

Governor's Clean Water Initiative: Shoreland Rules Update Project Article Number 6

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Your Lake, Our Lakes: The Science of Septic Systems

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We drain our sinks and flush our toilets without thinking about where the waste goes. For many people living around lakes, sewer systems are not available. They must rely on Individual Sewage Treatment Systems (ISTS), commonly called septic systems, to treat and disperse waste and recycle water.

A septic system consists of a septic tank and a drainfield. The septic tank captures solid material and anaerobic bacteria decompose some of the solids. The wastewater that leaves the septic tank, or effluent, contains significant amounts of pathogens, pollutants, and nutrients, such as nitrogen and phosphorus. The drainfield, with a system of perforated pipes, distributes the effluent to a large area so that aerobic bacteria can further break down pathogens and the soil can absorb phosphorus and filter the effluent.

Septic systems that are properly installed and maintained in areas with appropriate soils do meet public health standards. However, septic systems have limited capabilities and have the potential to pollute groundwater and lakes.

Conventional septic systems are relatively ineffective in removing nitrogen. Nitrogen (in the form of nitrate) can flow with groundwater through the soil and end up in well water or lakes. Nitrate in drinking water increases the risk to infants of methemoglobinemia, or blue baby syndrome. Nitrate that gets into the lake will increase aquatic plant and algae growth.

Phosphorus is another concern because it is usually the limiting nutrient for lake algae. One pound of phosphorus can produce 500 pounds of algae. A household produces about two pounds of phosphorus per person each year, and it is discharged to septic systems. Conventional septic systems can be effective at removing phosphorus. Drainfield soils usually absorb or mineralize phosphorus. However, certain soil conditions and close proximity of drainfields to lakes can result in phosphorus pollution.

The Minnesota Pollution Control Agency has found that elevated phosphorus concentrations in groundwater are usually within 50 feet from functioning septic systems. However, some phosphorus plumes have been found to extend 66 feet from drainfields. Other evidence suggests that drainfields should be at least 100 feet from the lake to minimize the risk of phosphorus reaching the lake.

Maintenance of septic systems is critical. Sludge builds up in the septic tank and should be pumped out every two to three years. If sludge accumulates to the level of the outlet pipe, clogging will occur. This will damage the drainfield, reducing the life expectancy of the system. Drainfields can also fail when they are overloaded, either with too much water or with garbage disposal waste in volumes higher than designed for the system.

The average life of a drainfield is 10 to 20 years. Minnesota shoreland development standards require that each residential lot in areas not served by sewer systems have sufficient area for two septic systems. This provides one backup area for system replacement when the drainfield fails. For sensitive lakes or places with poor soils for drainfields, higher standards may be necessary to accommodate permanent and year-round housing.

Lakehome owner management of septic systems is sometimes inadequate. Regular pumping of the septic tank is needed to minimize pollution problems. Some areas have developed comprehensive management programs that track routine maintenance and compliance with public health standards. These programs can save homeowners money, because regular maintenance and inspection costs are much less than replacement of failed systems.

New septic systems are available that provide additional treatment of septic tank effluent. Recirculating sand filters, aerobic treatment systems, and peat filters can prolong the life of drainfields. Information on these systems, plus tips on septic system operation and maintenance can be found online at the Water Resources Center at <http://septic.umn.edu>.

Minnesota has rules for location, design, installation, maintenance, and use of septic systems. Minnesota shoreland development rules also specify septic system setbacks from lakes and rivers. Given recent research on phosphorus migration from septic systems, existing setbacks that are less than 100 feet may be insufficient.

Governor Pawlenty's Clean Water Initiative pilot project in the north central lakes area is bringing people together to create an alternative set of shoreland development standards in the lakes area. Citizens working on the Shoreland Rules Update project have been discussing the need for higher sanitary standards that will protect lake water quality. The updated standards adopted through this project will give local governments an alternative for local ordinances.

Details of the Shoreland Rules Update project are online at www.dnr.state.mn.us/waters (Click on the Governor's Clean Water Initiative link). Email comments to shorelandupdate@dnr.state.mn.us.

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