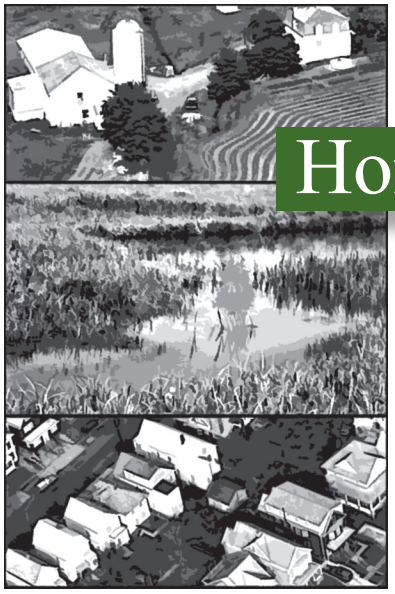
COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT, LEXINGTON, KY, 40546

HENV 509



Home & Environment

How Water Use Impacts Septic System Performance

Brad D. Lee, Plant and Soil Sciences

In this Publication

Most residential households not connected to a community wastewater treatment system require individual wastewater treatment systems, or septic systems. The most common type of septic system used in the U.S. is the trench system (see Figure 1). All properly functioning septic systems (whether conventional or not) rely on the soil to treat and disperse wastewater. Soils can adequately treat wastewater as long as the wastewater volume and its constituents leaving the home do not exceed the soil's ability to absorb and treat it. The purpose of this publication is to discuss home water use patterns and suggest water conservation measures that could improve septic system performance and reduce the risks of hydraulic overload or other kinds of system failure.

Household Water Use

There are two ways in which we load septic systems hydraulically: loading over time and instantaneous loading. The system must be designed, constructed and operated to handle both. When a septic system fails due to hydraulic overload, the results can be disastrous (see Figure 2).

Loading Over Time

The average person uses about 69 gallons of water per day on average, according to the U.S. Environmental Protection Agency. This amount includes typical activities such as flushing toilets, showering and bathing,

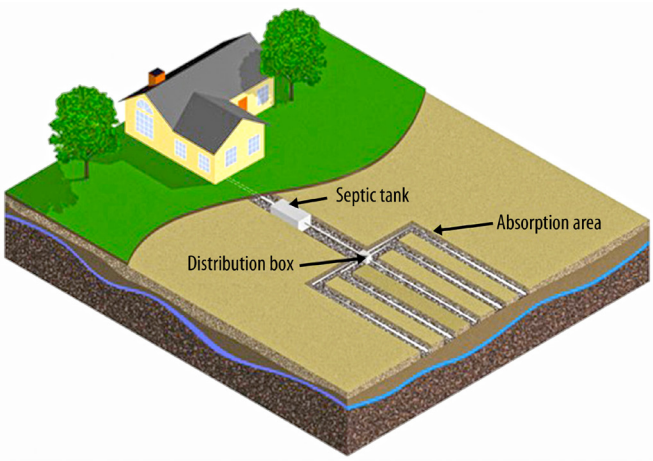


Figure 1. In a trench septic system, wastewater flows from the house into the septic tank. In the tank, solids settle out and liquid waste flows into a distribution device, then through a network of perforated pipes placed in distribution media–filled trenches that are covered with soil. Collectively, this network of pipes is called the soil treatment area (Sharron Katz).

Figure 2. Septic system failure due to hydraulic overload. The soil absorption field could not accept the volume of water discharged from the home, resulting in septic tank effluent coming up to the ground surface.

washing clothes and dishes and using faucets (see Figure 3).

Although a soil absorption field of the right size can accommodate average water use in a typical home, there may still be situations when septic systems cannot keep up with wastewater loads. For example, in spring, soils can become saturated during periods of snowmelt or high rainfall. Under these conditions, household plumbing may drain more slowly than usual. Excessive wastewater flows can occur after the arrival of an infant or during visits from relatives or friends. When experiencing any of these conditions, it is a good practice to reduce wastewater load on the septic system. Non-typical uses that require additional wastewater generation or high strength waste can cause wastewater disposal problems. If non-typical uses such as hot tubs or food service activities are occurring in the home, additional wastewater loads must be accounted for in the design of the septic system.

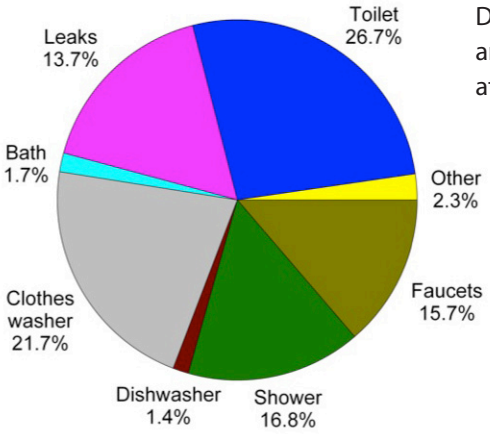


Figure 3. Indoor per capita water use by fixture (AWWA).

Instantaneous Loading

Depending on individual habits, the amount of wastewater leaving a home at any given time can vary widely. Hourly fluctuations in wastewater flow (see Figure 4) can adversely affect septic system performance and result in hydraulic overload during peak flow conditions.

Because water use is not uniform throughout the day, most states require septic systems to be appropriately sized to accommodate these fluctuations. For example, Kentucky requires systems to be designed to handle 120 gallons of wastewater per bedroom per day. So, for a three-bedroom home, a septic system must be designed to handle 360 gallons of wastewater per day. If that same home has only four occupants, the average daily flow would be 276 gallons (based on the EPA average of 69 gallons per person), so the average estimated daily flow is somewhat lower than the designed 360 gallons per day. Because of this extra capacity built into the rule, the designed septic systems can accommodate wastewater fluctuations as well as brief periods of high water use—such as temporary additions to the number of occupants.

Methods to Reduce Wastewater Load

Several modifications to behavior and plumbing can reduce the amount of wastewater generated in the home. A number of these modifications suggested by the EPA are listed below. Inspect your water using devices to insure they are functioning properly. Leaky or running faucets and toilets can lead to tens of thousands of gallons of water in a year.

Behavioral Modifications

Changing personal habits to use water more efficiently can reduce water consumption and the chances of septic system failure. Because these choices do not involve costs, modifying water use habits are the most cost effective changes available to homeowners. Following any one of these

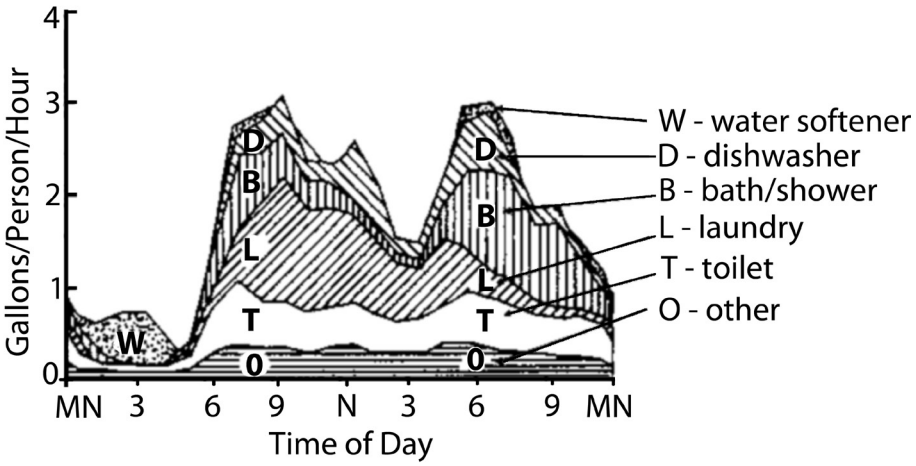


Figure 4. Gallons of residential water use per person over a 24-hour period by fixture or appliance (University of Wisconsin-Madison).

practices may not dramatically reduce water use, but the family who adopts these practices can make a significant difference in water use and wastewater generated.

- **Dishwashing:** Typically, 10 to 20 gallons of water can be saved each day by running the dishwasher only when it is full rather than after each meal. If dishes are washed by hand, fill the sink or a dishpan with water rather than running the faucet continuously.
- **Brushing teeth and shaving:** Turn off the faucet while brushing teeth or shaving.
- **Showers:** Take shorter showers and turn the water off while soaping.
- **Toilets:** Use only for sanitary waste, not ash tray contents, cat litter, facial tissues, or diapers.
- **Laundry:** Adjust the washing machine's water level to match the size of the load. If the washing machine does not have a variable load control, run the machine only when it is full. If washing by hand, do not leave the water running; fill a laundry tub with water, and reuse the wash and rinse water as much as possible. Spread your laundry throughout the week rather than running the machine several times in one day to reduce peaks in water use that could overload your septic system.

Plumbing Modifications

Replacing older indoor plumbing fixtures with new water-saving fixtures can usually reduce water use. Low-flow plumbing fixtures and retrofit programs are permanent, one-time conservation measures that can be implemented with little cost. In addition to reducing septic system loads, these modifications usually can save homeowners money over the long term by reducing water use. Homes built after January 1994 probably have many of these water-saving fixtures already installed, in accordance with U.S. Energy Policy Act, which required national standards governing the flow capacity of showerheads, faucets, urinals, and toilets. Below are some examples of plumbing modifications homeowners can make to reduce wastewater flow.

- **Low-flow toilets:** More than 4.8 billion gallons of water are flushed down toilets each day in the United States. Prior to 1994, the average American used about 9,000 gallons of water per year to flush 230 gallons of waste. During remodeling projects, there is great potential to reduce water consumption by installing low-flow toilets. Conventional toilets use 3.5 to 5 gallons (or more) of water per flush. Low-flow toilets use 1.6 gallons of water or less, substantially reducing the volume of wastewater produced. If all high-flow toilets in a home are replaced with low-flow units, wastewater load could be reduced by 10 to 15 percent. Early low-flow toilet models generated a number of complaints about their effectiveness and noise, but newer models work much better.
- **Toilet displacement devices:** An inexpensive alternative to replacing old, high-flush toilets is to place plastic containers (such as plastic milk jugs) filled with water or pebbles into the flush tank of older units, reducing the amount of water used per flush. When installing such devices, make sure containers do not interfere with flushing mechanisms or water flow. Displacement devices can reduce the water volume from older toilets by a gallon or more per flush. Similarly, a toilet dam, which holds back a reservoir of water when the toilet is flushed, can also be used in a high volume toilet flush tank to save water. If toilet dams are installed in all high-flush toilets in a home, wastewater load could be reduced 3 to 5 percent.
- **Low-flow showerheads:** Showers account for about 20 percent of total indoor water use. By replacing older 4.5-gallon-per-minute showerheads with 2.5-gallon-per-minute heads that cost less than $5 each a family of four could save approximately 20,000 gallons of water per year, reducing the loading on septic systems by about 10 percent.

- **Faucet aerators:** Faucet aerators break flowing water into fine droplets and trap air bubbles in the flow while maintaining wetting effectiveness. Aerators are inexpensive and homeowners can easily install them to reduce each faucet's water use by as much as 60 percent while still maintaining a strong flow. If all a home's faucets are retrofitted, wastewater load can be reduced 8 to 9 percent.
- **Pressure reduction:** Because water flow rate is related to pressure, the maximum water flow from fixtures operating on fixed settings can be reduced if water pressure is reduced. Homeowners can reduce a home's water pressure by installing pressure-reducing valves or by modifying the pressure on-off settings that control the well pump. Many home water fixtures, however, such as washing machines and toilets, operate on a fixed amount of water, so reducing water pressure would have little effect on water use at those locations.

References

AWWA Research Foundation and American Water Works Association. 1999. Residential End Uses of Water. AWWA Research Foundation, Denver, CO.

Jensen, R. 1991. Indoor Water Conservation. Texas Water Resources 17(4).

University of Wisconsin-Madison. 1978. Management of Small Wastewater Flows. EPA- 600/7-78-173. U.S. Environmental Protection Agency, Office of Research and Development, Municipal Environmental Research Laboratory (MERL), Cincinnati, OH.

U.S. Environmental Protection Agency. 1995. Cleaner Water through Conservation. EPA 841-B-95-002.

U.S. Environmental Protection Agency. 2002. Onsite Wastewater Treatment Systems Manual.

About the author

Brad D. Lee, Associate Professor and Water Quality Extension Specialist, Department of Plant and Soil Sciences

Issued 7-2013