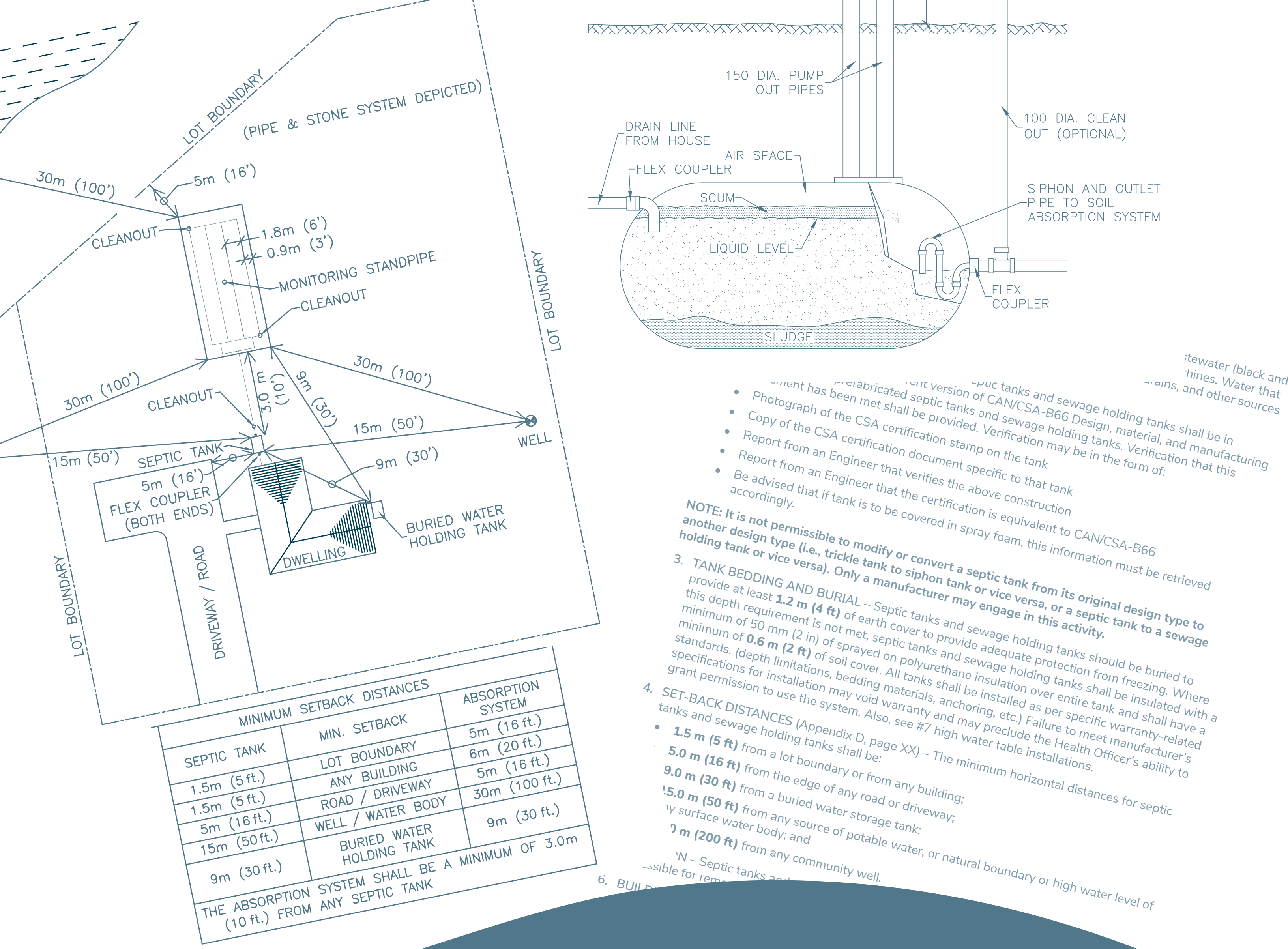

Design Specifications for Sewage Disposal Systems

A Guide to their Design and Maintenance

Yukon

This document provides a single consolidated design criteria for the following documents referenced in the *Sewage Disposal Systems Regulation*:

- *Septic Systems in the Yukon, Design Specifications for the Septic Tank and Soil Absorption System, Section 21*; and
- *Sewage Holding Tank Standards, Section 22*.

> **No person shall construct, install, enlarge, rebuild, substantially repair, or connect to an existing system, any sewage disposal system or any part thereof, or cause the same to be done, without first obtaining a written permit from a health officer.**
> 9(1) Sewage Disposal Systems Regulation

Design Specifications for Sewage Disposal Systems - A Guide to their Design and Maintenance
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Water, Sewage and Environmental Health

On-site sewage disposal systems are used to treat wastewater from any building not connected to a municipal sewer system or authorized under the *Yukon Waters Act* (Canada). The *Sewage Disposal Systems Regulation O.I.C. 1999* is the legislative authority governing on-site sewage disposal in Yukon.

Properly operating sewage disposal systems are a good way to control water-related diseases and protect water resources. Bacteria, viruses and parasites found in sewage are the principal causes of water-related diseases, such as various gastrointestinal illnesses, hepatitis A and giardiasis ("beaver fever"). Other typical pollutants in household wastewater include nitrogen and phosphorus.

Sewage from toilets is classified as black water and all other domestic sewage – e.g., wastewater from the shower, kitchen sink, washing machine – is referred to as grey water. Both grey and black water can be expected to contain significant numbers of disease-causing microorganisms. Some people believe that grey water can bypass the septic tank or other sewage treatment system, but this tends to ignore the characteristics of such waste. Grey water typically contains between one and three million fecal coliforms and between three and ten thousand *Fecal streptococci* microorganisms per 100 ml.

These "indicators" confirm the potential presence of a wide range of disease-causing microorganisms originating in the intestines of humans and animals. Additionally, grey water tends to have sufficiently high levels of suspended solids and fat that, without pretreatment, nuisance conditions can result and health risks arise when it is discharged into the ground. Sewage disposal systems must receive all grey and black water discharges. Surface water from roofs, yards and foundation drainage, together with spring run-off, must be excluded from the septic tank and soil absorption area.

Full treatment of septic tank effluent requires that it be discharged into the unsaturated soil zone. This discharge, at an appropriate rate, will fully utilize the treatment available through filtration and chemical and biological breakdown processes. Disease-causing organisms can survive for longer periods during prolonged cold spells in Yukon. Their containment and eventual breakdown beneath the ground surface protects human and animal health. Travel through unsaturated silty, sandy, or clay loam soil can be expected to remove the sewage microorganisms, and protect ground and surface water.

Protection of the environment and public health is further enhanced because of the required set-back distances, the safety zones established for surface water, wells and property lines. Soil conditions vary and a greater unsaturated soil depth and/or a sand filter is required in coarse, granular soils. In Yukon, many areas are suitable for soil absorption systems. However, there are some situations where they cannot be used. Factors preventing installation include lot size, soil type, and the proximity of bedrock, high water table or permafrost.

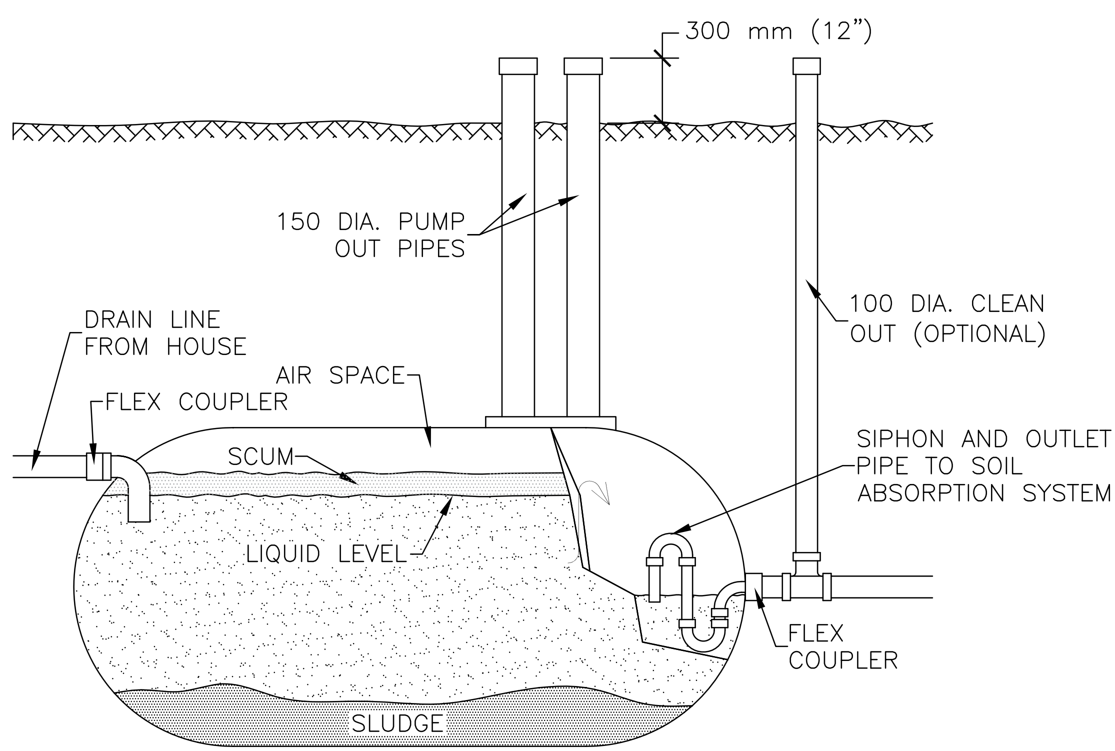
Septic Tanks and Sewage Holding Tanks

A typical septic tank consists of a two-compartment, watertight container that is used to pre-treat household sewage (black and grey water) before it enters the soil absorption system. The sewage stays in the first compartment long enough to enable the heavier solids to settle out to the bottom and the lighter solids, including fats and grease, to rise to the surface and form a scum layer. The retained sludge and scum undergo partial digestion and conversion to a liquid form acceptable to the receiving ground. A properly sized and maintained septic tank can remove most of the settleable solids before wastewater (effluent) is discharged into the soil absorption system. It is highly recommended to have an effluent filter to catch any unsettled solids before they enter the siphon chamber and leave the tank. A siphon chamber, which is usually incorporated in the second compartment of the tank (it could be a separate tank), stores the clarified effluent and intermittently discharges it to the absorption system in large flushes. The owner should inspect the septic tank to ensure that the baffles have been properly installed and test the siphon before it is backfilled.

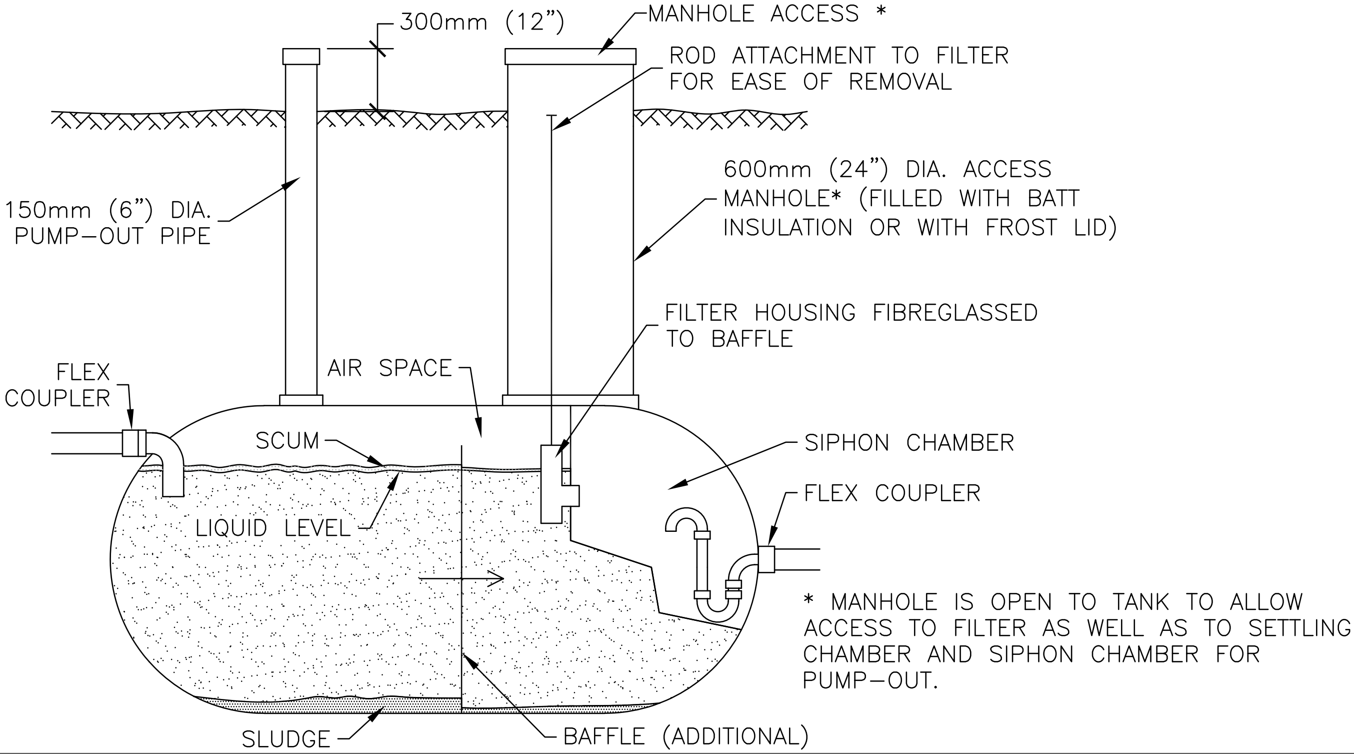
A sewage holding tank is a watertight container that allows for the collection and temporary storage of wastewater from a residence or building for future removal and transport to an approved treatment and disposal site.

Septic tanks and sewage holding tanks must meet the current CSA standard for design, material, and manufacturing requirements.

TYPICAL SEPTIC TANK CROSS SECTION

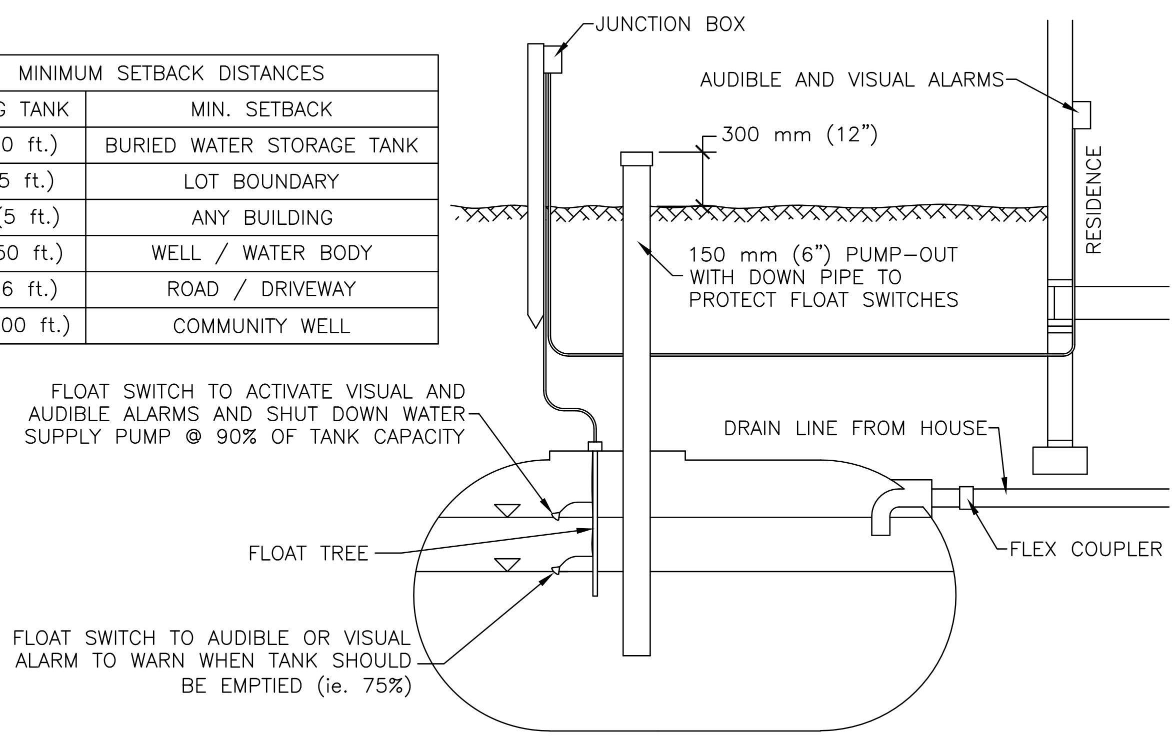


SEPTIC TANK WITH EFFLUENT FILTER SUGGESTED ARRANGEMENT



SEWAGE HOLDING TANK CROSS SECTION SCHEMATIC

MINIMUM SETBACK DISTANCES	
HOLDING TANK	MIN. SETBACK
9m (30 ft.)	BURIED WATER STORAGE TANK
1.5m (5 ft.)	LOT BOUNDARY
1.5m (5 ft.)	ANY BUILDING
15m (50 ft.)	WELL / WATER BODY
5m (16 ft.)	ROAD / DRIVEWAY
60m (200 ft.)	COMMUNITY WELL



Septic Tanks and Sewage Holding Tanks

1. WASTEWATER – Septic tanks and sewage holding tanks shall receive all wastewater (black and grey water), from toilets, baths, showers, wash basins, sinks and washing machines. Water that must be excluded, includes run-off water from roofs, yards, foundation drains, and other sources not considered to be wastewater (industrial processes).

2. CONSTRUCTION – The construction of septic tanks and sewage holding tanks shall be in accordance with the most current version of CAN/CSA-B66 Design, material, and manufacturing requirements for prefabricated septic tanks and sewage holding tanks. Verification that this requirement has been met shall be provided. Verification may be in the form of:
   - Photograph of the CSA certification stamp on the tank
   - Copy of the CSA certification document specific to that tank
   - Report from an Engineer that verifies the above construction
   - Report from an Engineer that the certification is equivalent to CAN/CSA-B66
   - Be advised that if tank is to be covered in spray foam, this information must be retrieved accordingly.

NOTE: It is not permissible to modify or convert a septic tank from its original design type to another design type (i.e., trickle tank to siphon tank or vice versa, or a septic tank to a sewage holding tank or vice versa). Only a manufacturer may engage in this activity.

3. TANK BEDDING AND BURIAL – Septic tanks and sewage holding tanks should be buried to provide at least **1.2 m (4 ft)** of earth cover to provide adequate protection from freezing. Where this depth requirement is not met, septic tanks and sewage holding tanks shall be insulated with a minimum of 50 mm (2 in) of sprayed on polyurethane insulation over entire tank and shall have a minimum of **0.6 m (2 ft)** of soil cover. All tanks shall be installed as per specific warranty-related standards. (depth limitations, bedding materials, anchoring, etc.) Failure to meet manufacturer's specifications for installation may void warranty and may preclude the Health Officer's ability to grant permission to use the system. Also, see #7 high water table installations.

4. SET-BACK DISTANCES (Appendix D) – The minimum horizontal distances for septic tanks and sewage holding tanks shall be:
   - **1.5 m (5 ft)** from a lot boundary or from any building;
   - **5.0 m (16 ft)** from the edge of any road or driveway;
   - **9.0 m (30 ft)** from a buried water storage tank;
   - **15.0 m (50 ft)** from any source of potable water, or natural boundary or high water level of any surface water body; and
   - **60.0 m (200 ft)** from any community well.

5. LOCATION – Septic tanks and sewage holding tanks shall be located so that they are readily accessible for removal of liquid sewage and sludge, service, and maintenance.

6. BUILDING CONNECTION – A flexible coupling shall be used on the inlet pipe to septic tanks and sewage holding tanks and shall be installed near the entrance to the tank. For septic tanks, a flexible coupling shall be installed on the outlet pipe.

NOTE: Bends in the sewage pipe (the pipe between building and tank) should be avoided at all costs due to risk of clogging and freezing. Any proposed bends must be based on demonstrated need and are to be documented on application and on associated diagram. Such proposal must be recognized and approved by a Health Officer. Reason for bends in pipes must be clearly stated on the application with a clear rationale. Be advised that should bends be necessary, the slope must be at least three per cent, bends must be long sweep type 90 degree or two 45 degree with one foot of straight pipe between the bends.

7. HIGH WATER TABLE INSTALLATIONS – Where the septic tank or sewage holding tank may be subject to buoyancy effects caused by high water table or seasonal flooding, the tank shall be anchored in accordance with manufacturer's requirements. Where no such requirements exist, the installation shall be done under seal of an engineer registered in Yukon and in a manner that will not damage the tank or invalidate its warranty.

8. SEWAGE HOLDING TANKS – The installation of a sewage holding tank may be permitted when on-site soil absorption conditions make the lot unsuitable for an in ground absorption system or the location of the absorption system cannot comply with the provisions of the Regulation.
    - LOCATION – Sewage holding tanks should be installed outside of a building, below ground, and strategically located to minimize heat loss, prevent structural damage, and protect the building from contamination. See required set back distances in Appendix D. Sewage holding tanks may be located above ground when certain conditions exist (e.g., permafrost, bedrock). Pre-authorization by a health officer is required to install a sewage holding tank above ground, as the design must contain safety features such as adequate weatherproofing, proper venting, secondary containment, accessibility, etc. to prevent a public health risk.
    - PUMP-OUT ACCESS – Where, under limited circumstances and with pre-authorization from a Health Officer, a building is serviced by an above-ground sewage holding tank and water holding tank, the sewage pump-out line should be on a different wall face than the water fill line. Where they are on the same wall face, there shall be a separation distance between the two connectors of at least 3 m (10 ft), with the sewage connector being located at least 300 mm (1 ft) lower in elevation than the water connector. Both the sewage pump-out line and water fill line should be clearly labeled so that they can be distinguished from one another.
    - HIGH LEVEL ALARM & AUTOMATIC WATER SHUT-Off – Sewage holding tanks shall have a functional audible and visual alarm that warns when the tank should be emptied (e.g., 75 per cent full), and both a warning light and an automatic shut-off which activates when the tank is 90 per cent full and turns off the water system to the building to prevent the tank from overflowing or backing-up into the building. The floats required to perform these tasks must be mounted on a float tree. A certified electrician or qualified electrical contractor must confirm that all relevant electrical components for the sewage holding tank have been installed as specified and function accordingly.
    - DROP PIPE – The clean-out pipe(s) should be installed in a manner that avoids risk of damage to floats during sewage eduction (see image on page 2)
    - MINIMUM VOLUME – The minimum volume for any sewage holding tank is recommended as 4,500 litres (1,000 imperial gallons).

9. SEPTIC TANKS – There are several types and styles of septic tanks to discharge sewage. Namely trickle tanks, siphon tanks and pumping chamber units (pump-up systems). Only siphon style septic tanks are to be used unless it is demonstrated to the Health Officer that a siphon system is not possible. In such a case the Health Officer may consider an alternate design.

Table 1

Septic Tank Sizes for Residences		
Number of bedrooms	***Minimum liquid capacity** (not including siphon chamber)	
	Litres	**Gallons (Imperial)**
1 or 2	2747	600
3	3409	750
4	4091	900
5	4773	1050
6	5455	1200
*Actual size may very depending on the make and model of the septic tank.		

SEPTIC TANK VOLUMES – The volume of septic tanks is dependent on the size and type of the building(s) to which it will be connected.

- Septic tanks that will have more than one building connection require adequate working volume to allow for 2 days retention (length of time effluent remains in tank for proper settling to occur before moving out into the absorption system).

RESIDENTIAL (6 bedrooms or fewer) – The volumes of septic tanks required for residences are outlined in Table 1 (above).

RESIDENTIAL AND NON-RESIDENTIAL (7 to 10 bedrooms (14-20 persons)) – the septic tank is to be sized using the following formula:

- **V (in litres) = 0.75 x Q (in litres) + 5100**

  Where: V = minimum liquid capacity (not including siphon chamber); and

  Q = estimated average sewage flow per day, for residential housing of 7 to 10 bedrooms (i.e., 14 to 20 persons) in capacity, a daily estimated flow of 180 litre/person/day should be used. (See Appendix A for non-residential sewage flows.)

SEPTIC TANKS FOR LARGE CAPACITY SEPTIC SYSTEMS

The minimum working capacity for septic tanks serving large systems may be calculated using 2.0 x peak sewage flow per day (Appendix A).

Septic tanks for large capacity systems must be pumped out every two years at minimum to remove sludge accumulation.

Large capacity septic systems should be designed and sealed by an engineer registered in Yukon. Large capacity septic systems include those that serve more than 20 persons, fewer than 50 persons, and do not require a water licence under the *Waters Regulation*. Large capacity systems may serve establishments such as the following:

- Apartment buildings
- Trailer parks
- Schools
- Commercial buildings
- Campgrounds and parks
- Hotels and restaurants
- Mining or exploration camps
- Daycare facilities
- Swimming pools
- Abattoirs

Where a large-capacity system is engineered, the design engineer must review the installation of the septic tank and soil absorption system, and provide as-built drawings and a sealed letter of confirmation that the installation was completed in accordance with the sealed and permitted plans and specifications.

Additional septic tank recommendations

- Septic tanks with effluent filters are strongly recommended.
- Consider additional dividers (baffles) to separate the septic tank chamber into more than two compartments. Additional compartments will prevent the passage of floating materials and settled solids (i.e., scum and sludge) to provide better quality effluent entering the soil absorption system. Baffles must be provided by manufacturer and be compatible with the tank material
- To increase working capacity, two septic tanks may be installed in series. The typical combination for this is a trickle septic tank followed by a siphon septic tank.
- Larger systems (more than 6 bedrooms or non-residential) may require a septic tank with larger volume siphon chamber and capability to flush greater than the minimum 340 L or 75 gal volume per flush cycle. This requirement is intended to provide even distribution of the effluent to the absorption system with each flush. Note: Applicant will be required to provide rationale and specifications to support the alternate septic tank design

10. WASTEWATER TREATMENT SYSTEMS – These are mechanical treatment units for wastewater (black and grey water) that are used to produce high-quality effluent for on-site disposal to a soil absorption system. Typical installation consists of a primary septic tank, treatment unit and effluent tank. All septic tanks must meet construction requirements per item 2 (detailed above). A mechanical treatment unit must be certified to appropriate NSF standards for operation. All requirements for installation shall be in accordance with the Regulation and design specifications detailed in this manual. Terms and conditions for operation must be met to obtain approval to use.

Soil Absorption Systems

Two main types of soil absorption systems are used in Yukon: the ***absorption bed***, and the ***absorption trench***. Due to cold winter climatic conditions, the soil absorption system (if uninsulated) requires a minimum soil cover of 1.2 m (4').

SITE INVESTIGATION – Before designing a septic system, it is essential that complete and accurate site investigations are carried out. This is important to determine whether a lot is suitable for on-site disposal. For new house construction, these investigations should be carried out before the house design is completed in order to ensure that the house location is suited to the septic system location, thereby allowing you to determine the most cost effective design. A soils investigation and percolation test is the single most important parameter used for sizing a soil absorption system.

Several physical characteristics and uses of the land where soil absorption systems are to be located may affect the suitability of the site. These include:

Surface features:

- Slope of the land – The slope of the land where a soil absorption system is to be located cannot be too steep. The effect of a steep slope depends on the type of system to be installed. For absorption beds, too steep a slope can have a significant effect during installation, one end or side will be very deep, while the other will be very shallow. Trenches can only be installed across the face of the slope.

  For both types of systems, slope can affect the way sewage travels through the subsurface soil. Instead of moving down (vertically), sewage instead moves both down and sideways (laterally). If the slope is too steep, sewage can come to the surface (break-out) and create a risk to human health through accidental exposure.

  The maximum allowable ground slope for absorption beds is 10 per cent; and in trenches is 25 per cent.

- Rock outcrops may indicate areas of land where bedrock is close to the surface and soil cover is limited.

Soil conditions:

- A test pit is the best method to determine soil conditions. Conditions that are not suitable for the installation of a soil absorption system include fine grained soils such as silt and clay (very slow percolation rate), and impervious layers – beneath the surface of the ground, there may be impervious layers of bedrock, permafrost, or clay. In some cases, there may be features on the ground surface which may indicate the presence of an impervious layer. For example, densely packed spruce trees in an area which is mostly shaded from direct sunlight may indicate the presence of permafrost.

If an impervious layer is present, there must be at least 1.2 m (4 ft) of suitable receiving soils from the bottom of the soil absorption system to the impervious layer.

Depth to groundwater:

Trees and plants such as black spruce, Labrador tea, peat moss, reeds and sedges may indicate the presence of ground water.

- The minimum vertical clearance required from the bottom of absorption system to seasonal high groundwater levels is 1.2 m (4 ft). Setback Distances: (See Appendix D)

- A soil absorption system shall not be less than:
  - **a. 1.2 m (4 ft)** from the seasonal high ground water level;
  - **b. 9.0 m (30 ft)** from a buried drinking water holding tank;
  - **c. 60.0 m (200 ft)** from any community well;
  - **d. 30.0 m (100 ft)** from any source of potable water (e.g., drinking water well); and
  - **e. 30.0 m (100 ft)** from any the natural boundary or high water level of any surface water body (e.g., pond, lake, stream, river).

Vehicular traffic:

Soil absorption systems should be situated where there will never be any possibility of future vehicular traffic. Vehicular traffic can cause vibration within the soil, or cause soils to settle unevenly.

- Driveways, parking or storage areas, snowmobile or bike trails, dog runs, etc., should never pass over any part of a sewage disposal system.
- Undisturbed snow cover reduces heat loss and helps to prevent sewage disposal systems from freezing during winter.

Provision for replacement:

Space on the lot must be available to install a second sewage disposal system in the event that a septic system fails or reaches the end of its life expectancy and needs to be repaired or replaced. For example, if you are considering building a large home on a small lot, the space required for a sewage disposal system and a replacement system could restrict the placement of the residence on the lot as well as the size of residence that can be constructed.

Once a potentially suitable site for the future soil absorption system has been chosen, **a soils investigation and percolation test must be performed** in accordance with the criteria laid out in the *Guidelines for Soils Investigation and Percolation Tests* section on page 41.

The natural, on-site soils will be considered the receiving soils for which the system must be designed.

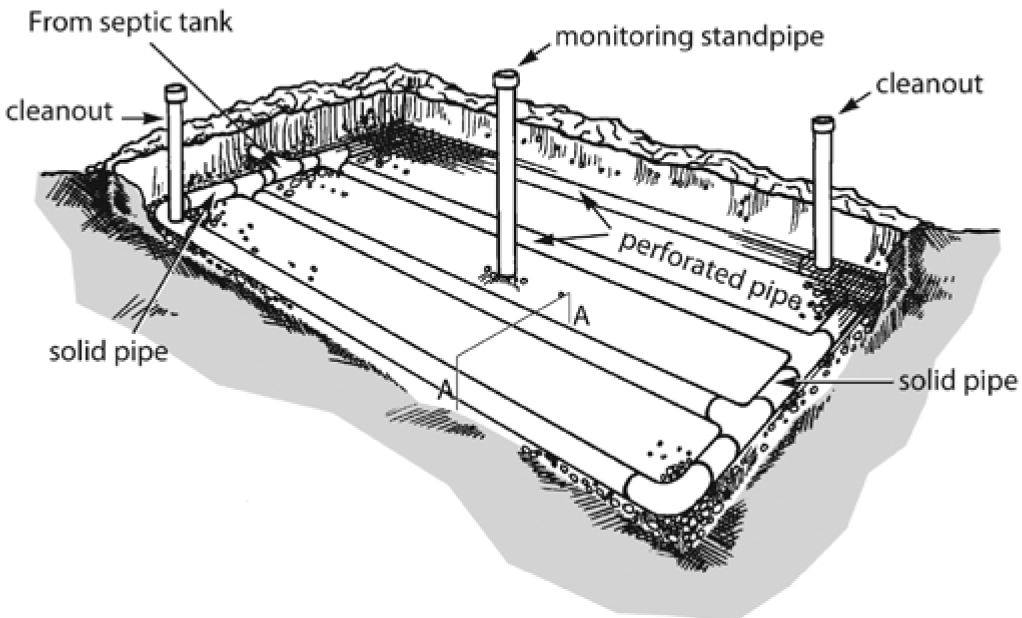
PLEASE NOTE: Site-specific characteristics may require or allow for the minimum requirements detailed in this document to be varied. The overriding consideration for varying a requirement is the protection of human health and the application of sound environmental health principles. The decision for varying a minimum requirement rests with an Environmental Health Officer.

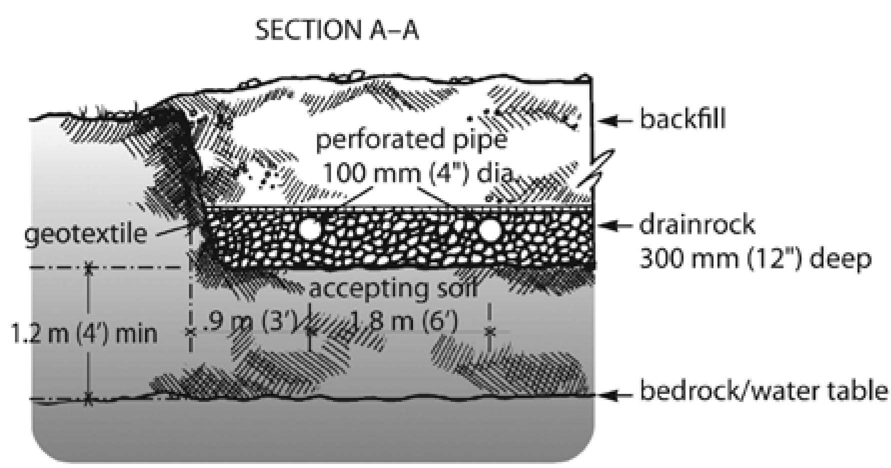
Specifications That Apply To All Soil Absorption Systems

1. A soil absorption system shall be located not less than 5 m (16 ft) from a parcel boundary and any road or driveway; 6 m (20 ft) from any building; 9 m (30 ft) from a buried water storage tank; 30 m (100 ft) from any source of potable water, or natural boundary or high water level of any water body; and 60 m (200 ft) from any community well.
2. Minimum soil cover over system is 1.2 m (4 ft) without insulation. With a minimum of 50 mm (2 in) of approved rigid insulation, soil cover may be reduced to a minimum of 0.6 m (2 ft).
3. There must be a minimum of 1.2 m (4 ft) of vertical separation between the bottom of a bed and the seasonally high groundwater table and/or impervious layer such as bedrock, fractured or weathered bedrock, clay or permafrost.
4. Drain rock must be clean with no more than 3 per cent fines (0.080 mm screen) residual after screening, and be between 20 to 65 mm (3/4 to 2-1/2 in) in size. Drain rock is to cover the entire absorption area, and surround the perforated pipes with a minimum of 2 inches placed over the pipe. To calculate the amount of drain rock required, refer to DETERMINING THE QUANTITY OF DRAIN ROCK on page 18.
5. Perforated pipe must be installed level or to a maximum slope of 0.3 per cent with perforation holes at 4 and 8 o'clock. One additional 13 mm (½ in) hole should be drilled through the bottom section of each pipe length to allow for complete drainage of the pipes.
6. All piping and fittings must meet appropriate CSA standards (e.g., 4-inch PVC solid and perforated pipes).
7. Maximum length of perforated pipe runs is 20 m (66 ft). This is a maximum length and it is recommended that for a more uniform and equal distribution of effluent a length of 12 m (40 ft) be used.
8. Base Preparation: In receiving soils with a percolation rate slower than 10 min./25 mm, the base should be scarified with a rake to help prevent smearing of the soil surface, and a 75 mm (3 in) thick layer of clean sand (less than 3 per cent fines) may be placed on the base prior to placing the pipe. The main purpose of the sand is to allow the biomat to develop in the sand layer rather than in the tighter soils at the infiltrative surface, which will enhance the system efficiency.
9. The sewage disposal system shall be so designed and constructed as to promote equal distribution of effluent throughout the soil absorption area. This may require a double header configuration.
10. Monitoring standpipes should be installed and are to extend to the bottom of the bed, and be detached from the rest of the system. This pipe is to be a minimum of 100 mm (4 in) in diameter with holes drilled in part of pipe embedded in the drain rock, extend above the ground surface, and be capped.
11. Cleanout standpipes are to be a minimum of 100 mm (4 in) in diameter, extend above the surface, and be capped. These pipes extend vertically up from the closed-system of lateral pipes used in transporting the sewage effluent throughout the absorption system.
12. A silt barrier (geotextile or ridged insulation) must be installed between the top of the drain rock and the native soil backfill in order to keep the drain rock free of fines.
13. Bottom of the excavation must be level throughout.
14. The finished grade over the bed must be mounded to prevent the formation of a depression after settling, and allow for the run off of surface water. The area around the system should be graded to divert all surface runoff.

Absorption Beds Only

An absorption bed is a rectangular excavation containing 300 mm (12”) of drain rock, perforated pipes, geotextile and standpipes that receive septic tank effluent. Absorption occurs only through the bottom of the bed.





1. Maximum allowable slope of bed is recommended two per cent but should be level.
2. The maximum slope of the ground in the area that the bed is to be installed shall be no greater (steeper) than 10 per cent.
3. Drain rock depth below pipe must be a minimum 150 mm (6 in) and must extend throughout the entire base of required excavation dimensions.
4. Drain rock is to surround and extend 50 mm (2 in) above perforated pipe.
5. Distance between runs of perforated pipes is 1.8 m (6 ft). The edge distance between the outside pipe and the edge of the bed must be one-half the pipe spacing or 0.9 m (3 ft).
6. At least one monitoring stand pipe should be installed and located near the centre of the bed.

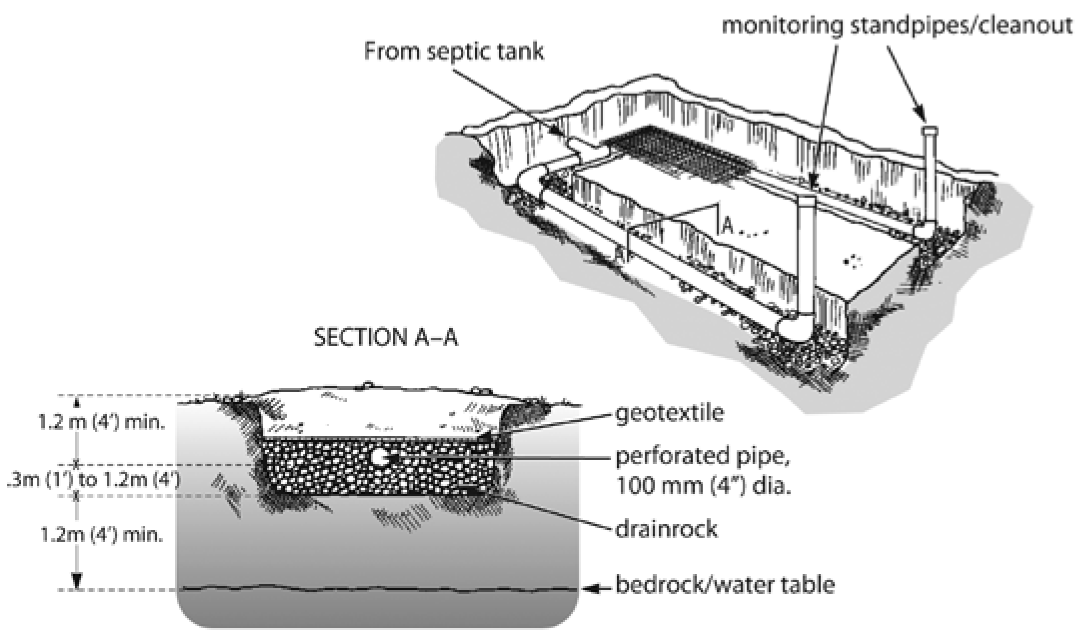
7. Two cleanout standpipes are to be located diagonally on the absorption bed system (on opposite and far corners of one another), which also will aid in determining the location of the bed.
8. Only the bottom area of a bed may be considered in determining the total absorption area.
9. The bottom of a bed should be scarified or raked before placement of drain rock.
10. A two-foot sand filter is required where the percolation rate is faster than five minutes.
11. Only absorption bed systems may be installed where the percolation rate is faster than five minutes.
12. Systems should be designed to provide equal distribution of effluent to each of the perforated pipes. This will require an even number of perforated pipe runs with multiple headers as required such that each feeder from a header serves no more than two pipe runs.

Wide Trench Only

A wide absorption trench combines some of the features of the absorption bed and deep trench and is usually 900 mm (3') to 1500 mm (5') wide and has 300 mm (12") to 1200 mm (48") of drain rock below the perforated pipe.

When trenches are installed parallel to each other, the separation distance between trench walls must be three times the depth of the drain rock below the pipe or 3m (10'), whichever is greater.

See Specifications 1 to 14 listed in this booklet on page 10, as they also apply to aspects of trench installations.



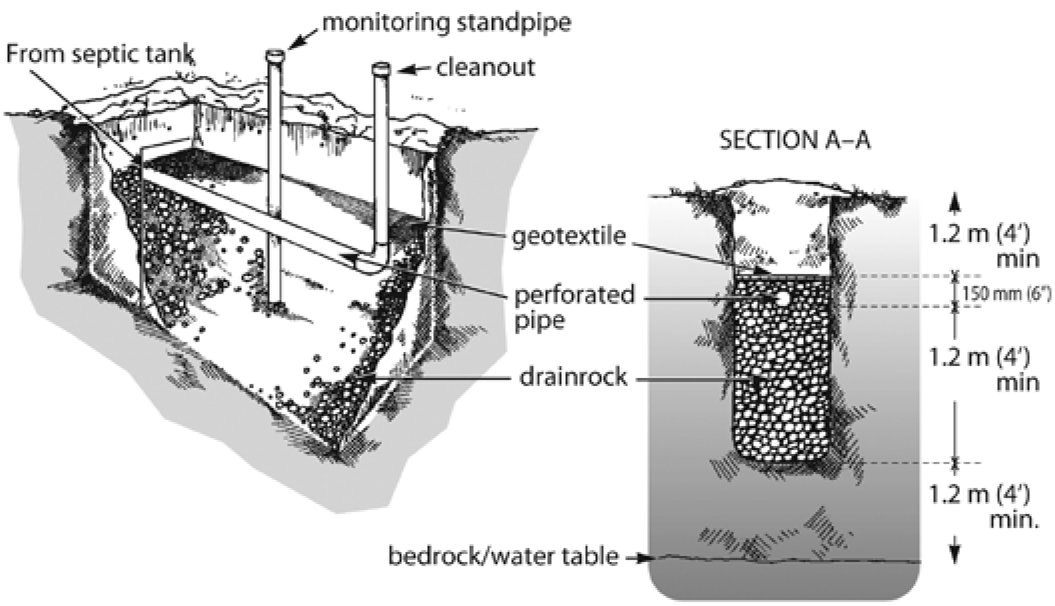
1. Maximum allowable ground slope in area of a trench is 25 per cent.
2. Trench must be installed parallel to the slope contour.
3. Trench width must be 0.9 m to 1.5 m (3, 4, or 5 ft) wide (Table 2) unless otherwise approved by a Health Officer.

4. When two or more trenches are being used, the horizontal distance between the trench walls must be three times the depth of drain rock below the perforated pipe or 3 m (10 ft), whichever is greater.
5. The depth of drain rock below the perforated pipe must be at least 0.3 m (1 ft) and no greater than 1.2 m (4 ft).
6. A monitoring standpipe should be installed near the end of each trench. It is to be separate from the rest of the distribution pipes.
7. A cleanout standpipe is to be installed at the end of each run of perforated pipe.
8. The bottom and sides of a wide trench must be scarified or raked before placement of drain rock.
9. The side wall and bottom area of the trench will be used in determining the absorption area. A reduction (see Table 2) to the total area will apply.

Deep Trench Only

A deep absorption trench is 450 – 900 mm (18” – 36”) wide and contains at least 1200 mm (4’) of drain rock below the perforated piping. The effluent seeps into trench sidewalls from the drain rock.

See Specifications 1 to 14 listed in this booklet on page 10, as they will apply to aspects of trench installations.



1. Maximum allowable ground slope in area of trench is 25 per cent.
2. Trench must be installed parallel to the slope contour.
3. Trench width must be 450 – 900 mm (1.5 – 3 ft).
4. Depth of drain rock below pipe must be a minimum 1200 mm (4 ft).
5. A monitoring standpipe should be installed near the end of each lateral trench, unattached from the rest of the system.

6. A cleanout standpipe is to be installed at the end of each run of perforated pipe.
7. The sides of the trench walls must be scarified or raked before placement of drain rock.
8. The absorbing soil strata must be a least 1.2 m (4 ft) thick.
9. Only the sidewall area of a deep trench may be considered in determining the total absorption area. The bottom of the trench shall also be within acceptable percolation rates.
10. The maximum allowable depth of a deep trench is 4 m (13 ft).
11. When two or more trenches are being used, the horizontal distance between the trench walls must be three times the depth of drain rock below the perforated pipe or 3.7 m (12 ft), whichever is greater.

Sizing your Absorption Bed or Trench

After the average percolation rate (GUIDELINES for SOILS INVESTIGATION and PERCOLATION TESTS, page **41**) has been calculated and the type of soil absorption system has been determined, the minimum surface area required for your sewage disposal system can be obtained by using Appendix B. This area is based on the number of bedrooms in a standard household, assuming a water usage of 570 litres per bedroom (125 Imperial gallons per bedroom). Pages 19-25 cover Chamber Systems.

If you have used Appendix A to determine the estimated peak volume of sewage flow in a 24-hour period, divide by 570 L (125 imp. gal.) to obtain the bedroom equivalence.

TOTAL AREA REQUIRED = Area for one bedroom X No. of bedrooms
(from *Appendix B*)

Absorption Bed

Example 1

For a 1 bedroom dwelling with a 10 min./25 mm percolation (perc.) rate, the minimum total area required for an absorption bed system would be 23 m² or 248 ft² (refer to Appendix B).

Then, divide the desired width into the total area required to determine the length of the absorption bed, given:

- 1 run of perforated pipe requires a width of 1.8 m (6 ft)
- 2 runs of perforated pipe requires a width of 3.6 m (12 ft)
- 4 runs of perforated pipe requires a width of 7.3 m (24 ft)

For more lateral runs of perforated pipe, use multiple of 1.8 m (6 ft).

If 1 run was chosen, then:

23.0 m² (248 ft²) ÷ **1.8 m** (6 ft) **= 12.8 m** (42 ft)
Total Area Width Length

Example 2

Given the same percolation rate with a dwelling having three bedrooms, multiply the total area required for 1 bedroom by 3:

23.0 m² (248 ft²) per bedroom **x 3** bedrooms **= 69** m² (744 ft²)

If four runs were chosen, then:

69 m² (744 ft²) ÷ **7.3** m (24 ft) **= 9.5 m** (31 ft)
Total Area Width Length

To determine the length of the perforated pipe required for each run, subtract 1.8 m (6 ft) from the total length, as the pipes commence and end 0.9 m (3 ft) from the edge of the absorption bed.

To determine the length of the solid footer and header pipes required, subtract 1.8 m (6 ft).

Wide Trench

Given that the bottom and sidewall area of the trench will be used in determining the total absorption area, then a reduction factor (Table 2 below) is applied.

Table 2

Length Reduction Factors (RF) for Wide Absorption Trenches				
Depth of drain rock below pipe		Trench width		
		0.9 m (3 ft)	1.2 m (4 ft)	1.5 m (5 ft)
milimetres	inches	Length reduction factor (RF)		
300	12	0.83	0.86	0.87
450	18	0.71	0.75	0.78
600	24	0.62	0.66	0.70
750	30	0.55	0.60	0.64
900	36	0.50	0.54	0.58
1060	42	0.45	0.50	0.54
1200	48	0.41	0.46	0.50

Example 1

For a 1 bedroom dwelling with a 10 min./25 mm percolation rate, the minimum total area required for a wide trench system would be 15.3 m^2 or 165 ft^2 (refer to Appendix B).

If 600 mm (24 in) of drain rock below the pipe and a width of 1.5 m (5 ft) was chosen, then a reduction factor (RF) of .70 would be applied.

15.3 m^2 (165 ft^2) x **.70 = 10.7** m^2 (115.5 ft^2)

Area Required (from Appendix B) — RF Adjusted Total Area Required

Then, divide the chosen width (1500 mm or 5 ft) into the total area required to determine the length of the trench.

10.7 m^2 (115.5 ft^2) ÷ **1.5** m (5 ft) = **7.1** m (23 ft)

Total Area — Width — Length

Example 2

Given the same percolation rate (10 min./25 mm), depth of drain rock (24 in) and width of trench (5 ft) with a dwelling having four bedrooms, multiply the total area required for one bedroom by four.

10.7 m² (115.5 ft²) per bedroom **x 4** bedrooms **= 42.8** m² (462 ft²)

42.8 m² (462 ft²) ÷ **1.5** m (5 ft) = **28.5** m (92.4 ft)

Total Area Width Length

Length of pipe is determined by subtracting 1.8 m (6 ft) from the length of the trench.

As the length of the pipe exceeds 20 m (66 ft) then the total area required is to be evenly divided into two, the length of each trench will then be 14.25 m (46.2 ft). The edge of each trench will have minimum of 3 m (10 ft) distance between them.

Deep Trench

Since only the side walls of the soil absorption area are taken into consideration the following formula applies:

Total Area Required x No. of Bedrooms ÷ (2 x Depth of Drain rock Below Pipe) = Length of Trench (from Appendix B)

Example 1

For a one-bedroom dwelling with a 10 min./25 mm percolation rate, the minimum total absorption area required for a deep trench system would be 15.3 m² or 165 ft² (refer to Appendix B).

If 1.2 m (4 ft) of drain rock was placed below the pipe, then:

15.3 m² (165 ft²) **x 1** bedroom ÷ (**2** x **1.2m** (4 ft)) = **6.3** m (20.6 ft)

Example 2

Given the same percolation rate, and depth of drain rock with a dwelling having four bedrooms, multiply the total area required for one bedroom by four.

15.3 m² (165 ft²) **x 4** bedrooms ÷ (**2** x **1.2m** (4 ft)) = **25.5** m (82.5 ft)

Length of pipe is determined by subtracting 1.8 m (6 ft) from the length of the trench.

As the length of the pipe exceeds 20 m (66 ft) then the total area required is to be evenly divided into two. The length of each trench will then be 12.75 m (42 ft). The edge of each trench will have minimum of 3.7 m (12 ft) distance between them.

Determining the Quantity of Drain Rock

To determine the amount of drain rock needed for a soil absorption system, the following formula (imperial measure only) may be used:

length (ft) x width (ft) x depth (ft) of area to be filled with drain rock ÷ 27 = amount in cubic yards

One truck load is approximately 12 cubic yards.

Example 1

The size of the absorption bed is 7.3 m (24 ft) x 14 m (46 ft) and depth of drain rock required (including pipe cover) is 0.3 m (1 ft), then the calculation would be:

24 ft x **46** ft x **1** ft ÷ **27 = 40.8** cubic yards

= Approximately 3½ truck loads

Example 2

The length of each 1.5 m (5 ft) wide trench is 14 m (46 ft) and depth of drain rock required (including pipe cover) is 0.76 m (2.5 ft), then the calculation would be:

(46 ft x **5** ft x **2.5** ft ÷ **27)** x **2** trenches = **42.5** cubic yards

= Approximately 3½ truck loads

Chamber Guidelines

General:

1. All chambers shall be certified by the International Association of Plumbing and Mechanical Officials (IAPMO) under PS-63-2019 or the most recent versions of the standard. Chambers that may be subjected to vehicle loads shall meet or exceed the requirements of the American Association of State Highway and Transportation Officials (AASHTO) H-20 rating, as defined in PS-63-2019. The AASHTO H-10 rating, as defined in PS-63-2019 is adequate for systems that will not be subject to vehicles or other similar heavy loadings.

2. **Manufacturer's Instructions**: Chamber systems shall be installed in accordance with the manufacturer's instructions, except that in the event of a conflict with these guidelines, the requirements of the guidelines shall apply.

3. **Side Openings**: Each chamber unit shall have a louvered sidewall open area not less than 35 per cent of the bottom infiltrative area. The sidewall openings shall be designed to restrict the entry of soils into the chamber area. The louvered area shall have a height of at least 150 mm (6 inches).

4. **Absorption Bed**: The effective infiltrative area provided by the chambers in an absorption bed shall be calculated considering the interior area at the base of the chamber where the sewage effluent contacts the soil. See Appendix B - absorption bed column as the total absorption area will be the same as with existing design specifications.

5. **Absorption Trench**: The effective infiltrative area provided by the chambers in an absorption trench shall be calculated considering the interior area at the base of the chamber and a portion of the trench side walls to the height of the chamber louvers. See Table 3 for trench calculations.

6. **Sand Filter**: A 600 mm (24 in) thick sand filter is required beneath chambers where the soil has a percolation rate faster than 5 min./25 mm. In such cases, only absorption beds will be permitted. Absorption trenches are not permitted in fast-perc. soils because the trench sidewalls will not have the required sand filter protection.

7. **Depth of Cover**: The chambers must be rated for the depth of soil cover over the units. Failure to adhere to manufacturer's burial limits may void warranty and preclude ability to receive Health Officer approval.

8. **Chamber Dimensions**: Chambers shall be a minimum of 600 mm (24 in) wide and a maximum of 900 mm (36 in) wide.

9. **Spacing of Chambers**: In absorption beds, chambers shall be spaced no greater than 150 mm (6 in) apart (i.e., from the outside edge to outside edge) and may be placed edge-to-edge. In trenches, adjacent trenches shall be a minimum of 2 m (6 ft) from sidewall to sidewall.

10. **Base Preparation**: In receiving soils with a percolation rate slower than 10 min./25 mm, the base should be scarified with a rake to help prevent smearing of the soil surface, and a 75-mm (3 in) thick layer of clean sand (less than 3 per cent fines) may be placed on the base prior to placing the chambers. The main purpose of the sand is to allow the biomat to develop in the sand layer rather than in the tighter soils at the infiltrative surface, which will enhance the system efficiency. The sand can also be used as a levelling course to ensure that the chambers are laid onto a level surface and as such the long term performance of the system may be enhanced.

11. **Installation Notes**: Care must be taken not to "impact" load the chambers when backfilling. This can occur from machinery dumping fill from high elevations. Backfill should be "ladled" and placed

on the chambers and then spread by hand to fill in the voids between each row of chambers in a bed, or between the chambers and earth walls in a trench. Consult the manufacturer's product installation instructions regarding the operation of machinery over the chamber.

12. **Perforated Piping within Chambers**: Although not mandatory, perforated piping may be installed within the chambers to enhance the distribution of effluent along the trench or within a bed. When installed, the piping should be supported above the ground surface at least 25 mm (1 in) using PWF lumber or other suitable materials, at intervals that will not result in the pipe sagging when distributing effluent. The extra 12 mm (½ in) dia. hole in the bottom of the perforated piping should only be installed in the last length of pipe in a run, to allow more effluent to continue to the end of the pipe run and allow for better distribution within the absorption system. The perforated piping should be laid a maximum slope of 0.5 per cent to allow for distribution of effluent to the end of each run.

13. **Inspection Port**: An inspection port or monitoring standpipe shall be installed at the end of each trench and in each corner of an absorption bed. It shall consist of a 100 mm (4 in) dia. PVC pipe connected to the top of the chamber and extending to 300 mm (12 in) above ground, and capped. This allows for monitoring of system performance.

14. **Prevention of Soil Erosion**: In order to dissipate the hydraulic energy of the effluent discharging into the end of the chamber and to minimize soil erosion, protection shall be provided, which may consist of:
    - The product-specific splash plate that is compatible with the chamber end cap system and is capable of extending to a point below the influent entry point.
    - GEOTEXTILE covering the base area of the chamber and extending at least 1.5 m (4 ft) from the beginning of the chamber; or
    - A 50 MM (2 IN) THICK LAYER OF GRAVEL extending at least 1.5 m (4 ft) from the beginning of the chamber; or
    - OTHER SUITABLE MEANS to dissipate the hydraulic energy and prevent erosion to the satisfaction of the Health Officer.

15. **Length of Chamber Run**: The maximum allowable length of chamber run is 20 m (66 ft). This is a maximum length and it is recommended that for a more uniform and equal distribution of effluent a length of 12 m (40 ft) be used.

16. **Depth of Cover**: The minimum allowable depth of earth cover over the top of the chambers without styrofoam board insulation is 1.2 m (4 ft). Soil cover may be reduced to a minimum of 0.6 m (2ft) when the system is covered with 50 mm (2 in) of approved rigid styrofoam type insulation.

17. **Pump-Up Systems**: Pump-up systems with gravity discharge will normally provide for improved distribution of effluent within the chambers. The Sewage Pump-Up Systems Guidelines shall be followed, pages 26-32.

18. **Pressure Distribution**: In a pressure distribution system, effluent is pumped under pressure to laterals within the chambers where it is evenly distributed to the soil from small diameter orifices in the lateral piping. A properly designed pressure system will provide equal distribution of effluent throughout the chamber system during each pump cycle. With this type of system, the laterals shall be suspended and fastened near the top of the chambers with the effluent being discharged upward to the top of the chamber, allowing it to deflect and be evenly distributed to the soils at the base of the chamber. All pressure distribution systems must be designed by an engineer registered in Yukon, with the engineer's seal affixed to the design plans and report.

Examples of System Designs Using Leaching Chambers

Example 1

Given: 3-bedroom home
Soil percolation rate: 9 min/25 mm (1 in)
Chamber width: **864 mm (34 in)**

Design a system using trenches.

From Table 3, the trench length/bedroom in soil with a 9 min./25 mm (1 in) percolation rate is 13.6 m (45 ft) for 864 mm (34 in) wide chambers.

Total trench length required = 3 x 13.6 m (45 ft)
= 40.8 m (135 ft)

Since 20 m (66 ft) is the maximum trench length allowed, four trenches should be provided for equal distribution of effluent.

40.8 ÷ 4 = 10.2 m (33 ft)

Each trench will then be 10.2 m (33 ft) long.

Example 2

Given: 2-bedroom home
Soil percolation rate: 20 min./25 mm (1 in)
Chamber width: **559 mm (22 in)**

Design a system using trenches.

From Table 3, the trench length/bedroom in soil with a 20 min./25 mm (1 in) percolation rate is 29.9 m (98 ft) for 559 mm (22 in) wide chambers.

Total trench length required = 2 x 29.9 m (98 ft)
= 59.8 m (196 ft)

Three trenches would be required so that each trench length is less than the maximum allowed length of 20 m (66 ft).

59.8 ÷ 3 = 19.9 m (65 ft)

However, in order to ensure equal distribution of effluent from the header, an even number of trenches should be provided.

59.8 ÷ 4 = 15 m (49 ft)

Each trench will then be 15 m (49 ft) long.

Example 3

Given: 3-bedroom home
Soil percolation rate: 25 min./25 mm (1 in)
Chamber width: **864 mm (34 in)**

Design a system using chambers in an absorption bed.

From Appendix B, the absorption bed area required per bedroom in soil with a 25 min./25 mm (1 in) percolation rate is 32.4 m² (348 ft²).

Therefore the total area required = 32.4 (348) x 3 = 97.2 m² (1,044 ft²)

With the chambers spaced 152 mm (6 in) apart, the centre-to-centre spacing in the absorption bed will be 1,016 mm = 1.016 m (3.33 ft).

As such, the total length of chambers in the bed will be:

97.2 (1,044) ÷ 1.016 (3.33 ft) = 95.7 m (314 ft)

This will be divided into runs, each having a maximum length of 20 m (66 ft).

The minimum number of runs required = 95.7 m ÷ 20.0 m = approximately 5 runs.

However, an even number of runs provides better distribution from the header and as such, six runs should be used. This results in a bed length of:

97.2 m² ÷ (6 x 1.016 m) = 15.9 m (52 ft) = chamber run length

As such, the absorption bed would be 15.9 m (52 ft) long x 6.1 (6 x 1.016) m (20 ft) wide and will contain six runs of chambers spaced 152 mm (6 in) apart.

An alternative design, which would shorten the chamber run length and improve performance, would be to increase the number of runs to eight:

97.2 m² ÷ (8 x 1.016 m) = 12 m (39 ft) = chamber run length

In this case, the absorption bed size would be 12 m (39 ft) long x 8.1 m (27 ft) wide and contain eight runs of chambers spaced 152 mm (6 in) apart.

Example 4

Given: 3-bedroom home
Soil percolation rate: 15 min./25 mm (1 in)
Chamber width: **559 mm (22 in)**

Design a system using chambers in an absorption bed.

From Appendix B, the absorption bed area required per bedroom in soil with a 15 min./25 mm (1 in) percolation rate is 26.4 m² (285 ft²).

Therefore the total area required = 26.4 (285) x 3 = 79.2 m² (855 ft²)

With the chambers spaced 152 mm (6 in) apart, the centre-to-centre spacing in the absorption bed will be 711 mm = 0.71 m (2.33 ft).

As such, the total length of chambers in the bed will be:

79.2 (855) ÷ 0.71 (2.33) = 111.5 m (367 ft)

This will be divided into runs, each having a maximum length of 20 m (66 ft).

The minimum number of runs require = 111.5 m ÷ 20.0 m = approximately 6 runs.

This results in a bed length of 79.2 m² ÷ (6 x 0.71 m) = 18.6 m (61 ft) = chamber run length.

As such, the absorption bed would be 18.6 m (61 ft) long x 4.26 (6 x 0.71) m (14 ft) wide and will contain six runs of chambers spaced 152 mm (6 in) apart.

An alternative design, which would shorten the chamber run length and improve performance, would be to increase the number of runs to eight.

Chamber run length = 79.2 m² ÷ (8 x 0.71 m) = 14 m (46 ft)

In this case, the absorption bed size would be 14 m (46 ft) long x 5.7 m (19 ft) wide and contain eight runs of chambers spaced 152 mm (6 in) apart.

Figure 1: Leaching Chambers in Trenches

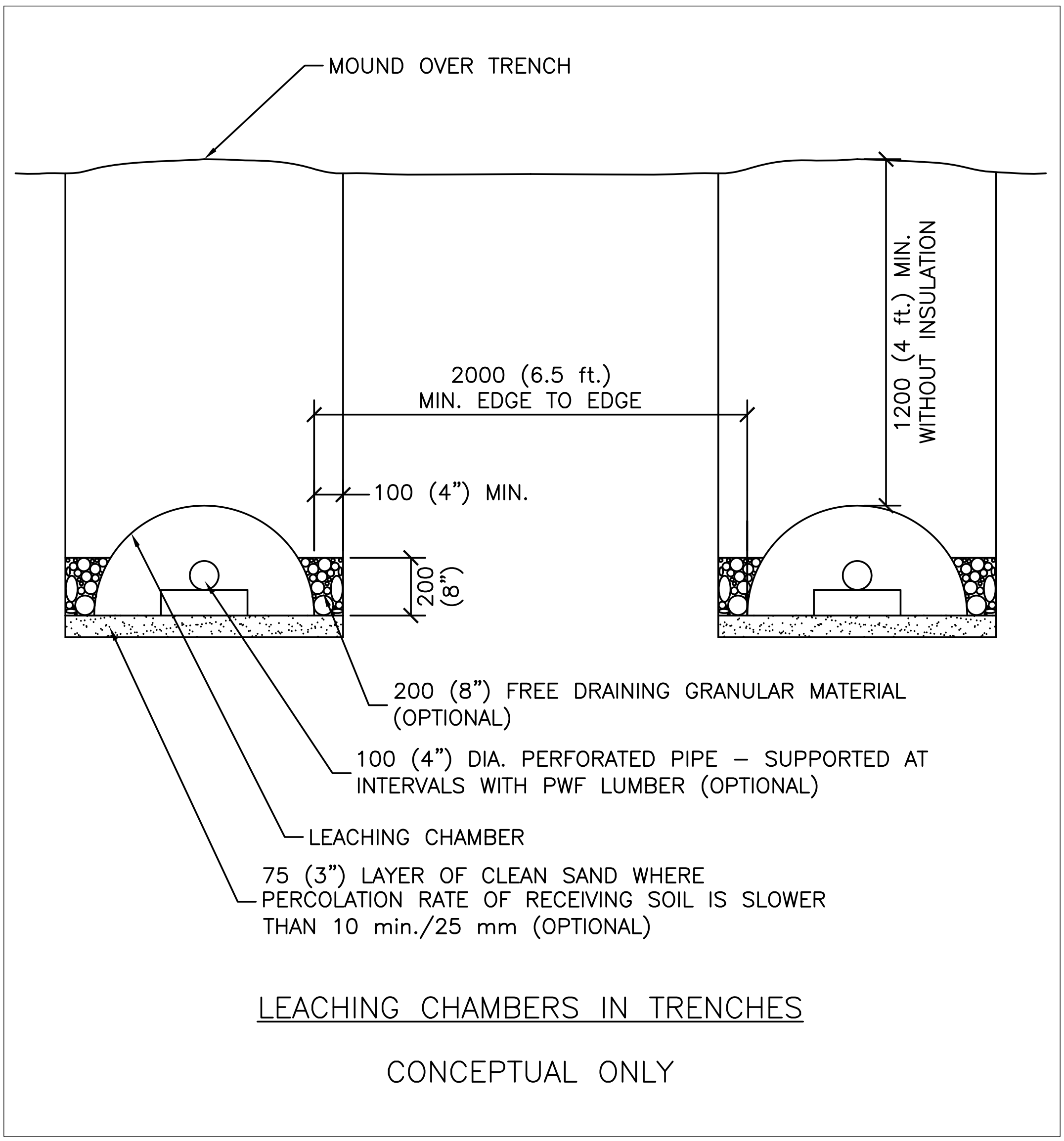


Figure 2: Leaching Chambers in an Absorption Bed

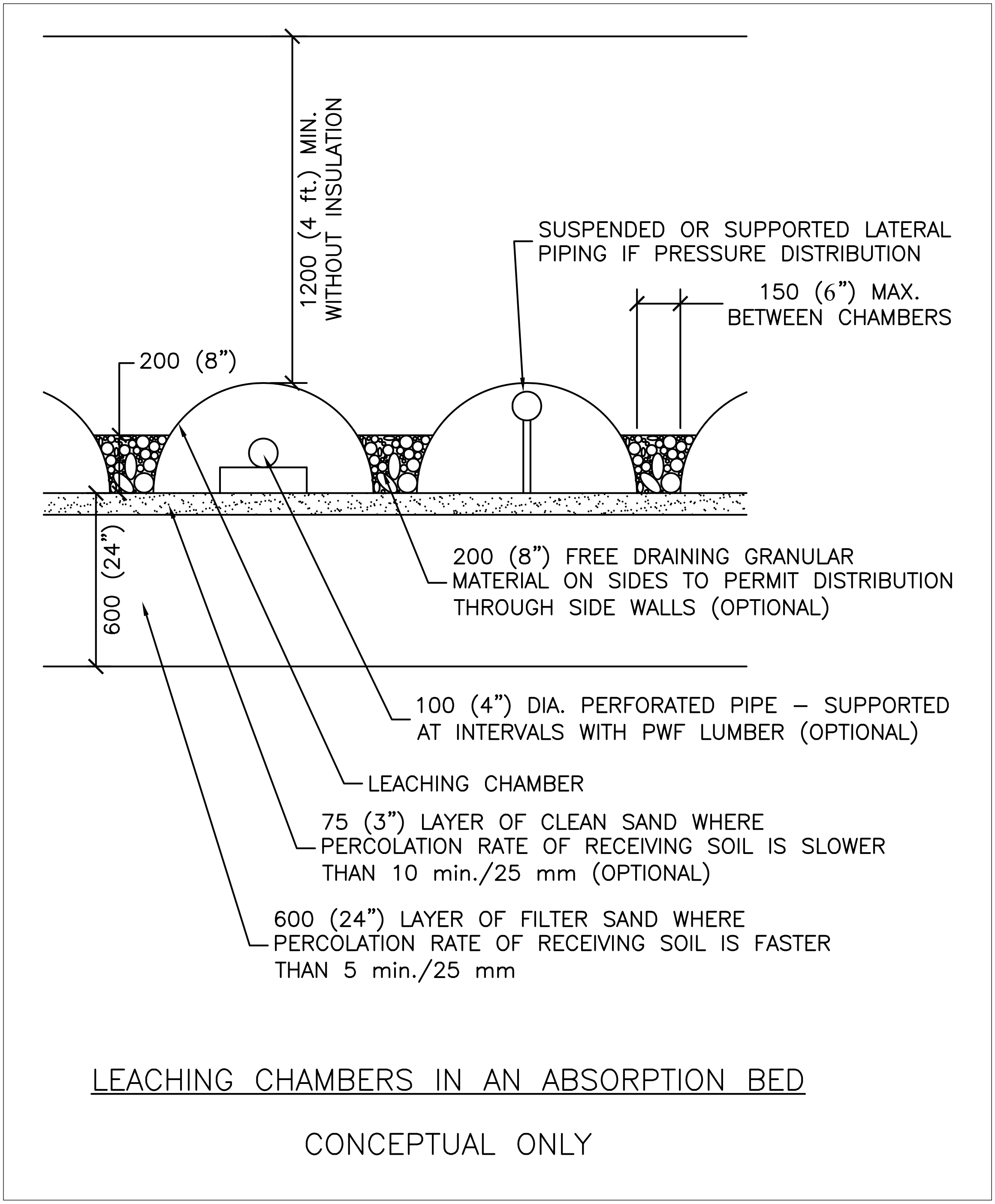


Table 3 – Trench Lengths for Chambers

Percolation Rate minutes/inch (25 mm)	Chamber width (metric)		Chamber width (Imperial)	
	864 mm	559 mm	34 in	22 in
	Length of trench/bedroom (metres)		Length of trench/bedroom (feet)	
5	10.8	16.6	35	55
6	11.6	18.0	38	59
7	12.3	19.0	40	62
8	13.0	20.1	43	66
9	13.6	21.0	45	69
10	14.2	21.9	47	72
11	14.6	22.6	48	74
12	15.1	23.3	49	76
13	15.5	23.9	51	78
14	15.9	24.6	52	81
15	16.3	25.3	54	83
16	17.2	26.6	56	87
17	17.7	27.4	58	90
18	18.2	28.2	60	92
19	18.9	29.3	62	96
20	19.4	29.9	63	98
21	19.9	30.7	65	101
22	20.4	31.5	67	103
23	20.9	32.3	69	106
24	21.5	33.3	71	109
25	22.0	34.0	72	112
26	22.5	34.8	74	114
27	23.0	35.6	76	117
28	23.7	36.6	78	120
29	24.2	37.4	79	123
30	24.7	38.2	81	125
31	25.2	39.0	83	128
32	25.7	39.8	84	130
33	26.3	40.7	86	133
34	26.8	41.5	88	136
35	27.3	42.3	90	139
36	27.9	43.1	91	141
37	28.5	44.0	93	144
38	29.0	44.8	95	147
39	29.5	45.6	97	150
40	30.0	46.4	98	152
41	30.5	47.2	100	155
42	31.2	48.3	102	158
43	31.6	48.9	104	160
44	32.2	49.7	105	163
45	32.7	50.5	107	166
46	33.2	51.3	109	168
47	33.6	52.0	110	170
48	34.1	52.8	112	173
49	34.7	53.6	114	176
50	35.0	54.1	115	177
51	35.3	54.7	116	179
52	35.7	55.2	117	181
53	36.0	55.7	118	183
54	36.5	56.4	120	185
55	36.7	56.8	120	186
56	37.1	57.3	122	188
57	37.3	57.7	122	189
58	37.7	58.3	124	191
59	37.9	58.7	124	192
60	38.3	59.2	125	194

Sewage Pump-up Systems Guidelines

General

A sewage pump-up system is typically required when effluent must be pumped to a soil stratum at a higher elevation which is more suitable for absorption (see Figure 7). It may also be required where, due to building lot characteristics, house location and topography, the sewage must be pumped to a higher elevation for on-site disposal. Sewage effluent is pumped from the septic tank through a force main and into an absorption system for in-ground treatment and disposal (see Figure 3).

Following are general guidelines for the design and installation of sewage pump-up systems. The guidelines are primarily focused on residential applications, but may also be applied to institutional or commercial systems such as for schools, lodges, camps, etc. They are intended to be used as a general guide for contractors and designers and will be used to assist Environmental Health Services when assessing applications received for such systems. They are intended to help ensure that public health and safety issues are adequately addressed and to provide general consistency in the design of key system components.

Sewage Pump-Up Systems

There are three main components to a sewage pump-up system, namely:

- **Pump Chamber** (receives and holds septic tank effluent)
- **Pump and Controls** (pumps liquid from the tank within liquid level ranges as required)
- **Force main** (conveys the effluent under pressure to the soil absorption system where it flows by gravity into the perforated piping system for treatment and disposal)

Two typical arrangements are depicted in Figure 3. These two configurations show the pumping chamber as a compartment within the tank or as a separate stand alone chamber. There are also situations where a lift system precedes the septic tank and is situated in the home basement. In such a case, the pump must be suited to handle raw sewage. Lift systems are not discussed in these guidelines, however, the design principles are similar.

Pump Chamber

The pump chamber can be a compartment of a septic tank or a self-contained separate tank as shown in Figures 3 and 4. Consideration should be given to the use of three compartments, the last of which will house the pump so as to improve the quality of effluent entering the soil absorption system. The following design features shall be adhered to:

- The tank must be structurally sound, watertight and of a material that is non-corrosive or subject to decay. Acceptable materials are fiberglass, polyethylene and concrete and must comply with the most current version of CSA B66.
- The tank must be of sufficient size to store the required volume of sewage for each pump cycle, plus a 15 per cent daily flow reserve capacity above the alarm level in order to prevent sewage backup in the event of pump failure. The reserve capacity should allow for collection of all drainage wastes from the building which are stored and under pressure within the system (i.e., toilet flush tanks). This assumes that, when the alarm level is reached, the water service pump within the building is automatically shut down.
- A man-way must be provided in order that the pump and controls can be readily accessed and serviced at any time. The man-way should be at least 600 mm (24 in) in diameter and extend 300 mm (12 in) minimum above grade. (see Figure 4).

- A frost lid or other suitable method should be provided to prevent loss of heat from the pump chamber during winter. The access man-way can also be insulated with spray-on polyurethane. (see Figure 4).
- The access lid must be watertight and secured to prevent unauthorized entry.
- After installation, the lift system should be tested for proper operation and the owner provided with an operations and maintenance manual for the system. The O&M manual should include product specifications for all materials and equipment, plus instructions on operation and maintenance of the system.

Pump Selection

There are many types of pumps on the market that are suitable for handling sewage. The most common type used in on-site sewage systems is a submersible centrifugal pump, designed to handle either raw domestic waste or septic tank effluent. The pump must comply with CSA and UL Standards and have a noncorrosive impeller. The pump should be selected based on the following parameters:

- Design pumping rate
- Total Dynamic Head (TDH)

The **pumping rate** should be sufficient to move the liquid through the force main without resulting in any settling of solids within the pipe. The recommended minimum allowable pipe velocity is 0.6 m/s (2 ft/sec). If a 38 mm (1.5 in) force main is used, then a flow rate of about 0.8 lps (13 US gpm) would be required to maintain the required 0.6 m/s.

A 0.9 m/s (3 ft/sec.) velocity would require a flow rate of 1.2 lps (19.5 US gpm).

The **total dynamic head** (TDH) is the sum of the static and friction head that the pump must overcome. The static head is the vertical distance between the low liquid level (shut-off level) in the pump chamber and the pipe discharge level at the absorption bed. The friction head is directly related to the type of pipe used, its diameter, the length of force main, and the number and type of fittings used in the line. Published tables can be referenced to determine the head loss for fittings (bends and valves, etc.). However, since these losses are relatively small for this type of system, it is generally acceptable to add 25 per cent to the total pipe length for fitting losses for calculation purposes. A pipe friction loss table is then used to determine the equivalent head loss for various flow rates.

A system head curve is generated by plotting the total dynamic head for various flow rates. This system head curve is applied to a pump performance curve. The pump will perform at any point on the pump performance curve. The intersection of the system head curve with the pump curve is the exact place where this pump will perform under the design conditions in terms of flow rate and total dynamic head. As such, by taking a few simple measurements and making a few calculations, it is possible to select the pump that will best meet the requirements of the system.

Pump Controls

Level control switches are used for pump start, stop and for the high-level alarm.

- The shut-off level should be set above the pump so that it is kept cool at all times while pumping.
- The pump start level should be set based on the desired volume of effluent to be pumped to the absorption system for each pump cycle. Typically, this volume should be 75 per cent of the volume of the perforated piping in the absorption system or a minimum of 340 litres (75 Igal). This is to provide sufficient volume of liquid during each cycle to inundate all of the perforated pipe system

and therefore allow for even distribution of effluent into the receiving soil. As an example, with a 1.5 lps pumping rate and a pump-out volume of 340 litres, the pump will operate for about 3.8 minutes during each cycle. It is desirable to maintain pump cycles to 3-5 per day.

- The high-level alarm should be set at about 75 mm (3 in) above the start level.
- Ensure that the float switches are not restricted from free movement in any way.

Other guidelines pertaining to the pump and controls are as follows:

- Float switches must have a dedicated power supply and be mounted on a separate bracket of a float tree so that they can be easily replaced and/or adjusted without removing the pump.
- The high-level switch must activate the alarm, a weatherproof warning light at the pump-up station and an audible alarm.
- The high level switch must also automatically shut off the power to the water supply pump in the building.
- A light should be provided which is activated during the time the sewage pump is running. This can be mounted on the control box and should be easily visible.
- The high-level alarm must be wired separately from the pump and able to be heard within a 30-m radius. The alarm should be placed in a conspicuous location.
- Provide a quick-release coupling on the discharge piping so the pump can be readily removed for servicing. A pump removal assembly must be designed to remove the pump efficiently and safely without having to enter the chamber. Use corrosive resistant fittings.
- It may be advantageous to install a valve on the discharge line so that the discharge flow rate can be adjusted if necessary by throttling.
- The pump must be capable of allowing for drain-back of the force main into the pump station after each cycle.
- The pump must be raised from the bottom of the station by at least 200 mm (8 in) to allow for sludge settlement. Concrete blocks or a plastic box may be used for this purpose.
- The electrical controls, relay switches, etc., must be housed within an approved weatherproof enclosure and comply with the Canadian Electrical Code for wet and corrosive locations. It should be positioned outside the pump chamber and allow for easy access for maintenance and adjustment requirements.
- Junction box to be NEMA 4X or equivalent.
- The control box is to be built and certified by an authorized manufacturer.
- The power supply entry through the tank must be gas-tight and watertight.
- All wiring must be carried out by a certified electrician

Force main

- The recommended material for the force main is high-density polyethylene (HDPE).
- The class of pipe chosen must be compatible with the anticipated pressures to be encountered with a minimum class of DR 17.
- The pipe diameter should allow for pipe velocities of at least 0.6 m/s (2 ft/sec). For a typical three bedroom household, the desired pump discharge rate would be in the 1.5 lps (24 USgpm) rate. Using a 38 mm (1.5 in) I.D. pipe, the velocity will be about 1.1 m/s (3.8 ft/sec), which is acceptable.
- The force main shall be insulated to help guard against freezing if 4-ft burial is not met.
- The force main should be properly bedded and backfilled. A recommended trenching, bedding and backfilling detail is shown in Figure 6.
- The force main must be sloped to completely drain the pipe from the discharge point back to the pump chamber after each pumping cycle. The recommended minimum pipe slope is 2 per cent.
- The force main connection to the header pipe must be made secure with a clamp. Both the force main and header should be bedded in gravel or sand (See Figure 5).
- The force main must discharge into the header pipe from above and be provided with a vacuum breaker to prevent back-siphoning should the absorption bed ever become fully saturated. The high point of the force main should be at least 400mm (16 in) above the header pipe as shown in Figure 5.

Operation and Maintenance

- The access manhole and pump chamber must be entered only by persons properly trained in confined space entry and following the requirements as laid out in the General Safety Regulations on Confined Spaces as per the *Yukon Occupational Health and Safety Act.*
- Periodic checks should be made of the pumping system to ensure that the pump is operating satisfactorily, that the cycling length and frequency are as intended, and that it is functioning as intended.
- Inspect all electrical connections. The level controls should be checked from time to time and the high-level switch should be triggered to ensure that the alarm and light are functioning and that the water pump shut- off is working.
- Inspect all plumbing fittings and connections.
- Pump maintenance should be carried out by a mechanical contractor as required and as recommended by the pump manufacturer.

Figure 3: Pump-up System Configurations

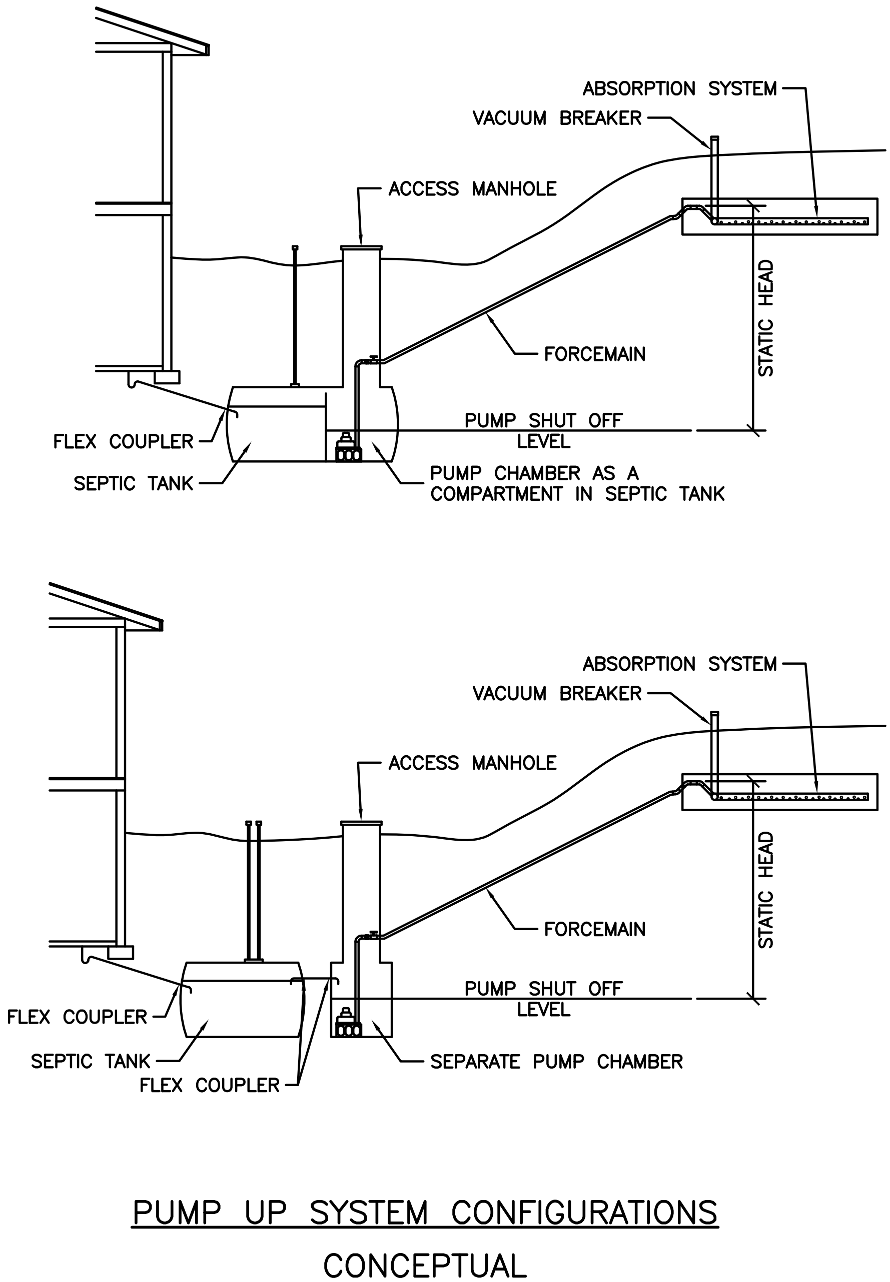
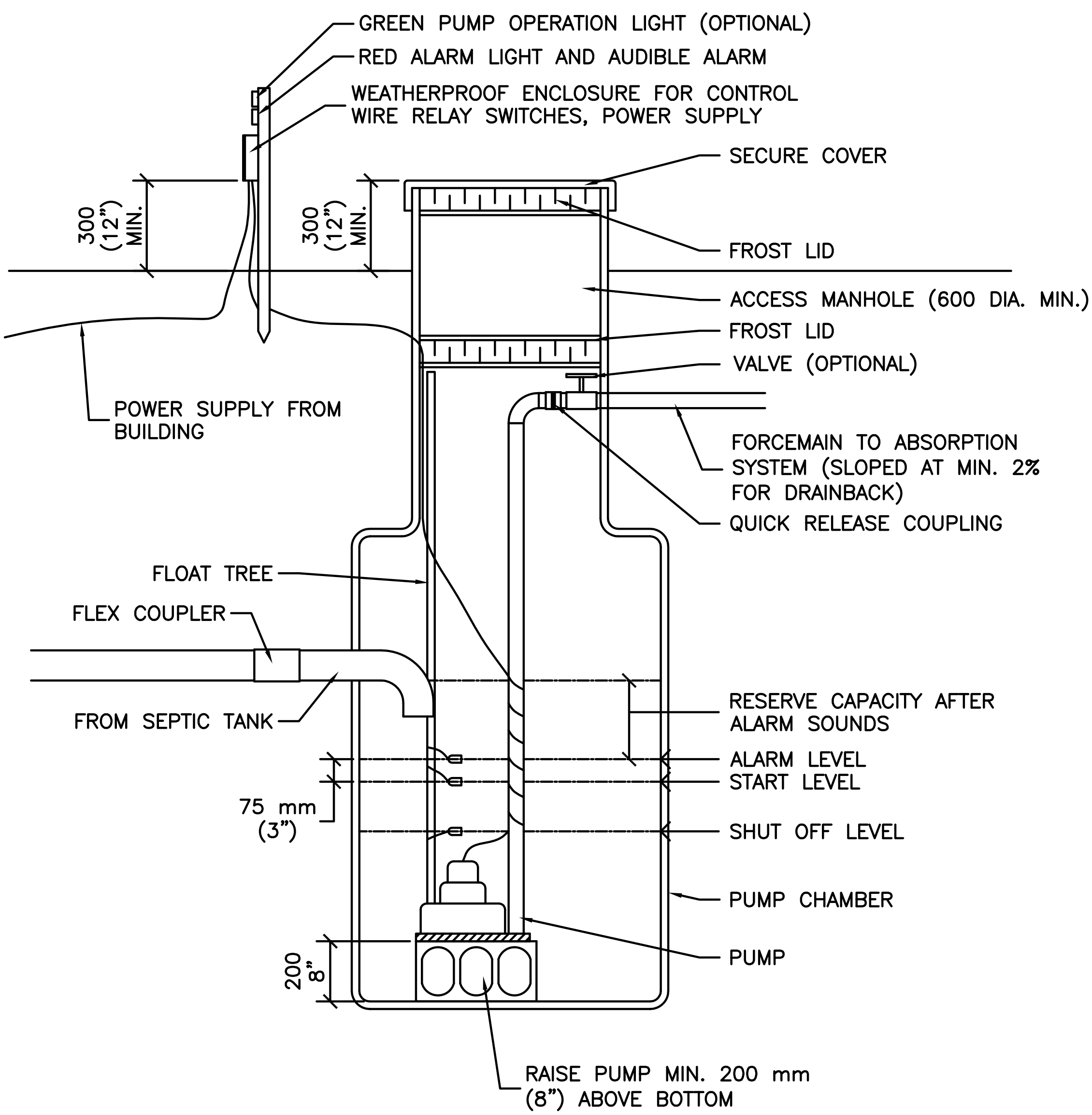


Figure 4: Pumping Chamber Details



PUMPING CHAMBER DETAILS

CONCEPTUAL ONLY

Figure 5: Force Main Connection to Absorption System

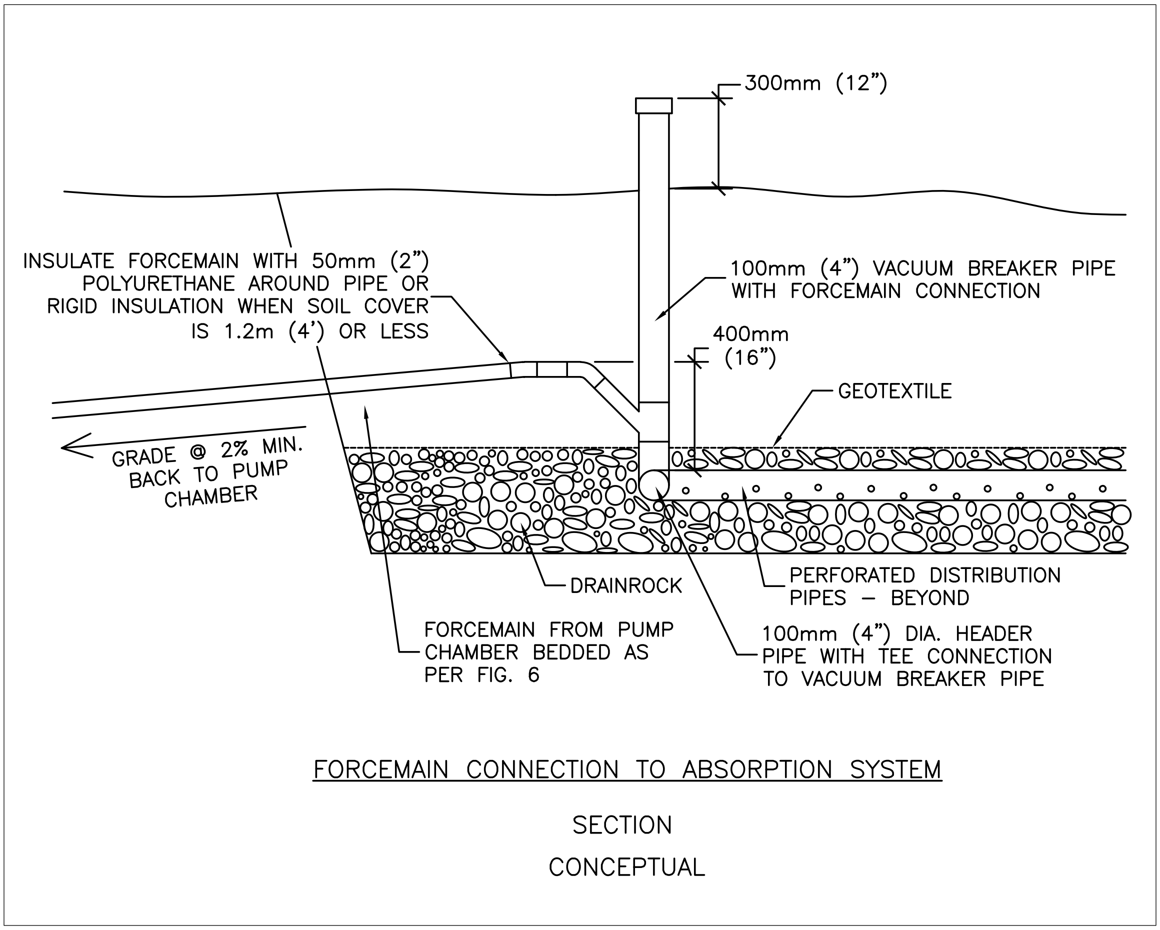
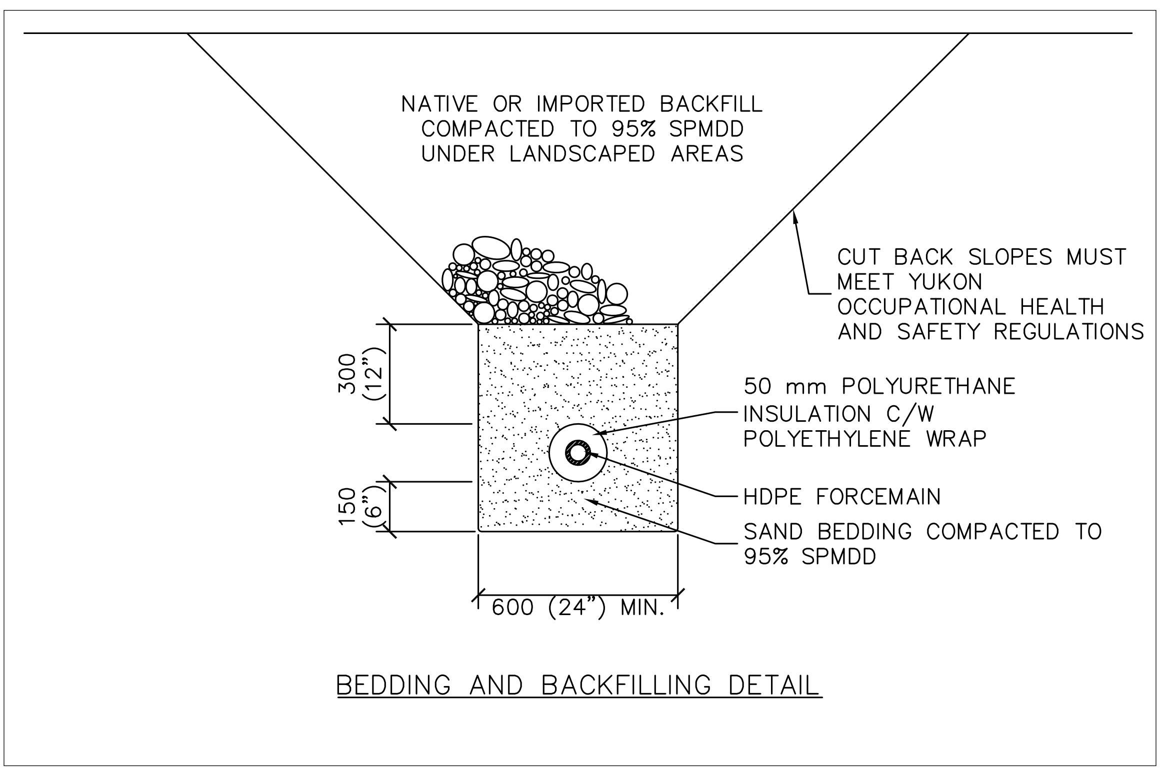


Figure 6: Bedding and Backfilling Detail



Raised Bed Systems (Refer to Figure 7)

A raised bed is a soil absorption system which has been constructed on top of a natural soil surface. It consists of an absorption bed using either drain rock and perforated piping or chambers which distributes septic tank effluent through a layer of filter sand and thence into the underlying natural receiving soils for ultimate dispersal. The sand layer provides treatment through a filtering process and the underlying natural soils provide additional treatment and final disposal. A raised bed is suited to sites where the required vertical separation distance to groundwater, impermeable soil layer or bedrock cannot be met by excavating an in-ground system. A pump-up system must be used to deliver septic tank effluent to the raised bed.

Site conditions, design criteria and construction details are as follows:

Site Conditions

- The raised bed cannot be constructed on slopes steeper than 15%.
- There must be at least 1.2m (4’) of original soil above an impermeable soil layer, bedrock, or groundwater and the accepting soil layer must have a percolation rate faster than 60 minutes/25mm. If accepting soil layer has a percolation rate slower than 60 minutes/25mm, a raised bed cannot be installed. Alternate sewage system designs (outside the scope of these design specifications) must be engineered.

Design Considerations

- The perforated piping or chambers must be oriented perpendicular to the ground slope.
- Provide at least 0.6m (2’) of filter sand beneath the perforated piping (or chambers).
- The total absorption area shall be based on the effluent hydraulic loading rate for the filter sand but shall be no greater than 30 Litres per m^2 per day (0.6 Imp. gal. per ft^2.per day).
- The length of the absorption bed shall be determined based on the linear loading rate for the original soil considering the textural characteristics of the soil, the measured percolation rate, the depth of the receiving soil and the gradient of the slope. The average daily sewage flows should be used in these calculations rather than peak flows. The linear loading rate is important to consider where effluent in the soil will move primarily horizontally due to site slope or low permeability.
- For sloped sites, the maximum width of the absorption bed shall be 3.6 m (12 ft).
- Other design features shall be as per specifications for soil absorption systems and absorption beds as described in this manual.
- CSA B-65 “Installation code for decentralized wastewater systems” shall be used to provide input to the design process for hydraulic loading rates and linear loading rates based on the textural characteristics of the soil and site conditions.

Construction

- Do not allow heavy construction equipment within the footprint of the absorption bed.
- The original ground surface and topsoil should be left undisturbed before constructing the raised bed.
- The sand filter surface, the drain rock and perforated piping (or chambers) shall be level.

- Side slopes (on all sides) must be no steeper than 3 horizontal : 1 vertical.
- At least 1.2m (4') of insulating soil cover (preferably silt/loam) shall be provided over the system, lightly compacted and mounded to shed water runoff. The soil cover may be reduced to 0.6m (2') if 50 mm (2") of rigid, back fillable, moisture resistant insulation is placed directly on top of the drain rock covering the perforated pipes. The insulation should extend at least 0.6m (2') beyond the required absorption bed area on all sides.
- If the system is on a sloping site, construct a diversion ditch or curtain drain upgradient of the field to prevent surface water runoff from reaching the side slopes of the mounded absorption bed.

A cross section of a typical raised bed system is shown in Figure 7.

Submission Requirements

The design process for a raised bed system tends to be more complex than for a conventional absorption bed in order to ensure effluent dispersal into the natural soils and guard against breakout. The following must be submitted along with the application:

- Textural descriptions and percolation test data for the filter sand and the natural receiving soils.
- Samples of both the filter sand and the natural receiving soil (8 cups each).
- Design rationale for the raised bed system.
- Separate plan and section drawings of the absorption system, preferably to scale, showing dimensions and labelled components.

The Environmental Health Officer may request that the design be prepared and sealed by an Engineer registered in the Yukon.

Raised Bed Design Example

Given:

- 3-bedroom home: Estimated peak daily sewage flow (Appendix A) – 3 x 570 lpcd =1710 lpd
- Native soil type: Loam with soil percolation rate = 25mpi (based on percolation test)
- Filter sand, 600mm thick: Assume hydraulic loading rate of 17.4 lpd/sq.m (Appendix B)
- 5% slope
- 1.2 m natural soil cover over bedrock

Design:

The minimum soil absorption area required = 17.4 x 3 (bedrooms) = 52.2 sq.m.

But considering the linear loading rate ensures that there is sufficient cross-sectional area along the length of the absorption bed to allow the liquid to adequately disperse below grade and not result in break out above grade:

From Table 13, CSA Standard B-65 Installation Code for Decentralized Wastewater Systems (current version), the maximum linear loading rate for loam with slope of 5% and soil depth below infiltrative surface of 1.2 m = 57.1 l/(m*d)

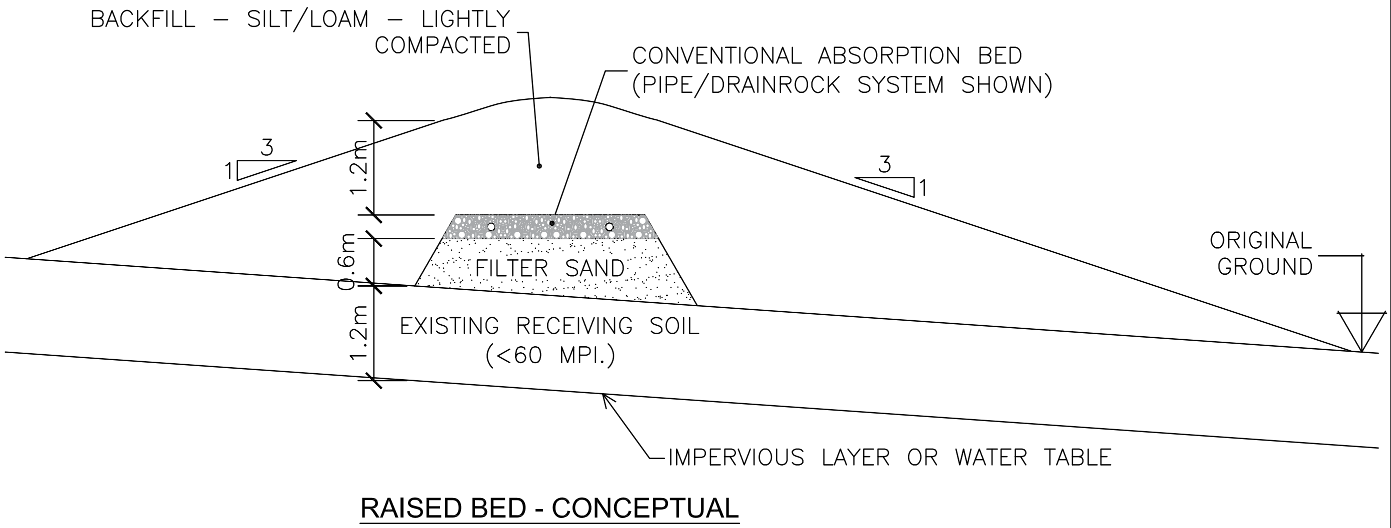
Average daily flow = 1710 lpd/1.5 = 1140 lpd (peak daily flow is 1.5 times the average daily flow)

Length of bed required = 1140 lpd/57.1 l/(m*d) = 20 m

Absorption bed area = 20 x 3.6 (two runs of perforated pipe) = 72 sq.m. would be the the required soil absorption area to prevent break out.

It is recommended that the line connect to the piping system at mid point (at right angles from higher elevation), and provide dispersal 10m in each direction which would provide more equal distribution to the entire absorption bed.

Figure 7: Raised Bed Conceptual



Construction of a Septic System in Dredge Tailings

The construction of an absorption bed over a sufficient thickness of suitable soil provides ample treatment against the migration of organics and bacteria.

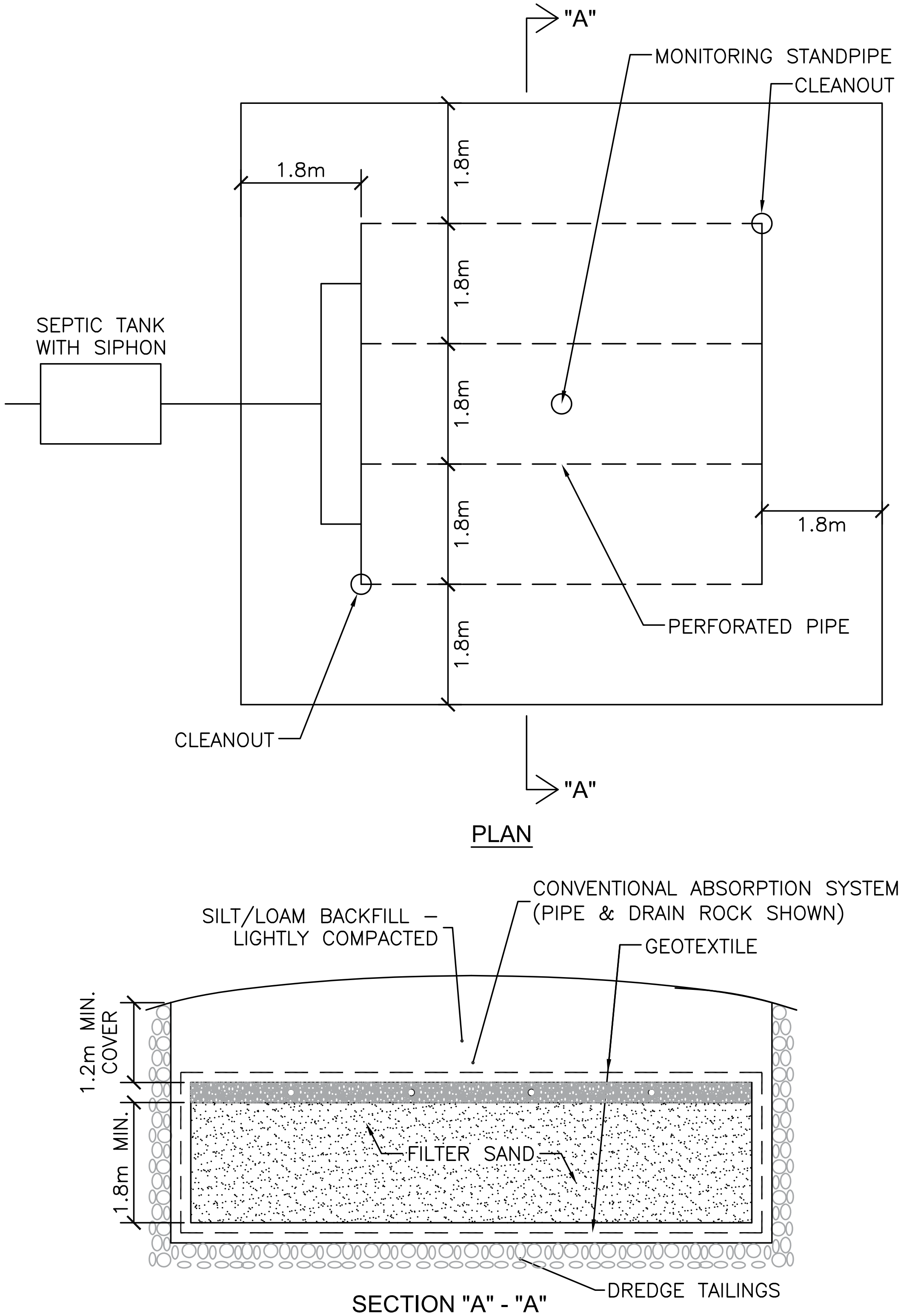
Setback distances should be examined carefully with respect to the proximity of surface water and potable water supplies, given that the migration of the effluent will likely be direct due to the coarse nature of the underlying tailings (a minimum of 200 feet is recommended).

Design criteria for a septic system in dredge tailings is as per the *Design Specifications for Sewage Disposal Systems* except for the following modifications to the absorption bed:

- Minimum of 6 feet (1.8 m) of accepting soil with a percolation rate of 5 min./25 mm [1 in.] or slower (see Appendix C) is to be provided beneath the drain rock.
- Accepting soil is to extend a minimum of 6 feet (1.8 m) from the distribution pipes.
- Geotextile is to be placed under the accepting soil at the dredge tailings interface and extend on all sides up to the upper layer of the geotextile.
- Finish grade over the bed must be backfilled and mounded with silt loam material and extend 2 feet beyond the edge of the absorption bed area to ensure the diversion of surface water.

See Figure 8 on next page.

Figure 8: Septic System in Dredge Tailings



SEPTIC SYSTEM IN DREDGE TAILINGS (CONCEPTUAL)

Appendix A – Estimated peak sewage flows per day*

ESTABLISHMENT	Litres	Gallons (Imp.)	Per each:
BARS and LOUNGES	120	26	Seat
CHURCHES			
With kitchen	32	7	Sanctuary seat
Without kitchen	22	5	Sanctuary seat
CAMPS			
Campsite with central comfort station	130	29	Campsite
Campsite with flush toilets - no showers	90	20	Campsite
Construction camps (semi-permanent)	190	42	Person
Day camps	55	12	Person
COTTAGES and SMALL DWELLINGS (seasonal occupancy)	160	35	Person
DWELLINGS			
Boarding houses	160	35	Person
Apartments (multi-family)	200	44	Person
Rooming houses	150	33	Person
Single family	570	125	Bedroom
FACTORIES			
No showers	110	24	Employee
With showers	150	33	Employee
FOOD SERVICE OPERATIONS			
Ordinary restaurant	150	33	Seat
24-hour restaurant	225	49	Seat
Take-out	20	5	Square metre of floor space
HOTELS (private bath)	365	80	Double room
LAUNDRIES (coin operated)	1700	374	Machine
MOTELS	320	70	Double unit
NURSING and REST HOMES	450	99	Person
OFFICE BUILDINGS	90	20	Employee
PUBLIC PARK	40	9	Person
RECREATIONAL VEHICLE PARKS	450	99	R.V. space with water and sewer hook-up
SCHOOLS			
Elementary	70	15	Pupil
Junior/Senior High	90	20	Pupil
SWIMMING POOLS	31	7	Swimmer

* The above estimated peak sewage flows per day should be used as a guide and represent average figures for various types of establishments. Actual values may vary, depending on site-specific conditions and usage factors. Peak daily flow = 1.5 times average daily flow

Appendix B – Calculating Soil Absorption Area Based on Percolation Test

PERCOLATION RATE [minutes per 25 mm (1 in)]
If the percolation test rate is between 0.1 and 5 minutes, the soil is considered too coarse and therefore the percolation rate too fast for trench systems. The absorption bed system must be installed with a sand filter 0.6 m (2ft) below the drain rock.

Percolation Rate minutes/25 mm (1 inch)	Minimum Soil Absorption Area Required			
	Absorption Bed		Wide and Deep Trench	
	m^2/bedroom	ft^2/bedroom	m^2/bedroom	ft^2/bedroom
5	17.4	188	11.6	125
6	18.8	203	12.5	135
7	20.0	215	13.3	143
8	21.0	227	14.0	151
9	22.1	237	14.7	158
10	23.0	248	15.3	165
11	23.7	255	15.8	170
12	24.5	263	16.3	175
13	25.1	270	16.7	180
14	25.8	278	17.2	185
15	26.4	285	17.6	190
16	27.5	296	18.6	200
17	28.1	302	19.1	206
18	28.5	308	19.7	212
19	29.1	314	20.4	220
20	29.7	320	20.9	225
21	30.3	326	21.5	231
22	30.6	330	22.0	237
23	31.2	336	22.6	243
24	31.8	342	23.2	250
25	32.4	348	23.8	256
26	32.7	353	24.3	262
27	33.3	359	24.9	268
28	33.8	363	25.6	275
29	34.4	369	26.1	281
30	34.8	375	26.7	287
31	35.3	380	27.2	293
32	35.9	386	27.8	299
33	36.3	390	28.4	306
34	36.8	396	29.0	312
35	37.5	401	29.6	318
36	37.7	405	30.1	324
37	38.3	411	30.8	331
38	38.6	416	31.3	337
39	39.2	422	31.9	343
40	39.6	426	32.4	349
41	40.1	431	33.0	355
42	40.5	435	33.6	362
43	40.8	440	34.2	368
44	41.3	444	34.8	374
45	41.7	449	35.3	380
46	42.2	453	35.9	386
47	42.5	458	36.3	391
48	42.8	461	36.9	397
49	43.2	465	37.5	403
50	43.5	468	37.8	407
51	43.8	471	38.2	411
52	44.1	474	38.6	415
53	44.4	477	38.9	419
54	44.6	480	39.4	424
55	44.9	483	39.7	427
56	45.2	486	40.1	431
57	45.5	489	40.3	434
58	45.8	492	40.7	438
59	45.9	494	41.0	441
60	46.1	495	41.4	445
Slower than 60 minutes per 25 mm (1 inch) soil absorption system may not be used.				

Appendix C – Absorption Bed/Sand Filter

In a soil formation with a percolation rate between 0.1 and 5 minutes/25 mm (1 in), 0.6 m (2 ft) of filter sand is to be installed below the drain rock. This sand (accepting soil) is to meet the following gradation:

Sieve (mm)	Percent Finer by Weight
#4 sieve (4.75)	**100**

- 100 per cent of the "sand" must pass through a #4 sieve (i.e., cannot contain any gravel)

#10 sieve (2.00)	**75-100**

- Up to 25 per cent of the "sand" can be retained on a #10 sieve
- Between 75 per cent to 100 per cent of the "sand" can pass through a #10 sieve

#60 sieve (0.25)	**15-75**

- Between 25 per cent to 85 per cent of the "sand" can be retained on a #60 sieve
- Between 15 per cent to 75 per cent of the "sand" can pass through a #60 sieve

#200 sieve (0.08)	**0-15**

- Between 85 per cent to 100 per cent of the "sand" can be retained on a #200 sieve
- Up to 15 per cent of the "sand' can pass through a #200 sieve (i.e., can have up to 15 per cent silt and/or clay)

Silt & Clay	Sand	Gravel
Less than #200 sieve (0.08 mm)	Between #200 sieve (0.08 mm) and #4 sieve (4.75 mm)	Greater than #4 sieve (4.75 mm)

Different graded material may be used if the percolation rate is limited to 5 min/25 mm (1 in). This is equivalent to a design rate of 60 lpd/m² (1 gpd/ft²). The intent of the filter sand is to ensure that wastewater does not exit the layer too quickly to permit the organic mat to complete treatment. Where a sand filter is required, an absorption bed system must be used which only uses the bottom area for percolation.

Appendix D – Summary of Setback Distances

Septic tank, sewage holding tank or contained privy must not be less than:

1.5 m (5 ft):	from a lot boundary
1.5 m (5 ft):	from any building
5.0 m (16 ft):	from a road or driveway
9.0 m (30 ft):	from a buried water storage tank
15.0 m (50 ft):	from any source of potable water, or natural boundary or high water level of any water body

Soil absorption system or pit privy must not be less than:

1.2 m (4 ft):	from any seasonal high ground water table or impermeable barrier such as bedrock, clay or permafrost
3.0 m (10 ft):	from septic tank (refers to distance between the outlet of septic tank to header pipe of soil absorption system)
5.0 m (16 ft):	from a lot boundary
5.0 m (16 ft):	from any road or driveway
6.0 m (20 ft):	from any building
30.0 m (100 ft):	from any source of potable water, or natural boundary or high water level of any water body

Sewage disposal system must not be less than:

9.0 m (30 ft):	from a buried holding tank for potable water
60.0 m (200 ft):	from any community well

Guidelines for Soils Investigation and Percolation Testing

Accurate soils information together with percolation test data are key ingredients necessary to properly design a soil absorption system. Following are guidelines for soils investigation work and for conducting a percolation test.

Soils Investigation

A test pit using a backhoe is normally required for the soils investigation and must be excavated within 3 metres of the anticipated absorption system. The test pit must be at least 4m in depth or more to confirm that there will be at least 1.2 m separation below the absorption system to groundwater, impermeable soil layer or bedrock. See Figure 9. For large systems and residential systems with 5 bedrooms or more, a minimum of two soils investigations and test pits are required.

Prepare a detailed log of the test pit as per the application form describing changes in soil texture and colour as well as identifying the presence of bedrock, impermeable soil layer or bedrock. Soil texture is the proportion of sand, silt, and clay content in the soil. The Canadian Soil Textural Triangle is used to classify different combinations of sand, silt and clay into thirteen texture classes (Figure 11). In the field, the objective of the soils investigation is to determine the appropriate textural class for the on-site soils. Soil textures are described in Table 4.

Collect a sample consisting of 8 cups of soil at the depth of the proposed absorption system and submit it with the *Application for a Permit to Install a Sewage Disposal System*. This will aid in determining that the percolation rate obtained is consistent with the soil texture identified in the soil description and will provide a hydraulic loading rate to be used in the design of the absorption system (the hydraulic loading rate is expressed in area/bedroom – see Appendix B).

Correctly identifying soil texture is especially important for fine-grained soil types, as the accuracy of using percolation rates to determine hydraulic loading rates in silt and clay soils has been shown to differ significantly in comparison to other methods of soil characterization, including hydraulic conductivity and soils profiling. Inaccurate loading rates can decrease the life expectancy of the soil absorption system. A range of percolation rates based on soil textural properties is provided in Table 4. In some cases, a soils analysis and classification from a geotechnical firm may be warranted.

Percolation Test

The percolation test is a field procedure conducted in the soil horizon selected for installation of the proposed absorption system. The test is a method for observing the rate at which clean water will permeate the soil under saturated conditions. The volume of effluent per day that is applied onto the infiltrative surface of the soil absorption system per unit area is defined as the hydraulic loading rate. The percolation rate together with soils investigation information is used to determine the hydraulic loading rate for sizing the absorption system which in this manual is expressed as the minimum soil absorption area that is required for an applied volume of effluent from two persons (i.e., one bedroom) in a residence and is equivalent to 570 Lpd (125 IGpd) for various percolation rates.

Following is an approved method for carrying out a percolation test:

- During the soils investigation work, excavate a bench into the sidewall of the test pit at the depth of the proposed absorption system.
- Dig a test hole into the bench, 150 mm in diameter and 300 mm deep for the percolation test. The hole must be no closer than 0.5m from the edge of the pit excavation. The bottom of the test hole must be at least 1.2 m above bedrock, impermeable soil layer or groundwater. See Figure 9.

- If the sidewalls or bottom of the hole became smeared during the excavation with the auger, they should be scratched or scarified.
- Remove all loose material from the bottom of the test hole. Place 50 mm of 6 mm to 20 mm size gravel to protect the bottom from scouring when water is added. Alternatively, the gravel can be contained in a mesh bag to be removed after the test is performed for use in future percolation tests.
- Carefully fill the test hole with clean water to at least 300 mm in depth, and continue to do so until the soil is saturated. Keep soaking the hole until the rate at which the water level drops becomes constant.
    - If the soil layer consists mainly of silt or clay materials, which will have a low rate of permeability, water will have to be kept in the hole for a long time period to allow for saturation and swelling. Keep water in the hole for at least 4 hours and preferably overnight. Refill as necessary, or supply a surplus reservoir of water, maintaining the 300 mm depth with an automatic siphon. Use a hose or similar device to add water to the hole and to prevent washing down the sides of the hole. This ensures that the soil has ample time to become fully saturated and approach actual field conditions when the system is operational. The test must be carried out immediately after pre-soaking.
    - If the soil layer consists mainly of sand or gravel materials, it may be difficult to retain water in the hole after attempting to saturate the soil. In this case it can be assumed the percolation rate will be faster than 5 minutes per 25 mm. Should this be the case, then 0.6 m of filter sand must be installed below the absorption bed in order to provide treatment to the sewage before it enters into the underlying soil.
- The testing is best carried out with the use of a percometer which can be constructed as shown in Figure 10. Regardless of the methods used, a set-up is required which can be used to accurately measure water levels in the hole.
- To undertake the test, fill the test hole with water. When the water level drops to 130 mm or less from the bottom of the hole, refill the hole to the top. No recording of the time needs to be done for these two fillings. When using the percometer, pour the water into the hole through the percometer. Note that the water depth measurements are from the bottom of the hole and not from the top the gravel layer.
- When using the percometer, ensure that it is adequately supported to prevent lateral movement. Lath may be used as indicated in Figure 10.
- When the water level, after the second filling is 130 mm or less from the bottom of the hole, add enough water to bring the depth of water to 150 mm or more.
- Commence timing when the water level is at 150 mm and stop timing when the level reaches 125 mm. Record the time interval in minutes for the drop of 25 mm.
- Repeat the test until the last three rates of fall do not vary more than 10 per cent.
- Where more than one percolation test hole is required, the percolation rate for the proposed absorption system is obtained by averaging the slowest rate for each of the test holes.

Record the test results in the *Application for a Permit to Install a Sewage Disposal System*.

Figure 9: Soils Investigation and Percolation Test Hole

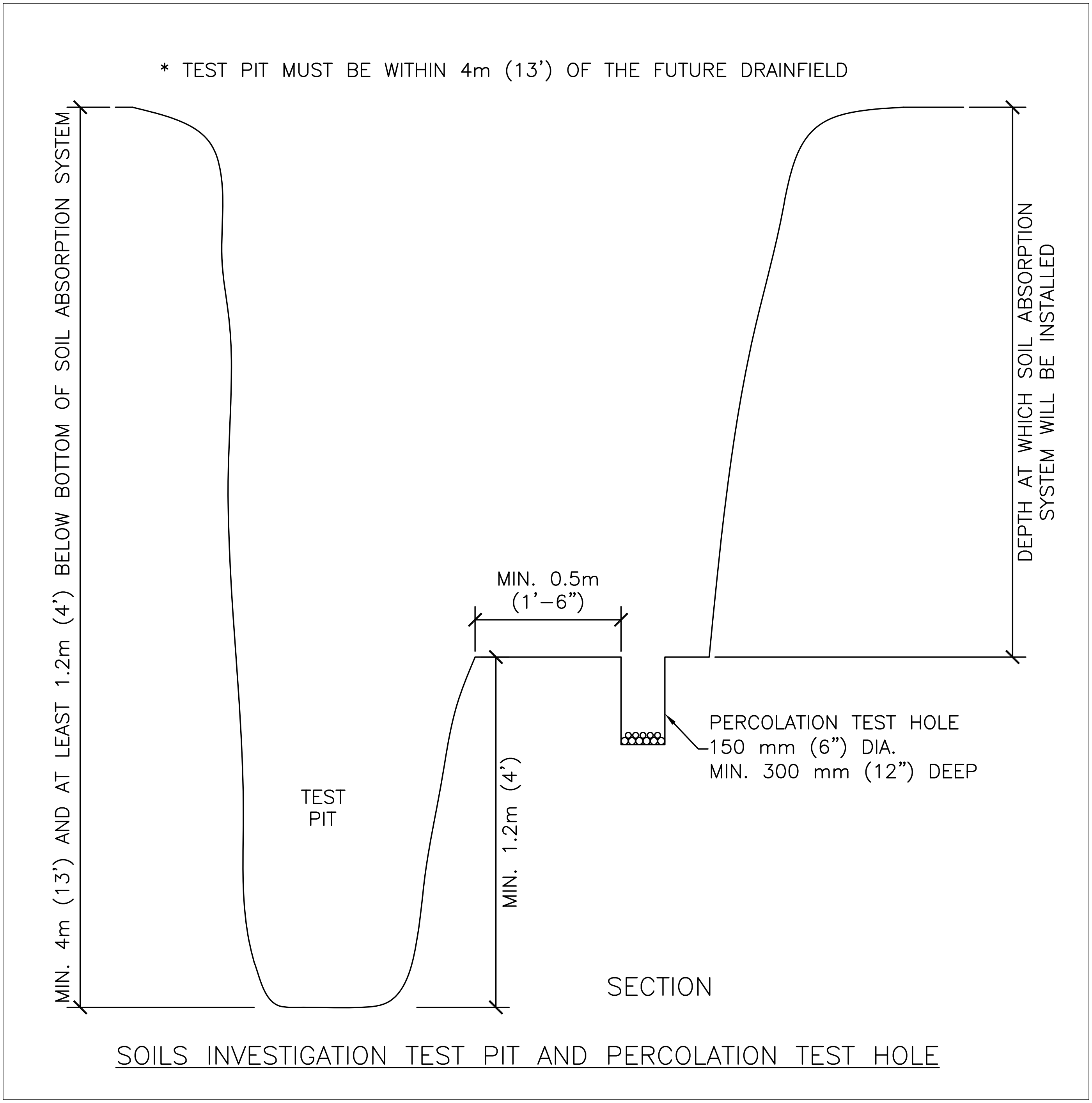


Figure 10: Percometer

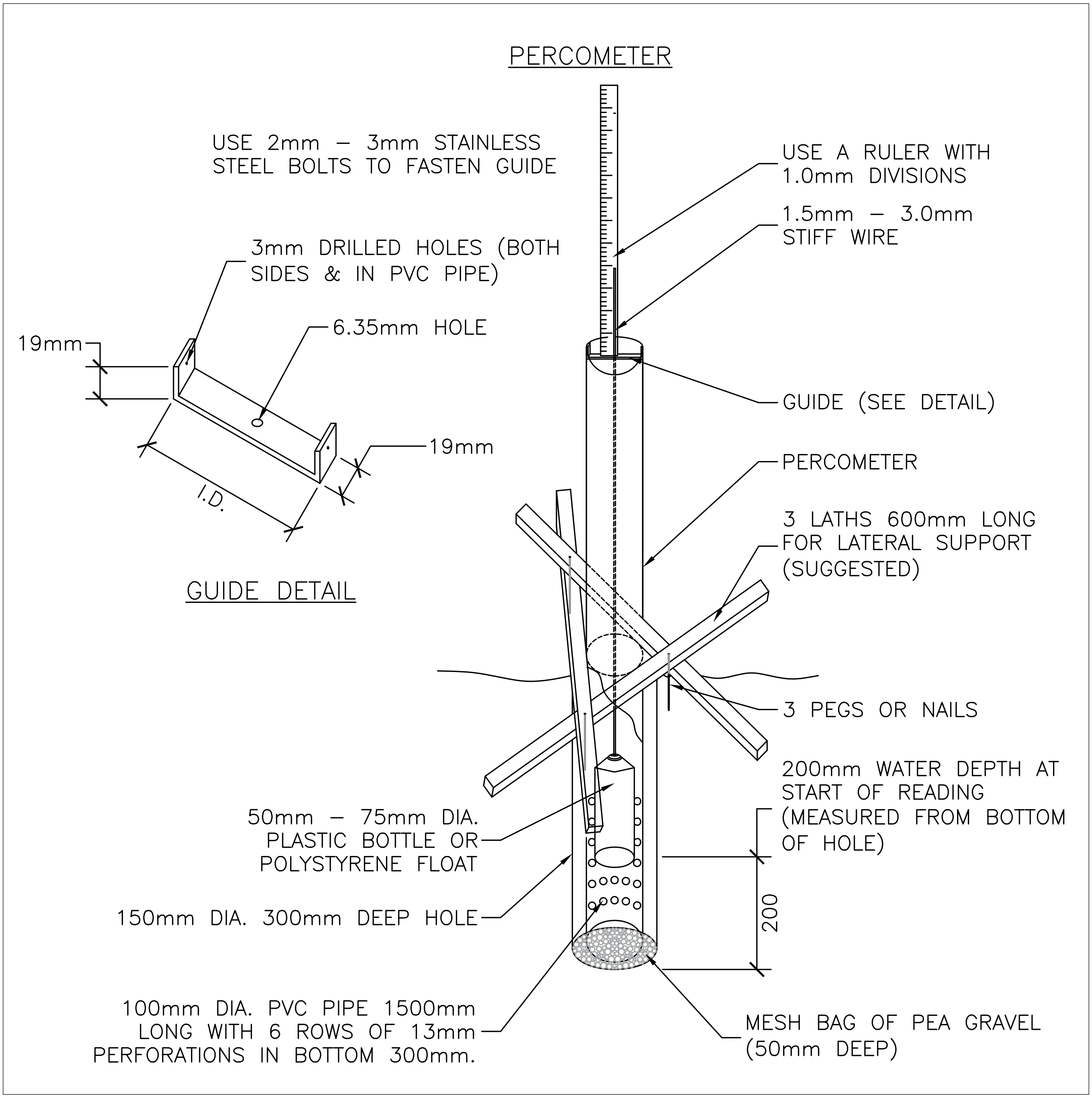
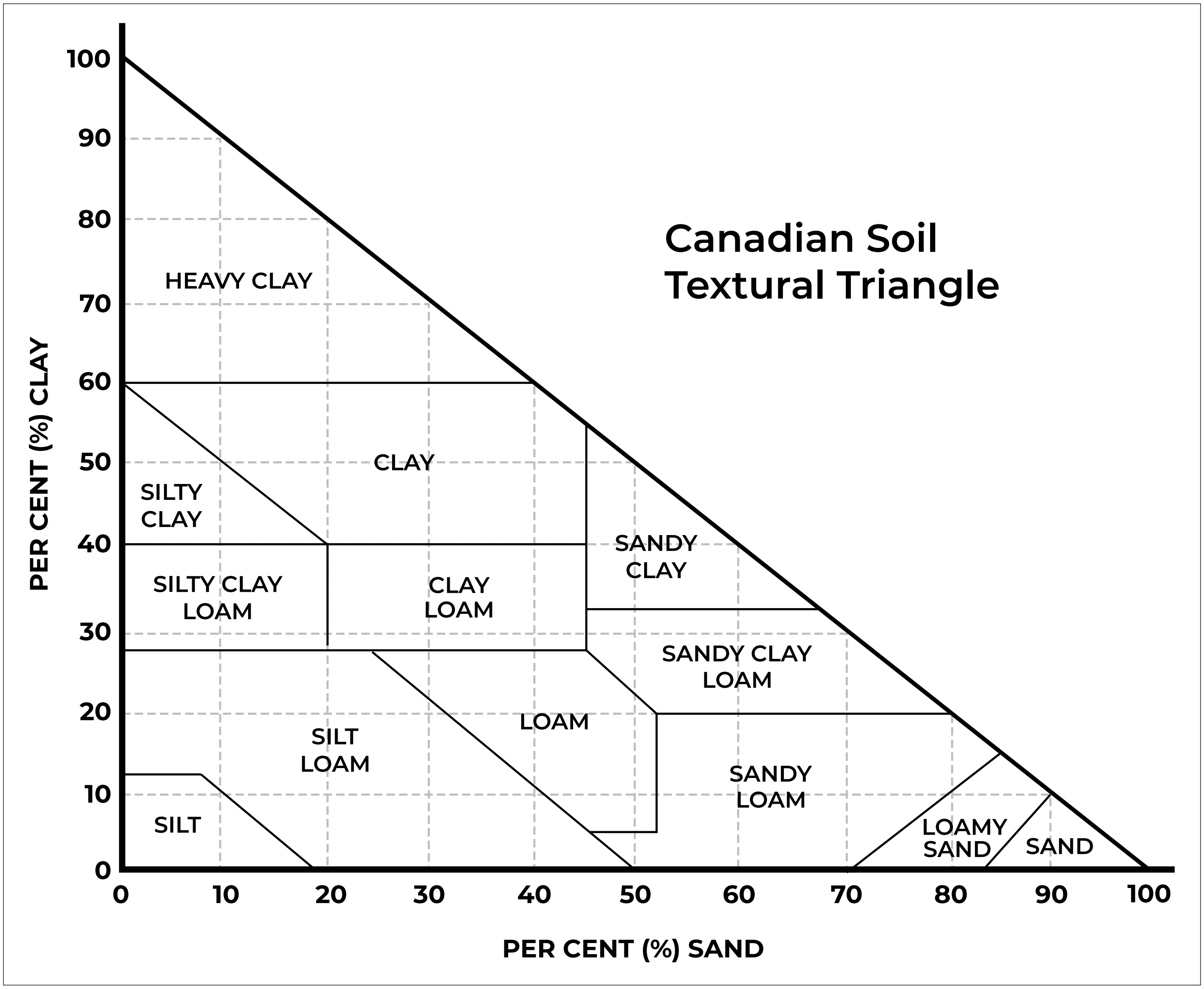


Table 4 – Textural Properties of Soils

Soil Texture	Dry Soil	Moist Soil	Percolation Rate (Minutes/25mm)
Gravelly sand	Loose stones and single grains which feel gritty	Squeezed in the hand, it does not form a cast. Does not form a ribbon between thumb and forefinger	Less than 2.5
Coarse to medium sand, loamy sand	Gritty with slight amount of floury material	Squeezed in the hand, it forms a very weak cast which crumbles when touched. Does not form a ribbon between thumb and forefinger	2.5 – 5
Fine sand, fine loamy sand	Gritty with moderate amount of floury material	Weak cast no handling. Almost flakes if sand portion is very fine sand or fine sand. Does not form a ribbon between thumb and forefinger	5 – 15
Coarse sandy loam, medium sandy loam	Gritty with considerable amount of floury material	Weak cast, allows careful handling. Does not form ribbon.	10 – 30
Fine sandy loam, very fine sandy loam	Gritty to very gritty. Forms weak aggregates.	Moderate cast, easily handled. Will stain fingers.	30 – 60
Loam	Fairly soft and smooth, somewhat gritty. Aggregates are slightly difficult to break.	Good cast, readily handled. Barely begins to ribbon.	20 – 40
Silt loam, silt	Aggregates are moderately difficult to break, floury powder clings to fingers. Feels soft and floury.	Weak cast, allows careful handling. Flakes, rather than ribbons. Smooth, slick, velvety or buttery feel.	20 – 60
Clay loam, sandy clay loam, silty clay loam	Very firm aggregates and hard clods that break with some difficulty.	Moderate to strong cast. Sandy clay loam will form short and thick ribbon (<3cm). Clay loam and silty clay loam will form fairly thin ribbon which break readily, barely supports own weight.	40 – 90
Sandy clay, silty clay, clay	Aggregates are extremely hard and strongly resist crushing by hand. When pulverized, has grit-like texture due to harshness of numerous very small aggregates which persist.	Forms strong to very strong cast with thin fairly long ribbon (5 to 7.5 cm), flexible and holds own weight. Rubbed surface has very smooth, satin feeling. Sticky, plastic and easily puddles.	90 – 120 or greater

Figure 11: Canadian Soil Textural Triangle



Application Submission Requirements

Please be advised that applications must be received at least 48 hours in advance of planned receipt of the permit.

As a minimum, the following must be submitted to Environmental Health Services along with an *Application For A Permit To Install A Septic System*:

- A site plan drawing showing a profile of the system layout, including septic tank, absorption system, plus a the location and horizontal distances between all system components, water supply, structures and lot boundaries.
- An 8-cup soil sample from the percolation test hole from the depth at which the soil absorption system will be installed.
- Where applicable, the pump-up system design rationale and specifications for:

  - pump selection

  - controls (level switch settings)

  - force main (type, diameter, class, insulation)

  - height and distance for effluent transfer from tank to absorption system

Designs for septic systems can be completed by the homeowner, contractor or an engineering consultant.

A permit must be issued prior to installing any part of the system.

Permitting

If all necessary data is supplied and the proposed system is deemed suitable, a ***Permit to Install a Sewage Disposal System*** will be issued. Note that the permit is also subject to compliance with federal, territorial and municipal laws, including subdivision prospectus agreements.

After the sewage disposal permit has been issued, a building permit for new house construction may be issued by the municipal or territorial government. An occupancy permit will not be issued by the Building Department until final approval to use the septic system is obtained from Environmental Health Services.

> ***Once a permit has been issued there can be no alteration to the sewage disposal system or other work it refers to without the approval of a health officer.***
> *S.11 Sewage Disposal Systems Regulation*

Installation

It is very important that a septic system be installed carefully and in strict accordance with the approved design. Failure to do so may result in problems with the system. The septic tank must be installed and suitably bedded, design grades for building sewers must be adhered to, and care must be taken to ensure the absorption bed components are installed according to the approved design and design specifications.

Before backfilling a septic system, the owner or agent must contact Environmental Health Services at least 72 hours before a final inspection is required. An inspection may be scheduled by a health officer. The system may not be backfilled until permission is granted by Environmental Health Services.

Photographic Record of the Stages of Installation Required

The *Sewage Disposal Systems Regulation (s.13(1)(a)* requires a photographic record of the stages of installation to be provided to a Health Officer within 30 days of installation of the sewage disposal system.

The photographic submission requirements must be met, regardless of whether a health officer completes an inspection during the system installation.

All photographs must be marked with the permit number and the legal description of the property on which the sewage disposal system was installed. **Please refer to the list below** and **add the relevant number from the list to the photograph so as to confirm what is depicted in the photograph**. Several listed items may be shown in a single photograph; in such case please add all relevant numbers to that photograph.

Delays in issuing Approval to Use may occur if the photographs do not clearly depict all stages of installation of the sewage disposal system, or if the record is incomplete.

Septic Tanks and Sewage Holding Tanks

If a septic tank or sewage holding tank will be installed, submit photos depicting the:

1. Certification marking or label on septic tank or sewage holding tank (e.g., CAN/CSA-B66).
2. Volume marking(s) on the septic tank or sewage holding tank (e.g., stencil on the tank).
3. Excavation with bedding material at base (prior to placement of tank).
4. Excavation containing the septic tank or sewage holding tank.
5. Bedding material (e.g., pea gravel) surrounding tank.
6. Trench between septic tank or sewage holding tank and the building to which it will be/is connected – must show pipe in place with flex coupler.
7. The septic tank or sewage holding tank covered with soil to original ground level showing all clean-outs and observation pipes, and relationship to building that it services (if present) or other distinguishing permanent landmark(s).

If a septic tank will be installed, submit a photo depicting the:

8. Pipe with flex coupler in place in trench between septic tank and soil absorption system.

If a sewage holding tank will be installed, submit photos depicting the:

9. High level alarm and automatic water shut-off.
10. Floats attached to float tree within the tank. If the tank will be installed in a location with high ground water or an area prone to flooding, submit a picture depicting the:
11. Anchoring harnesses, turnbuckles, and cables in place and attached to tank as per manufacturer’s requirements.
12. “Deadmen” or concrete pad used for anchoring purposes as per manufacturer’s requirements.

Soil Absorption System

If a soil absorption system will be installed, submit a photo depicting the:

13. Excavation for the soil absorption system that shows the soil profile.

If installing a soil absorption system in **"fast soils"** (less than 5 minutes per inch percolation rate) submit photos depicting the:

14. Filter sand and its depth – a tape measure or similar device must appear in the picture.

If installing a soil absorption system using **drain rock**, submit a picture depicting the:

15. Drain rock and its depth – a tape measure or similar device should appear in the picture. For trenches, show width and depth.
16. Perforated pipe(s) laid out on the drain rock - the total length of the pipes and width between the pipes must be clear and easy to determine - a tape measure or similar device should appear in the picture. If soil absorption system is installed in sections, a picture of each stage of installation of the pipe must be provided.
17. Solid header and footer pipes. A level should appear in the picture to show that these have been installed level.
18. Cleanout and monitor standpipes in place.
19. Perforated pipe(s) covered with drain rock.
20. Drain rock covered with geotextile or rigid insulation.
21. Soil absorption system covered with soil to original ground level showing all clean-outs, observation pipes, and relationship to building that it services (if present) or other distinguishing permanent landmark(s).

If installing a soil absorption system using **chambers**, submit a picture depicting the:

22. Chambers (the area and width must be clear and easy to determine) – if installed in sections, a picture of each stage of installation of the chambers must be provided.
23. Layer of geotextile cloth laid beneath first section of chamber (unless product-specific splash plate, gravel, perforated piping or other method is used, if so provide photo showing that).
24. Monitor and clean-out pipes in place extending from chambers.
25. Header pipe feeding each chamber run.
26. Soil absorption system covered with soil to original ground level showing all clean-outs, observation pipes, and relationship to building that it services (if present) or other distinguishing permanent landmark(s).

Pump-Up and Raised Soil Absorption Systems

If the sewage disposal system is to contain a mechanical pump (inside your septic tank) that discharges sewage to a raised soil absorption system, submit photos depicting the:

27. Pump on mount or stand in septic tank.
28. Floats in place attached to float tree.
29. Force-main exiting man-way.
30. Force-main mounded or otherwise elevated (to ensure that the pipe drains completely back to pump chamber).
31. Insulation of the force-main (if/when burial depth is less than four feet).
32. Vacuum breaker (to prevent back-siphoning)
33. Frost lid or other suitable insulating method of man-way.
34. Warning indicator system and automatic water shut-off systems in place.

Note: Please include photographs that show any part of the installation of the sewage disposal system not described above.

Getting Your System Approved

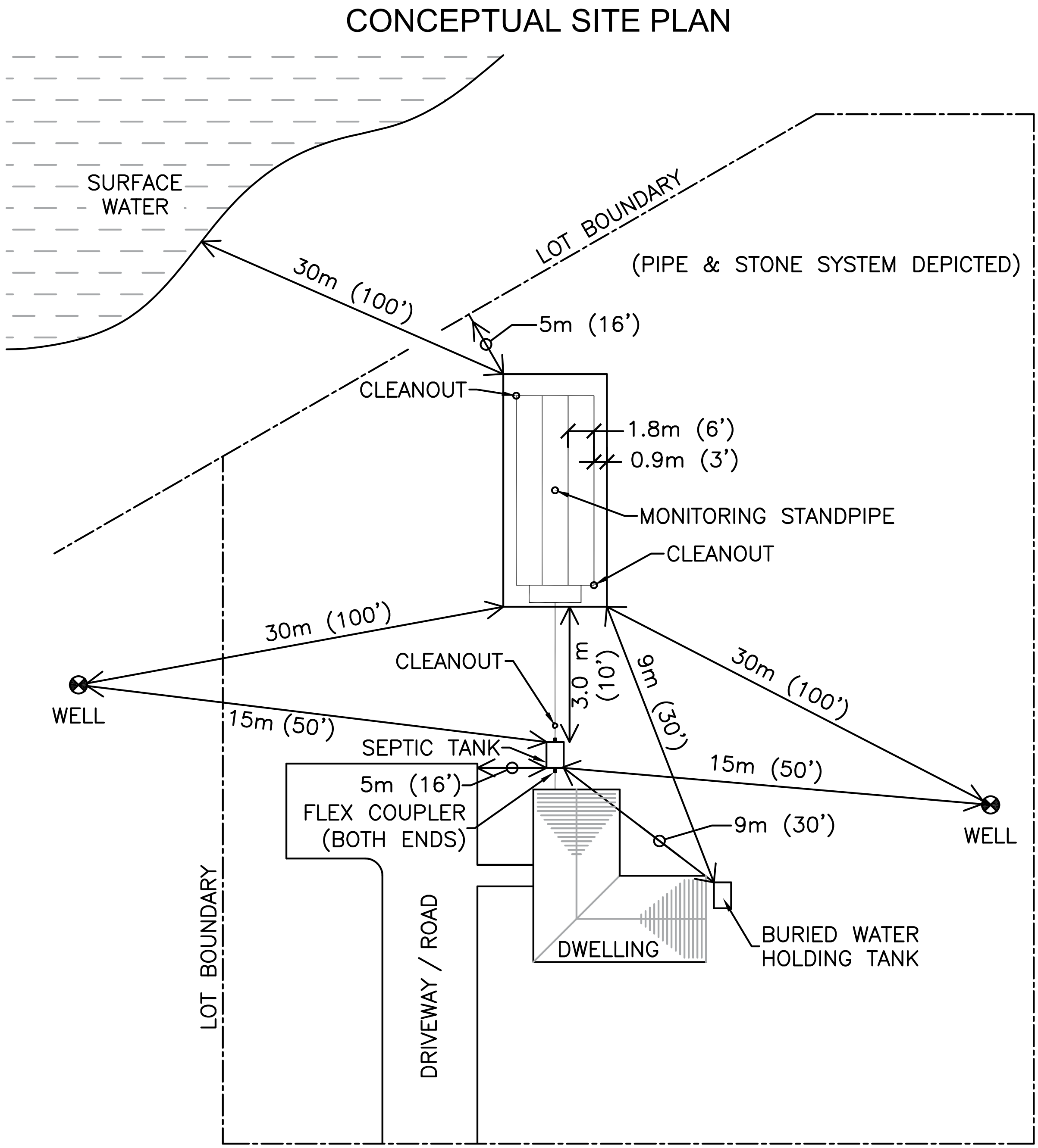
Within 30 days of the installation of the system, the following information shall be provided to a Health Officer:

- *Septic Tank and Sewage Holding Tank Installation Declaration* form;
- *Notification of Installation and Undertaking to Maintain a Sewage Disposal System* form, or *Notification of Installation and Undertaking to Maintain a Sewage Holding Tank* form;
- *Electrical Assurance* forms completed by a certified electrician;
- Photographic Record of the stages of installation;
- Other documentation as requested by the Health Officer (e.g., septic or holding tank CSA approval, *Notification of Abandonment and Reclamation of a Sewage Disposal System* form, receipts for purchase).

> ***Provided that the Health Officer is satisfied that all requirements have been met, written approval to use the sewage disposal system shall be issued by the Health Officer.***
> *13(2) Sewage Disposal Systems Regulation*

Records of installation and a letter of approval will help in future sale of the property and in the processing of financing arrangements.

Figure 12: Site Plan Example



MINIMUM SETBACK DISTANCES		
SEPTIC TANK	MIN. SETBACK	ABSORPTION SYSTEM
1.5m (5 ft.)	LOT BOUNDARY	5m (16 ft.)
1.5m (5 ft.)	ANY BUILDING	6m (20 ft.)
5m (16 ft.)	ROAD / DRIVEWAY	5m (16 ft.)
15m (50 ft.)	WELL / WATER BODY	30m (100 ft.)
9m (30 ft.)	BURIED WATER HOLDING TANK	9m (30 ft.)
THE ABSORPTION SYSTEM SHALL BE A MINIMUM OF 3.0m (10 ft.) FROM ANY SEPTIC TANK		

Operation and Maintenance of a Sewage Disposal System

A sewage disposal system which has been properly installed should, with proper care and maintenance, provide many years of service. There are, however, some things which you, the homeowner, should be aware of that will help the system to function properly. These are:

1. Surface Water
Do not allow roof drains to discharge to the septic tank or surface waters to drain towards the area of the soil absorption system.

2. Water Usage
Excessive and unnecessary water usage should be kept to a minimum in the home. If automatic washers and dishwashers are used, make sure full loads are washed each time. Excessive use of water, such as doing numerous washings in one day, could flush solids from the tank to the disposal field.

3. Garbage Disposal Units
Wastes from garbage disposal units are not easily digested by bacteria in the septic tank and only add to the volume of solids in the septic tank which must be removed by pumping the tank. Therefore, the use of garbage disposal units is not recommended.

4. Operation
Moderate use of household drain solvents, cleaners, disinfectants, etc. should not interfere with the operation of the sewage disposal system, but indiscriminate use may cause problems. Toilet paper substitutes, paper towels, newspaper, sanitary napkins, etc. should not be flushed into the septic tank since they will not readily decompose.

5. Starters and Cleaners
There is no need to use commercial “starters”, “bacterial feeds”, or “cleaners” for the septic tank or disposal field. Some additives can actually create problems by causing solids to be carried into the absorption system, resulting in soil clogging.

6. Inspection and Cleaning
The septic tank should be inspected once every year and the tank pumped out when necessary. As a minimum, the tank should be cleaned every two years. Failure to pump out a septic tank when required may result in sludge or scum being carried over to the disposal field, resulting in soil clogging and complete failure of the system. The tank should not be washed or disinfected after pumping. The cleaning should be performed by professionals familiar with proper procedures and having adequate equipment.

7. Vegetation
The area over a disposal field should have a good vegetation cover. However, shrubs or trees should not be planted over the area in order to allow the system to be kept open to sunlight.

8. Increased Waste Loads
If the waste loads and volumes of sewage entering the soil absorption system are greater than that for which the system was designed, failure of the field can occur. Contact the Environmental Health Office regarding enlargement/repair/replacement options.

9. Vents and Accesses
During the winter, airtight caps should be securely fastened on all cleanouts and monitoring pipes. These pipes should also be fitted with insulation plugs to help discourage the escape of heat from the soil absorption system.

10. Traffic Over Absorption System

The area above and near a soil absorption system should never be used as a traffic area for vehicles or pedestrians. An accumulation of snow is important in order to maintain a cover of natural insulation to prevent freezing.

During winter months, it is recommended that a snow fence or other suitable barrier be placed around the absorption system to discourage any traffic on the area. This will help maintain a thicker layer of snow insulation over the area.

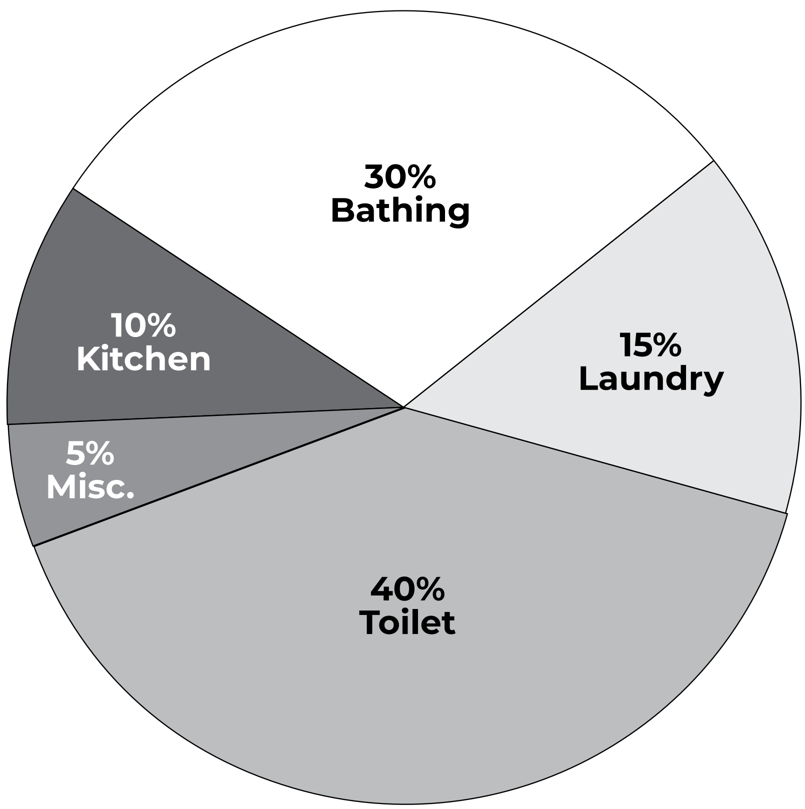
11. Periodic Occupancy

If the residence is used only periodically, or if extended absences occur, freezing problems can develop in the winter. Extra insulation (i.e. leaves, straw, sawdust, snow) over the system can help to reduce the freezing potential. When the house will be vacant for extended time periods, and there is a potential for freezing, it is advisable to have the septic tank emptied.

12. As-Built Plans

A detailed diagram showing the exact location of the septic tank and disposal field should be placed in a suitable location in the home for future reference along with the application, final approval certificate, and photos of the installation. This documentation can also be helpful when selling the property at a later date.

Water Usage of a Typical Household



Glossary

chemical and biological breakdown
A natural treatment process whereby sewage is converted to other materials that are less harmful to humans and the environment.

drain rock
Clean gravel, 20 to 65 mm (3/4 to 2-1/2") in diameter, with no more than 3 per cent fines (0.080 mm) residual after screening. These specifications must be adhered to for final approval of soil absorption systems.

fecal coliforms
A large group of bacteria which normally thrive in the intestines of warm-blooded animals including humans. Their presence indicates recent sewage contamination.

geotextile
An approved permeable filter fabric which prevents mixing of finer soil materials with the underlying drain rock.

microorganisms
Organisms which cannot be seen with the naked eye, e.g. bacteria, viruses, and certain parasites.

percolation rate
The time rate of water drop in a test hole expressed as minutes per 25 mm (1''). The percolation rate must be determined in accordance with procedures specified by Environmental Health Services. It is a measure of the soil's ability to absorb liquid and is the single most important parameter used to size a soil absorption system.

sand filter
Fine sand/silt material that has a percolation rate of 5 minutes/25 mm (1") or slower. In course, granular soils having a rapid percolation rate, a sand filter 600 mm (2 feet) deep must be installed to reduce the rate of effluent percolation through the soil to ensure adequate soil treatment of the effluent.

septic tank effluent
The liquid that flows out from a septic tank.

set back
A separation distance, measured horizontally.

soil absorption system
A subsurface disposal system used to absorb effluent from the septic tank. Two main types of systems are the absorption bed and the absorption trench.

References

CSA B65:12 Installation code for decentralized wastewater systems

CSA B66:21 Design, material, and manufacturing requirements for prefabricated septic and sewage holding tanks.

For more information on sewage disposal systems in Yukon, please contact:

Environmental Health Services

2 Hospital Road

Whitehorse, Yukon Y1A 3H8

Phone: 867-667-8391

Toll-free (within Yukon): 1-800-661-0408, ext. 8391

Fax: 867-667-8322

E-mail: **environmental.health@yukon.ca**

Yukon

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