City of Kawartha Lakes Infrastructure Guidelines – 2024 Sanitary

Contents

1.0 Introduction

1.1 Purpose

The City of Kawartha Lakes Sanitary Sewer Design Guidelines shall be read in conjunction with the Ministry of the Environment and Climate Change (MOECC) Design Guidelines for Sewage Works (2008) and Ontario Provincial Standards and Specifications (OPSS). In cases where the standards and specifications presented herein differ from the MOECC or OPSS guidelines, the City of Kawartha Lakes Standards shall supersede the MOECC or OPSS.

Sanitary sewers designed and constructed in accordance with the most recently revised specifications of the City of Kawartha Lakes shall be required in all residential subdivisions unless specifically exempted from this requirement by the City. All sanitary sewers shall be designed in such a manner and be of adequate size and depth to provide for the service of adjacent lands where so required by the Director of Engineering & Corporate Assets.

1.2 Definitions

1.2.1 Public Sewage Systems

A piped collection system that transports wastes of domestic origins and other such wastes suitable for treatment at a sewage treatment facility in accordance with City of Kawartha Lakes Management and Use of the Sewer Works By-Law (2016-006) and the Water and Wastewater Connection By-Law 2011-260, both as amended and updated.

1.2.2 Private Sewage Systems

A sewage system (or systems) with a total design capacity of less than 10,000 litres per day, shall be designed, constructed, operated, and maintained in accordance with Part 8 of the Ontario Building Code (OBC).

A sewage system (or systems), with a total design capacity greater than 10,000 litres per day, falls under the jurisdiction of the MOECC.

1.2.3 Separated Sewer

A separated sewer system is one in which all municipal sewage is conveyed to sanitary sewers and all surface runoff and foundation drain flow is conveyed to a storm sewer. These types of systems are standard for all new development.

1.2.4 Combined Sewer

A combined sewer system is a system that receives both incepted surface runoff and municipal sewage. The construction of new combined sewers is not permitted.

1.2.5 Non-Permitted Flows

Connections from foundation, weeping tile drainage or roof drainage are not permitted to enter the sanitary sewer system, in accordance with the City of Kawartha Lakes Management and Use of the Sewer Works By-Law (2016-006).

1.3 Location and Alignment

Generally sanitary sewers shall be located in front of, or in locations accessible to each lot and block facing a Municipal road. Sanitary sewers are to be located 1.5 metres from the centreline of the road. Sanitary sewers are to be located upon the inside loop of a proposed crescent or cul-de-sac with the maintenance hole located at a 1.5 metre offset from the centreline of the road.

When a maintenance hole is proposed/designed to be located within the vicinity of a roundabout, it shall be located in the asphalt area of the roundabout. Sanitary maintenance holes are not permitted within the grassed area of the roundabout.

1.4 Sanitary Sewers on Private Property

Sanitary sewers on private property are regulated by the OBC. Where specific regulations do not appear within the OBC, details from this manual will govern. Refer to block requirements for the purposes of sanitary infrastructure that crosses private property.

2.0 Blocks

Note that block conveyance is the required method of land transfer through the development process for any new development. In instances where block conveyance cannot be achieved, the use of easements may be permissible, at the discretion of the City.

The design of a sanitary sewer system must ensure that all proposed municipal sanitary sewers are located on municipal property.

Table 1: Minimum Block and Easement Requirements

If service, size and depth is	**Width of Block Required (metres)**
Single Sewer less than 600 mm diameter, and less than 3.7 m deep	6m
Single sewer larger than 750 mm in diameter in excess of 3.7 m deep	9m
A combination of two mains less than 3.7 m deep	9m
A combination of two mains greater than 3.7 m deep	12m
Major trunk sewer or forcemain	20m*

*Sewer main will be located off centre in the easement for future infrastructure.

3.0 Drainage and Sub-Drainage Area Plans

3.1 Sanitary Drainage Area Plan

The tributary areas used in the evaluation of the design flows shall be shown on a plan to a scale of 1:5000. This plan shall indicate the land use, area, population density, number of units, and the design flow (l/s). For each area included on the design sheet, the maintenance

hole numbers, the size and grade of the sewers, and the plan number of the details plan and profile for each section of the sanitary sewers shall also be specified.

3.2 External Sewershed Limits and Drainage Areas

Designs must accommodate future development, draft plan approved, or otherwise as directed by City of Kawartha Lakes Engineering & Corporate Asset Department, that will contribute capacity to the proposed development. When a design abuts an undeveloped or draft plan approved area, the external sewershed must be identified and designed for.

4.0 Design Parameters and Considerations

4.1 Residential

When lands are zoned for a specific residential use the following population densities shall apply.

Table 2: Residential Population Densities (per Hectare) for Design

Unit Type	Person Per Hectare
Residential	92

*All types, 40 units/ha.

Development Proposed Land – when the number and type of housing units within a proposed development are known, the calculation of population for the proposed development shall be based on the following:

4.2 Per Unit Populations

Table 3: Residential Population Densities (per unit type) for Design.

Unit Type	Person Per Hectare
Residential	2.3

All types.

4.3 Undeveloped Lands

Future land use and population shall be based on the City of Kawartha Lakes Official Plan and Secondary Plans.

4.4 Land Use Standard for 100 ha. of Developable Land

When such information is not available for the land under consideration, the following land use standard shall be used:

Table 4: Land Use Standard for 100 Hectares

Land Use Type	Area (hectares)
Local Open Space	10.0 ha.
Residential	75.0 ha.

Land Use Type	Area (hectares)
Commercial	5.0 ha.
Schools and Institutions	10.0 ha.
Total	100.0 ha.

4.5 Peak Flow

Table 5: Peak Flow Design Parameters

Design Flow Type	Peak Flow Design Parameters
Residential	450 L/capita/day
Commercial	0.4 L/sec./ha
Industrial	0.4 L/sec./ha
Schools and Institutions	0.32 L/sec./ha

4.6 Infiltration

22.5 m^3/gross ha. /day (0.26 L/sec./ha) – when foundation drains are **not** connected to the sanitary sewer.

45.0 m^3/gross ha. /day (0.52 L/sec./ha) – when foundation drains are connected to the sanitary sewer.

Calculated based on the number of gross hectares of residential, commercial, industrial, schools and institutions lands tributary to the sanitary sewer systems.

5.0 Design Flows

Sanitary sewer design calculations for approved drainage area plans are to be completed on the City of Kawartha Lakes Sanitary Sewer Design Sheet.

5.1 Peak Flow Calculation

Peak flow calculations are to be completed using the following formula:

$$Q = \frac{P \times q \times M}{86.4} + IA$$

Where:
P = Population (in thousands),
q = Average daily per capita domestic flow (L/cap/day),
M = Harmon peaking factor,
I = Unit of peak extraneous flow (infiltration),
A = Gross tributary area (in hectares).

5.2 Peaking Factor Calculation

Peaking Factor is to be determined based on Harmon Formula:

$$M = \left[1 + \frac{14}{4 + P^{\frac{1}{2}}}\right]$$

Where:
P=Population (in thousands),
M = Ratio of peak flow to average flow

$M_{MAX.}$ = Maximum 3.8

$M_{MIN.}$ = Minimum 2.0

5.3 Pipe Capacity (Q)

Pipe size is calculated using Manning's Formula where the pipe design flow is equal to or greater than the calculated peak design flow:

$$Q = \frac{1}{n} \times A \times R^{\frac{2}{3}} \times S^{\frac{1}{2}}$$

Where:
Q = Design flow (m^3/s),
n = Manning's roughness coefficient,
A = Cross sectional flow area,
R = Hydraulic radius ($R = \frac{A}{WP}$),
S = Slope (m/m) %.

5.4 Mannings Roughness Coefficient

A coefficient of 0.013 is to be used for all concrete and PVC pipe.

5.5 Flow Velocity

Velocities in sanitary sewers shall be calculated using the following formula:

$$V = \frac{Q}{A}$$

Where:
V = Flow velocity (m/s)
Q = Design flow (m^3/s)
A = Cross sectional flow area (m^2)

5.5.1 Velocities and Grade

Minimum velocity permitted in sanitary sewers is 0.6 m/s and minimum grade is 0.5% for all local sewers. A minimum grade of 1% is required for the first upstream leg.

Maximum velocity permitted in sanitary sewers is 3.0 m/s.

Velocity change from one pipe to another in a maintenance hole shall not exceed 0.60 m/s.

Peak flow shall be less than 80% of the full capacity of the pipe to prevent surcharging.

To determine sewage velocities based on actual flows refer to hydraulic elements graph.

5.6 Pipe Materials

Both rigid and flexible pipe are permitted in the construction of sanitary sewer systems including private drain connections. These materials include concrete and polyvinyl chloride (PVC) and must conform to OPSS 1820 – Material Specification for Circular and Elliptical Concrete Pipe and OPSS 1841 - Material Specification for Non-Pressure Polyvinyl Chloride (PVC) Pipe Products, respectively.

Mainline PVC sewer shall be used up to 375 mm and will have a dimensions ratio (DR) 35 and be green in colour.

PVC or reinforced concrete pipe shall be used for 450 mm diameter sanitary sewers.

Mainline reinforced concrete sewer pipes shall be used for pipes greater than 450 mm and will be a minimum class of 65-D, conforming to OPSS 1820.

In industrial areas, vitrified clay (VC) pipe shall be used up to and including 600 mm diameter, reinforced concrete pipe shall be used for pipes greater than 600 mm.

On private property, materials for sanitary building sewers and private sewers shall comply with Part 7 of the OBC.

Ribbed or corrugated pipe is not approved for the use as a sanitary sewer.

The class and type of pipe shall be shown on all of the profile drawings.

5.7 Bedding Material

The class and type of bedding shall be selected to suit loading and proposed construction conditions.

The pipe material, class, and type of bedding shall be shown on the profile drawing for each section of sanitary sewer.

Bedding materials shall conform to OPSS. MUNI 401 – Construction Specification for Trenching, Backfilling, and Compacting.

Compaction of granular bedding and backfill materials shall conform to OPSS.MUNI 402 – Construction Specification for Excavating, Backfilling, and Compacting for Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers

When the groundwater table is above the base of the trench bedding shall be 19 mm Clear Stone Type I conforming to OPSS.MUNI 1004 – Material Specification for Aggregates - Miscellaneous, 150 mm in depth.

The class and type of bedding shall be shown on the profile drawings.

5.8 Minimum Size of Pipe

Minimum size of pipe shall be 200 mm diameter.

5.9 Minimum Depth of Pipe

Table 6: Minimum Sanitary Sewer Depth.

Land Use	Minimum Depth
Residential, Commercial, and Institutional	2.75 m
Industrial	2.15 m

The minimum depth of a sanitary sewer will be measured from the centre line of the road to the obvert of the sewer.

5.10 Parallel Installations and Crossing Clearances

Parallel installations and crossing clearances shall be as per Ministry of the Environment, Conservation and Parks “F-6-1 Procedures to Govern Separation of Sewers and Watermains”.

Sanitary sewer crossing over or under a storm sewer a minimum clearance of 300mm is required.

5.11 Concrete Encasement

If concrete encasement is necessary for rigid pipe, a detailed design shall be submitted for approval. Concrete encasement shall be designed from maintenance hole to maintenance hole to prevent pipe shear. All concrete encased pipes shall be upsized one size to allow for potential future liners.

5.12 Sanitary Sewer Testing

Low pressure air testing shall be performed on all sanitary sewer pipes as per OPSS.MUNI 410 Construction Specification for Pipe Sewer Installation in Open Cut.

Deflection testing of pipe sewers shall be performed on all sanitary sewer pipes as per OPSS.MUNI 410 Construction Specification for Pipe Sewer Installation in Open Cut.

Video inspection shall be conducted for all sanitary sewer pipes, both main line sewers and service laterals. The inspection shall be as per OPSS.MUNI 409 Construction Specification for Closed-Circuit Television (CCTV) Inspection of Pipelines. Video inspection of service laterals is required prior to permission to place surface asphalt and following occupancy of said lot.

6.0 Maintenance Holes

Maintenance holes shall be constructed of pre-cast concrete as detailed within the standard drawings.

6.1 Spacing of Maintenance Holes

Table 7: Maximum Maintenance Hole Spacing by Pipe Size.

Sewer Diameter	Maximum Spacing
200 mm – 750 mm	120 m
825 mm – 1200 mm	125 m
Greater than 1200 mm	155 m

6.2 Maintenance Hole Bedding

Bedding materials shall conform to OPSS. MUNI 401.

Compaction of granular bedding and backfill materials shall conform to OPSS.MUNI 402.

When the groundwater table is above the base of the trench, bedding shall be 19 mm Clear Stone Type I conforming to OPSS.MUNI 1004, 150 mm in depth.

6.3 Maintenance Hole Sizing

All sizing of sanitary precast maintenance holes is based on incoming and outgoing pipe sizes and will be sized in accordance with OPSD 701.021 – Maintenance Hole Benching and Pipe Opening Alternatives.

The type and size of the maintenance hole shall be specified on the profile drawings.

6.4 Maintenance Hole Frame and Covers

Maintenance hole frame and covers are required for all maintenance holes, shall be in accordance with OPSD 401.010 type ‘A’ closed – Cast Iron, Square Frame with Circular Closed or Open Cover for Maintenance Holes, and shall be clearly labelled “Sanitary” or “SAN.”

Maintenance hole frame and cover will be clear of curb and gutters and clear of bends in the road for new construction.

All maintenance hole chamber openings will be located on the upstream side of the maintenance hole.

6.5 Maintenance Hole Inflow Dishes

Upon completion of base asphalt all sanitary maintenance holes located within storm low points, ponding areas and over flow routes shall be fixed with an Inflow Dish manufactured by Cretex Specialty Products or approved equivalent made of High Density Polyethylene (HDPE) meeting the requirements of ASTM D-1248 Class A, Category 5. All maintenance hole inflow dishes shall be equipped with a tether attached to the top of ladder or step, or

anchored to the wall, tether to be 0.125mm vinyl coated aircraft cable or polyweb strap complete with aluminum spring snap bolt. All maintenance hole inflow dishes shall come with a manufactured strap for removal and an appropriate valve for venting gas and relieving vacuum pressure.

6.6 Watertight Maintenance Hole Lids/Covers

Watertight bolt down covers are required when sanitary maintenance holes are located within storm low points, ponding areas and overland flow routes. Overland routes can include flood plain areas, walkways within an easement, open space areas, gutter locations or any other location where overland flow is directly over and adjacent to the maintenance hole lid. Watertight maintenance hole lids will also be required to be installed at locations where it is necessary to protect against sanitary surcharge conditions.

6.7 Lockable Maintenance Hole Covers

Lockable maintenance hole covers are required to control access and to protect the public. We recommend that they be located through park blocks, open space blocks, pumping stations or water pollution control plants.

Maintenance holes located within easements in parks, open space or other locations deemed necessary shall be equipped with lockable watertight maintenance hole covers.

6.8 Maintenance Hole Risers

For maintenance holes, precast concrete adjustment units shall be as per OPSD 704.010 – Precast Concrete Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.

All maintenance holes that have a deviation in excess of 10mm from surface asphalt elevation shall be milled, re-adjusted, and re-paved to suit final grades.

6.9 Maintenance Hole Steps

For pre-fabricated maintenance holes, steps will be solid circular steps as per OPSD 405.020 – Maintenance Hole Steps - Solid.

For cast-in-place maintenance holes, steps will be solid rectangular steps as per OPSD 405.020.

6.10 Drop Structures

If the design of the sewer system is such that the difference in elevation between the maintenance hole inlet and outlet will exceed 0.25 m, then a drop structure shall be required.

A maximum drop of 0.25 m will only be permitted if the design of the sewer cannot be modified to reduce the drop or modified to accommodate the drop structure.

Sewer systems shall be designed to avoid the use of drop structures.

6.11 Maintenance Hole Safety Landings

Safety platforms shall be required in all maintenance holes when the invert to top of maintenance hole exceeds 5.0 m in depth. Safety platforms shall not be more than 5.0 m apart as per OPSD 404.020 – Aluminum Safety Platform for Circular Maintenance Holes. Access hatches in safety grating are required to line up to allow proper use of fall arrest equipment.

6.12 Benching

Benching of maintenance holes shall conform to the most recent revision of OPSD 701.021.

Benching height will extend from the pipe obvert to improve hydraulic performance. All benching is required to slope at 2% and the sewer shall extend 150mm into the maintenance hole before a change in alignment.

If the benching is to vary from the OPSD, and be designed a detail is to be shown on the design drawings.

6.13 Connections to Maintenance Holes

A flexible joint shall be installed at all maintenance hole structures 300 mm from the outside face of the maintenance hole in accordance with OPSD 1001.01 – Material Specification for Aggregates – General, as amended in that Type D support is only acceptable.

6.14 Hydraulic Losses at Maintenance Holes

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

Table 8: Hydraulic losses for non-pre-benched maintenance holes.

Alignment Change	**Drop Required**
Straight run	Grade of sewer
15-45 degrees	0.03 m
45-90 degrees	0.06 m
Junctions and transitions	Physical modeling recommended.

7.0 Sanitary Service Laterals

New sanitary laterals shall be 100mm diameter PVC SDR 28 and shall be green in colour.

All service connections to the mainline sewer will be made that the invert of the service connection is above spring line of the main pipe and shall be installed using a manufactured tee.

Risers shall be used when the obvert depth of the sanitary main exceeds 4.5m, rise connection shall not exceed 3.0m in depth and shall be in accordance with OPSD 1006.010.

Under no circumstances will flow from the service connection enter the main against the flow.

Where horizontal or vertical bends are required, long radius sweeps shall be used. Short bends are not permitted.

7.1 Minimum and Maximum Size and Grade

Table 9: Sanitary Service Laterals Minimum and Maximum Size and Grade.

Development type	**Diameter and grade of service connection**
Single family and semi-detached residential	100 mm at 2% - 10%
Multi-family block	150 mm at 1% - 10%
Non-residential block	150 mm at 1% - 10%
Commercial block	150 mm at 1% - 10%
Institutional block	150 mm at 1% - 10%

Note: The actual size of a private sanitary sewer connection for multi-family, non-residential, commercial, and institutional blocks is dependent on the flows and design.

8.0 Forcemains

At design pumping rates, a desired cleansing velocity (of at least 0.9 m/s) shall be maintained. The minimum force main diameter for raw wastewater shall not be less than 100 mm.

An air relief valve shall be at high points in the forcemain to prevent air locking. Vacuum relief valves may be necessary to relieve negative pressures on force mains. The force main configuration and head conditions should be evaluated as to the need for and placement of vacuum relief valves. Fittings and isolation valves shall be stainless steel.

Forcemain design shall include transient analysis and consider the provision for water hammer relief.

Forcemain should enter the gravity sewer system at a point not more than 200 mm above the flow line of the receiving maintenance hole.

Pipe and joints shall be equal to water main strength materials suitable for design conditions. The forcemain, reaction block, and station piping shall be designed to withstand water hammer pressures and associated cyclic reversal or stresses that are expected with the cycling of wastewater lift stations. The need for surge protection chambers shall be evaluated. Forcemain pipe materials shall be approved by the City engineer.

Forcemains construction near streams or water works structures and at watermain crossings shall meet all applicable requirements.

Friction losses through force mains shall be based on the Hazen - Williams formula or other acceptable methods. When the Hazen – Williams formula is used the following “C” shall be used regardless of the pipe material:

Table 10: Hazen Williams C Factors

Pipe Diameter	**C - Factor**
100 mm - 150 mm	100
200 mm - 250 mm	110
300 mm - 600 mm	120
Greater than 600 mm	130

When initially installed, forcemains may have a significantly higher “C” factor.

The forcemain shall be appropriately identified when they are constructed of material that may cause the forcemain to be confused with potable watermains.

Tracer wire shall be installed on all forcemains. Tracer wire shall be brought to the surface using 50 mm diameter valve boxes spaced at 300 m intervals along the forcemain.

Forcemains shall be tested to ensure there is no leakage as per OPSS 412 – Construction Specification for Sewage Forcemain Installation in Open Cut.

9.0 References

Ministry of the Environment and Climate Change, Design Guidelines for Sewage Works, 2008.

Ontario Ministry of Transportation, Ontario Provincial Standards for Roads and Public Works.

Ontario Ministry of Municipal Affairs and Housing, Provincial Policy Statement 2005, 01 March 2005.

City of Ottawa, Sewer Design Guidelines, 2004.

City of Toronto, Design Criteria for Sewers and Watermains, 2009.

The Regional Municipality of Durham, Design Specifications for Sanitary Sewers, 2016.

The Regional Municipality of Durham, Appendices, 2013.

City of London, Design Specifications & Requirements Manual, 2015.