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What to Know About Septic Systems When Building a House

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Introduction

Owning land and building a home is a big part of the American dream for many of us. The septic system can often be overlooked when land owners are planning their dream house. This publication is intended to give those planning on building a house an idea of what must be considered in regards to their septic system.

What is a septic system?

Septic systems use the natural characteristics of soils to dispose, filter, and treat household waste for homeowners who are not part of a municipal sewer system. When wastewater leaves the house, it is transported first to a septic tank (Figure 1). Wastewater is separated into three distinct layers in the septic tank: a scum layer made up of fats, oil, and grease less dense than water; an effluent water layer; and a bottom sludge layer made up of heavier solids. Decomposition of the solids occurs while they are contained within the septic tank. Naturally present bacteria in the septic system digest solids that have settled to the bottom of the tank. These bacteria can transform up to 50% of the solids in the tank into liquids and gases.

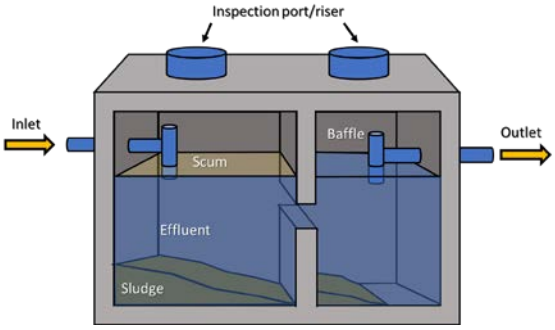

Figure 1. Illustration of a septic tank. Fats, oils, and grease that make up the scum layer float on the top, while heavier solids that make up the sludge settle to the bottom. This allows effluent water to leave the tank and enter the drainfield where it is treated by the soil.

The main function of the septic tank is to remove solids from household wastewater so that the effluent can more readily filter through the soil in the soil absorption field. Removing solids from the wastewater protects the soil absorption field from getting clogged and failing. When the liquid within the tank rises to the level of the outflow pipe, it enters the drainage system. This outflow, or effluent, is then distributed throughout the drainfield through a series of subsurface pipes typically bedded in gravel (Figure 2). Final treatment of the effluent occurs as it enters the soil profile and is filtered, where soil microbes convert the rest of the waste into harmless products.

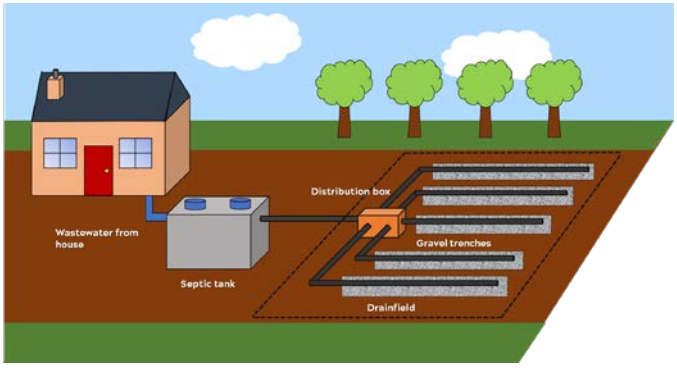

Figure 2. Effluent leaves the septic tank and is distributed through the drainfield via a distribution box. Effluent is treated as it passes through the soil profile.

Have your soil evaluated

If your property requires a septic system, you must have your soil evaluated and obtain a permit. The

Virginia Department of Health accepts and reviews soil evaluations and designs from licensed Onsite Soil Evaluators (OSE's) and Professional Engineers (PE's). Soil scientists who investigate soils for drainfields and design systems are required to be licensed as an OSE. There are two classes of OSE; Conventional OSE and Alternative OSE. These titles define the types of systems they can design (an alternative OSE can investigate and design both conventional and alternative systems).

Septic systems require a soil which drains well, but not too rapidly. To fully treat effluent, it must pass through an aerobic soil (soil in the presence of oxygen) allowing bacteria in the soil to fully break down any harmful pollutants. If septic effluent passes through soil too rapidly, bacteria will not have time to remove pollutants, resulting in it being a danger to public health when it enters underground water systems.

The OSE will give the soil a flow rate which will be factored in when deciding how much space is required for an absorption field. The OSE will also investigate the land for shallow soils, shrink swell soils, distances to wells, slope and contour, gullies, occurrence of drainageways and floodplains, physical soil restrictions, and depth to seasonal high water tables.

How much space will my septic system take up?

The size of septic tank required for your property is calculated using the number of bedrooms proposed in the dwelling being built. Table 1 shows the sizes of septic tanks required based on the number of bedrooms in the dwelling. It is estimated that each bedroom will be occupied by two people (12VAC). The total flow is commonly estimated to be 75 gallons per day per person, this value is based on common rates of water used for food preparation, toilet and bathing facilities, handwashing, and laundering (12VAC). The area the septic tank occupies is a factor that needs to be considered in placement and construction design. Dimensions of various sized septic tanks can be seen in table 2.

Table 1. Various septic tank volumes based on number of bedrooms in the dwelling.

Number of Bedrooms	Approximate Tank Volume (Gallons)
1	750
2	750
3	900
4	1200
5	1500

Source:12VAC5-610.

Table 2. Approximate dimensions of septic tanks of different volumes in feet

Approx. Gallons	Length (ft)	Width (ft)	Liquid Depth (ft)	Freeboard (ft)
750	7	3.5	4	1
900	8	4	4	1
1200	9	4.5	4	1
1500	9.5	5	4.7	1

Source:12VAC5-610.

The biggest factor to consider is the area the drainfield occupies. The drainfield is where the effluent enters the soil as part of its treatment. The square footage required is determined by the number of bedrooms in a dwelling and the percolation rate of effluent through the soil. Various drainfield areas required for a conventional system listed in ft2/bedroom are shown in table 3. Note, the minimum absorption area for a single-family home is 400 ft2 (12VAC). The drainfield is by far and away the largest area to plan for in building a septic system. Reductions in drainfield area requirements can be obtained by using various dispersal methodologies.

Table 3. Drainfield trench bottom (for a gravel trench system) area in ft^2/100 gals or ft^2/bedroom based on soil percolation rate.

Soil Percolation Rate (Minutes/Inch)	Drainfield Area Required (Ft^2/Bedroom)
5	165
20	218
40	314
60	452
80	656
100	946
120	1368

Source:12VAC5-610.

VDH sewage handling and disposal regulations require a 50% reserve when drainfield trenches are in a soil horizon with silty and clayey textures (12VAC). Also, some counties and cities in Virginia require a 100% reserve area, and in some districts, this can be a 200% reserve area, so it is important to check the regulations in your district. Reserve areas are designed as a backup site that can be used if the original site fails. At some properties a reserve is not required. If failure occurs at these properties, the soil between the trenches, a new area available on the property, or an adjacent property are considered for a repair/replacement drainfield.

Setback Distances

Septic tanks are required to be installed at certain setback distances from the home and other features on the property. For example, the septic tank must be 10 ft from the dwelling without a basement or 20 ft with a basement. More distances can be seen in table 4. For a more detailed list of separation distances to structures and property features refer to 12VAC5-610, the Sewage Handling and Disposal Regulations of the Virginia Department of Health (12VAC).

Table 4. Distances between sidewalls of absorption trenches and various structures or topographic features found on properties. For a more detailed table see 12VAC 5-610, the Sewage Handling and Disposal Regulations of the Virginia Department of Health.

Structure or Topographic Feature	Minimum Distance from sidewall of absorption trench (ft)
Property lines	5
Building foundations	10
Basement	20
Drinking water wells	50
Lakes	50
Steams	50
Utility lines	10

Source:12VAC5-610.

References

VDH (Virginia Department of Health). 2014. Sewage Handling and Disposal Regulations. 12VAC 5-610. Richmond: VDH. https://www.vdh.virginia.gov/EnvironmentalHealth/ONSITE/regulations/documents/2012/pdf/12VAC 5 610.pdf.

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