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On-site wastewater treatment systems

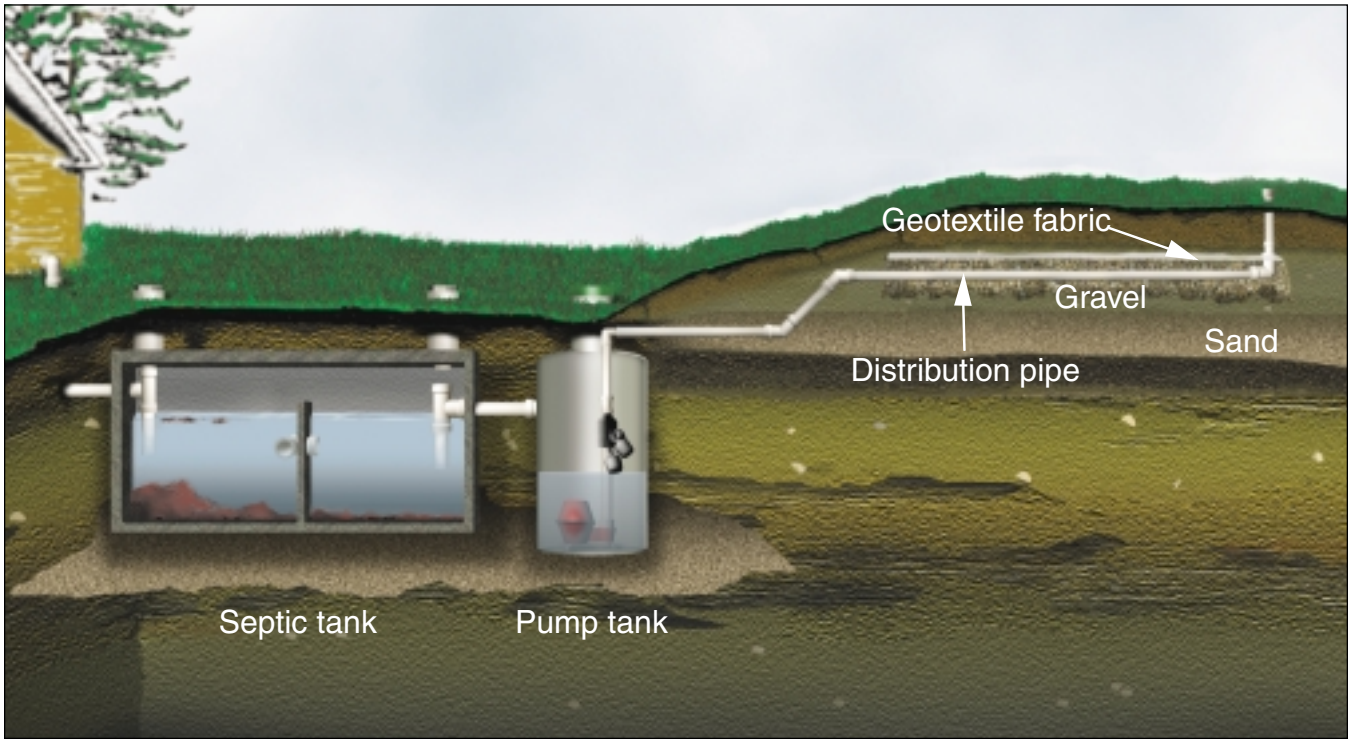

Figure 1: A mound system for distributing treated wastewater to the soil.

Mound system

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A mound system for wastewater is a soil absorption system placed above the natural surface of the ground. Mound systems are used to distribute water on sites where there is minimal soil before reaching groundwater, impermeable soils or bedrock.

For this type of system, an elevated "mound" of soil is built above the native soil to achieve the required separation distance between the wastewater application and the limiting soil condition of the site.

A mound system includes a pretreatment chamber, usually a septic tank; a pump tank for dosing the wastewater; and a mounded drain field containing a pressurized distribution system. The mound itself is a layered structure consisting of:

- ✓ **A sand layer** placed above the native soil to obtain the required 24 inches of separation between the wastewater application and groundwater, and 18 inches of separation from impermeable soils or bedrock.
- ✓ **An absorption area** that stores the pretreated wastewater until it percolates down into the sand layer. A variety of materials can be used in the absorption area, including rock 3/4 to 2 inches in diameter, chipped tires 2 inches long, leaching chambers and pipe drain fields.

- ✓ **A low-pressure distribution system** of pipes to distribute effluent evenly throughout the absorption area.
- ✓ **Geotextile fabric** placed over the absorption area to prevent soil from entering the pores of the media and clogging the absorption area.
- ✓ **A layer of sandy loam soil** that covers the absorption area. This soil is used to retain some water to be used by the plants in the vegetative cover.
- ✓ **A topsoil cap** of 6 inches of soil that can support vegetation. The plants growing on this cap prevent erosion and give off moisture through transpiration, which helps move the treated wastewater into the air.

In mound systems, the effluent from a septic tank is pumped through pipes to a soil absorption bed. The wastewater is pumped at low pressure in controlled doses to ensure that it is distributed uniformly throughout the bed. It flows through holes in the pipes, trickles downward through the absorption area and percolates into the sand.

Treatment

Wastewater must be pretreated before it enters a mound distribution system. The pretreatment system is generally a septic tank, which removes the settleable and floatable solids from the wastewater.

Advanced pretreatment systems, such as aerobic treatment units or media filters, can also be used to remove additional solids and organic matter from the wastewater before it is applied to the mound. These are used when the sewage is stronger than normal residential wastewater.

A mound application system purifies wastewater through three main mechanisms:

- ✓ Filtration, in which particles are physically strained from the wastewater;
- ✓ Chemical sorption, in which contaminants stick to the surface of the soil and to the biological growth in the soil; and
- ✓ Assimilation, in which aerobic microorganisms (microbes) eat the nutrients in the wastewater. In this process, the microbes transform the waste material into another harmless state.

Just as with conventional soil absorption systems, the effluent in mound systems is treated as it moves through the fill material and into the natural soil. The microbes and pathogens found naturally in the soil help remove nutrients (waste) from the water.

As the effluent is applied continuously over time, a biological mat forms in the soil. This mat tends to slow the movement of water through the soil and help maintain unsaturated conditions below the mat.

The water must move into unsaturated soil in order for the microbes in the soil and in the mat to feed on the waste and nutrients in the water. The grass in a soil absorption system also uses those nutrients for its growth.

Design

The pretreatment system for residences is generally a septic tank. It provides the primary treatment of the wastewater. Generally, wastewater from a home does not require other advanced pretreatment before entering a mound system.

After pretreatment, a pump tank collects the wastewater and doses it to the mound. A low-pressure distribution system is generally used to distribute it into the mound's absorption area. The design for a pipe network and distribution piping for a mound system should use the same guidelines as for low-pressure dosing systems.

Arrange the mound system along the contour of the slope to maximize the down-slope movement of water. The mound bed should be as long and as narrow as possible. The total area of the mound is based on the ability of the native soil to accept wastewater.

Also, make sure that the bottom of the absorption area is level to prevent any one part of the bed from being overloaded.

Before building a mound system on a site, plow the soil to a depth of 6 to 8 inches to help the water better filter into the native soil. The native soil should be tilled when it is dry enough that it crumbles and does not form a wire when rubbed between your palms. Mixing some of the sandy fill material into the native soil can help the water move from the absorption area into the native soil.

Above the native soil is a sand layer, which consists of coarse sand with a minimum amount of fine particles (less than 5 percent).

The next layer is the absorption area, which can be built in either a bed or trench configuration. Trenches should be used on clay soils or on slopes greater than 6 percent. Do not use mound systems on sites with a

slope greater than 10 percent. The construction materials and methods for the trenches and beds for mound systems are similar to those used for conventional soil absorption systems.

Distribution pipes are placed in the trenches. The holes on the distribution pipes should face downward. If leaching chambers are used in the absorption area, connect the distribution pipes to the top of the chamber and face the holes up, with one or two holes down to allow the pipes to drain. Then fill the trenches with rock or another approved material.

Cover the trenches with a geotextile fabric. On top of that, place a 6-inch layer of sandy loam soil so that oxygen can move more easily into the absorption area.

The mound is then covered with topsoil. After settling, there should be a minimum of 6 inches of topsoil covering the edges of the absorption area and 12 inches covering the center of the mound. The topsoil should be able to support vegetation.

Grade and landscape the area up slope of the mound to divert rainfall runoff around the mound and prevent ponding of rainwater behind it.

After completing the final grade, seed and mulch the entire mound. To prevent roots from intruding into the distribution system, avoid planting deep-rooted woody vegetation on top of the mound.

Some considerations when building a mound system:

✓ Do not use mounds on slopes greater than 10 percent. On clay soils, the slope should be 6 percent or less.

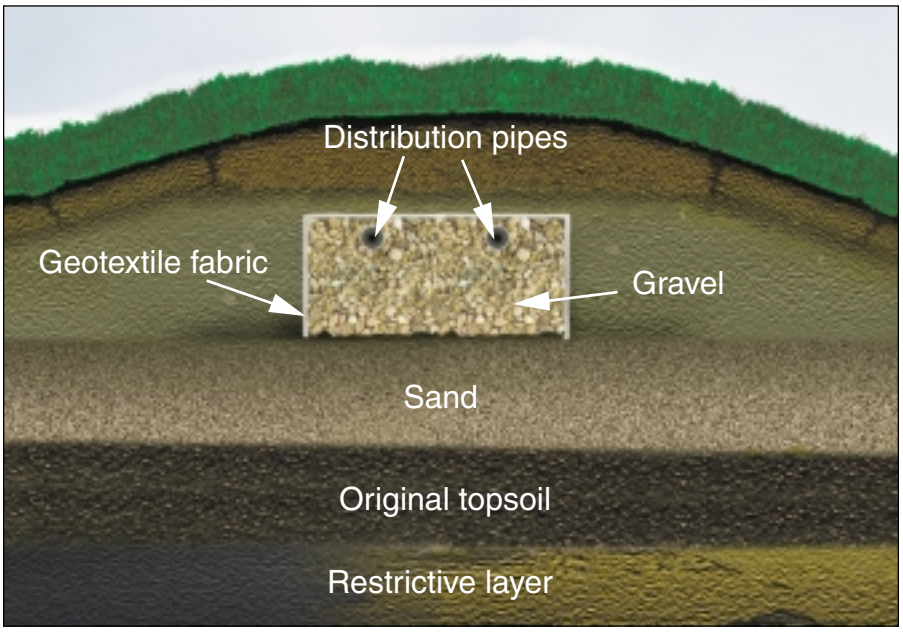

Figure 2: A mound system is placed above the natural surface of the ground.

✓ Mounds require 24 inches of fill between the absorption bed and groundwater, and 18 inches of fill between restrictive horizons, which are impermeable soils or bedrock.

✓ To prevent soil erosion, the side slope of the mound should be between 2:1 and 3:1. If the mound system will be mowed, make the side slope 3:1 for mowing safety.

✓ Install observation tubes to monitor water infiltration into the mound. The tubes will enable you to see if wastewater is ponding in the absorption area.

Make the height of the mound as short as possible while maintaining the required 24 inches of separation between groundwater and restrictive horizons. This will promote evaporation, water use by vegetation and oxygen diffusion to the absorption surface.

How to keep it working

The most important maintenance concern for a mound system is to ensure that the pretreatment system (usually a septic tank) is operating properly. If solids, grease or scum are sent to the absorption area of a mound, they will significantly reduce the life of the mound as a filtration device. Follow the operation and maintenance recommendations for your pretreatment system.

Standard mound systems are intended only for residential-quality sewage. Mound systems for stronger effluents must be larger than standard systems or have additional pretreatment before wastewater is applied to the absorption area.

One measure of wastewater quality is biological oxygen demand (BOD_5), which is the amount of oxygen used by microorganisms to break down waste material. The maximum BOD_5 of pretreate waste-

water entering a standard mound should be about 140 mg/l.

The pressure distribution systems need periodic attention. You may need to flush the distribution lines to remove scum deposits from inside the pipe. If the discharge opening becomes clogged with debris, remove the material to allow the wastewater to flow through.

Inspect the mound surface periodically for areas with little or too much water, which indicates that the water is not being distributed uniformly throughout the mound.

Here's how to maintain your mound system properly:

- ✓ Plant and maintain grasses and other ornamental ground cover on the mound. These plants will use the water and help minimize soil erosion from the cover. Because the top of the mound can dry out during the summer months, be sure that the plants can resist water stress.
- ✓ Remove trees from near the mound because their roots can damage the system.
- ✓ Divert rainfall around the system. Prevent runoff from accumulating on the system's up slope side.
- ✓ Develop good water conservation habits at home. Excessive water use overloads the system and causes it to fail.

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