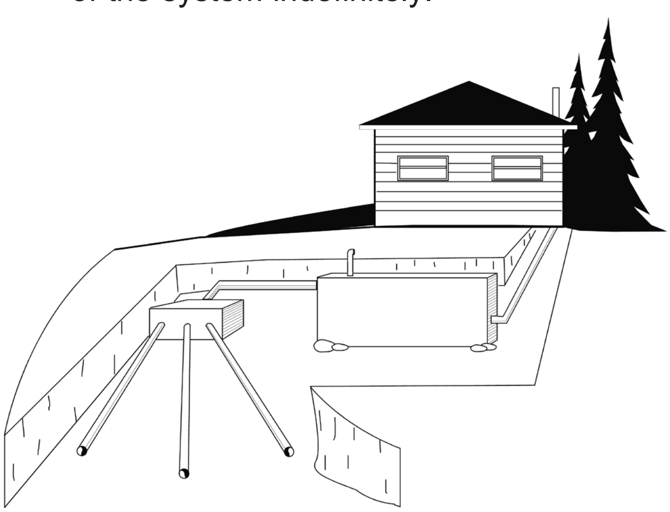
INTRODUCTION

A septic tank/soil absorption system (ST/SAS) is the most common method of onsite wastewater treatment and disposal.   This system is considered conventional because it works well in many situations and is normally the least expensive option.

The ST/SAS provides all the wastewater treatment of large, municipal plants. The septic tank functions to remove solids and floatables (oil, grease, etc.), with the effluent passed on to the SAS. Here, the soil works as a filter to physically strain out waste, as well as a biological reactor. The soil particles provide an attachment point for bacteria where they can “feed” on the waste in the effluent flowing past. As the bacteria feed, they grow and multiply, forming a “biomat” or biological mat in the soil. Even bacteria have a lifespan, though, and some bacteria are continually dying off to be replaced with new ones.

The growth of the biomat is linked to the supply of food provided in the effluent. Biomats grow faster with more effluent, or higher strength effluent, and degrade or die off when deprived of enough food. When drainfields were first installed, the accepted thinking was that they had a limited lifespan and would eventually clog up completely. Current procedure is to consider the long-term acceptance rate (LTAR), which regulates the application of wastewater so that the bacterial growth rate is balanced by the bacterial die-off rate, and the system never completely clogs.

The LTAR is dependant on many complex factors, such as the soil permeability, the amount of oxygen present, the hydraulic and biological loading rates, and the growth and death curves of the bacteria. Since our knowledge of the growth of bacteria in soil is somewhat limited, and many of the factors fluctuate considerably, calculating the precise LTAR is difficult, so drainfields continue to clog and fail. However, based on our knowledge that biomats deprived of food will degrade, onsite system designers have recommended alternating drainfields. The theory is that as one drainfield is being used, and the biomat there growing, the biomat on the other field is deprived of food and decaying. After a suitable time of starvation, the second drainfield is regenerated, which means the clogging mat of bacteria dies off and the soil is restored to its original permeability. Switching periodically between drainfields should extend the life of the system indefinitely.

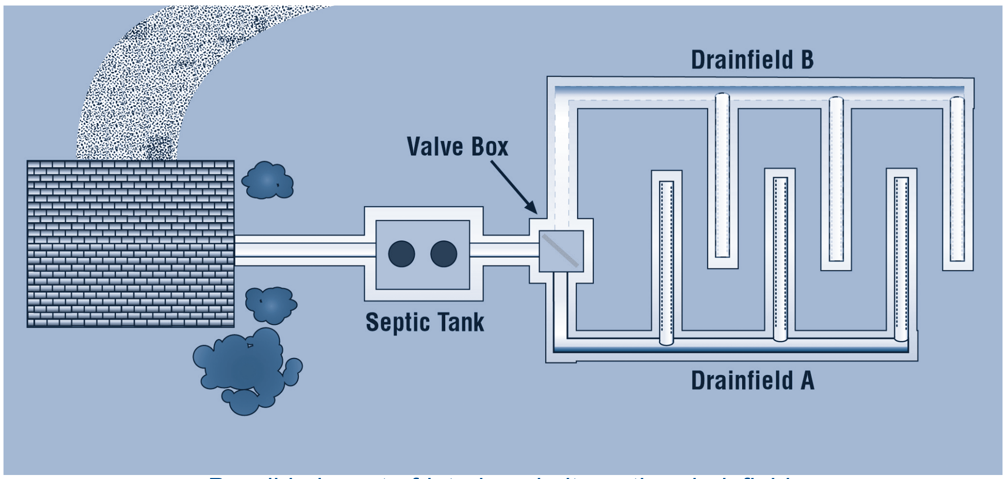


Schematic of single drainfield

DESIGN

The design of alternating drainfields follows closely on conventional drainfield design. Trench design and layout should be done as prescribed by your state and local authorities in terms of depth, spacing, depth of cover and material used in the trench. The concept of resting and regeneration for drainfields works with pipe and gravel trenches, chamber systems, gravelless pipe systems, or alternative media systems such as those using chipped tires.

Several authorities, including Ohio State University (Mancl, 1983) and J. T. Winneberger (1976), suggest an interlaced design for new construction. Ohio State University recommends that the full-sized drainfield, its size being determined by local regulations, should be divided by two and switched periodically. That is, each alternate drainfield is one-half the required size. Other states say each drainfield should be 75 percent of the required size for one field. Winneberger (1976) suggests two full-sized fields.



Possible layout of interlaced alternating drainfields

Switching the use of the fields is key to the alternating drainfield concept. This is done through a diverter valve, housed in a valve box on the effluent line from the septic tank. Pipes from the valve box run to each field, carrying the effluent entirely to one field on the other.

For repairs or renovations to an existing field, interlacing is not recommended. Winneberger also suggests "breathers" or vent pipes to stimulate airflow during resting. The U.S. Department of Agriculture (USDA) (Jones, 1977) offers an equation based on percolation rate and design life, suggesting that a design life of 3 years is acceptable for alternating systems. The USDA formulas are:
For example, for a site with a perc rate of 33.5 min/in, alternating drainfields would be sized at 187 square feet each, for a total size of 374

Percolation Rate	Equation for Drainfield Area
10 min/in	$A = 75 + 9t$
15 min/in	$A = 100 + 9t$
30 min/in	$A = 160 + 9t$
45 min/in	$A = 210 + 9t$
60 min/in	$A = 240 + 9t$

where A is in square feet and t, the design life of the system, is in years.

square feet. A single drainfield with a design life of 40 years should be 520 square feet. Of course, local and state regulations take precedence over USDA guidelines and must be followed in any system design.

Many references, including Kreissl (1982) and Jones (1977) suggest that pressure dosing is equivalent to installing alternate drainfields, as this achieves the resting/dosing cycle on one field. Pressure dosing uses a pump and a separate tank to send water to the field several times a day. The field rests between doses, which increases oxygen flow. Additionally, the pressure dose spreads the effluent more evenly throughout the whole drainfield.

SITING ADVANTAGES AND DISADVANTAGES

Obviously, two drainfields take up more space than just one, but most states require a reserve area be set aside. If the fields are being constructed as interlocking, as suggested by Kreissl (1982) and Winneberger (1976), the increase in needed space is not that great, especially if the fields are sized at 75 percent. The homeowner would still be required to set aside a repair area. For repairs, a completely new drainfield needs to be constructed, hopefully in the set- aside repair area.

The main advantage of interlacing the fields, besides reducing the area dedicated to the absorption field, is that interlaced fields may increase the effects of evapotranspiration, according to Winneberger (1976). His claims are that each of the interlaced fields is roughly twice the size of one drainfield, and that all the vegetation above the field receives the benefit of irrigation. Splitting the fields irrigates a single area for a period, then another area receives the benefit when the fields are switched.

OPERATION AND MAINTENANCE

Septic tank and drainfield maintenance is fairly basic. The tank should be inspected periodically, perhaps every 3-5 years, and the solids pumped out when needed. If an effluent filter is used, which is a good idea, it should be inspected with the tank and cleaned by washing the solids off of it and back into the tank. There is only a little more maintenance required for alternating fields than for one field, with the addition of a valve box that needs to be switched periodically. However, alternating fields provide the homeowner with an immediate solution to a clogged drainfield; merely turning the diverter valve. For normal operation, the homeowner must remember to operate the valve periodically, usually every six months to a year. Penn State (Makuch, 1984) suggests 1-year intervals, as research showed 10 months completely reduced the biomat. Kreissl (1984) cites a Virginia example with annual switching and Wisconsin research showing 4 weeks as sufficient to unclog a system in sandy soils. Winneberger (1976) says switching should be done annually.

One consideration about switching too frequently is that a biomat is an important part of the soil treatment. Annual switching provides time for the biomat to establish and provide good treatment before becoming so extensive that it clogs the system. Switching drainfields more frequently than every six months may not give the biomat time to develop enough for effective treatment.

The alternative to frequent switching would be to use one drainfield until it clogs and then switch over to the alternate. This, of course, brings with it the disadvantages of failure, namely ponding in the yard or backing up sewage into the house, if only for a short time. One might also consider switching drainfields after two or three years of use.

COSTS

For a replacement system, the cost would be equal to that of a new drainfield, as that is essentially what is being installed. For new construction, the costs would be slightly higher than for a new drainfield, considering extra excavation and more pipe and gravel, or chambers to install. However, it need not be twice the cost of a single drainfield, as the size can be reduced, and installing both parts together would save on labor costs. The diverter valve represents a small additional capital cost.

The benefits that an alternating drainfield system brings are longer system life and reduction of clogged systems. Operating an alternative drainfield will prevent typical clogging and allow both fields to function indefinitely. Also, installing a second drainfield will allow a failed field to rest and restore its capabilities.

CASE STUDIES

An interesting research study at Penn State (Fritton, 1983) examined the possibilities of restoring clogged drainfields to proper operation. Part of the study involved the installation of an alternate trench for failed drainfields. In this study, only one trench was used to replace the four trenches of the failed drainfield.   The replacement trench was longer and wider than a normal trench, however, it did not provide the full amount of infiltrative area. The replacement trench did provide more storage capacity, using four inches of sand and six inches of gravel below the pipe, instead of the normal six inches of sand.

Effluent was diverted from the clogged drainfields to the alternate trench