# Decentralized System Solution

By Dennis F. Hallahan & Jessica L. Kautz

## Wastewater treatment method offers groundwater recharge & water resource sustainability

The stadium that serves as the home of the NFL's New England Patriots has the distinction of having one of the largest recreational water reuse systems. When the town of Foxboro, Mass., advised the private developers that constructed the stadium and adjacent stores that it could not treat the wastewater from the planned 68,000-seat stadium, it became apparent that a solution was necessary. Designed to meet the design flow of 1.3 million gal per day (mgd), the treatment system needed a solution for a discharge point. The stadium is located atop a hill, and there is no surface disposal option and no tributaries to dump into. Hence, the idea was to discharge to the subsurface, but the whole property surrounding the stadium was consumed by parking, so the design team also designed the system to withstand H-20 loading for parking purposes over the subsurface discharge. Working closely with the town, the team developed a program to support the stadium, which resulted in the construction of the following facilities:

- A 250,000-gal-per-day (gpd) membrane bioreactor capable of being expanded to treat 1.3 mgd;
- A 680,000-gal equalization tank to capture the half-time wastewater surge; and
- Subsurface discharge: a 2.4-acre recharge field for the excess highly treated effluent.

### Water Resource Sustainability

Access to a safe and reliable water source is vital to creating and sustaining thriving communities. The lack thereof is a major reason why there are hundreds of countries rich with human and natural resources that have yet to fully develop. Water is imperative to survival and growth.

Yet, rising drought conditions, growing population and accelerating urbanization have led to the exploitation of natural water sources. The water table is dropping at drastic rates worldwide. As water tables drop and wells run dry, saltwater begins intruding inland, contaminating freshwater, and an increasing number of people are left without a reliable source of potable water.

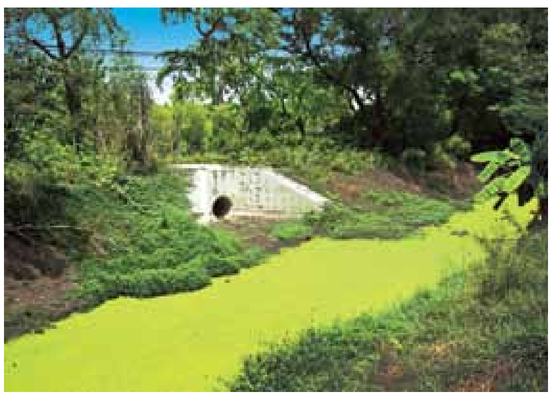
Solutions to the issues of poverty, hunger and disease are all dependent on consistent, maintainable clean water supplies. It is helpful for new methods of groundwater management to be developed to provide a sustainable future for the clean water supply.

### Decentralized Wastewater Treatment

Wastewater treatment impacts the water cycle and the sustainability of water use, as large volumes of water are processed on a daily basis. Two general models are used in wastewater treatment: centralized and decentralized onsite wastewater treatment.

Decentralized wastewater treatment provides treatment either directly on site or at a nearby location, where wastewater is treated and filtered through naturally occurring soil directly into local aquifers. The recharged water acts as a barrier against saltwater intrusion in coastal areas, and also is used to supplement drinking and irrigation water supplies. This method of wastewater treatment has been successfully implemented for thousands of years, helping to maintain aquifer levels worldwide.

While traditionally thought of as a single-home wastewater treatment solution, a decentralized system can be built to treat any volume of wastewater. Community decentralized systems can be designed where individual site conditions limit the use of soil-based treatment systems. Large systems also can be developed for large-flow commercial and industrial sites where nearby centralized systems are often too small to accept the total volume of wastewater generated.



**Decentralized systems offer high levels of treatment and groundwater recharge.**

## Groundwater Recharge

The key to decentralized systems lies in proper siting, installation and maintenance to adequately accept wastewater into the underlying soils. Factors affecting the system's ability to accept wastewater include soil type, distance to limiting layers, total available area on site and wastewater quality.

In the past, many of these factors led to sites being connected to a centralized sewer, as wastewater could not be adequately filtered and dispersed on site. As technology continues to advance, however, more sites have become available for decentralized systems. For example, designing a small-scale, advanced treatment train prior to dispersal of the effluent into the native soil can decrease both the absorption area and depth to limiting layers that are required for adequate treatment. This has allowed decentralized systems to be placed in areas previously inaccessible, in turn increasing the volume of groundwater recharge associated with decentralized systems.

Despite the operational and environmental benefits, centralized sewer replacement, expansion and separation continue to be the focus of federal funding and new development. The funds distributed through the Clean Water Act State Revolving Fund are largely biased toward centralized wastewater management programs; a mere 0.2% of the allocations are used for decentralized wastewater treatment, despite approximately 25% of all homes currently using decentralized wastewater management schemes.

Decentralized wastewater treatment is increasingly centrally managed, through publicly and privately owned community systems that can be staffed with trained and educated personnel, in the same manner as centralized systems.

## Infiltration Solution

The town of Hopkinton, Mass., had a municipal sewer system, but no wastewater treatment plant. The wastewater was being sent to other towns that were at their discharge limits. A study was conducted to investigate townwide alternatives and to perform a cost analysis, which led to the construction of a new 350,000-gpd treatment plant.

A sewer-mining solution was designed that partially diverts flows from an existing sewer main to the new treatment plant. A new surface discharge was impossible; therefore, a subsurface outfall consisting of a large infiltration basin was proposed. The plant has a capacity of 350,000 gpd, and the soil application rate was 3 gpd per square foot. Due to the proximity to natural wetlands, the space available for the system was constrained and irregular. This problem was solved by an efficient chamber infiltration system. Another positive of the infiltration system was that it could help recharge the local aquifer and adjoining wetlands.

Decentralized systems have evolved to treat to high levels, and can be designed to meet high flow. They also can help sustain the local watershed balance with the introduction of water to replenish depleted aquifers. W&WD

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