

## EXHIBIT A

### 3.0 STORM SEWERS

#### **Storm Sewer Pipe Shape**

- Refer to [Section 3.3.1](#) for more detailed information/explanation
- Circular – preferred shape
- Horizontal elliptical – must be hydraulically equivalent to the round pipe size
- Arch – must be hydraulically equivalent to the round pipe size
- Box

#### **Storm Sewer Pipe Material**

- Refer to [Section 3.3.1](#) for more detailed information/explanation
- Reinforced Concrete Pipe (RCP)
  - RCP shall be used in all street right-of-way areas and under all traffic areas (including parking lots, driveways, etc. that are outside of right-of-way).
  - RCP shall conform to:
    - Circular pipe - AASHTO M 170/ASTM C-76
    - Arch pipe - AASHTO M 206/ASTM C-506
    - Elliptical Pipe - AASHTO M 207/ASTM C507
  - All STS pipe having a diameter of 18-inches or greater shall be RCP.
  - Minimum 2-foot cover in traffic areas.
  - Minimum 1-foot cover in all other areas.
  - RCP must meet ASTM Class III specifications
  - Flared end sections must meet ASTM Class II or higher specifications
  - The joint seal shall be either cement mortar, three parts sand and one part cement, or cold applied performed plastic gaskets conforming to the latest applicable AASHTO designation.
- Corrugated Metal Pipe (CMP) [including Smooth Lined (SLCMP)]
  - CMP may not be used:
    - ...in City right-of-way

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- ...under traffic areas
- ...in City drainage easements
- ...to convey water through a development from properties upstream
- ...on properties where drainage structures are maintained by a residential POA
- All STS pipe having a diameter of 18-inches or greater shall be RCP.
- CMP up to 18-inches can be used in areas outside of the right-of-way and outside of city drainage easements if it meets all other criteria herein.
- CMP shall conform to:
  - Galvanized Steel - AASHTO M218/ASTM A929; AASHTO M36/ASTM A760 and AASHTO Section 12/ASTM A796
  - Aluminized Steel Type 2 – AASHTO M274/ASTM A929; AASHTO M36/ASTM A760 and AASHTO Section 12/ASTM A796
  - Aluminum – AASHTO M197/ASTM B744; AASHTO M196/ASTM B745 and AASHTO Section 12/ASTM B790
- CMP shall have a minimum cover of 2-foot.
- Flared end sections shall be of the same material as the culvert pipe for a given installation, and shall be fabricated from steel sheets having a thickness of 0.064 inches or more.
- Coupling bands and other hardware for corrugated metal pipe shall conform to the latest applicable AASHTO designation and shall be made of the same base metal and coating as the pipe. Band widths shall be as specified in the latest applicable AASHTO designation.
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- Corrugated Polyethylene Pipe (CPP) [including Smooth Lined (SLCPP)]
  - CPP may not be used:
    - ...in City right-of-way
    - ...under traffic areas
    - ...in City drainage easements
    - ...to convey water through a development from properties upstream
    - ...on properties where drainage structures are maintained by a residential POA

## STORM SEWER SYSTEM DESIGN

- All STS pipe having a diameter of 18-inches or greater shall be RCP.
- CPP up to 18-inches can be used in areas outside of the right-of-way and outside of city drainage easements if it meets all other criteria herein.
- CPP shall conform to AASHTO M 294, Type S specification / ASTM F2648, ASTM D3350 and ASTM F2306.
- CPP shall have a minimum cover of 2-foot.

### Storm Sewer Pipe Physical and Operational Constraints

- Refer to [Section 3.3.1](#) for more detailed information/explanation
- All STS pipe having a diameter  $\geq$  18-inches must be RCP.
- Minimum Pipe Size = 18-inches
- Minimum Pipe Slope = 0.004-ft/ft
- Design storm frequency = 10-year design storm
- Maximum design flow capacity at Design Storm Frequency (10-yr) = 80% full flow capacity
- 2 feet from ground surface (gutterline) to Hydraulic Grade Line (HGL).
- Design shall manage 100-year storm runoff so that it is contained within the R.O.W. or a drainage easement and adjacent properties are protected from damage.
- Minimum Flow Velocity flowing under Design Storm (10-yr) Capacity = 3.0-ft/sec
- Maximum Flow Velocity flowing under any design storm and capacity = 12-ft/sec
- Maximum Pipe Cover shall be per Manufacturer's recommendation or ARDOT standards, whichever is more restrictive.
- Assume full flow conditions for discharge into an existing storm sewer system or ditch for which no design information exist

## STORM SEWER SYSTEM DESIGN