Township of
SEVERN

ENGINEERING STANDARDS

Sanitary System

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1 Introduction

The purpose of this section is to outline the minimum requirements for the design and construction of municipal servicing within the Township. These requirements are intended to provide guidance and minimum expectations, but this shall not relieve the practitioner of the responsibility of ensuring a completed product demonstrating competent engineering and full compliance with all applicable legislation.

2 Other Applicable Acts, Codes, Standards, Legislation, Design Guidelines

Practitioners must be fully familiar and ensure compliance with other applicable acts, codes, standards, legislation, and design guidelines when carrying out municipal servicing design.

Practitioners are fully responsible for obtaining all approvals and permits necessary for the project from the relevant approval authorities.

3 Deviation from Standards

If the practitioner deems that a deviation from these standards is required, they must make a formal request to Town, complete with a memorandum identifying the proposed deviation along with an explanation of the rationale behind the requirement and how it will be of benefit. The Township may approve or reject any/all requests and the practitioner must comply with that decision. If a deviation is approved, a copy of the written approval must be included with any submissions to the Township.

4 General Requirements

In certain settlement areas the Township holds the responsibility for the local collection and treatment of sanitary waste.

This section provides guidance for the design and construction of any related sanitary system components. The design must accommodate sanitary drainage from all sources, including any contributing external areas as well as infiltration. Sanitary flows must be conveyed by gravity, in general. Pumped systems may be considered, at the Township's discretion, only where other alternatives are not possible.

5 Design Flows

The design flow in each length of sewer shall be computed on a standard sanitary sewer design sheet. For each area entered on the design sheet, the maintenance hole numbers, the size and grade of the sewers, and the plan and profile drawing reference number for each section of the sanitary sewer shall also be shown.

Sanitary sewer design flows prepared using hydraulic modelling software may be accepted. The practitioner must confirm the use and type of software with the Township prior to proceeding with the design in this manner. The Township may still request a traditional sanitary sewer design sheet be submitted in conjunction with any modelling.

Calculations shall be based on the sections below. It is recognized that system flows may change between design and construction as more information becomes known, particularly in the case of commercial and industrial uses. The Township reserves the right to request updated sanitary flow calculations and confirmation of design sufficiency prior to building occupancy.

5.1 Infiltration Rates

A peak design flow of 0.23 L/s/ha shall be used for infiltration. To satisfy self-cleaning requirements in sanitary sewers, assume dry weather infiltration reduces to zero for several days during dry months.

5.2 Residential Sewage Flows

The following formula shall be used to calculate the sewage flow for residential areas.

Equation 5-1: Sewage Flow Formula

$$Q_{(d)} = \frac{P_q M}{86.4} + IA$$

Where;

$Q_{(d)}$ = Peak domestic flow plus extraneous flows, in L/s

P = Design population, in thousands

q = Average daily per capita flow, in L/cap/d

M = Peaking factor

I = Unit of peak extraneous flow, in L/s/ha

A = Gross tributary area, in hectares

An average daily per capita flow of 350 L/c/d shall be used.

The value of peak extraneous flow shall be 0.23 L/s/ha.

The peaking factor shall be calculated based on the Harmon formula.

Equation 5-2: Harmon Formula for Peaking Factor Calculation

$$M = 1 + \frac{14}{4 + P^{0.5}}$$

Where:

P = population, in thousands

Maximum M – 4.0

Minimum M – 1.5

The design population shall be derived from the contributing drainage area, based upon the following.

Table 5-1: Design Population by Type of Housing

Type of Housing	Persons/Unit
Single and Semi-Detached	2.707
Townhouse and Duplex	2.416
Apartments (Studio and 1 bedroom)	1.208
Apartments (2 bedroom +)	1.751

The expected maximum population over a design period of 20 years shall be utilized.

For areas where lands are zoned for residential use, but detailed planning information is not available, the Township shall be consulted to determine population densities for calculation of sewage flows.

Future land use and population shall be based on the approved Official Plan and Secondary Plans of the area.

5.3 Commercial and Institutional Sewage Flows

An average design flow of 28 m^3/ha/day shall be used for the design of all local sewers, with a peak factor of 1.60.

The area shall be based on the gross lot area.

This flow criteria will apply unless specific information is known regarding the proposed use that would require higher design flows be used.

5.4 Industrial Sewage Flows

An average design flow of 36 m^3/ha/day for industry shall be used.

Peak factors shall be applied as per MECP Design Guidelines.

The area shall be based on the gross lot area.

This flow criteria will apply unless specific information is known regarding the proposed industrial use that would require higher design flows be used.

6 Pipe Sizing and Specifications

6.1 Pipe Capacities

Manning's formula shall be used in determining the capacity of all sanitary sewers. The capacity of the sewer shall be determined on the basis of the pipe flowing full.

For all types of pipe, a roughness coefficient of n = 0.013 shall be used.

6.2 Flow Velocities (Full Flow Conditions)

Sanitary sewers shall be designed such that they will have a minimum and maximum flow velocity, as follows:

Minimum acceptable velocity = 0.6 m/s

Maximum acceptable velocity = 3.0 m/s

The actual velocity at peak flow conditions shall also be calculated to ensure adequate flushing velocities are maintained.

The velocity change in a maintenance hole from one pipe to another shall not exceed 0.6 m/s.

6.3 Pipe Size

The minimum size for any sanitary sewer shall be 200 mm diameter.

6.4 Pipe Slopes

The maximum and minimum grades for pipes shall be the grade necessary to meet the maximum and minimum acceptable velocity requirements.

The minimum desirable design grades shall be 0.5% for all local sewers, with a minimum grade of 1% for the first upstream leg. Grades between 0.3% and 0.5% may be considered at the Township's discretion in areas where the minimum desirable pipe grade may not be achievable.

6.5 Depth of Cover

The depth of the sewer shall be measured from the final centreline finished road elevation to the top of the sanitary sewer.

In all instances, the proposed sanitary sewer shall be installed at a depth sufficient to also service lands external to the site as determined by the Township.

For residential, commercial and institutional areas the minimum depth shall be 2.8 m.

For industrial areas, the minimum depth shall be 2.15 m.

Sanitary sewers shall be located below basement floor elevations to allow for the installation of sewer laterals. Generally, the sanitary sewer shall be at least 1.0 m below the

basement floor elevations. Under special circumstances, the municipality may approve individual private sewage pumps equipped with a backflow preventer.

The maximum depth of cover shall not exceed the applicable OPSD maximum height of fill table requirements.

6.6 Location

All sanitary sewers shall be located as shown on the typical Township roadway cross sections.

A minimum horizontal clearance of 3.0 m is required between the sanitary sewer and watermain.

Sanitary sewers shall be laid in a straight line between maintenance holes unless radius pipe has been designed. Joint burial (common trenching) with storm sewers will be considered when supported by the recommendations of a soils report prepared by a qualified geotechnical engineering consultant.

6.7 Pipe Clearance

Sufficient vertical separation between any pipe crossings must be provided to allow for proper bedding and structural support.

Generally, a minimum clearance of 0.3 m shall be provided between the outside of all pipe barrels at all points of crossing.

Sanitary sewer service connections are required to cross under the storm sewer.

For clearances between sanitary sewers and watermain, practitioners shall follow the Ministry publication entitled F-6-1 Procedures to Govern Separation of Sewers and Watermains.

6.8 Changes in Pipe Size

No decrease of pipe size from a larger size upstream to a smaller size downstream will be permitted, regardless of any increase in grade.

6.9 Pipe Bedding

The class of pipe and the type of bedding shall be designed to suit loading and proposed construction conditions. Details are illustrated in the OPSD standard Bedding and Backfill details. In general, Type B bedding and cover (compacted Granular A bedding and cover over the sewer) shall be used for rigid pipe sewers.

Embedment for flexible pipe shall be homogeneous Granular A material in accordance with OPSD requirements.

The width of trench at the top of the pipe must be carefully controlled to ensure that the maximum trench width is not exceeded unless additional bedding or higher strength pipe is used.

Alternate granular materials for pipe bedding may be specified, subject to the approval of the Township. In areas where it is difficult to control the infiltration of ground water into the sewer trenches, clear stone bedding may be considered provided it is completely wrapped in a suitable geotextile, selected and installed in accordance with the pipe manufacturer's requirements.

Where poor soil conditions and high ground water levels are present, the Consultant shall prepare special designs for the Township's approval.

6.10 Materials

Sanitary sewers shall be constructed of reinforced concrete pipe, Polyvinyl Chloride (PVC) pipe or polyethylene.

The type and classification of all sanitary sewer pipe shall be clearly indicated on all profile drawings for each sewer length.

Reinforced concrete pipe shall be used for sewers 600 mm diameter or larger. PVC pipe may only be used for sanitary sewers up to and including 600 mm in diameter.

Reinforced Concrete Pipe shall be steel reinforced and conform to OPSS 1820.

Polyvinyl Chloride Pipe (PVC) shall conform to OPSS 1841.

Dimension ratio (DR) of PVC sewer pipe shall not exceed 35.

Polyethylene pipe shall conform to OPSS 1840.

For sewer applications requiring pressure pipe, pipe design should reference MECP guidelines.

7 Maintenance Hole Requirements

7.1 Size, Location, and Spacing

Maintenance holes shall be sized based on incoming and outgoing pipe sizes. All maintenance holes shall be minimum 1200 mm diameter.

The minimum size of any maintenance hole access shall be 685 mm.

All maintenance holes shall be centered on the sanitary sewer main.

Maintenance holes shall be located at each change in alignment, grade, or pipe material, and at all pipe junctions as well as at regular intervals along the pipe to permit entry for maintenance to the sewer.

Maximum spacing of maintenance holes shall be 110 m unless otherwise approved by the Township.

Where maintenance holes are located within a boulevard, they shall be a minimum of 1.5 m from the face of curb and any other service, utility, or appurtenance.

7.2 Frame and Grate

All maintenance holes located within the travelled portion of a roadway shall have the rim elevation initially set flush with the surface of the base course asphalt. The concreting and setting of the frame and cover shall be completed in accordance with the details provided in the Standard Drawings. A minimum of two modular rings and a maximum of 300 mm of modular rings shall be permitted on maintenance holes in new subdivisions. Use Denso Re-instatement Tape Seam Seal Mastic or equivalent. No concrete shall extend over the edge of the maintenance hole.

Prior to the placement of the final lift of asphalt, maintenance hole frames shall be reset to final elevation.

Where maintenance holes are located in areas to be flooded by the major design storm, maintenance hole covers shall be water tight and the maintenance hole is to be suitably vented.

All other maintenance hole covers shall be as per OPSD 401.010 with Type A closed cover labelled “Sanitary”.

7.3 Drops Across Maintenance Holes

A sufficient drop shall be provided across the maintenance hole to compensate for energy losses due to changes in flow direction and velocity. Where the difference in elevation between the maintenance hole inlet and outlet pipes is between 0.25 m and 0.6 m, pipe grades shall be adjusted such that the drop is not more than 0.25m. In cases where this is not achievable and the difference exceeds 0.6 m, a drop structure must be provided. This can be either a 1500 mm diameter MH with an internal drop structure or a 1200 mm diameter MH with an external drop structure.

When pipe size does not change through a maintenance hole and the upstream flow velocity does not exceed 1.5 m/s, the following minimum invert drops across the maintenance hole shall be made to compensate for hydraulic losses.

Table 7-1: Minimum Invert Drops for Hydraulic Loss Compensation

Change in Direction	Minimum Drop (mm)
Straight run	30
≤ 45°	50
> 45° ≤ 90°	80

When the upstream flow velocity exceeds 1.5 m/s and for all junction and transition maintenance holes, the drop required shall be calculated in accordance with MECP guidelines.

7.4 Additional Requirements

a) Maintenance holes shall be precast concrete and shall be designed and constructed in accordance with the most recent OPSS and OPSD. Where the standard drawings are not applicable, the maintenance holes shall be individually designed and detailed.

b) All maintenance hole chamber openings shall be located on the side of the maintenance hole parallel to the flow for straight run maintenance hole, or on the upstream side of the maintenance hole at all junctions.

c) The maximum change in the direction of flow in any sanitary sewer maintenance hole shall be 90 degrees. A change of flow direction at acute interior angles shall not be permitted.

d) The obvert(s) on the upstream side of a maintenance hole shall in no case be lower than the obvert(s) on the downstream side of the maintenance hole.

e) All maintenance holes shall be benched as per OPSD.

f) All maintenance holes shall have frost straps in accordance with OPSD 701.100.

g) When any dimension of a maintenance hole exceeds those detailed by OPSD, the maintenance hole must be individually designed and detailed.

h) Safety platforms shall be required in all maintenance holes greater than 5.0 m in depth. Safety platforms shall not be more than 5.0 m apart and shall be constructed in accordance with OPSD.

i) Whenever practical, safety platforms shall be located 0.5 m above any drop structure inlet pipes.

8 Service Connections

Individual sanitary sewer service connections shall be provided for single, semi-detached, and townhouse dwellings.

8.1 Location

The location for sanitary sewer service connections shall be in accordance with the locations specified on the applicable Standard Drawing. The sanitary service shall not be located in a driveway.

Any bends on sanitary service connections shall be long radius, sweep bends.

Sanitary connections shall be in accordance with the following Standards:

OPSD 1006.010 Sewer Service Connection for Rigid Pipe;

OPSD 1006.020 Sewer Service Connection for Flexible Pipe.

Residential connections shall terminate 1.5 m inside of the property line and shall be provided with a cleanout at the property line, capped and buried approximately 0.15m below surface.

Cleanouts on private property shall be sized and spaced in accordance with the Ontario Building Code.

Where a final connection is not being made at the time of installation, a plug suitably braced to withstand test pressures shall be provided along with a 50 mm x 100 mm marker placed from the invert of the connection extending 900 mm above grade, with the top of the marker painted green.

8.2 Size & Materials

Single, semi-detached, and townhouse dwellings sanitary service connections shall be a minimum 125 mm diameter PVC SDR 28, green in colour.

Sanitary service connections for multiple family, ICI, and other blocks shall be sized according to the intended use and shall be a minimum of 150 mm diameter.

An inspection maintenance hole shall be required at the property line.

8.3 Depth

The minimum depth of residential sanitary service connections shall be 2.6 m, measured from the final centreline road elevation. For buildings with no basement (i.e. slab on grade), the minimum depth shall be 1.8 m.

Risers shall be used when the depth to obvert of the sewer main exceeds 4.50 m. The riser connection shall not exceed 3.0 m in depth.

8.4 Grade

The minimum and maximum grades for sanitary sewer service connections shall be as follows.

Table 8-1: Minimum and Maximum Grades by Size of Connection

Size of Connection (mm)	Minimum Grade (%)	Maximum Grade (%)
125	2.0	8.0
150	1.0	6.0
200	0.5	6.0

Minimum and maximum flow velocities of 0.6 m/s and 3.0 m/s must be achieved.

8.5 Connection to Main

Connections to new mainline sewers shall be made with an approved manufactured tee. Approved saddles shall only be used for connections to existing sewer mains.

8.6 Backflow Prevention

All sanitary service connections within the areas designated in the Township's Water and Sewer Service By-law, must be equipped with an approved backflow preventer. Backflow preventers are also to be provided where required by the Ontario Building Code or requested by the Township.

9 Low Pressure Sanitary Sewer System (LPSS)

Low pressure sanitary sewer systems shall be designed on a site-by-site basis in accordance with the MECP design guidelines.

9.1 Materials

- Low Pressure Mains – Polyethylene SDR11 (CTS)
- Low Pressure Service – Polyethylene SDR11 (CTS)
- Main Stop – Mueller H15008 or approved equal
- Curb Stop – Mueller H15209 or approved equal
- Service Box – Mueller A-726, Clow 80-1 or approved equal with stainless steel rod. Service box cap to read "Low Pressure Sewer"
- Check Valve – Valmatic VM-1401.5THR or approved equal
- Tracer Wire – 12-gauge T.W.U. standard copper, light coloured, plastic coated
- Linkseal – Model LS-315-S-316-6 by Thunderline Modular Seal or approved equal
- Fittings (elbows, tees, etc.) – HDPE SDR11 brass fittings or approved equal, installed in accordance with manufacturers recommendations
- Connections to the main shall be made with a brass "T" coupling or approved equal

9.2 Depth

A minimum of 1.7 m cover shall be maintained over low pressure sanitary sewer mains and services. Appropriate depth rigid insulation shall be installed where the minimum cover cannot be achieved.

9.3 Embedment

Sewer embedment for low pressure sanitary sewer systems shall be equivalent to the embedment specified for gravity sanitary sewer pipe.

9.4 Cleanouts

Cleanouts shall be specified in accordance with Standard Drawing No. 127. Cleanouts shall be located at minimum 75 m intervals and at all distinct changes in direction.

9.5 Grinder Pump System

Private properties connecting to the low-pressure sanitary sewer must install a grinder pump system that has been designed to suit the mainline system. Refer to Standard Drawing No. 128 for a typical grinder pump layout.

9.6 Thrust Restraint

Adequate restraint must be provided at all fittings and deflections in the low-pressure sanitary sewer system to prevent pipe movement and subsequent joint failure.

Mechanically restrained joints or concrete thrust blocks in accordance with OPSD shall be used for all low-pressure sewer. Use thrust block requirements for 100 mm dia. pipe for all sizes less than or equal to 100 mm dia. The recommended type of restraint in the design will depend on anticipated soil conditions.

9.7 Tracer Wire

Tracer wire shall be installed with the pipe and brought to the surface at all valve boxes and chambers. Tracer wire shall be No. 12 gauge stranded copper (TWH) complete with plastic coating.

Joints in the tracer wire are discouraged, but when necessary, splicing must be waterproofed in accordance with OPSD requirements or using outdoor waterproof electrical connectors and done in such a way to ensure electrical conductivity.

A continuity test must be completed to ensure there is no damage to the tracer wire following construction.

9.8 Corrosion Protection

All ferrous fittings and tracer wires shall have corrosion protection provided by means of sacrificial anodes.

Sacrificial anodes shall be in the form of packaged zinc anodes and meet ASTM B-418-73-type II.

One 2.3 kg zinc anode is to be installed for every 500 m of tracer wire. The location for the anodes shall be shown on the engineering drawings.

10 Inflow and Infiltration Reduction

Effort shall be made during the design to reduce inflow and infiltration in the sanitary system.

In areas of high groundwater and in flood-prone areas, the following considerations shall be made:

- maintenance holes placement outside of ponding/flooding areas and/or use of watertight covers
- use of bituminous seal tape around rings on maintenance holes
- wrapping of all maintenance hole joints and pipe connections with water-proofing membrane
- use of watertight joints and heavy wall (SDR 26) gasketed fittings
- clay/collar plugs provided in bedding (at regular intervals)

11 Sanitary Sewer Rehabilitation

Methods of sewer rehabilitation may include internal and external point repairs, sealing cracks and joints, application of coating or spray and partial replacement of a component of the sewer.

Trenchless technology can be considered to repair or replace pipes with minimal digging or disruption to property including pipe bursting, relining and cured-in-place pipe.

Sewer rehabilitation will be considered by the Township on a case-by-case basis in accordance with ASTM and OPSS. If a designer is considering sewer rehabilitation, it is recommended that a pre-consultation meeting be held with the Township to discuss specific requirements.

12 Permitting and Approvals

The designer shall be responsible for obtaining all required permitting and approvals. This includes but is in no way limited to, satisfying all requirements of the Township's Consolidated Linear Infrastructure Environmental Compliance Approval.

13 Testing and Acceptance

All sewers are to be cleaned and flushed prior to testing.

All maintenance holes and other structures shall be visually inspected by the practitioner and the Township for any deficiencies.

All sewer main testing shall be carried out from maintenance hole to maintenance hole, including service connections.

An infiltration or exfiltration test, as per OPSS MUNI 410, shall be completed on all sewers. The Township shall determine which test is to be undertaken. Low pressure air testing may be considered.

A deflection test, as per OPSS MUNI 410, shall be performed on all sewers constructed using flexible pipe material, not sooner than 30 days after the completion of backfilling and installation of service connections.

A CCTV inspection as per OPSS MUNI 409 shall be conducted upon satisfactory completion of all other testing; prior to the Township's recommendation for issuance of "Substantial Completion"; and prior to the placement of any surface course asphalt. For land development projects, additional CCTV inspection may be required at other milestones and prior to final assumption.

A digital recording shall be supplied, illustrating a continuous record of the sewer installations, service connections, maintenance holes, etc. A report identifying any unusual or sub-standard conditions shall also be submitted.