4 Sanitary Sewerage Systems

4.1 GENERAL

These standards cover the design and construction of sewer mains and accessories to be built or re-built in the Town of Lamont. Drawings relating to sanitary sewer system construction, trenching and backfill are provided in the Municipal Development Standard Drawings.

These standards provide the minimum design criteria, general construction requirements and construction materials for consulting engineers to use in their preparation of specifications and drawings. These standards may be exceeded if warranted by the design consultant. Good engineering practices and designs must prevail on all projects.

4.1.1 Separation of Storm and Sanitary Systems

All new systems or extensions from existing systems are to be designed on a separated basis. Run off from roofs, lots, streets and other outside areas including yards and parking areas and infiltration water from foundation drains and other sources, is to be excluded from the sanitary sewer system.

4.2 DESIGN FLOW

The sanitary sewer system shall have sufficient capacity to convey the peak dry weather flow, extraneous flows, and sanitary flow from all future contributing areas. This section outlines the methodology and design criteria that applies to the design of the sanitary sewer system.

Sanitary sewage systems shall be designed on whichever of the following is greater:

- The ultimate subdivision design population in the Outline Plan or Land Use Bylaw;
- Equivalent population subject to the peak day demand multiplier.

The equivalent populations are:

- Residential = 42 persons/ha
- Medium Residential = 90 persons/ha
- High Residential = 178 persons/ha
- Commercial/Industrial/Institutional = 48 persons/ha

Residential design populations can be further broken down as follows:

Residential-Low Density

- Single detached dwelling — 12 units/ha @ 3.5 people/unit

Residential-Medium Density

- Semi detached or duplex dwellings — 25 units/ha @ 2.4 people/unit
- Mobile home parks — 17.5 units/ha @ 2.4 people/unit

Residential-High Density

- Apartments — 74 units/ha @ 2.4 people/unit
- Townhouses — 37.5 units/ha @ 2.4 people/unit

The sewer main capacity shall be designed to convey the peak hourly sewage contribution plus infiltration, without the use of holding tanks and based on the following:

4.2.1 Residential/Domestic Contribution

The sewer main capacity shall be designed on the basis of either the subdivision design population, or 42 persons per hectare, whichever is greater, including all future contributing areas.

- Minimum average contribution of 360 litres per capita per day.
- Peak hourly flow for each contributing area calculated at an average flow multiplied by a peaking factor:

$$\text{C Peak Factor} = 1 + \frac{14}{4+P^{1/2}} \quad \text{(Harmon Formula)}$$

Where P = the population in thousands.
The maximum peak factor shall be 3.8.

4.2.2 Commercial/Industrial Contribution

Commercial and Industrial design flows will be based on the gross developed area or the specific application.

- Industrial flows - minimum average contribution of 0.2 litres per second per gross hectare.

- Commercial and Institutional (churches, schools, etc.) flows - minimum average contribution of 0.2 litres per second per gross hectare. Lower contributions may be considered on a per case basis.
- Peak dry weather flow for each contributing area calculated at average flow multiplied by a minimum peaking factor of 3.0. Maximum peak factor shall be 3.8.

4.2.3 Infiltration

- Roof leaders and weeping tiles shall not be connected to the sanitary sewer system. New development of existing areas where roof leaders and weeping tile are connected to the sanitary system, connections must be removed.
- The sanitary sewer and manhole system shall be constructed as water-tight. However, a maximum infiltration rate of 0.28 litres per second per gross hectare is acceptable.
- All new manholes are to be located out of "sags".

4.3 PIPE FLOW FORMULA

All sanitary sewers shall be sized using the Manning's equation and an "n" value of 0.013 for all smooth walled pipes of approved material.

Application of a depth variable friction factor at a flow depth of 80% of the sewer diameter results in a flow rate of approximately 86% of the sewer's full flow capacity. Therefore, the required flow capacity for sizing of the sewer shall be computed using the following relationship:

4.3.1 Gravity Sewers

$$\text{Required full flow sewer capacity} = \frac{\text{estimated total design peak flow rate}}{0.86}$$

$$\text{Using Manning's formula } Q = \frac{AR^{0.667}S^{0.5}}{n}$$

Where Q = Design flow in m^3/s
A = Cross sectional area in m^2
R = Hydraulic radius (area/wetted perimeter) in m
S = Slope of hydraulic grade line (m/m)
n = Roughness coefficient

4.3.2 Sewage Force Mains

Use Hazen-Williams formula:

$$Q = CD^{2.63}S^{0.54} \times 278.5$$

Where Q = Rate of flow in L/s
D = Internal pipe diameter in m
S = Slope of hydraulic grade line (m/m)
C = Roughness coefficient = 120 for all mains

4.4 VELOCITY

4.4.1 Minimum Velocity

Gravity sewers	V = 0.6 m/s
Forcemains	V = 0.76 m/s

4.4.2 Maximum Velocity

Unless specifically designed the maximum velocities are:

Gravity Sewers	V = 3.00 m/s
Forcemains	V = 1.5 m/s

4.5 MINIMUM PIPE DIAMETER (GRAVITY SEWERS)

- Residential Areas D = 200 mm
- Commercial/Industrial Areas D = 250 mm
- Service Connections D = 100 mm (single family dwelling)

Note: D = internal pipe diameter.

4.6 MINIMUM PIPE GRADE

Table 4.1 lists minimum pipe grades. Steeper grades are desirable.

Table 4.1
Minimum Pipe Grades

Internal Pipe Diameter mm	*All Pipe Types %Grade*
200	0.40*
250	0.28
300	0.22
375	0.15
450	0.12
525	0.10
600	0.10

*The % grade shall be increased to 1% for top ends/dead ends of sanitary systems.

For curved sewers, the minimum grade shall be as follows.

Table 4.2
Minimum Pipe Grades

Internal Pipe Diameter mm	*All Pipe Types %Grade*
200	0.40
250	0.31
300	0.25
375	0.18
450	0.15
525	0.13
600	0.10

4.7 MINIMUM DEPTH OF COVER

Minimum cover to be 3.0 m to invert and shall be of sufficient depth to satisfy the following requirements:

- Permit service connections to basements. Typically the obvert of the sewer should be at least 1.0 m to 1.5 m lower than the proposed basement elevation;
- Prevent freezing;
- Clear other underground utilities;
- Prevent damage from surface loading.

4.8 MANHOLE SPACING

- Manholes shall be provided at the end of each line and at all changes in pipe sizes, grades or alignment;
- The maximum allowable distance between manholes is 120 m for sewers smaller than 600 mm and 150 m for sewers 600 mm and larger;
- For curved sewers, manholes spacing shall be a maximum of 90 m for sewers smaller than 600 mm and 120 m for sewers 600 mm and larger.

4.9 CURVED SEWERS

Maximum joint deflection shall be as recommended by pipe manufacturer. Curved sewers shall be aligned parallel to the road centreline.

4.10 HYDRAULIC LOSSES ACROSS MANHOLES

The following criteria shall be used:

- Generally, for increasing pipe diameters the obvert of the downstream pipe shall match obvert of the upstream pipe;
- Minimum drop in invert levels across manholes:
    - Straight runs – 30mm drop minimum;
    - Deflections up to 45° - 30 mm drop minimum;
    - Deflections 45° to 90° - 60 mm drop minimum;
- Deflection greater than 90° shall be accommodated using two (2) or more manholes;
- A drop pipe shall be installed when the drop between inverts exceeds 1.0 m. The manhole barrel shall be sized to attain a clear main entry access of 1.0 m or greater.

4.11 PIPE LOCATION

- Sanitary sewers shall be installed on the centreline of the roadway;
- Separation of sewer main from watermains, storm sewers, power/telephone/cable:
    - Minimum 3.0 m horizontally unless sewer depth requires increased spacing;
    - Minimum 0.5 m vertical clearance between the bottom of the sewer service pipe and the top of the watermain;
    - Minimum 0.3 m vertical separation between the top of the sewer service pipe and the bottom of the watermain.

4.12 SERVICE CONNECTIONS

- Service connections shall be installed:
    - In separate trench if larger than 200 mm;
    - In common trench with water service laterals. For service connection details, see Standard Drawings;

- The minimum size of sanitary sewer service connections to a single family dwelling shall be 100 mm;
- Sanitary sewer service connections for commercial, industrial, multi-family or institutional areas, unless otherwise approved by the Town, shall be 150 mm or greater based on required design flows;
- Each Sanitary sewer service connection shall be designed as a single connection from the main to the property line;
- Sanitary and water sewer service connections shall be extended 4.0 m past the property line;
- All sanitary sewer service connections from the main to property line shall be designed for gravity flow with a minimum grade of 2.0%, and provide a minimum of 2.85 m of cover at property line;
- Sanitary sewer service connection materials shall be polyvinyl chloride (PVC) DR35 building service pipe conforming to CSA specification B182.2, latest revision thereof;
- Sanitary service connections can be made at manholes but must connect to a sewer main within the manhole. Where this is not feasible, sanitary service connections shall be made by the use of in-line tees or saddles;
- Risers shall be employed where the service connection at the main is 4.0 m or deeper;
- Roof leaders and building foundation drains shall not be connected to the sanitary sewer system;
- Grease, oil and sand interceptions or filters shall be provided on private property for all restaurants, garages, petroleum service stations, vehicle and equipment washing establishments as per Bylaw 2002-06/43

4.13 SERVICE CONNECTION RECORDS

The Developer's Consultant shall provide detailed record drawings for all installed service connections with such drawings providing information related to pipe dimension, invert elevations at the property line, location of services relative to property line(s), manholes or watermain valves, and lot number.

4.14 MATERIALS AND SPECIFICATIONS

Pipe materials shall be selected using a rational design method with the following information as a guide:

4.14.1 Gravity Sewers

Table 4.3
Acceptable Pipe Materials for Gravity Sewers

Preferred Materials	*General Size Range (mm)*	*Specification*
Polyvinyl Chloride (PVC) Reinforced Concrete	100 to 900 900 & larger	ASTM D3034, SDR 35 (CSA B182.2) CAN/CSA A257, Class 3 min.

4.14.2 Force Mains

Table 4.4
Acceptable Pipe Materials for Sewer Forcemain

Preferred *Materials*	*General Size Range*	*Specification*
Polyvinyl Chloride (PVC)	150 to 300 400 & larger	AWWA C900, DR18 or approved AWWA C905, DR25 or approved
High Density Polyethylene HD PE	75 & larger	AWWA C906, DR-11 or approved

Alternate materials will be evaluated on individual presentations (justification for deviation) by the Developer to the Town.

4.14.3 Manholes

All manholes are to be 1200 mm inside diameter and as per standard drawings.

- Manholes shall be manufactured using sulphate resistant Type HS cement;
- Manhole sections shall be precast reinforced concrete sections conforming to ASTM C478 and CSA A257.4;

- Manhole steps shall be standard safety type, aluminum forged of 6061-76 alloy having a minimum tensile strength of 200 MPa. Spacing to be no more than 400 m on center for the full depth of manhole;
- All joints shall be sealed with rubber gaskets conforming to ASTM C443 and grouted inside and outside with non-shrink grout;
- Manholes shall be fitted with the appropriate cast-iron frame and cover conforming to Class 20 ASTM A48 as shown on the Standard Drawings;
- Pre-benched manhole bases shall be used wherever possible with pre-cored connection holes and water-tight Duraseal or G-Loc joints or approved equal;
- Tee-riser manholes shall conform to CSA 257.2/ASTM C76 (pipe components) and CSA A257.4/ASTM C76 for the manhole riser component;
- Aluminum safety platforms shall be required in all manholes with a depth greater than 5 m. See Standard Drawings.

4.14.4 Bedding Materials

Granular material for bedding of pipes in sound dry soils shall be Class B sand conforming to Table 4.5:

Table 4.5
Acceptable Bedding Material Gradation

Standard Sieve Size (µm)	*% Passing*
10 000	100
5 000	50 – 100
2 000	30 – 90
400	10 – 50
80	0 - 10

In high water table areas with poor soils, course granular or washed rock shall be used.