

**SECTION 3 – SUPPLEMENT TO DENVER WATER ENGINEERING STANDARDS**

*CHAPTER 5 – SYSTEM DESIGN AND LAYOUT*

**3.1. SECTION 5.03 - SIZING OF DISTRIBUTION MAINS**

Water lines shall be designed to transport average annual, peak day, peak hour, and fire flow demands in accordance with Denver Water Section 5.03, these Specifications, and the District's Water Master Plan, using a pipe network reviewed by the District.

A variety of peak demand or critical demand conditions exist for different types of developments. Peak conditions shall be reviewed by the designing Engineer with the highest demand condition being used to size water lines. Some typical peak demand conditions include: peak hour demand, and peak day demand plus fire flow with one feed closed.

No public water line shall be less than six inches (6") in diameter, unless specifically requested by the District. Water systems shall be looped systems and shall provide a level of service consistent with the Southgate Water District, the Denver Water Engineering Standards, and appropriate Fire Protection District Standards.

The maximum allowable head loss in peak hour conditions for water lines six inches (6"), eight inches (8"), and twelve inches (12") in diameter, shall be two feet (2') of water per thousand feet (1000') of pipe. Maximum allowable head loss in peak hour conditions for water lines sixteen inches (16") and twenty inches (20") in diameter shall be one and one-half feet (1.5') of water per thousand feet of pipe. A Hazen-Williams "C" factor of 130 shall be used for all new Ductile Iron Pipe (DIP) and Polyvinyl Chloride Pipe (PVC).

Summary of Design Requirements	
Design Factor	District Requirement
Maximum Head Loss (6"-12")	2.0-feet per 1000-feet of pipe
Maximum Head Loss (16"-20")	1.5-feet per 1000-feet of pipe
Hazen-Williams "C" Factor	130 for all DIP and PVC

**3.2. SECTION 5.04 – FIRE PROTECTION SYSTEMS**

The Southgate Water District is overlain by two (2) fire protection jurisdictions being: the South Metro Fire Rescue Authority, and the Littleton Fire Protection District. It is the owner's responsibility to contact the appropriate Fire Protection Agency and establish the minimum required fire flow and hydrant locations for each specific project. Final fire hydrant locations must be approved by the District.

**3.3. SECTION 5.11 – LAYOUT OF THE DISTRIBUTION SYSTEM**

**3.3.1. 5.11B - ALIGNMENT**

Where water lines are located in street right-of-way, they shall be designed to the following guidelines.

- In streets running generally north and south, the water line shall be located ten feet (10') east of the street centerline.

- In streets running generally east and west, the water line shall be located ten feet (10') north of the street centerline.

Water lines may be designed on curvilinear streets parallel to street centerline using deflected pipe joints. Joint deflections shall be within the manufacturer's maximum recommended deflection per joint. Bending of PVC water lines to achieve a change in alignment is not permitted. Where conditions require multiple joint deflections or bend fittings, installation of fusible PVC water lines meeting at least the manufacturer's minimum allowable bending radius may be accepted on a case-by-case basis.

In streets shaped as a "U" or on streets having unusually sharp turns, the water line will conform to the above Specifications as near as is practical, but the final location shall be determined by the District. Where water lines are proposed to cross the street centerline, they shall be designed to cross the street using 45° horizontal bends.

In cul-de-sacs, water lines shall be located in conformance with the "Water Distribution System Typical Plan for Cul-de-sacs" detail, found in the Standard Drawings of the Denver Water Engineering Standards. Where stubouts are to be provided for service to future areas, they shall be located in conformance with the "Stubout Configurations" detail, found in the Standard Drawings of the Denver Water Engineering Standards.

In no case shall the water line be designed closer than five feet (5') to the lip of a crossspan, or gutter, or ten feet (10') to any right-of-way line or easement boundary.

### 3.3.2. RELATION TO OTHER UTILITIES

Water lines in streets shall be designed to provide a minimum separation of ten (10) horizontal feet measured between the centerline of any sanitary sewer line and any water line or appurtenance. Horizontal separation with utilities other than sanitary sewer lines shall be five (5) horizontal feet minimum, but shall in all cases allow for future excavation of the water line without causing damage to the adjacent utility.

Where water lines are proposed to cross sanitary sewer lines or other utility lines, they shall be designed to cross at an angle close to ninety degrees (90°). Minimum vertical clearance between the edge of any water line and edge of any other water line or utility shall be eighteen inches (18") minimum.

### 3.3.3. WATER SYSTEM LAYOUT AT CREEK CROSSINGS

Where water lines are proposed to cross creeks or drainage ways, they shall be designed to cross perpendicular to the creek or drainage way centerline. Valves with marker posts shall be provided on each side of the crossing to isolate the crossing in the event of a line break. A specific geotechnical investigation shall be performed by the owner for each proposed crossing to evaluate potential 100-year flood scour depths of the creek or drainage way at ultimate development of the drainage basin.

After the investigation has been reviewed by the District, a minimum water line depth will be established, as well as encasement and/or erosion protection requirements. Generally, waterlines shall be installed in steel casing pipe extending well into the stabilized drainage way banks. The downstream channel shall also be stabilized or permanently established to prevent washout and erosion. Review by the County, SEMSWA, or Urban Drainage and

Flood Control District may be required.

### 3.3.4. ENCASEMENTS, CASINGS AND INSULATION

Concrete Encasements:

Concrete encasements shall be required by the District under the following conditions:

- Where water lines are at a depth too shallow to sustain traffic load or any other load to which they are subjected.
- At any other location designated by the District.

Concrete encasements shall provide concrete and reinforcement in accordance with the "Concrete Encasement" detail, found in the Standard Construction Drawings of these Specifications, and shall be of a length to completely span the condition encountered. The concrete encasement detail is generally acceptable for most conditions; however, the District may require a special, site specific concrete encasement detail on a case by case basis.

Pipe Casings:

Pipe casing shall be used where waterlines cross under utilities 36" in diameter or larger and where bores or protective installations are required by the District. All pipe casings shall be constructed to conform to the "Steel Casing for Carrier Pipe" detail, found in the Standard Construction Drawings of these Specifications.

Water Line Insulation:

The District may require that water lines be insulated from freezing where cover considerations, bridge crossings, culvert crossings, or other special freezing related considerations warrant. The minimum limits of the insulation shall be determined by the District.

Insulation material shall have a minimum compressive strength of 40 psi and shall be Dow Styrofoam HIGHLOAD brand polystyrene foam or approved equal. Insulation shall be a minimum of 4-inches in thickness. See Detail W-17 for additional information.