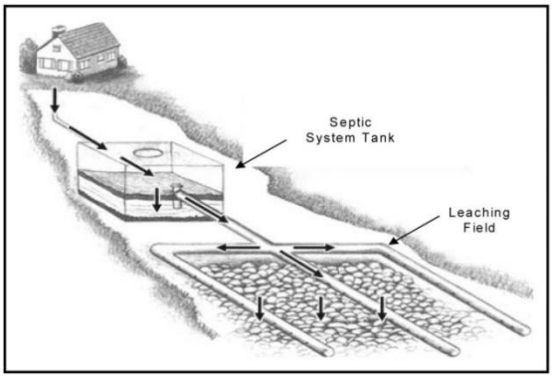
Septic Systems

Septic systems are wastewater treatment systems that collect, treat and dispose of wastewater generated by homes or businesses. A septic system consist of two main parts: a septic tank and a soil absorption system (SAS), also known as a drainfield, leachfield or disposal field. The septic tank is an underground, watertight vessel which collects wastewater from the home. It is designed to treat the wastewater by holding it in the tank long enough to allow the solids to settle out and separate from the liquid. The soil absorption field provides the final step in the treatment process. The drainfield treats the wastewater by allowing it to slowly trickle from the pipes out into the gravel and down through the soil. The gravel and soil in a drainfield act as biological filters.

Advantages

- Simple and effective wastewater treatment
- Less expensive to operate than centralized treatment facilities
- Provide wastewater treatment in areas where it would not be available otherwise
- When functioning properly, can help replenish groundwater



Disadvantages

- Water use must be monitored to not overload the system
- Must use care not to dispose of chemicals or other toxic substances through your drains and toilets
- Sludge may pose an odor problem
- Siting limitations
- Improperly functioning systems can introduce nitrogen, phosphorus, organic matter, and bacterial and viral pathogens into the surrounding area and groundwater

Costs

The cost of installing and maintaining a septic system varies greatly depending on location, system size and type, and specific soil and geological characteristics of the site. Conventional septic systems range in cost from $3,900 to $11,700 (adjusted to January 2020). Septic systems are most cost-effective in communities where houses are spaced widely apart, and where a connection to a sewer system in not an option.

Common Suppliers

National Rural Water Association Online Buyer's Guide - http://nrwa.officialbuyersguide.net/

Source

- United States Environmental Protection Agency – Decentralized Systems Technology Fact Sheet September 1999, "Septic Tank – Soil Absorption Systems" http://water.epa.gov/scitech/wastetech/upload/2002_06_28_mtb_septicfc.pdf
- National Small Flows Clearinghouse – Pipeline Summer 2004 Issue, "Septic Systems – A Practical Alternative for Small Communities" http://www.nesc.wvu.edu/pdf/ww/septic/pl_su04.pdf

Other Links

- United States Environmental Protection Agency. "Septic Systems (Onsite/Decentralized Systems) "http://water.epa.gov/infrastructure/septic/
- National Environmental Services Center. "Drainfield Rehabilitation" Small Community Wastewater Issues Explained to the Public. http://www.nesc.wvu.edu/pdf/WW/publications/pipline/PL_WI05.pdf

Septic Tanks

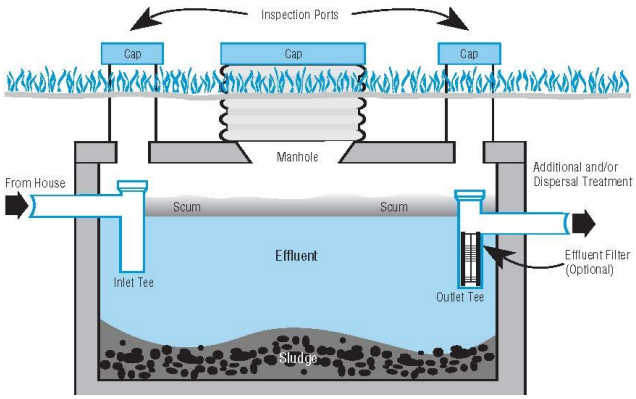
Septic tanks are made of precast concrete, fiberglass or plastic. In order to work properly, they must be watertight and resistant to corrosion. Most are single-compartment tanks; although some people prefer two or more compartments because they feel settling ability may be enhanced. An effluent filter is a basket-like screen that is placed on the outlet pipe of the septic tank. It is a relatively inexpensive method for preventing solids from discharging to the drainfield. It is a relatively new technology and can be retrofitted to work with older designs. Septic tanks are usually rectangular, oval or round; overall shape has little to do with performance. The size of the tank is a very important factor because it must be large enough to accommodate the needs of the household and is usually determined by the number of bedrooms in a home. A formula of 150 gallons per bedroom per day along with a two day retention time in the tank is a good estimate. Standard sizes include 750, 1,000, 1,200 and 1,500 gallons. A homeowner does not need to add a stimulator or enhancer to a septic tank that is designed, operated and maintained properly.

Advantages

- Septic tanks are relatively inexpensive
- Low maintenance requirements
- Effluent screens help prevent solids from clogging the drainfield

Disadvantages

- Septic tanks must be pumped routinely, usually once every three to five years
- Toxic gases are produced by the natural treatment process and extreme care should be taken when inspecting your tank
- "Cloggers" like diapers or coffee grinds and "killers" like household chemicals cannot be flushed or disposed of in the drain



Costs

The costs for tanks greatly vary for each site. The factors that affect costs include location, access, subsurface site conditions, and the type of tank installed. A general cost range for tanks is from $2 to $7 per gallon (adjusted to January 2020).

Source

- United States Environmental Protection Agency – Decentralized Systems Technology Fact Sheet September 2000, "Septic System Tank" http://water.epa.gov/scitech/wastetech/upload/2002_06_28_mtb_septic_system_tank.pdf
- National Small Flows Clearinghouse – Pipeline Summer 2004 Issue, "Septic Systems – A Practical Alternative for Small Communities" http://www.nesc.wvu.edu/pdf/ww/septic/pl_su04.pdf

Other Links

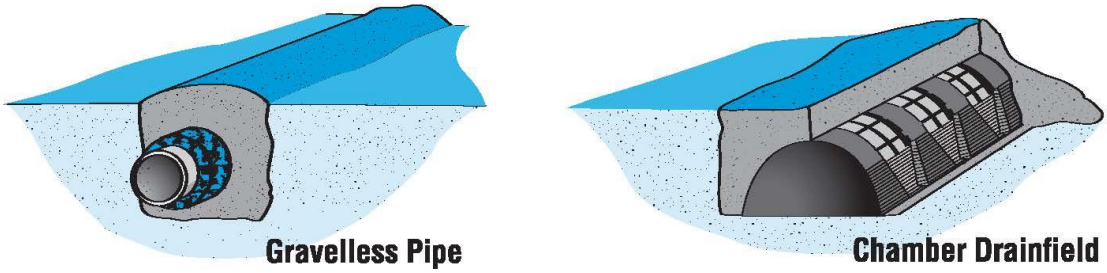
- United States Environmental Protection Agency. "Septic Tank Effluent Screens" https://www.epa.gov/sites/production/files/2015-06/documents/effluentscreens.pdf
- Small Flows Quarterly. "Septic Tank Additives" Winter 2002, Volume 3, Number 1. http://www.nesc.wvu.edu/pdf/ww/septic/additives_sfqw02.pdf
- National Small Flows Clearinghouse. "Septic Tank Enhancements". Fall 2003, Vol. 14, No. 4 http://www.nesc.wvu.edu/pdf/WW/publications/pipline/PL_FA03.pdf

Gravelless Drainfield Systems

A standard drainfield is a series of trenches or a bed lined with gravel or coarse sand and buried one to three feet below the ground surface. Perforated pipes or drain tiles run through the trenches to distribute the wastewater onto the aggregate.

Gravelless systems do not use gravel in their drainfield trenches and instead use alternative materials such as crushed glass, recycled crushed concrete, and rubber tire chips as alternatives to gravel. As gravel sources become scarcer and more expensive, these alternative media products have potential as being excellent substitutes when they would otherwise be sent to a landfill.

A gravelless pipe system can consist of a fiber-wrapped large diameter corrugated pipe, expanded polystyrene foam, or chamber technology. Chamber systems use high-density plastic segments molded into a dome shape with an open bottom. The sides of the forms are slotted to allow for the seepage of wastewater into the soil.



Advantages

- May be more economical to use a light-weight or locally available alternative when the cost to transport a heavy shipment of gravel can raise the construction cost of an onsite system considerably
- Light-weight media materials are easier to handle and can reduce labor costs and allow the systems to be constructed in areas inaccessible by heavy machinery
- Good choice in areas with soils susceptible to structural damage due to the weight of gravel itself and during construction
- Simple to maintain and easy to install
- Chambers systems can store a large amount of effluent

Disadvantages

- Transporting glass for any distance is not cost-effective
- Tire chips have protruding wires and handlers should wear thick gloves, appropriate clothing and boots
- Chambers are commercially produced and manufacturers recommendations should be followed
- Chamber systems can be more expensive than gravel drainfields if a low-cost source of gravel is readily available

Costs

Except in those areas where high-quality gravel is expensive or not readily available, a gravel-lined system will usually cost less overall. However, reduced labor and transportation costs may offset the higher material costs.

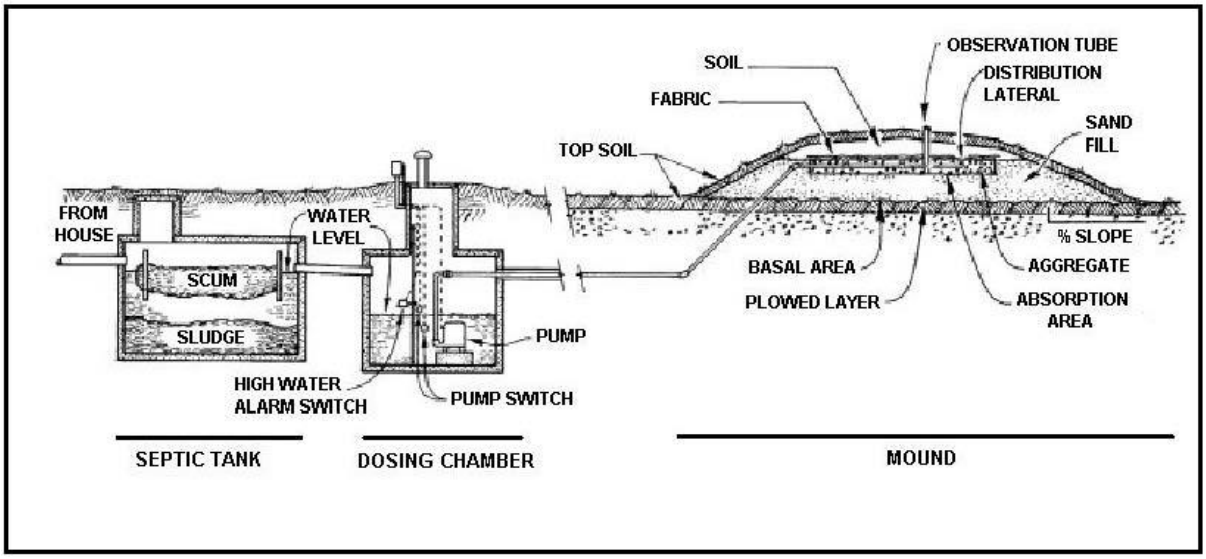
Source

- National Small Flows Clearinghouse – Pipeline Summer 2001 Issue, “Gravelless and Chamber Systems: Alternative Drainfield Designs”
  http://www.nesc.wvu.edu/pdf/WW/publications/pipline/PL_SU01.pdf

- National Small Flows Clearinghouse – Pipeline Spring 2005 Issue, “Alternatives to Gravel Drainfield”
  http://www.nesc.wvu.edu/pdf/WW/publications/pipline/PL_SP05.pdf

Mound Systems

A septic tank mound system is a technology used for treating and disposing of wastewater in areas unsuitable for conventional septic tank soil absorption systems. Mounds are pressure-dosed sand filters placed above, and discharging directly to the natural soil. The three components of a mound system are a pretreatment unit, dosing chamber and the elevated mound. Factors that determine good performance is the selection of sand media, proper design, installation and maintenance.



Advantages

- Mound system enables use of land that would otherwise be unsuitable for onsite systems
- Natural soil utilized in a mound system is usually the top layer, which is typically the most permeable
- Little excavation is required
- Minimal maintenance is required

Disadvantages

- Construction costs are higher than conventional systems
- Mound may have to be partially rebuilt if seepage or leakage occurs
- All systems require pumps or siphons
- May not be aesthetically pleasing

Costs

The cost of a mound system is dependent on design costs, energy costs, contractor, manufacturers, land and characteristics of the wastewater. The average total cost for a mound system serving a three-bedroom single home is approximately $18,900 (adjusted to January 2020).

Source

United States Environmental Protection Agency – Decentralized Systems Technology Fact Sheet September 1999, “Mound Systems”
http://water.epa.gov/scitech/wastetech/upload/2002_06_28_mtb_mound.pdf

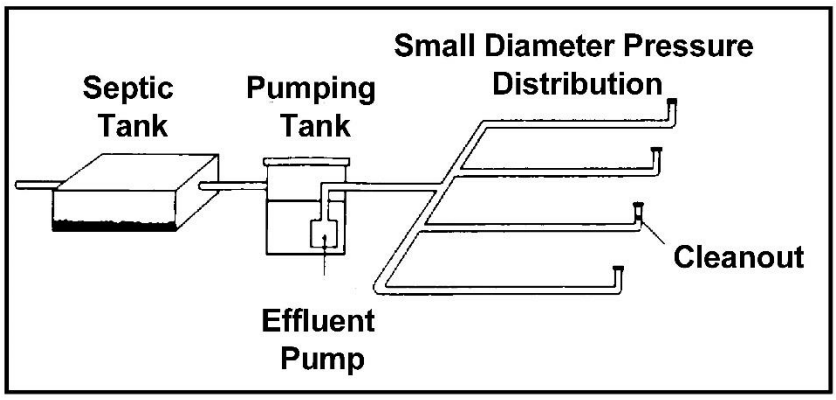
National Small Flows Clearinghouse – Fact Sheet, 1998, “Mound Systems”
http://www.nesc.wvu.edu/pdf/WW/publications/eti/mounds_gen.pdf

Low-Pressure Pipe Systems

A low-pressure pipe (LPP) system is a shallow, pressure-dosed soil absorption system with a network of small diameter perforated pipes placed 10 to 19 inches deep in narrow trenches 12 to 18 inches wide. LPP systems were developed as an alternative to eliminate problems such as: clogging of the soil from overloading, anaerobic conditions due to continuous saturation, and a high water table. The main components of a LPP system are: septic tank or an aerobic unit; a pumping (dosing) chamber with a submersible effluent pump, level controls, high water alarm and supply manifold; and small diameter distribution laterals with small perforations. The level controls are set for a specific pumping sequence of 1 to 2 times daily, which allows breaks between doses for the soil to absorb the wastewater effluent.

Advantages

- Absorption fields can be located on sloping ground or uneven terrain
- Significant reduction in land area required
- Effluent is uniformly dispersed throughout the entire drainfield area
- Costs are comparable to other alternative distribution systems
- Periodic dosing and resting cycles overcomes the problem of peaks flows and enhances the aerobic conditions in the soil



Disadvantages

- Holes can be clogged by solids or roots
- Regular monitoring and maintenance of the system is required by professional operators
- Wastewater can be accumulated in the trenches
- Moderate to severe infiltration problems can occur

Costs

The costs depend on the contractor, manufacturers, site and characteristics of the wastewater. The overall cost is largely determined by the annual operating costs. It costs an average of $6,300 to install a LPP system for a three-bedroom house (adjusted to January 2020 dollars). The range of the installation costs was inversely related to the extent of their use. Therefore, the more LPP systems are installed, the less the cost per system.

Source

- United States Environmental Protection Agency – Decentralized Systems Technology Fact Sheet September 1999, “Low Pressure Pipe Systems” http://water.epa.gov/scitech/wastetech/upload/2002_09_23_mtb_finallpp.pdf

- National Small Flows Clearinghouse – Fact Sheet, 1998, “Low-Pressure Pipe Systems” http://www.nesc.wvu.edu/pdf/WW/publications/eti/LPP_tech.pdf