

## **SECTION 3: WATER DISTRIBUTION SYSTEM**

### **3.1 GENERAL**

The water distribution system consists of the treatment plant, reservoirs, booster stations, feeder mains, distribution mains, and appurtenances.

In general, larger water mains carrying large quantities of water between treatment plant, storage reservoirs and major pumping stations are designated Feeder Mains, or Arterial Mains. Services should not be connected to these Mains. Water mains connecting Feeder Mains to areas to be served are designated as Distribution Mains.

The development plan shall include the information for Feeder Mains, which connect to the proposed developments, as well as the distribution system for the ultimate developments.

#### **3.1.1 WATER LINE LOOPING**

A loop, or grid shall be formed if there are more than 24 single residential units to be served, or if the main serving the area in the dead end is longer than 130 m, as measured from the nearest loop or grid, or along the centre line from the extension of the street curb line to the curb line at the dead end.

Notwithstanding the above, if the lot sizes in the area to be serviced are substantially smaller than the regular lots, and the situation of the water supply system in the area is generally above 420 kPa (60 psi) in average in summer months, up to 32 residential units may be allowed without looping.

#### **3.1.2 REFERENCE MATERIAL**

In addition to the above, the design of the water distribution system shall be based on the following design factors, as well as other guidelines, and shall conform to, the design standards provided by the most up-to-date version of the "Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems in Alberta", as published by Alberta Environmental Protection Services. For other guidelines, please see the Medicine Hat (Environmental Utilities) Detailed Construction Specifications, Fire Underwriters Survey, geotechnical reports (if available), and other documents as directed by the City.

### **3.2 DESIGN FACTORS**

#### **3.2.1 HYDRAULIC ANALYSIS REQUIREMENTS**

For developments that contain more than 24 regular residential lots, or for industrial or commercial developments, where no Functional Servicing Report has been prepared or the proposed development's water usage will be greater than what was anticipated in the Functional Servicing Report, the City's Environmental Utilities Department may require a Hydraulic Network Analysis Report using a method acceptable to the City to ensure both domestic and fire flow requirements are met. In such cases, the City will supply data near the developments major system connection(s), if available in the City's water master plan model. The provided data will normally be the calculated flows, pressures, pipe sizes. It is the developer's

responsibility to provide appropriate data on hydrant flow tests, conducted by a qualified tester, as the cross-reference for the Analysis.

The required report shall outline the results of the analysis, and shall be submitted to the Environmental Utilities Department with the subdivision design drawings.

The Friction Coefficient 'C' shall be no greater than 130 for subdivision design.

Currently the Environmental Utilities Department is using WaterCAD model for water network analysis.

### **3.2.2 DESIGN PARAMETERS**

The following parameters shall be used in the design or evaluation of the water distribution system:

#### **3.2.2.1 DESIGN POPULATION**

The design population shall be the ultimate population in the area under consideration based on the approved Zoning By-law requirements, unless otherwise indicated in writing by the Environmental Utilities Department.

#### **3.2.2.2 CONSUMPTION RATES**

##### Residential Per Capita Consumption Rates

- ❑ Average Day Demand: 1000 litres (220 imp. gal.) per capita per day.
- ❑ Maximum Day Demand: 2600 litres (580 imp. gal.) per capita per day.
- ❑ Peak Hour Demand: 3370 litres (720 imp. gal.) per capita per day.

##### Non-residential Consumption Rates:

For non-residential development that uses water in its business processes, estimated peak water consumption rate shall be submitted by the developer to the Environmental Utilities Department as part of the design approval from the City.

For non-residential development that does not use water in its business process, in the absence of practical data, or site specific service requirements, the above residential per capita consumption rates may be used for estimating.

#### **3.2.2.3 FIRE FLOW REQUIREMENTS**

Fire flow requirements shall be in accordance with the recommendations of the Fire Underwriters Survey for the type of development being considered.

The minimum fire flow used for low density residential subdivisions shall be 4,500 litres/minute (1000 igpm).

The minimum fire flow used for medium density residential subdivisions shall be 7,200 litres/minute (1600 igpm).

The minimum fire flow used for commercial, industrial, institutional and high density residential developments, as well as schools shall be 9,000 litres/minute (2000 igpm).

### **3.2.2.4 PRESSURE**

Residual line pressure under maximum day plus fire flow conditions shall be no less than 140 kPa (20 psi) at ground level of any point in the system. Residual line pressure under peak hour flow conditions should be no less than 280 kPa (40 psi).

### **3.2.2.5 VELOCITY**

Main line flow velocities should be 1.8 m/s (6'/s) or less during peak hour flow conditions, and 2.5 m/s (8'/s) during maximum day plus fire flow conditions.

## **3.3 MAINS**

### **3.3.1 GENERAL**

The grid mains must coincide with those in adjacent subdivisions to maintain the continuity of main sizes between subdivisions. Distribution mains shall be continuous (looped) wherever practicable.

Please refer to the following sub-section for the maximum length of main permissible between ties in residential developments. The standard grid main network required within residential subdivisions is illustrated in the Standards Drawings.

In the initial stage of a large development area, the Environmental Utilities Department may temporarily waive this requirement in writing, provided that the developer can demonstrate that the necessary maximum daily consumption plus fire flow can be delivered via the single water feed without looping. In such case, up to a maximum of two times (2 x) of the residential lots specified in Section 3.1.1 may be serviced temporarily of the system. Looping shall be provided within two years of temporarily servicing without looping. Commercial and industrial developments will be determined in a case-by-case basis.

A 25 mm service line must be installed at the end-cap of dead end main.

At water main crossings of sanitary and storm sewers, the following shall apply:

- Under normal conditions, water mains shall cross above sewers with a sufficient vertical separation to allow for proper bedding and structural support of water and sewer mains. The recommended minimum vertical clearance is 0.1 m. Special supporting structure is required in the case that the clearance is less than 0.1 m, but no less than 0.05 m. (See Construction Specifications for Details)
- Where it is necessary for the water main to cross below the sewer, the water main shall be protected by providing:
  - A vertical separation of at least 0.5 m from water main crown to sewer invert whenever practicable, otherwise the following will be required;
  - Structural support of the sewer to prevent excessive joint deflection and settling; and
  - A centering of the length of water main at the point of crossing so that the joints are equidistant from the sewer.

In designing a feeder main, or a distribution main without services connecting at the high points, an air release valve or hydrant shall be placed at significant high points in the water main profile to allow for purging of stale water or trapped air. (For detail of hydrant see Construction Specifications for Drawing)

### **3.3.2 DISTRIBUTION MAIN SIZES**

The minimum size of distribution mains shall be as follows:

#### Residential

- ❑ No smaller than 150 mm diameter, if the length of the main between the supply grids or larger supply mains is 300 m or less.
- ❑ No smaller than 200 mm diameter for a hydrant supply line that is also used for service connections.
- ❑ No smaller than 200 mm diameter if the length of the main between the supply grid or larger supply mains is over 300 m, but not more than 500 m.
- ❑ 150 mm diameter if the main serving the area in the dead end is not longer than 130 m.

#### Non-Residential

- ❑ No smaller than 200 mm for all subdivisions designated as industrial or commercial, as well as areas containing predominantly industrial or commercial premises.

### **3.3.3 ALIGNMENTS**

Water mains should be located in streets whenever possible. For consistency, it is recommended that the water main should have a separation of 3.0 m from sanitary or storm sewers, as well as other utilities.

In lanes or public utility lots where space is limited, with the approval of the Environmental Utilities Department, a minimum separation of 2.5 m from sanitary or storm sewer, or from the adjacent property line, and 2.0 m from other utilities shall be provided.

At street intersections, a minimum clearance of 1.2 m horizontally, measured from the outside surfaces, shall be maintained between water mains and any catch basins or storm manholes.

### **3.3.4 DEPTH OF COVER**

Water mains shall be installed with a minimum depth of cover of 2.6 m from the road/lane/utility lot surface grade to the top of pipe.

Where existing conditions dictate that the depth of bury be less than 2.6 m, the main/service is to be insulated as specified in the Construction Specifications.

The depth of cover over service line goosenecks from finished grade to top of pipe shall be 2.6 m.

### 3.4 APPURTENANCES

#### 3.4.1 HYDRANTS

##### Spacing

The maximum spacing between hydrants in residential area, as measured along the centre line of the right of way, shall be 185.0 m. Spacing of hydrants in industrial or residential subdivisions should be reduced to half of this measurement.

In cul-de-sacs of 75.0 m in length or less, the hydrant shall be installed at or near the intersection of the intersecting street.

##### Alignment and Placement

Fire hydrants should be placed at street intersections where possible to improve their visibility to emergency vehicles, particularly at cul-de-sac entrances. They shall be located at an alignment of 2.0 m of the lip of gutter or 0.5 m back of sidewalk. Where a hydrant is installed at the corner of an intersection, it shall be installed at the centre of the corner. Hydrants not installed at the corner should be at the extension of property lines whenever practical.

All hydrants must be separated from the distribution system by means of a hydrant lead with a valve. The valve shall be installed no more than one metre from the main. The total length of the lead should be 60.0 m or less, with a minimum diameter of 150 mm (6").

#### 3.4.2 VALVES AND FITTINGS

##### Spacing

Maximum spacing of shut-off valves in feeder mains should be 1500 m.

Boundary valves shall be clearly identified on the engineering design drawings.

##### Alignment and Placement

Main valves should be located such that no more than 24 single family lots (or up to 32 single and multi-family "mixed" lots) and one hydrant are involved in a shut down and no more than four valves are required to shut down any section of line.

A valve and one length of pipe should be installed at interim limits of construction.

Distribution main valves should be located at the beginning of curb returns at road intersections.

Valves are required on a water main at each end of the utility right-of-way or easement.

#### 3.4.3 THRUST BLOCKS

Thrust blocks shall be installed at all the bends, tees, crosses, reducers, as well as all the other appurtenances as designated by the Environmental Utilities Department. (See Construction Specifications for Details)

### **3.4.4 SERVICE CONNECTIONS**

- Each lot, including a multi-family unit, shall have its own separate service connection. The service shall be installed at a point inside the property line (house side). This point shall be the maximum practical but no less than 4.0 metres inside the property line. In the case where there are shallow utilities or easement inside the property line the services shall be no less than 1.5 metres beyond the easement. All services connections shall be completed, or supervised by the Environmental Utilities Department, according to the details shown in Construction Specifications for Drawings.
- The minimum size shall be 25 mm (1 inch) inside diameter. Non-residential or apartment service connections shall be sized according to anticipated user requirements. A shut-off valve shall be installed at the property line (0.3 m within the RROW) when the lot is serviced. The private portion of service connections would normally be installed at the time that the lot is developed.
- Service line to parks or green strips for irrigation purpose shall have minimum diameter of 50 mm (2 inch).
- The minimum depth of cover shall be 2.6 m to the top of pipe from finished grade.
- In cul-de-sacs or developments serviced with dead end main, a 25 mm copper or equal water service shall be connected directly to the end of main at the end-cap, and to be used as a service to a lot, unless there is a 50 mm flushing device at the location.

### **3.5 RESERVOIRS AND PUMP STATIONS**

All reservoirs and pump stations shall be treated as a special facilities that will be designed and constructed under the management of the Environmental Utilities Department with development costs, if applicable, to be determined on a case by case basis.