Technical Overview

DRIP AND SPRAY DISPERSAL SYSTEMS

National Environmental Services Center

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INTRODUCTION

Drip and spray dispersal systems are an upcoming and novel solution to some difficult onsite wastewater treatment needs. Sometimes referred to as irrigation methods, these systems use irrigation technology, but with another purpose. Whereas irrigation focuses on providing enough water for plants to grow, these dispersal methods are designed to disperse a daily flow of water, regardless of what the local plants might require.

Both drip and spray systems are intended for the ultimate dispersal of wastewater through soil treatment. In this regard, they parallel conventional drainfields. However, they have decided advantages over the conventional systems, although at a greater installation cost.

The main difference between drip and spray systems is in the delivery of effluent to the soil. Drip systems use small-diameter, flexible tubing installed at a depth of 9 to 12 inches below the surface. These tubes have emitters placed every 2 to 5 feet that allow a small amount of effluent to escape into the soil. Spray systems use sprinkler heads that spray effluent over the surface of the ground.

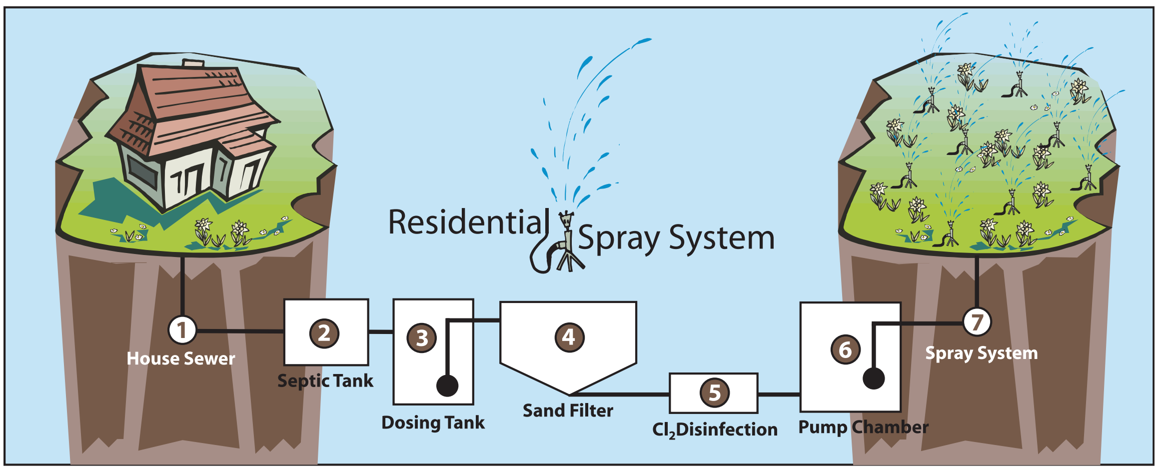

Figure 1: Example of residential spray system schematic

DESIGN: General

Drip and spray dispersal systems generally consist of treatment, pumping, and distribution components. Treatment requires a minimum of primary treatment, or settling of solids, such as a septic tank. It may also include filtration, aeration, and/or disinfection. Pumping consists of a separate pump tank, pump, and controls to pressurize the effluent through the distribution system. The pump must be properly sized to accommodate the desired flow and elevation changes required. Normally, the pump is a small submersible unit, from ⅓ to ¾ horsepower.

One of the most important design considerations is choosing the soil loading rate. This is the amount of effluent that will be distributed to the soil each day. A site evaluation to determine the type of soil in the dispersal area will yield a range of possible hydraulic loading rates, up to a maximum of what the soil can accept on a recurring basis. Designing a system with a high loading rate will reduce the required area for dispersal, and thus the cost of the system, but may lead to premature failure. Selecting a lower loading rate will increase the necessary field size and costs, but will also serve to increase the system's longevity.

DESIGN: Drip Dispersal Systems

The most important aspect of treatment for drip systems is providing a clean enough effluent to prevent clogging in the soil and the drip emitters. Since the tubes and emitters are so small, even suspended solids can affect the distribution. Disk filters are routinely installed after the pumps to remove any solids in the effluent. The filters are backwashed automatically at the end of each pressure dose.

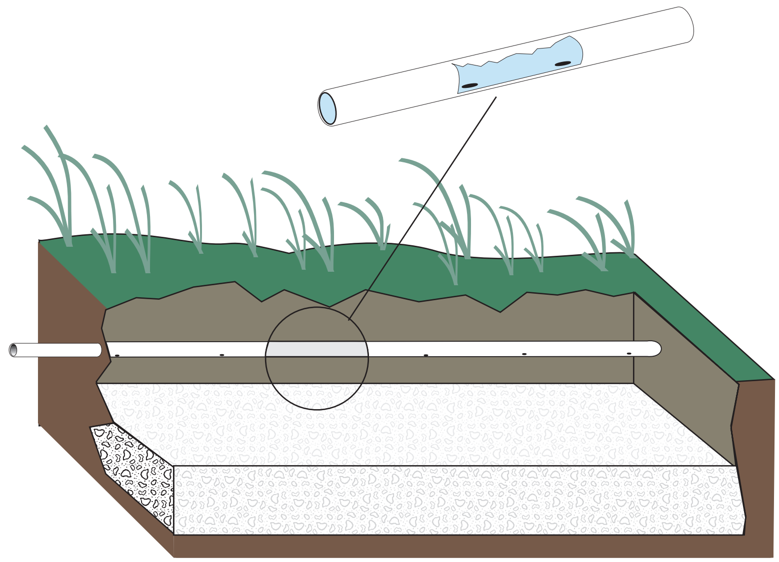

Figure 2: Example of drip tubing

Sizing the drip field is then a matter of good soil testing. A dosing rate should be based on the amount of effluent the soil is capable of accepting and is usually in the range of 0.1 to 0.7 gallons per day per square foot. Emitters are usually placed two feet apart on the tubes, and tubes are laid 2 to 3 feet apart, so each emitter serves 4 to 6 square feet.

As an example, if 1000 gallons need to be dispersed daily and the chosen loading rate is 0.5 gallons per day per square foot, you would need 2000 square feet of area. Laying the tubes 2 feet apart, you would need 1000 lineal feet of drip tubing, and would have 500 emitters. Each emitter would then allow 2 gallons per day into the soil, and spread it out over the 4 square feet that it covers.

Figure 3: Typical installation of drip irrigation tubing Photo courtesy of GEOFLOW

DESIGN: Spray Dispersal Systems

Since spray systems include the risk of human contact, they usually require a higher level of treatment and disinfection prior to dispersal. Most states allowing spray dispersal typically require at least secondary standards of treatment, or 30 parts per million (ppm) of Biological Oxygen Demand (BOD) and 30 ppm of Total Suspended Solids (TSS). Additionally, given the risk of human contact, disinfection is usually required to reduce the concentration of pathogens in the effluent.

The tubes are then laid from the pump tank to the spray heads. Spray fields are typically laid out in forested areas, as the trees tend to break up the spray and confine it to the field area. Forested hillsides are good candidates for spray irrigation fields.

A typical configuration on a hillside would be to place the spray heads at the bottom of the slope, facing upward. The spray would then cover the ground and flow back toward the spray heads, infiltrating the ground in a dispersed pattern.

Again, the dosing rate is a key parameter to consider. Since the spray heads can cover a lot of area without additional tubing, they can be more cost-effective at covering large areas. Thus, a spray field will tend to be larger than a drip field for the same quantity of effluent. Indeed, with spray dispersal it makes sense to use all the available area devoted to the field.

One other consideration is setback distances. In more open areas, 50 to 100 feet must be devoted for a buffer area between ground that is sprayed and a contact line or fence. This is to prevent human contact with the drifting of the spray through the air. As noted before, there is less setback needed in forested areas, since the trees will serve to block the drifting spray.

There may also be a requirement to fence or otherwise block access to the spray site. This may be time-dependent. If, for instance, the spray is only used at night, access would only be allowed in the daytime. Be sure to check with your state and local authorities about the restriction of access to the spray site

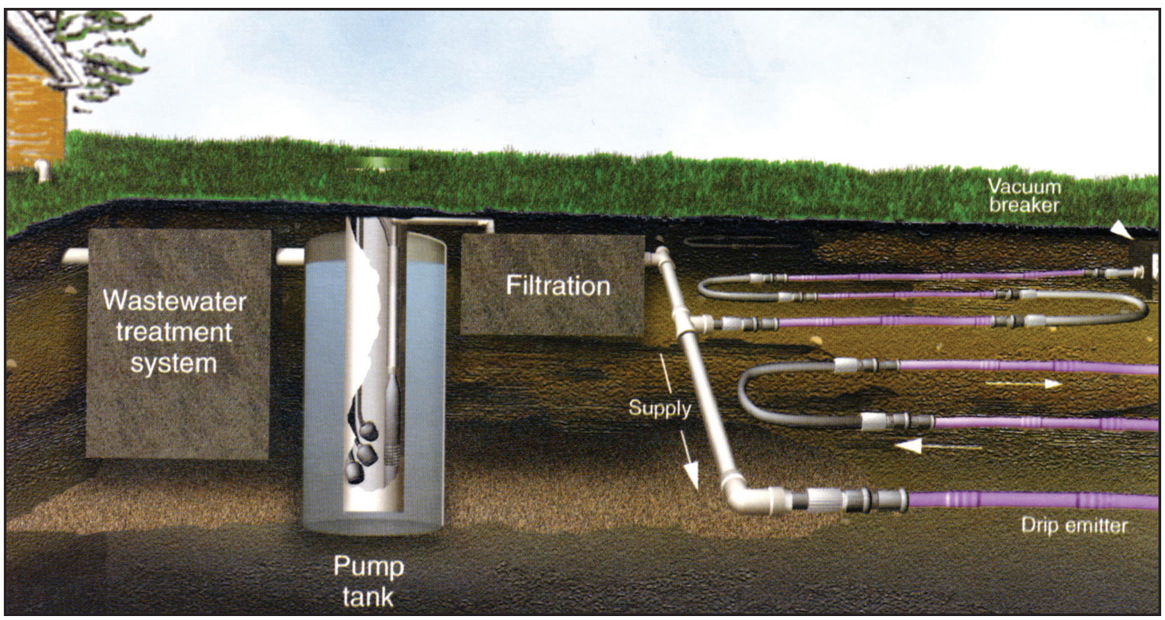

Figure 4: A subsurface drip system
Diagram courtesy of Texas Agricultural Extension Service

in your area.

SITING ADVANTAGES AND DISADVANTAGES

Drip and spray dispersal work very well with tight soils, such as clayey soil with low permeability, and high limiting layers of bedrock or water tables close to the ground surface. Both systems can be constructed in forested areas with little disruption to the existing vegetation. It is also possible to use either system on sloped sites. Drip systems are usually limited to slopes of 25 percent or less, although steeper sites may be used with manual installation of the tubing. The slope restriction is mainly due to safety for the installers. Spray systems can be installed to use almost any slope. This technology is very versatile in application.

On the downside, it can take up a large area. For drip systems, this may not be a problem. For instance, a system laid out in a hayfield will not disrupt the primary function of the field (hay production). However, on space-limited sites, irrigation technology may not be suitable.

Additionally, spray irrigation works better in remote areas where human contact is less of an issue. It can be used on fields or lawns with appropriate care and the provision of disinfection.

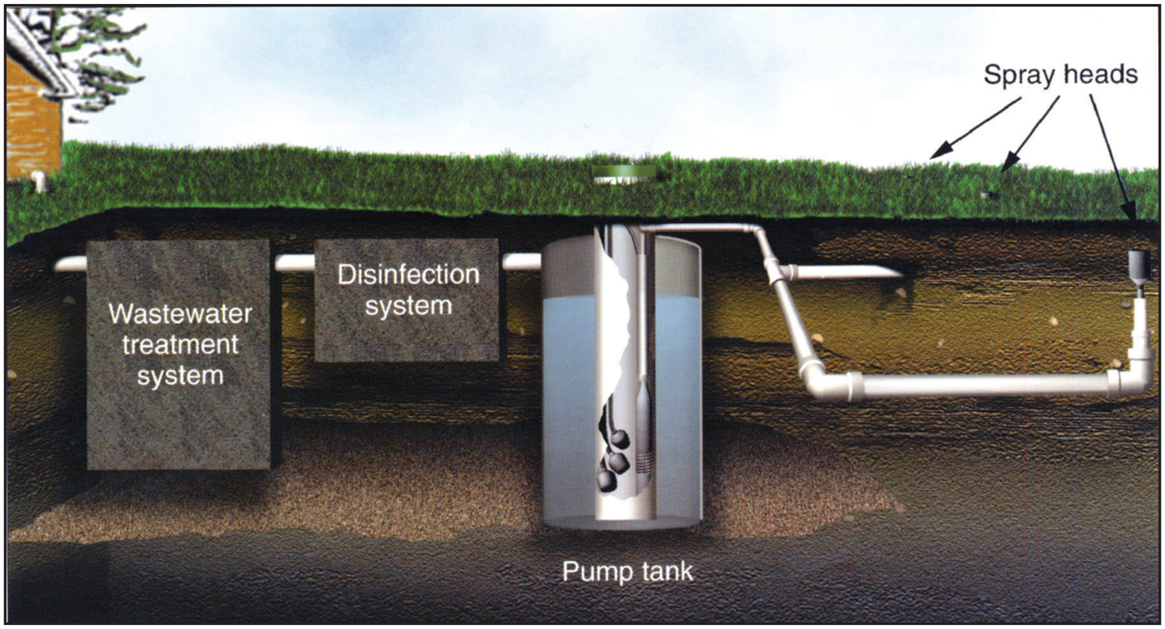

Figure 5: A spray distribution system with treatment and disinfection devices
Diagram courtesy of Texas Agricultural Extension Service

OPERATION AND MAINTENANCE

Operation and maintenance concerns are mostly centered around the pump tank, filters, controls, and initial treatment. Electrical and mechanical components must be properly serviced and replaced when necessary.

However, the daily operation can be largely automated. Maintenance checks need to be regular, but daily oversight is not generally required. The systems are designed for automatic backflushing to keep disc filters and lines free from clogging. Alarms in the pump tank indicate to operators of any problems that may occur.

For spray systems, disinfection is a critical component for good maintenance practices. Chlorination and dechlorination systems must be maintained for adequate disinfection. Ultraviolet systems can be more automated, but also require a high quality (less turbid, low TSS) effluent.

COSTS

Most of the costs of these systems are in the pumping and treatment components. Actually laying the tubes is relatively easy, though it can be labor intensive, depending on the site. On steeper sites, it may be necessary to dig the trenches and lay the tubes by hand, if it is unsafe for machinery to be positioned there.

Costs will also vary considerably based on the size of the system, land acquisition costs, and the amount of additional treatment needed before dispersal. Systems designed for only one house tend to be more expensive than other onsite alternatives, typically in the range of $12,000 to 15,000. With clustering, economies of scale bring the price per house down considerably.

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