Residential Onsite Wastewater Treatment

An Overview

IOWA

DNR

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Residential On-site Wastewater Treatment: An Overview

Introduction

This publication will answer many questions that homeowners or potential homeowners, real estate agents and lenders may have about residential on-site wastewater treatment systems. Information is based on *Iowa Administrative Code (IAC)567-Chapter 69, Private Sewage Disposal Systems* of the Iowa Department of Natural Resources. This code requires that any home or building that generates wastewater have an on-site wastewater treatment system in accordance with those regulations, or be connected to a public wastewater treatment system. *IAC567 - Chapter 69* applies to domestic wastewater from 4 homes or less or non-residential wastewater with a flow of less than 1,500 gallons per day. Industrial or commercial waste of any flow rate is not covered by these rules. *See IAC 567 - Chapter 69* for more information.

Be sure to contact the local health or environmental department prior to constructing an on-site wastewater treatment system to obtain a permit.

Local regulations may be the same as or more strict than those issued by the state, but should never be more lenient.

Many Iowans live in homes that do not have access to public wastewater treatment systems. Instead, they must rely on their own on-site wastewater system, whether it is a traditional septic tank and drainfield, or other system specifically engineered for the site. Success or failure of a system depends on the site, design, installation, operation and maintenance.

In Iowa, domestic wastewater is defined as the liquid and waterborne wastes that result from ordinary living processes. It consists of blackwater, which are wastes carried off by toilets, urinals and kitchen drains; and graywater, from baths, lavatories, laundries and sinks. Both blackwater and graywater must be collected and treated. Restaurant wastewater is considered domestic waste. Water from roof and footing drainages and swimming pools does not require treatment, and should not be directed to an on-site wastewater treatment system.

The State of Iowa requires a homeowner to have a permit to construct — and in some counties to operate — an on-site wastewater treatment system. This permit is normally issued by the local county board of health or its agent. This agent is the county environmental health office or county sanitarian.

Every system must meet all provisions for design and separation distances required in *Chapter 69*. A site and soil evaluation or percolation test must be conducted to determine the capability of the soil to handle the treatment function. Information about the final system including the contractor/designer must be kept onsite for future reference. The primary goal is that onsite wastewater treatment systems must not endanger human health and must not cause environmental pollution. Realistically, all wastewater treatment systems may cause some increase in pollutant concentrations in ground and surface water. The intent is to minimize pollution and the risk associated with it as much as humanly and technologically possible.

What Does a Wastewater Treatment System Do?

A properly designed, sized, installed and maintained on-site wastewater treatment system should safely remove and treat wastewater from a home. Untreated or improperly treated wastewater is a disease risk to people through direct contact with sewage or animals (flies, dogs, cats, etc.) that have been in direct contact with sewage. Also, untreated or improperly treated wastewater is a threat to human health and the environment when it pollutes surface water or groundwater.

Human Health and Safety Issues

There are direct health hazards associated with untreated or improperly treated wastewater. Untreated or improperly treated wastewater contains pathogens – organisms that can cause diseases. These organisms may enter groundwater and contaminate drinking water supplies. Untreated or improperly treated wastewater also can introduce pathogens to surface water. Ponds, rivers or lakes containing these organisms may not be safe for recreation. Also, flies and mosquitoes may spread diseases; they may be attracted to and breed in wet areas where wastewater reaches the surface. Dogs and other animals that have been in contact with wastewater also can be carriers of disease organisms.

Diseases which may be transmitted through contact with improperly treated wastewater include, but are not limited to, cholera, dysentery, Hepatitis A, polio, salmonella, giardiosis, cryptosporidiosis and typhoid. Parasites also can be transmitted by improperly treated wastewater, including, but not limited to, hookworm, pinworm, roundworm and tapeworm.

High concentrations of nitrate can cause methemoglobinemia, or blue baby syndrome, in infants by interfering with the blood's ability to carry oxygen. Although most wastewater treatment systems do not remove nitrate, proper system siting and design will reduce the risk of contaminating groundwater, the source of drinking water for many rural dwellers.

Environmental Risks

Poorly functioning on-site wastewater treatment systems also can affect the surrounding environment. On-site systems can release nitrogen from human waste into groundwater and surface water. They also can release phosphorous, found in some household detergents and water conditioners, as well as human waste, into surface water. These nutrients promote algae and weed growth in lakes and streams. These plants eventually die and settle to the bottom where they decompose. This decomposition process depletes oxygen that fish and other aquatic animals need to survive, which may result in the death of fish and other aquatic organisms.

Cleaning products, pharmaceuticals and other chemicals dumped down the household drain also enter the wastewater treatment system. Some of these materials can be dangerous to humans, pets and wildlife. If allowed to enter a system, many of these chemicals will pass through without degrading and may contaminate groundwater, surface water and/or soil.

Components of an On-site Wastewater Treatment System

All on-site wastewater treatment systems must perform the same basic functions. They must collect wastewater from the home and treat it to break down organic material, destroy pathogens and absorb nutrients. A typical system consists of plumbing in the home to collect wastewater and send it to a septic tank, where treatment begins. From there, the partially treated wastewater, called effluent, travels to an effluent treatment system. Further treatment occurs and the wastewater is released to the environment ***(Figure 1)***. More information on different options and how treatment occurs are given in the following section.

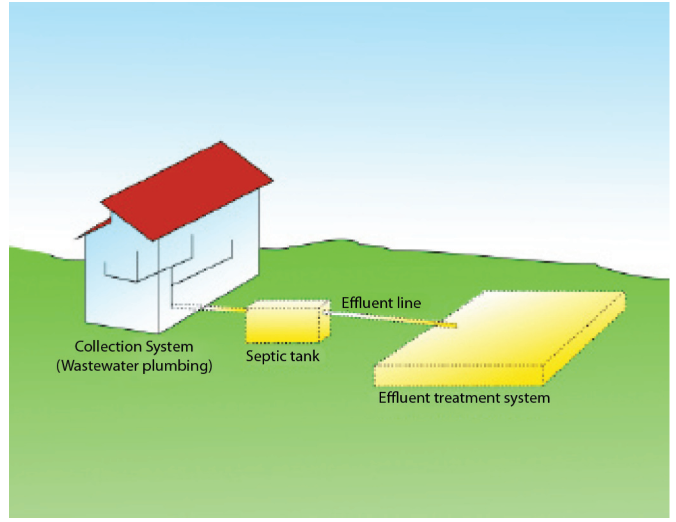


Figure 1: Typical composition of an on-site wastewater treatment system.

Information on New Construction

What Options Are Available?

In most situations, there are a number of different options available for residential on-site wastewater treatment. This section lists various options and explains how treatment occurs. It may be of special interest to those planning new construction or replacing an existing system. At the end of the section, ***Table 1 (page 13)*** lists conditions or characteristics and gives maintenance requirements and drawbacks to each option.

Septic Tank (Primary Treatment)

Wastewater flows through the plumbing from the home into a watertight septic tank ***(Figure 2)***, which acts as a settling area for the wastewater. Heavy materials settle to the bottom of the tank as sludge. Water, other liquids and suspended solids are found above the sludge. Soaps and grease form a floating scum layer. This physical separation of sludge, liquids with suspended solids and scum is called primary treatment. In Iowa, a septic tank or primary treatment tank is required for all treatment systems. In addition, an effluent screen is required in the outlet of the tank to prevent solids from traveling into the treatment system.

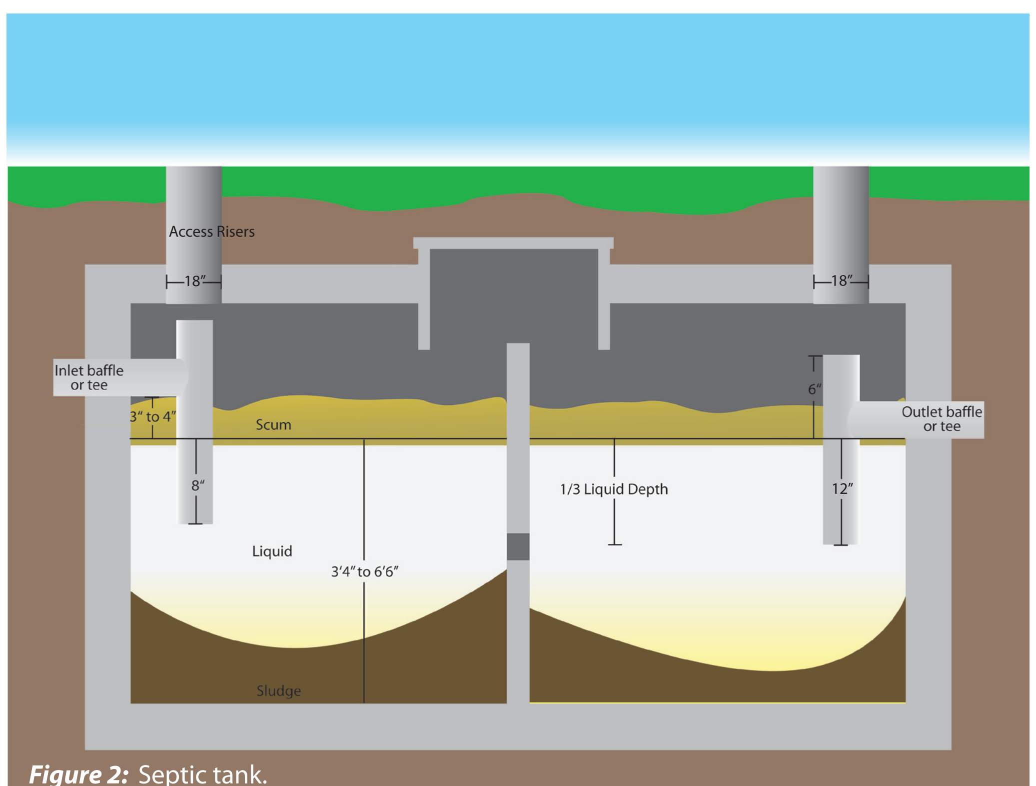


Figure 2: Septic tank.

Illustration by Karri Wells, DNR

Bacteria naturally occur in sewage entering the septic tank. They begin to break down and dissolve organic materials in the wastewater under anaerobic conditions (without oxygen). The settling and bacterial breakdown that occur in the tank prepare wastewater for final treatment in the soil.

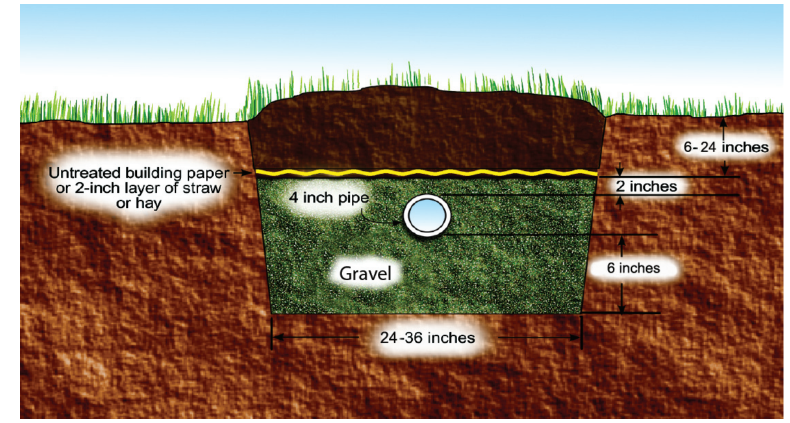


Figure 3: Trench with pipe lateral.

Secondary Treatment: Soil Drainfield

The most common type of secondary wastewater treatment system is a drainfield, also called the leach field, seepage bed or absorption field. When site conditions allow, this is often the most economical method available.

In a traditional gravel leachfield, wastewater from the septic tank, called effluent, travels through a pipe to the drainfield. The drainfield is a trench filled with gravel, surrounding a four-inch PVC perforated pipe, topped with soil ***(Figure 3)***. Effluent moves through spaces in the gravel and enters the soil, where millions of naturally occurring microorganisms consume the organic matter and kill some pathogens. The soil helps tie up viruses and some nutrients, such as phosphorous, before the effluent reaches groundwater. Nitrate, another nutrient found in effluent, is water soluble; effluent and precipitation movement will carry some through the soil. The type and condition of the soil are important factors for a properly functioning drainfield. Drainfield size is determined by the amount of wastewater generated and soil characteristics. In many traditional septic tank/drainfield systems, gravity moves wastewater through the system. In some situations, a pump may be needed to move wastewater through the system.

Gravelless Systems

Although a traditional drainfield system has trenches filled with gravel, there are now several gravelless alternatives. In a gravelless system the trench may be held open by a fabric covered corrugated pipe ***(Figure 11, page 14)***, a plastic gravelless chamber ***(Figure 4)***, a mesh casing of Styrofoam packing "peanuts," a bundle of four-inch corrugated plastic pipe or other material set in a trench and covered without the use of gravel. In the gravelless chamber system, effluent moves through piping from the septic tank through the distribution box into the chambers where it is free to travel along the earthen base of the trench until it is absorbed. In other gravelless systems the effluent may be conveyed along the trench through various diameter pipes and exits through holes or slots located in the pipe to enter the soil for treatment. In all cases, the effluent treatment takes place in the soil along the trench bottom and some of the sidewall. The purpose of the gravel or gravelless trench fill material is only to hold the

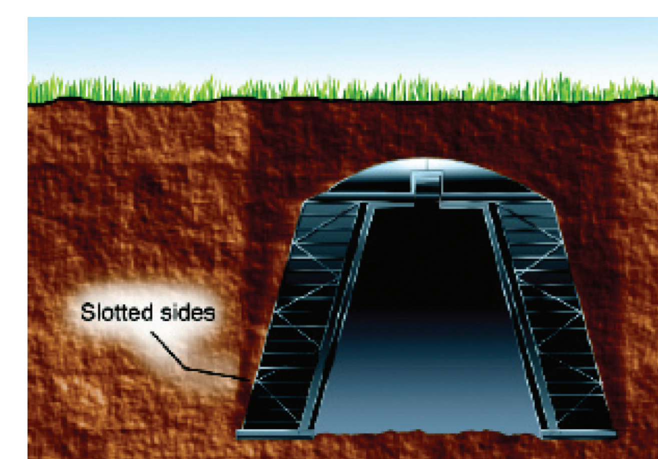


Figure 4: Gravelless chamber for effluent treatment.

trench open and allow the effluent to move along the trench and enter the soil profile.

Some types of gravelless systems are easier to install. The lightweight components can be carried to remote or difficult-to-reach sites. Gravelless systems have greater storage capacity than traditional drainfields because there is no gravel to occupy the space that water could occupy. Also, there is no gravel on the base of the trench impeding wastewater absorption and treatment can occur as wastewater enters the soil through slits along the sidewalls of the chamber.

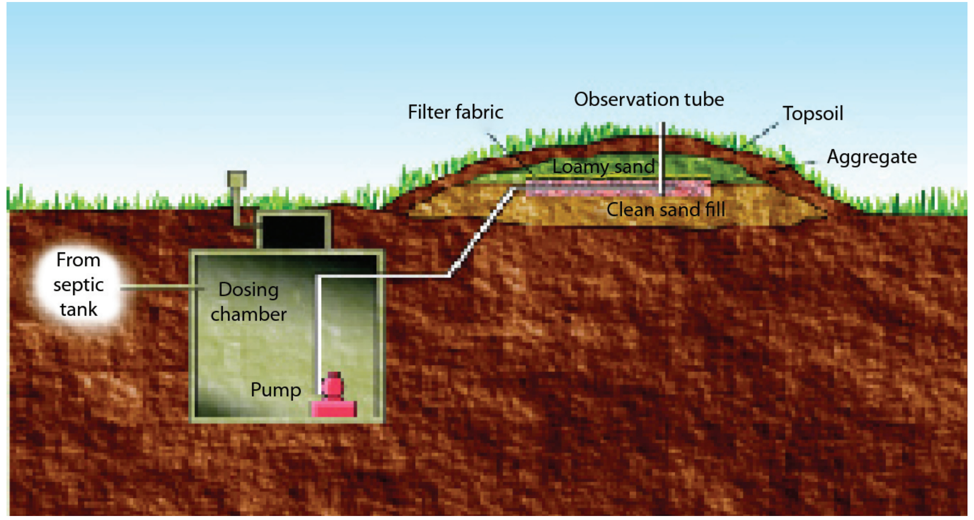


Figure 5: Mound system.

Alternative Systems

In Iowa, more development is occurring in rural areas where on-site systems must be used for wastewater treatment. In some areas, the conventional septic tank/drainfield will not properly treat wastewater. This may be due to a high groundwater table, bedrock or soil types that allow water to percolate or travel through the soil too quickly or too slowly for proper treatment. Properly functioning drainfields require that soils have appropriate percolation rates and are normally unsaturated, meaning spaces between soil particles are not all filled with water. Some areas of Iowa have clay soils with very slow percolation rates. Alternative wastewater treatment systems have been developed for these situations.

Pressure Dosing

Iowa regulations strongly recommend pressure dosing for proper treatment of wastewater anytime more than 500 linear feet of drainfield is needed or in sand filters and mound systems. Pressure dosing is also recommended where elevation restrictions prohibit gravity distribution. The quantity of wastewater generated and the soil characteristics, especially the percolation rate (the rate at which water travels through the soil), are used to determine the size of pump and drainfield needed. Effluent is pumped out of the dosing chamber following the septic tank at regular intervals, in doses. This forces the wastewater along the entire line so that the drainfield is used evenly, increasing the probability of uniform distribution.

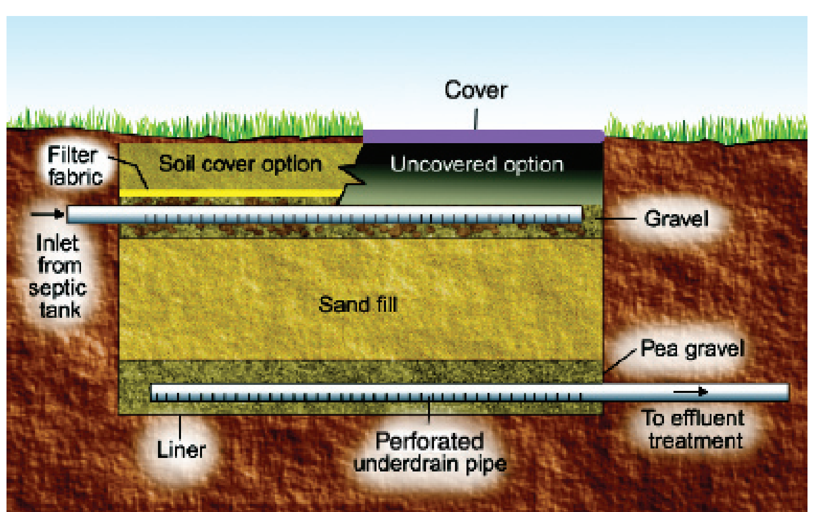


Figure 6: Sand filter.

Mound System

Mound systems ***(Figure 5)*** are helpful where the water table or bedrock is close to the soil surface, or percolation rates are too slow or too fast for adequate soil wastewater treatment.

In this system, the drainfield is located on top of a layer of sand covered by a mound above the natural soil surface. Effluent is pumped from the septic tank to the mound. There, effluent trickles through gravel beds or trenches, through a bed of sand fill, and then flows into the natural ground surface.

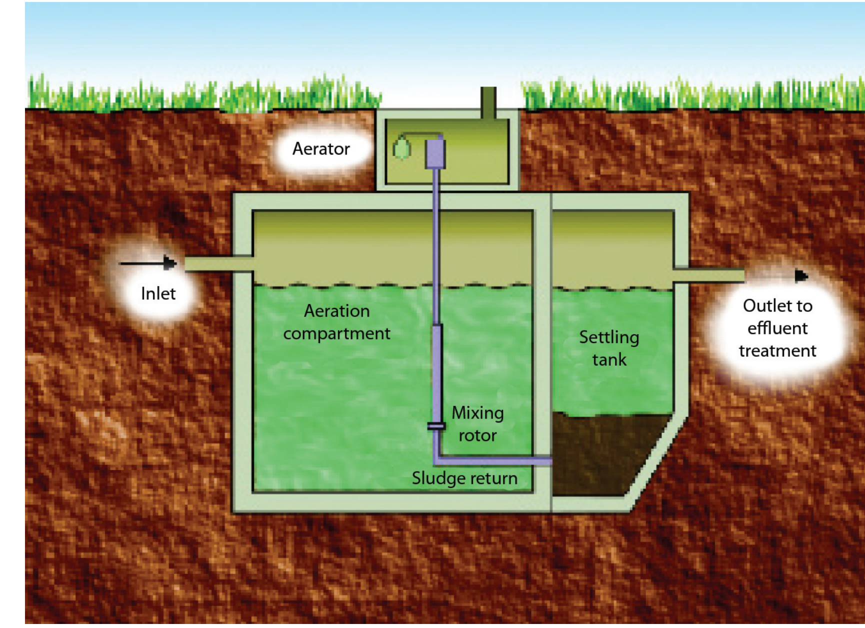


Figure 7: Aerobic treatment unit.

Sand Filters

The sand filter is an option for secondary treatment where the size of the site or the condition of the soils will not support a wastewater system that relies on the soil for treatment ***(Figure 6, page 6)***. Sand filters are often used as a replacement for a failed system or for "final" treatment following another type of alternative system.

The typical sand filter is an excavation, sometimes plastic lined, filled with clean, coarse sand and rock. The surface may be covered with soil (buried) for large sand filters or a removable cover for smaller free access sand filters.

Wastewater from the house flows to the septic tank or aerobic unit where solids settle out and a scum layer forms. The effluent may be further treated with screens or filters to ensure that no solids carry over to the sand filter bed. Then effluent is distributed evenly in the bed by pumping controlled doses through a network of small diameter pipes. Wastewater leaves the pipes, trickles down through the gravel and is treated as it filters through the sand. There it is collected and can travel to an effluent treatment system or be discharged to the ground surface. If the water is surface discharged, the owner may need a National Pollution Discharge Elimination System (NPDES) permit and may have to provide disinfection. Discharging systems also require regular sampling to verify effluent quality.

Figure 8: Textile filter.

Media Filters

Media filters are similar to sand filters in that they treat the wastewater as it filters through the media material. The media can be textile ***(Figure 8)***, peat ***(Figure 9)*** or foam cells. These units are usually manufactured package type devices that can be purchased and installed directly in the ground. All

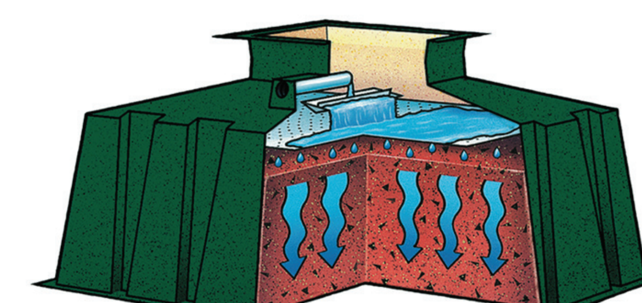


Figure 9: Peat filter.

of the necessary parts are sold with the package with the exception of the septic tank.

Wastewater flows from the house through the septic tank, where the solids settle out and primary treatment occurs. The effluent from the septic tank then travels into the media filter where secondary treatment further treats the wastewater. The wastewater can then travel to an effluent soil treatment system or be discharged to the ground surface. If the water is surface discharged, the owner may need a National Pollution Discharge Elimination System (NPDES) permit and may have to provide disinfection. Discharging systems may also require regular sampling to verify effluent quality.

Aerobic Treatment Units

These systems are sometimes called package treatment plants ***(Figure 7, page 7)***. All of these use aerobic digestion – breaking down wastes in the presence of oxygen. Aerobic bacteria, those that need oxygen, break down the organic portions of the wastewater into simpler compounds. This aerobic treatment is normally rapid and odor-free. In the aerobic unit, an air compressor bubbles air through the wastewater, or a pump or stirring device incorporates air. Because this type of system uses mechanical parts and energy, it is more costly and requires more maintenance than the traditional secondary treatment system. A perpetual maintenance contract is required by *Chapter 69*. After treatment in the aerobic unit, effluent flows to a reduced size drainfield, sand filter, mound system, subsurface drip tube irrigation system or some other type of effluent treatment system for final treatment and release to the environment.

Constructed Wetland

A constructed wetland ***(Figure 10)*** mimics a natural wetland to treat wastewater. Cattails, reeds and other aquatic plants in the constructed wetlands remove or take up some nutrients and other contaminants. Wastewater travels from the house to the septic tank, and then to the constructed wetland. The wetland cell is filled with rock or gravel and may be lined with an impermeable material to prevent untreated wastewater from entering the soil. Plants, microbes and bacteria on the fill material treat the effluent. Water is collected from the constructed wetland through pipes and flows to a drainfield or sand filter. If the water is surface discharged, the owner may need a National Pollution Discharge Elimination System (NPDES) permit and may have to provide disinfection. Discharging systems may also require regular sampling to verify effluent quality. Discharging systems also require regular sampling. A continuously discharging lagoon requires further treatment.

Waterless Toilets

Portable and chemical toilets are two types of waterless toilets. These systems may be useful where water is in short supply, or one wants to reduce the quantity and improve the quality of

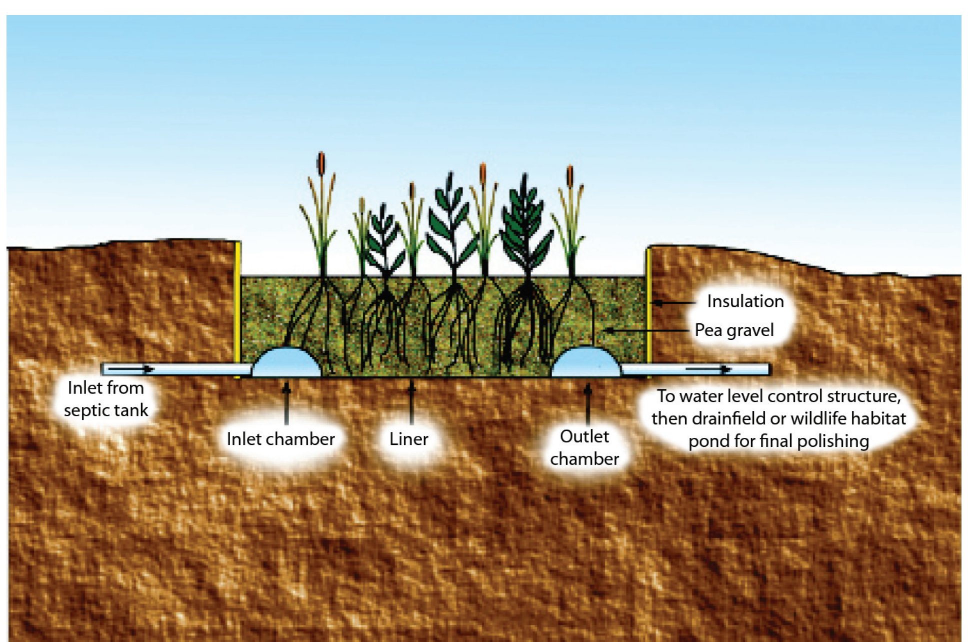


Figure 10: Constructed wetland cell.

These different types of toilets do not eliminate the need for some type of wastewater treatment system for other domestic wastewater.

wastewater that requires treatment. Most waterless toilets will handle feces, urine, toilet tissues and some other biodegradable materials. A separate system must handle other wastewater from the home. These systems are not intended for day-to-day household use. Most often, these toilets are used for campsites or remote locations. The waste pumped from these toilets should be disposed of at a permitted municipal wastewater treatment facility.

Holding Tanks or Impervious Vault Toilets

Holding tanks are used in Iowa for temporary or very low use situations. This may include public parks and recreation areas; riverside, lakeside cabins or hunting cabins; or until a proper system can be installed. Waste from holding tanks or impervious toilets must be pumped and transported to a public wastewater treatment plant.

A designer/contractor can help select the appropriate type of system. To make the right decision, they'll need information on:

- **Type of soils, including percolation test**
- **Lay of the land (topography)**
- **Depth to groundwater**
- **Distance to surface water**
- **Lot size and configuration**
- **Water usage and wastewater quality**

Which System is Right for Me?

Selecting the most appropriate on-site wastewater treatment system depends on the residential site and water usage. Choosing a good site and appropriate system can save time, money and problems in the future. The right site and system also will protect human health and the environment.

One of the first things to do is hire a professional designer, contractor or installer. Iowa currently has no statewide certification system for these professionals, although some counties do. Training is available, but not required, except in counties with certification systems. When contacting potential designers/contractors, ask about their experience, if they attend on-site wastewater treatment training sessions or receive professional publications to keep informed of new technology, and references for systems they have installed. The local health or zoning department may have a list of professionals who have attended training sessions. Hiring an untrained, inexperienced person with a backhoe to install a system may save money on installation, but most likely will cost more later when the poorly designed or poorly installed system doesn't function properly and requires costly repairs or replacement. In addition, a malfunctioning system may endanger human health and the environment.

Type of Soils

Soil characteristics are very important in determining the type of on-site wastewater treatment system that will work for a home. The type of soil determines how fast the water will move through the system. Water moves very quickly through coarse, sandy soils, in some cases too quickly for the effluent to be treated. Clay soils hold water so that it moves too slowly for sufficient amounts to be treated. This may cause wastewater to build up and surface on top of the ground. County soil survey reports provide a wealth of information about soils in an area. These reports are usually available from the Natural Resource Conservation Service (NRCS), formerly known as the Soil Conservation Service (SCS), Natural Resources

Districts (NRDs) and Iowa State University Extension offices.

The soil percolation (or perc) test, or professional soil analysis required by Iowa code *Chapter 69*, will help determine how quickly water moves through the soil. The percolation rate is measured in the number of minutes it takes ponded water in a test hole to drop one inch in elevation in undisturbed soil. It is a good indicator of whether a traditional drainfield is feasible and, if so, the proper size required for a given loading rate. Although *Chapter 69* does not specify qualifications for individuals conducting percolation tests, it is important to know and be familiar with the correct procedure. Some counties require percolation tests to be conducted by a certified professional. The percolation test must be conducted on undisturbed, unfrozen ground, in the area and the depth where the drainfield will be installed. See Appendix B of *Chapter 69* for information on how to conduct a percolation test.

Alternatively, Iowa rules encourage the use of a professional soil analyst to perform a soil morphology evaluation of the site to determine the soil acceptance rate. In this case the texture, structure and color of the soil indicate how well the soil will move and treat the wastewater. Soil analysis must be done by a trained professional. Contact your local environmental health office for people qualified to do this in your area.

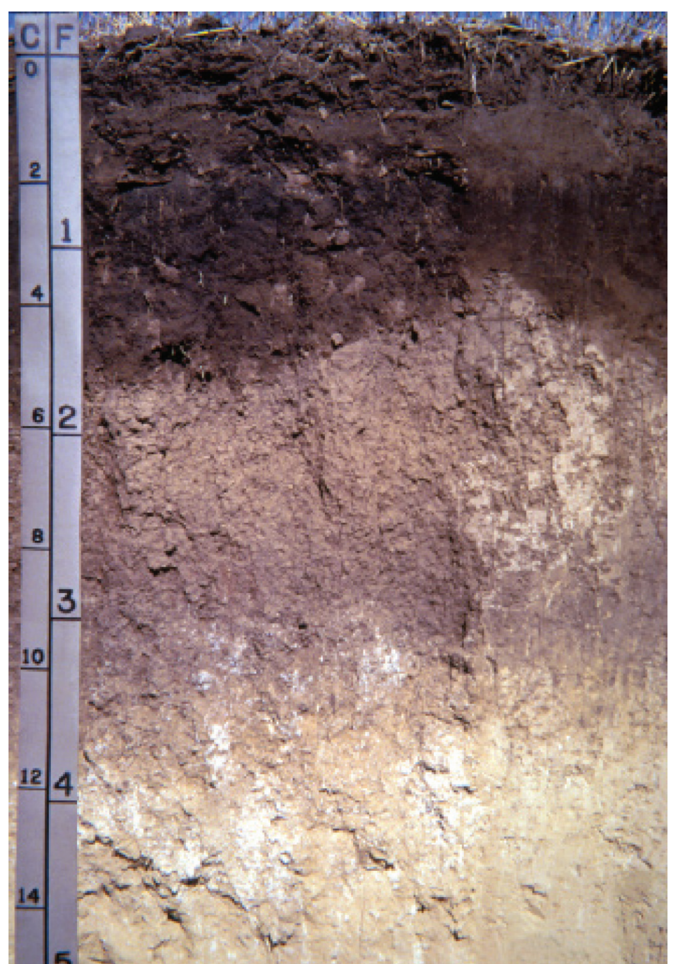
Ideally, drainfields should be installed in natural soils, not in fill soils. Fill soils are those that have been moved from their site of geologic formation and deposited in a new location. When soils with textures other than clean sand are moved to a new location, soil structure is destroyed, and settling may occur. This affects pore space, causes silt and clay particles to migrate when water is added and ultimately results in percolation problems in the soil. Soil percolation tests on loamy fill can range from seven to more than 200 minutes per inch, making it difficult if not impossible to accurately size the drainfield.

Topography

The topography of a site influences the retention and movement of water, rate and amount of runoff, potential for erosion and ease with which machinery can be used to install a system. Slope is important in deciding what type of system to use, whether gravity distribution is feasible, and system layout. For example, sites with steep slopes may not be suitable for traditional septic tank/drainfield systems, although a drop box system may be more effective. Do not construct an on-site wastewater treatment system in natural drainageways, low spots where water might pond or other areas with a high groundwater table.

Depth to Groundwater

Bacteria and other microorganisms in the soil that perform the final treatment of wastewater require oxygen. If soil is saturated, meaning all air spaces are filled with water, aerobic microorganisms will not be able to work. Iowa regulations require that



There can be great variation in soils from site to site as well as at different depths at the same site.

the bottom of the drainfield system trench or bed must be at least three feet above the highest expected level of the groundwater. If there is less than three feet of unsaturated soil, the traditional drainfield may not be suitable, as wastewater will not receive adequate treatment. A more shallow installation may be necessary. Soil color is a good

Soils are often disturbed during construction.

indicator of whether a soil is or has been saturated. Alternate saturation and drying of the soil results in discoloration or staining, called mottling, which is not part of the dominant soil color. Mottled soils may have streaks or spots of various shades of gray, brown, and/or reddish brown. This is used as an indicator of seasonal high groundwater; for example, the ground may be dry in summer, but saturated in spring. Mottling shows that groundwater had, at some point in time, risen up to this particular elevation, and remained long enough to cause a chemical reaction. Because groundwater had risen that high at some point in the past, the potential exists for a recurrence. The groundwater elevation is assumed to be the elevation at which the mottling is observed regardless of whether water is present at the time of the percolation test or site evaluation. Soil boring or excavation may be needed to determine the seasonal high water table.

Distance to Surface Water

The closed portion (septic tanks, mechanical aeration tanks, impervious vault toilets, fully contained media filters) of the treatment system must be at least 50 feet from lakes and 25 feet from ponds, streams, rivers or other surface water. The open portion (absorption trenches, mounds, sand filters, wetlands) of the treatment system must be 100 feet from lakes and 25 feet from ponds, streams, rivers or other surface waters. These setback distance requirements reduce the risk of contaminating surface water with pathogens or excess nutrients from wastewater. More information on setback distance is given in the section on design and installation.

Lot Size and Configuration

For new construction, a lot must be large enough and have soils suitable to support an on-site wastewater treatment system, and preferably have a reserve space for a replacement system. The reserve space cannot be built on or developed. Both the on-site system and the reserve system must meet all state regulations, including setback distances, such as distance to groundwater, surface water, property lines and wells.

Water Usage and Wastewater Quality

Besides the site and its characteristics, consider the quantity and quality of wastewater the home will generate when selecting a type of on-site wastewater treatment system. Some types of systems cannot handle extreme fluctuations in volumes that might occur at a seasonal dwelling.

The quality of wastewater also affects which type of system to select. Home-based businesses or hobbies such as beauty salons, taxidermy shops or autobody repair shops introduce chemicals into the wastewater that an on-site system may not be able to handle effectively. Restaurants generate grease, which can cause failure of on an on-site system, unless grease traps are installed and maintained. On-site wastewater treatment systems are designed for residential waste only. Wastewater or chemicals from business or industrial activity cannot be disposed of in an on-site treatment system. Check with your county sanitarian or the Iowa DNR for more information about what to do with these types of waste.

Summary for Selecting an On-site Wastewater Treatment System

There are many factors to consider when selecting an on-site wastewater treatment system for new residential construction. The most common systems in Iowa are septic tank/drainfield and sand filter systems. There are many other options, however. ***Table 1 (page 13)*** summarizes the primary options and factors to help determine the system that will work best for a given situation.

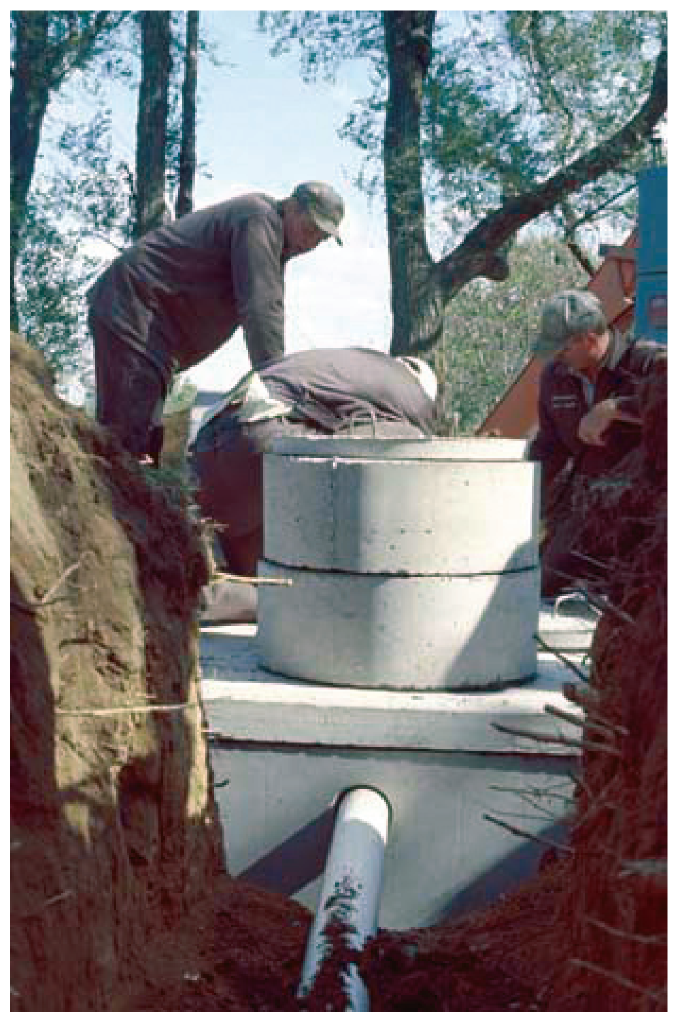
How Do I Have a System Designed and Installed?

A professional installer will help explore options and help select the best system for each situation. System design must be based on *Chapter 69* regulations and local codes and approved by the county environmental health or sanitarian's office. A permit is also required from your local county environmental health office. More information appears in the permit section. Use a reputable business since industry professionals are not regulated or certified by the state at this time, although some counties do require certification. Get several bids and select the installer who can design and install a system based on state and local codes. Your county sanitarian can provide information and possibly a list of certified contractors.

Site Evaluation

A completed site evaluation will include the type, size, location and elevation of the proposed system as well as the reserve area for a replacement system. Most of the information collected to determine which system to select also will be used in designing a system. If the lot is large enough to allow a choice, the site evaluation will help you choose between different potential system locations. A designer/contractor should conduct a site evaluation and use the information that was collected to develop a scaled drawing that includes:

- the legal description of the property
- property lines
- buildings
- water supply wells
- buried water pipes and utility lines
- the high water mark of lakes, rivers and streams



Workers install a new septic system.

***Table 1.* Primary considerations for selecting type of on-site wastewater system.**

Type of System	Consider when:	Maintenance *(*Depends on use)*	Drawbacks
Gravel Drainfield	• Soil percolation rate: 5 to 60 min./in. • Bottom of trenches and beds at least 3 ft. above highest expected groundwater level. • Slope of site is less than 15 percent.	• Pump septic tank every 2• 3 years*. • Prevent deep• rooted vegetation over drainfield. • Prevent soil compaction over drainfield.	• Excessive water use may overload the system. • Garbage disposal use increases pumping frequency.
Pressure Dosing	• Drainfield is more than 500 linear ft. dosing is recommended, mound, sand filter.	• Pump septic tank every 2• 3 yrs*. • Flushing and cleaning of small diameter distribution pipe.	• Cost of pump and energy to run pump.
Mound System	• Soils with slow or fast percolation rates. • Shallow soil cover over fractured or porous bedrock. • A high groundwater table.	• Pump septic tank every 2• 3 yrs*. • Pumps and siphons must be maintained. • Flushing and cleaning of small• diameter distribution pipe.	• Costs are higher than conventional systems due to design costs and materials.
Gravelless Drainfield System	• Site is remote or difficult to reach. • Typical drainfield materials (gravel) not available or expensive.	• Pump septic tank every 2• 3 yrs*.	• Potential problems in sandy soils.
Recirculating Filter	• No space for any other system.	• Pump septic tank every 2• 3 yrs*. • Clean filter every year.	• Small treatment system easily abused.
Sand filter	• Repairing existing malfunctioning system. • Site is an environmentally sensitive area. • Soils with slow percolation.	• Pump septic tank every 2• 3 yrs* • Maintenance varies by design. • Dosing chamber pumps, controls and timer sequence must be checked.	• Cost is high where media is expensive or must be transported long distances. • Pumps require electricity. • Surface discharged water requires NPDES permit.
Peat Filter	• Similar to sand filter.	• Pump septic tank every 2• 3 yrs*. • Rake filter surface every year.	• Peat must be replaced every 8 years.
Aerobic Treatment Unit	• Soil characteristics are not appropriate for a traditional septic tank/drainfield system. • Groundwater table is high or shallow bedrock exists. • A very small lot. • A traditional septic system has failed. • Desirable to extend the life of a drainfield.	• Inspect and pump secondary settling chamber as needed (may be as frequent as 3• 6 months)*. • Mechanical parts require periodic checks, maintenance and repair.	• Costs more to install than other systems. • Problems with sudden heavy loads or neglect. • Electrical costs and associated maintenance. • Requires final treatment in drainfield, sand filter, or other system. • Surface discharged water requires NPDES permit. • May require disinfection.
Constructed Wetland System	• Soil cannot treat wastewater before it percolates to groundwater, such as in clay soils. • Aesthetics are important.	• Pump septic tank every 2• 3 yrs*. • Prevent trees from growing in wetland cell. • Maintain wetland plants.	• Surface discharged water requires NPDES permit • Costs are higher than conventional systems due to professional design costs and materials. • Disinfection may be required.
Holding Tank	• There is no suitable effluent treatment area. • Temporary or seasonal use only.	• More frequent pumping is required. • Alarm or visible float needed to indicate when tank is 90 percent full.	• Restricted water use. • Pumping and disposal costs.

- the type of water supply wells within 200 feet of the proposed system
- depth to groundwater
- depth to confining layer (rock, clay layer)
- direction of groundwater flow
- soil conditions, properties and permeability
- proposed area for the system
- proposed reserve area for a replacement system
- slope

The county sanitarian must conduct a site evaluation to approve or modify the submitted plan.

Wastewater Flow

Wastewater treatment systems are designed and sized according to the number of bedrooms and water-using appliances in the home. They are not based on the number of residents because ownership and family size often change.

Wastewater design flow is 150 gallons per day for each bedroom. It assumes at least some water-using appliances such as a clothes washer and dishwasher will be operated in the home. A water softener, garbage disposal or large Jacuzzi-type bath may require increase in the size of the septic tank to allow ample settling time.

Consider family water habits. If family members take long showers, have heavy use of a garbage disposal or wash a number of loads of laundry in a given day, tell the designer/contractor so the system can be sized accordingly. Since high water use is a common cause of system failure, it is a good idea to be conservative in water use. This is covered in more detail in the section on operating and maintaining a system.

Once the designer knows the site characteristics and estimated wastewater flow, the size of the drainfield, sand filter, mound, constructed wetland or other effluent treatment system can be calculated. The estimated wastewater flow is also important in sizing a lagoon or holding tank.

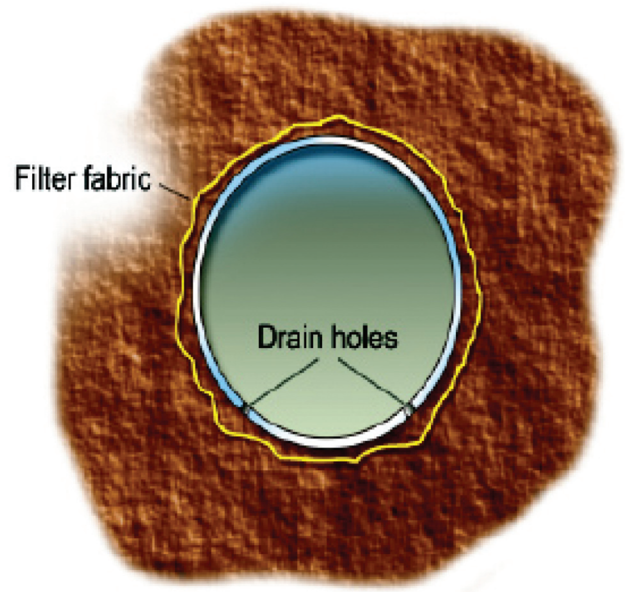


Figure 11: Gravelless pipe system for effluent treatment.

Setback Distances

When determining where to place an on-site wastewater treatment system, adhere to all required setback distances. Iowa regulations require that septic tanks, effluent treatment systems (traditional drainfields, sand filters, mound systems, etc.) must be a minimum distance from surface water, wells and buildings. These distances are listed in ***Table 2 (page 15)***.

These setback distances are important to reduce the possibility of contaminating drinking water and other groundwater and surface water. Also, a drainfield should be far enough away from buildings so that rainwater from the roof and other drainage sources do not overload it.

How Should I Protect the Selected Site?

After determining where the on-site wastewater treatment system and reserve area will be located, mark and fence that area so it will not be disturbed during construction. This is especially important for an effluent treatment system such as a drainfield or mound, since *compaction can seriously impair the soil's ability to treat wastewater*. It is wise to determine where to place the on-site wastewater treatment system, as well as the future replacement system, prior to building a home. New developments already may have designated areas for the system and reserve system.

***Table 2.* Minimum Setback Distances in Feet**

Minimum distance in fee from:	Closed portion of treatment system *(1)*	Open portion of treatment system *(2)*
Private water supply well	50	100
Public water supply well	200	200
Ground water heat pump borehole	50	100
Lake or reservoir	50	100
Stream or pond	25	25
Edge of drainage ditch	10	10
Dwelling or other structure	10	10
Property lines (unless a mutual easement is signed and recorded)	10	10
Other type subsurface treatment system	5	10
Water lines continually under pressure	10	10
Suction water lines	50	100
Foundation drains or subsurface titles	10	10

(1) Includes septic tanks, aerobic treatment units, fully contained media filters and impervious vault toilets.
(2) Includes subsurface absorption systems, mound systems, intermittent sand filters or constructed wetlands.

Permits

No on-site wastewater treatment and disposal system shall be installed or altered until an application has been submitted and a permit has been issued by the county environmental health office. Alteration includes any changes that affect the treatment or disposal of the waste. Repair of existing components that does not change the treatment or disposal would be exempt. Examples of exempt repairs may include repairing an inlet pipe, baffle or a mechanical device such as a pump or blower. Contact your county sanitarian for more information about permitting.

Floor Drains

A floor drain may be installed in a garage for a private residence provided oil, paint, engine cleaners or other hazardous materials are not washed into the septic system. These drains are designed to handle snow, ice melt and wastewater from occasional (external) vehicle washing. Although residential garage floor drains are not prohibited by *Chapter 69* regulations, some counties and cities do not allow them. Contact the local environmental health department to find out what is allowed in your area.

Septic Tank/Drainfield Sizing and Installation

Since the septic tank/drainfield is the most common type of on-site wastewater treatment, more specific information on its sizing and installation is provided here. Septic tanks are made of concrete, plastic or fiberglass. In Iowa, metal tanks no longer can be installed because of the potential to rust. Septic tanks must be watertight to prevent untreated wastewater from entering the soil in an improper manner and to prevent groundwater from entering the septic tank and hydraulically overloading the treatment system.

The number of bedrooms in the house will determine the size of the tank. Ideally, the septic tank will hold wastewater long enough (two days) for primary treatment to occur — the solids to settle as sludge and the lighter materials to float and form a scum layer. Excessive water use or an undersized tank will force wastewater to the drainfield before primary treatment is completed, and may clog the drainfield system. The minimum size septic tank for a residential dwelling is 1,250 gallons.

Baffles or tees are important components of a septic tank ***(Figure 2, page 4)***. The tank should have an inlet baffle or tee to force entering wastewater down into the tank. This ensures mixing, which encourages bacterial break down of organic materials. The inlet baffle also prevents the scum layer from floating back and clogging the inlet pipe. Each tank also needs an outlet baffle or tee, to prevent the scum layer from moving into the drainfield or other type of effluent treatment system and clogging it.

Figure 12: Distribution box.

The tank must have one or more access manholes for cleaning. These often are buried below ground level. The septic tank should have inspection lids if the inlet and outlet do not have manholes over both of them ***(Figure 2, page 4)***. *Chapter 69* now requires access lids or manholes over both ends of the tank that come to the ground surface.

Effluent from the septic tank travels through a pipe to a treatment system, often a drainfield, where final treatment occurs. The drainfield is composed of trenches or beds, the most economical and preferred method for treating the effluent. Trenches are between 24 and 36 inches wide (most commonly 24 inches) for pipe laterals ***(Figure 3, page 5)*** or alternative trench-fill materials. Beds are over 36 inches wide for pipe laterals and for chambers. Beds have a slower filtration rate than trenches and therefore require twice the infiltrative surface area. Traditional trenches and beds are filled with gravel or other filter material.

A typical drainfield will require 18 to 36 inches of vertical depth, from the soil surface to the bottom of the bed or trench, depending upon soil characteristics and materials ***(Figure 3, page 5)***. More shallow depths are preferred because there is more oxygen closer to the surface. The drainfield relies on bacteria that require oxygen to break down the wastewater. The maximum depth from soil surface to the bottom of the trench is 36 inches. In addition, the bottom of the trench or bed must be at least three feet above the groundwater table, bedrock or other barrier so that there is enough soil for the effluent to be properly treated. The specific size of the trench or bed depends upon the percolation rate for the site, and the amount of

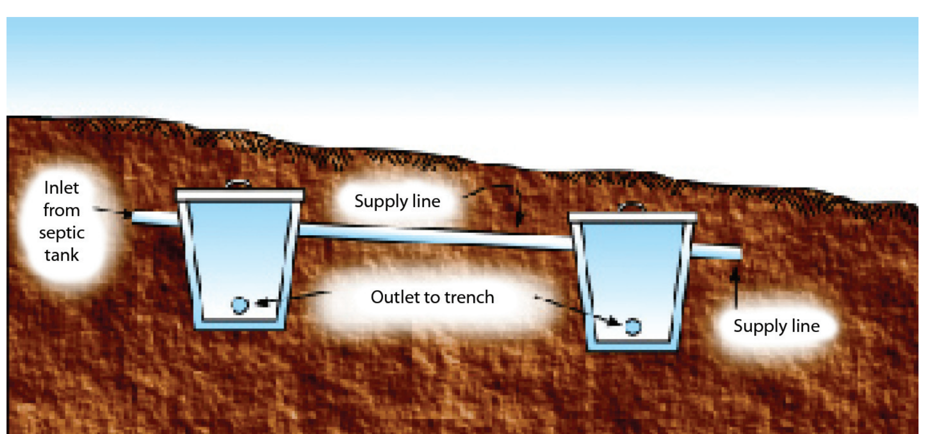


Figure 13: Serial distribution with drop boxes on slope.

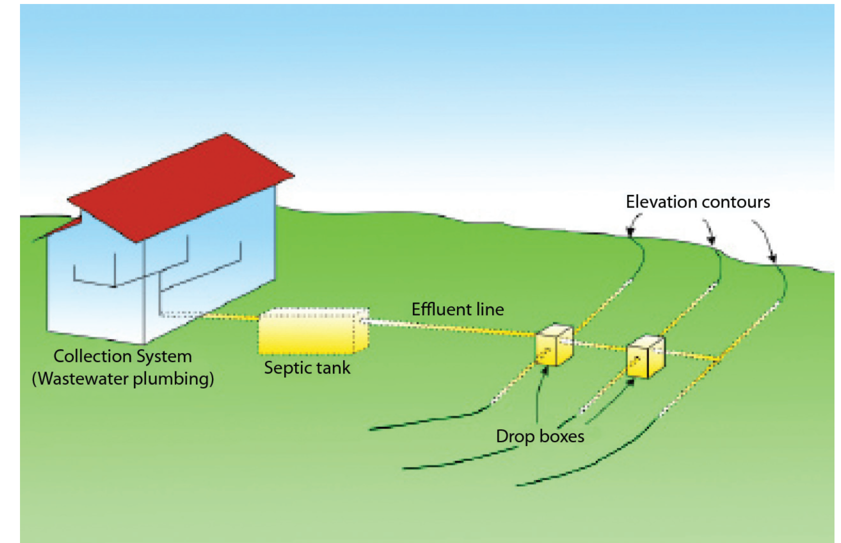


Figure 14: On-site wastewater treatment system on the contour, using drop boxes.

water that will be treated each day. See *Chapter 69* for design specifications.

The depth of the septic tank depends on the house wastewater plumbing and whether gravity flow from a basement sewer drain or toilet to the tank is feasible.

For homes with a basement sewer drain or toilet, try to build the house high enough relative to the septic tank for gravity flow from the basement plumbing to the tank, if possible. *Chapter 69* requires the tank lid or top of the riser to be brought to the ground surface. If the tank is set deeper it must have risers that are brought to the ground surface. The system may need a pump and pump chamber to lift septic tank effluent from the septic tank to a drainfield at a higher elevation. In this situation, only the septic tank effluent, liquid with large solids removed, needs to be pumped. If it is not possible to build the house high enough for gravity flow from the basement plumbing to the septic tank, install a grinder pump or sewage ejector pump to lift wastewater out of the basement to an elevation suitable for drainage to the septic tank. In this situation both solids and liquids must be pumped. Your system installer/designer will help you select the type and size of pump, and frequency of pump operation to provide the desired application of wastewater to the drainfield area.

A good installer will not construct the soil treatment system when the soil is extremely wet, such as after heavy rainfalls. Heavy equipment will compact wet soils and may result in a poorly functioning system. Before any excavation, call Iowa One Call to locate underground utilities. During construction, the installer should take proper safety precautions when excavating to install septic tanks and sewer lines by using supports to prevent sidewalls from collapsing. People have been seriously injured and killed when sidewalls have caved in. Also, cover holes that could be dangerous for children, adults or animals with boards that cannot be readily removed, and surround with fencing. The installer should backfill immediately after inspection of the tank to reduce the possibility of accidents.

Drop Boxes and Distribution Boxes

Septic tank effluent must be spread or distributed between trenches of a drainfield with a distribution box or drop boxes. The distribution box is a separate unit installed after the septic tank ***(Figure 12, page 16)***. As with septic tanks, a distribution box must be watertight and noncorrosive. The distribution box must have an opening of adequate size to allow for inspection, cleaning, leveling and maintenance.

The distribution box must be level and arranged so that effluent is evenly distributed to each trench or bed. Each trench or bed must have its own connection to the box. All of these outlets must be the same elevation. Each outlet also has a leveling device attached to it. The installer will level the box, but when covered with soil, or due to settling over time, the distribution box may occasionally become out of level. It will not perform its function of spreading effluent evenly throughout all trenches. For this reason, the distribution box must be set on undisturbed soil and located so the leveling devices can be readjusted.

For hillside installations, a pressurized distribution system or drop box may be used. A drop box is a different way to distribute water through a drainfield installed on a slope ***(Figure 14, page 17)***. Drop boxes must be watertight and noncorrosive. The bottom of the inlet pipe must be at least one inch higher than the bottom of outlet pipe to the next trench *(Figure 13, page 16)*. The outlet pipe to the next trench must be at least two inches higher than the outlet pipe of the trench in which the box is located.

Drop boxes work well on slopes. They eliminate the problem of poor distribution among trenches and potential of one trench (especially the lowest one) receiving most of the flow. A series of trenches is dug parallel to the slope so that each trench is higher/lower than the next. Starting with the highest, each trench fills with wastewater completely, then overflows through a series of drop boxes to each succeeding trench. Each trench must be level from end to end and follow the contour. Running trenches perpendicular to the slope is not an option, as all water would run to the end of the trench, not allowing full use of the entire trench area, and usually resulting in system failure.

Information on Existing Systems:

How Do I Locate the Main Parts of an Existing System?

Counties may have information about existing on-site wastewater treatment systems. The location of alternative systems such as media filters or aerobic tanks which require more frequent maintenance may be obvious. As the owner of an older home or potential new owner of a home that has no records, it is important to find the system to confirm that one is in place, that it is functioning properly, and that wastewater is not illegally being discharged to surface water, groundwater or land. Also, distance to water wells and other setbacks should be determined. An owner should know where the system is located for tank pumping and maintenance, as well as for any future remodeling or construction. Before purchasing property, have the tank pumped by an Iowa-licensed septic hauler and the system inspected by your county environmental health office or a competent professional.

Warning: Only a qualified service person using proper safety precautions should enter a septic or dosing tank.

Lack of oxygen or the presence of dangerous gases could be fatal. Do not allow anyone to smoke in the vicinity because volatile gases may be present. Make certain septic tank lids are secured to keep out children and animals.

Look for an access manhole or inspection pipe at ground level to locate the septic tank. Unfortunately, these are often buried several inches to several feet below ground. In this case, you may want to contact a professional to investigate your system. Older tanks may be metal, and concrete tanks may have metal reinforcing rods, so a metal detector may be helpful. Another option is to have a septic tank maintenance person flush a small transmitter down the toilet and use a receiver to locate the tank.

To find the drainfield, look around the yard in the general direction where the sewer pipe left the house for an area where the grass grows differently. The drainfield releases water and nutrients to the soil, which may give clues as to its location. In summer the grass may be greener. In winter the snow may melt more quickly. There may be a slight depression or mound. The area may be soggy when the rest of the yard is dry, which is not a good sign. It means the wastewater is surfacing instead of draining down into the soil for treatment.

If the owner is unable to find the drainfield, a pumper or designer usually has the tools to find it. If no one can find the drainfield, there simply may not be one. The wastewater may be going to a ditch, surface water, or just into the ground. This doesn't treat wastewater to remove pollutants such as pathogens and nutrients and is not legal. Existing systems with septic tanks that discharge to a ditch, the ground surface, surface water or a field tile are illegal and are **not** "grandfathered." A proper, permitted system must be installed.

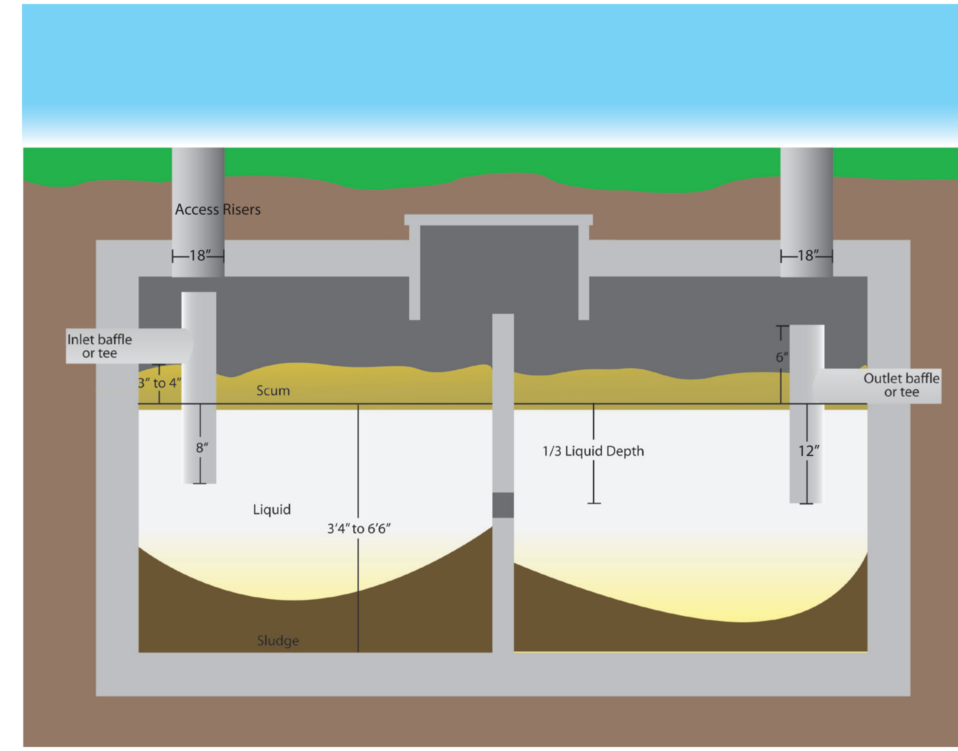


Figure 15: Measurements to determine if a septic tank should be pumped. Take measurements in first compartment.

Once the septic tank and drainfield have been located, sketch a map to keep with other wastewater treatment system records. This will be important when the system is inspected and pumped, or when the property is sold.

How Do I Operate and Maintain My System?

Homeowners should know what to expect from a properly functioning on-site system and be able to tell when a system is malfunctioning. Besides overuse of water, homeowner neglect is one of the most common factors contributing to system failure. An on-site wastewater treatment system is not as forgiving as a municipal system in terms of water usage and materials that go down the drain.

An on-site wastewater treatment system may fail in two ways. The system may fail to accept all of the wastes discharged into it, or the system may fail to properly treat the wastewater. Both of these may be due to faulty design, faulty installation or homeowner neglect/abuse.

Owner's Responsibilities for Using a Septic Tank/Drainfield System

Practice sound water conservation measures.

Excessive water use places a strain on the septic system. For best performance, an on-site system needs enough time to treat the wastewater. Every time wastewater enters the septic tank, an equal amount leaves it and enters the drainfield. Large amounts of wastewater entering the septic tank over a short period of time may stir up the scum and sludge, and resuspend solids in the liquids. These solids could be carried into the drainfield and eventually clog it, causing the system to fail.

What you can do:

- Use low volume water appliances (toilets and shower heads) when possible. Newer toilets use as little as 1.5 gallons of water or less per flush, compared to older models which use up to six gallons. Low volume toilets are required in new construction.
- Try to distribute wastewater loads over a number of days. Don't wash five loads of laundry in one day. Instead, wash one or two

loads per day.
- Fix leaky faucets and toilets.
- Take short showers.
- Shut off water while shaving or brushing teeth.
- Fill the basin to wash hands or dishes instead of washing under running water.
- Wash only full loads of dishes or laundry.
- Route roof drains and basement drainage tile water outside of the septic system and away from the drainfield (see ***"Never apply large amounts of water to the drainfield,"*** in this section).

Have the septic tank pumped regularly.

This is one of the few but vital tasks a homeowner faces. If sludge and/or scum enter the drainfield, they could cause expensive and possibly irreparable damage. How often you should have your tank pumped depends upon the size of the tank, the volume and quality of wastewater generated, and the number of water-using appliances in the home. Garbage disposals and newer dishwashers that have garbage grinders built into them can greatly increase the load to the septic system. Many experts recommend a tank be pumped every two to three years.

What you can do:

Have the tank inspected annually until it is determined that pumping is required. The tank should be pumped when the bottom of the scum layer is within three inches of the bottom of the outlet baffle, the top of the scum layer is within one inch of the top of the outlet baffle or the top of the sludge layer is within 12 inches of the bottom of the outlet baffle ***(Figure 15, page 19)***. Once the pumping interval is established, follow it until there is a change in your water-use patterns that would require the tank to be pumped more or less frequently.

When performing maintenance tasks, always minimize exposure to wastewater by wearing protective and waterproof gloves. After completing the tasks, thoroughly wash hands or shower, and disinfect any breaks in the skin.

A licensed professional should pump and inspect a tank, as this involves more than just removing the septage, or wastewater, from the septic tank. A septic tank cannot be adequately cleaned or inspected using the inspection pipe, typically only four inches in diameter. If the inspection pipe is used, the scum layer could plug the outlet baffle when liquid again fills the tank. To properly pump the tank, use the manhole.

Some of the liquid should be pumped out, and then injected back into the tank under pressure to agitate the sludge into suspension. If the scum layer is hard, the septage should be agitated in the tank with air or a long-handled shovel through the manhole to break up the scum layer.

When all of the solids have been broken up and are suspended in the liquid, the septage should be pumped out of the septic tank into the truck. Unless the manhole is open, it is impossible to tell if all of the solids have been removed. Also, when the manhole is open, the condition, length and submergence of the inlet and outlet baffles should be checked and replaced if they are the wrong length or in poor condition. Septage should be disposed of according to *Iowa Administrative Code (567)-Chapter 68 "Commercial Septic Tank Cleaners,"* or local regulations if they are more stringent.

It is not necessary to leave solids in the septic tank as "seed." Incoming wastewater contains enough microorganisms to repopulate the system. Do not wash, scrub or disinfect the tank. Because microbial action is necessary, you do not want a clean, sterile environment.

Never apply large amounts of water to the drainfield.

Do not allow water from roofs, driveways patios and other areas to drain over any part of the on-site wastewater treatment system.

What you can do:

- Divert runoff water from roofs, concrete patios, driveways, or other impervious surfaces away from the system.
- Do not install an underground lawn sprinkler system that would discharge water over any part of the drainfield.
- If a slight amount of watering is required on a mound system or a lawn to maintain the grass cover, use a manually operated sprinkler, and measure the amount supplied. Do not over-water the drainfield.

Do not place additional soil fill over the drainfield other than to fill slight depressions due to settling.

However, a slight mounding will ensure runoff of surface water. Microbial breakdown occurs in the drainfield, and these organisms need air, which is more readily available closer to the soil surface.

What you can do:

- If any surface water ponds over the system, add adequate fill and diversion landscaping to eliminate ponding.
- Do not add large amounts of soil to any portion of the system; only add enough to maintain the original grade, not change the grade.

Maintain vegetation over the drainfield.

Establish grass or natural vegetation over the drainfield unit, as this cover helps the system remove some water and prevents erosion.

What you can do:

- For drainfields and mound systems, establish grass vegetation.
- Mow frequently to encourage vegetative growth.

Installation of a new septic system.

- Keep rodents out of the drainfield area.
- Do not plant trees or other plants with deep invasive roots within five feet of the drainfield.

Don't compact soil in the drainfield.

Driving vehicles on the mound system or drainfield before, during or after construction can damage it. Soil treatment depends on undisturbed, uncompacted soils to treat wastes. In winter, a vehicle's weight can drive frost deep into the soil and prevent treatment from occurring.

What you can do:

- Avoid unnecessary vehicular traffic over the drainfield.
- Do not allow traffic of any type in the winter that would compact accumulated snow over the drainfield.
- Do not tie or confine livestock or pets over the drainfield at any time.

Do not use additives.

Additives fall under three major categories:

- Starters to get bacterial action going in the septic tank;
- Feeders to supplement and/or feed bacterial populations; and
- Cleaners to clean the tank.

Current research indicates that additives do **not** improve the performance of a septic tank and may actually increase the chance for clogging a drainfield. Some additives, especially "cleaners," allow solids to remain in suspension, instead of settling into the sludge layer. Then, they may be carried to the drainfield and clog it.

What you can do:

- Do not use additives. Millions of bacteria enter the septic system through normal use. There is no need to add more, nor is there a need to feed them.
- Do not wash or disinfect the tank.

Avoid disposing of potentially hazardous materials in the septic system.

Remember that any chemicals such as antifreeze, bleach, ammonia or other products that are poured down the drain flow to the septic tank and drainfield. Overloading the system with these products may reduce the ability of bacteria and other microorganisms to break down waste. Chemicals that are not broken down in the septic tank or drainfield may enter groundwater.

What you can do:

- Avoid using toilet bowl cleaners that automatically dispense chemicals with each flush.
- Use household cleaners and drain cleaner sparingly. Careful use of chemicals should not harm the system.
- Unused and unwanted chemicals should not be disposed of in toilets or drains. They should be properly handled through a household hazardous waste collection program.
- Do not dump unwanted pesticides such as herbicides, fungicides or insecticides down the drain.
- Do not dump paints, thinners or solvents down the drain.
- Do not dump excess medications down the drain.

Don't expect the septic system to handle all household wastes.

Do not use the toilet as a garbage can. Cigarettes, facial tissues and sanitary products will clog the plumbing or increase the scum or sludge in your tank. Discarding food through a garbage disposal uses a lot of water and adds significant amounts of scum and sludge to the septic tank, which will require more frequent pumping, and may contribute to premature drainfield failure.

What you can do:

- Manage these as solid waste rather than with wastewater.
- Compost vegetable scraps if possible.
- Have effluent filter/screen installed at septic tank effluent tee to further protect drainfield.

What Happens to Waste Pumped from the Septic Tank?

In Iowa, septage may be taken to a public wastewater treatment system for disposal, or land applied following *Iowa Administrative Code (567)-Chapter 68 "Commercial Septic Tank Cleaners."* Local regulations may be more stringent.

Septage provides valuable nutrients and some organic matter to the soil. To protect public health, septage that is land applied must be either injected immediately, or plowed or disked into the soil within 48 hours of application.

Another option requires that the septage be stabilized with lime to decrease odors, decrease the levels of pathogens, and provide further breakdown of the waste. Then it can be applied to the land without injection or incorporation provided it is an acceptable distance from a waterways, sinkholes or tile lines.

There are restrictions as to what crops may be grown, or what the land can be used for if septage has been applied. See *Chapter 68* for more details.

Contact Iowa DNR or your local environmental health department to learn if there are more stringent local regulations.

FOR MORE INFORMATION

Visit the DNR's septics website at: www.iowadnr.gov/water/septic/

OSWAP helps replace outdated and failing septic systems in Iowa

The DNR's Onsite Wastewater Systems Assistance Program (OSWAP) helps rural Iowans replace inadequate or failing septic systems in an effort to help clean up polluted waterways statewide. Since beginning in 2002, the program has helped finance the replacement of more than 700 septic systems, totalling $4,000,000, at an average cost of $6,400 per loan.

OSWAP offers low-interest loans to homeowners at 3 percent, for amounts beginning at $2,000, for a maximum repayment period of 10 years. Loan applicants must be creditworthy and apply for a loan through participating lenders. The program limits eligibility to owners of existing homes only, in unincorporated areas not served by a public sewer.

The program was created to help replace outdated septic systems in Iowa that still dump untreated wastewater from household septic tanks to open ditches or underground tile lines that flow directly into streams, rivers, lakes or fractured bedrock. Inadequate and failing septic systems contribute to the pollution of wells, groundwater and surface waters with fecal bacteria, viruses and nutrients.

An estimated 100,000 septic systems in Iowa are at substandard levels. And many landowners with those systems may not realize their systems are breaking the law. According to Iowa law, all septic systems, regardless of when they were installed, must have secondary wastewater treatment following the septic tank.

Homeowners wanting to apply for an OSWAP loan must first obtain a septic construction permit from their county sanitarian and complete an OSWAP approval form. Next, they apply for a loan through a participating lender. If their loan is approved, the final step is to hire a septic contractor to complete the approved project.

OSWAP is funded through the state revolving loan fund.

For more information, contact Daniel Olson R.S., Iowa DNR Environmental Specialist Senior, at (515) 281-8263, or your county sanitarian. Or visit www.onsiteiowa.com.

Troubleshooting On-site Wastewater Treatment Systems

Some of the problems that occur include sluggish drainage, contaminated drinking water, wastewater surfacing in the yard, odors, pipes freezing or lagoons overflowing. If any of these occur, the following list may help narrow down the cause of the problem.

Sluggish or no drainage from fixtures, or backup of wastewater into the house may be caused by:

- Improperly designed and/or installed system
- Improper plumbing in the house
- Blockage in house plumbing
- Improper appliance operation
- Excess water entering the system
- Improper elevations in wastewater system
- Pump failure or improper operation if system is not a gravity flow
- Blockage in wastewater line between house and septic tank
- Blockage in septic tank
- Blockage in line from septic tank to drainfield
- Blockage in distribution box, drop box, or pipe
- Blockage at the drainfield/soil treatment interface, where wastewater enters soil
- Effluent filter may need cleaning.

Contaminated drinking or surface water may be caused by:

- Inappropriate or improperly designed and/or installed wastewater treatment system
- Wastewater treatment system too close to water supply well
- Direct flow of wastewater to surface or groundwater
- Improper water supply well construction or damaged water supply well
- Broken water supply pipe
- Broken wastewater lines
- Leaking septic tank
- A source other than owner's system

Sewage odors indoors may be due to:

- Improper plumbing and venting in house
- Traps not filled with water
- Wastewater backup into house
- Wastewater surfacing in yard
- Unsealed wastewater ejector sump pump

Sewage odors outdoors may be due to:

- Wastewater surfacing in yard
- Improper plumbing and venting in house
- Pump station vent or an inspection pipe located too close to house
- Inspection pipe caps damaged or removed
- Wastewater backup into house
- Unsealed wastewater ejector sump pit
- Source other than owner's wastewater treatment system

Wastewater surfacing in yard may be caused by:

- Excess water entering system
- Blockage at the drainfield/soil treatment interface where wastewater enters soil
- Blockage in distribution pipe
- Improper elevation for drainfield
- Restricted or impaired flow through the distribution box, drop box, or drainfield
- Undersized drainfield due to design or construction
- Pump failure or improper operation
- Inappropriate or improperly designed and/or installed system

Distribution pipes and/or drainfield freezes in winter may be due to:

- Improper construction
- Check valve in pump to lift wastewater to tank or effluent to drainfield not working
- Traffic over subsurface pipes (drainfield, pipe to drainfield, etc.)
- Low wastewater flow rate
- Lack of use

Additional Resources

On the Web

Iowa Administrative Code 567-Chapter 69
http://www.legis.state.ia.us/aspx/ACODOCS/DOCS/567.69.pdf

Iowa Administrative Code 567-Chapter 68
http://www.legis.state.ia.us/aspx/ACODOCS/DOCS/567.68.pdf

Iowa Department of Natural Resources, Septics Information
www.iowadnr.gov/water/septic/

U.S. EPA
http://cfpub.epa.gov/owm/septic/home.cfm

National Onsite Wastewater Recycling Association
www.nowra.org

National Small Flows Clearinghouse
www.nesc.wvu.edu/nsfc/nsfc_index.htm

DNR Contacts

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County Soil Survey Maps are available from your local National Resources Conservation Service (NRCS), formerly known as Soil Conservation Service (SCS) office or from Iowa State Extension offices.

Iowa Department of Natural Resources

www.iowadnr.gov

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