

GENERAL:

1. To provide minimum standards for Storm Drainage systems.
2. This section applies to stormwater conveyance systems outside the footprint of buildings. Building systems are covered in Section 22 0100.

DESIGN GUIDELINES:

1. Stormwater systems shall be designed using the actual time of concentration. The worst case of complete development, per current planning, or current conditions shall be used for calculation of offsite flow.
2. Generally, the Rational Formula shall be used for areas under 200-acres. Runoff coefficients shall consider percentage of impervious area and average site grade (slope).
3. Design Return Periods:
 - 3.1. 10 years for parking lots, park space, and open areas.
 - 3.2. 25 years for all building sites, pedestrian malls, streets, quadrangles, and storm sewer piping.
 - 3.3. 100 years for all buildings and structures such that no entry of water is allowed through entrances, window wells, area ways, basements, drains, etc. Design shall maintain positive drainage away from building entrances.
 - 3.4. Project Manager (PM) will establish "return periods" for all other areas.
 - 3.5. Return period must satisfy governing municipality's regulations. Designer will compare above return periods with those required by the local municipality. Coordination with municipality may be required and should be reviewed with the PM. Any discrepancies will be discussed with the project manager.
4. Pipe Size:
 - 4.1. Building downspout drains shall be 4" minimum.
 - 4.2. Area drains shall be 8" minimum.
 - 4.3. Storm sewer piping shall be 12" minimum.
 - 4.4. Standard sizes (inches); 4, 8, 12, 15, 18, 24, 30, 36, 42
5. Drain tiles shall be installed at footings and tied to sanitary or storm sewer system as allowed by local municipalities.
6. Downspouts shall be tied into storm sewers (in lieu of foundation drain tiles) and cannot discharge on grade.
7. Storm junction boxes shall be installed at all connections to storm sewer piping.

8. No ponding is allowed on paved areas.
9. Detention basins shall be labeled on the drawings.
10. Sidewalk grade shall be set to prevent surface from collecting and channeling surface drainage.
11. Particular attention will be paid to bicycle and wheelchair safety in the design of storm drainage systems. Grate bars will be placed perpendicular to direction of traffic flow. Grates in pedestrian areas should be sized to avoid catching heels of shoes.
12. **MU only**, The City of Columbia standard “Type M” curb inlet used for all work not in the public right-of-way, shall be modified to remove setbacks, and gutter deflectors.
13. Storm sewer piping less than 36” in diameter shall run on a straight line and grade between structures. Horizontal and vertical bends are permitted in less than 12” lines, provided a cleanout is included. The deflection should utilize a wye with the cleanout as an upstream extension of the downstream line’s alignment.
14. Bury and backfill:
 - 14.1. Minimum and maximum pipe backfill coverage limits shall be per pipe manufacturers installation requirements.
 - 14.2. Maximum depth of fill above HPP pipe shall not exceed 9 feet.
 - 14.3. Backfill methods that vary from the manufacturer’s installation requirements shall be approved by the “Engineer of Record”.
15. Tracer wire shall be installed for all new or fully replaced sewer installations in public right of way.

SPECIFICATION REQUIREMENTS:

1. Drain Tiles
 - 1.1. Perforated pipe for subgrade drains shall be SDR-35 or Schedule 40 PVC.
 - 1.2. Pipe shall be installed in a geotextile envelope with clean rock. Perforated pipe in a ‘sock’ is not acceptable.
2. Downspouts Drainage (4” minimum)
 - 2.1. Preferred Material - Polyvinyl chloride (PVC) conforming to ASTM D2241, PVC 1120, DR 21, PR 200 (SDR-21). Color: Green.
 - 2.2. Ductile iron conforming to ASTM A746 with cement lining conforming to ANSI/AWWA C104/A21.4, and asphaltic coating on the interior and exterior conforming to ANSI/AWWA C110/A21.10, and asbestos-free. DI installation

shall include a 8-mil thick V-Bio polyethylene encasement attached with 10 mil thick PVC polywrap tape.

3. Area Drain Piping, (8" & under)

- 3.1. Preferred Material - Polyvinyl chloride (PVC) conforming to ASTM D2241, PVC 1120, DR 21, PR 200 (SDR-21). Color: Green.
- 3.2. Ductile iron conforming to ASTM A746 with cement lining conforming to ANSI/AWWA C104/A21.4, and asphaltic coating on the interior and exterior conforming to ANSI/AWWA C110/A21.10, and asbestos-free. DI installation shall include a 8-mil thick V-Bio polyethylene encasement attached with 10 mil thick PVC polywrap tape.

4. Storm Sewer Pipe (12" & greater)

- 4.1. Reinforced Concrete Pipe (RCP) conforming to ASTM C76 or AASHTO M170, Class 3 minimum, and asbestos-free.
 - i Joints shall be flexible rubber gasket conforming to ASTM C443 or ASTM C361.
- 4.2. Preferred Material - High Performance Polypropylene Pipe (HPP) having a smooth interior and an annular corrugated exterior.
 - i Where up to 30 inches in diameter HPP pipe shall meet or exceed ASTM F2736.
 - ii Where 36 to 60 inches diameter HPP pipe shall meet or exceed ASTM F2881.
 - iii AASHTO loading requirements shall be met.
 - iv Minimum gage of piping shall be per manufacturers recommendations.
- 4.3. **MS&T only:** High Density Poly Ethylene Pipe (HDPE) up to 48" in diameter, can be used in all areas, except easements and roadways, conforming to AASHTO M294 and ASTM F2306, HDPE pipe to be ADS N-12 WT IB, smooth interior, dual wall or approved equal is another option.

5. Fittings and Connections

- 5.1. All connections and fittings shall be compatible and approved for use with piping system being installed.
- 5.2. Tee connections into HPP Storm Sewer Pipe shall be Inserta-Tee lateral connection manufactured by ADS Pipe or MU engineer approved equivalent.

6. Inlets and Junction Boxes

- 6.1. May be cast-in-place or precast conforming to ASTM C478.
- 6.2. Storm manholes (junction boxes) shall use a Deeter 1247, Neenah R-1642, or exact equal frame and lid. The lid shall be lettered with the words 'Storm Sewer' or 'Storm Drain'.

- 6.3. Structures over 3-feet from lid to lowest flow line shall include steps. Steps shall be Neenah 1980-J, Deeter 1606, M.A. Industries PS2-PF, or equal.
- 6.4. Manholes shall have eccentric top sections.

7. Trace Wire & Test Stations

- 7.1. MU: Tracer Wire shall be #14 AWG solid, steel core soft drawn high strength tracer wire, 250# average tensile break load, 30 mil High Molecular Weight (HMWPE) or High Density (HDPE) polyethylene jacket complying with ASTM-D-1248, 30 volt rating. Jacket color shall be green. No THHN insulated wire shall be allowed. Tracer wire shall be Copperhead Industries HS-CCS or approved equal. The tracer wire shall be taped to the pipe at the three o'clock position every 5 feet. The tracer wire ends will terminate at a tracer wire test station.
- 7.2. MU: Tracer wire shall have moisture resistant splices for direct bury applications. Splices shall be Copperhead Industries Snakebite or 3M DBR or approved equal.
- 7.3. MU: Tracer Wire test stations shall be installed 2 feet of the manhole or structure in the flow line of the pipe. These test stations shall be designed to be easily detected by magnetic and electronic locators. A magnet shall be securely attached at the top of the upper tube of the box for locating purposes. Lid shall be green and have a brass terminal for attaching locating equipment and a brass 5 sided nut for removing cap. Tracer wire test station shall be Copperhead Industries Snake Pit or approved equal.
- 7.4. **MS&T**, **UMSL** and **UMKC**: Tracer wire shall be #12 THHN attached to top of pipe at 5' intervals. Tracer wire ends to terminate in manhole near the lid with 5' coil of wire.

8. Warning Tape

- 8.1. Install warning tape at least 12" above the top of pipe. Warning tape shall be 100% plastic.

INSTALLATION REQUIREMENTS:

1. Installation Requirements

- 1.1 Piping and fittings shall be installed per manufacturer's instructions and ASTM D2321-20.
- 1.2 Inserta-Tee penetrations into HPP Storm Sewer Pipe shall be made with correctly sized Inserta-Tee core saw.

- 1.3 Installation details shall be same as local municipality details where storm sewer is being installed.