

Land & Water

Conserving Natural Resources in Illinois

University of Illinois at Urbana - Champaign, College of Agriculture, Cooperative Extension Service

Septic Systems

Operation and Maintenance of On-Site Sewage Disposal Systems

Wastes and Water Quality

As more people move to rural and suburban areas not served by municipal or community sanitary sewers, homeowners must turn to on-site sewage disposal for the treatment and disposal of household waste.

The proper operation and maintenance of an on-site sewage disposal system is necessary to increase the system's longevity and to protect surface water and groundwater quality. Improper use and maintenance can result in one or more of the following problems:

- Objectionable and undesirable odors.
- A breeding area for mosquitoes.
- Very expensive repair and/or replacement costs of a new system.
- Costly damage caused by sewage backing up inside the home.
- Condemnation of the house and eviction.

- Contamination of groundwater and surface water.
- The spread of many serious diseases associated with sewage, such as cholera, infectious hepatitis, and typhoid fever.

When on-site sewage disposal systems are installed on the proper site and are properly designed, constructed, operated, and maintained, they provide a safe, cost-effective alternative to municipal and community sanitary sewage treatment.

These systems are designed to treat and dispose of the normal wastewater generated in a household. Wastewater includes the drainage from household plumbing fixtures (toilet, sink, and shower) and the washing machine. It does not include water softener discharges and water from foundation footing drains.

The Septic Tank/Soil Absorption System

The most common form of on-site sewage disposal is a septic tank/soil absorption system. A conventional septic system consists of a septic tank, distribution box, and a gravel-filled absorption field installed below the soil surface (see Figure 1). The following processes occur in the system:

1. Household wastes are collected in the septic tank.
2. The septic tank retains the wastewater for approximately 24 hours, allowing the solids to separate and settle out. This also allows bacteria to partially decompose and liquify the solids.

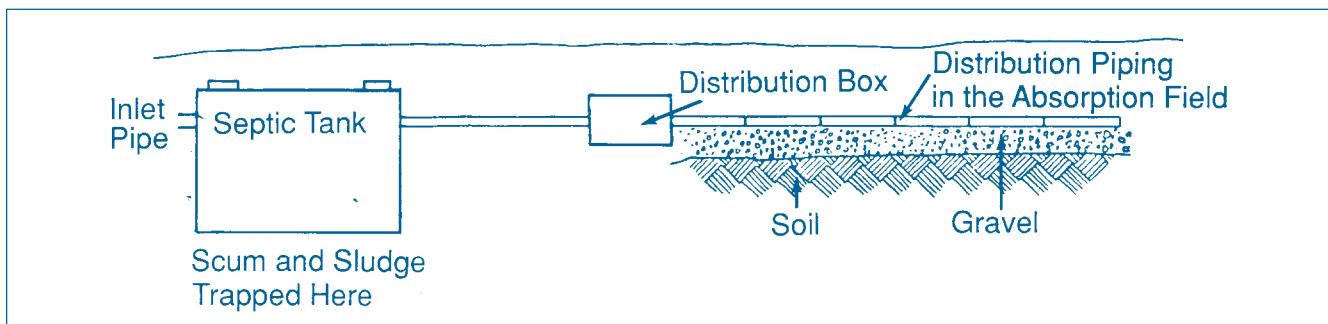


Figure 1. The components of a conventional septic tank/soil absorption system consist of the septic tank, distribution box, and absorption field. Solid wastes settle out in the septic tank and the liquid (called effluent) moves to the distribution box. Through piping, effluent is evenly distributed throughout the absorption field. As effluent moves through the soil, impurities are removed.

Percolation Test Results (Minutes for 6 inches of water to infiltrate soil)	Required Absorption Area (Square feet per bedroom)
18-30	130
60	165
90	210
120	235
150	265
180	290
240	320
300	350
360	385
above 360	*Unsuited

*A soil with a percolation rate exceeding 360 minutes is unsuitable for a conventional subsurface soil absorption system. Consult with the county Public Health Department to find out what alternative or innovative system to use.

Table 1. The size of an absorption field is based on percolation tests and the number of bedrooms in a house. For example, if the percolation test indicates that it takes 60 minutes for 6 inches of water to infiltrate the soil, the absorption area must be 165 square feet *per bedroom*. This means that a three-bedroom house must be serviced by a 495-square-foot absorption area (165 square feet x 3 = 495 square feet).

3. A scum layer, consisting of fats and oils, floats on the surface of the wastewater. Heavy, partially decomposed solids, called sludge, are retained in the septic tank and must be removed periodically (see Figure 2).

4. The partially treated liquid, called effluent, flows out of the septic tank to the distribution box, where it is evenly distributed throughout the absorption field.

5. As effluent moves through the soil, impurities and pathogens are removed.

Types of Absorption Fields

The absorption field consists of 4-inch-diameter perforated pipe surrounded by gravel. In recent years, however, the gravel-filled absorption field has been replaced by a gravel-less field. The gravel-less field consists of 8- or 10-inch-diameter corrugated plastic pipe.

An absorption field can be constructed with either a trench or a bed design. Looking at Figure 3, note that the trench design differs from the bed design by consisting of one or more long, narrow trenches. Each trench cannot be more than 3 feet wide and must be more than 6 feet apart.

The major advantage of the trench system is that it has more sidewall space than the bed design, making it less subject to premature failure. Sidewall space is critical because effluent moves through it more effectively than through the bottom of an absorption area. Slime, produced by organisms in the soil, collects on the bottom of an

absorption area, creating a barrier and slowing the movement of effluent into the surrounding soil (see Figure 4).

Although the trench system takes up more land than the bed design, the trenches do not have to be parallel. They can be sent in any direction, providing flexibility in design. The flexibility makes it easier to construct the trenches in an odd-shaped lot or when obstacles limit the area.

The size of an absorption area is based on the volume of wastewater generated in the home and the permeability of the soil. Permeability, the ability of water to flow through soil, is determined through percolation tests or is estimated from county soil survey information. Table 1 shows that the size of the absorption area is determined by the number of bedrooms in a home and the percolation test results. Consult your county or regional health department to determine what sizing method is used.

Alternative Systems

In areas where a conventional septic tank/soil absorption system is unsuitable (such as areas with high water tables or slowly permeable soils), you may be able to modify site conditions or use alternative systems.

In areas with high water tables, for example, you may be able to use underdrains or curtain drains to lower the water table (see Figures 5 and 6). Another option is to raise the level of the soil surface with layers of fill soil.

When it is not practical to modify the site, consider an alternative system. For example, the mound system and the aerobic system are alternatives that may be used in areas with high water tables or slowly permeable soils.

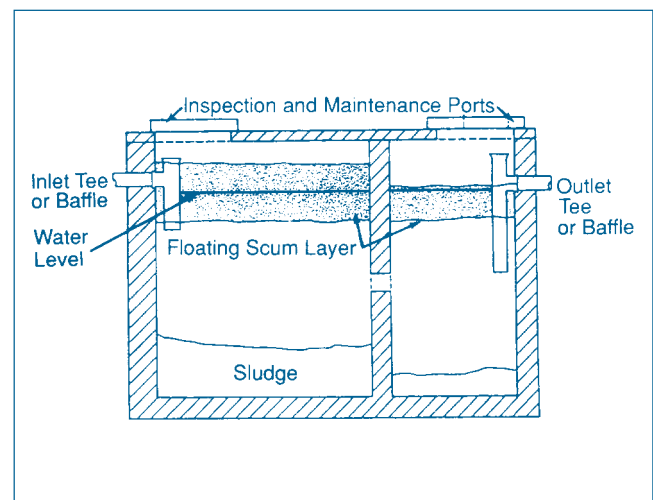


Figure 2. Heavy, partially decomposed solids, known as sludge, collect in the bottom of septic tanks, while a scum layer of lightweight material (including fats and greases) rises to the top. Sludge should be removed by pumping it out every two to three years or sooner, if needed. A multi-compartment septic tank, shown here, performs somewhat better than a single compartment tank of the same capacity because it more effectively prevents solids from reaching the distribution system.

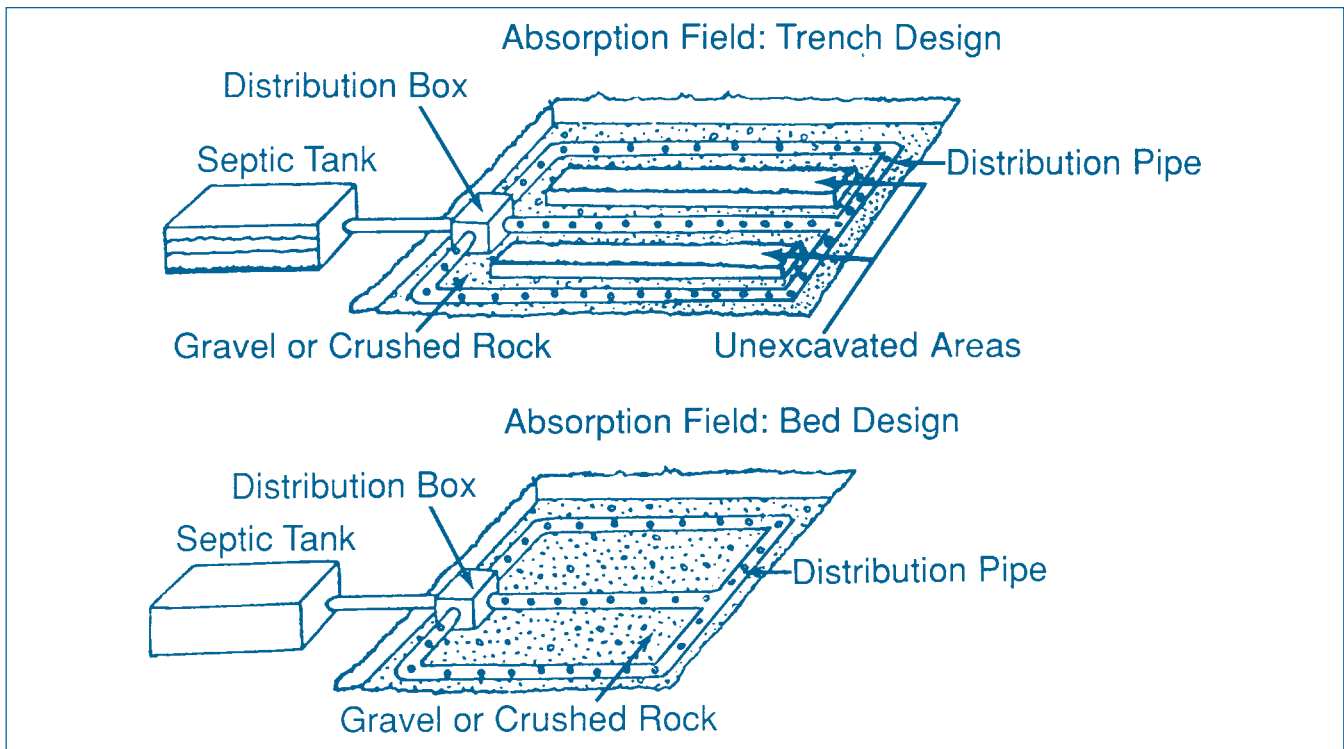


Figure 3. An absorption field with the trench design consists of long, narrow trenches, each which cannot be more than 3 feet wide. The trenches also cannot be spaced any closer than 6 feet apart. Although this design takes up more space than the bed design, it discharges effluent into the soil more efficiently.

With the mound system, the absorption field is built above the natural ground level (See Figure 7). A distribution network supplies effluent to the mound, and the effluent is treated as it passes through the fill sand and natural soil.

The aeration system consists of a chamber that mechanically aerates (mixes air with) the effluent and decomposes the solids. Effluent is discharged to an absorption field or, after chlorination, to surface water or an evaporation pond.

Other alternatives include sand filters, lagoons, electro-osmosis systems, dropbox distribution systems, serial distribution systems, pressure-dosed distribution systems, and leaching chambers. In general, alternative systems are more costly to install and operate than conventional septic tank/soil absorption systems and may require additional maintenance.

For more information on alternative systems, contact your county or regional Department of Public Health or your county Cooperative Extension Service office.

The Do's of Septic System Operation

- Determine the condition of the septic tank and the level of sludge in the tank annually, and have sludge pumped out every two to three years or sooner, if needed. A licensed septic tank pumper can perform this simple task. The septic tank pumper also can demonstrate how you can determine the level of sludge in the tank.

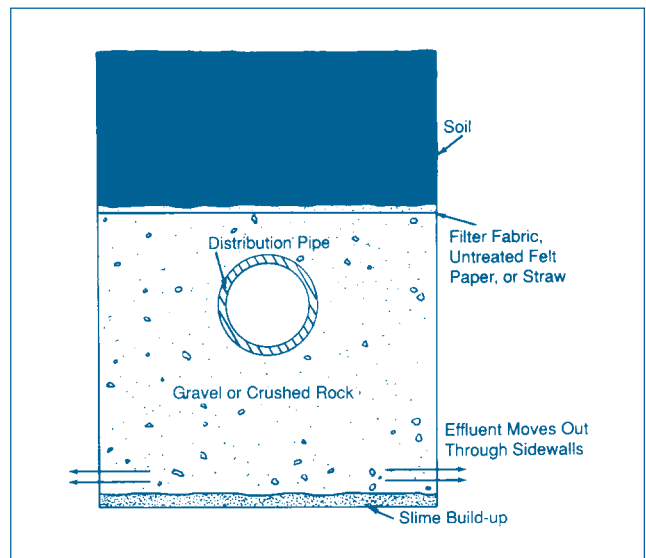


Figure 4. This cross-section of an absorption field shows how slime collects on the bottom. The slime, or “crust” as it is sometimes called, restricts the downward flow of effluent. Consequently, the sidewalls are chiefly responsible for discharging effluent into the soil. Absorption *trenches* have more sidewall area and less bottom area than absorption *beds*; therefore, trenches discharge effluent more efficiently.

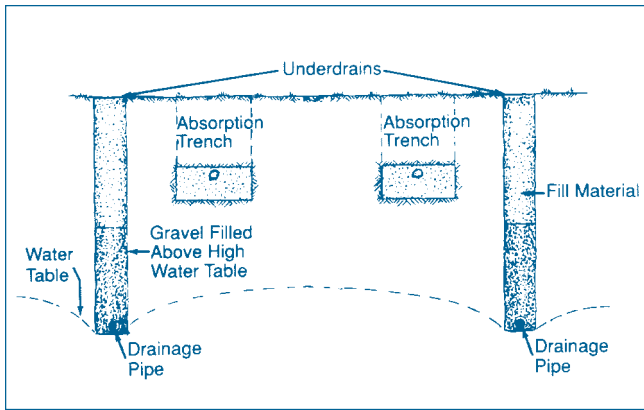


Figure 5. In areas with seasonally high water tables, underdrains can be installed to lower the water table (the upper level of groundwater). If effluent is to be properly treated, the water table should be at least 2 feet below the bottom of the absorption field.

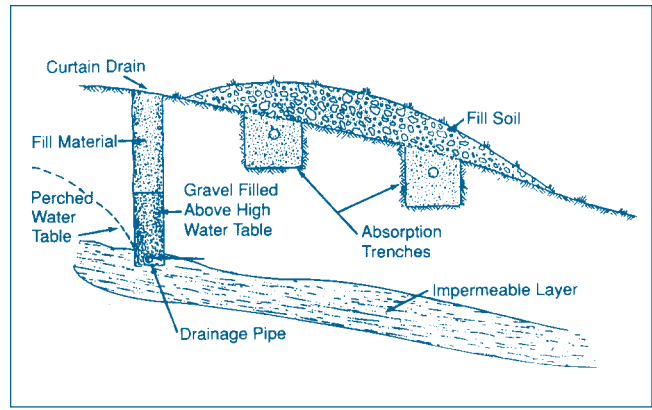


Figure 6. In some areas, soils may have a "perched water table." This means the water table is on top of, or perched on an impermeable layer of soil. Soil below the impermeable layer may be dry, while soil above the layer is saturated. In some cases, a curtain drain may be able intercept and channel away groundwater moving downslope before the water reaches the impermeable layer.

Letting the tank overload with sludge reduces the time that wastewater remains in the tank. As a result, less solids settle in the tank, less solids decompose, and more solids reach the absorption field. Clogging the field with solids can result in premature failure of the absorption field and may require costly repairs or replacement.

- Allow accessibility for a pumper truck or backhoe to service your system. Septic tanks require routine pumping and periodic maintenance, so keep access to the area easy.

- Keep water from footing drains and water softener discharges out of the septic system. Water from footing drains can overload the capacity of the absorption field, reducing its ability to accept effluent. Water softener discharges contain high concentrations of sodium, which react with the soil to reduce permeability. Remember, the system was designed and sized to handle only the wastewater from plumbing fixtures and washing machines.

- Divert surface run-off around the system, if possible.
- Check and repair all leaking plumbing fixtures.
- Install water-conserving devices on all plumbing fixtures.
- Discard grease in garbage cans. Grease is very resistant to decomposition. If it is allowed to enter the plumbing system, it can clog the septic tank, carry over to the absorption field and reduce soil permeability.
- Install a lint trap on the washing machine. Lint also can clog the septic system.

The Don'ts of Septic System Operation

- Do not breathe or inhale gas emitted from an open septic tank. Gas emitted from a septic tank can be toxic, so take precautions to minimize exposure to it.
- Do not put non-biodegradable items in the toilet. Non-

biodegradable items, such as sanitary napkins, disposable diapers, paper towels, and plastic, do not break down. They may block the septic tank's inlet or outlet. Also, they may fill the septic tank and result in the need for more frequent pumping of the tank.

- Do not pour toxic substances into plumbing fixtures. Toxic substances, such as paints, solvents, oils, degreasers, acids, and pesticides, may contaminate groundwater or well water. Because the soil is not capable of removing many of these compounds from wastewater, they may move out of the absorption field and into groundwater supplies.

- Do not install a garbage disposal or grinder. They markedly increase the load of suspended solids in wastewater, causing more rapid buildup of sludge in the septic tank and resulting in a premature failure of the system. If you must install a grinder, the size of the septic tank must be increased 1-1/2 to 2 times the normal tank volume. That way, the tank will be better able to handle the increased level of solids.

- Do not use septic tank additives. Additives, such as hydrogen peroxide, acids, and solvents, are sometimes put into the distribution system to unclog a failing absorption system. In many instances, however, they have been shown to have little or no benefit and can result in groundwater contamination. For instance, additives that contain microorganisms may provide no benefit to a septic system because the effluent already contains millions of microorganisms. Some counties prohibit the use of additives that contain solvents.

- Do not drive cars or heavy equipment over the septic system or compact the soil around the system during construction. Heavy equipment can damage the septic tank, distribution box, or the perforated pipe in the absorption field. It also can compact the soil, reducing soil permeability.

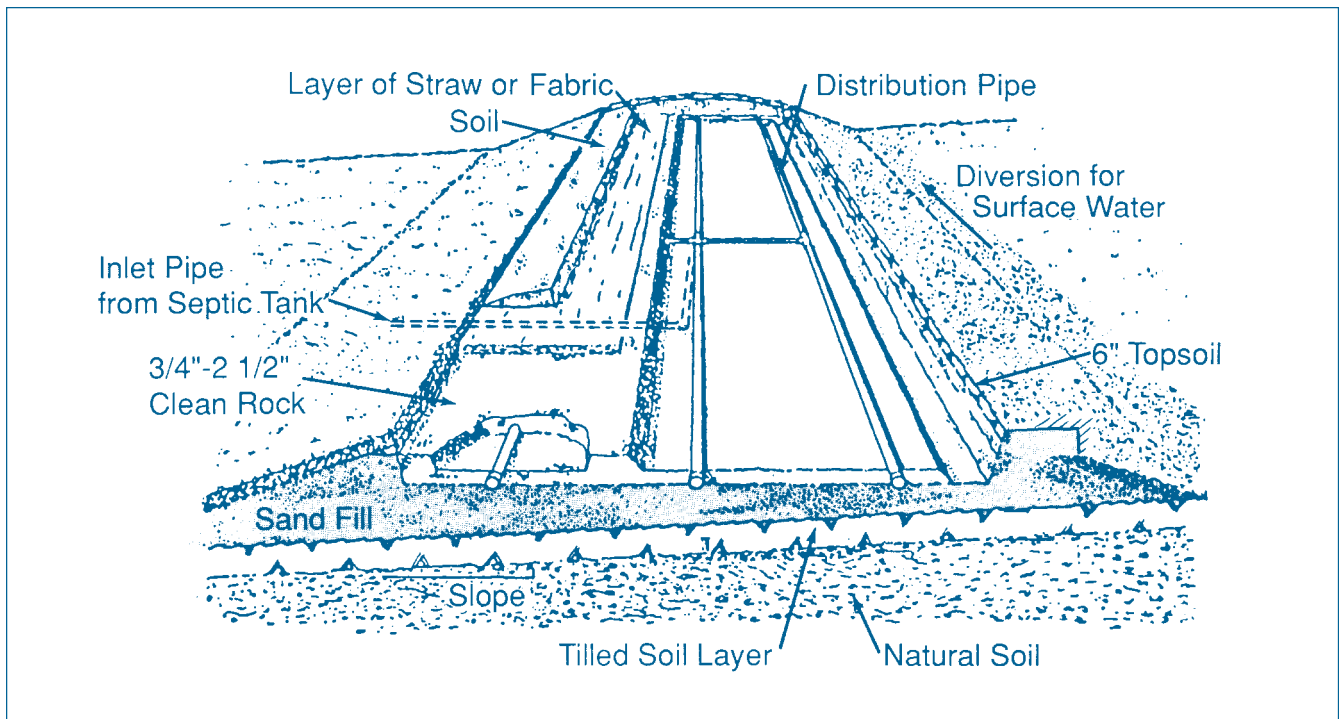


Figure 7. An alternative to the conventional septic tank/absorption field system is the mound system. The mound is comprised of layers of tilled soil, sand fill, clean rock, straw or fabric, and a topsoil cover. Effluent flows by gravity or is pumped to the mound through an inlet and then moves into perforated lateral pipes. Effluent is treated as it passes through the sand fill and natural soil.

- Do not build over the septic system. Constructing driveways, patios, aboveground swimming pools, and other structures over the absorption field can substantially reduce the system's performance. Absorption systems remove a large amount of effluent by evaporation from the soil surface and by transpiration from plants. If you seal over the surface of the absorption area with construction, you restrict the removal of effluent.
 - Do not plant new trees or leave existing trees close to the absorption field. Tree roots can grow into the perforated pipe and clog the system, disrupting the distribution system and resulting in its failure.
 - Do not divert the runoff water from downspouts or other sources onto or toward the absorption system.
 - Do not wastefully use water.
- By practicing these "do's" and "don'ts," you can improve system performance, extend the life and usefulness of your on-site sewage disposal system, avoid costly repair and replacement costs, and protect our water resources.

The county or regional Department of Public Health or the local Cooperative Extension Service adviser can provide further information or answer any questions about on-site sewage disposal systems. To obtain the state sewage code or the Environmental Protection Agency publication, *On-Site Treatment and Disposal Systems*, write to the addresses below:

Private Sewage Disposal Licensing Act and Code, 1986
 Illinois Department of Public Health
 535 W. Jefferson St.
 Springfield, IL 62761

On-Site Treatment and Disposal Systems, 1981,
 EPA 625/2-81-013
 U.S. Environmental Protection Agency
 Center for Environmental Research Information
 Cincinnati, Ohio 45268

Record-Keeping

It is a good idea to keep a record of installation information, as well as the maintenance performed on your septic system. Information about your system may be available from your county or regional Department of Public Health. To collect installation and maintenance information, record sheets have been provided on pages 6 through 8.

Septic System Installation Record

Date Installed: _____

Building Permit Number: _____

Name and Address of Licensed Installer: _____

Size and Location of Septic Tank: _____

Layout of System: _____

Location, Length, and Depth of Trenches or Bed: _____

Distance From Tank to Any Well: _____

Distance From Absorption Field to Any Well: _____

Septic System Inspection and Maintenance Record

Date of Service	Type of Service	Name, Address, and Phone of Contractor
1. _____	_____ _____ _____	_____ _____ _____
2. _____	_____ _____ _____	_____ _____ _____
3. _____	_____ _____ _____	_____ _____ _____
4. _____	_____ _____ _____	_____ _____ _____
5. _____	_____ _____ _____	_____ _____ _____
6. _____	_____ _____ _____	_____ _____ _____

Date of Service

Type of Service

Name, Address, and Phone of Contractor

7. _____

8. _____

9. _____

10. _____

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