

SECTION 4: SANITARY SEWER SYSTEM

4.1 GENERAL

The sanitary sewer system consists of the treatment plant, lift stations, mains, and appurtenances.

The sanitary system must be designed with consideration for the service area boundaries established by the City's Environmental Utilities Department for each sanitary trunk system.

Manhole bases may be cast-in-place or precast complete with flow channel, benching, and pipe stubs.

In addition to the above, the design of the sanitary sewer 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 (AEP) Services. For other guidelines, please see the Medicine Hat (Environmental Utilities) Detailed Construction Specifications, Sewage Lift Station Design and Construction Standards and Procedures, geotechnical reports (if available), and other documents as directed by the City.

4.2 DESIGN FACTORS

4.2.1 SYSTEM ANALYSIS REQUIREMENTS

For developments that contain more than 24 regular residential lots, or for industrial or commercial developments, the City's Environmental Utilities Department may require a System Analysis Report using a method acceptable to the City to ensure that there is sufficient system capacity. This report will typically be included in the Functional Servicing Report.

4.2.2 DESIGN PARAMETERS

The following parameters shall be used in the design or evaluation of the sanitary sewer system.

4.2.2.1 DESIGN POPULATION

The design population shall be the ultimate population in the area under consideration based on the approved statutory plans, unless otherwise indicated in writing by the Environmental Utilities Department.

4.2.2.2 AVERAGED SEWAGE FLOW

Residential

For design purposes, the year-round average per capita daily flow for the City is 454 litres (100 igpd), out of which, 68 litres (approx 15%) is the assumed quantity from the weeping tiles and ground water infiltration. In areas where water table is

within 1.0 m below the lowest footing of building, extra quantity in addition to the 68 litres may be required. The extra quantity of groundwater flow shall be determined by the developer based on on-site geological investigation records submitted to the City for Approval.

Non-residential

For non-residential land use areas, in the absence of practical data, or site specific service requirements, one of the following options could be used for flow estimation:

- The average wastewater flow could be estimated with the statistical information as outlined in Section 7 of the Standards and Guidelines for Municipal Water Supply, Wastewater, and Storm Drainage.
- For low density non-residential, the estimated per hectare flow could be 16,800 litres per hectare per day (3700 igpd/Ha).
- Sewage flow estimates to be based upon consumptive demand of water and is not to include process waste water unless discharge to the sanitary sewer has been applied for and permitted for the process waste water.

The inflow/infiltration may be handled with the method as described under the residential section above.

4.2.2.3 PEAKING FACTORS

Residential (Population Generated)

In the absence of existing data, the peak (population generated) residential flows are to be calculated as follows:

$$Q_{pwd} = (G \times P \times P_f) / 86.4$$

Where: Q_{pwd} = the peak design flow rate (litres/sec)
G = the per capita average daily design flow (litres/day/person)
P = the design contributing population in thousands
 P_f = Harmon's Peaking Factor = $1 + 14/(4 + P^{0.5})$ but not less than 2.5

Non-Residential

For non-residential developments (other than the home based occupation), the peaking factor could vary greatly with the type of development. Each case shall be considered on an individual basis.

4.3 MAINS

4.3.1 GENERAL

The sanitary sewer shall be of sufficient capacity to carry peak flows.

In the case that the trunk main is connected to areas where a high groundwater table exists or manholes are located in street sags, appropriate allowance for the inflow/infiltration shall be included in the design.

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 the water and sewer mains. The recommended minimum vertical clearance is 0.1 m.
- Where it is necessary for the water main to cross below the sewer, the water main shall be protected by providing:
 - Vertical separation of at least 0.5 m from water main crown to sewer invert;
 - 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.

The guidelines in the following sections shall be used in the design of sanitary sewer system.

4.3.2 MAIN SIZES, VELOCITY AND SLOPE

TABLE 5.3.2 (1) – MINIMUM PIPE DIAMETERS

DEVELOPMENT	DIAMETER
Industrial developments	250 mm
Residential and other developments	200 mm

TABLE 5.3.2 (2) – MINIMUM SLOPE OF SEWER MAIN

SIZE (mm)	SLOPE (%)
200	0.40
250	0.28
300	0.22
375	0.15
450	0.12
525	0.10
600	0.08

Slopes for pipes lines larger than 600 mm will be based on the following:

- Minimum flow velocity = 0.6 m/sec
- Maximum flow velocity = 3.0 m/sec

unless otherwise approved by AEP and/or City Environmental Utilities Department.

4.3.3 ALIGNMENTS

Sewer mains shall be located in streets whenever possible. For consistency, it is recommended that the sewer main be installed in the middle of the street, with separation of 3.0 m from water mains and storm sewer.

A minimum separation of 2.5 m from water main and storm sewer, and 2.0 m from other utilities shall be provided, except in lanes or public utility lots where space is limited, in which case, with the approval of the Environmental Utilities Department, the minimum separation requirement from storm sewer could be reduced.

4.3.4 DEPTH OF COVER

Sewer main shall be installed with a minimum depth of cover of 2.5 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 2.5 m, the main/service shall be insulated as specified in the Construction Specifications.

4.3.5 CURVED SEWER

Although it is required that sanitary sewers be laid with straight alignments between manholes, curved sewers shall be permitted with the following restrictions:

- The sewer shall be laid as a simple curve with a radius equal to or greater than that recommended by the pipe manufacturer. Minimum radius shall not be less than 60 m.
- Manholes shall be located at the beginning and the end of the curve, unless otherwise approved by the Environmental Utilities Department.
- The curve shall run parallel to the centre line of the right-of-way.
- The minimum grade for sewers on curves shall be 50% greater than the minimum design grades.
- If concrete pipe is the preferred material for installation, curved pipes with proper radius shall be used (opening joint of pipe for curve is not acceptable).

4.4 APPURTENANCES

4.4.1 MANHOLES

4.4.1.1 LOCATION

Manholes are to be installed at the following:

- The end of each line, and at all changes in grade, size, alignment.
- Distances not greater than 120 m for sewers 375 mm or less.
- Distances not greater than 150 m for sewers 450 mm to 750 mm.

Efforts shall be made by the Engineering Consultant to avoid locating manholes in street sags.

4.4.1.2 SIZING

- Minimum sizing of manhole shall be 1200 mm in diameter for sewers up to 600 mm;
- For 675 mm or larger sewer, 1500 mm manholes, or specially designed manholes, or precast manhole vaults, including tee riser manholes may be used.

4.4.1.3 CHANNELLING AND BENCHING IN MANHOLES

- The depth of the flow channel shall be at least one-half the diameter of the downstream sewer.
- The flow channel for straight run sewer manholes shall be made to conform in shape and slope to that of the downstream sewer, if the size of upstream pipe equals that of the downstream. At changes in direction, manholes shall have at least 50 mm fall across the manhole in the direction of flow from inlet to outlet elevation.
- In the case that the downstream pipe is larger, it is good practice that the obvert (crown) elevation of the lowest upstream pipe be equal to, or higher than the obvert of the downstream pipe. However, if it is not practical to do so, to maintain a continuous energy gradient through manholes, a minimum of 80% of the diameter above the invert elevation of the lowest upstream pipe shall be equal to, or higher than 80% of the diameter above the invert elevation of the outlet pipe, unless otherwise approved by the City's Environmental Utilities Department (See Construction Specifications for Details).

4.4.1.4 DROP MANHOLES

Drop structures shall be used on every inlet to a manhole when the elevation of the inlet is more than 600mm above the outlet.

In a new installation of sewers and manholes, the drop structure shall be an exterior drop.

Interior drop structures will only be permitted for inlet lines 200mm maximum size where the velocity of the flow in the inlet line is less than 2.0 m/s, upon tie in to existing manholes.

For design details of drop structures see EU Construction Specification Details.

4.4.2 SERVICE CONNECTIONS

- The minimum grade on the sanitary sewer service line shall be 2.0%; the minimum size shall be 100mm inside diameter; the minimum depth of cover shall be 2.5 m to the top of pipe from finished grade.
- Non-residential and apartment service connections shall be sized according to anticipated user requirements. These service connections would normally be installed at the time that the lot is developed.
- Each residential lot, including multi-family lot, shall have its own separate sanitary sewer 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 that there are shallow utilities or easements inside the property line, the services

shall be no less than 1.5 m 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.

- In cul-de-sacs sanitary sewer service may be connected directly to the manhole provided that the lead enters the manhole less than 0.60 m above the invert of the main.
- Unless otherwise approved by the Environmental Utilities Department, service line size shall be at least two (2) sizes smaller than the main, if it is to be connected directly to the main. If this condition is not met, a manhole will be required.
- If deemed necessary by the City's Environmental Utilities Department, a sanitary sewer sampling manhole shall be provided within the road right-of-way or easement for the industrial or commercial lot. The sampling manhole shall be installed at the time that the lot develops and the service is installed.

4.5 PUMP STATIONS

All pump stations shall be treated as a special facility developed in accordance with Environmental Utilities Department document "Sewage Lift Station Design and Construction Standards and Procedures."