Background Information for On-Site Sewage Permit Applicants

Northwestern Health Unit

www.nwhu.on.ca

Revised 2022-06-10

Legislative Authority

The Northwestern Health Unit (NWHU) is legislated under the Building Code Act, S.O. 1992 through the Ministry of Municipal Affairs and Housing to enforce Part 8 (Sewage Systems) of the Ontario Building Code. Associated responsibilities include:

- Issuing permits and performing inspections to ensure on-site sewage systems with a design capacity of 10,000L/day or less meet minimum requirements of Part 8 of the Ontario Building Code.
- Conducting inspections of proposed land development sites and providing comment to the appropriate regulatory authority on the suitability for on-site sewage treatment.
- Investigating complaints concerning malfunctioning sewage systems.
- Conducting sewage permit searches.

Property owners are permitted under the Ontario Building Code to design and install their own septic system on that property; however, any other individual conducting the design activities or installing a sewage system must be qualified to do so and registered accordingly with the Ministry of Municipal Affairs and Housing.

Under the Building Code Act, **NWHU is not permitted to design sewage systems**.

When Do I need a Sewage Permit?

Under the Building Code Act, a permit must be issued by the Chief Building Official prior to construction of a sewage system, other than a Class 1 sewage system.

"Construction" includes activities involved in the:

- installation of a sewage system (including components moved from elsewhere)
- extension or material alteration of a sewage system
- repair of a sewage system

Initial Building Plans Must be Reflected on Permit Application

The information provided on the permit application about the building that will be serviced by the sewage system must reflect the initial building plans, not potential future additions. A sewage system may be designed to accommodate specific future additions; however, the initial building plans must be reflected in the application to prevent confusion when reviewed at a later time (i.e. when the permit application for the construction of the addition is submitted to the municipal building department).

A **Performance Level Review** is generally required by municipal building officials at the time of application for a permit to construct an addition.

Annual Winter Season Pause of Permit Application Process

NWHU does not conduct initial or substantial completion inspections during winter months when snow cover and/or frozen ground makes proper site assessment difficult. During this pause in inspection services, any regular permit-related timeframes are not in effect.

- Please visit the Sewage and Land Development page at www.nwhu.on.ca to find out if permit-related inspections are currently paused.
- In some circumstances, we may be able to offer an *approval in principle* letter to provide to other building authorities when proper site assessment is not possible.

Roles & Responsibilities in the Sewage System Approval Process

Initial Site Evaluation

- The property owner is responsible for conducting the initial site evaluation, unless hiring a qualified installer or third-party designer to complete this task.
- If hired to design the sewage system, a qualified installer or third-party designer must conduct an appropriate site assessment.
- Site assessment must include the determination of the percolation time of the soil using a method identified in Ontario Building Code section 8.2.1.2.

Permit Application

- The permit application must be completed in full and submitted to the NWHU with payment by the property owner unless an authorized agent has been designated to complete this task.
- If designated as authorized agent, the qualified installer or third-party designer must complete the application in full and submit the application with payment to NWHU.
- Once the application is completed and submitted to the NWHU with payment, the Chief Building Official will review and issue or refuse the permit.
- An on-site inspection will be conducted during the application review where the inspector will confirm site-specific information.
- Once approved, a permit is issued by NWHU to the applicant. Permits are valid for two years after date of issue.

Installation

- A copy of the permit must be posted on-site in a conspicuous place at all times during construction, and the person in charge of construction must have a copy of drawings and specifications approved by the Chief Building Official on-site during construction.
- Installation must be completed by the property owner or qualified installer with a valid Building Code Identification Number (BCIN) indicated on the permit application.
- Installation must be conducted in accordance with the information on the permit, as well as Part 8 of the Ontario Building Code.
- If any changes to the information on the permit are required, NWHU must be notified, and changes must be approved prior to implementation.
- Once installation is at the point of substantial completion, the person installing the system must notify NWHU of readiness for inspection.

Substantial Completion Inspection

- Once notified of readiness for inspection, NWHU will work with the applicant to determine a suitable date to carry out the substantial completion inspection.
- The substantial completed system is inspected for compliance with the permit design and the Ontario Building Code. If satisfactory, permission to continue with installation is granted, and NWHU issues the Certificate of Completion to the applicant.

Completion of Installation and Maintenance of System

- The installer must complete the installation as per Ontario Building Code and Certificate of Completion.
- The homeowner must maintain the system and ensure it does not create a health hazard.

Basic Components of a Site Evaluation

A site evaluation (accompanied by a written record) must be conducted on every site where a new or replacement sewage system is to be installed to ensure the site is suitable.

Test Pits to Evaluate Sub-Surface Conditions

Test pits help assess the ground characteristics at the proposed location of a sewage system. Where this information is required for design purposes (i.e. the class of proposed system requires specific vertical separation from components or certain soil characteristics), a minimum of two test pits must be dug. Test pits must be deep enough to demonstrate required vertical clearance distances.

Information about a test pit that must be recorded includes:

- Evidence of high groundwater table (if discovered, note depth below grade)
  "High groundwater table" means the highest elevation at which there is physical evidence the soil or leaching bed fill has been saturated with water
- Location of any bedrock within the area of the pit (if discovered, note depth below grade)
- Soil description (soil type, colour, depth)

Test pit conditions that inform the design process (i.e. vertical separation, description of native soil that will be used to calculate the size of a leaching bed) must be verified by an inspector during the initial site inspection. If not dug during the inspector's site visit, test pits must be clearly marked and covered to prevent water from entering. Care must be taken to prevent unauthorized access to open pits to prevent injury or death.

Determining the Percolation T-Time of Soil

The percolation T-time is the rate at which liquid moves through the specific soil or material (expressed in min/cm). Some design calculations require T-time of the native soil, while some design calculations will require T-time of imported leaching bed fill or filter sand.

T-time may be determined through:

- **Percolation tests**, which involve a third-party certified soil technician digging at least three test pits at the site and measuring how long it takes for the water to go through the soil.
- **Classifying the soil according to the Unified Soil Classification System.** *This is the most common method and involves sending a soil sample to an accredited lab for analysis and classification to determine estimated T-time.*
  - *Collect a sample of soil that sufficiently reflects the soil in the area where the proposed leaching bed will go. Testing a thin seam/small pocket of good soil in a mixture is not sufficient. Test pits should be in the proposed bed area.*
  - *If the soil analysis report from the lab indicates an estimated range of values for the percolation (T-time), use the highest value for design purposes.*
  - ***Laboratory analysis reports for imported fill and filter sand are only considered valid if dated within 24 months of system installation.***

Please note: If visual assessment of the soil suggests it likely has a T of 50 or greater (i.e. clay), you are not required to prove this specific T-time with soil analysis.

Horizontal Separation Distances

Within the Ontario Building Code, there are horizontal separation distances identified that help facilitate proper placement, and function of the system, as well as protection of nearby water sources.

A site diagram is required as part of the sewage permit application process. This diagram must indicate horizontal distances in relation to the proposed sewage system, as well as any planned routes for tank maintenance, test pit locations, and utility corridors. The site diagram must be submitted as part of the sewage permit application.

*Additionally, some municipalities have zoning by-laws that require **extra clearance distance to watercourses beyond what is listed in the following charts**. Contact your municipality to inquire about additional conditions.*

Minimum Horizontal Clearance Distances

Class 1, 2 And 3 Sewage Systems				
System	**Drilled Wells**	**Dug Wells**	**Watercourse***	**Property Line**
Earth Pit Privy	15m	30m	15m	3m
Privy Vault	10m	15m	10m	3m
Greywater System	10m	15m	15m	3m
Cesspool	30m	60m	15m	3m
Treatment Unit (i.e. Septic Tank) or Holding Tanks				
Structure				1.5m
Well				15m
Watercourse				15m
Property Line				3m
Distribution Piping and Leaching Chambers for Class 4 Systems				
Structure				5m
Drilled Well				15m
Dug Well				30m
Watercourse*				15m
Property Line				3m
***Note:** Where distribution piping is part of a raised Class 4 system, the distances listed above must be increased by 2x the height of the system above the existing grade (i.e. if leaching bed is a height of 1m above grade, 2m must be added to each separation distance listed above)*				

Brief Description of Different Classes of On-site Sewage Systems

There are five classes of on-site sewage systems described in the Ontario Building Code.

Class	Description	Designed to receive	Maximum daily design flow
Class 1	• Chemical toilet • Incinerating toilet • Recirculating toilet • Self-contained portable toilet • All forms of privy (i.e. portable, earth pit, pail, vault) • Composting toilet system	• Human body waste • If specifically designed to do so, may also receive non-waterborne biodegradable kitchen waste or small quantities of plant matter	N/A
Class 2	• Greywater system	• Only greywater	1000 L/day
Class 3	• Cesspool	• Only contents collected from a Class 1 sewage system	1000 L/day
Class 4	• Leaching bed system	• Domestic sanitary sewage	10,000 L/day
Class 5	• Holding tank system	• Domestic sanitary sewage	10,000L/ day

Definitions for chart reference:

Greywater: Sanitary sewage of domestic origin derived from fixtures other than sanitary units.

Sanitary sewage: Liquid or water borne waste,

a) of industrial or commercial origin, or

b) of domestic origin, including human body waste, toilet or other bathroom waste, and shower, tub, culinary, sink, and laundry waste.

Basic Design Principles of Class 1-5 Sewage Systems

Please refer to Part 8 of the Ontario Building Code for more information when designing your on-site sewage system. This section is intended to provide basic information only. It is recommended that homeowners who are not familiar with Part 8 of the Ontario Building Code obtain the services of a qualified installer and/or designer when designing and installing an on-site sewage system.

In general, it's important to determine:

- Soil characteristics (i.e. T-time)
- Building characteristics (i.e. m^2 of floor space, number of bedrooms, number of fixture units) *More information on fixture unit counts can be found on page 13.*
- Daily design sewage flow (based on soil characteristics and building characteristics)
- Horizontal clearance distances
- Vertical separation to groundwater or bedrock

Class 1 Systems

Class 1 systems are designed to receive only human body waste and not the other components of sanitary sewage. Class 1 systems are not designed to accept water-borne waste. If a Class 1 system has an overflow drain for the removal of excess liquid or requires periodic emptying, the waste being drained or removed must be received by a Class 3, 4 or 5 system.

The Ontario Building Code describes specific construction requirements for:

- portable privies
- earth pit privies
- privy vaults and pail privies

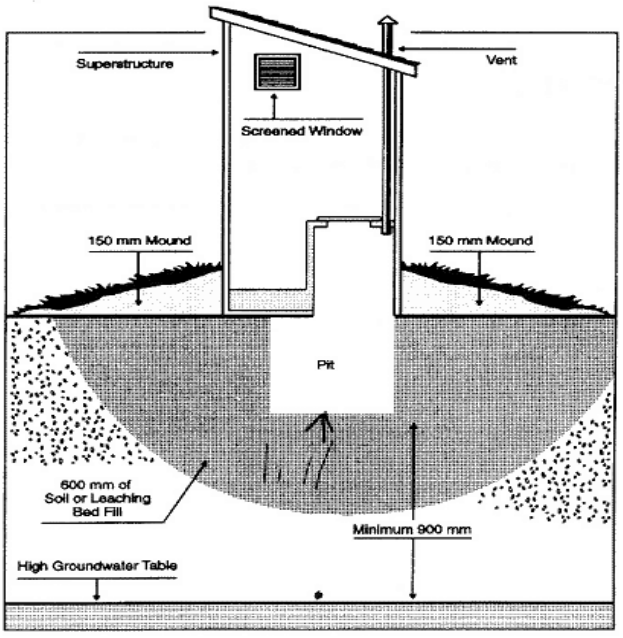
For each of these privy types, the privy must be enclosed in a structure that:

- is constructed of strong, durable, weatherproof materials
- has a solid floor supported by a sill constructed of treated timber, masonry, or other material of equal strength and durability
- is easily sanitized
- unless it only contains a urinal, is equipped with one or more seats, each having a cover and supported by an enclosed bench or riser lined with an impervious material on all interior vertical surfaces
- is equipped with a self-closing door
- has one or more openings for purposes of ventilation, all of which have a screen
- has a ventilation duct with a screen at the top end and that extends from the underside of the bench or riser to a point above the roof of the structure
- shall not have any additional openings for the reception of human body waste

Earth pit privies

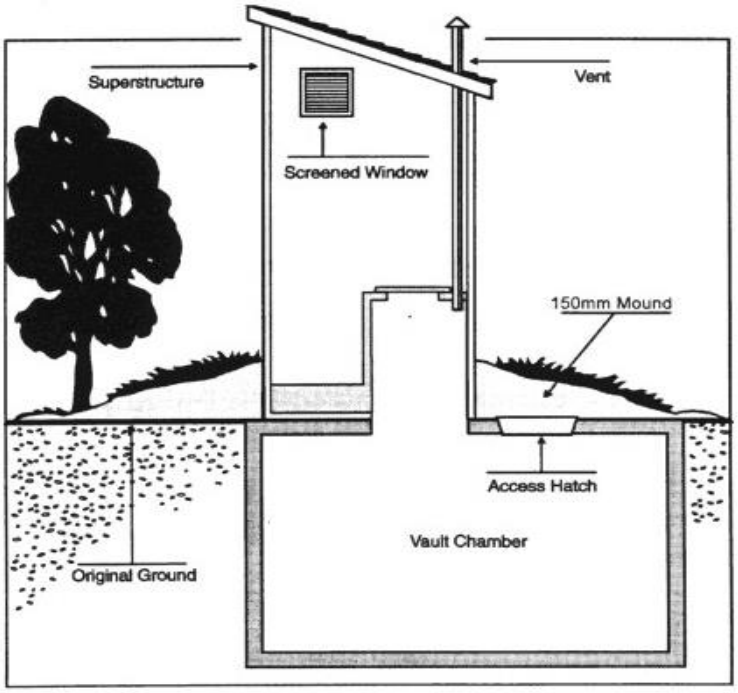
Earth pit privies are latrines that consist of an excavation in the ground surmounted by a superstructure, and must meet the following requirements:

- the bottom of the pit must be at least 900mm above the high groundwater table
- the sides of the pit must be reinforced to prevent collapse
- the pit must be surrounded (on all sides and bottom) by at least 600mm of soil or leaching bed fill
- the soil or leaching bed fill around the base of the sides of the structure must be raised or mounded at least 150mm above ground level
- the privy must meet the minimum horizontal clearance distances indicated on page 5



Privy vaults

Privy vaults are latrines in which the receptacle for human waste consists of a constructed vault from which the waste is periodically removed, and a pail privy is a latrine in which the receptacle for human waste consists of a removable container within a structure.



Privy vaults and pail privies must meet the following requirements:

- The container or structure to be used for holding or storage of sanitary sewage shall be watertight and made of a material that can be easily cleaned
- The soil or leaching bed fill around the base of the sides of the structure must be raised or mounded to at least 150mm above ground level
- The surface of the ground around the privy-vault or pail privy must be graded to adequately divert surface drainage
- The privy must meet the minimum horizontal clearance distances indicated on page 5

Portable privies

Portable privies are portable latrines in which the receptacle for human body waste and the structure are structurally combined into one unit. Portable privies must meet the following requirements:

- Must have a watertight receptacle suitable for the holding and storage of sanitary sewage
- The receptacle for the holding and storage of sewage shall be designed and constructed to be easily emptied and cleaned
- Must be constructed to withstand stresses during loading, unloading, and transportation
- Portable privies are generally emptied into municipal-scale wastewater treatment systems by licensed sewage haulers.

Class 2 Sewage Systems (Greywater Systems)

Greywater is defined as wastewater from sinks, showers, bathtubs, and other non-toilet fixtures. A Class 2 system is a soil-based system that treats and disposes of greywater. The Ontario Building Code allows a **maximum daily design flow of 1000L/day** for Class 2 systems.

Class 2 systems have limited application and are not always practical. Class 2 systems are meant to accept only small amounts of greywater and cannot accept wastewater from laundry machines.

A Class 2 Sewage System is sized by the amount of sidewall area necessary for the daily design flow water to be properly absorbed and filtered by the surrounding soil.

Sidewall area is calculated as:

$$\text{Sidewall area } (m^2) = \frac{\text{Daily Design Flow (L/day)}}{\text{Loading Rate } (L/m^2)}$$

Daily Design Flow for a Class 2 Sewage System is calculated as:

- 200L per fixture unit where there is a supply of pressurized water
- 125L per fixture unit where there is no supply of pressurized water

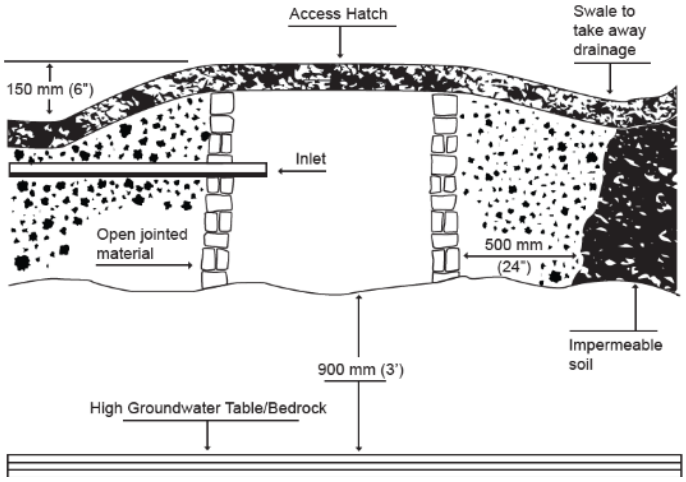
Please see the table on page 13 for a list of common fixture unit values.

Loading Rate for a Class 2 Sewage System is calculated as:

$$\text{Loading Rate} = \frac{400}{\text{T-time of native soil}}$$

The Ontario Building Code also indicates the following construction requirements:

- The bottom of the pit must be at least 900mm above the high groundwater table
- The pit must be constructed to prevent the collapse of the sidewalls
- Material used to support or form the sidewalls of the pit must be an open-jointed material that will permit leaching from the pit
- The pit must have a tight, strong cover that remains over the pit except when adding or removing greywater from the pit or during pit maintenance



- The earth around the perimeter of the pit must be raised or mounded to a height of at least 150mm above ground level
- The surface of the ground around the pit must be graded so surface drainage in the area will be diverted away from the pit
- The pit must be surrounded (on all sides and bottom) by at least 600mm of soil with a percolation T-time of less than 50 minutes.
- The pit must meet the horizontal clearance distances outlined on page 5

Class 3 Sewage Systems (Cesspools)

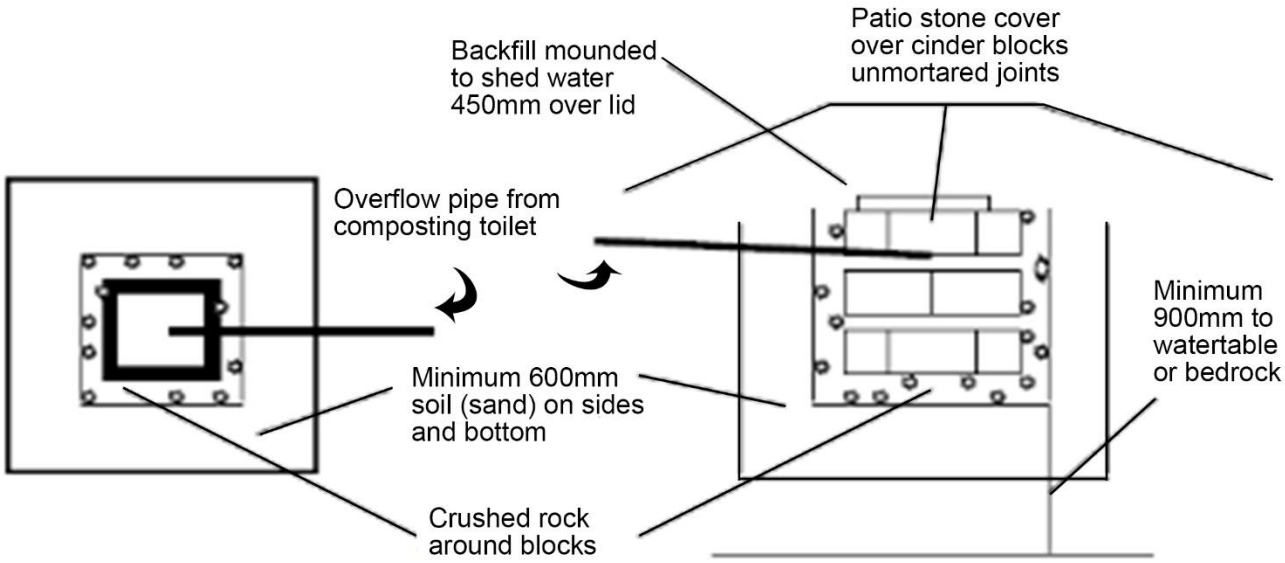
Class 3 sewage systems are designed to **receive only the contents of a Class 1 Sewage System or effluent from a Class 1 Sewage System** for disposal. Class 3 systems are typically used in conjunction with a composting toilet to receive waste from an overflow drain, or periodically receive the contents from recirculating or chemical toilets.

The Ontario Building Code allows for a **maximum daily design flow of 1000L/day** to be accepted by Class 3 systems. The typical volume of effluent generated for disposal into a Class 3 system is minimal, though it should be noted Class 3 systems can have a short operating life due to soil clogging.

Construction requirements for cesspools are:

- The bottom of the cesspool shall be at least 900mm above the high groundwater table
- The cesspool must be constructed in a manner that prevents the collapse of its sidewalls
- Any material used to support or form the sidewalls of the cesspool must be an open-jointed material that will permit leaching from the cesspool
- The cesspool must be provided with a tight, strong cover that must remain over the cesspool except when adding or removing sanitary sewage or during maintenance
- If the cesspool extends to the ground surface, the cover must be lockable
- The soil or leaching bed fill around the perimeter of the cesspool must be raised or mounded to a height of at least 150mm above ground level
- The surface of the ground around the cesspool must be graded to divert surface drainage
- The cesspool must be surrounded (on all sides and bottom) by at least 600mm of soil or leaching bed fill, except the top where the cesspool extends to ground surface
- Must meet the minimum horizontal clearance distances outlined on page 5

Figure 2. Top View and Side View of Cesspool

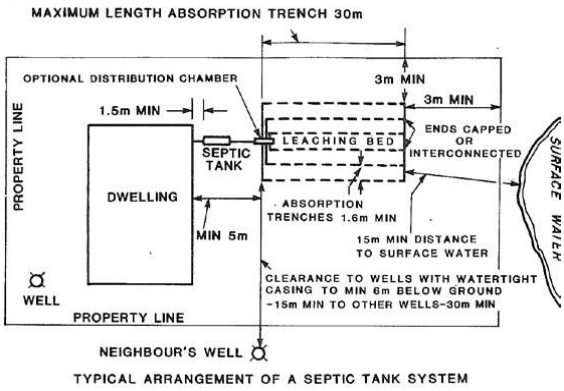


Class 4 Sewage Systems (Leaching Bed Systems)

Class 4 sewage systems are soil-based absorption systems designed to accept the waste from most plumbing fixtures.

Class 4 systems are composed of:

- A treatment unit
- A leaching bed
- An additional loading area (called a Mantle) if constructed in leaching bed fill



TYPICAL ARRANGEMENT OF A SEPTIC TANK SYSTEM

The Ontario Building Code outlines construction requirements for five types of leaching bed systems. This document will explain basic design and construction principles for the components of two types of leaching bed systems:

- Conventional leaching bed (stone and pipe systems or leaching chambers)
- Sand filter bed

The design and installation of the three other types of leaching bed systems outlined in the Ontario Building Code (shallow buried trench, Type A dispersal bed, and Type B dispersal bed) must be carried out by a person who is competent in the specific field of work.

Important Terms Related to Leaching Bed Construction

Distribution pipe: A line or lines of perforated or open-jointed pipe or tile installed in a leaching bed for the purpose of distributing effluent from a treatment unit to the soil or leaching bed fill in the leaching bed. *The header pipe, for example, is not considered distribution pipe*.

Effluent: Sanitary sewage that has passed through a treatment unit

Leaching bed fill: Unconsolidated material suitable for the construction of a leaching bed, placed within the area of the leaching bed to obtain required unsaturated zone below the distribution pipes or leaching chambers and the required lateral extent such that the effluent is absorbed.

Soil: in situ, naturally occurring, unconsolidated mineral or organic material, at the earth's surface that is at least 100mm thick and capable of supporting plant growth, and includes material compacted or cemented by soil forming processes but does not include displaced materials such as gravel dumps, mine spoils, or similar deposits.

Horizontal separation distance requirements for components of Class 4 systems can be found on page 5. The next few sections will provide information about calculating **daily design sewage flow** (required for size calculations), as well as sizing and other construction requirements for:

- Treatment units
- Leaching beds made of absorption trenches
- Leaching beds that are filter beds
- Loading area (mantle) for leaching beds constructed in leaching bed fill
- Effluent pump chambers (where required)

Daily Design Sewage Flow (Q)

The daily design sewage flow for a Class 4 system is calculated based on the characteristics of the building that will be served by the sewage system. The chart below is Table 8.2.1.3 A from the Ontario Building Code and outlines how to calculate the daily design sewage flow (Q) for a residential setting. Other settings can be found on Table 8.2.1.3B

Residential Occupancy	Volume (L)
Apartments, Condominiums and Other Multi-Family Dwellings - per person	275
Boarding Houses	
a) Per person	
i) with meals and laundry facilities, or	200
ii) without meal or laundry facilities, and	150
b) Per non-resident staff per 8-hour shift	40
Boarding School - per person	300
Dwellings	
a) 1-bedroom dwelling	750
b) 2-bedroom dwelling	1100
c) 3-bedroom dwelling	1600
d) 4-bedroom dwelling	2000
e) 5-bedroom dwelling	2500
f) Additional flow for	
i) each bedroom over 5, **or**	500
a. each 10 m^2 (or part of it) over 200 m^2 up to 400 m^2	100
b. each 10 m^2 (or part of it) over 400 m^2 up to 600 m^2, **and**	75
c. each 10 m^2 (or part of it) over 600 $m^{2(2)}$, **or**	50
ii) each fixture unit if over 20 fixture units	50
Hotels and Motels (excluding bars and restaurants)	
a) Regular (per room)	250
b) Resort hotel, cottage (per person)	500
c) Self-service laundry (add per machine)	2500
Work Camp or **Construction Camp**, semi-permanent (per worker)	250

Please Note:

- Guest cabins need to be included in the daily design sewage flow calculation whether they are plumbed or not, unless there is another approved system servicing them. If there is no plumbing, they are still counted as additional floor area and bedrooms.
- Floor area refers to finished floor area and does not include finished floor areas in portions of the structure that meet the definition of a basement. **"Basement" is defined as any storeys of a building that are located below the first storey.**

"Basement" vs. "First Storey"

Some areas referred to as basements, especially those on sloping sites (i.e. a walkout basement) may fall under the definition of *First Storey* under the Ontario Building Code. If this is the case, the finished floor area of that level must be included in the daily flow calculation.

- **First Storey**
  The closest floor to surrounding grade with a ceiling more than 1.8m above that grade
- **Grade**
  The average level of proposed or finished ground adjoining a building at all exterior walls

If a portion of the bottom level's wall area is above grade, a calculation will need to be done to determine if the space meets the definition of a basement. **Most walkout basements where the backfill on the back wall is to the top of the wall will meet the definition of basement.**

Fixture units

Fixture units are units of measurement related to plumbing fixtures in the Ontario Building Code. Fixture units express the hydraulic load imposed by a plumbing fixture on the sewage system. Below is a list of common fixture units from the Ontario Building Code for reference when calculating the daily design sewage flow. For plumbing fixture types not listed below, please refer to table 7.4.9.2. of the Ontario Building Code.

Plumbing Fixture	Fixture Units
Bathroom group (with flush tank)	6
Bathtub (with or without shower)	1½
Bidet	1
Toilet (with flush tank)	4
Shower drain	
a) from 1 head	1½
b) from 2 or 3 heads	3
c) from 4 to 6 heads	6
Domestic Dishwasher (not connected to garbage grinder/domestic sink)	1

Plumbing Fixture	Fixture Units
Clothes washer	1½ with 2" trap
Laundry tub	
a) single or double units or 2 single units with common trap	1½
b) 3 compartments	2
Floor drain	
a) 2-inch pipe	2
b) 3-inch pipe	3
Domestic Sink (maximum of 2 with or without garbage grinders, with common trap)	1½

Please Note:

- **"Bathroom group"** refers to a group of plumbing fixtures installed in the same room that consist of one domestic-type sink, one toilet with a flush tank, and either one bathtub (with or without a shower) or one one-headed shower.
- Water softener backwash water should not be directed to a septic system. This wastewater adversely affects bacterial action, adds unnecessary volume, and can deteriorate concrete tanks.
- Water from chemically treated hot tubs should not be directed to a sewage system.
- Garbage grinders are not recommended as solid waste generated may clog the effluent filter.
- Domestic dishwashers have no fixture unit count if connected to garbage grinder or domestic sink.

Treatment Units

There are two basic categories of treatment units listed in the Ontario Building Code: **Septic tanks** and **Class II, III, or IV treatment units**. Each of these categories has specific code-related requirements.

Septic Tanks

Septic tanks are the most basic type of treatment unit included in the Ontario Building Code. Septic tanks must have at least two compartments of adequate size to help solids in the wastewater settle out and require an effluent filter to help prevent solids from exiting the tank and accumulating in the leaching bed. When purchasing a septic tank, ensure the "working capacity" of the tank is the capacity number you select the tank based on. Never enter a septic tank, as there are dangerous gases present that could be fatal.

Septic tanks must meet Ontario Building Code standards:

- Conform to the requirements of CSA B66 (other than Clause 10.2 (j))
- Ensure the septic tank has at least two compartments that meet the following criteria:
  - First compartment working capacity at least 1.3x daily design sewage flow (but not less than 2400L)
  - Each subsequent compartment must have a working capacity at least 50% of the working capacity of the first compartment
- Equip outlet with an effluent filter that meets NSF/ANSI 46 standards (among others; see Ontario Building Code section 8.6.2.1. (2) for more information)
- Ensure access within 3cm of ground surface (via tank height or CSA B66 standard risers) to facilitate the pumping of all compartments and servicing of inlet and outlet of each compartment as well as effluent filter maintenance.
- Install as per manufacturer's specifications (i.e. proper depth), and securely anchor when located in an area subject to flooding or hydrostatic pressure

Sizing the Septic Tank:

To calculate the minimum working capacity (tank size) required:	
• Tank servicing residential building →	daily design sewage flow x 2 = _____
• Non-residential building →	daily design sewage flow x 3 = _____
Please note: Septic tanks must have a working capacity of at least 3600L	

(Multiple tanks may be used to achieve the required size of septic tank, if the tanks meet certain conditions; see Ontario Building Code section 8.2.2.3 (4) for more information.)

Class II III and IV Treatment Units

Treatment units other than septic tanks must be certified to CAN/BNQ 3680-600 standard and must meet certain effluent quality criteria laid out in Ontario Building Code section 8.6.2.2. There are specific operating instructions for these units, and the system must be periodically serviced by a qualified technician. A service contract must be signed with the technician, and a copy of this contract must be provided to NWHU by the time of the substantial completion inspection.

Leaching Beds

Leaching Beds are absorption systems constructed as absorption trenches or as a filter bed or area bed where effluent from a treatment unit (i.e. septic tank or Level II, III, or IV treatment unit) is received for distribution and treatment. Leaching beds can be installed in-ground in the native soil or in imported leaching bed fill above natural grade, depending on site conditions.

Leaching beds are composed of:

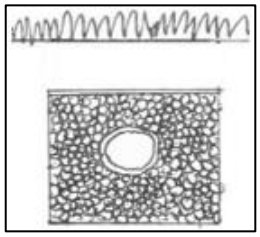
- native soil or imported leaching bed fill contained between the surface where the effluent is applied and the bottom of the bed.
- distribution pipe and the stone or gravel layer in which the distribution pipe is located, **or** alternatively, a leaching chamber (no gravel layer required)
- backfill above the distribution pipe, including topsoil and sodding or other anti-erosion measure, as well as side slopes of any portion elevated above natural ground elevation

Leaching beds composed of absorption trenches or sand filter beds:

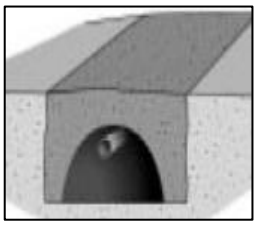
- must not be in an area with an average slope of more than one vertical unit to four horizontal units
- must not be in soil with a T-time less than one minute or greater than 50 minutes or in an area subject to flooding
- must not be covered with any material having a hydraulic conductivity less than 0.01m/day
- must not have any part with a slope steeper than one vertical unit to four horizontal units
- must have a surface sloped to shed water and be protected against compaction and erosion in a way that does not impact function.

Absorption Trenches

Absorption trenches are excavated rows containing either perforated distribution pipe and stone, or leaching chambers. Absorption trenches allow infiltration of effluent into the underlying soil or leaching bed fill for treatment. The trenches are connected to a distribution box or solid header pipe to allow for even distribution of the effluent from the treatment unit.



Leaching chambers are an alternative to conventional stone and pipe and are installed right in the soil or leaching bed fill (no gravel layer required). Leaching chambers have two different size options; one of which requires the same length and spacing as a conventional stone and pipe system, the other that requires less length, but additional spacing if the bed is installed in native soil.



Construction requirements for all types of absorption trenches:

- There must be a minimum vertical separation distance of 0.9 m from the bottom of the trench to underlying bedrock, high groundwater table or soil with a T of >50
- If constructed with leaching bed fill instead of native soil, a loading area with specific criteria referred to as a mantle is required to make sure the effluent fully absorbs.
- Trenches must be approximately the same length and not more than 30m in length
- Total length of pipe or chamber must be at least 40m
- Must be between 500-1000mm in width and 600-900mm in depth
- Header pipe and trenches must be detectable by magnetic means or tracer wire
- Must be backfilled with leaching bed fill to ensure no depressions will form
- If there is more than 150m in length required for distribution pipe or leaching chamber, a dosing pump is required (see Effluent Pump Chamber section for more information)

Specific construction requirements for stone and pipe distribution:

- Centreline to centreline, distribution pipes must be spaced at least 1.6m apart
- Distribution pipe must be installed within a layer of stone that:
  - Must be comprised of washed septic stone, free of fine material, with a specific grade (see Ontario Building Code Table 8.7.3.3.)
  - Must be at least 500mm wide, and extend at least 150mm below the distribution pipe, and at least 50mm above
- Stone layer must be protected by untreated building paper or permeable geo-textile fabric to prevent soil or leaching bed fill from falling into the stone layer
- For gravity flow systems, the distribution pipe must be at least three-inch trade size, and must be installed with a uniform downward slope from the inlet with a drop between 30-50mm for each 10m of distribution pipe
- Trenches constructed in imported leaching bed fill (i.e. raised systems) must also:
  - Be installed over an area generally clear of vegetation
  - Be constructed in a way where fill can be compacted in layers to avoid uneven settlement (distribution boxes, pipes and trenches installed after this)
  - Be installed in leaching bed fill that meets the 75% rule (see Loading Area)
  - Be stabilized against erosion
- **Length of distribution pipe** must be determined by one of the formulas below:

Absorption trenches paired with a septic tank:	
Length of pipe (m) = $\frac{Q \times T}{200}$	Q= daily sewage design flow T= percolation time of design soil
Absorption trenches paired with a level II, III or IV treatment unit:	
Length of pipe (m) = $\frac{Q \times T}{300}$	Q= daily sewage design flow T= percolation time of design soil

Specific construction requirements for leaching chambers:

- Leaching chambers must conform to requirements of IAPMO PS 63, and must comply with the dimension requirements for one of these two size categories:
  - **Type I**: between 380-410mm wide, and between 280-305mm high
  - **Type II**: between 555-575mm wide, and between 300-320mm high
- Prior to backfilling, the leaching chamber must be:
  - Installed level over the length of the absorption trench
  - Securely connected, section to section
  - Free of structural damage, uncut, and used full-length
  - Equipped with end caps installed on both ends
  - Equipped with an integrated splash plate at the inlet end of each line of leaching chamber, to prevent soil scouring
  - Protected in such a manner to prevent soil or leaching bed fill from entering the leaching chamber (i.e. covered with geo-textile fabric)
- Where there is more than 150m of leaching chamber, a distribution pipe must be installed at the centreline of the leaching chamber that extends the total length of the leaching chamber. This distribution pipe must be at least 3-inch trade size and should:
  - have a cap on the end
  - be supported within the chamber

- **Centreline to Centreline, leaching chambers must be spaced:**

Leaching Chamber Installation Scenario	**Minimum Distance**
Type I Leaching Chamber	1.6m spacing
Type II Leaching Chamber constructed in native soil	2.4m spacing
Type II Leaching Chamber constructed in leaching bed fill	1.6m spacing

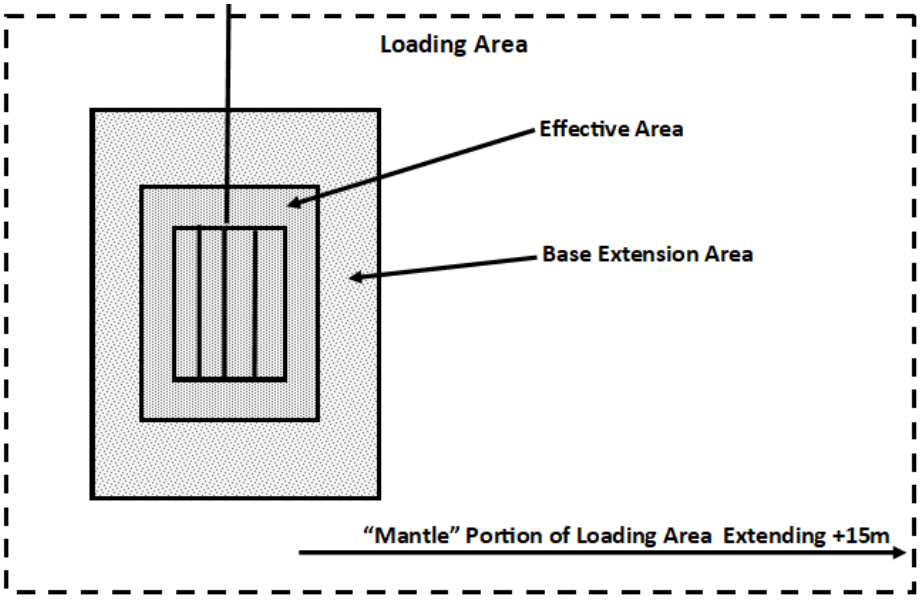
- **Length of chamber must be determined by:**

Type I leaching chamber paired with a septic tank:	
Length of pipe (m) = $\frac{Q \times T}{200}$	Q= daily sewage design flow T= percolation time of design soil
Type I leaching chamber paired with a level II, III or IV treatment unit:	
Length of pipe (m) = $\frac{Q \times T}{300}$	Q= daily sewage design flow T= percolation time of design soil
Type II leaching chamber:	
Length of pipe (m) = $\frac{Q \times T}{300}$	Q= daily sewage design flow T= percolation time of design soil

Filter Beds

Filter beds are leaching beds that consist of:

- A 750mm thick layer of filter medium referred to as the **"effective area"**
- Distribution pipe on a layer of septic stone or leaching chambers (no stone layer) that sit on top of the effective area
- A lateral extension of the filter medium past the effective area, referred to as the **"base extension"** area
- The overall **loading area**, with a portion called a **mantle** extending at least 15m beyond the centreline of the outer distribution pipe or chamber in any direction that the effluent is likely to move (see next section)



Soil analysis must be performed to confirm that the sand to be used as filter medium meets the Ontario Building Code criteria of *clean sand comprised of particles ranging in size between the limits of:*

a) an effective size of 0.25mm with a uniformity coefficient not less than 3.5
b) an effective size of 2.5mm with a uniformity coefficient not greater than 1.5, and
c) having a uniformity coefficient not greater than 4.5

When paired with a septic tank, the maximum daily sewage flow that can be received by a filter bed is 5000L. If a level II, III or IV treatment unit is used, then 10,000 can be received. Filter beds have a minimum and maximum size (based on the size of the effective area). Filter beds cannot be smaller than $10m^2$, or bigger than $50m^2$.

If more than $50m^2$ of effective area is required, more than one filter bed may be used, provided the beds are separated by at least 5m between distribution pipes or leaching chambers.

Specific construction requirements for filter beds:

- If using distribution pipe, it must be installed in a layer of stone that:
  - is comprised of washed septic stone, free of fine material, with gradation conforming to Ontario Building Code table 8.7.3.3
  - extends at least 150mm below the distribution pipe and at least 50mm above

- There must be a minimum vertical separation distance of 0.9 m from the bottom of the stone layer or leaching chamber to underlying bedrock, high groundwater table, or soil with a T of >50

- To evenly apply the effluent in a filter bed, the maximum centreline spacing of distribution pipes or chambers permitted is:
  - for **distribution pipes**: 1.2m
  - for **Type I leaching chambers**: 0.9m
  - for **Type II leaching chambers**: 1m

- The effective area is composed of at least 750mm in depth of uniformly graded sand that meets the criteria of filter medium installed over an area calculated with one of the following formulas:

Where daily design sewage flow (Q) is <3000L	$A_{eff} = Q/75$
Where daily design sewage flow (Q) is >3000L	$A_{eff} = Q/50$
Where paired with a Class II, II or IV treatment unit	$A_{eff} = Q/100$

- The base extension layer of filter sand must extend out, to a depth of at least 250mm to ensure overall filter sand coverage across an area that is calculated with the following formula:

$A_{base}\,(m^2) = \frac{Q \times T}{850}$	Q = daily design sewage flow (L) T = the lesser of 50 and the percolation time of the native soil

- As a fill-based system, an adequate hydraulic loading area must be accounted for with the addition of a mantle area. Hydraulic loading area and mantle size calculation and construction criteria are discussed in the next section.

Loading Area

An important part of the design and construction of leaching bed fill-based sewage systems is the loading area. The loading area is composed of the footprint area of the leaching bed as well as an additional area referred to as the mantle. The loading area is designed to make sure the effluent will be fully contained until it is completely absorbed by the underlying soil. An inadequately sized loading area can lead to breakout of sewage or partially treated effluent onto the surface of the ground.

The size of this loading area is determined through a calculation that accounts for T-time of the soil as well as daily design sewage flow. There is a predetermined loading rate assigned to a set range of T-times used in the calculation. This loading rate represents the volume of effluent per m^2 per day that can be applied to soils within that T-time range.

The loading area must meet the following criteria:

- To a depth of 250mm, it must cover the area over the area covered by the leaching bed fill and for at least 15m beyond the centreline of the outer distribution pipes or chambers in any direction in which the effluent will move horizontally
- If the soil or leaching bed fill used to construct the loading area has a T-time greater than 15 minutes, then the leaching bed fill used to construct the bed must have a T-time not less than 75% of the T-time of the mantle soil or leaching bed fill.
- The area covered by the bed and mantle must be at least the size determined by the following calculation:

Loading Area (m^2) = $\frac{Q}{LR}$
Q = daily design sewage flow LR = designated loading rate from Ontario Building Code table 8.7.4.1

Ontario Building Code Table 8.7.4.1	
T-time of native soil	**Loading rates**
1< T ≤ 20	10
20 < T ≤ 35	8
35< T ≤ 50	6
T > 50	4

Effluent Pump Chambers

Effluent pumps are required for systems that are unable to receive effluent from the tank via gravity, and for absorption trenches that are constructed of 150m or more distribution pipe or leaching chamber. Effluent pumps are designed to provide even distribution of the effluent. A permit from the Electrical Safety Authority is required to install an effluent pump.

Where two or more pumps are used within a dosing tank, the pumps must be designed so they alternate dosing, and dosing continues if one pump fails. Siphons may also be used in lieu of pumps; however, alternating siphons are not permitted.

Dosing Tank or Pump Chamber

The pump or siphon must be contained in a dosing tank that may be a separate compartment within the septic tank structure or a standalone tank. The dosing tank must be large enough to hold at least the minimum required dose of effluent, and the pump float must be set at an appropriate level to provide an adequately sized dose.

The minimum dose must be an amount of at least 75% of the internal volume of the distribution pipe within a period not exceeding 15 minutes.

To calculate this minimum dose (L):

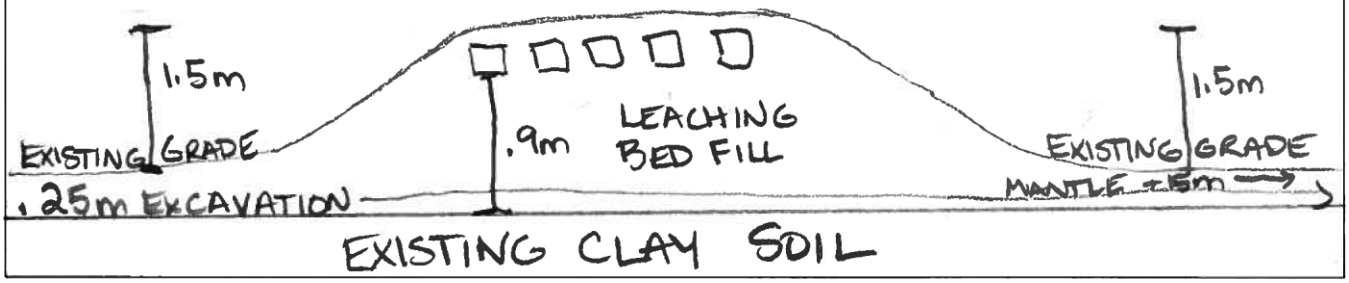
3” Diameter Distribution Pipe	4” Diameter Distribution Pipe
3.3 x length of distribution pipe (m)	5.9 x length of distribution pipe (m)

High Water Level Alarm

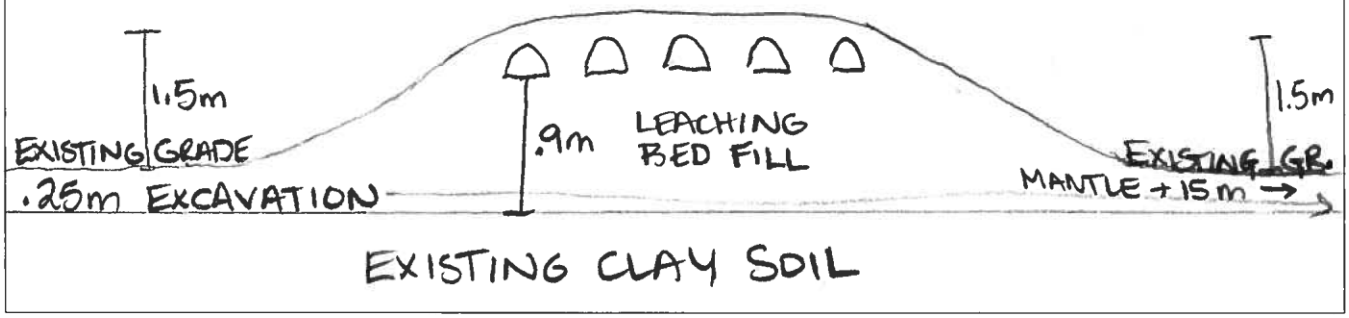
Pumps and siphons must be equipped with a device that produces an audible and visual alarm signal that indicates a high water level in the pump or siphon chamber.

Sample Cross-Sectional Drawings of Fill-Based Leaching Beds

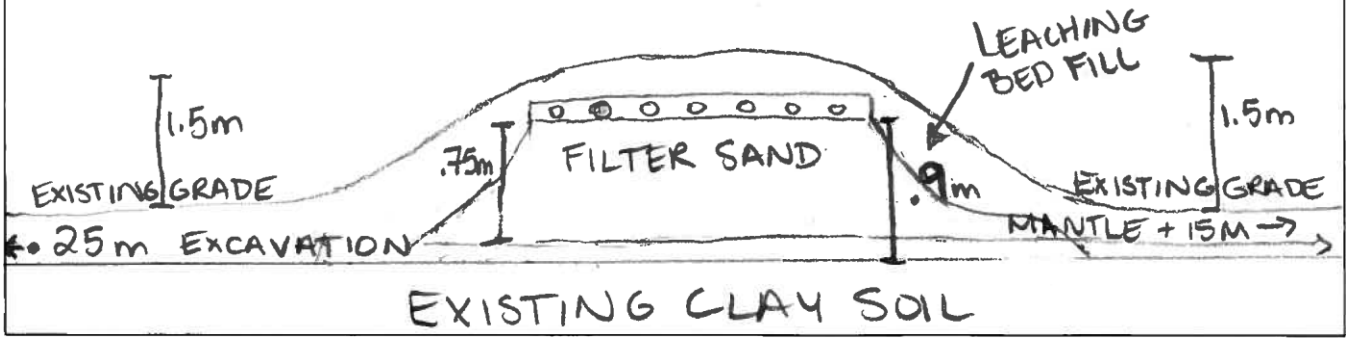
Conventional Stone & Pipe Leaching Bed - Raised System



Conventional Leaching Bed with Chambers - Raised Bed



Filter Bed - Raised Bed



Class 5 Sewage Systems (Holding Tanks)

Class 5 sewage systems are those that require or use a holding tank for the retention of hauled sewage at the site where it is produced prior to its collection.

Holding tanks are only allowed in limited circumstances:

- For a temporary operation (i.e. construction trailers at industrial sites where the proposed use won't exceed 12 months) not including seasonal recreational use.
- To remedy an unsafe existing sewage system where the remediation of the unsafe condition by the installation of a Class 4 sewage system is impractical.
- To upgrade a sewage system serving an existing building, where upgrading using a Class 4 sewage system is not possible due to lot size, site slope, or clearance limitations.
- As an interim measure where municipal sewer is going to be available soon.

Horizontal separation distance requirements for Class 5 systems can be found on page 5. Other construction requirements for holding tanks include:

- The minimum size of tank for any installation is 9,000L.
- Tank must conform to requirements of CSA B66 (other than Clause 10.2 (j)), and must be of such design and construction to allow for the complete removal of solid matter that can be expected to settle in the holding tank.
- Tanks must not be buried deeper than the tank is designed to be buried and must be anchored if subject to lifting by groundwater forces.
- A written agreement with a licensed sewage hauler must be obtained for appropriate hauling and disposal of sewage at an approved site.
- All tanks shall be equipped with both an audio and visual alarm. This device is intended to indicate the tank is nearing capacity, and must:
    - be designed to provide suitable advanced warning to building occupants
    - consider the total daily design sanitary sewage flow, the location of the Class 5 system, and the response time of the hauled sewage system contractor
- Holding tanks must have a vent that is at least 3-inch trade size, terminates at least 3.5m away from any air inlet, window, or door, and at least 300mm above finished grade with a vent cap (or 600mm above finished grade with a vent cap when located in an area subject to flooding).
  Alternatively, holding tanks may have a vent that connects to the venting system of the building served by the holding tank, if the vent is at least 3-inch trade size and installation conforms to requirements in Part 7 of the Ontario Building Code.
- Holding tanks are sized according to the same Daily Design Flow Rate (Q) criteria used for sizing a Class 4 system. Please refer to page 12. **The minimum working capacity** of a holding tank for residential applications is calculated by:

Daily Design Flow Rate (Q) x 7 = _____

References

1. Ahmed Sharaf (2013) Code Reference Series: On-Site Sewage Systems
2. George Brown College (2013) On-Site Sewage Systems Participant Workbook
3. Northwestern Health Unit (2015) Part 8 Backgrounder and Guide