Septic Systems and Nutrients

STATE OF MICHIGAN, DEPARTMENT OF ENVIRONMENTAL QUALITY

Nutrient Framework to Reduce Phosphorus and Nitrogen Pollution

The invention of the first septic tank is often credited to a Frenchman by the name of Jean-Louis Mouras in 1860 (Fig. 1). Mouras invented a tank for waste disposal with the idea that storing the solid wastes would be a better disposal method than discharging them straight into the nearest waterway. Which, up until then, had been the preferred method of waste disposal. The first septic tank was later installed in the U.S. in 1883. Some 50-60 years later, drainfields or "soakaways" were recognized as being necessary for the liquid effluent that left the tank. Today, the basic design and concept of the septic tank system has changed little from its earlier prototypes.

A typical septic system consists of a one or two chamber tank, where solid waste settles out and undergoes anaerobic decomposition, and a piped drainfield where the liquid effluent disperses and filters through the soil and back into the groundwater. When septic tank systems are properly designed and are located in adequately-sized drainfields, the majority of nutrients from the effluent can be removed. However, in Michigan, an estimated 87% of the soils are not suitable for septic system placement, meaning they either drain too fast and do not properly filter the effluent, or they drain too slow and can cause back ups.

Poor septic system performance, or failure, typically occurs when effluent loading is too high, the soil type is unsuitable, the drainfield is too small, or the drainfield is too close to the water table. Also, neglecting to pump a septic tank often enough can lead to failure. Most septic system manufacturers recommend that the tank be pumped when it becomes 30% full of solids, though this recommendation is often ignored by home owners. When a tank becomes damaged or full of sludge, the solids may end up entering the drainfield tile network, which may then become clogged. When a system is clogged, the drainfield may become "soggy" and water may start ponding in the yard (Fig 2.). In worse-case scenarios, water may stop draining from the sinks, bathtubs, and toilets in the house that are hooked up to the septic system.

Unfortunately, many homeowners do not realize that their septic system is not functioning properly until a failure occurs, resulting in costly repairs. Often times, a septic system may appear to be functioning properly as long as water is properly draining from the house. However, if the system is failing to properly treat the effluent, is placed too close to surface water, or doesn't exist at all (straight pipes discharging to a surface water, storm drain, field tile, or ditch; Fig 3), then septic systems can be a significant source of *E. coli* bacteria and nutrients to surface waters.

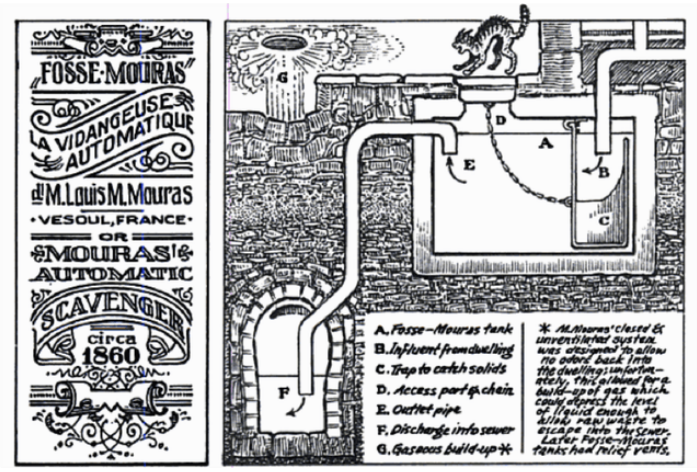

Fig 1. Schematic of an early-design septic tank from 1860. (from http://djwl.co.uk/blog/brief-history-septic-tanks/)

Figure 2. Saturated drainfield that has become clogged and has ponding water at the lawn surface. Photo from http://www.aero-stream.com/septic-tank-problems.html

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Fig 3. Illicit sewage discharge to a ditch. Photo from www.oregonohio.org.

For waterbodies and groundwater that are near failing septic systems, the nutrient concentrations will increase. A recent study by Michigan State University (MSU) found that all 64 rivers that they sampled in Michigan had human-specific, digestive bacteria present in them, indicating that human waste was a pollutant to the surface waters. Further analysis by MSU revealed that septic systems were the largest contributors of the human waste bacteria. *E. coli* bacteria contamination to surface waters is typically the most immediate concern with failing septic systems. However, a failing septic system will also contribute nutrients to local surface waters as well. In some cases, failing septic systems, or septic systems with inadequate drainfields can be the largest contributors of nutrients to a waterbody. A recent study by the United States Geologic Survey and Grand Valley State University that examined nutrient sources to a eutrophic lake in west Michigan found that septic systems of the homes along the lake were the biggest contributor of nutrients.

Michigan is the only state that does not have a statewide regulation for small (<10,000 gallon/day) septic systems. Rather, local county health departments are responsible for ensuring that septic systems are designed and functioning properly. A goal of the Michigan Department of Environmental Quality's (MDEQ) Office of the Great Lakes 25-year water strategy is to enact a state-wide septic code. Currently, 10 counties, 8 townships, and 1 village in Michigan have adopted time-of-sale/transfer ordinances (Fig. 4).

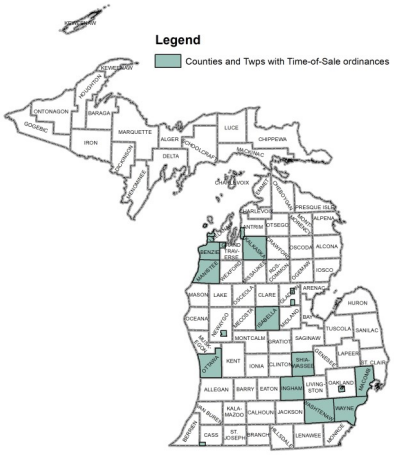

Figure 4. Counties and municipalities that currently have time-of-sale/time-of-transfer ordinances requiring septic system inspections.

These ordinances require that a house's septic system be inspected upon sale or transfer of ownership. This is beneficial for the new home owners who can be assured that their septic system is properly functioning. Time-of-sale/transfer ordinances also help to reduce the amount of nutrients entering groundwater and surface water because if a system is failing, or does not exist, then the system must be repaired or replaced.

In the first six years after Barry and Eaton Counties began a time-of-sale/transfer ordinance, almost 1000 failed septic systems were discovered. Additionally, nearly 300 residences were found to have no septic system at all.

The MDEQ promotes efforts to find and fix failing onsite septic systems. The MDEQ has funded projects to use innovative techniques to find failing systems such as areal imagery and bacteria sniffing dogs. Also, the MDEQ has funded projects to help jurisdictions develop onsite septic ordinances and information and outreach campaigns to encourage onsite septic inspections and proper maintenance. In addition, local health departments have used grant funds to find failing systems and use their regulatory authority to require repairs or replacement.

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For homeowners with on-site septic systems, proper maintenance is important. For assistance with a septic system that may be failing, it is important to contact your local health department. The MDEQ does not provide direct funding to individual homeowners for septic system repair or replacement. Potential funding assistance may be available through the Michigan State Housing Development Authority, the Federal Home Loan Bank of Indianapolis, and the Michigan Department of Health and Human Services.