RCAP

NOWRA
National Onsite Wastewater Recycling Association

Onsite Wastewater Treatment System

USER GUIDE

NOWRA

National Onsite Wastewater Recycling Association

ADVOCACY

MEMBERSHIP

EDUCATION

About NOWRA

The National Onsite Wastewater Recycling Association (NOWRA) is the largest organization within the U.S. dedicated to educating and representing members within the onsite and decentralized industry. NOWRA was founded in 1991 to promote sound federal, state, and local policies, to improve standards of practice, and to increase public recognition of the need for and benefits of onsite and decentralized wastewater infrastructure. With a membership of more than 5,500 individuals, our members include educators, regulators, engineers, contractors, manufacturers, suppliers, service providers, and other parties in the protection of North America's water resources and environment. All segments of the industry are represented on NOWRA's Board of Directors that provide broad perspectives to promote and sustain our industry and service to the public. NOWRA headquarters is in Westford, Massachusetts, with local constituent groups throughout the United States.

NOWRA provides a national forum to address the challenges facing our industry. We provide education and training programs for professionals and bring uniformity to the industry. As the national educational resource and clearinghouse for onsite and decentralized systems and promoter of best management practices, NOWRA plays a lead role in state and federal legislative initiatives to protect water sources, human health, and the environment. NOWRA works to educate the public and policy makers about the advantages and benefits of onsite and decentralized wastewater management and serves as an advocate at the federal, state and local levels to encourage legislative and regulatory changes that facilitate expanded use of these systems.

NOWRA

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INTRODUCTION

The U.S. EPA estimates that one in five households use individual onsite wastewater treatment systems to collect, treat, and safely return reclaimed water back into the environment. Because improperly treated wastewater is a threat to both public and environmental health, it is very important that homes, businesses, and institutions that use Onsite Wastewater Treatment Systems (OWTS) provide the required maintenance to ensure that their systems will properly function. This guide is intended to help homeowners understand how their onsite systems operate and to learn about the required maintenance.

Purpose of the User Guide

This user guide will help you:

- understand the basic principles of how an OWTS works;
- learn how to operate the system efficiently and effectively;
- know how to maintain the system to prevent costly repairs and water contamination; and
- resolve problems with the system.

TERMINOLOGY

ONSITE WASTEWATER TREATMENT SYSTEM (OWTS) (aka septic system) is the term used to describe an individual wastewater treatment system that serves a single or a small cluster of homes or businesses. OWTS can provide treatment the same as or better than a central sewer system at a lower cost.

RCAP
Rural Community Assistance Partnership

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CHAPTER ONE

Importance of Sewage Treatment

Simply put, wastewater is water that contains waste compounds. Water is often called the universal solvent, and that property makes water the ultimate fluid for transporting human waste. This includes suspended solids, dissolved organic and mineral compounds, odoriferous gases, and pathogens. When we bathe and launder our clothes, water dissolves the sweat and soil and rinses those compounds down the drain. When we flush the toilet, water is used to transport the by-products of our metabolism out of the house.

The primary objective of your OWTS is to remove the waste from the water. Proper treatment of sewage recycles water back into the natural environment with reduced health risks to humans and animals and prevents surface and groundwater contamination. Sewage from our homes contains four primary groups of contaminants that must be removed to effectively protect public and environmental health:

- Pathogens—harmful viruses and bacteria
- Solids—organic and inorganic material
- Nutrients—nitrogen and phosphorus
- Chemicals—cleaning products, personal care products, medications, etc.

Systems that do not provide adequate treatment represent a danger to humans and the environment. It is unhealthy for humans, pets, and wildlife to drink or come in contact with surface or groundwater contaminated with sewage. Inadequate treatment of sewage allows bacteria, viruses, and other disease-causing pathogens to enter ground and surface water. Hepatitis, dysentery, and other diseases may result from bacteria and viruses in drinking water. Disease-causing organisms may make water unsafe for recreation. Flies and mosquitoes that are attracted to and breed in wet areas where sewage reaches the surface may also spread disease.

An OWTS that fails to adequately treat sewage can also allow excess nutrients (phosphorus and nitrogen) to reach nearby surface waters, promoting algae and plant growth. Algal blooms and abundant weeds may make the lake unpleasant for swimming and boating and can affect water quality for fish and wildlife habitat. Aerobic bacteria decompose the plant matter as it dies and settles to the bottom. The aerobic decomposition process consumes the dissolved oxygen that fish need to survive. Nitrogen can also be a problem for families that depend on groundwater for drinking water. Inadequate treatment of sewage can raise the nitrate levels in groundwater. High concentrations of nitrate in drinking water are a special risk to infants. Nitrate affects the ability of an infant's blood to carry oxygen, a condition called methemoglobinemia (blue baby syndrome).

Many synthetic cleaning products, pharmaceuticals, and other chemicals used in the house can be toxic to humans, pets, and wildlife. When using bleach and detergents, follow the recommended use guidelines on the product label. Strong disinfectants can reduce the population of good bacteria in the OWTS.

Treating sewage is everyone's responsibility. In many cases, residents of towns and cities have their sewage treated at a centralized wastewater treatment plant. Costs are covered by taxes, assessments, and direct usage charges. Residents in areas without access to centralized wastewater disposal and treatment own, operate, and maintain their own OWTS. When your OWTS is properly designed, installed, operated, and maintained, it will provide economical and effective sewage treatment. If you properly treat sewage today, future generations will not incur the costs of cleaning up the health or environmental problems that may have otherwise been created by untreated sewage.

Maintenance and System Longevity

Just as roofs must be replaced and walls need to be repainted, OWTS need to be maintained and sometimes replaced. Even with routine maintenance, OWTS have a finite life before repair or replacement are needed. Wastewater may start ponding on the soil surface after years of receiving septic tank effluent. The soil can become clogged with solids that are still suspended in the water after it passes through the septic tank. **Operation and maintenance of the system is the owner's responsibility.** Contact the your local permitting agency (planning and zoning, environmental services, health department, etc.) with questions about local requirements.

Outdated Systems That Do Not Provide Proper Treatment

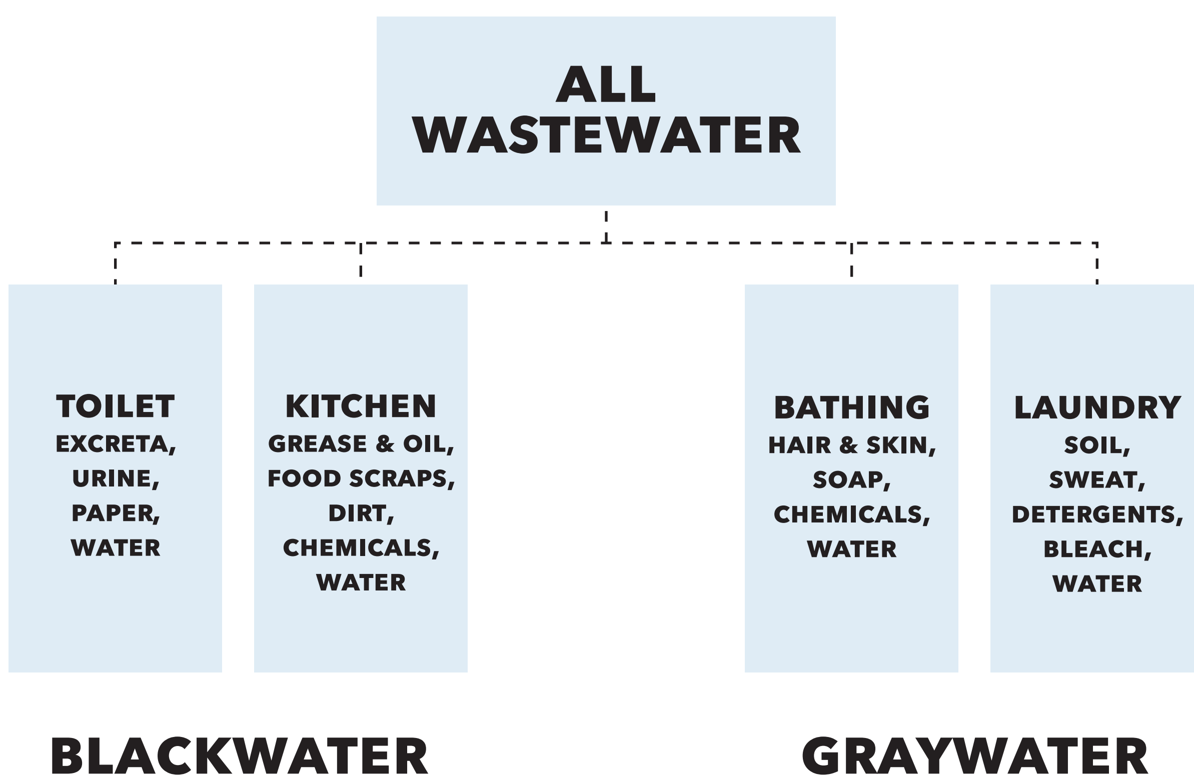
Our understanding of the human and environmental impact of wastewater has evolved with time. Some OWTS that were considered acceptable are now known to provide inadequate of treatment. Examples of these earlier types of systems are drywells, seepage pits, and cesspools. Some older homes and businesses may still be connected to these systems. These disposal systems, though popular in the past, are just that—relics of a time when treatment of sewage was not considered the priority it is today. As the population grows and the demand for natural resources continues to increase, society's expectations that sewage be responsibly treated and returned to the environment will also increase. These systems will eventually be discontinued. Many of these outdated systems do not meet current codes, and compliance with these regulations is an important component of public health and environmental protection.

Some OWTS owners incorrectly assume that, if their sewage does not back up into the house or pond in the yard, then the system must be working properly. OWTS are designed to utilize physical, chemical, and biological processes to treat sewage and effluent. In order to accomplish this objective, the OWTS must be properly designed, installed, operated, and maintained.

TERMINOLOGY

SEWAGE is the term used in this publication to include all toilet water and bathing, dishwashing, cleaning, and laundry water. Sewage sources are sometimes described as blackwater (heavily contaminated) and graywater (lightly contaminated), as shown in Fig 1. It is important to note that both types of wastewaters have contaminants and need treatment.

DISPOSAL VERSUS DISPERSAL It is frequently stated that we dispose of wastewater when, in fact, we return it back into the hydrologic cycle. Treatment is provided to remove the waste compounds from the water before it is discharged. Using the term "dispersal" emphasizes that treatment is provided, thus returning reclaimed water back to the environment.



CHAPTER TWO

Overview of Household Wastewater Treatment

The design and installation of an OWTS is controlled by local and state rules, typically through a permit process. The design should take into consideration all specific site characteristics including the type of soil, size of house, and sewage-generating fixtures and appliances. All systems should be designed and installed by licensed professionals and inspected by qualified officials to ensure proper installation.

An OWTS can be divided into four primary groups of components.

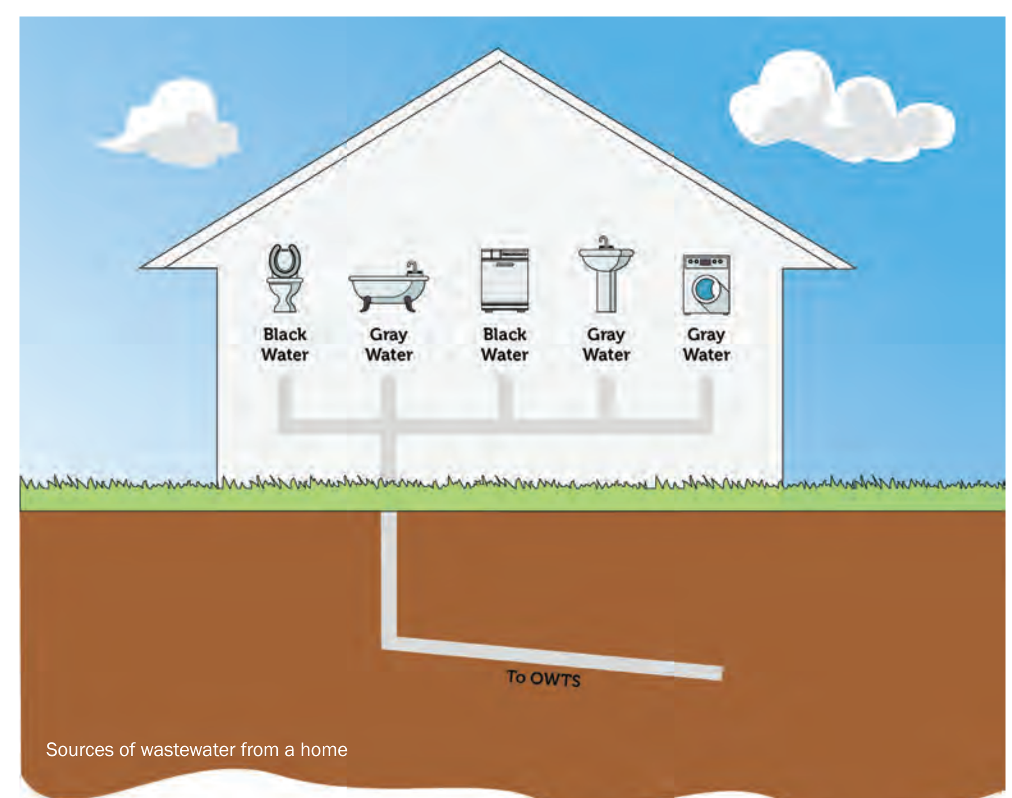
1. Plumbing/collection The plumbing collects used water from fixtures and appliances, and the collection delivers it to the treatment system.

2. Pretreatment The treatment component is divided between pretreatment and final treatment. The first step in the treatment train is a septic tank that receives the sewage and promotes the separation of solids from the liquid. Most of the solids are retained in the tank, thus reducing the solids and organic matter content of the sewage. Liquid leaving the septic tank is referred to as septic tank effluent or just effluent.

3. Advanced pretreatment When site and soil conditions are limited in their ability to provide final treatment, advanced pretreatment can be added in place of the septic tank or in addition to the septic tank. There is a strong demand to build new homes on marginally suitable soils and, in some locations, these advanced pretreatment devices may offer a means to provide suitable wastewater treatment and dispersal at these locations.

4. Final treatment and dispersal A soil treatment area (STA) receives the pretreated effluent (from the pretreatment/ advanced pretreatment) for final treatment and dispersal.

Final treatment is provided as the effluent passes through the soil. The size of the soil treatment area needed depends on the volume of water to be treated and the infiltration capacity of the soil on the site. Water returns to the environment as groundwater recharge or as water vapor from evapotranspiration through plants.



Sources of wastewater from a home

TERMINOLOGY

A **SOIL TREATMENT AREA (STA)** is used to infiltrate pretreated wastewater into the soil. Common names for this area include drainfield, trench, leachfield, and soakaway.

CHAPTER THREE

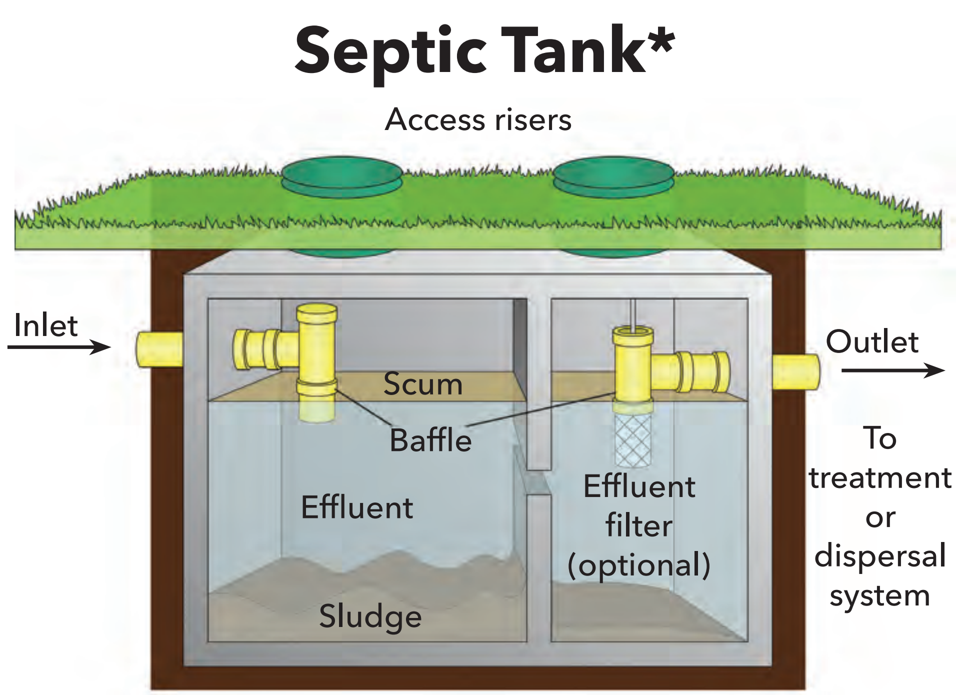
Typical Onsite Wastewater Treatment Systems Features

Fixtures and Plumbing

Approximately 80% of the water we consume becomes wastewater. All water containing human waste, nutrients, dirt, and other contaminants must be collected and delivered to the septic tank for pretreatment and then to the soil treatment area for final treatment and dispersal. In some older homes, the drain from the laundry may have been plumbed to bypass the septic tank; however, this can cause damage by allowing too many solids to enter the soil treatment area. In addition, some drains from laundry discharge to the surface, resulting in a risk to public health and the environment due to the contaminants. In contrast, water from roof drains, basement drainage sump pumps, hot tubs, swimming pools, and air conditioning condensate are not considered wastewater, and should not be put into the OWTS. The discharge from water treatment systems (such as a water softener or reverse osmosis) could be handled separately from the OWTS because the large water volume needed to regenerate these devices could overload the system.

Original and remodeled plumbing systems must be correctly designed and installed to allow trouble-free operation. **Before remodeling, consider the impact of changes on the OWTS.** The addition of a bedroom may trigger a need to upgrade the OWTS to a larger capacity.

Every home has a wastewater piping system that collects wastewater from the source and transports the wastewater to the OWTS. This plumbing is called the drain, waste, and vent (DWV) system, because it is used to drain wastewater from the home and to allow air to vent. You may have noticed pipes protruding from your roof— these pipes allow air to enter the DWV system as water moves through the plumbing system. Air is displaced as water moves through the piping, and this air must be allowed to vent. Likewise, after the water moves through, air must be allowed to enter the piping, or a vacuum will form. This vacuum can pull the water out of the toilet bowl and other gas traps, which will allow sewer gases to enter the home.



* Please note: The configuration of your septic tank may vary.

For most homes, the DWV system is designed to flow by gravity. Pipes are installed on a minimum 2% slope to move the wastewater out of the home. For homes that have plumbing fixtures located in a basement or somewhere below the elevation of the DWV plumbing, a sewage pump is used to pump the wastewater up to the DWV system.

Household Sewage Lift Station

When gravity cannot be used to move sewage from the building to the septic tank, a sewage lift station is incorporated into the system. A lift station is a pump that transfers raw sewage from the lowest portion of the building's plumbing system to the septic tank.

Building Sewer

The building sewer is the pipe that transfers raw sewage from the building to the first component of the treatment system. Most OWTS are arranged so wastewater will flow by gravity between the building and the septic tank.

Conventional Pretreatment

Septic Tank

How the Tank Works

The operation of the septic tank is based on buoyancy. Objects that are denser than water will sink, and objects less dense than water will rise. As such, a properly functioning septic tank should form three distinct layers:

- Floating layer—soaps, greases, toilet paper, and other light objects will rise to the surface of the water in the tank.
- Liquid layer—water, liquid, and suspended solids in the center of the tank.
- Sludge—heavy organic and inorganic materials at the bottom of the tank.

Naturally occurring bacteria in the sewage begin to break down the organic materials. Anaerobic bacteria, bacteria that can live with little to no dissolved oxygen, provide some digestion, but solids will accumulate faster than the bacteria can break down.

Components of the Tank

The septic tank is typically the first step of the sewage treatment process. The septic tank is a solid, water-tight tank. Septic tanks are commonly constructed of concrete, but plastic (typically polyethylene or polypropylene) or fiberglass-reinforced plastic tanks can be used if they are specifically designed to accept sewage and approved by the local permitting agency. The goal of septic tank design is for the sewage to take at least two days for the liquid to move across the length of the tank. In order to achieve the necessary volume to hold two days of flow, some installations may have two tanks in a row or one large tank with two compartments. Increased tank capacity is recommended if a garbage disposal is installed. It is recommended that the septic tank has two compartments; the first is generally two-thirds the septic tank volume, and the second is one-third the volume. Passage between the two compartments should be from within the liquid (or middle) layer.

Several tank designs are available, but all tanks must have inlet and outlet baffles or tees, inspection pipes, and manholes for cleaning. The **inlet baffle** forces sewage entering the tank towards the bottom to be mixed with the liquid contents to begin bacterial breakdown of organic materials and separation of solids. The inlet baffle also prevents the floating scum layer from clogging the inlet pipe.

The **outlet baffle** prevents scum from leaving the tank. If the scum layer reaches the outlet pipe, the pipe will become plugged. Scum in the soil treatment unit will clog soil pores and destroy its ability to treat sewage. Filtering devices, known as effluent screens/filters, can be installed at the outlet of new or existing tanks to prevent solids from reaching the soil treatment unit. Regular maintenance is required to keep the filters from clogging and causing backups.

Filters are a very good idea and may be required in some states but are not a substitute for proper operating or maintenance practices.

Inspection pipes of 4- or 6-inch PVC (plastic) material should be located above the inlet and outlet baffles to allow for inspection of pipes and baffles, if the baffles cannot be accessed through the manhole/access riser. Clogs in the inlet or outlet pipes can be unplugged through the inspection pipes or manholes/access risers. When operating properly, the septic tank is always "full" to the level of the bottom of the outlet pipe.

Inspection pipes must always be capped. They may be cut off flush with the ground to ease lawn care; however, the pipes should be left "long" until the final grade on a new site is determined. Metal covers can help in locating the inspection pipes if the ground is covered with snow.

A much better option is for the septic tanks to be designed so the manholes/access risers are located over the inlet and outlet baffles so the riser also serves as the inspection pipe.

The **manhole/access riser** in the cover of the septic tank is the large entrance (20"-24") through which the tank should be cleaned. The mahole/access riser may be buried below ground level but should be close to the ground surface for easy access. It may be raised from the cover of the tank with concrete or plastic risers for easier access. It is usually located in the center of the tank; however, some manufacturers locate it closer to the inlet end of the tank. There may be more than one manhole/access riser, in which case they are usually located at the ends of the tank. The manufacturer, installer or installation records may be able to tell you where it is. Manhole/access riser covers may be concrete or plastic.

Manholes/access risers allow proper cleaning and inspection of the tank. Manhole/access riser covers must be kept securely in place. If the existing septic tank cover does not have a manhole/access riser or inspection openings, sometimes the tank can be retrofitted with a new cover with these features.

Advanced Pretreatment Devices

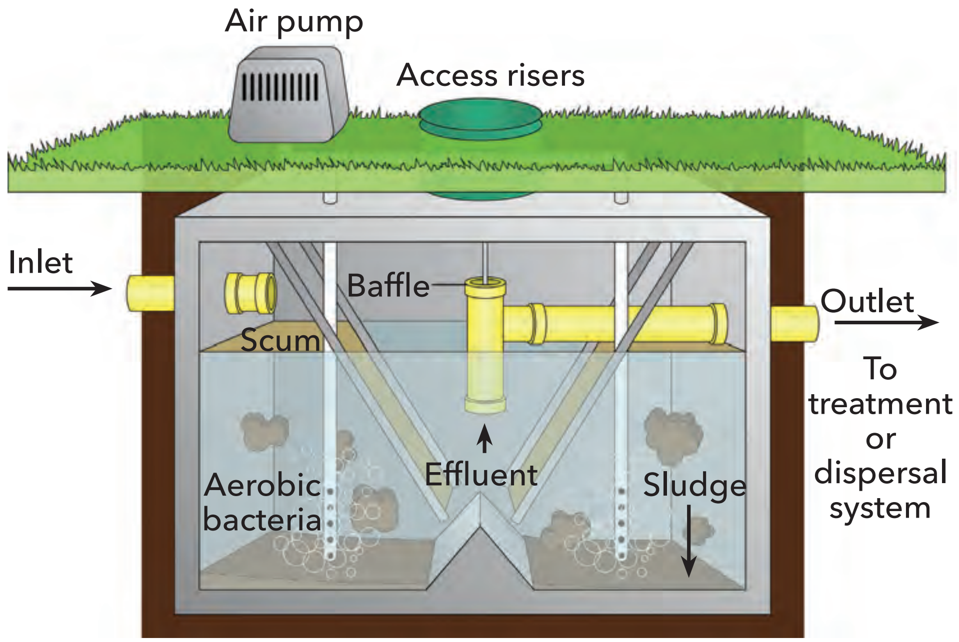
Site limitations may be overcome by providing additional pretreatment before the effluent is discharged into the soil profile. Advanced pretreatment usually involves the reduction of organic matter, suspended solids, and pathogens and may offer some removal of nitrate (denitrification). Reducing organic matter and suspended solids lessens the potential for these constituents to clog soil pores and thus maintains infiltration. Disinfection will further reduce pathogens, thereby reducing the demand on the soil to remove pathogens, and denitrification helps to protect shallow groundwater reservoirs from nitrate contamination.

Aerobic Treatment Units (ATU)

Aerobic (oxygen-loving) bacteria are the workhorses of wastewater treatment. As part of their metabolism, they use oxygen to oxidize many organic compounds to carbon dioxide and water. The organic compounds essentially serve as food to the bacteria, and the bacterial population will grow to match the food source. An ATU provides the dissolved oxygen needed to support the necessary population of active aerobic bacteria. A few aerobic treatment units are preceded by a separate septic tank, but most systems have an integrated tank to separate out trash and paper products in place of a septic tank and allow settling of the solids. This pretreatment device provides rapid decomposition of organic matter, a reduction of pathogens due to the hostile environment, and transformation of nitrogen-containing compounds to nitrate.

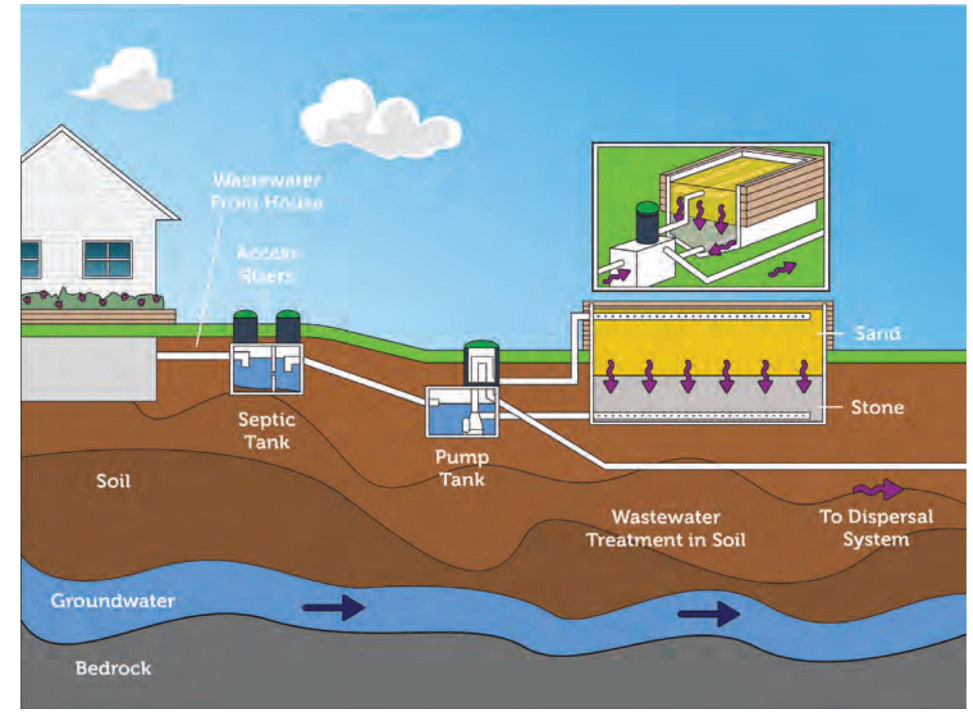
All ATUs have a device that delivers air into the water being treated. Oxygen (contained within the air) will dissolve into the water and create aerobic conditions. Depending on the manufacturer, the aeration system may be a blower, a compressor, or an aspirated propellor. The aeration process also serves to mix the contents of the ATU tank, ensuring good contact with the organic compounds and the bacteria. This process is called **suspended growth** because the dense population of aerobic bacteria is suspended in the effluent by the mixing action of the aeration system. After mixing, the effluent then moves into a quiescent zone where the bacteria will settle to the bottom of the compartment, forming a sludge-like layer called **biosolids**. The clarified effluent now moves to the next septic system component.

Aerobic Treatment Unit

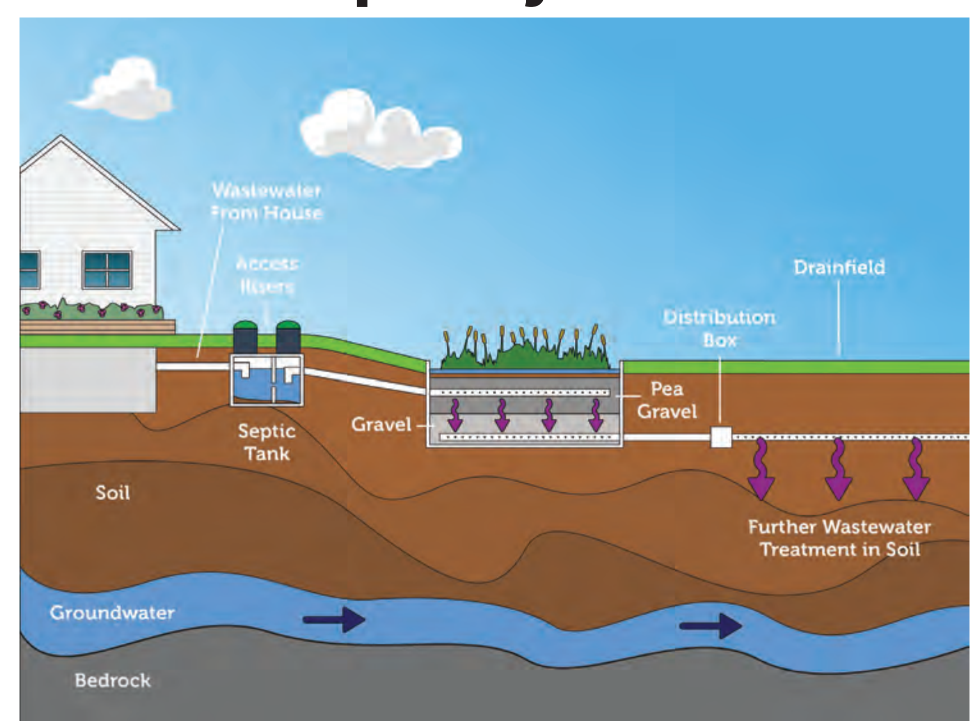


Installation of an aerobic treatment unit.

Media Filter Septic System



Constructed Wetland Septic System



Media filters

A packed-bed media filter (or just media filter) uses media such as sand, peat, gravel, or a textile to provide an attachment location for aerobic bacteria. This is a different configuration than the ATUs. Instead of mechanical aeration, media filters provide aeration by trickling the water through the media where oxygen, nutrients, and organic compounds diffuse through the biofilm formed by the attached bacteria. As with the ATUs, media filters provide excellent removal of organic matter, reduction of pathogens due to the hostile environment, and conversion of nitrogen compounds to nitrate (nitrification). Biosolid formation (overgrowth of bacteria on the media) tends to be slower in media filters; however, an accumulation will occur over time and can cause clogging in the pore space of the media. Professional service providers can perform the necessary maintenance to keep the media filter operational.

Constructed Wetlands

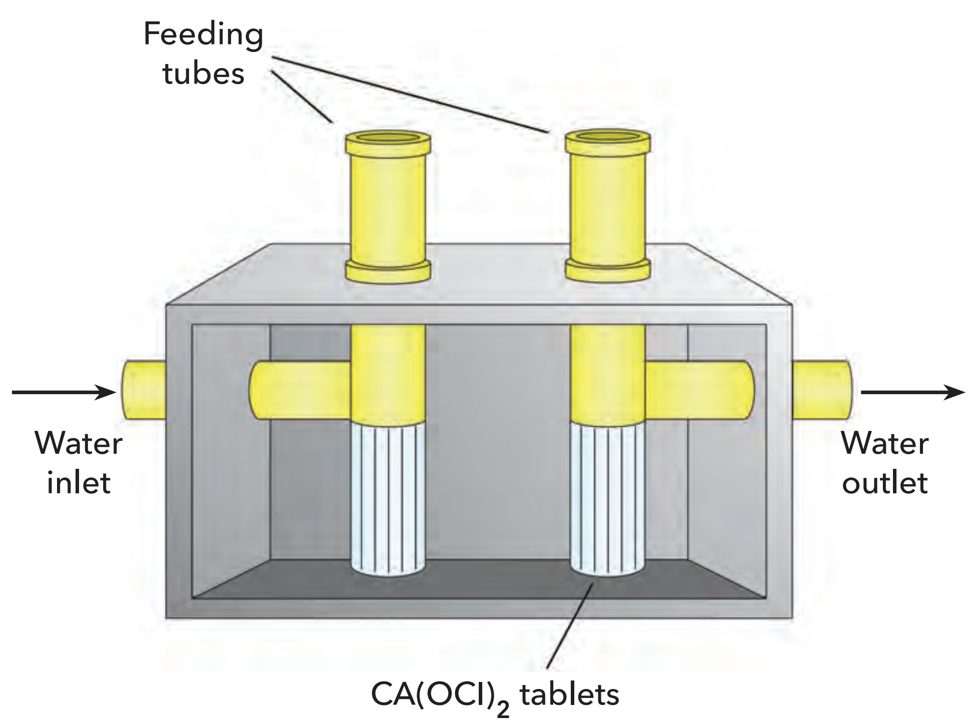
Just as the name suggests, constructed wetlands are small wetlands that are constructed for the purpose of wastewater treatment. A gravel bed is constructed within a watertight liner (either a plastic membrane or highly compacted clay) and wetland vegetation is planted within the gravel bed. The water level is maintained at or just below the top of the gravel bed. Aeration is provided by atmospheric oxygen that crosses the interface between the air and water and by the release of oxygen via photosynthesis by algae and the roots of other green plants submerged in the water. Reaeration is a slow process in constructed wetlands. This means that the system must have a large footprint relative to mechanical systems such as ATUs and media filters.

Disinfection Units

Disinfection is the destruction of pathogens. A conventional septic system provides wastewater disinfection by passing the effluent through the soil, where pathogens are filtered out by soil particles and die off in the hostile environment. Most human pathogens found in wastewater like a warm, oxygen-limiting environment. Transferring these microorganisms to the soil where the temperature is cooler, oxygen is plentiful, and predators are abundant is a natural way to provide disinfection.

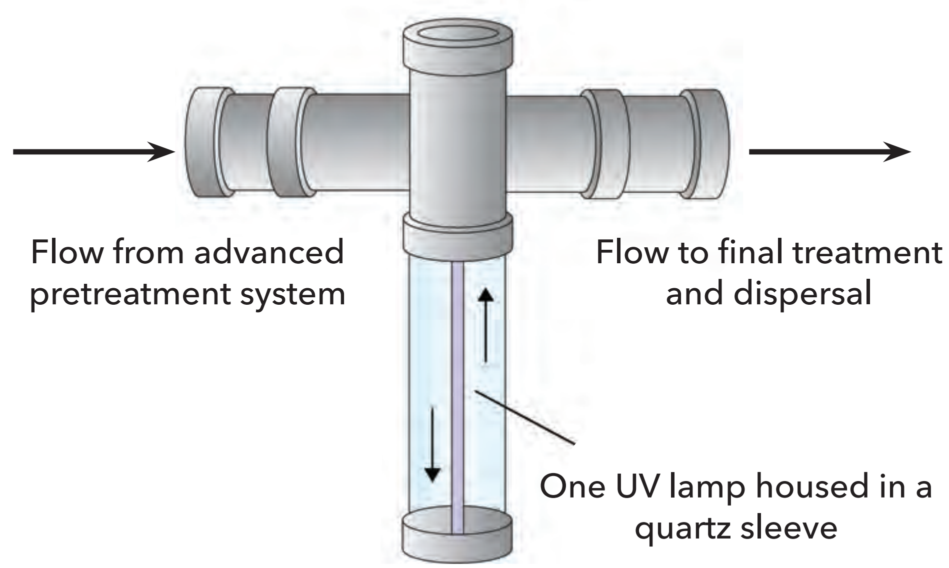
When the soil is not suitable to provide disinfection or when there is a potential for someone to come into contact with partially treated wastewater (such as spray irrigation), pathogens can be inactivated by installing a disinfection system between the last treatment component and the effluent dispersal system. There are two commonly used disinfection methods: chlorine and ultraviolet light. The most common chlorine systems are known as **tablet feeders**. These devices hold a stack of three-inch-diameter calcium hypochlorite $[Ca (OCl)_2]$ tablets. These tablets slowly dissolve, releasing chlorine into the effluent. It should be noted that these tablets are not the same product used to chlorinate swimming pools or drinking water.

Tablet Feeder



Ultraviolet light (UV) provides disinfection by irradiating the effluent with light wavelengths between 200 and 300 nanometers (nm). This radiation damages the DNA of the microorganisms, and they cannot reproduce. Most UV systems that are employed with onsite wastewater systems use low-pressure lamps that are similar in appearance to a fluorescent lamp. UV systems are more expensive to purchase but do not have the continued cost of chlorine replacement. Manufacturers of UV systems recommend replacing the lamp on an annual basis. Some of these lamps contain a small amount of mercury, and they must be disposed of properly.

Ultraviolet Light



Tankage, Pumps, and Controls

Where possible, OWTS are designed to let gravity do the work of moving effluent. In some situations, effluent may need to be pumped to the next component in the treatment train because it is up-gradient from the previous component. In other situations, effluent may need to be dose-fed and recirculated through a treatment device such as a recirculating media filter. Under these circumstances, an additional tank, pump, and pump controls are installed.

The purpose of the tank is to store effluent between pumping events. Effluent trickles into the tank as wastewater is generated within the residence. At designated times, or when a pre-set volume of effluent has accumulated, the pump is activated and rapidly transfers effluent to the next component. A common design standard is to size the tank to hold a volume equivalent to two days of generated wastewater. This volume provides temporary storage in case of pump failure.

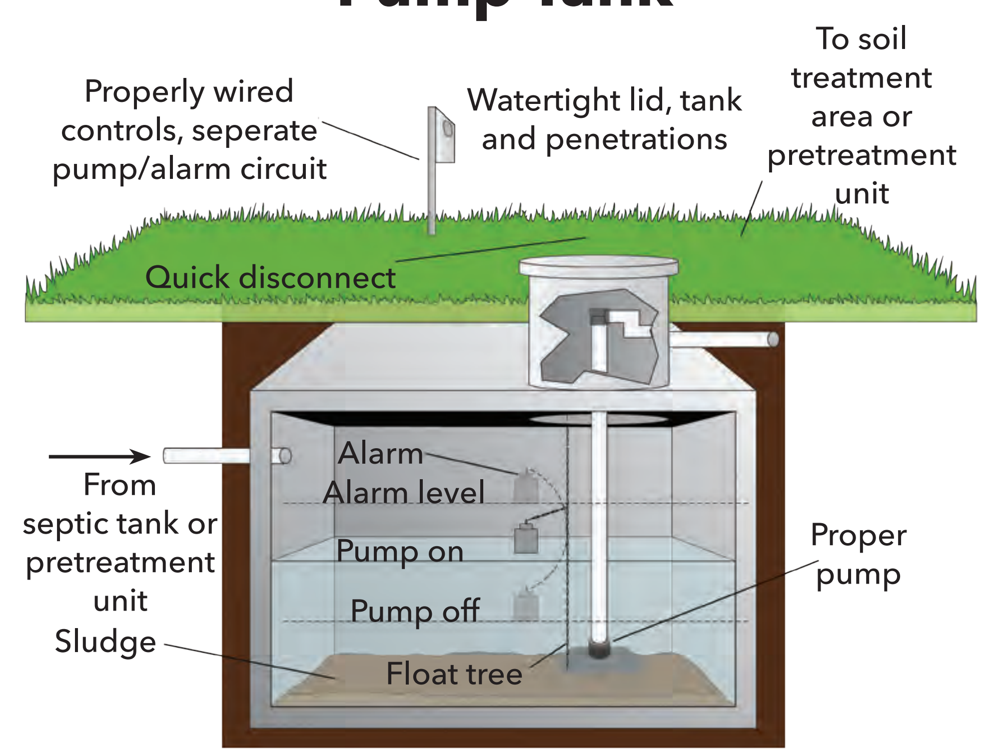
Most septic system pumps are submerged in the effluent and are designed to withstand the corrosive wastewater environment. Pump selection is made by appropriately trained persons who understand the required flow rate and pressure needed to move effluent to the next component. Generally speaking, most septic system pumps are a fraction of one horsepower, operate on 120 voltage (VAC), and will last 7 to 10 years before needing to be replaced.

Pump controls are used to activate/deactivate the pump as needed. There are two styles of pump controls: **demand dose** and **timed dose**. With a demand dose system, the effluent accumulates in the tank until it reaches the pre-set level. Effluent levels are commonly determined using floats; however, pressure transducers are becoming more popular. Once the effluent reaches the pre-set level, the pump transfers the effluent until a lower pre-set level is reached, at which time the pump is deactivated.

Timed dose systems transfer smaller doses of effluent on a more frequent basis. This dosing method allows the downstream component to receive predictable and consistent allocations of effluent. The control panel for a timed dosed system includes a clock device that will activate the pump at a pre-set frequency and only allow the pump to operate for a pre-set period.

Control panels are weatherproof electrical enclosures that allow for the transfer of electricity from the circuits of the residence or business to the septic system components that require electric power. These boxes are typically mounted on the side of the building facing the septic system or on a post near the septic system. If the septic system includes a pump and/or has an alarm system, then a control panel should be present. During septic system installation, an electrician will install one or more circuits from the main breaker box to the control panel. The control panel contains secondary circuit breakers that allow the septic system component to be electrically disconnected. Pump control panels will include a heavy-duty relay (motor starter) to engage/disengage the pump and often include event counters to record the number of times the pump was started. It could also include an elapsed time meter to indicate the total pump run time. An additional feature of most pump control panels is a high-water alarm. This will warn the homeowner when the water level is too high. If this happens, the problem needs immediate attention. Be sure to know where this alarm is, what it means, and what to do when it is activated.

Pump Tank



The alarm also provides notification of a pump failure. Control panels require professional installation and maintenance. The enclosure should be locked to prevent direct access to the high-voltage wiring contained within. All pump systems must have access to the pumps and controls by having manhole access to the soil surface. Pumps and floats are maintenance items and will need to be replaced upon failure.

Transfer to Final Treatment and Pressurized Distribution

The two most common reasons to have a pump tank and pump associated with a OWTS are 1) the final treatment area is located up-gradient from the septic tank, and 2) there is a pressurized distribution system over the soil treatment area.

It is not uncommon for the septic tank to be located at a lower elevation than the soil treatment area. When this situation happens, a pump system is placed after the septic tank and, on a demand basis, the effluent is transferred to the beginning of the soil treatment area. There are two commonly used configurations: **pump-to-trench** and **pressurized distribution**. The pump-to-trench method only uses the pump to lift the effluent up to the beginning of the trench within the soil treatment area. Pressurized distribution uses the pump to lift the effluent and pressurize the network of pipes within the soil treatment area, which provides a more uniform dispersal of effluent.

CHAPTER FOUR

Final Treatment and Dispersal

Soil-Based Final Treatment and Dispersal

Small wastewater systems tend to use the soil as a medium to provide final treatment and to return the reclaimed water back into the environment, while larger, municipal-scale systems tend to discharge reclaimed water to a surface water body such as a creek, river, lake, or ocean. Systems that directly discharge to surface water have extensive permit requirements that ensure that the effluent meets discharge standards. Very few OWTS discharge to surface because of the difficulty of maintaining compliance with the discharge permits.

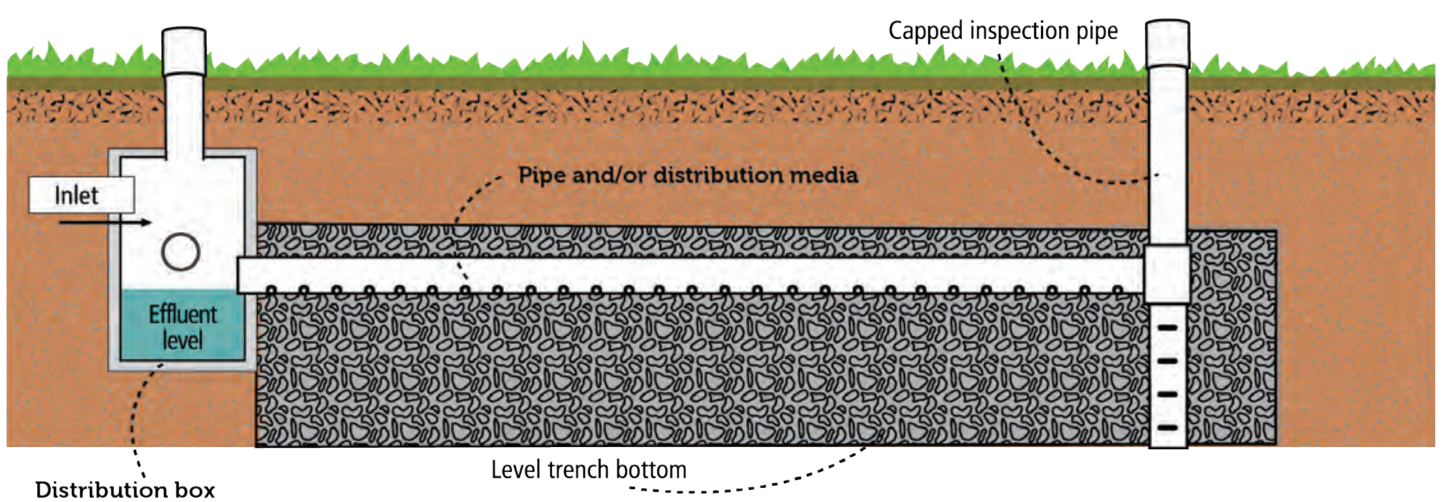
How the Soil Treatment System Works

Final treatment of sewage occurs in the soil. Uncompacted, unsaturated (not full of water), undisturbed soil must surround the soil treatment system. Soil treatment kills disease-causing organisms in the effluent and removes organic material. There are millions of naturally occurring beneficial microscopic organisms in every tablespoon of soil that complete the effluent treatment process.

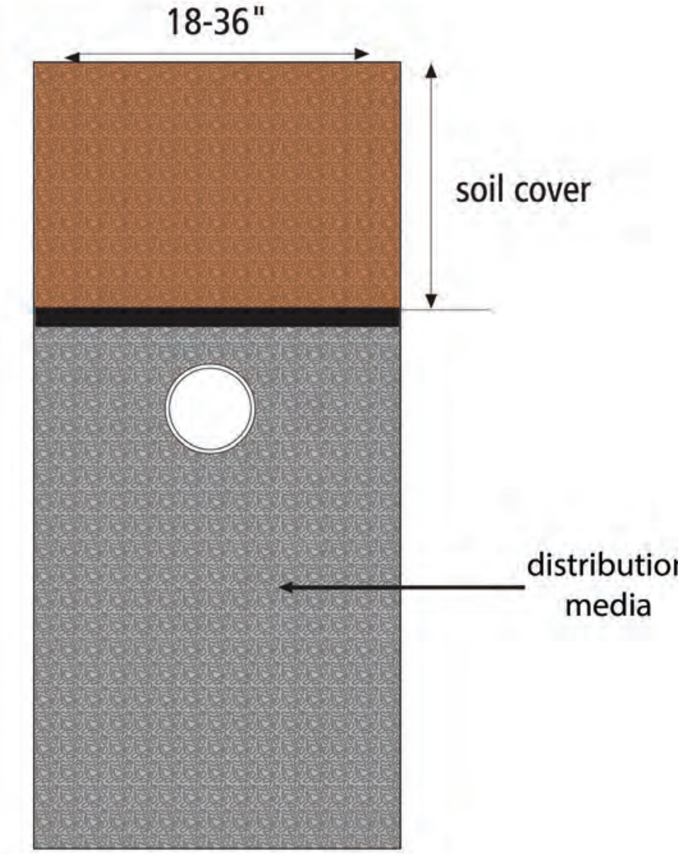
The beneficial bacteria in the soil need air to live. Therefore, a zone of unsaturated soil must be present below the effluent's point of entry into the soil for complete treatment. At least two to three feet of unsaturated soil above a restrictive layer (bedrock or water table) is the recognized standard. Some local units of government have established different requirements based on local conditions. Each site has a unique shape and slope. The soil type, effluent volume to be treated, and other factors determine how large an area is needed to provide final treatment and disposal.

The **biomat** is a thin layer of fine solids, dead bacteria, and soil bacteria that forms where the effluent meets the soil. This biomat layer regulates how fast liquid passes out of the trench or bed into the soil so the soil beneath the trench remains unsaturated. Once the effluent is through the biomat layer and unsaturated soil, most harmful pathogens have been destroyed and much of the phosphorus has been removed.

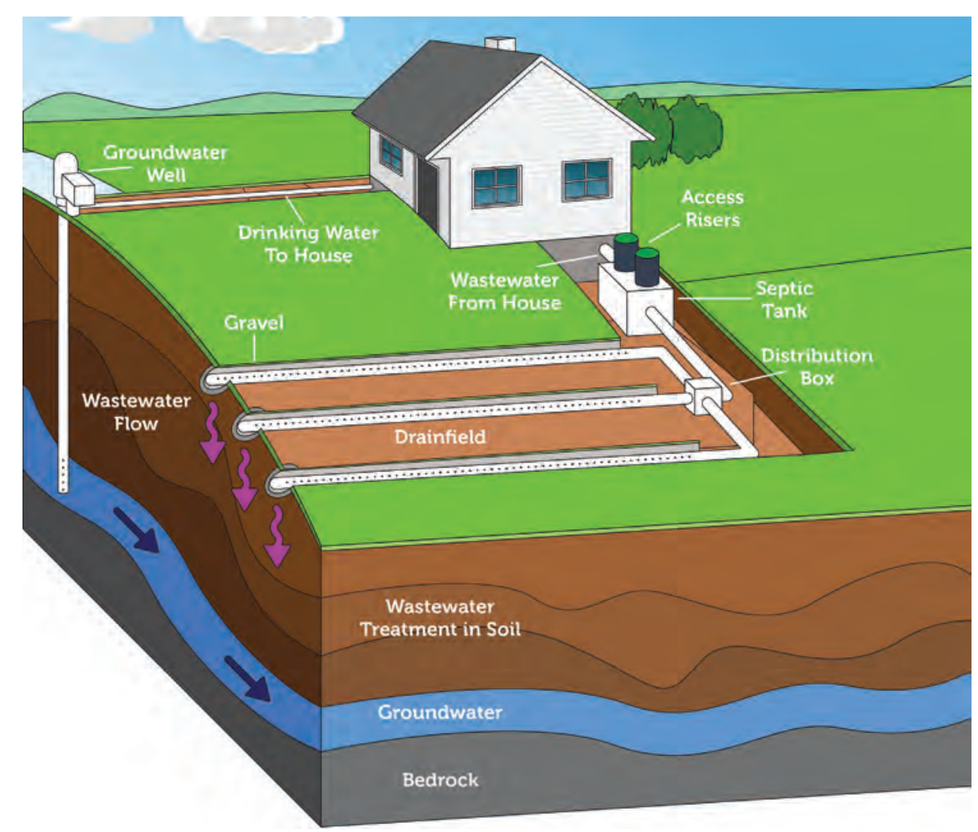
Trench Cross Section



Conventional Trench



Conventional Septic System



Saturated soil is determined by its color and **redoximorphic features**. Redoximorphic features are the change in color of the soil due to extended periods of water saturation. Redoximorphic features and depth to bedrock are detected by soil borings or pits dug by professionals when the system is designed.

Gravity Flow Drainfields

The least expensive distribution and soil treatment system is gravity flow effluent from the septic tank to a trench system. A traditional soil treatment system is constructed by excavating a series of trenches (18 to 36 inches wide) into the soil profile. The trenches are placed on contour and have level bottoms. These excavations are then partially backfilled with a high-porous media or chambers to provide effluent storage. This storage is needed when the infiltration rate of effluent into the soil is less than the discharge rate of the septic tank into the trench, such as during a heavy water-use day. Effluent enters one end of the trench and flows by gravity to the other end. To help facilitate effluent movement through a porous media, a four-inch-diameter perforated pipe is embedded in the porous media along the length of the trench. Depending on the local regulations, trenches are capped with 6 to 12 inches of soil, bringing the fill back up to the natural grade.

The trench system may be laid out in one of many configurations to fit the property and allow for the necessary square footage of treatment area. There are often inspection pipes used to evaluate the system on one or both ends of the trenches. These can be cut off at ground level and capped for easier lawn maintenance. The ground surface of the soil treatment area should always be slightly raised above the surrounding ground to avoid excess rainfall flooding the system.

Sewage is discharged to the drainfield, then moves through the biomat and infiltrates into the soil. Bacteria are removed or destroyed in this process, and the remaining suspended solids are retained. Dissolved organics provide food for the good bacteria in the soil.

The near-uniform distribution of effluent into a gravity soil treatment system is accomplished using **drop boxes** and **distribution boxes**. The covers of either of these types of boxes should be accessible for inspection and cleaning.

Pressurized Dispersal Systems

Gravity distribution systems do not ensure uniform effluent distribution along the length of the trench or across multiple trenches. This is not a problem when there is sufficient soil depth between the bottom of the trench and a restrictive layer to provide treatment. For sites that have a restrictive layer closer to the soil surface, pressurized distribution can often be used to ensure adequate treatment. Pressurized distribution systems allow the effluent to be applied evenly along the length of the trench and across all trenches.

Low-Pressure Distribution

A low-pressure distribution (LPD) system is a network of perforated PVC pipes (typically 1 to 1¼ inches in diameter) that are placed in narrow (6- to 12-inch) trenches. The perforations, called orifices, are typically spaced on 60-inch centers and have small diameters (less than ¼ inch).

Drip Distribution

Drip distribution systems utilize drip irrigation technology to slowly and precisely apply effluent to the soil. Drip distribution systems typically follow an advanced pretreatment system, although there are a few areas where they are allowed after pretreatment in a septic tank. A drip system is composed of polyethylene tubing that has embedded emitters on a two-foot spacing. The emitters are typically pressure-compensated, meaning that the flow of effluent from the tubing is controlled by the emitter rather than by how much hydraulic pressure is in the tubing. These systems do not use trenches per se; the tubing is installed in a narrow slot opened by a vibratory plow or a chain trencher. Emitters have very narrow passageways that provide tremendous resistance as water flows from within the tubing to where it is discharged into the soil. Before entering the drip distribution system, the effluent is passed through a filter that removes suspended solids down to 120 mesh. The filtration helps to protect the emitters. To further protect the emitters, most systems are programmed to periodically "flush" the tubing and return any suspended material back to the septic tank. Air/Vacuum release valves at the high points are placed in the drip distribution system to vent the air from the tubing when the pump activates and to allow air into the system to prevent vacuums from occurring when the pump shuts off.

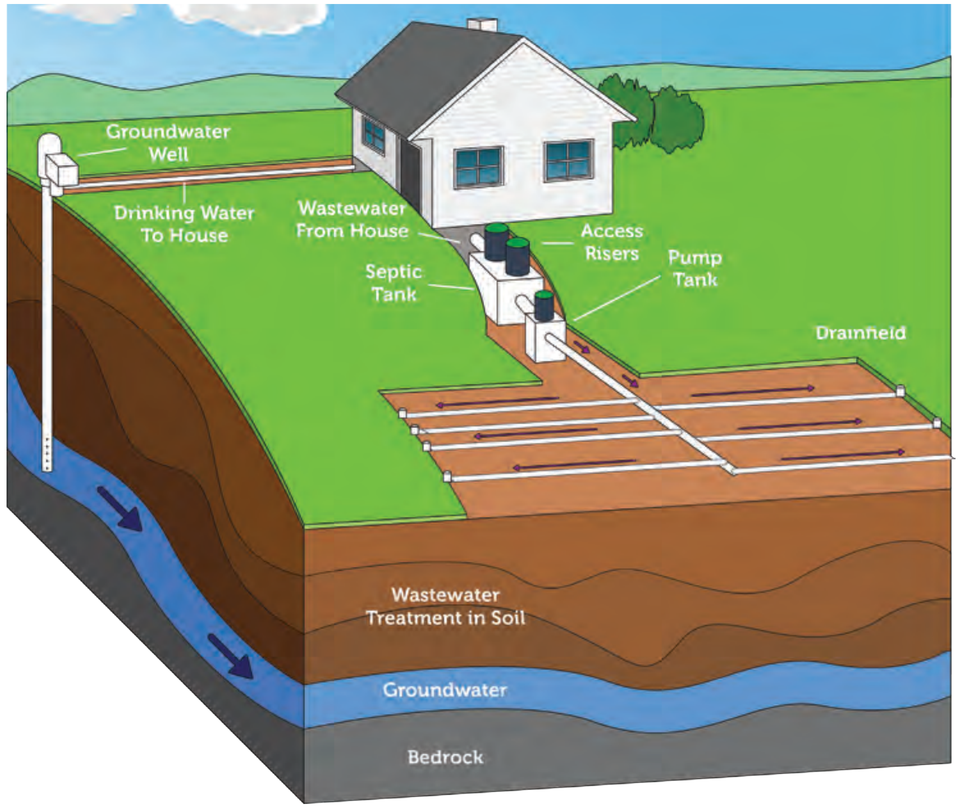
Spray Fields

Spray irrigation is another potential means of applying effluent to the soil. However, there are safety concerns, because people and pets could come into contact with inadequately treated effluent and because stormwater could carry contaminants off-site. Most jurisdictions that allow spray irrigation require use of a disinfection system, demand that the area is fenced, and only permit late-night effluent application to minimize odor complaints and contact with the effluent.

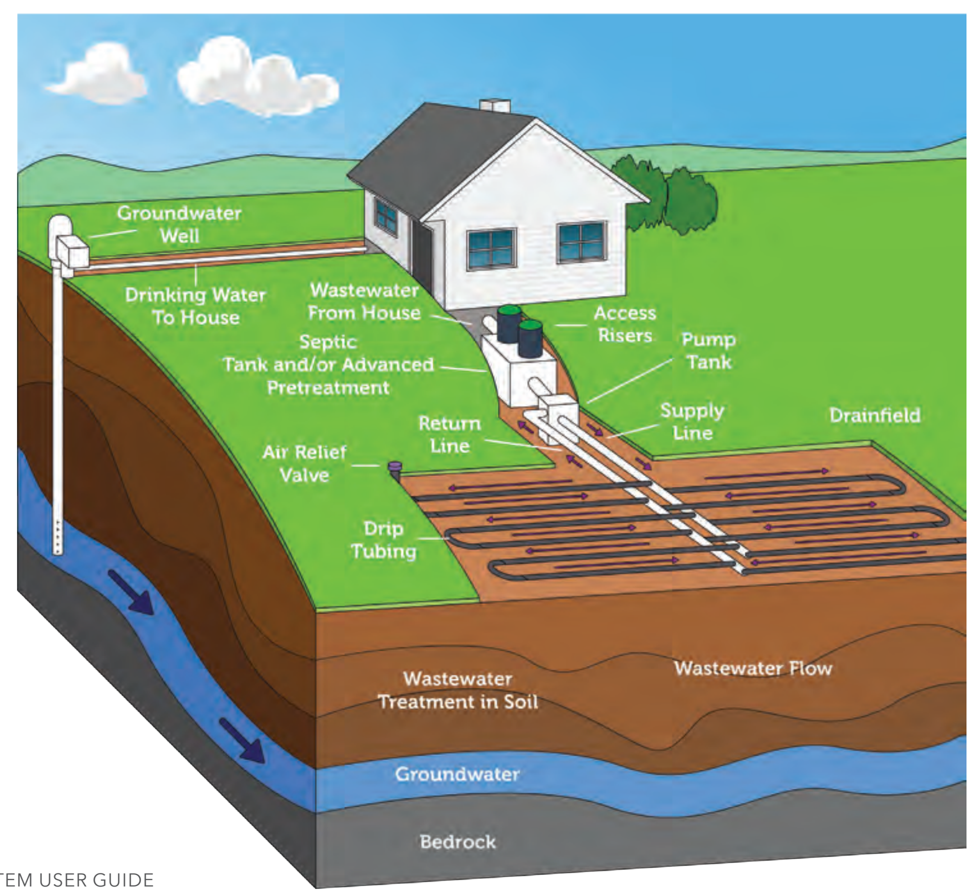
Combination Treatment and Dispersal (CTD)

Advanced wastewater pretreatment was discussed on pages 8–9 as a means of removing waste before the water is applied to marginal soils. These are engineered treatment devices that are placed between the septic tank and the soil treatment area. Treatment systems can also be incorporated into the design of the soil treatment area. Referred to as CTD systems, these designs can provide additional treatment before the effluent infiltrates into the soil. Effluent passes through a layer of engineered media—typically uniformly sized sand or other manufactured products that provide extensive surface area and porosity—where bacteria and other microorganisms oxidize organic compounds and reduce the potential for those same compounds to clog the soil. There are several configurations of CTD systems; however, this guide will focus on mounds, sand-lined trenches, and sand-filled beds.

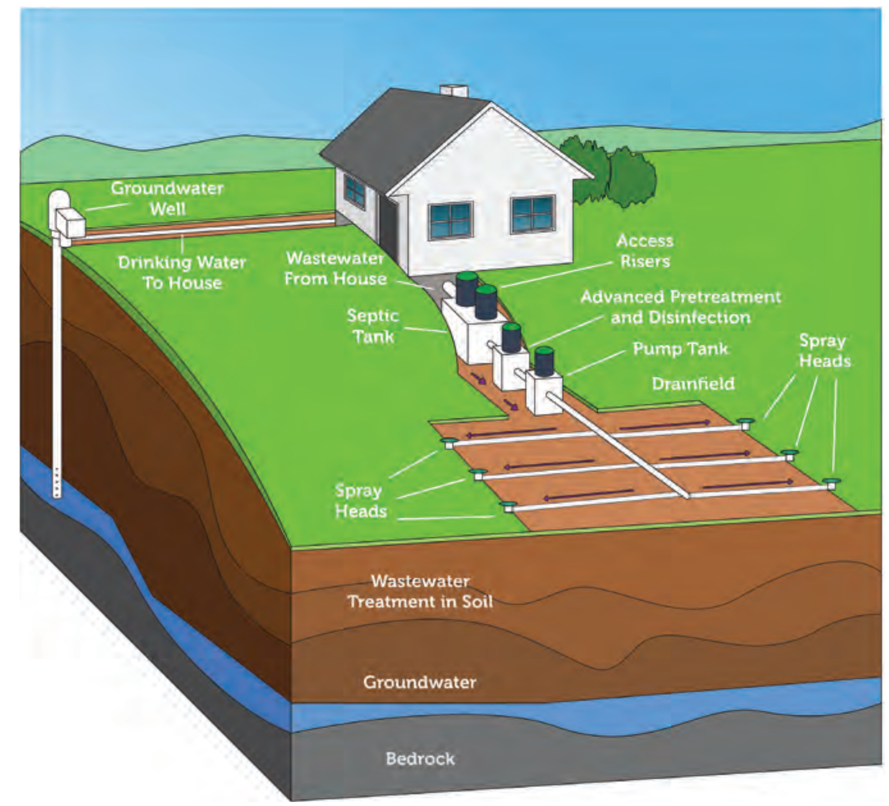
Low Pressure Pipe System



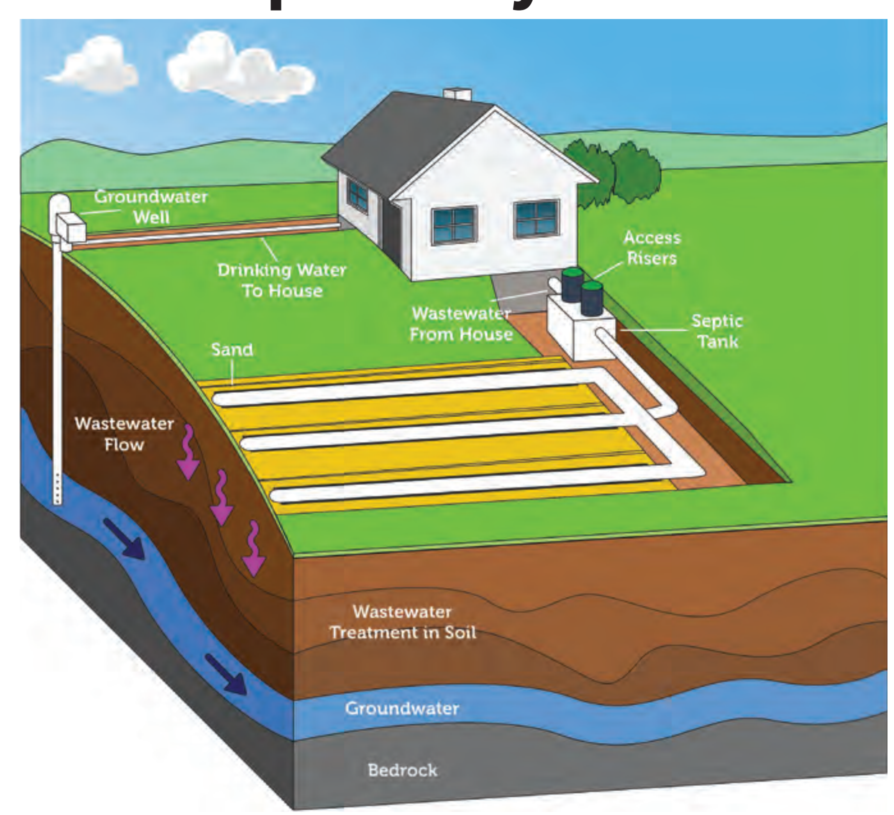
Drip Distribution Septic System



Spray Field



Combined Treatment and Dispersal System



Mounds

An effluent treatment mound is a pressurized seepage bed raised with clean, uniformly-sized sand (or other manufactured media) to provide adequate soil depth between the effluent released in the mound and the saturated soil or bedrock underneath. It is equally as effective in treating effluent as a conventional trench system if it is properly constructed and operated and the septic tank is maintained correctly. The mound system has a pressurized distribution system similar to a LPD system that applies effluent into a layer of distribution media on top of the sand. The mound is covered with topsoil and typically planted to grass.

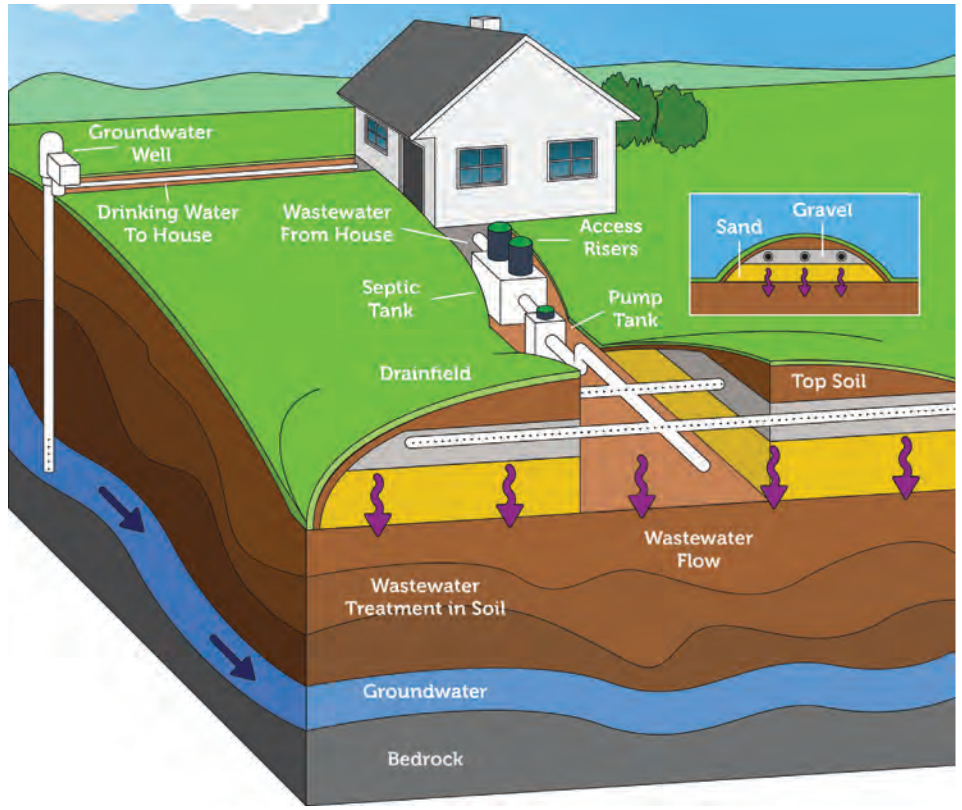
Sand-Lined Trenches

Sand-lined trenches are used to provide additional treatment before the effluent enters the soil. Trenches are excavated and then partially backfilled with uniform-sized sand or other manufactured media. The distribution system is typically pressurized and used to provide uniform application; however, a few gravity flow systems have been approved in a few states. The media provides the same type of treatment as a mound or a packed-bed media filter. The distribution system is then backfilled with native soil to the natural grade. Sand-lined trenches are sometimes used when the underlying soil is too porous due to sand content or fractured bedrock and would not provide adequate treatment. Sand-lined trenches are vented to allow greater air circulation through the media and maintain aerobic conditions.

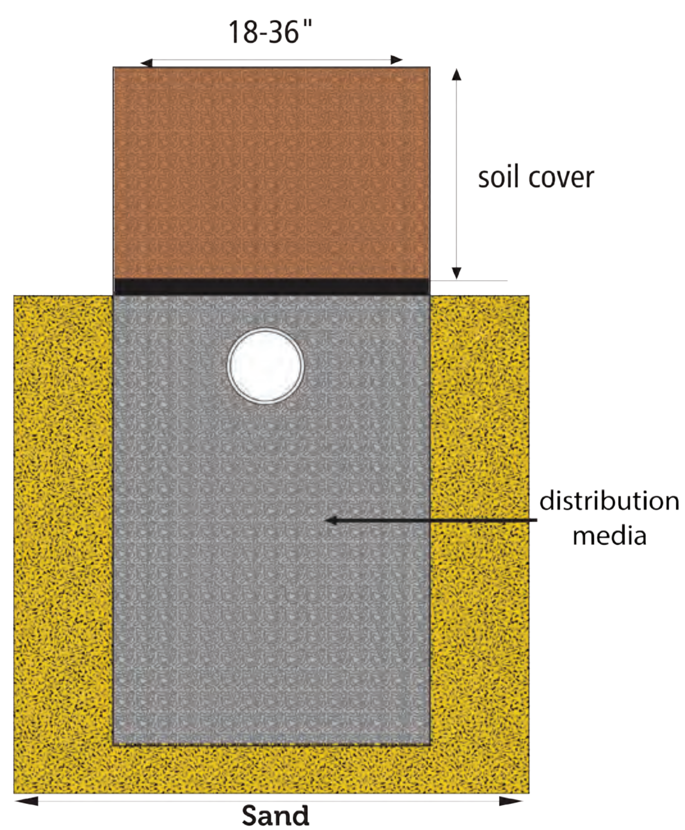
Sand-Filled Beds

Similar to sand-lined trenches, sand-filled beds are shallow excavations that are backfilled with a uniform-sized sand or other manufactured media and use a gravity-based effluent distribution system. Beds are distinguished from trench systems by the width of the excavation. Generally speaking, beds are below-grade excavations greater than three feet wide. Sand-filled beds are vented to increase air circulation and maintain aerobic conditions. This is similar to a

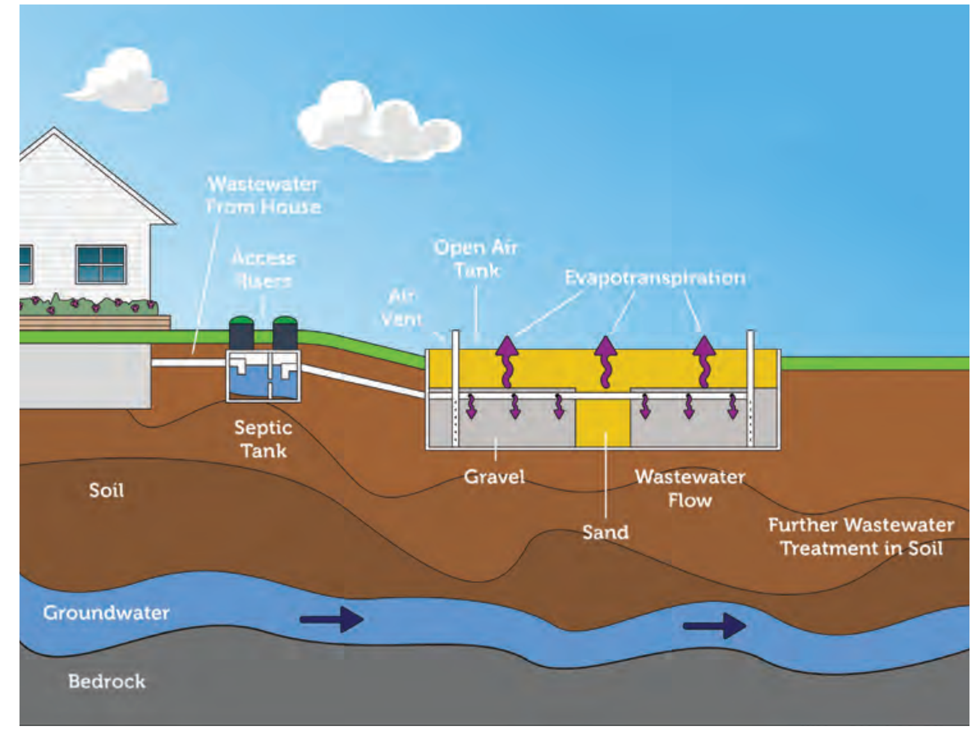
Mound Septic System



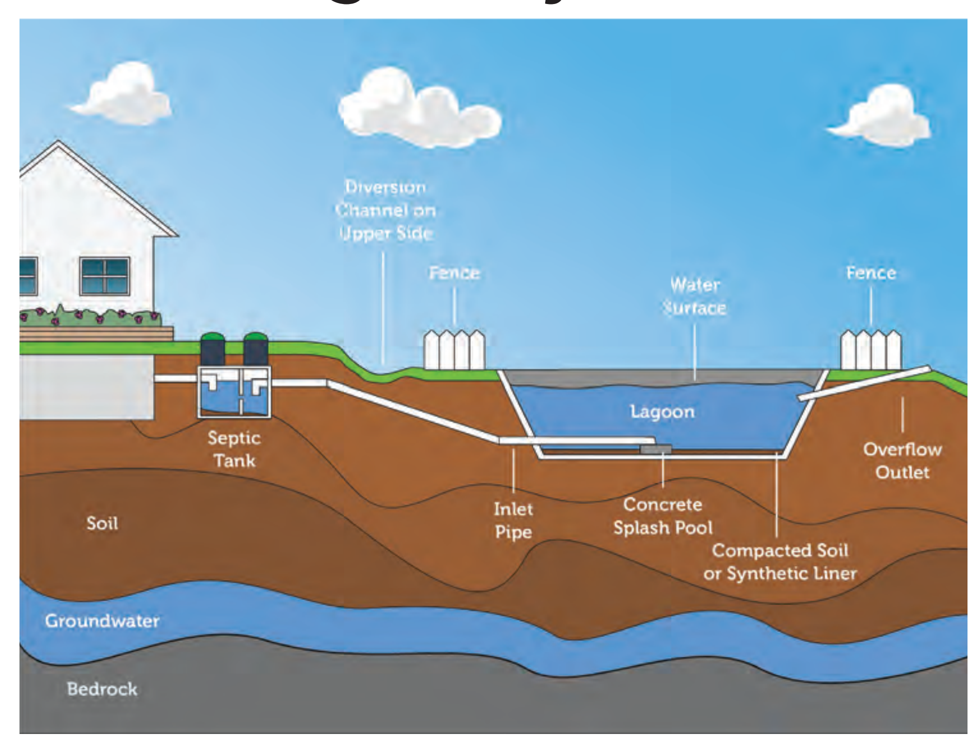
Sand Lined Trench



Evapotranspiration Septic System



Lagoon System



buried sand filter.

Non-Soil Based Final Treatment and Dispersal

In locations where conditions allow, evapotranspiration can be used to disperse effluent back into the hydrologic cycle. Another method is the discharge of treated effluent to surface water.

Evapotranspiration Beds (ET)

ET is the combination of transpiration (the water that passes through a plant) and evaporation (water that is converted to a gas). In locations where evapotranspiration is much greater than rainfall, there is potential to disperse effluent using evapotranspiration beds. These beds contain water-loving plants that encourage the movement of water into vapor. At the same time, these plants encourage the growth of bacteria that can remove many of the waste constituents from the effluent.

Lagoons

Lagoons are small ponds that provide some level of treatment and hold the effluent during dry weather conditions. During the rainy season, when there should be plenty of diluted water, controlled releases are made to surface waters to regain the storage capacity of the lagoon. Lagoons provide aerobic treatment near the water surface where there is a water/air interface. Anaerobic treatment is provided in the deeper water.

Direct Discharge

As mentioned above, a few OWTS have direct discharge permits. These systems discharge the reclaimed water straight into surface waters. These are high-risk systems that require permit compliance and extensive operation and maintenance.

CHAPTER FIVE

The number one source of wastewater from a home is the bathroom.

COURTESY OF PEXELS

TERMINOLOGY

OPERATION AND OPERATOR We often use the phrase "O&M" meaning operation and maintenance. But how does the word operation apply to an OWTS? We operate the system each time wastewater goes down the drain. As a volume of wastewater enters the septic tank, it displaces an equal volume out of the septic tank that becomes effluent and flows to the next component. Because the system operates in response to our generation of wastewater, we are the operators of the OWTS system.

Management

OWTS need to be managed to operate properly. **System management** is understanding how the system works, knowing where the components are located, and recognizing that regular maintenance is required. There are components that will wear out and need replacement, and there are components that will fill with non-degradable solids that need to be removed. It is critical to understand that every properly operating system needs management to serve as a long-term solution. These activities are straightforward, necessary, and time sensitive for systems to operate properly.

Usage

The septic tank works on a flow-through basis: As wastewater enters the tank, it displaces an equal volume of water that exits as effluent. As a result, the time that wastewater stays in the tank is dependent upon how quickly we generate wastewater. Most regulation-sized septic tanks have approximately two days of retention within the tank. In other words, if 500 gallons of wastewater is generated per day and you have a 1,000-gallon septic tank, then the water should be in the tank for two days before it moves to the next component in the system. Thus, the rate, measured in gallons per day, at which we generate wastewater has an impact on the effectiveness of the OWTS to treat and disperse wastewater.

Water Use

OWTS are not designed for average water usage; rather, they are designed for an infrequent heavy water-use day. It is frequently stated that we use approximately 75 gallons of water per person per day. From this value, and the notion of a household with two people per bedroom, most regulatory agencies specify a hydraulic loading rate in the range of 120 to 150 gallons per day per bedroom. Using 150 gallons per day per bedroom as an example, then the hydraulic loading rate for a three-bedroom home is 450 gallons per day. Again, this is not an average water usage – it is an infrequent daily usage, such as when we wash four or five loads of laundry in the same day.

The total amount of water and the pattern of water use affect how well the OWTS performs and how long it will last. Property owners should be conservative with their water use and spread water usage throughout a day and week whenever possible. For complete and uniform treatment of waste, the system needs time to work. The ideal situation would be to have sewage enter the system as evenly as possible throughout the day and week. Every time water is used, sewage enters the septic tank, and an equal amount of water leaves the tank. Large volumes of water entering the septic tank or other treatment component in a short period of time may agitate and re-suspend sludge and scum into the liquid contents. If this happens, suspended solids are carried into the soil treatment system, clogging soil pores and preventing adequate treatment.

Excessive water use, or clean water allowed into the system, puts an unnecessary load on the OWTS. In most households, toilet flushing is the largest use of water, followed by bathing, laundry, and dishwashing. Allowing faucets to drip, fixtures to leak, and water to run continuously while washing dishes, shaving, and brushing teeth are wasteful habits that contribute to extra wastewater entering the OWTS. OWTS can also be overloaded with water from high-efficiency furnaces and recharge water from water softeners, water purification devices, and iron filters.

One of the best ways to reduce the amount of water needing to be treated by the OWTS is to replace old water-using appliances. Look for WaterSense-labeled products (epa.gov/watersense/watersense-products), which are backed by independent, third-party certification and meet EPA's specifications for water efficiency and performance. When you use these water-saving products in your home or business, you can expect exceptional performance and be assured that you are saving water for future generations.

WaterSense Meets EPA Criteria

OPTIONS TO REDUCE WATER USAGE

IN THE BATHROOM

Bathing and handwashing are the second biggest water use, so installing low-flow shower heads and faucets is a great idea. Take short- to moderate-length showers instead of tub baths. Showers use less water than tub baths, as there are five gallons or more per inch in a tub. In cold climates, consider a tankless water heater that only heats the water being used and reduces the need to leave the faucet open until the arrival of hot water. Shutting off water while shaving and brushing teeth could save up two to four gallons for each minute the faucet is open.

Old-style five-gallon flush toilets are the No. 1 water-using devices. Utilizing low-flow or dual-flush toilets can make a significant difference. Repair leaky faucets and toilets immediately, as these can add ten to hundreds of extra gallons to your system.

IN THE KITCHEN

You can save water by hand washing dishes in the basin instead of under running water. Keep a pitcher of drinking water in the refrigerator instead of running the tap to get cool water. Wash only full loads in the dishwasher, with an efficient dishwasher.

IN THE LAUNDRY ROOM

Select a front-loading washing machine, which will use 40% to 65% less water, and/or use a water/suds-saving or highly efficient top-loading washing machine to reduce water and detergent use. Wash only full loads or be sure to adjust load level settings for small loads. Distribute wash loads evenly throughout the week to avoid overloading the system with large volumes of water in a short period of time.

IN YOUR HOME

If you have a water treatment device, it may have a meter that tracks your water usage. Also, check with your OWTS service provider to determine if your OWTS tracks flow and review this during your next scheduled maintenance.

If you have a water treatment system such as a water softener, iron filter, or entire home reverse osmosis system, consider routing the backwash or reject water out of the OWTS. These units have the risk of overloading your system and adding waste products to the system that may affect longevity.

CHAPTER SIX

Wastewater Strength

OWTS systems are designed to process water and the waste constituents dissolved in or carried by that water. Scientists and engineers often use the word "strength" to quantify the amount of waste contaminants in the wastewater. We would expect a fast-food restaurant to have more fats and oils in their wastewater as compared to a normal household. In this case, the fast-food wastewater would be considered high-strength for organic matter. OWTS systems that serve restaurants and commercial kitchens would need additional components to manage the additional fat and oil loading. A residential OWTS is designed to handle wastewater that is of normal strength.

Other Waste Constituents

Practices and habits within the home can potentially overload the system with more waste contaminants than the system was designed to handle. In general, the less contamination you have, the easier it will be for your system to treat the wastewater and the longer your OWTS will last. Property owners should be mindful of the products they use and limit cleaners and sanitizers to a minimal amount needed to keep the household clean. Select products given an "A" by the Environmental Working Group (ewg.org/guides/cleaners), which have been found to be the least toxic to the environment and public health.

Below are some specific examples of options to reduce your family's contaminant load:

Limit the use of harsh cleaners in the toilet to lessen the load to your septic system.

STASZWIG FROM PIXABAY

1. Throughout the home

- Reduce use of cleaners by doing more scrubbing with less cleanser. Be sure your cleaners do not contain phosphorus. Use the minimum amount of soap necessary to do the job. This is often less than suggested by cleaning product manufacturers.

2. In the bathroom

- Do not use "every flush" toilet bowl disinfectants that are placed in the tank or bowl.
- The only waste aside from human that should enter the bowl is toilet paper. Use moderate amounts of toilet paper that break up easily in water.
- Do not flush facial tissues, sanitizing wipes, paper towels, cigarette butts, condoms, or personal hygiene products down the toilet.
- Try to limit hair entering the system by installing screens over drains and disposing of it as solid waste.
- Do not dispose of unwanted prescription or over-the-counter medications in the OWTS.
- To clean the bathroom, focus on biodegradable, nontoxic, and hypoallergenic products. Limit or eliminate the use of antibacterial soap/cleaners. Lime and hard water deposits can be removed with hot white vinegar, mild scouring products, abrasive pads, or a pumice stick.
- Do not use drain cleaners to remove clogs. If the drain slows down due to build up, clean with a plunger or plumber's snake instead of using a chemical-based solution.
- Use natural-based personal care products. Bar soap is recommended over liquids to minimize the amount used. Avoid anti-bacterial products, as they will harm the natural bacteria needed to treat the wastewater.

3. In the kitchen

- Do not use a garbage disposal or dispose of vegetables, meat, fat, oil, coffee grounds, and other undigested food products in the OWTS, as it is better to either compost or handle with your garbage service.
- Reduce the use of drain cleaners by minimizing the amount of grease and food particles that go down the drain.
- Either run full loads in your dishwasher or fill the sink with water to wash versus running the faucet.

4. In the laundry room

- Install a filter on the washer to remove lint and use laundry detergents that do not contain phosphates or are labeled as sanitizing.
- Use the minimum amount of detergent or bleach necessary to do the job.
- Select natural-based, biodegradable detergents that do not contain clay that can clog downstream components.

5. In your utility room

- Consider rerouting the water softener and ion filter recharge water outside the OWTS.
- Recharge the water softener as infrequently as possible to reduce water use.
- Dispose of all solvents, paints, antifreeze, and chemicals through local recycling and hazardous waste channels. Consult local solid waste officials for proper methods. These materials kill valuable bacteria in the system and may pass through to contaminate drinking water.
- Never let wash water from paint on brushes or rollers go down the drain and into the OWTS.
- Neutralize condensation in high-efficiency furnaces due to its acidity or route away from the OWTS.

6. Outside your home

- Be sure to route chlorine-treated water from swimming pools and hot tubs away from the OWTS.
- Route roof drains and basement drainage tile water (sump pumps) away from OWTS.

Additives

There is no quick fix or substitute for proper operation and regular maintenance. There is no scientific or technical data indicating that additives are required. Do not use starters, feeders, cleaners, or other additives. Many of these additives suggest they work via "enzyme" or "bacterial" action. Below is some information on these products.

Starter

A starter is not needed to get the bacterial action going in the septic tank. There are naturally occurring bacteria present in sewage.

Feeders

It is not necessary to "feed" the system additional bacteria, yeast preparations, or other home remedies. There are millions of bacteria and plenty of food for them entering the system in normal sewage. If the bacterial activity level is low, figure out what is killing them, e.g. household cleaners, and correct it. High levels of activity will return after the correction.

Cleaners

Additives effective in removing solids from the septic tank will probably damage the soil treatment system. Some additives may suspend the solids in the liquid layer that would normally float to the top or settle to the bottom of the tank. This allows them to be carried into the soil treatment system, where they clog pipes and soil pores and lead to partial or complete failure of the system.

Other Additives

Additives, particularly degreasers, may contain carcinogens (cancer-causing agents) that flow directly into the groundwater along with the treated sewage.

Many state regulations ban the use of OWTS additives that contain hazardous materials. In addition, they specify that additives must not be used as a means of replacing or reducing the frequency of proper maintenance and removal of scum and sludge from the septic tank. EPA or USDA approval statements on labels only mean that the product contains no hazardous material. It does not mean the product is effective at what it claims to do.

CHAPTER SEVEN

Safety

OWTS can pose a safety concern: The sealed components are devoid of oxygen, there is a strong potential for contact with human pathogens, and tanks are filled with contaminated water. Some OWTS have pumps and controls that add electricity to this mixture. The following guidelines should be followed when attempting to perform maintenance on your system.

Collecting of a sample from a septic system with advanced pretreatment.

RULES

NEVER ENTER THE SEPTIC TANK. The tank has a manhole for cleaning and inspection from the outside only. The tank contains very little oxygen and has high levels of hydrogen sulfide, methane, carbon dioxide, and other life-threatening gases.

ALWAYS REMEMBER that the liquid and solid contents of the OWTS can cause infectious diseases. After working on any part of the OWTS, always wash hands thoroughly. Change clothes before coming into contact with food or other people.

NEVER USE ELECTRICAL lights, appliances, or tools in or close to the water or wet ground near the septic tank, pump tank, or soil treatment unit. This can result in explosion or electrical shock.

NEVER SMOKE NEAR SEPTIC TANK OPENINGS. Methane is produced in the tank and may potentially be combustible.

KEEP VEHICLES AND OTHER HEAVY EQUIPMENT AWAY from the OWTS. The tank and other components may collapse due to weakness from corrosion.

KEEP CHILDREN AND OTHER SPECTATORS AWAY from the OWTS when it is being cleaned or excavated.

IF YOU SMELL "SEWER" GAS in your home, you may want to look for a dry plumbing trap (under sinks and floor drains) and fill with water to block the flow of gas.

MAKE SURE THE LIDS ARE SECURE ON SEPTIC TANKS. The tanks contain 4 or more feet of liquid, which can pose a safety issue if a person or animal falls in.

CHAPTER EIGHT

Improper traffic over a mound system causing compaction.

Landscaping and Land Use Near Your Onsite Wastewater Treatment System

Good vegetative cover—usually grasses, wildflowers or groundcovers—should be planted over the soil treatment area (STA) and mowed or weeded as needed. With turf grass, mowing is necessary to encourage growth without using fertilizer and to prevent woody vegetation from growing in the area. The vegetative cover helps the system remove nutrients such as nitrogen and phosphorus by using them for plant growth and, in cold climates, it will help to insulate the system. If the correct vegetation is planted, watering is only necessary within the first few weeks after planting. Once the vegetation is established, it needs to be watered only when the vegetation shows extreme signs of stress. STA areas receive hundreds of extra gallons of water per day during rain events, and the added moisture of excessive watering or irrigation could stress the septic system. All surface drainage should be directed away from septic system components. Fertilizing over the STA is not advisable, as human wastewater contains significant amounts of nitrogen and phosphorus and fertilizing may cause over-accumulation or leaching of the nutrients.

Do not plant trees or shrubs over the septic system; roots may invade the piping and cause damage or blockages. Water-seeking trees such as poplar, birch, beech, walnut, maple, willow, linden and elm should be planted at least 50 feet from the STA. The rule of thumb is to keep a distance equal to the anticipated height of the tree at its maturity, plus 20%. Thus, a tree that will be 30 feet tall at maturity should be kept 36 feet away when planting. In general, it's advisable to choose smaller ornamental trees.


A rural site where a new septic system is being installed.

During construction of the septic system, nearby trees should be protected to prevent root structure compaction. If the trees are influenced by the water from the septic system, they may be stressed by the increase in moisture, which is not positive for many varieties.

Any woody perennial including bamboo, vines (wisteria, bittersweet, morning glory, campsis and hops), and shrubs (low, woody perennial plants 3-15 feet in height) should not be planted on top of the STA but can be planted with caution within 5 to 10 feet of the edge of the system. Vegetable gardens **should not** be planted in the STA, as disturbing the soil with these annual crops is not good for the septic system, and most vegetable gardens need frequent irrigation.

Driving heavy vehicles on the STA before, during, or after construction can cause damage. Good soil treatment depends on undisturbed, uncompacted, unsaturated soil to treat waste. This is especially important in winter, when a vehicle's weight can drive the frost deep into the soil and prevent effective treatment from occurring. Nothing heavier than a riding lawnmower should ever be driven over any part of the OWTS. Do not grade or add soil to the OWTS without consulting your installer and/or permitting authority.

There are required setbacks in most regulations from building, structures, and other architectural features to allow for maintenance access and repairs. Architectural features like retaining walls, stone walkways, ponds, pools, hot tubs, decks, patios, or fire pits are items to avoid over your OWTS. These heavy architectural features can create problems, including lack of maintenance access, septic tank leaks, and pipe ruptures. Additionally, swimming pools, sports courts, storage sheds, swing sets, and sand boxes should not be placed over any part of your OWTS to avoid soil compaction. These features may get damaged if repairs are needed to the OWTS. Decorative items including art or benches are possible, but homeowners must remember that it's possible to smell odors from an OWTS near the pretreatment components. Fencing and gate placement can affect septic pumper truck access. The hoses on the service truck are heavy, and going over fences can cause damage. For tank cleaning, access within 50 feet of the truck is best.

KAREN CANN ON UNSPLASH

CHAPTER NINE


Pumping of a septic tank.

Maintenance

Working with an Operation and Maintenance Service Provider

Your OWTS requires periodic maintenance. Much of the material retained by the septic tank will not biodegrade and will accumulate until the tank is either full or the material is removed by a pumping service. The advanced pretreatment components also require periodic maintenance, which could include biosolids removal, changing UV lamps, and/or replacing pumps or floats. In many jurisdictions, OWTS that include advanced pretreatment components must have a maintenance contract with an approved service provider. Often, these individuals have been factory-trained by the component manufacturer and have been vetted through a certification program provided by the local or state jurisdiction. Regulatory agencies maintain lists of locally approved service providers.

Maintenance of Pretreatment Components

Septic Tanks

The pumping or "cleaning" of the septic tank must be done by a licensed and bonded professional. Proper pumping will remove ALL scum and sludge from the septic tank(s) and lift tanks. This requires pumping, flushing, and back-flushing liquid contents back and forth between the truck's tank and the septic tank through the manhole several times. This process breaks up all scum and sludge in the tank, allowing all solids to be removed by the truck's suction line. Some contractors use special tools other than back-flushing to liquefy the solids. Floating scum left in the tank after pumping may plug baffles or allow solids to enter the soil treatment area when the tank refills. Pumping will leave a black film on the tank walls and a small amount of liquid on the tank floor. This contains millions of bacteria to quickly regenerate the bacterial activity following the pumping. The material removed from the tank is called septage and must be managed in accordance with state and federal regulations.

When the tank is pumped, be sure to have the service provider check for leaks and make sure the baffles are in place and functioning properly. Pumping a tank through the inspection pipes is a bad idea and will often leave solids in the tank and possibly damage baffles. Insist that the tank be pumped through the manhole/access riser if the tank has one. Most tanks have manholes/access risers, but they may be covered with soil. **Ask the service provider beforehand if the tank will be pumped through the manhole/access riser, and if it will not, find a different service provider.** It may cost slightly more to have the tank pumped through the manhole/access riser, but this will save money in the long run. Bringing the manhole/access riser to the ground surface by adding risers can reduce future costs and facilitate proper pumping.

After pumping, it is not necessary to add a starter. Bacteria present in sewage and in the tank will do the job.

In **new home installations**, the tank should be pumped either before occupying the home or after six to twelve months of use as a precautionary measure to ensure good bacterial activity and proper function. In new homes, sewage containing paint, varnish, stain, and other construction-related products can reduce the initial levels of bacterial activity, causing damage to the soil treatment system. If construction work is yet to be completed, the tank should be pumped before it is used for sewage.

With regard to the frequency of pumping, **all** septic tanks **must** be periodically pumped (cleaned) to remove floating scum and sludge that accumulate. If either floating scum or sludge is allowed to enter the soil treatment system, it will cause expensive and often irreparable damage. Pumping frequency depends on system size, use, and operating condition. Septic tanks for single-family homes are typically cleaned every two to five years, but be sure to check with your jurisdiction about when it may be required or needed based on your unique system and use.


Pumping of a septic tank.


Cleaning of an effluent screen.

Effluent Screen

If the septic tank has an effluent screen on the outlet baffle, it should be cleaned periodically according to screen size, system use, and the condition when cleaned. The screen can be cleaned by the owner or a septic professional but always in a manner prescribed by the manufacturer or as suggested by the installer. **Be sure to wear protective gloves and wash hands and clothing thoroughly. Return the rinse water and contents to the OWTS.**

TERMINOLOGY

O&M SERVICE PROVIDER Simply said, a service provider is an individual who is trained to perform certain tasks associated with long-term maintenance of your OWTS. These tasks may include pumping out the septic tank, inspecting the soil treatment area, and performing the maintenance required by advanced pretreatment components.


Service of a chlorinator

Maintenance of Advanced Pretreatment Components

ATU

ATUs should typically be checked by a qualified professional every six to twelve months. At that time all components are inspected, including the tank(s), pump, timer, blower, biosolids buildup, and other mechanical components along with the soil treatment system.

Media filter

Media filters (sand, gravel, peat, textile) are typically inspected on an annual basis by a qualified professional. All components of the system should be checked, including the septic tank(s), pump, timer, pressure distribution system, media, and final soil treatment area. A sample of the effluent from the filter is often collected, and either a visual or laboratory test is performed, depending on the monitoring plan.

Constructed Wetlands

Constructed wetlands should be checked annually to be sure the appropriate plant population is present and the water level in the wetland is being maintained according to the design. It may be necessary to adjust the water level before winter to prevent freezing. This means that both a fall and spring adjustment may be necessary.

Disinfection system

Chlorine—A routine O&M schedule should be developed and implemented for any chlorine disinfection system. Typically, this will include disassembling and cleaning the various components. With tablet chlorinators, the chlorine will need to be added monthly.

UV—The quartz sleeves need to be cleaned regularly. The cleaning frequency is very site-specific, and some systems need to be cleaned more often than others, but every six months is a common frequency for residential applications.

Maintenance of Gravity Dispersal Systems

When service visits are conducted and the pretreatment components are being maintained, the service provider should evaluate the soil treatment area. This person should look for surfacing of effluent, signs of traffic over the system, excessive surface water collecting over the system, and any inappropriate vegetation growing over the system. If available, the distribution boxes in the system should be opened, cleaned out if needed, and adjusted in order to ensure equal flow to the various lines.

Maintenance of Pressurized Dispersal Systems

Low Pressure Distribution

When service visits are conducted and the pretreatment components are being maintained, the service provider should evaluate the soil treatment area. This person should look for surfacing of effluent, signs of traffic over the system, excessive surface water collecting over the system, and any inappropriate vegetation growing over the system. On an annual basis the pressure head should be checked and the system serviced based on the results. If accessible, the distribution system should be evaluated for uniform effluent application across the soil treatment area. The laterals should be flushed periodically to remove any accumulated biosolids.

Drip Distribution

Drip systems are typically checked semi-annually and include checking pressure gauges, walking around the application area while the effluent is being applied, checking air relief valves, and flushing the tubing and filters. The procedure is carried out to ensure that there are no leaks, broken connections, clogged emitters, or other possible system problems.

Record Keeping

Some jurisdictions require that a report be submitted to them when service is performed on the system. It is wise to keep records of your system's design, installation, and service reports. The permitting authority may keep a copy of these records, but having a copy for yourself can be helpful if problems arise or when you sell your property.

CHAPTER TEN

Troubleshooting

Finding an Existing System

Finding the OWTS may not be an easy task but is necessary for proper maintenance of the septic tank and distribution system, for troubleshooting problems, and for making future plans for the property. Many counties and cities with permit and inspection programs for OWTSs will have this information on file. Be sure to verify the accuracy of the records at the site. If no plans or drawings exist, the following steps can be taken.

First, locate the septic tank. If the access manhole or inspection pipes are at ground level, they will be easy to find. Unfortunately, they are often buried several inches, or even several feet, below the ground surface. To locate the tank, go into the basement or crawlspace and determine the direction the sewer pipe goes out through the wall or floor. The sewer pipe should be easy to find. It is usually the largest diameter pipe made of plastic or cast iron with a cleanout access.

Once the sewer pipe is located, determine the direction it leaves the house. With a metal rod as a probe, start carefully poking around in the soil 10 to 15 feet from the foundation of the house in the same direction as the pipe was headed out from the basement. A metal detector may be of assistance in finding the tank, since most concrete septic tanks contain metal reinforcing rods. NOTE: Prior to probing with a metal or fiberglass rod, contact your locally required utility locates for any underground utilities.

Collecting a wastewater sample.

Next, locate the STA. Above-grade systems are easy to find, but a below-ground system may be more difficult. Try looking around the yard in the general direction where the sewer pipe left the house. These clues may help locate the system:

- An area where the grass isn't growing well, or where the grass is greener or grows faster.
- An area where there is a slight rise or depression.
- An area where the soil is soggy when the rest of the yard is dry.

Often, a licensed contractor or inspector has tools to locate the STA. Once the STA is located, be sure to make a map of its location. If the STA cannot be found, there may not be one or it may be discharging into ground or surface water. If the STA is located but not the septic tank, work backwards toward the house, probing for the tank.

CHAPTER ELEVEN

Common Problems

The three most common causes of OWTS failure are:

1. The system is not properly designed or installed.
This could be the result of bad choices and mistakes made by designers, installers and inspectors, or homeowners who have increased their water usage without making appropriate adjustments to their OWTS.

2. Over-use of the system
Too much water or high strength wastewater, abnormally high water use, leaks, or short periods of very high water use can all cause failure. Wastewater containing high levels of organic material, solids, or cleaners could overload the system.

3. Improper maintenance
When too many solids are allowed to accumulate in the septic tank or other pretreatment component, the treatment volume is reduced and the solids will be carried out into the STA and can plug it. Most frequently, this is just because the owner did not have the septic tank cleaned (pumped) periodically.

Installation of septic tanks.

CHAPTER TWELVE

OWTS Troubleshooting Guide for Homeowners

The system is failing if it is not effectively treating the sewage. **Diagnosing the specific causes of failure may be difficult for the owner and often requires the skills of a professional.** The following chart shows common problems, possible causes, and remedies.

PROBLEM	RISK	CAUSES	REMEDIES
Alarm going off	Effluent may back up into home or surface in yard.	• Pump failed or undersized • Fuse breaker tripped • Pump plugged • Controls malfunctioning • Water infiltration • Excessive water use • Frozen or blocked pipe • Stuck toilet valve	• Control water use • Check breaker & plugs • Check controls & pump • Make sure a professional replaces pump with proper size unit • Fix leaks in plumbing, tank, or piping • Hire a professional to thaw the system
Freezing	Effluent may back up into home or surface in yard.	• Extreme cold temperatures • Improper drainage of pipes and components • Lack of proper soil cover • Lack of snow cover • Leaks or other low use	• Control water use • Thaw line and determine where and why it froze • Fix leaks • Insulate components • Confirm no components were damaged
Fire over system	System components above the ground and shallowly buried may have been damaged.	• Grass or forest fire over system	• Evaluate safety concerns due to exposed/ damaged components • Hire a professional to evaluate the system • Repair damaged components prior to use
Flooding over system	Effluent may back up into home or surface in yard.	• Large rainfall events • System in a floodplain • Improper grading	• Do not use system when flooded • After flood water recedes, clean out the tanks/pretreatment components to remove sediment and debris • Keep traffic off the system to limit compaction • Have a professional evaluate your system • Repair/replace damaged components
Sewage on surface or backing up in home	Human contact with sewage is a serious public health risk. Many waterborne diseases exist in household sewage.	• Excess water entering system • Improper plumbing • Blockage in plumbing • Improper operation • Pump/control panel failure • Improper system design • Roots clogging pipes • Improper venting • A portion of the system is frozen or flooded • Stuck toilet valve	• Fence off area or operate as a holding tank until fixed • Fix leaks/vents • Install water-saving fixtures • Stop using garbage disposal • Pump septic tank and check pump(s) • Replace broken or cracked pipes and remove roots • Avoid planting water -loving trees • Seal pipe connections • Hire a professional to thaw the system
Sewage odors inside or outside the house	Toxic gases can cause discomfort or illness.	• Improper plumbing • Sewage surfacing in yard • Sewage backup in house • Unsealed basement/ crawl space sewage pump • Roof vent pipe frozen shut or blocked • Dry trap in underused fixture or floor drain	• Repair plumbing • Pump septic tank and check pump(s) • Add water to drain traps in the house • Tighten seals on pump(s) and cleanout(s) • Thaw or clear roof vent • Add water to fill the dry trap

PROBLEM	RISK	CAUSES	REMEDIES
Power failure	Effluent may back up into home or surface in yard.	• Fuse breaker tripped • Lack of power supply • Electrical line cut to system components	• Control water use • Check fuse box and see if tripped and, if so, evaluate why • Have a professional evaluate where the power failure is if the system is the only impacted feature
Pump/control panel failure	Effluent may back up into home or surface in yard.	• Controls malfunctioning • Fuse breaker tripped • Lack of power supply • Electrical line cut to system components	• Control water use • Check breaker & plugs • Check controls & pump • Make sure a professional replaces pump or panel with proper size unit

RESOURCES

Education Resources Across the U.S.
epa.gov/septic/septic-systems-technical-resources#training

Environmental Working Group
Household and consumer product ratings
ewg.org/guides/cleaners

EPA Household Hazardous Waste (HHW)
epa.gov/hw/household-hazardous-waste-hhw

EPA's List of Health and Environmental Agencies for U.S. States and Territories
epa.gov/aboutepa/health-and-environmental-agencies-us-states-and-territories

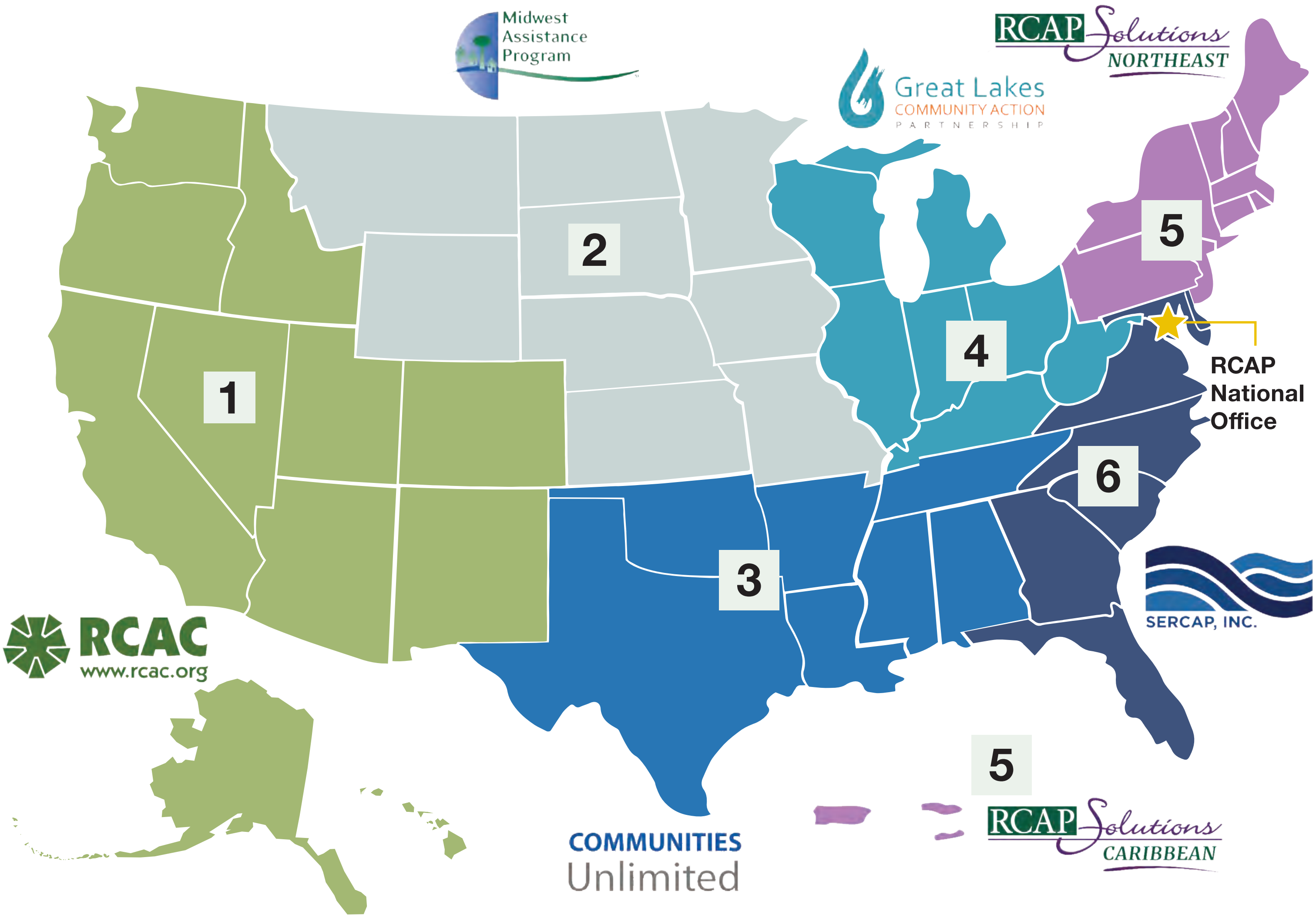
FDA Drop-Off Locations for Unused Medicines
tinyurl.com/3j3nx8c2

National Small Flows Clearinghouse (NESC)
800.624.8301
nesc.wvu.edu

NOWRA
Database of septic system professionals and homeowner's guide
nowra.org

Smart Label
Active ingredients in household cleaners
smartlabel.org

US Environmental Protection Agency (EPA) Septic System Program
800.621.8431
epa.gov/septic



Rural Community Assistance Partnership

We envision a resilient, equitable, and thriving rural America.

The Rural Community Assistance Partnership (RCAP) is a national network of nonprofit organizations that works with rural communities across the country to elevate rural voices and build local capacity to improve quality of life, starting at the tap. Through RCAP's regional partners, more than 300 technical assistance providers (TAPs) support communities in building their own capacity through technical assistance and training focused on access to safe drinking water, sanitary wastewater, solid waste, and economic development. RCAP works across every U.S. state, the U.S. territories, and Tribal lands.

To learn more, visit **rcap.org**.

1. Western RCAP
Rural Community Assistance Corporation (RCAC)
916.447.2854
rcac.org

2. Midwestern RCAP
Midwest Assistance Program (MAP)
660.562.2575
map-inc.org

3. Southern RCAP
Communities Unlimited (CU)
479.443.2700
communitiesu.org

4. Great Lakes RCAP
Great Lakes Community Action Partnership (GLCAP)
800.775.9767
glcap.org

5. Northeastern and Caribbean RCAP
RCAP Solutions
800.488.1969
rcapsolutions.org

6. Southeastern RCAP
Southeast Rural Community Assistance Project (SERCAP)
866.928.3731
sercap.org

WE envision

a resilient,

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