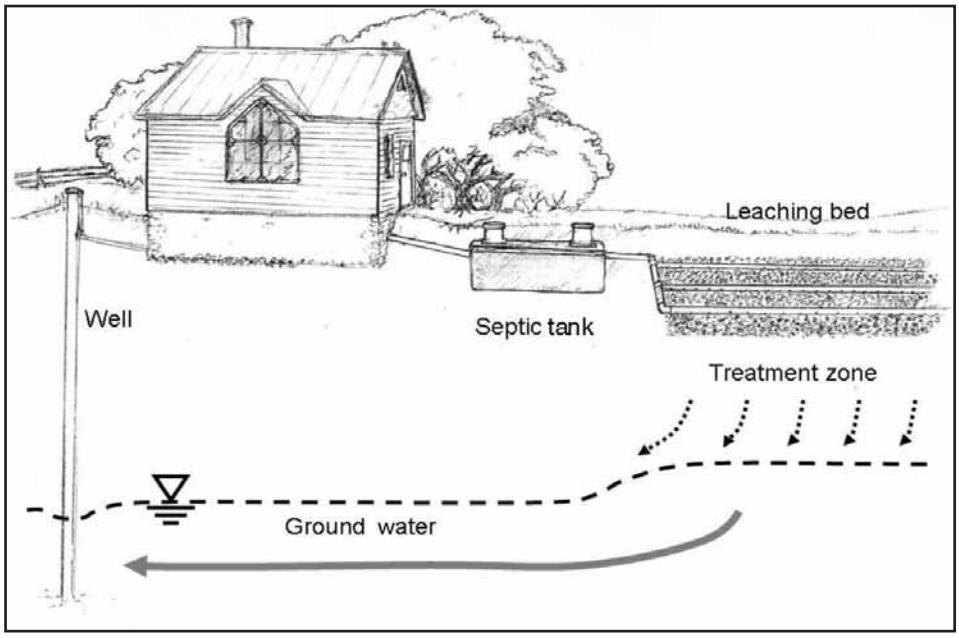
CE 34

Your Septic System

Do you know where the water goes when you empty a sink or flush a toilet? If your home is in a city, the wastewater likely goes into a municipal sanitary sewer system to a sewage treatment plant. If your home is located in a rural area or a small community, you are likely one of the 25 per cent of Canadians whose wastewater is treated by a septic system (also referred to as an onsite wastewater system). A septic system treats your sewage right in your own yard and releases the treated effluent back into the groundwater (see Figure 1).



Credit: Eric Brunet, Ontario Rural Wastewater Centre, University of Guelph

Figure 1 Wastewater recycling from an onsite system

HOW DOES MY SEPTIC SYSTEM WORK?

A properly functioning septic system receives all the wastewater created from household use (including toilets, showers, sinks, dishwasher, washing machine, and so on), treats the wastewater to a safe level, and returns the treated effluent to the groundwater system. A conventional septic system is composed of a septic tank and a soil filter called a leaching bed. A leaching bed may also be called a drain field, an absorption field or a tile field.

Septic tank

The purpose of the septic tank is to separate liquids from solids and to provide some breakdown of organic matter in the wastewater. A septic tank is a buried, watertight container made from concrete, polyethylene or fiberglass. In the past, the tank was sometimes made of steel or wood. If you have a steel tank, it is likely rusted through and needs replacing. If you have a wooden one it is likely rotting and may need replacing. The size of the septic tank will depend upon the size of the house (number of bedrooms) and household water use, with minimum tank volumes ranging from 1,800 to 3,600 L depending on the province or territory. Older tanks may be smaller than those installed today and tanks may have one or two compartments, depending upon when and where they were installed.

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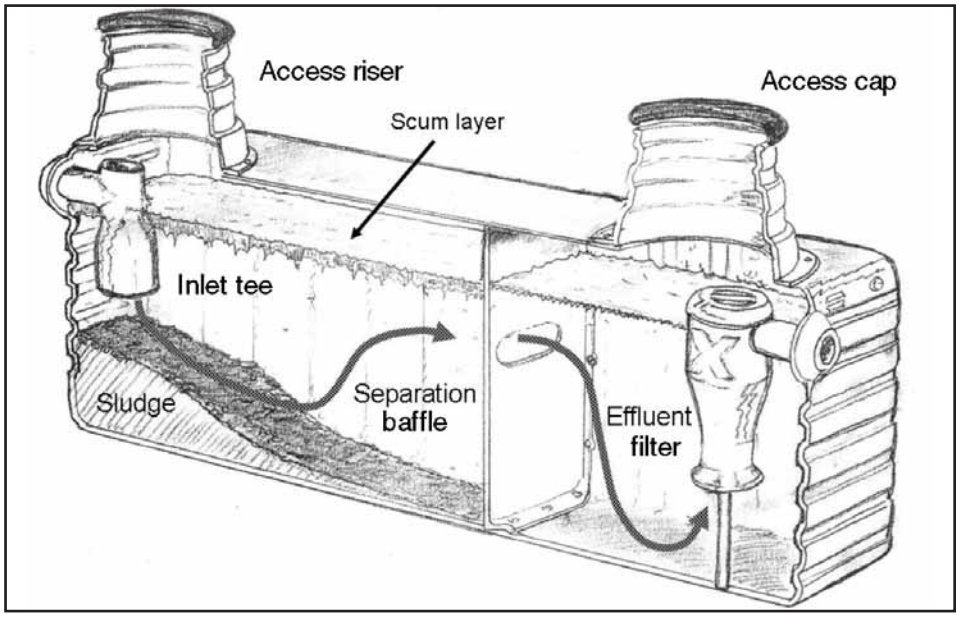
As wastewater from the house enters the septic tank, its velocity slows allowing heavier solids to settle to the bottom and lighter materials to float to the surface (see Figure 2). The accumulation of settled solids at the bottom of the tank is called "sludge" while the accumulation of lighter solids (greases and fats), which form a mass on the surface, is called "scum". Anaerobic bacteria, which are always present in wastewater, digest some of the organic solids in the tank. Clarified wastewater in the middle of the tank flows by displacement into the leaching bed for further treatment in the soil layer.

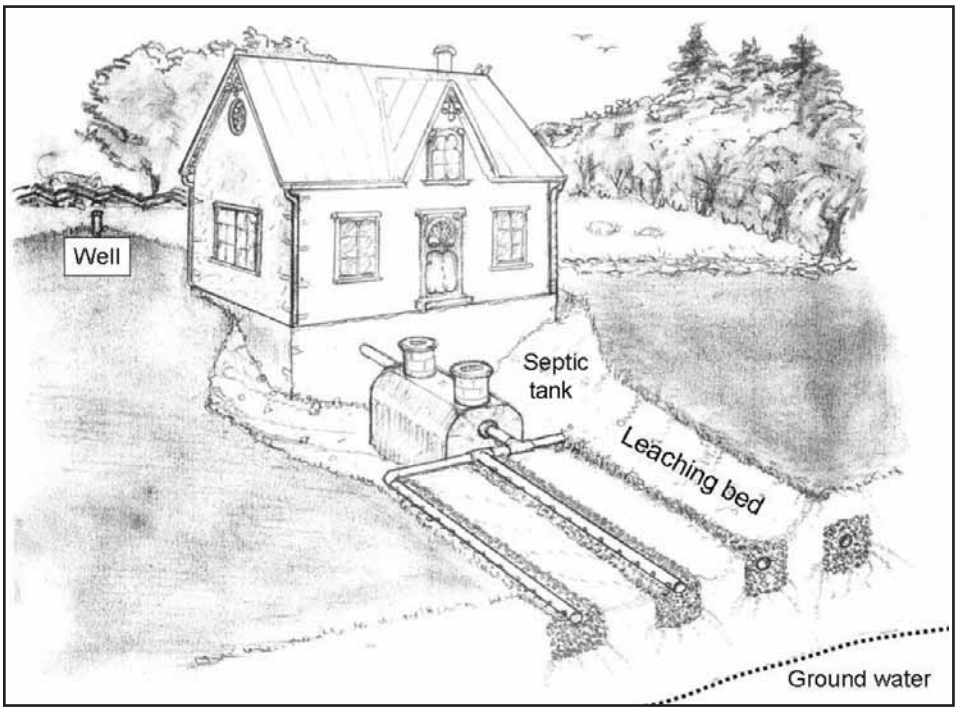


Credit: Eric Brunet, Ontario Rural Wastewater Centre, University of Guelph

Figure 2 Common septic tank with access risers and effluent filter

Leaching bed

The partially treated wastewater from the septic tank flows into the leaching bed (see Figure 3). The leaching bed is typically a network of perforated plastic distribution pipes laid in gravel trenches over a layer of soil. In most provinces, the soil layer must be a minimum of 0.7-1.2 m above the high ground water table or a restrictive layer such as bedrock or clay and have a certain permeability (absorptive capacity). Older systems may have been constructed with clay tiles instead of plastic pipes, while new systems may use plastic chambers to replace the gravel trenches and perforated piping. The actual size, design and layout of the leaching bed is defined in provincial/territorial code or regulation and is based upon the volume of sewage generated, the absorptive capacity of the underlying soils, and the depth to the high groundwater table or limiting/ restrictive layer. Wastewater can flow by gravity from the septic tank to the distribution lines, or where required, can be collected in a pump chamber and pumped to a leaching bed at a higher elevation.

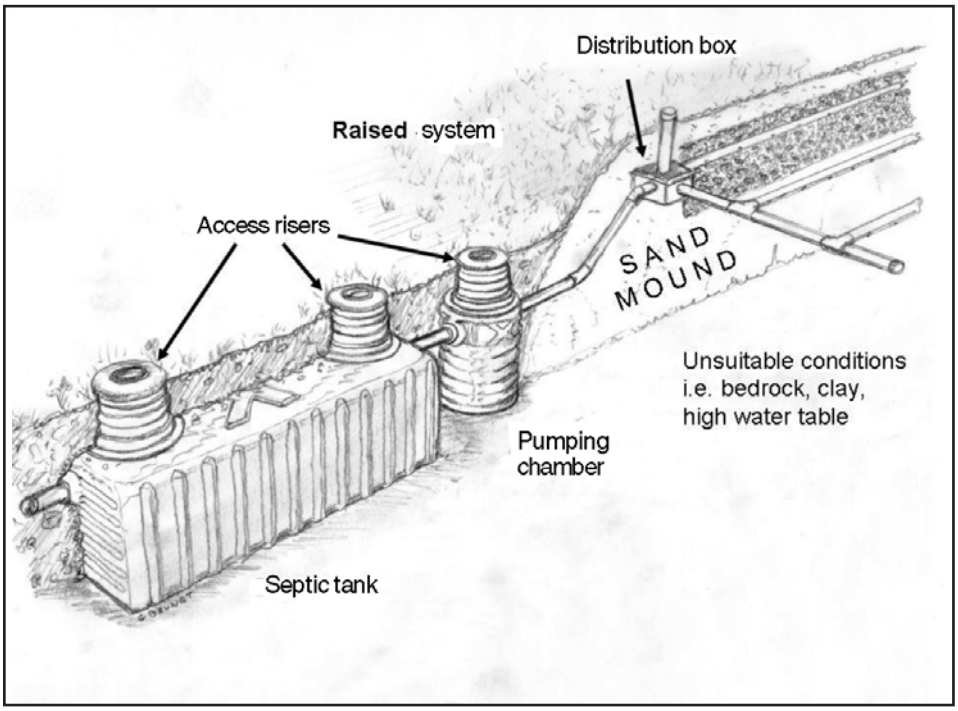


Credit: Eric Brunet, Ontario Rural Wastewater Centre, University of Guelph

Figure 3 Conventional septic system

The leaching bed is a soil filter which uses natural processes to treat the wastewater from the septic tank. Contaminants in the wastewater include solid and dissolved organic matter (carbon compounds), nutrients (nitrogen and phosphorus) and harmful bacteria and viruses. A slime layer of bacteria, called a "biomat" layer, forms at the bottom and sidewalls of each distribution trench; and it is in this layer where much of the treatment occurs. Bacteria in the biomat layer and surrounding soils consume the organic matter in the wastewater as well as transform ammonia nitrogen, which is toxic to some aquatic species, to the less toxic form of nitrate-nitrogen. Harmful bacteria and viruses present in the wastewater are largely removed in the leaching bed through filtration, predation (eaten by other microbes) and environmental exposure. Some leaching bed soils will contain iron, aluminium or calcium which can adsorb phosphorus from the wastewater. The soil bacteria which perform the treatment require oxygen to function; therefore the leaching bed must be installed in soils that are not saturated by surface water run-off or a high groundwater table, and should not be paved or covered over with pavement, patios, sheds, and so on.

The leaching bed soil must be the right type to retain the wastewater long enough for treatment to occur, while at the same time allowing the wastewater to infiltrate into the ground (refer to your provincial or territorial regulations).



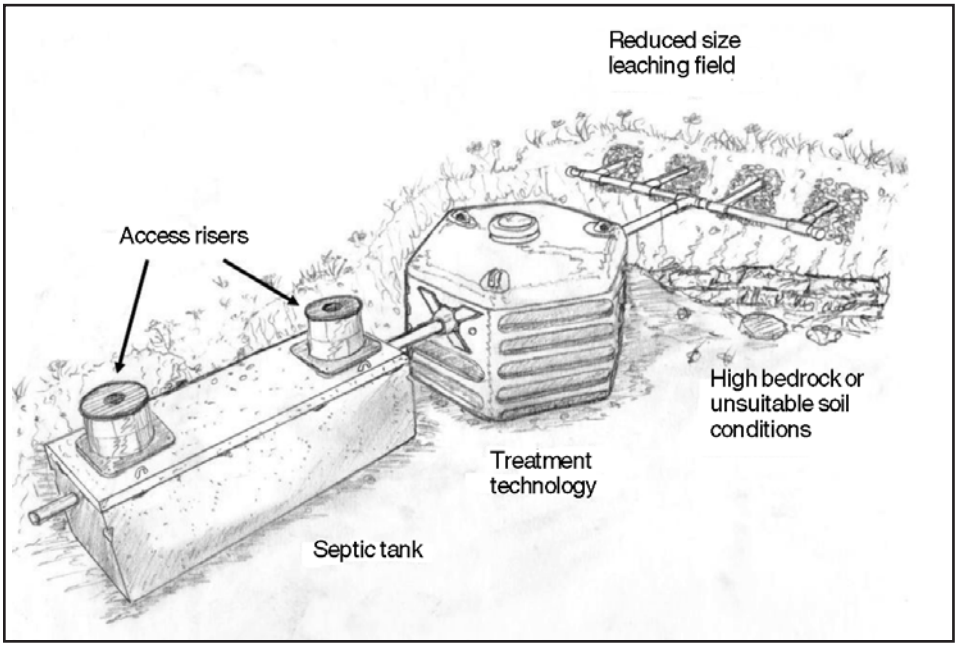
Credit: Eric Brunet, Ontario Rural Wastewater Centre, University of Guelph

Figure 4 Raised bed system

In cases where there is a sufficient separation from either the high groundwater table or bedrock, the network of drainage piping is installed directly in the native soil or in imported sand if the permeability of the native soil is not suitable. This is called a **conventional system** (see Figure 3). In cases where the high groundwater table or bedrock is close to the surface, the leaching bed must be raised so that there is sufficient unsaturated soil under the drainage piping. This is called a **raised (bed) system** or a **mound system** (see Figure 4).

Aerobic treatment technologies

There are many site conditions where it is impractical to impossible to install a conventional septic system such as: high groundwater table, bedrock, poor soil conditions (i.e. clay, silt, till) or inability to meet the setback distances from surface water, wells or property boundary lines. In these cases, an aerobic treatment technology is often used. These treatment technologies are proven technologies which have been on the market since the 1970s with numerous installations across North America. Aerobic technologies treat the wastewater to a higher level (secondary and tertiary) than a septic tank, permitting the treated effluent to be discharged into a much smaller area than is required for treatment by a conventional leaching bed. Each province and territory has its own regulations for aerobic treatment technologies and you should consult with your local regulatory authority to determine which technologies are approved in your locality.



Credit: Eric Brunet, Ontario Rural Wastewater Centre, University of Guelph

Figure 5 Alternative treatment technology

Aerobic treatment technologies typically have three components: a settling tank (this may be smaller than a conventional septic tank), the aerobic treatment unit which removes much of organic matter from the wastewater, and a dispersal system, which is often a small leaching bed (see Figure 5).

Aerobic treatment technologies all rely on aerobic micro-organisms to break down the organic matter in the wastewater. In order to optimize treatment, the treatment unit vessels either include a material to support the growth of micro-organisms (called attached growth media), or a continuous mixer to keep micro-organisms in suspension (called suspended growth). Many technologies utilize either an air pump or blower to provide oxygen to the micro-organisms, while some technologies are designed as "trickling filters", where effluent is dosed onto an unsaturated media and the micro-organisms use the oxygen in the air which surrounds the media.

The treated effluent is typically discharged into a small leaching bed, although there are alternative methods in some jurisdictions including pressure distribution systems near the soil surface or even discharge to surface waters. Consult with your provincial/territorial authority to see which methods of dispersal are permitted in your area.

In most provinces, homeowners with aerobic treatment technologies are required to have a maintenance contract with an authorized service provider to inspect and maintain their systems. Things to consider when purchasing an aerobic treatment technology are :

- Is the technology or product brand approved in your province?
- Does the manufacturer provide a reliable service contract and support in your area?
- What are the maintenance requirements and costs associated with the technology (frequency and timing required for inspections, effluent sampling, and replacement parts)?
- What is the cost and availability of replacement parts?
- What are the annual energy costs (pumps, aerators)?
- What are the frequency, volume and costs of pumping out the system?
- What are the special considerations for installing the system for seasonal use and winterization?

WHAT DO I NEED TO DO TO KEEP MY SEPTIC SYSTEM WORKING?

Access risers

Having easy access to the septic tank is the first step to routine maintenance. For tanks that are buried in the ground it is a very good idea to install access risers, which extend the tank lids to or near the surface (see Figure 2). Should there be a need to access the tank during the winter, risers will make the job much easier. Risers can be made of plastic or concrete and must be secured against entry.

Tank pump-out

Over time, the sludge will build up in the bottom of the septic tank. If the sludge is allowed to accumulate it will eventually flow into the leaching bed and rapidly clog the distribution pipes. Once the pipes become clogged, the wastewater will either seep to the surface of the ground, or worse yet, back up into your house. Not only can a clogged septic system be hazardous to the environment and to your family's health, it also represents a very expensive repair bill.

A septic tank should generally be pumped out every three to five years or when 1/3 of the tank volume is filled with solids (measured by a qualified practitioner). The frequency of pumping out the tank will depend upon household water use (number of people) and the size of the septic tank. For example, a family of five with a 2,300 L tank may require a tank pump-out as frequently as every two to three years, while a retired couple with a 3,600 L tank only require a tank pump-out every five to seven years. Some jurisdictions define how frequently a septic tank must be pumped out. In the province of Quebec, for instance, septic tanks are required to be pumped every two years for full time residences and every four years for seasonal residences.

The best time to have the tank pumped out is summer to early fall. At these times, the ground will not be frozen, allowing easier access to the tank, and the biological activity in the tank can re-establish itself before it gets too cold (micro-organisms like it warm). In the spring, a high water table caused by melted snow can sometimes create sufficient pressure on the underside of an empty tank to push it up out of the ground. This is more of a concern with lighter tanks made of polyethylene or fibreglass than those made of concrete.

> Never inspect or pump out a septic tank yourself. There is no oxygen in the tank for you to breathe and the tank contains deadly gases which can kill you in only a few seconds. When it is time to clean or inspect your tank, call a licensed pumper.

Effluent filters

An effluent filter is a relatively new accessory for a septic tank. It is a simple filter which is installed at the outlet of the septic tank to prevent large solid particles from flowing out of the septic tank and into the leaching bed. An effluent filter could prevent the premature clogging of your leaching bed with solids. There are many different effluent filters on the market, so consult with a local contractor to determine which filter is best for your system.

Effluent filters need to be cleaned periodically depending upon the type and size of filter and household water use. Some filter models can be fitted with an alarm which sounds when the filter requires cleaning.

What not to put down the drain

Because septic systems rely on bacteria to break down the waste material, it is important that you don't poison these micro-organisms. Even small amounts of paints, solvents, thinners, nail polish remover and other common household compounds flushed or poured down the drain can kill the bacteria that break down the organic matter in the wastewater. Household disinfectants such as laundry bleach or toilet bowl cleaner can be used in moderation without affecting the operation of the septic system; however, overuse of disinfectants can kill the bacteria in a septic tank. Some manufacturers promote the use of septic tank "cleaners", "starters" or "enhancers" to aid in the digestion of the waste. These products are typically of little value and are not recommended.

You should avoid putting anything into the septic system that doesn't break down naturally or anything that takes a long time to break down. Materials such as oils, grease, and fat, disposable diapers, tampons and their holders, condoms, paper towels, facial tissues, cat box litter, plastics, cigarette filters, coffee grounds, egg shells, and other kitchen wastes, should never be put into the septic system. You should also avoid the use of in-sink garbage disposal units ("garburators") unless the septic tank and leaching bed are designed to accommodate the increase water and organic load created from these devices.

DO I NEED TO CONTROL MY WATER USAGE?

Every time you put water into the septic tank, that same amount of water moves into the leaching bed. The longer the wastewater is retained in the septic tank, the more the effluent has less suspended solids and organic matter. Conversely, if the water moves too quickly through the septic system (through excessive water use in the household), the solids may not have time to settle out and then could flow into the leaching bed. Therefore, whenever possible, you should try to regulate the amount of water entering the septic system; for instance, laundry can be spread out over several days during the week. You can reduce water usage by installing water saving features in plumbing fixtures and by only running the washer or dishwasher when it is full. Fix leaky faucets and watch out for running toilets—a running toilet can waste a huge amount of water and can wash out a septic tank. Foundation drainage (sump pump) and furnace condensate should be excluded from the septic tank. You can also control the amount and timing of wastewater you put into the system by using a discharge pump package to dose the leaching bed.

HOW DO I LOOK AFTER THE LEACHING BED?

Looking after the leaching bed is easy. There's nothing you have to do, but there are a few things you shouldn't do. The area over the leaching bed should have a good cover of grass. Good ventilation and adequate sunlight should also be maintained to promote evaporation. This means that nothing should be constructed over the leaching bed including: parking areas, patios, tennis courts, decks or storage sheds. Covering the leaching bed will prevent oxygen from getting into the soil. The bacteria responsible for digesting the wastewater need oxygen to survive and function.

You should not drive vehicles or machinery over the bed, as the weight could crush the distribution pipes or compact the soil. In winter, you should also keep snowmobiles off the leaching bed. The compaction of the snow will reduce its natural insulating effect, increasing the chances of the pipes freezing.

Don't plant trees or shrubs near the leaching bed. The roots of some trees, especially willows and poplars, will travel significant distances to reach water. The roots can plug and damage the distribution pipes. Lastly, don't water the grass over the leaching bed and ensure that all surface drainage (particularly eave troughs) is directed away from the leaching bed. The additional water may interfere with the ability of the soil to absorb and treat the wastewater.

The leaching bed of a conventional septic system should last at least 20 years; however, the distribution lines will eventually become clogged with biomat and the bed will have to be repaired or replaced.

HOW WILL I KNOW IF I HAVE A PROBLEM WITH MY SEPTIC SYSTEM?

Some of the warning signs that your septic system may be failing include the following:

- The ground around the septic tank or over the leaching bed may be soggy or spongy to walk on.
- Toilets, showers and sinks may back up or may take longer than usual to drain.
- Occasional sewage odours may become noticeable, particularly after a rainfall.
- Gray or black liquids may be surfacing in your yard or backing up through fixtures into the house.
- *E. coli* or fecal coliform indicator bacteria may be found in nearby well water or in a surface ditch close to the leaching bed.
- The water level in the septic tank is higher than the outlet pipe (this indicates that the water is ponding in the distribution lines) —inspection should be conducted by a qualified practitioner.
- Wastewater is ponding in the distribution lines—inspection should be conducted by a qualified practitioner or an engineer.

HOW DO I PREVENT MY SYSTEM FROM FREEZING?

Septic systems are most likely to freeze in periods of cold temperature when there is little snow cover. The first line of defence against system freezing is adequate insulation. Adding 0.3 m (1 ft) of mulch (leaves, straw, hay) or letting the grass grow long over the system in the fall will provide a good insulating layer. Snow can also be piled over the system in the early winter. Other options include: insulate the pipe from the house to the septic tank, add Styrofoam sheets above the septic tank, and increase the soil cover over the system.

There are three major causes of system freezing :

1— Pipes not draining properly

Any standing water in pipes may freeze. This may result from poor installation without sufficient slope or ground settling or frost heaving over time. The solution to this problem is to excavate and replace the faulty section of piping.

2— Low water usage

Water slowly trickling through piping (for instance from a leaking tap or toilet) can create a film of water which can freeze the line solid. Low water use (or vacancy) for an extended period of time can lead to the septic tank freezing. If you are going away for an extended period of time during the winter, it is a good idea to have the tank pumped out before you leave.

3— Waterlogged system

If your leaching bed is saturated (either through poor design or clogging of the distribution lines) it could freeze solid. If this happens, the only solution is to use the septic tank as a holding tank until spring, when the leaching bed thaws and can be repaired or replaced. This means the septic tank will have to be pumped out every time it fills up, which could be as frequently as twice a week. If you have to use your septic tank as a holding tank, it would be a good idea to have the pumper install a high level alarm in the tank to indicate when pumping is required.

If your system freezes call a qualified practitioner (pumper or installer). Many contractors have high pressure steamers to defrost frozen piping or can install heat tape or a tank heater. **Do not** add antifreeze, salt or additives to the tank and do not try and run water continuously to unfreeze the system.

WHAT IF I HAVE TO REPAIR MY SEPTIC SYSTEM?

If you notice a problem with your system, it is important that you take action immediately to protect your health and the environment. Contact a qualified practitioner to advise you on how to proceed. Repairs can range from pumping out the septic tank, repairing a broken tank baffle or cracked pipe, levelling the distribution header line, replacing the septic tank to ultimately replacing the entire leaching bed.

YOUR SEPTIC SYSTEM AND THE LAW

You are required by law to report any problem to your local authorities before proceeding with repairs or replacement. A final inspection will need to be carried out and a Use Permit granted before you can legally use a new or altered septic system. Your contractor and/or your local authorities can also help you determine the required size of your septic system. You may find that you need a larger system than you currently have. If you are repairing, replacing or installing a new septic system, you will also have to be aware of the legal limitations imposed on where your septic system can be located with respect to your house and your well, your neighbour's house and well, and nearby bodies of water. These distances are required to help ensure that wastewater from your septic system cannot reach and contaminate nearby water supplies. Depending upon the province, the leaching bed must be at least 1.5-9 m from a property line, 3-11 m from a building, 15-30.5 m from a well, and 15-75 m from a body of water.

The agency responsible for onsite septic system permits varies depending on the province or territory and is described in Table 1.

Table 1 Provincial/territorial septic system regulations

Province/Territory	Department/Ministry	*Act*—Regulation
Prince Edward Island	Department of Technology and Environment	*Environmental Protection Act*—Sewage Disposal Regulation
Newfoundland and Labrador	Department of Health	*Public Health Act*—Sanitation Regulation
Nova Scotia	Department of the Environment	*Environment Act*—On-site Sewage Disposal Regulation
New Brunswick	Department of Health and Community Services	*Health Act*—Regulation 88-200
Quebec	Department of Environment	*Environmental Quality Act*—Regulation Respecting Wastewater Disposal Systems for Isolated Dwellings
Ontario	Ministry of Municipal Affairs and Housing	Ontario Building Code Part 8
Manitoba	Department of the Environment	*Environment Act*—Private Sewage Disposal Systems and Privies Regulation
Saskatchewan	Department of Health	*Public Health Act*—Plumbing and Drainage Regulation
Alberta	Ministry of Labour	*Safety Codes Act*—Alberta Private Sewage Systems Standards of Practice
British Columbia	Ministry of Health Services	*Health Act*—Sewerage System Regulation
Northwest Territories	Department of Health and Social Services	*Public Health Act*—General Sanitation Regulations
Yukon Territory	Department of Health	*Public Health and Safety Act*—Sewage Disposal System Regulations

WHERE CAN I GET MORE INFORMATION?

- Local municipal offices or public health offices
- Licensed septic system installers (check the Yellow Pages™)
- Provincial and territorial ministries responsible for septic systems (e.g. environment, health)

Websites

Canada Mortgage and Housing Corporation (May 2008)
www.cmhc.ca

Ontario Rural Wastewater Centre (May 2008)
http://www.orwc.uoguelph.ca

Centre for Water Resources Studies (May 2008)
http://centreforwaterresourcesstudies.dal.ca

USEPA Septic (Onsite) Systems Homepage (May 2008)
http://cfpub.epa.gov/owm/septic/index.cfm

National Environmental Services Center (May 2008)
http://nesc.wvu.edu/wastewater.cfm

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