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# Subsurface Drip Distribution System

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## Introduction

This fact sheet is designed to help community leaders, homeowner associations; developers and other interested parties understand how a subsurface drip distribution system can be a feasible, long-term solution for dispersing domestic wastewater effluent into the soil. Drip dispersal is already accepted as an alternative for single-family on-site wastewater treatment (septic) systems. When properly implemented, these large capacity drip distribution systems can help overcome considerable site limitations while reducing the potential for adverse effects to the environment. The system can also protect public health by diverting discharges away from sensitive waters of the state.

With the implementation of more stringent discharge limits on domestic wastewater effluent, several design engineers have proposed either some type of overland application or a drip distribution for domestic wastewater facilities. Unfortunately, there is limited information about design criteria for drip distribution systems in Missouri regulations. The purpose of this fact sheet is to provide references to resource materials and a general discussion regarding drip distribution systems in Missouri until design criteria can be developed. This fact sheet is not intended to address specific design criteria questions nor is it meant to be applicable for any other type of subsurface soil absorption system or overland application process.

Drip distribution systems and the associated technology can overcome a number of limitations and should be considered as a potentially viable option when planning a domestic wastewater treatment system. It is the design engineer's responsibility to justify the drip distribution system will work in a specific location under specific soil and geological conditions while ensuring the entire system is sustainable and protective of the environment and public health.

## What is Drip Distribution?

Drip distribution is a method of dispersing effluent from a domestic wastewater treatment facility into subsurface soil uniformly and under unsaturated soil conditions allowing for efficient water use and nutrient uptake by vegetation. Common manufacturing practices use a polyethylene material with an approximate diameter of one-half inch with emitters manufactured into the tubing every two feet. Depending upon the soils, landscape position and other site limitations the tubing is usually installed between 6- and 10-inches below the soils surface on 2-foot centers.

The drip distribution system includes a dosing tank where the effluent is held until one or more pumps deliver it under pressure to the drip tubing installed in the soil. This is usually done with timed dosing and alternating field zones allowing for the most effective treatment within the soil.

It should be noted that some consider a large capacity drip distribution system as nothing more than a large septic system. That is a misconception and for the purpose of this fact sheet the term septic will not be used except as a component of a system, (e.g., septic tank or anaerobic treatment).

## **Treatment before the Drip Distribution**

The first question often asked about a drip distribution system is: what type of pretreatment is required? Septic tank effluent can be used, but it is generally only used for single-family residences and not the larger systems permitted by the department.

There are two manufactures of drip tubing in the United States and both companies' products require secondary treatment. This guidance is not intended to discuss how that level of treatment is achieved, although it should be noted some experts believe a higher level of pretreatment before the drip distribution system will allow a higher soil hydraulic loading rate than is typically used in a septic drip systems. The design engineer must justify the level of treatment is appropriate for the receiving soils and underlying geology to warrant the higher hydraulic loading rate.

## **Geohydrologic Evaluations**

As stated in Missouri regulation 10 CSR 20-8.020 *Design of Small Sewage Works*, an engineer's report must contain a geological evaluation of the proposed soil absorption area performed by the Department of Natural Resources Division of Geology and Land Survey. A copy of the *Request for Geohydrologic Evaluation of Liquid-Waste Treatment/Site*, Form MO 780-1688 is available online at [dnr.mo.gov/forms780-1688-f.pdf](http://dnr.mo.gov/forms780-1688-f.pdf).

Section (14)(B) CI of 10 CSR 20-8.020 states; "In general, sites will not be approved where the geological limitations are severe and in some cases where the geological limitations are moderate." When this section became effective April 15, 1989, it was primarily meant to apply to conventional subsurface soil absorption systems (trenches with pipe and gravel). It is the design engineer's responsibility to justify the limitations cited in a geological evaluation can be overcome using this technology. If the limitations cannot be overcome, then an alternative treatment system must be considered.

If an area is determined to have a potential for groundwater contamination, a groundwater monitoring program consisting of a geohydrologic site characterization and installation of monitoring wells may be required in the state operating permit when recommended by the department's Division of Geology and Land Survey. The permit will incorporate the recommendations as to the characterization of the site, construction details and sampling plan. This work must be performed by a geologist registered with the State of Missouri.

## **Soils Investigation**

As with any type of soils based dispersal system, a detailed soil morphological and site investigation prepared by a qualified soil scientist must be conducted and included with the design engineer's report. The required documentation can only be compiled after a thorough, systematic investigation of the soil properties and landscapes of the primary and reserve sites where the drip distribution system is to be placed. Calculations showing the predicted maximum height of the groundwater mound under the system or perched groundwater mound shall also be part of the report. If the soil documentation indicates the possibility of water mounding under the drip lines, the landscape linear loading rate may be used to estimate water mounding.

Missouri's Department of Health and Senior Services suitability ratings for individual on-site wastewater treatment drip systems should only be used as a guide if given within a report.

It is the design engineer's responsibility to justify the soil and site limitations cited can be overcome using drip technology. If that can not be accomplished an alternative treatment system must be considered.

## **Design of Drip Distribution Systems**

There are several different approaches that have proven successful in the design, operation and maintenance of large-capacity drip distribution systems. The reference material listed represents some of the current practices. In the end, it remains the design engineer's responsibility to justify the use of this technology.

## **Operation and Maintenance**

The primary problem associated with drip distribution systems, whether they serve a single-family home, a subdivision or the entire community, is they are not always properly managed by individuals trained for this specific technology. Long-term operation and maintenance by qualified individuals is essential to ensure any wastewater facility is sustainable and the risk of failure is reduced. This issue must be resolved prior to developing any site using drip technology.

## **Antidegradation Review**

An antidegradation review is not required for non-discharging systems, (e.g., subsurface soil irrigation). A copy of the *No Degradation Evaluation – Conclusion of Antidegradation Review*, Form- MO 780-2026 must be submitted with the permit application. It is available online at [dnr.mo.gov/forms/780-2026-f.pdf](http://dnr.mo.gov/forms/780-2026-f.pdf)

## **Operating Permits**

A department issued state operating permit is required for all drip distribution systems that disperse more than 3,000 gallons per day into the soil.

## **Underground Injection Control Wells**

Drip Distribution systems are considered Class V, Underground Injection Control (UIC) Wells when they either receive domestic wastewater from two (2) or more family residences or from a non-residential establishment (schools, offices, shopping malls, etc.) when the system has a design capacity to serve 20 or more people per day.

As part of the department's Division of Geology and Land Survey management of the Underground Injection Control Program, maintains an inventory of Class V Underground Injection Control Wells located within Missouri. The sole purpose of the inventory is to maintain an accurate list of permitted wells. In order to maintain accurate records, the consulting engineer shall notify the department's Division of Geology and Land Survey when applying for a state operating permit from the department. For more information about Class V Underground Injection Control Wells, contact the department's Division of Geology and Land Survey at 573-368-2100.

## **Summary**

Drip distribution systems can overcome a number of soil and site limitations and should be considered as an alternative to point discharging systems or other forms of land application. This fact sheet is not intended to answer specific questions with regard to site selection, design criteria or the operation and maintenance of a drip distribution system. The purpose is to provide guidance to accepted resource material that can be used in determining when and if the technology is appropriate and to answer some of the common questions associated with drip distribution systems.

## Reference Material

There are several case studies of different manufacturer's products, along with other guidance available for suitability, design, installation and the operation and maintenance of drip distribution systems. The following resources are intended to provide a sample of the material available.

- *On-site Wastewater Treatment Systems Manual*, EPA/625/R-00/08, February 2002, [www.epa.gov/owm/septic/pubs/septic\\_2002\\_osdm\\_all.pdf](http://www.epa.gov/owm/septic/pubs/septic_2002_osdm_all.pdf).
- *2004 Guidelines for Water Reuse*, EPA/625/R04/108, August 2004, [www.epa.gov/nrmrl/pubs/625r04108/625r04108.pdf](http://www.epa.gov/nrmrl/pubs/625r04108/625r04108.pdf).
- *USDA Missouri Soil Survey*, all 114 counties in Missouri have a completed soil survey, [soils.missouri.edu/](http://soils.missouri.edu/).
- *Wastewater Subsurface Drip Distribution, Peer Reviewed Guidelines for Design, Operation, and Maintenance*, 1007406, Final Report March 2004 (Revised May 2004), EPRI, [onsite.tennessee.edu/Drip\\_Guidelines.pdf](http://onsite.tennessee.edu/Drip_Guidelines.pdf).
- *Consortium of Institutes for Decentralized Wastewater Treatment – Decentralized Wastewater Treatment Glossary*, Second Edition 2009, [www.onsiteconsortium.org/Glossary2009.pdf](http://www.onsiteconsortium.org/Glossary2009.pdf).

## For More Information

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