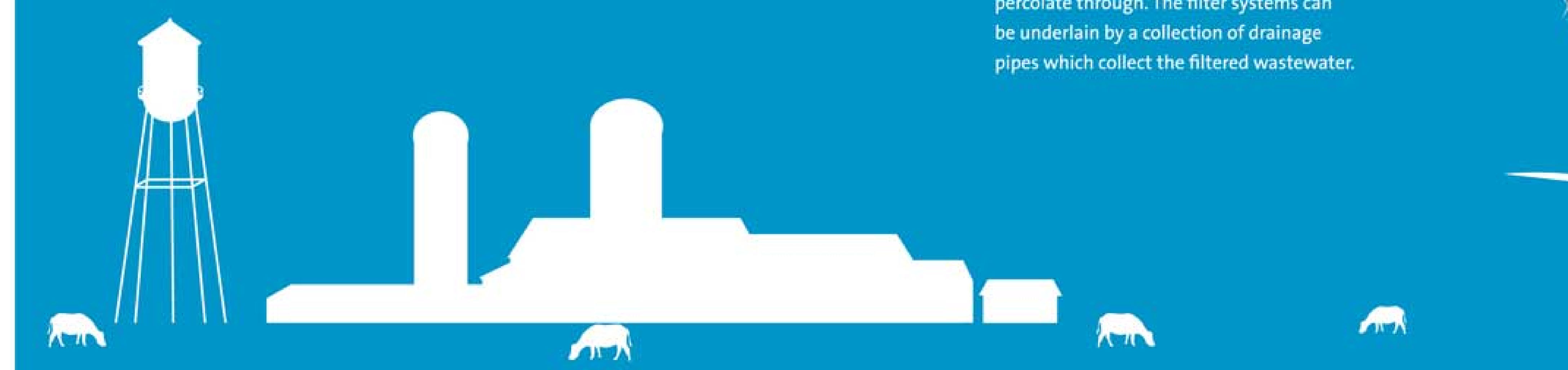
When a Septic Tank System is not working

There are a number of signs which indicate that a septic tank system is not working properly.

- Strong odours may emanate from the site of the septic tank.
- Toilets and sinks may drain more slowly.
- Raw sewage 'backs up' into the house.
- Surface ponding occurs over the percolation area.
- Luscious green grass grows above the percolation area.

Alternative Treatment Systems

Depending on the characteristics of the site, a conventional septic tank system may not be capable of adequately treating wastewater and providing protection for groundwater. In such situations an alternative treatment system must be used. Alternative treatment systems are also used to serve larger developments such as hotels and leisure centres which produce more wastewater than the typical domestic dwelling. Alternative methods for treating wastewater include the use of filter systems, constructed wetlands, mechanical aeration systems and polishing filters.



Filter Systems

Filter systems are used in conjunction with a septic tank and provide an alternative to a conventional percolation area. A filter system may be used where the existing soil cannot provide adequate treatment for wastewater. The filter material acts to purify the wastewater as it passes through it.
Filter systems include:

- Soil filters
- Sand filters
- Peat filters
- Percolating filters

Soil filters consist of layers of soils placed in a man-made overground mound which the effluent from the septic tank is passed through. Sand filters are similar except that the filter consists of layers of sand and can be placed underground or overground. Peat filters consist of a mass of peat placed in the ground. The effluent is distributed evenly over the surface of the peat and allowed to percolate through. The filter systems can be underlain by a collection of drainage pipes which collect the filtered wastewater.

Filter systems can treat the wastewater from small communities, single domestic dwellings and larger developments. Percolating filters use bacteria attached to a plastic or stone media to remove the organic waste from wastewater. The effluent from the septic tank is continuously distributed over the surface of the media to allow treatment.

Constructed Wetlands

Man-made wetlands can be used to treat wastewater from a wide range of sources including single dwellings, small housing developments, hotels and visitor centres. Constructed wetlands can be used to effectively treat the runoff from farmyards. They have also proved to be successful for treating surface runoff from roads. Constructed wetlands provide a high level of treatment and can significantly reduce the level of nutrients in wastewater. Natural wetlands are transitional areas between land and water where the soil is waterlogged or submerged. They can exist permanently or at certain times of the year.

The wastewater first undergoes sedimentation in a septic tank before being discharged to the wetland. The treatment of wastewater by a constructed wetland occurs as it passes through the wetland. It is the water tolerant plants which grow in abundance in wetlands that are the key to wastewater treatment. Wetland vegetation acts to slow down the flow of wastewater allowing solid material to settle out. The vegetation also filters out pollutants and 'takes up' nutrients from the wastewater. Most importantly the vegetation acts as a biological filter to remove pollutants. The roots, stems, and leaves of plants provide the ideal environment for micro-organisms to grow and live. These organisms biodegrade organic waste and reduce the level of nutrients in the wastewater. There are two types of man-made wetlands; Horizontal Flow Systems (Figure 4) and Vertical Flow Systems (Figure 5).

Horizontal flow systems

In horizontal flow systems wastewater enters at a single entry point and flows horizontally across a gently sloping bed of reeds towards the outlet. An impervious plastic liner is placed at the bottom of the bed to contain the wastewater within the system. This system is popular for domestic dwellings. For a household of six people a reed bed of 10 m2 is required.

Vertical flow systems

In vertical flow systems the wastewater flows vertically through a bed of reeds where it is collected by underlying drainage pipes and discharged. The system consists of a flat bed of sand and gravel. Reeds are planted in the upper layer of sand. Wastewater is spread uniformly over the bed so that it floods the surface. As it percolates through the bed it is purified.

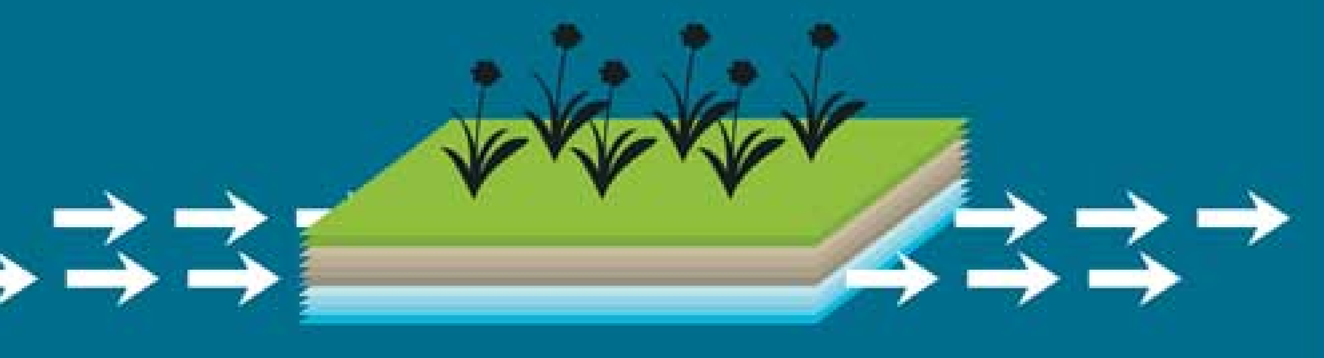


Figure 4 Horizontal Flow System

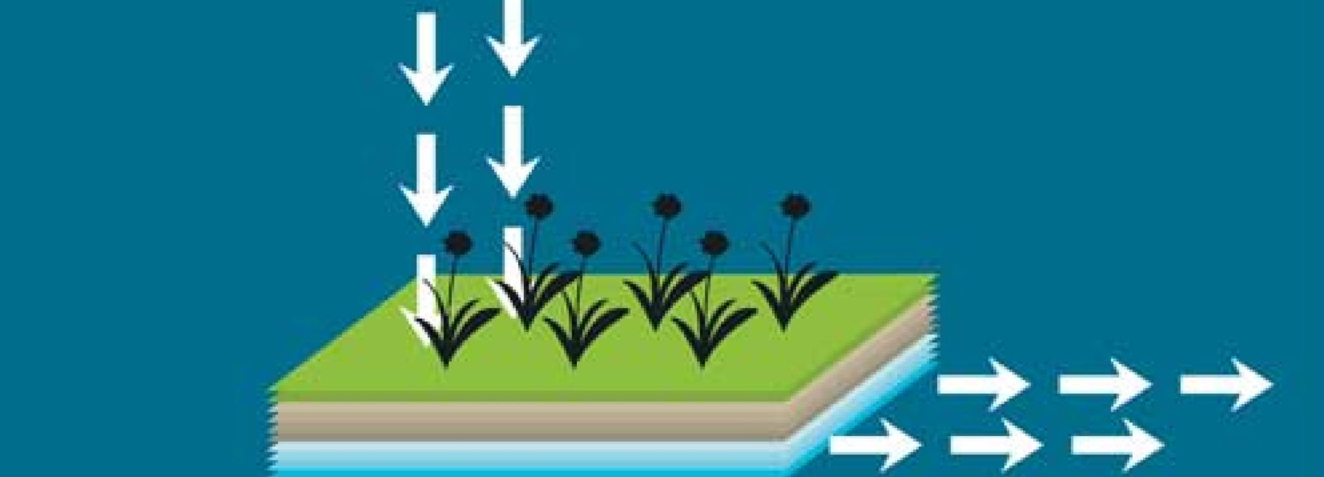


Figure 5 Vertical Flow System

Mechanical aeration systems

In recent years many mechanical aeration systems have come on the market and are now widely used throughout Ireland. Mechanical aeration systems include:

- aerated systems
- Rotating biological contactor systems
- Sequencing batch reactor systems.

Biofilm systems consist of a primary settlement tank, aerated filter media and a secondary settlement tank. The system can be purchased in a prefabricated form. Biofilm systems use bacteria which live on the surface of a filter media to treat wastewater. It operates in a similar way to a percolating filter system except aeration is applied. Aeration is used to oxygenate the wastewater before it is passed through the filter media to promote the aerobic digestion of waste. The system uses a pump to aerate and distribute the wastewater over the filter media. On some systems the wastewater is passed through the filter repeatedly to enhance treatment. Biofilm systems are a good replacement for a conventional septic tank system and can also be used to treat wastewater from larger developments.

Rotating Biological Contactor systems use rotating drums as a medium for supporting bacteria which biologically treat the wastewater. The system consists of a primary settlement tank, biological treatment compartment and a secondary settlement tank. As the drums rotate the bacteria on their surface come into contact with the wastewater and the air allowing aerobic digestion to occur. Rotating units, which contain all three compartments, can be purchased as packaged treatment units for single dwellings.

The Sequencing Batch Reactor process involves a five-stage cycle. Each stage is carried out in sequence in the same tank called a reactor. Firstly the tank is filled with wastewater and then aerated to allow aerobic biological treatment. The wastewater is then allowed to settle. During this stage the biomass by-product of biodegradation is allowed to settle on the bottom of the tank forming wastewater sludge. Once sedimentation is completed the clarified liquid remaining is drawn from the tank and the sludge is removed for treatment. The SBR process is carried out only after primary sedimentation in a septic tank. SBR systems are very well suited to housing developments in rural areas.

Polishing Filters

The treated wastewater from systems other than a conventional septic tank system should be treated by a polishing filter system. Polishing filters reduce the level of micro-organisms and nutrients in the wastewater. Polishing filters work in the same way as a conventional percolation area. The wastewater is percolated through a layer of sand or soil before it enters groundwater. The filter can consist of the existing soil, if this will not provide adequate treatment imported sand or soil may be placed on site to act as the percolation medium.

Failing Systems

Poorly sited, badly installed and inadequately maintained on-site treatment systems are believed to be one of the primary causes of groundwater pollution in Ireland. Recent studies carried out suggest that many on-site systems are not working properly. A pilot survey carried out in County Cavan in 2002 found that more than one-third of on-site systems were defective. Systems were not being desludged on a regular basis or were installed in an unsuitable location. In some cases the wastewater was not undergoing percolation at all and was being discharged directly to drainage pipes or nearby streams. Any problems with on site systems, especially conventional septic tank systems, may go unrecognized for years resulting in the continual pollution of groundwater. Due to the proximity of drinking water wells to on-site systems, it is important that we maintain the treatment systems and ensure they are working correctly.

Further Information

For more information regarding rural wastewater or on-site treatment systems you can consult the following websites:

- **www.epa.ie**
- **www.gsi.ie**

The following documents, which can be accessed from www.epa.ie, give authoritative information about on-site systems and should be consulted if you are operating or installing such a system.

- Wastewater Treatment System for Single Houses - Consultation Draft
- FAQs Wastewater Treatment Single Houses
- Wastewater Treatment Manuals - Treatment Systems For Single Houses
- Wastewater Treatment Manuals - Treatment Systems for Small Communities, Business, Leisure Centres and Hotels

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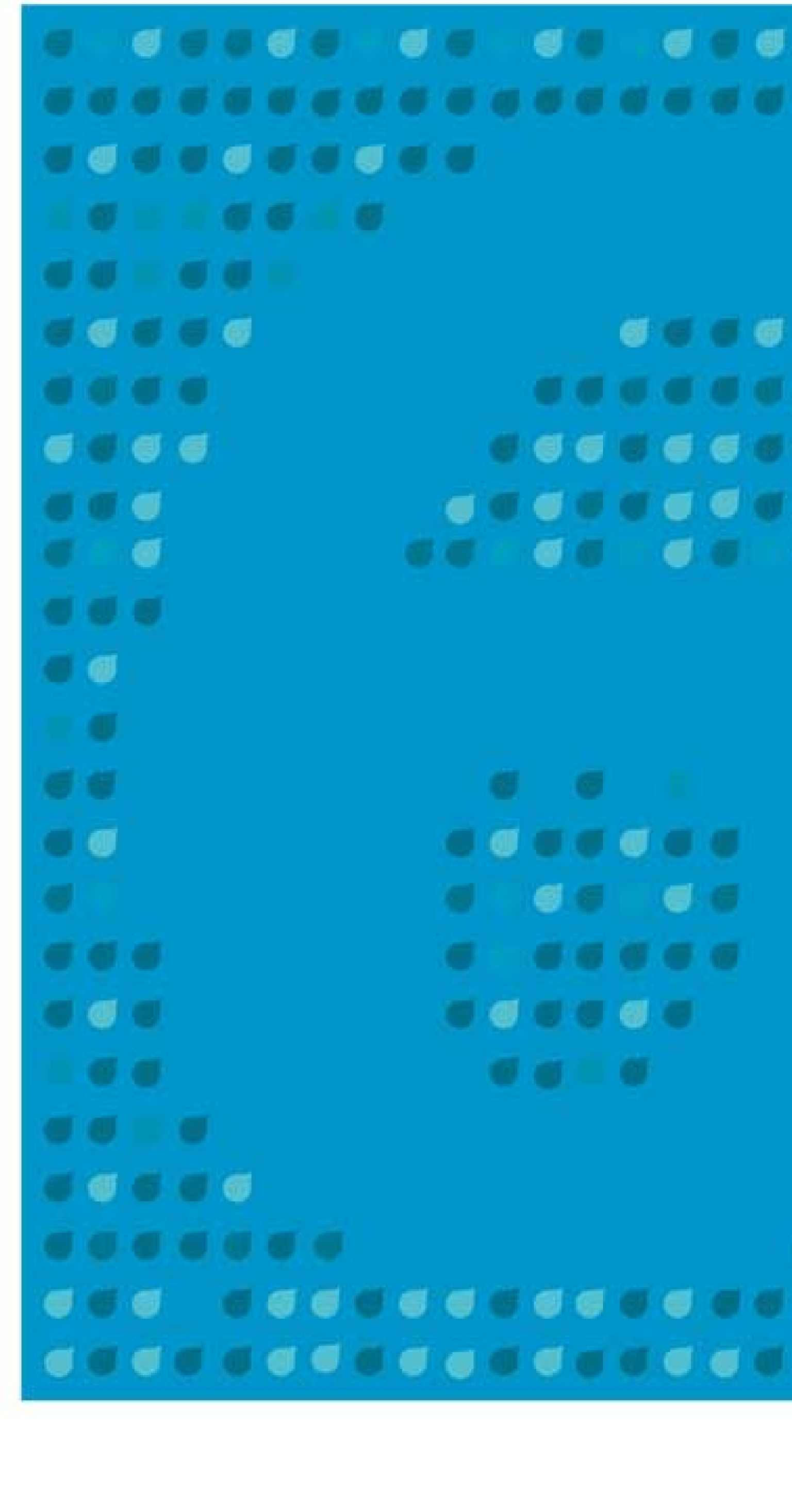
Managing Wastewater in Rural Areas



Managing Wastewater in Rural Areas

Managing Wastewater in Rural Areas
In many rural areas it is not possible for homes or businesses to connect to a public system that collects, treats and disposes of wastewater. In these areas wastewater is treated using an on-site treatment system which is designed to treat wastewater at or near the location where it is produced. On-site systems are designed to:

- Provide treatment for wastewater in unsewered areas.
- Minimise soil and water contamination.
- Prevent untreated wastewater entering ground and surface waters.
- Protect public health by preventing human contact with untreated wastewater.
- Prevent the contamination of drinking water supplies.

On-site systems are widely used in rural areas throughout Ireland. More than 400,000 properties, representing over 1.3 million people are served by an on-site treatment system. It is estimated that 230 million litres of wastewater per day are discharged to on-site systems for treatment. The septic tank system is the most widely used and well known on-site system in Ireland. In some cases a conventional septic tank system will not provide adequate treatment for wastewater. Where this exists alternative treatment systems, which provide better protection for groundwater, must be used.

The number of on- site systems in Ireland has increased as population growth and development in rural areas has occurred. More than half a million of the houses built in Ireland since 1991, 20% were detached houses in rural areas served by a septic tank system. Although we associate on-site systems with 'one-off' rural housing, they are also used to treat wastewater produced from larger developments such as hotels, leisure centres, commercial premises, small housing developments and visitor centres. Such developments require on-site systems with a greater capacity to treat wastewater than the conventional septic tank system. Many of the on-site systems for larger developments are scaled down versions of the treatment systems used in public treatment works. Figure 1 shows various on-site treatment systems serving a number of different rural developments.

Figure 1 On-Site Treatment Systems

Conventional Septic Tank System

The septic tank system is one of the most effective ways to treat wastewater. It has high removal rates for most wastewater pollutants, including organic matter, suspended solids, pathogenic organisms, inorganic materials and phosphorous. However, if the system is incorrectly located, poorly installed or inadequately maintained it poses a threat to groundwater quality, private water supplies and the wider aquatic environment.

It is the responsibility of the homeowner to ensure that the system is correctly installed and maintained. The '*Manual for Wastewater Treatment Systems for Single Houses 2000*' published by the Environmental Protection Agency, contains guidance on the design, operation and maintenance of on-site wastewater treatment systems, including, the septic tank system. To ensure the system functions properly any statuary regulations or codes of practice regarding septic tank systems should be followed. With proper maintenance the system should have a life span of 20-30 years. The septic tank system is typically used to treat wastewater from a single domestic dwelling; larger systems can be used to treat wastewater from larger developments.

How a Septic Tank System Works

The septic tank system is not intended to treat surface runoff generated by rainfall, which should be piped to a separate drainage area. There are two parts to a conventional septic tank system; the septic tank itself and the percolation area. Figure 2 shows the septic tank system and figure 3 shows the septic tank itself. The tank is designed to remove the solid waste from the wastewater before it is discharged to the percolation area. In the percolation area the wastewater flows into and through the soil which acts to naturally purify the effluent before it enters ground or surface waters. Septic tanks can be prefabricated or constructed on site. Household wastewater flows through an inlet pipe into the septic tank where it is allowed to 'settle'. As the wastewater settles it separates into three layers; the scum layer, the middle layer and the sludge layer. Heavy solids in the wastewater sink to the bottom of the tank forming a layer of sludge. Light solids, soaps, detergents, fats, oils and greases float to the top of the wastewater forming a layer of scum. As wastewater enters the septic tank the clarified liquid in the intermediate layer, between the sludge and scum layers, is displaced and flows from the tank into the percolation area. For the wastewater to separate properly it must be allowed to settle in the tank for at least 24 hours. The sludge and scum remain in the tank where they are broken down by bacteria. As they cannot be completely removed by microbial activity, over time the sludge and scum accumulate in the tank.

Percolation provides the most important part of the treatment process. The effluent from the septic tank flows into a number of perforated pipes laid beneath the ground surface on a layer of gravel. From here the wastewater slowly seeps into the underlying soil. The soil acts as a natural filter to remove suspended matter and pathogenic organisms. Micro-organisms which live in the soil break down the organic waste in the effluent. The purified wastewater then either enters the groundwater or evaporates from the soil. Ideally the treatment offered by the soil should ensure that the wastewater is fully treated before reaching the groundwater. In cases where the soil provides inadequate treatment, groundwater can become contaminated.

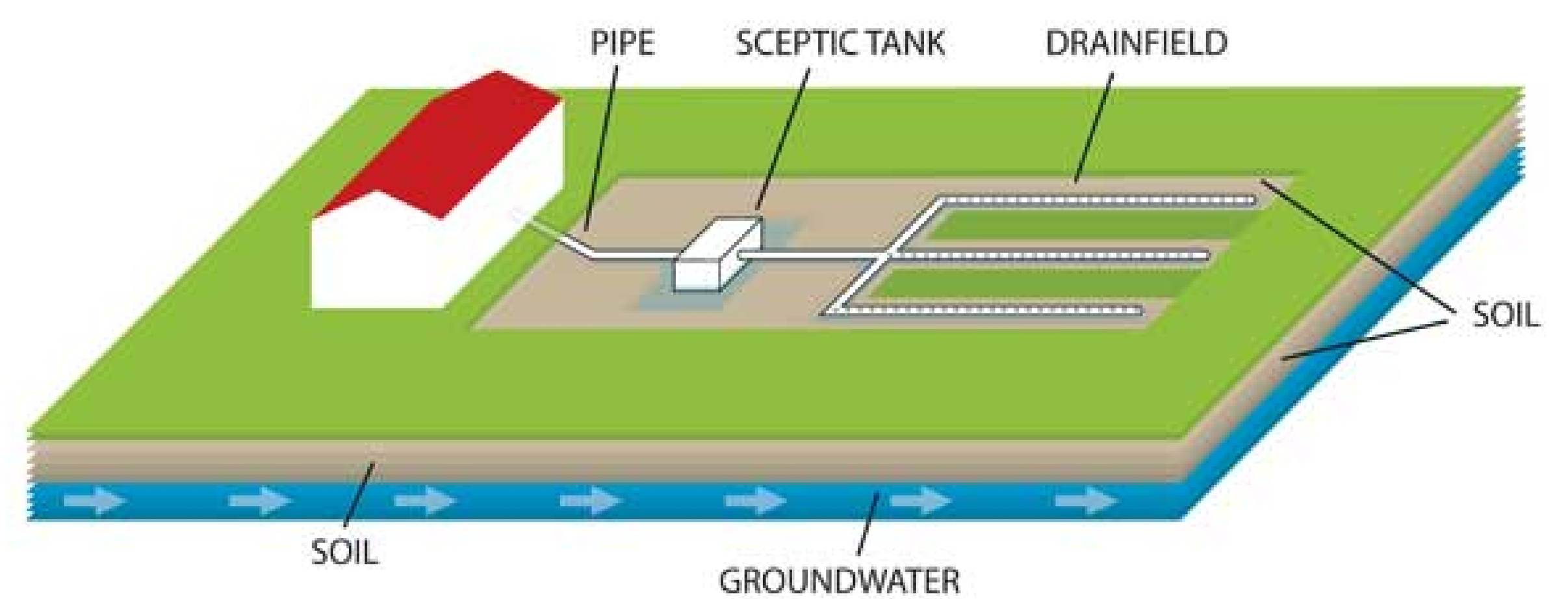


Figure 2 Septic Tank System

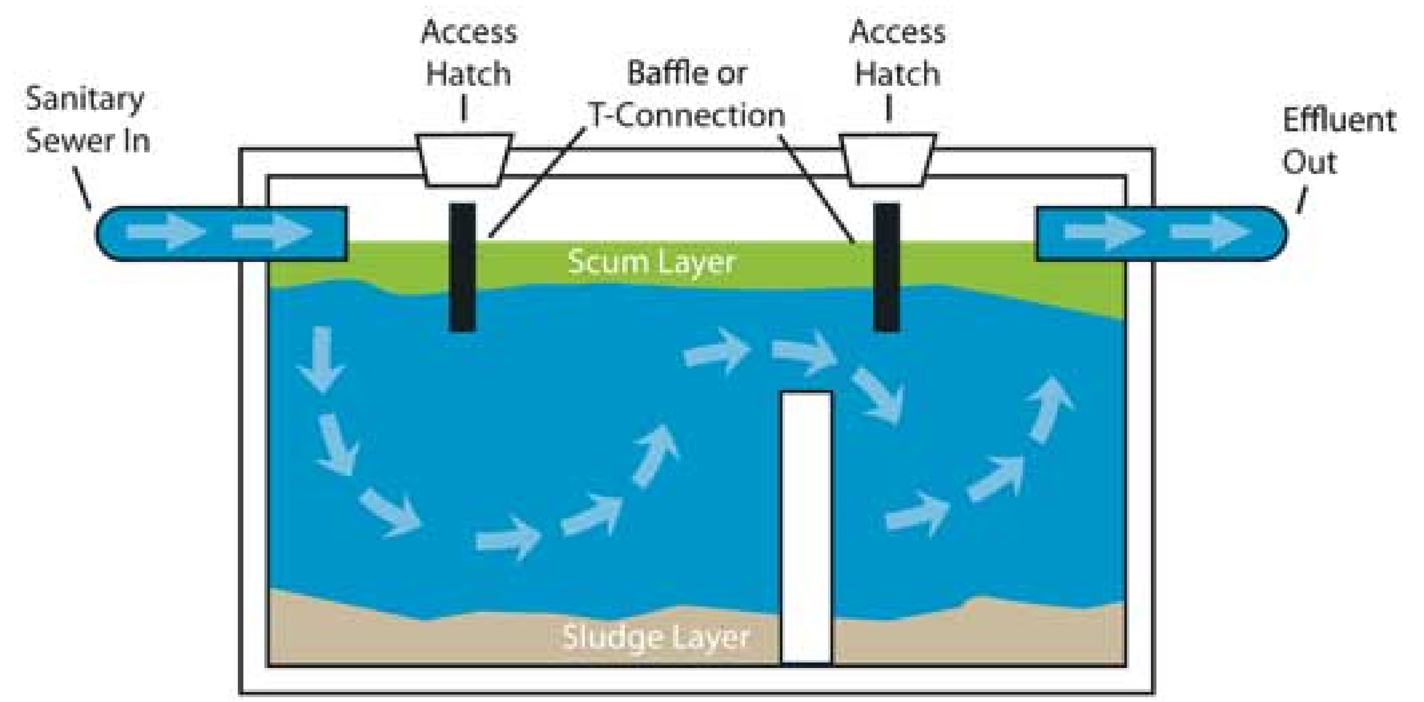


Figure 3 Septic Tank

Siting a Septic Tank System

The siting of a septic tank system affects how well it works and whether groundwater contamination can occur.

The amount of contact time the wastewater has with the soil affects the level of treatment provided by percolation. If the percolation field is located in an area where the soil is highly permeable (light soil) the effluent will drain too quickly for treatment to occur. However if the soil is not permeable enough (heavy soil) 'surface ponding' may occur where the effluent cannot drain from the soil and rises to the ground surface. Ponding poses a threat to public health as it exposes humans to harmful pathogens and it also generates foul odours.

The percolation area must be located where the underlying watertable is deep enough to ensure that wastewater is fully treated before reaching groundwater. If the layer of soil between the percolation pipes and the watertable is too thin it will not provide adequate treatment for the wastewater.

In many rural areas the septic tank system and the well used to supply drinking water serve the same dwelling, and are located on the one site. The septic tank must be located an appropriate distance from the well to ensure that drinking water supplies cannot become contaminated with the effluent entering groundwater from the percolation area.

Other factors which affect the location of a conventional septic tank system include the presence of sensitive waters or designated 'special areas' in the locality, the depth to the bedrock underlying the soil and the existing number of septic tank systems located in the area.

When obtaining planning permission for a development which will be served by an on-site system a site assessment must be carried out on behalf of the applicant to determine if a conventional septic tank system will provide adequate treatment, given the conditions of the proposed development site. If a conventional system is not suitable then one of the conditions of planning permission may be that an alternative treatment system is used.

Maintaining a Septic tank System

If the septic tank system is not maintained properly it can cause surface ponding and groundwater pollution. A poorly maintained system can also cause raw sewage to 'back-up' into toilets, sinks and showers. It is important that the system is regularly inspected by the homeowner or a trained professional, to ensure it is working properly.

To keep the septic tank system operating as it should, the sludge and scum must be removed from it on a regular basis. If this waste is allowed to build up it can prevent wastewater draining from the percolation area causing raw sewage to 'back-up' in the building's plumbing system and surface ponding to occur. It is recommended that the tank is 'desludged' by a licensed contractor every year. The percolation system may also become blocked if the wastewater is not allowed to fully settle and separate in the tank. This can occur if too much wastewater is being discharged into the system or if the tank is too small for the number of people using it. To avoid overloading the system household water use should be minimised.

What is put into the septic tank system affects how well it functions. Both the septic tank and percolation area contain living organisms which act to purify the wastewater. Even a small amount of certain household cleaning products can kill these organisms and temporarily disrupt the operation of the system. Harmful cleaning products include bleach, disinfectants and drain cleaner. It is important that they are only used in moderation and in accordance with any directions on the label. 'Eco friendly' household products which contain less harmful chemicals can be used in place of conventional products.

To avoid disruptive or permanent harm the system should not be used to dispose of hazardous household chemicals. Paints, paint thinner, varnishes, oil, petrol, anti-freeze, weed killer, pesticides and other harmful chemicals can kill off bacteria, preventing the biological digestion of waste. These chemicals will also move through the system and contaminate groundwater.

It is important that the materials going into the system which are difficult to break down or which are not biodegradable are minimised. In the kitchen, fats, greases, cooking oil and coffee grounds contribute to the scum collected in the tank and should not be put down the drain. Equally in the bathroom, plastics, sanitary towels, disposable nappies, paper towels and cotton buds should not be flushed down the toilet; only wastewater and toilet paper should be disposed of.

The septic tank and percolation field should be protected at all times. Vehicles must not be parked on or near the system. As the roots from trees and shrubs can damage the underlying pipes and septic tank, only grass should be planted close by. To ensure it works correctly, the percolation area should not be covered by asphalt or concrete.