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Agricultural and Biological Engineering

F 164

Elevated Sand Mounds for On-Lot Wastewater Treatment

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The purpose of this fact sheet is to explain what an elevated sand mound is and how, on sites requiring sand mound absorption areas smaller than 2500 square feet, they should be constructed and maintained. In many areas of Pennsylvania the soils have layers, defined as limiting zones, within the soil profile that are less than 60 inches deep. According to the Pennsylvania on-lot sewage regulations, a limiting zone is bedrock, an impervious soil layer, a high water table, a seasonal high water table or a layer with insufficient fines to properly treat the effluent. In soils with limiting zones within the top 60 inches, it is not possible to provide 48 inches of suitable soil between the bottom of an in-ground absorption area and the top of the limiting zone.

To provide for on-lot treatment of sewage in soils with between 20 and 60 inches of suitable soil available above the limiting zone, Pennsylvania has approved the use of elevated sand mounds. The elevated sand mound, a constructed mound of sandy fill material placed on top of the 20 to 60 inches of natural or prevailing soil, has been shown to provide excellent treatment of effluent. Elevated sand mound systems are limited to sites having a maximum of 12 percent slopes. In addition, the Perc Rate must be between 3 and 180 minutes per inch. Proper siting, design, construction and maintenance of mound treatment systems are key to their proper functioning.

Distribution System

The major difference between elevated sand mounds and conventional in-ground-absorption systems is the addition of sand to the top of the absorption area in order to increase the depth to limiting zone to the required 48 inches. This usually raises the elevation of the distribution system above the outlet elevation of the septic tank. This requires a pump to lift the wastewater from the septic tank up to the sand mound. In a few cases the topography may allow the pump to be replaced with a siphon.

In a pressure dosed distribution system, the treatment tank effluent flows into a second smaller

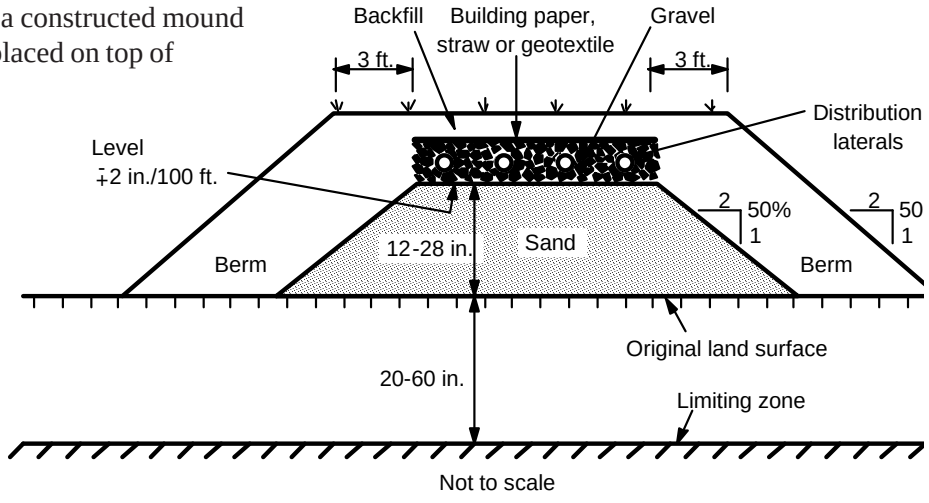

Figure 1. A cross-section of a bed mound.

tank called a dose tank, where the pump or siphon periodically distributes the effluent to the sand mound. The dose tank is an underground concrete or fiberglass chamber placed between the treatment tank and the effluent delivery line. It receives effluent from the treatment tank. When a prescribed volume of effluent has accumulated in the dose tank, the effluent is transferred to the sand mound. This process, called pressure dosing, uniformly distributes the effluent over the surface of the sand mound through the laterals, Figure 1. Most systems transfer effluent several times per day depending on the wastewater flow from the home. These periodic applications of effluent to the sand mound allow the mound to rest between applications of effluent. The mound can drain drawing air in, resulting in aerobic treatment of the wastewater.

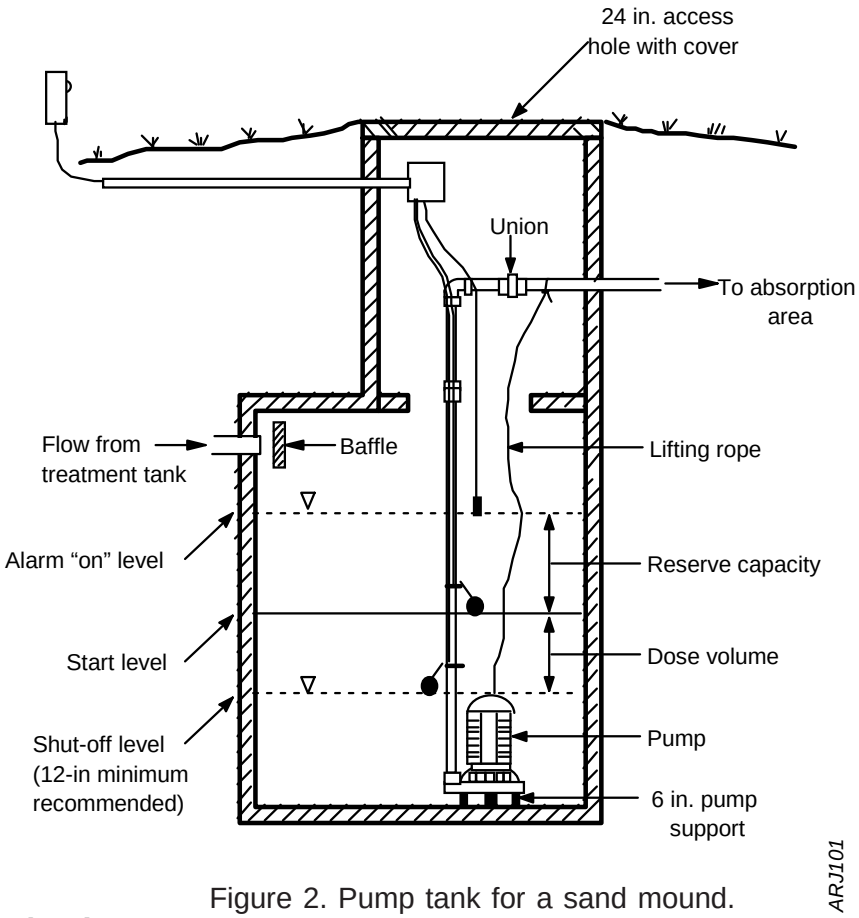

Figure 2. Pump tank for a sand mound.

Figure 2 illustrates a typical dose tank and pump. The dose tank must be a watertight, non-corrosive chamber. The dose tank must have a liquid capacity at least two times the dose volume. The minimum dose volume must be the larger of 100 gallons or five times the internal capacity of the delivery pipe, manifold, and laterals. The dose volume may not exceed the system's design daily flow volume. The pump must be manufactured for use in a wastewater environment so the wastewater does not corrode and damage the pump. A sealed manhole extension, rising to the land surface, should cover the tank's access hole. This is to prevent access to the dose tank by small children. It should also be placed and graded to divert all surface runoff water away from the dose tank. Finally, locate all electrical start and stop controls in the manhole extension above the dose tank. Install an alarm system that will both sound off and light up in case the effluent depth in the dose tank exceeds the alarm level. Standard alarm units are commercially available.

Site Selection and Preparation

Try to position the sand mound on the flat area of a hilltop or on a relatively level long and narrow area.

You should not allow the sand mound to be constructed unless the soil is dry enough. If the soil is too wet (too wet for tillage) the movement of the construction equipment over the site will compact the soil, reduce soil's infiltration rate, and destroy soil structure, the sand mound will most certainly fail. First, remove all vegetation by cutting it flush with the soil surface. Do not attempt to remove the roots. Finally, the absorption area not obstructed by stumps shall be roughed or plowed parallel with the contour to a maximum depth of 6 inches using a chisel plow or similar implement. Rotary tilling is prohibited.

Mound Construction

Now you are ready to construct the mound. The size of the mound depends on the system's estimated daily flows and the soil's Perc Rate. Sand mound absorption areas are about the same size as conventional in-ground absorption systems averaging 600 to 1,500 square feet for a three-bedroom home. Because the absorption area is raised and surrounded by a berm, the total sand mound area will be considerably larger than the absorption area.

First, cover the sand mound absorption area with enough approved sand mound sand to bring the vertical distance between the leveled top of the sand and the limiting zone to 48 inches. At least 12 inches of sand must be used. The depth of the sand layer is dependent on the site's depth to the limiting zone. For example, if the depth to the limiting zone is 20 inches, the depth of sand at the upslope edge of the absorption area must be 28 inches; the depth of soil plus this minimum depth of sand equals 48 inches. If the depth to the limiting zone is 36 inches (or more), the minimum depth of sand must be 12 inches; the depth of soil plus the depth of sand will equal at least 48 inches (more for those sites with a limiting zone between 36 and 60 inches). There must always be at least 48 inches of sand and soil above the limiting zone. It is important that the top of the sand layer be level. This helps ensure uniform flow of effluent through the sand and soil below the mound. The sides of the sand mound must be graded at a 2(H):1(V) slope. This is 2 feet horizontal for each foot of vertical drop as shown in Figure 1. Usually, the sand is a costly purchase because it must be tested and approved by the state. The sand supplier should provide a sand "spec" sheet showing that each load has been approved.

Next, the outer berm of the sand mound should be constructed with topsoil. This berm will hold the sand and aggregate in place, see Figure 1. Next, cover the level sand surface with aggregate (PennDOT gravel 2B and 3A meets the aggregate guidelines). Some installers place 6 inches of aggregate, place the distribution manifold and laterals and then add the final 6 inches of aggregate. Most installers place all 12 inches of aggregate and then dig trenches in the aggregate to receive the distribution manifold and laterals, before covering the pipes with aggregate. One and a half- or two-inch diameter PVC manifolds and laterals are common. The absorption area laterals may be spaced up to 6 feet apart and each lateral must have a series of holes spaced 6 feet apart and facing downward. The effluent must be pumped from the dose tank to a manifold that splits the long dimension of the seepage bed or the trenches. Laterals must be teed to both sides of the manifold. The first discharge hole in each lateral must be at least 3 feet from the manifold. The minimum hole-size shall be ¼ inch when a dose pump is used and 5/16 inch when a siphon is used. The laterals end in risers, which are used for inspection and cleaning. They can (and should) be flush with the final turf surface to prevent damage by animals or equipment. The sand mound absorption system can be built as either a seepage bed or a network of trenches, but seepage beds require much less total land area. After the aggregate and distribution pipes have been placed, cover the aggregate with a separation layer of untreated building paper, 2 inches of straw, or a geotextile to prevent backfill soil from moving downward into and clogging the aggregate. Finally, complete the berm and cover the separation layer with 12 inches of backfill soil. The berm around the perimeter of the mound must extend at least 3 feet outward in all directions from the top of the aggregate layer. The berm should have a 2(H):1(V) side slope and consist of clean topsoil free of rocks, rubble and vegetation.

General Tips for Constructing Elevated Sand Mounds

1. Avoid construction on wet soil to reduce compaction and smearing.
2. Use low-load, tracked construction vehicles and always keep sand between the vehicle and soil during construction.
3. Add the sand, berm soil and aggregate from the upslope side.
4. Keep all equipment and vehicles off the absorption area at all times.
5. Keep all equipment and vehicles off the undisturbed area down slope of the elevated sand mound at all times.
6. Lightly compact the berm to limit lateral flow.

Avoiding Malfunctions in Mound Systems

Elevated sand mounds should provide a lifetime of reliable on-lot sewage treatment if they are sited, designed, constructed and maintained properly. The most common sand mound malfunctions are due to hydraulic overloading caused by excessive water use in the home and poor siting. Typically, in the case of hydraulic overloading, water will emerge at the toe of the mound or erupt on top.

The following practices reduce the chances of malfunction in your sand mound:

1. Adopt a culture within the home of reducing water use.
2. Check the pump station and mound for any

malfunctions at least once every 6 months.

3. Divert surface runoff water and roof downspouts away from the mound.
4. Minimize foot traffic on the mound and on the area down-slope of the mound.
5. Keep all vehicle traffic off the mound and away from the area down-slope of the mound.
6. Have the septic and dose tanks pumped every other year.
7. Plant grass on the sand mound to prevent soil erosion.
8. Do not plant deep-rooted or water loving shrubs and trees on or near the sand mound.

More Information

Other Penn State Fact Sheets relating to on-lot sewage treatment systems include the following:

F-161 *Septic Tank Pumping*
F-162 *Preventing On-Lot Septic System Failures*
F-164 *Mound Systems for Wastewater Treatment*
F-165 *Septic Tank-Soil Absorption Systems*
F-166 *Inspection of Existing Septic Systems During Real Estate Transactions*
F-167 *Use of Dyes and Tracers to Confirm Septic System Failures*
F-168 *On-Lot Sewage Disposal Publications Available Through the Penn State College of Agricultural Sciences*

For further information or for a copy of our Fact Sheet Listing contact:

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