Texas Agricultural Extension Service
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On-site wastewater treatment systems

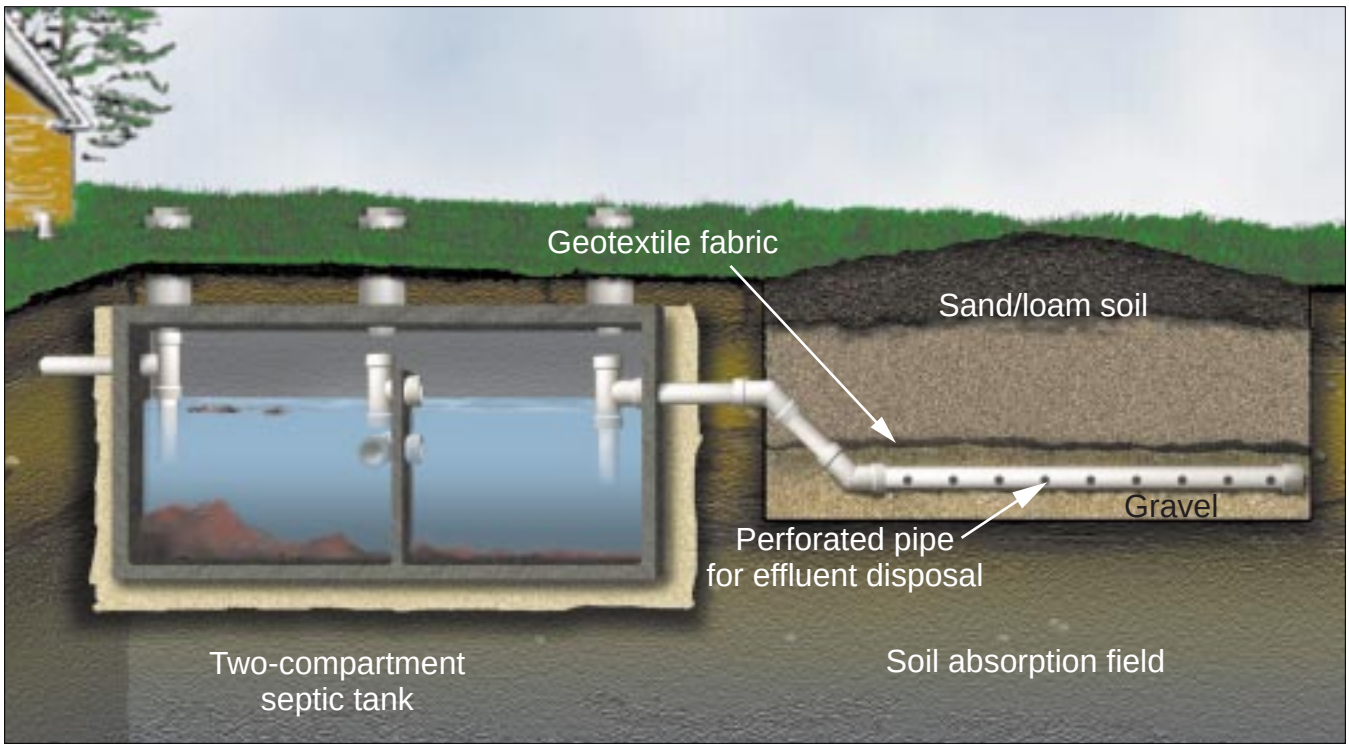

Figure 1: A septic tank and soil absorption field system.

Septic tank/soil absorption field

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The septic tank and soil absorption system is the most cost-efficient method available to treat residential wastewater. But for it to work properly, you need to choose the right kind of septic system for your household size and soil type, and you need to maintain it regularly.

This type of waste-treatment system has two components: a septic tank and a soil absorption system.

Septic tank

A septic tank is an enclosed watertight container that collects and provides primary treatment of wastewater by separating solids from the wastewater. It removes the solids by holding wastewater in the tank and allowing the settleable solids to settle to the bottom of the tank while the floatable solids (oil and greases) rise to the top. To provide time for the solids to settle, the tank should hold the wastewater for at least 24 hours.

Some of the solids are removed from the water, some are digested, and some are stored in the tank. Up to 50 percent of the solids retained in the tank decompose; the rest accumulate as sludge at the tank bottom and need to be removed periodically by pumping the tank.

There are three main types of septic tanks for on-site wastewater treatment:

- ✓ Concrete septic tanks, the most common;
- ✓ Fiberglass tanks, which are being used more often because they are easy to carry to “hard-to-get-to” locations; and

A watertight septic tank prevents rainwater from entering the tank and flooding the soil absorption field

- ✓ Polyethylene/plastic tanks, which come in many different sizes and shapes. Like fiberglass tanks, these are light, one-piece tanks that can be carried to "hard-to-get-to" locations.

All tanks must be watertight to prevent water from entering as well as leaving the system. Water entering the system can saturate the soil absorption field, resulting in a failed system.

From the septic tank, the wastewater passes through the outlet of the tank and enters the soil absorption field. The most common outlet is a tee fitting connected to the pipe going to the soil absorption field. However, an effluent filter can be placed in the outlet tee for additional filtering of the wastewater. The effluent filter removes additional solids from the wastewater and keeps them from clogging the absorption field and causing it to fail prematurely.

Soil absorption field

The soil absorption field provides final treatment and distribution of the wastewater. A conventional system consists of perforated pipes surrounded by such media as gravel and chipped tires, covered with geotextile fabric and loamy soil. To treat wastewater, this system relies heavily on the soil, where microorganisms help remove the organic matter, solids and nutrients left in the water.

As effluent continually flows into the soil, the microbes eating the components of the wastewater form a biological mat. The mat slows the water's movement through the soil and helps keep the area below the mat from becoming saturated. The water must travel into unsaturated soil so that microbes there and in the mat can feed on the waste and nutrients in the effluent. The grass covering the soil absorption system also uses the nutrients and water to grow.

Treatment

Used properly, the septic tank and soil absorption system works well. It reduces two ratios commonly used to measure pollution: biological oxygen demand, which is lowered by more than 65 percent; and total suspended solids, which are cut by more than 70 percent. Oil and grease are typically reduced by 70 to 80 percent.

Using a septic tank to pretreat sewage also makes other secondary treatment systems more effective. The effluent from the septic tank is mild, consistent, easy to convey and easily treated by either aerobic (with free oxygen) or anaerobic (without free oxygen) processes.

Design

For a septic tank to perform successfully, it must be the proper size and construction and have a watertight design and stable structure.

Tank size: The size of septic tank you need depends on the number of bedrooms in the home, number of people living there, the home's square footage and whether or not water-saving fixtures are used. For example, a three-bedroom house, assuming four people live there and it has no water-saving fixtures, would require a 1,000-gallon tank (see Table 1).

Tank construction: A key factor in the septic tank's design is the relationships between how much surface area it has, how much sewage the tank can store, how much wastewater is discharged and how fast it exits. All affect the tank's efficiency and the amount of sludge it retains.

The greater the liquid surface area, the more sewage the tank can collect. As more solids collect in the tank, the water there becomes shallower, which requires that the discharge be slower to allow more time to separate the sludge and scum.

A key to maintaining a septic tank is placing risers on the tank openings.

If a septic tank is buried more than 12 inches below the soil surface, a riser must be used on the openings to bring the lid to within 6 inches of the soil surface. Generally, the riser can be extended to the ground surface and protected with a good lid. These risers really make it easy to perform maintenance on the tank.

Soil texture: There are three textures of soil: sand, silt and clay. Soil texture affects how fast the wastewater filters into the soil (called hydraulic conductivity) and how big an absorption field you need. Sand transmits water faster than silt, which is faster than clay. Texas regulations divide these three soil textures into five soil types (Ia, Ib, II, III, IV). Sandy soils are in soil type I and clay soils are in soil type IV. A standard drain field cannot be used in a clay soil.

Hydraulic loading: Also important to the design is the hydraulic loading, which is the amount of effluent applied per square foot of trench surface. Because water filters through clay soils more slowly than through sand or silt, the hydraulic loading rate is lower for clay than for silt, and lower for silt than for sand. Because clay soils have a very low conductivity, only nonstandard drain fields can be used in clay.

Absorption field size: The size of the absorption field needed is also determined by how much wastewater goes into the system each day. Divide the wastewater flow by the hydraulic loading for the soil type in which the field will be built.

How to keep it working

To keep your septic system treating sewage efficiently, you need to have the tank pumped periodically. As the septic system is used, sludge accumulates in the bottom of the septic tank.

As the sludge level increases, wastewater spends less time in the tank, and solids are more likely to escape into the absorption area. If sludge accumulates too long, no settling occurs, the sewage goes directly to the soil absorption area, and little is treated.

Table 1. Minimum septic tank capacities for residential houses.

Bedrooms (number)	House size (square feet)	Tank capacity [without water-saving devices] (gallons)	Tank capacity [with water-saving devices] (gallons)
1 or 2	less than 1,500	750	750
3	less than 2,500	1,000	750
4	less than 3,500	1,250	1,000
5	less than 4,500	1,250	1,250
6	less than 5,500	1,315	1,250

Properly sized tanks generally have enough space to accumulate sludge for at least 3 years.

How often you need to pump it out depends on:

- ✓ The septic tank's capacity;
- ✓ The amount of wastewater flowing into the tank (related to size of household); and
- ✓ The amount of solids in the wastewater (for example, it has more solids if you use a garbage disposal).

In Texas, a 1,000-gallon septic tank is used for a home with three-bedrooms without water saving devices. If four people live in that three-bedroom house, the tank should be pumped every 2.6 years (see Table 2). If the same system serves a family of two in a three-bedroom house, the tank should be pumped every 5.9 years.

It is important to know that the soil absorption field will not fail immediately if you don't pump your tank. However, the septic tank is no longer protecting the soil absorption

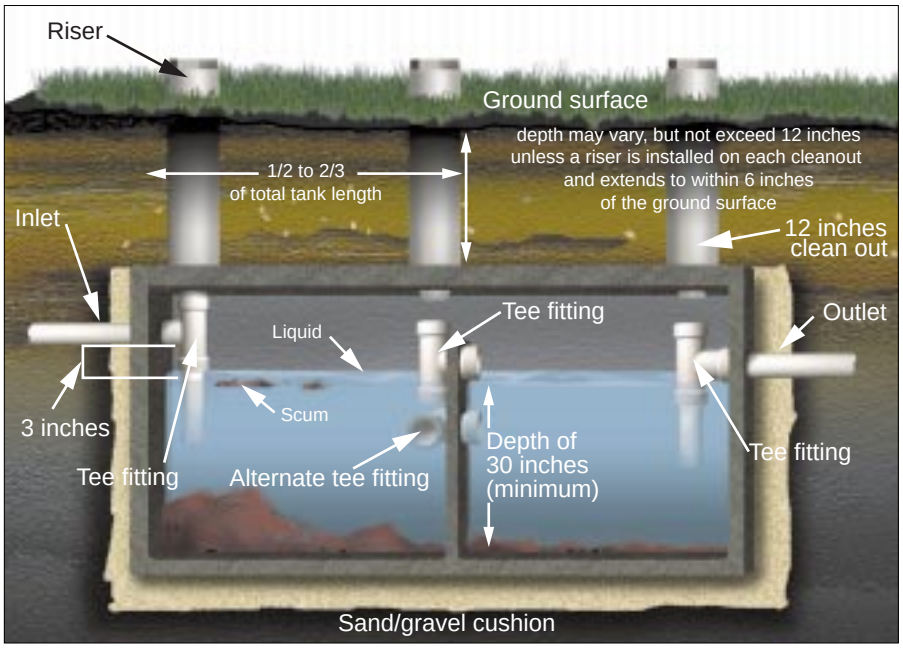

Figure 2. A two-compartment septic tank.

Table 2. Recommended number of years between pumpings of septic tanks according to size of tank and household.

Tank Size	Household Size (Number of People)									
(gals)	1	2	3	4	5	6	7	8	9	10
500	5.8	2.6	1.5	1.0	0.7	0.4	0.3	0.2	0.1	—
750	9.1	4.2	2.6	1.8	1.3	1.0	0.7	0.6	0.4	0.3
1000	12.4	5.9	3.7	2.6	2.0	1.5	1.2	1.0	0.8	0.7
1250		7.5	4.8	3.4	2.6	2.0	1.7	1.4	1.2	1.0
1500		9.1	5.9	4.2	3.3	2.6	2.1	1.8	1.5	1.3
1750			6.9	5.0	3.9	3.1	2.6	2.2	1.9	1.6
2000			8.0	5.9	4.5	3.7	3.1	2.6	2.2	2.0
2250				6.7	5.2	4.2	3.5	3.0	2.6	2.3
2500					5.9	4.8	4.0	4.0	3.0	2.6

Note: More frequent pumping needed if a garbage disposal is used.

Soil absorption fields need to be protected from solids and rain

field from solids. If you neglect the tank for long, you may have to replace the soil absorption field.

Another maintenance task you need to do periodically to keep the system from backing up is to clean the effluent filter. Clean it periodically by spraying it with a hose directly into the septic tank, or have your maintenance provider clean the filter.

Soil absorption fields need to be protected from solids and rainfall. If you don't pump the tank, solids can enter the field. Rainfall running off roofs or concrete areas should be drained around the soil absorption field to prevent the field from filling with water. Fields that are saturated with rainwater are unable to accept wastewater. Planting cool-season grasses over the soil absorption field in winter can help remove water from the soil and help keep the system working properly.

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