – if removal of the pipes and other structures related to the piping system is not feasible, the pipes and other structures should be grouted full with a grout based on cement-bentonite, or flowable fill. The grout or flowable fill mix should be approved by the Engineer. The grout shall be fluid enough, and pumped in the upslope direction, so that the pipe will be completely filled leaving no voids. Details of abandonment of the piping system, including plans and profiles showing the limits and elevations of pipes to be grouted relative to the existing/proposed surfaces, existing soil stratum at the pipe abandonment location, and grout mix should be provided in plans and approved by the Engineer.