# Advanced Onsite Wastewater Treatment Systems Could Reduce Phosphorus Pollution, Improve Water Quality in Greenwood Lake

What role do onsite wastewater treatment systems (OWTS) have in protecting water quality in lakes and ponds from phosphorus pollution? The answer is that, under some site and soil conditions, they can play an important role in reducing phosphorus levels—but more research is needed about the long-term attenuation of phosphorus in a range of soil conditions. Stone is assisting the Orange County Water Authority in an EPA-funded decentralized wastewater project to demonstrate practices and energy-efficient technologies capable of reducing phosphorus pollution from OWTS in the New York portion of the Greenwood Lake watershed, a 9-mile long lake spanning the New York and New Jersey border.

## Phosphorus Sources in Wastewater

The average person contributes 1-2 grams of phosphorus to wastewater per day simply by using the toilet. About 65% of that phosphorus is contained in urine, while feces contribute the rest. Other phosphorus sources in domestic wastewater include detergents and ground-up food from garbage disposal units. Although all but trace amounts of phosphorus have long been banned in laundry detergents, the increasing prevalence of automatic dishwashers has resulted in increased use of dishwashing detergents with significant phosphorus concentrations. Where water utilities add phosphorus compounds for corrosion inhibition, tap water can also be a significant phosphorus source. Most of this phosphorus passes through the distribution system into the home or business and then enters the wastewater stream.

*Excessive phosphorus levels are responsible for frequent algal blooms that impair recreational use and the ecological health of Greenwood Lake.*

## Treating Phosphorus Through Onsite Systems

The role of OWTS in attenuating phosphorus is an evolving area of research, and very few advanced treatment systems currently remove phosphorus from wastewater at the single-property scale. Furthermore, most codes for system siting and design do not explicitly address phosphorus mitigation.

In 2005, Stone completed a national research project that summarized the state of knowledge about the possibilities for phosphorus removal throughout the onsite wastewater treatment train. A few important concepts were emphasized in our findings. To make the best possible use of the phosphorus treatment capacity of existing soils, wastewater should be dispersed at shallow depths. In a conventional leachfield, effluent is typically dispersed two feet or more below ground surface. Dispersing wastewater at depths of 6-12 inches below ground surface increases the soil volume available to bind the phosphorus, and improves other aspects of treatment as well. Shallow dispersal also places nutrients within the plant root zone where they are available for uptake.

A second strategy is to use pressurized distribution to evenly disperse wastewater. Gravity distribution can result in non-uniform loading, saturating small areas of a leachfield while other areas are not loaded at all.

Pressurized distribution provides more uniform soil contact and reduces the risk of soil saturation, increasing the phosphorus sorption potential of the field.

Finally, on sites where the leachfield alone cannot remove phosphorus over the long term (30+ years), there is a need for waste diversion or advanced treatment. The availability of advanced treatment systems is limited by the fact that phosphorus treatment technologies for small wastewater flows are still in the early stages of development, and there is limited data to inform system designs.

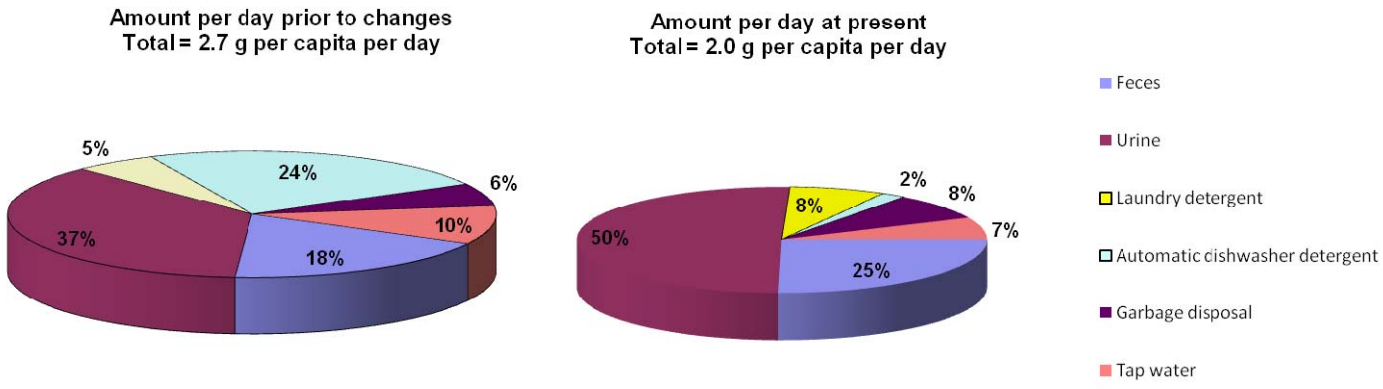
### Phosphorus Treatment Demonstration Project, Greenwood Lake, New York

Greenwood Lake is a popular recreation destination. Excessive phosphorus levels are responsible for frequent algal blooms that impair recreational use and the ecological health of some portions of Greenwood Lake. The New York Department of Environmental Conservation estimated that onsite wastewater treatment systems contribute approximately 10% of the phosphorus load to Greenwood Lake, or 710 kilograms per year—and in order for the lake to be restored, they estimated that a 40% (~280 kilograms per year) reduction in phosphorus loading from OWTS is needed.

The Greenwood Lake watershed contains many onsite wastewater systems that were installed before the existence of wastewater regulations. A typical system consists of a septic tank that discharges settled wastewater to a leachfield or a seepage pit. Cesspools are also in use. Components of older systems may be undersized for current uses, in part because they were built when most homes were only used in the summer. Because most areas in the watershed have shallow soils over bedrock or groundwater close to the surface (and sometimes both), minimally treated wastewater from onsite systems may enter the groundwater, which generally flows downslope to discharge in Greenwood Lake.

### Phosphorus Source Reductions So Far

Since the beginning of the demonstration project, two major developments have reduced the amount of phosphorus that reaches OWTS in the Greenwood Lake watershed. On July 15, 2010, the State of New York joined 16 other states in prohibiting the sale of automatic dishwasher detergents containing more than trace amounts of phosphorus. This change alone resulted in a 25% reduction in phosphorus input to OWTS in the Greenwood Lake watershed. In addition, during this project, the Village of Greenwood Lake's water utility has taken steps to reduce phosphorus additions to drinking water. This change is estimated to reduce phosphorus input to OWTS in the Village by another 5%. The figure below shows per capita phosphorus contributions in wastewater that are representative of conditions in the Village of Greenwood Lake before and after these developments.




*Per capita phosphorus contributions to wastewater in the Village of Greenwood Lake decreased markedly after the water utility reduced phosphorus additions to drinking water and the state prohibited the sale of dishwasher detergents containing more than trace elements of phosphorus.*

## Demonstration Systems

A central component of the project is the design, construction, and monitoring of demonstration OWTS that reduce phosphorus loading to Greenwood Lake. The demonstration systems are under construction this summer at two lakeshore properties in the Village of Greenwood Lake. One system will incorporate urine diversion to reduce phosphorus loading to the treatment units. The second system will serve a cluster of three church buildings and includes advanced secondary treatment, followed by a packed bed media filter for phosphorus reduction. Both demonstration systems disperse treated effluent to soil absorption systems placed as shallowly as possible in the soil profile.

These systems are replacing malfunctioning systems on existing developed lots where the phosphorus sorption capacity of the underlying soils is not sufficient to provide long-term (more than 30 years) removal. A year's worth of data will be collected about the performance of these systems, and used to evaluate the technologies and make recommendations about their potential use in the Greenwood Lake watershed.

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