While public sewer lines are commonplace in towns and the more urban areas of Augusta County, Virginia, it is more usual for residential homes in the rural areas to be served by an on-site private waste-water disposal system. Traditionally, this system has been the familiar septic-tank/drain field arrangement. However, more and more, we see real estate listings that disclose non-traditional sewer systems. Furthermore, the vast majority of new construction that is occurring in areas not served by public sewer lines requires an engineered septic system. This is because current inspection standards and county ordinances no longer permit traditional sewage disposal methods in most locations. What follows is a short discussion about engineered septic systems that might help real estate agents and their clients understand the subject a bit better.

**Wastewater Treatment Systems**

Current wastewater disposal systems are of three distinct types: conventional, mound, and engineered. While all three types include a septic tank and a drainage field, the manner in which they function is different. The conventional system begins and ends with those two afore mentioned elements; however, the mound and engineered systems expand on them.

**Conventional System**

The conventional septic system is the traditional one that has been used for years. It works entirely by gravity (unless a sewage pump is required to get the waste water up to grade). Under most conditions, wastewater from the home's plumbing flows into the septic tank where microbes break down the waste into solids and liquid. The solids settle to the bottom of the tank and the liquid effluent flows out of the tank into a drain field. The drain field consists of several hundred feet of perforated pipes that are buried several feet underground in gravel beds. The liquid then leaches from the drain field into the soil where it is absorbed and filtered.

**Mound System**

In areas where ground water tables are high or soil is dense, the drain field cannot be buried in the ground. The alternative approach in this case is often a raised or mound system. With a mound system, in addition to the septic tank, two additional components are needed: a pump/tank combination known as a dosing tank, and a raised mound of sand or peat moss that is from six inches to four feet high. The drain field is then located in this mound. Liquid effluent flows from the septic tank into the dosing tank. The tank pump sends the liquid out into the drain field where it can leach out into the mound. The slight pressure from the pump causes an even dispersal of the liquid throughout the drain field insuring uniform leaching into the mound. The mound material provides filtering of the wastewater before it disperses into the ground below. Installers employ creative landscaping methods to blend the mound into the normal contours of the building lot to conceal its appearance.

**Engineered System**

High ground water tables, dense soil, or insufficient lot space usually prevent the use of a conventional or a mound wastewater disposal system. These situations call for an engineered septic system. Engineered systems will usually include pumps and filters: pumps to insure an even low pressure throughout the pipes; and filters to treat the liquid effluent prior to its dispersal in some type of drain field.

Engineered systems can be quite complex and may differ from one installation to the next. Local building codes usually specify the particular system types that are approved for specific locations.
While conventional wastewater treatment systems are an-aerobic systems, engineered systems are aerobic. An-aerobic systems function without outside atmosphere while aerobic systems require outside air to function properly. A short discussion of these two different processes is in order.

**An-Aerobic (without air) Systems**

Conventional systems are an-aerobic systems. The bacteria composition of the waste in these systems is based upon action that takes place in a closed environment without the insertion of outside atmosphere. These systems are easy-use, low-cost and passive; however, they are less clean, less efficient, and slow acting.

There are problems associated with these systems. The processed effluent from an anaerobic septic tank is only about 40-65% clean requiring the naturally occurring aerobic bacteria of the soil surrounding the drain field to finish the job. This means a properly operating drain field is critical for proper treatment of the effluent liquid. The discharged effluent eventually causes a sludge build-up to occur in the drain field. This build-up forms a barrier to proper drainage and ultimately to system failure. The biological process associated with anaerobic systems is slow and inefficient, and it produces noxious gases such as methane and offensive odors. However, the biggest negative factor associated with these systems is that they discharge contaminated wastewater into the natural environment and depend upon natural processes to complete the waste treatment.

**Aerobic (with air) Systems**

Most towns and cities use aerobic wastewater treatment. It is cleaner, faster, and more efficient and universally accepted for the municipal treatment of household waste. The reason for this universal acceptance is the fact that the process produces liquid effluent that is 98 percent clean right out of the treatment tank making for a smaller and shallower drain field. Because the effluent is fairly clean, there is no sludge build-up in the drain field allowing it to last indefinitely. Aerobic systems are essentially one-phase, as they do not depend upon bacterial breakdown in the soil surrounding the drain field. Further, out-gassing is safe and odorless. Completely treated and clean water is released into the natural environment from these systems. The biggest negative factor to these systems is that they are costly, more complex, and are not passive in operation.

**Why Use an Engineered System**

The obvious questions then are why should residential builders use engineered aerobic systems in new construction, and why should users of conventional systems convert. The answer comes when one considers that conventional systems are inefficient, contaminate the natural environment, and only function properly when soil conditions are ideal. They put a serious threat upon streams and lakes and water wells that provide potable drinking water to rural dwellers—even many small towns and cities depend upon wells and containment ponds for their water source.

Engineered aerobic wastewater treatment systems remove contamination before the effluent is discharged and provides an expanded opportunity for on-site sewage treatment. Often, shallow drip-tube irrigation is all that is necessary to dispose of the liquid effluent discharged from the tanks of these systems. Installers route this tubing to avoid existing structure and landscaping, and because it is not gravity-fed, they can locate it at higher elevation than the discharge tank. Aerobic systems lend themselves well for use in difficult geographic situations such as small lots, steep slopes, shallow topsoil conditions, and areas with ground water close to the surface of the land. Because of the smaller footprint required by an engineered aerobic waste-water treatment system, building lots can be smaller and here-to-for unusable land can be used for residential purposes.
How Aerobic Engineered Systems Work

The technology behind how an engineered aerobic wastewater treatment system works is uncomplicated. The home’s wastewater plumbing routes the outflow to a set of three tanks for treatment. The first tank or (settling tank) is similar to the septic tank used in a conventional system. There, a biological breakdown of the material occurs with solids settling to the bottom and liquid effluent flowing off into a second tank. The second tank receives forced air from an air compressor located on the surface. The compressor directs the air to the bottom of the second tank. This forced oxygen from the atmosphere breaks down the matter aerobically (that is; with oxygen).

Between the second and third tank is a pipe that is accessed from the surface. Every 30 days or so, someone drops chlorine tablets into this pipe. The treated water slowly washes by the chlorine tablets on its way to the third tank, and is chemically sanitized during its passage. The third tank is a holding tank that receives and holds the aerobically treated and sanitized liquid. When the liquid in the third tank reaches a certain height, a sprinkler pump associated with this tank pumps the liquid out to the drain field arrangement.

Since the engineered system has moving parts, it is subject to eventual breakdown. The good news is that these parts are above ground, easily accessible, and designed for quick repair. Normally, repairs consist of nothing more than cleaning or replacing a filter and sometimes replacing a pump or compressor. Of course, adding the chlorine tablets is an on-going task; however, that task consists of nothing more that dropping a tablet down a pipe once a month.

Owners of aerobic septic systems must have these systems inspected often, to insure that proper operation is occurring. Usually, this is a requirement by local ordinance. Typical annual inspection costs are about $100 to $300 per year plus any repair costs; however local cost vary. Just like conventional systems, aerobic engineered systems require that someone pump the solid material from the settling tank every three years or so.

Conclusion

Engineered wastewater treatment in Augusta County, Virginia is a reality. Real estate buyers will encounter this reality on new construction and more and more often on resale properties that have conventional septic systems that do not pass resale inspection.

You can glean further information and system recommendations by navigating your computer browser to www.sf.org/certified/wastewater/. This is the site for NSF International a not-for-profit, non-governmental organization that develop standards, product certification, education, and risk-management for public health and safety. You should also visit: vdh.virginia.gov/EnvironmentalHealth/Onsite/index.htm. This is WEB site for the Division of Onsite Sewage and Water Services of the Virginia Department of Health. The mission of Division of Onsite Sewage of Water Services is to protect public health and ground water quality. Of course, you should consult with local county authorities concerning local requirements.

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