Common Types of Private Sewage Works

There are many types of private sewage systems. The Saskatchewan Onsite Wastewater Disposal Guide provides recommended selection criteria for a number of systems. The information provided for these systems is intended to allow for the adequate treatment of domestic wastewater. Commercial or industrial wastewater may need additional treatment and a design specific for the facility.

1. Holding Tanks

A holding tank is a one compartment tank designed to collect and hold sewage without treatment prior to its being transported to a final point of disposal.

Holding tanks are not treatment devices. Sewage haulers remove the sewage from the tank and dispose of it in a location acceptable to the Ministry of Environment. This may be an area of land or a nearby sewage treatment facility.

Advantages:

- There is no need for electricity and mechanical equipment.
- Very little maintenance of the system is required.
- Discharge of sewage and/or treated effluent does not occur in the location of the residence.
- The initial cost of the system is low.

Disadvantages:

- The frequency of sewage removal will vary based on water usage within the home and the size of the tank. However, a permanent residence will usually have to pump the tank once or twice a week.
- A sewage hauling truck requires easy access to the tank access port and will be onsite frequently.
- During pumping, a significant amount of noise and objectionable odours may be created.
- An improperly covered tank access point may create a hazard.
- Ongoing sewage hauling creates an ongoing cost that will increase with time based on higher environmental standards for disposal and increasing fuel costs.
- Total life cycle costs for this approach are often much higher than a well maintained septic tank and soil absorption field.

Holding tanks are covered in Section 5 of the Saskatchewan Onsite Wastewater Disposal Guide.

2. Lagoons

A lagoon is a large gently sloped basin in the ground that is designed to contain sewage. The liquid is disposed of through evaporation, while the solids are retained and broken down by microorganisms. A lagoon may be an acceptable private sewage system option for areas of clay where disposal fields are likely to fail due to the inability of the soil to accept water.

A lagoon should not be confused with a seepage pit. A seepage pit is an excavation which allows wastewater to soak into the surrounding soil and over time seep away. Seepage pits are not considered adequate private sewage systems for situations where domestic sewage is generated from a building with internal plumbing.

Population Health
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Regina, SK S4S 6X6

1-800-667-7766
(306) 787-0146

www.health.gov.sk.ca
HealthLine 1-877-800-0002
www.healthlineonline.ca

Lagoons can be designed to contain and treat the sewage before discharging effluent but easements along the discharge route and other considerations may make them unfeasible for an individual home or small commercial operation.

The primary requirement for a lagoon is that it is watertight. Lagoons are not designed to lose water to the soil and must be designed to contain water until it evaporates.

Advantages:

- Construction costs may be low in areas where a synthetic liner need not be installed.
- If a synthetic liner is used, a lagoon can be constructed on any soil type.

Disadvantages:

- Ongoing maintenance of the berms is required. This includes regular mowing, inspection for erosion and elimination of burrowing rodents.
- A large amount of land may be required.
- The local evaporation and precipitation rates need to be known in order to design a lagoon.
- Large lot sizes and separation distances (e.g. from residences) are required.
- Construction costs may be high if a synthetic liner is used.
- Over time solids will build up within the lagoon and will require periodic removal.

Lagoons are covered in Section 11 of the Saskatchewan Onsite Wastewater Disposal Guide.

3. Jet Type Disposal

A jet type disposal system is an open discharge of sewage. Effluent from a septic tank is pumped through a pipe to a location where the effluent is discharged onto the ground surface. This may be an acceptable private sewage system option for an isolated residence with a large amount of land. In areas of high residential development, this type of system is not recommended as it usually results in complaints with respect to odour and other aesthetic considerations.

Advantages:

- Construction costs are low.
- Little maintenance is required.

Disadvantages:

- Least effective treatment option.
- A large amount of land may be required.
- Surface discharge of sewage is visible and objectionable odours may be present.
- Large lot sizes and separation distances (e.g. from residences) are required.
- Changes to the system may be required in the future if the sewage effluent creates a nuisance, health hazard or the density of residential development increases.
- Winter operation may be problematic due to freezing.
- Spring thaw may result in effluent runoff from the area.
- Access to effluent by humans, rodents, birds, etc may be possible.

Jet type disposal is covered in Section 10 of the Saskatchewan Onsite Wastewater Disposal Guide.

4. Soil Absorption Fields & Septic Tanks

4.1. Septic Tank

A septic tank is a two compartment tank, where the first compartment is a settling tank and the second compartment provides storage of liquid effluent from the first tank. The working capacity is the volume of liquid held in the first compartment during regular operation. For a septic tank system of more than two compartments, the working capacity is the liquid volume of all but the final compartment.

Septic tanks in Saskatchewan must conform to CAN/CSA-B66 in all residential settings and may be made from reinforced concrete, fibreglass or polyethylene.

Everything that goes down the drain in the house travels first to the septic tank. It is a water tight receptacle designed to complete a number of essential functions. They are:

- Removal of solids by settling and floatation;
- Biological treatment; and,
- Storage of sludge and scum.

Septic tanks provide time for primary treatment to occur. This includes the settling of heavier solids to the bottom of the tank; the floatation of scum; and microbiological breakdown of material in the tank. The microbiological activity produces gases that must be vented from the tank (typically through the main house stack). Periodically, the built-up sludge and scum must be removed from the tank. The frequency is based on the usage of the system but often is in the range of two to three years.

Certain minimum sizes of septic tanks are specified for different types of homes. The volumes specified are intended to be based on 1.5 days of retention time under the highest flows likely to occur. It is important to realise that tanks may last for more than 25 years and therefore should not be sized based on actual water usage practices by the current residents of the home. Events such as family gatherings (e.g. Christmas) and other social events may result in a much higher flow for a short period of time. During these time periods, the septic tank should still be able to provide adequate treatment and protect the soil absorption field from excessive solids (and prevent the failure of the system).

Internal baffles hold the sludge and scum in the tank and the effluent leaves the tank usually using a siphon system or a pump. A siphon system uses a siphon to discharge a set amount of fluid to the field system. If a pump is used, it usually relies on a float system to turn the pump off and on. Another alternative is a trickle tank. This type of tank allows fluid to leave the tank at the same rate that it enters. This results in a slow trickle of effluent through the discharge pipe. A trickle tank is not a recommended method as it is very prone to freezing if the piping is not sufficiently buried.

The benefits of larger septic tanks are:

- Increased time for settling;
- Increased time for biological activity
- Increased storage capacity for sludge and scum (and decreased frequency of pumping).

The above benefits leads to lower amounts of solids and biological material reaching the soil absorption field, which prolongs the life of the field, increases the treatment of wastewater, and makes the field less prone to failure due to solids carry-over. In addition, a larger tank will often have to be pumped less frequently as more storage for sludge and scum is available.

There are some negatives related to larger septic tanks. Primarily this is due to increased installation costs and the increased possibility of additional heat loss during the winter.

It should also be noted that an improperly covered tank access point may create a hazard.

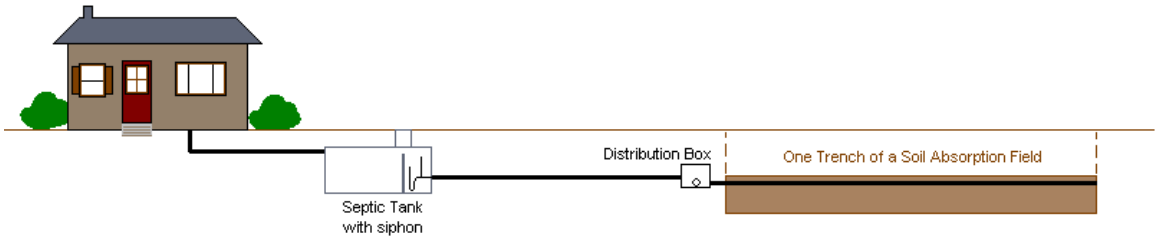
Septic tanks are covered in Section 6 of the Saskatchewan Onsite Wastewater Disposal Guide.

4.2. Soil Absorption Fields

Soil absorption fields are systems that utilize either the native soil or imported material to remove pathogens, organic matter and suspended solids. This removal occurs via physical filtration, aerobic biological reduction and ion bonding. The soil serves as a fixed medium on which beneficial aerobic microorganisms grow.

The distribution of effluent can occur below the level of the natural ground surface (e.g. gravity and pressure soil absorption fields), if sufficient native soil is present, or above the natural ground (e.g. type I and II mounds), where an insufficient depth of soil is present. The primary effluent from the septic tank can be discharged via gravity, if sufficient elevation difference is present between the field and the septic tank, or by pumping the effluent to the field. Once the effluent reaches the field, either gravity or pressure (from the pump in the septic tank) spreads the effluent through the field system.

4.2.1. Gravity Soil Absorption Field



A gravity soil absorption field consists of a septic tank and a below grade soil absorption field. The septic tank effluent is discharged to the soil absorption field usually by gravity but sometimes a pump is used. Within the field, gravity is used to distribute the effluent throughout the field. The most common methods in Saskatchewan use either a perforated pipe surrounded by stone or a chamber system within the field.

The main advantage of this type of system is simplicity. There are often no pumps and no electrical requirements. The main disadvantage is potential localized hydraulic overloading. As the system relies on gravity to distribute effluent, optimum distribution of effluent is not always achieved, which, in some cases, can lead to lower treatment or operational performance.

Advantages:

- The operation of the system is very simple.
- There are very low, and in some cases, no power costs.
- Because it is a below ground system, it is more protected from cold weather.
- There is no large mound of soil.

Disadvantages:

- Some studies indicate a less certain treatment performance in particular where underlying soils are granular.
- There is an increased difficulty locating the system in the future.
- Because it is below ground, it is more likely to be covered by parking pads, driveways, etc which may damage the system's integrity and performance
- Extreme care needs to be taken when installing the system to ensure that the trenches or distribution pipes are level.
- This system requires approximately 1.5 m (5 ft) of suitable soil below the 0.9 m (3 ft) deep trench.
- The distribution box may require periodic maintenance or re-levelling.

The following types of systems are considered gravity below grade soil absorption systems:

- Gravity absorption field
  - Section 8 of the Saskatchewan Onsite Wastewater Disposal Guide (Section 8.3.1 has specific instructions for gravity effluent distribution)

- Gravity chamber system
  - Section 7 of the Saskatchewan Onsite Wastewater Disposal Guide (Section 7.3.1 has specific instructions for gravity effluent distribution)
    - For some sites, the elevation drop between the septic tank and the soil absorption field is not sufficient to deliver the sewage effluent to the field. In those cases, a pump is used to lift the sewage to a pressurized manifold which feeds a gravity absorption field. Section 7.3.2 has specific instructions for gravity chamber system with pressurized delivery.

4.2.2. Pressure Soil Absorption Field

A pressure soil absorption field consists of a septic tank with pump that lifts the effluent to the field system. This results in evenly distributed effluent over the total area of the absorption field. Within the field, one of several options is used to distribute the effluent throughout the field. The most common methods in Saskatchewan are either a pipe surrounded by stone or a pipe and chamber system. The pipe has a number of small holes that spray the effluent into the surrounding material.

The main advantage of this type of system is a reduced potential for localized hydraulic overloading. The pressurized delivery system makes even distribution of effluent more certain. In addition, unlike a gravity absorption field, the distribution system for a pressure absorption field needs only to be approximately level. The main disadvantage is energy and power requirements. As the system relies on mechanical means to distribute the effluent, when a power disruption or a pump or control system malfunction occurs, the sewage does not leave the septic tank. If the disruption or malfunction occurs for a long enough period of time, the septic tank will become full and wastewater from the house will begin to backup into the home plumbing drainage system.

Advantages:

- There is more even distribution of sewage effluent leading to more reliable treatment.
- Because it is a below ground structure, it is more protected from cold weather.
- There is no large mound of soil.
- Typically, this is one of the least expensive treatment options.

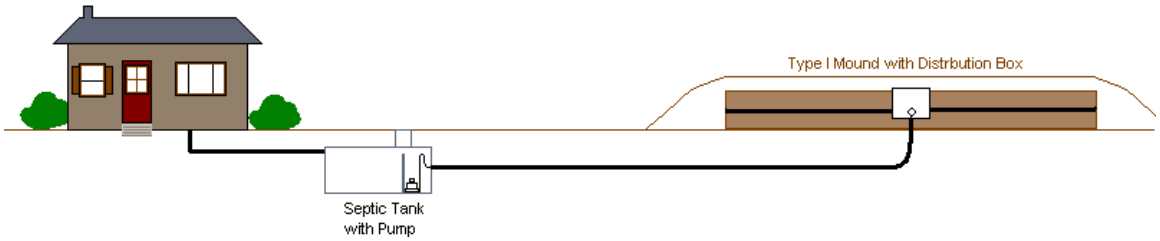
Disadvantages:

- There are increased power costs over a gravity system.
- There is an increased difficulty locating the system in the future.
- Because it is below grade, more likely to be covered by parking pads, driveways, etc which damages the system integrity and performance.
- Disruptions in power or equipment malfunctions may prevent the discharge of wastewater from the home plumbing drainage system.
- The system is required to be level therefore slopes on the property being served may make the system more difficult to site.
- This system requires approximately 1.5 m (5 ft) of suitable soil below the 0.9 m (3 ft) deep trench.
- Regular inspection of the pumps and controls necessary to maintain the system in proper working condition

The following types of systems are considered pressure below grade soil absorption systems:

- Pressure absorption field
  - Section 8 of the Saskatchewan Onsite Wastewater Disposal Guide (Section 8.3.3 has specific instructions for gravity effluent distribution)
- Pressure chamber system
  - Section 7 of the Saskatchewan Onsite Wastewater Disposal Guide (Section 7.3.3 has specific instructions for gravity effluent distribution)

4.2.3. Type I Mound



A type I mound is a private sewage system that consists of piping from the septic tank to the field. Septic tank effluent is pumped to the mound. In cases where sufficient elevation distance is available, a siphon in the septic tank can be used. Within the type I mound, gravity is used to distribute the effluent throughout a piping system. The sewage then trickles through a graded stone bed to the natural soil surface. A type I mound is a reasonable alternative to a surface discharge system in a sparsely populated area.

As the system is above ground, some people may be concerned that the system will freeze. While this is uncommon, if it occurs, it is usually related to a combination of the following issues: low water usage, periods of inactivity (such as when the residents take a winter vacation), no grass cover, unseasonably cold weather, lack of snow cover, and construction practices. Construction practices that may influence a mound's resistance to extreme cold could include the use of different soils or materials (geotextiles versus straw); incorrect placement of the effluent delivery pipe (e.g. leaving sags where water can collect); not designing for the site (e.g. using the minimums in the guide without consideration of site specific variables). Contractors must consider the implications for winter operation and adjust construction materials and methods as necessary. If this is a concern and there is less than 0.5 m of snow, straw bales placed over the mound will help to minimize the potential for freezing.

Advantages:

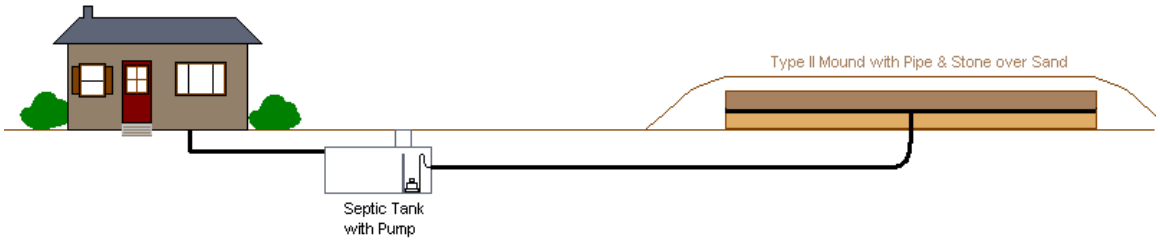
- Less costly than a Type II mound because there is no need for the costly clean and graded sand.
- Construction damage can be minimized since there is little excavation required in the absorption area.
- As the infiltration surface is just below the natural ground level, it can be used in areas where a restrictive layer is near the ground surface.

Disadvantages:

- Care must be taken to not damage the top permeable topsoil under the absorption area.
- The location of the system may affect drainage patterns and limit land use options.
- There may be a need for electricity and mechanical equipment to move the effluent to the mound from the septic tank (in some circumstances siphons can be used in place of pumps).
- Graded stone may be difficult to obtain in some regions.
- Mounds may not be aesthetically pleasing as the mound cannot be covered with trees or other screenings as this may damage the system operation.
- As the system is above ground, the system may be more susceptible to freezing during the winter months and, when there is less than 0.5 m of snow, homeowners may have to protect the mound with straw bales during the winter.

Type I mounds are covered in Section 9.1 of the Saskatchewan Onsite Wastewater Disposal Guide.

4.2.4. Type II Mound



A type II mound is a private sewage system that consists of piping from the septic tank to the field. The effluent is pumped through a piping system that is above a bed of clean graded sand. The effluent then trickles through the sand bed to the natural soil surface. A type II mound is a reasonable option where there are shallow restrictive layers in the soil; a shallow water table or a below ground system cannot be located on the lot.

As the system is above ground, some people may be concerned that the system will freeze. While this is uncommon, if it occurs, it is usually related to a combination of the following issues: low water usage, periods of inactivity (such as when the residents take a winter vacation), no grass cover, unseasonably cold weather, lack of snow cover, and construction practices. Construction practices that may influence a mound's resistance to extreme cold could include the use of different soils or materials (geotextiles versus straw); incorrect placement of the effluent delivery pipe (e.g. leaving sags where water can collect); not designing for the site (e.g. using the minimums in the guide without consideration of site specific variables). Contractors must consider the implications for winter operation and adjust construction materials and methods as necessary. If this is a concern and there is less than 0.5 m of snow, straw bales placed over the mound will help to minimize the potential for freezing.

Advantages:

- The mound system enables use of land that may otherwise be unsuitable for below ground systems such as areas of higher groundwater, bedrock or where there is a shallow clay layer in the natural soil.
- Construction damage can be minimized since there is little excavation required in the mound area.
- Mounds can be utilized in most climates.
- The mound system may require less space than a conventional below ground system.

Disadvantages:

- A type II mound can be difficult to design properly.
- Construction costs are typically much higher than those of conventional below ground systems.
- Care must be taken to not damage the permeable topsoil under the mound.
- The location of the mound may affect drainage patterns and limit land use options.
- There is a need for electricity and mechanical equipment.
- Mounds may not be aesthetically pleasing as the mound cannot be covered with trees or other screenings as this may damage the system operation.
- As the system is above ground, the system may be more susceptible to freezing during the winter months and, when there is less than 0.5 m of snow, homeowners may have to protect the mound with straw bales during the winter.
- Regular inspection of the pumps and controls necessary to maintain the system in proper working condition.

Type II mounds are covered in Section 9.2 of the Saskatchewan Onsite Wastewater Disposal Guide.

5. Package Treatment Plants

Package treatment plants are a set of treatment components that are part of an overall treatment system for the purification of residential wastewater. The category covers a wide range of technologies that are often scaled down versions of municipal type treatment units. The treatment plant can replace the septic tank or be in addition to a septic tank. The potential performance of a packaged treatment plant depends upon the type of technology that is implemented and a variety of design factors. In order to provide assurance that a package treatment plant can perform as claimed by the manufacturer, package treatment plants should be certified to produce effluent at least equivalent to B-II of CAN/BNQ 3680-600/2009 Onsite Residential Wastewater Treatment Technologies Standard; Class I of National Sanitation Foundation Standard 40 Residential Wastewater Treatment Systems; or other equivalent standard recognized by the local authority.

The primary advantage offered by package treatment plants is the potential for a higher quality effluent prior to discharge to a soil absorption field. This increased effluent quality allows for a smaller soil absorption field and can allow a soil absorption field to operate successfully in shallower soils. The primary disadvantage is operation and maintenance requirements. These systems require regular maintenance by qualified professionals. Without maintenance, package treatment plants may discharge effluent of a lower quality than would be seen from a septic tank. This may result in a failure of the soil absorption field.

Advantages:

- A smaller footprint is required for the soil absorption field.
- There is potential for more highly treated effluent and a decreased impact on the environment.
- Package treatment plants may be appropriate for areas of shallower soils or a high groundwater table.

Disadvantages:

- Costs of the package treatment plant system installed with a soil absorption field are significantly higher than a conventional gravity or pressure absorption field.
- There is a need for electricity and mechanical equipment. When either fails, proper treatment of effluent will not occur and eventually discharge of wastewater from the home will not occur.
- Regular operational oversight and maintenance by a qualified professional is required in order for the system to operate as designed.
- The life span of a package treatment plant may be less than that of a traditional septic tank and soil absorption field.
- Some systems require small buildings that may not be aesthetically pleasing.

Package treatment plants are covered in Section 12 of the Saskatchewan Onsite Wastewater Disposal Guide.

NOTE: This information was updated in October 2010. To confirm you are reading the most recent version of this document, check to see the most recent version on the Ministry of Health website.

6. Summary Chart

Parcel Size	Holding Tank	Chamber System	Absorption Field	Type I Mound	Type II Mound	Open Discharge	Lagoon
10 Acres or >	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<10 Acres and > 465 m^2 (5000 ft^2)	Yes	Yes	Yes	Yes	Yes	No	No
≤ 465m^2 (5000ft^2)	Yes	*	*	*	*	No	No
* Consult local Public Health Inspector							
Shoreland Development Area							
0' – 100' From High Water Mark	Yes	No	No	No	No	No	No
100' – 500' From High Water Mark	Yes	No	No	No	No	No	No
500' + From High Water Mark	Yes	No	No	No	Yes	No	No
Environmental Sensitivity and Density							
Adequate Location Low Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adequate Location Medium Density	Yes	Yes	Yes	Yes	Yes	No	Yes
Adequate Location High Density	Yes	Pressure	Pressure	No	Yes	No	Yes
Sensitive Location Low Density	Yes	Pressure	Pressure	No	Yes	No	Yes
Sensitive Location Medium Density	Yes	Pressure	Pressure	No	Yes	No	Yes
Sensitive Location High Density	Yes	**	**	No	**	No	**
Soil Type							
Sand/ Loamy Sand	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sandy Loam	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loam	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Silty Loam	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Silt	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sandy Clay Loam	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clay Loam	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sandy Clay	Yes	No	No	No	No**	Yes	Yes
Silty Clay Loam	Yes	No	No	No	No**	Yes	Yes
Silty Clay	Yes	No	No	No	No**	Yes	Yes
Clay	Yes	No	No	No	No**	Yes	Yes

**Consult local Public Health Inspector

Additional information

The Saskatchewan Ministry of Health's website (www.health.gov.sk.ca/environmental-health) provides information on private sewage systems.

For more information on this fact sheet and/or other onsite sewage system topics, contact your local health region public health inspector:

http://www.saskatchewan.ca/residents/health/understanding-the-health-care-system/saskatchewan-health-regions/regional-public-health-inspectors

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