world water

Volume 41 / Issue 4
July / August 2018

Dutch water innovation

Global partnerships, integrated solutions

Water Environment Federation
the water quality people®

A Supporting Publication of
weftec®
the water quality event™

In the Forest Lakes installation, the effluent is time-dosed on an intermittent basis using pressurized micro-dosing, to a multi-celled, soil dispersal system that incorporates Infiltrator Quick4 Plus Standard Chamber laterals in an area bed arrangement. Photo by Infiltrator

the tanks as needed to complete the project, saving time and space prior to installation.

Advanced Wastewater Treatment Units (ATUs)

The multiple reasons to use an Advanced Wastewater Treatment Unit (ATU) include poor soils, shallow vertical separation distances to limiting conditions, horizontal setback restrictions, tight lots, high strength wastewater, and nitrogen removal needs. One example of an ATU is a fixed film bioreactor (FFBR), a specially designed containment device that houses an engineered PVC media for residential installations, cluster designs, and small-to-medium commercial wastewater treatment applications. Often installed inside a plastic tank, FFBRs provide outstanding treatment in areas where traditional systems cannot be used. These systems excel where nitrogen removal is critical to the treatment plan, and they are extremely effective for high strength wastewater applications.

In Centralia, Washington, US, homeowners needed a new solution when faced with an aging conventional septic system and the desire to subdivide the property while retaining dedicated wastewater treatment service for their existing home. Due to changes in permitting requirements, any new system required the installation of a secondary treatment system to satisfy vertical separation. Several options were rejected due to size requirements, cost, and construction challenges. The final design features a FFBR system with pre-treatment and a chamber leachfield distribution system to provide seamless collection, treatment, and dispersal. Even better, all of the products used in the system design were sourced from the same company, adding to the ease of purchase and compatibility.

The effluent leaves a pretreatment tank and enters the Delta Treatment Systems' ECOPOD-N™ Fixed Film Wastewater Treatment System installed in an Infiltrator IM-1060 plastic reactor tank, where it is introduced to an oxygen-rich environment. In this environment, a colony of bacteria called the biomass develops and is capable of digesting (breaking down) biodegradable waste into carbon dioxide and water. This process continues as the biomass is supplied with incoming waste-water and oxygen. The effluent is then time-dosed to the 65-linear meter Infiltrator Quick4 Plus Low Profile chamber drainfield with pressure distribution.

Conclusion

Decentralized wastewater treatment can provide equal protection of public health while outshining centralized wastewater treatment in environmental protection. Where individual lots are not suitable for decentralized treatment on site, community decentralized systems can provide sustainable and responsible wastewater treatment. With aquifers becoming depleted at rapid rates and water tables dropping, minimizing the impacts to the water cycle is critical for sustainability.

Author's Note

Dennis F. Hallahan, PE is the technical director at Infiltrator Water Technologies, based in Old Saybrook, Connecticut, United States. The author has more than 30 years of experience with the design and construction of onsite wastewater treatment systems. Currently, Hallahan is responsible for technology transfer between Infiltrator and the regulatory and design communities, and consults on product research and testing for universities and private consultants. Hallahan received his MS in civil engineering from the University of Connecticut and his BS in civil engineering from the University of Vermont. He is a registered professional engineer in Connecticut and holds several patents for onsite wastewater products. For more information, contact the author by email at dhallahan@infiltratorwater.com.

Onsite STEP system handles seasonal peaks at US national park

The onsite effluent sewer system installed at Stinson Beach, part of the United States National Park Service system, keeps the facilities running smoothly during peak season when visitors rise to 5,000 per day. Michael A. Parker, PE of Orenco explains how the system works.

In 2017, the Golden Gate National Recreation Area in California, United States (US), was the second most visited place in the entire national park system, with almost 15 million visitors. Established in 1972, it's also one of the largest national parks located in an urban area, offering a wide variety of activities – from touring Alcatraz Island to hiking Montara Mountain to swimming at Stinson Beach.

While beachgoers might take the site's public restroom facilities for granted, the National Park Service (NPS) does not. When it was determined that the septic tanks and drainfields at Stinson Beach were coming to the end of their useful lives, they hired HECO Engineers of Idaho to recommend a cost-effective replacement that would not be overly noticeable to park visitors.

In addition to keeping costs down, the NPS needed an onsite wastewater collection and treatment system that would be relatively easy and inexpensive to maintain and troubleshoot because NPS staff would be responsible for its operation and maintenance.

To fulfill these requirements, the engineer recommended the installation of a septic tank effluent pump (STEP) system, also known as an effluent sewer system. In this type of system, raw sewage flows from the restroom facility to an underground tank. Only the filtered, liquid portion is discharged (by either pump or gravity) to shallow, small-diameter collection lines that follow the contour of the land.

An important feature of effluent sewer systems is the settling of solids in the onsite tanks. Solids remain in the tank and are removed every few years, depending on usage and tank volume. This onsite tankage provides primary treatment in the form of passive anaerobic digestion, which reduces the organic and solids load to the wastewater treatment facility.

As explained in the Metcalf & Eddy reference book *Wastewater Engineering: Collection, Treatment, and Disposal*, published in 1972, process evaluations show that typically 80 percent of biosolids in onsite tanks are digested on an annual basis. This lower load coming from the STEP tanks provides a substantial reduction in operating costs at the secondary treatment stage.

Because solids settle to the bottom of the onsite tanks, inexpensive pumps can be used to transport the wastewater to the treatment system. The cost-effectiveness and durability of these pumps, combined with infrequent tank pump-outs, translates to low solids management costs and low equipment repair and replacement costs for STEP systems.

At Stinson Beach, wastewater is collected from four restroom facilities and two maintenance buildings. For the restrooms, this process required the installation of four 19-cubic meter (m^3) onsite tanks in different locations. And for the maintenance buildings, a single 3.8-m^3 onsite tank was installed.

Primary-treated effluent from each tank's clear zone is pumped through small-diameter, 25-50 millimeter (mm) collection lines to a 19-m^3 flow equalization tank located next to the new wastewater treatment facility.

At the equalization tank, a timed-dose duplex pump system and control panel feed effluent at regular intervals to the treatment units. This process prevents the units from being overloaded during times of peak hourly flows.

Secondary treatment at the facility is handled by three AdvanTex® AX-Max™ units, manufactured by Orenco Systems® of Oregon and obtained through PACE Supply of California. AdvanTex treatment systems use a fixed-film, attached-growth treatment process and are well suited to facilities receiving seasonal flows – such as parks, rest areas, and campgrounds.

In AdvanTex treatment systems, wastewater is uniformly distributed onto textile media without saturating the media. The system uses fractional-horsepower fans to draw air through the media and provide sufficient oxygen for aerobic digestion. Low-horsepower, high-head turbine pumps operate intermittently with sophisticated controls that automatically adjust recirculation ratios and pump run-times based on daily flows so that treatment is optimized.

AX-Max units are pre-plumbed and easy to install either above grade or at grade, either individually or in multi-unit arrays. Treatment, recirculation, and discharge equipment is all housed inside an insulated fiberglass tank, which is available in lengths from 4.3 to 12.8 meters. At Stinson Beach, two of the units are 10.7 meters long, and the third is 8.5 meters. They were installed 0.6-0.9 meters above grade for easy maintenance.

Energy-efficient AdvanTex systems use fewer than 2 kilowatts (kWh) per 3.8 treated cubic meters, based on internal tests conducted by Orenco. In addition to low power consumption, these systems provide stable performance without requiring the daily oversight and expense of a full-time operator. NPS staff handles periodic operation and maintenance for the AX-Max units at Stinson Beach.

As wastewater flows fluctuate depending on the number of visitors to Stinson Beach, the AX-Max units automatically adjust to consistently meet treatment levels of 30 milligrams per liter (mg/L) 5-day Biochemical Oxygen Demand (BOD5) and Total Suspended Solids (TSS). The units were designed to handle an average daily flow of 36 m^3/day, with a maximum capacity of 71 m^3/day.

A variety of control panels manufactured by Orenco Controls™ are used throughout the Stinson Beach wastewater treatment system. Duplex MVP panels control the flow of effluent from each of the four STEP tanks to the flow equalization tank. These panels include a cell phone dialer for automatically calling in alarms to the NPS SCADA system.

Additionally, an Orenco Controls TCOM™ panel monitors and controls the operation of the treatment units as well as the timed dispersal of treated effluent to a multi-zone gravel trench drainfield. This panel, along with the panel controlling the flow equalization tank, is housed in a corrosion-resistant DuraFiber™ building made by Orenco Composites™ and located next to the AX-Max units.

This summer, when as many as 5,000 people per day will enjoy a sunny afternoon at Stinson Beach, none of them are likely to notice the three sand-colored AdvanTex AX-Max units sticking partially out of the ground near a maintenance building and quietly purifying effluent. But even though they won't be noticed, they're definitely appreciated by the National Park Service staff, who rely on these robust treatment units to keep the facilities running smoothly.

Left: When the septic tanks and drainfields at Stinson Beach were coming to the end of their useful lives, a septic tank effluent pump (STEP) system was installed. Also known as an effluent sewer system, a STEP collection system takes advantage of onsite tanks for the settling of solids and the primary treatment of wastewater, which reduces the organic and solids load at the treatment facility.

Top left: AdvanTex® AX-Max™ units provide cost-effective wastewater treatment at Stinson Beach in the Golden Gate National Recreation Area. The units are easy to maintain, which allows National Park Service staff to handle their operation and maintenance.

Top right: An AX-Max™ Treatment System can treat up to 56.8 m^3/day of primary-treated effluent. The system is pre-plumbed, with treatment, recirculation, and discharge equipment all located in an insulated fiberglass tank, which is available in lengths from 4.3 to 12.8 meters.

Photos by Orenco