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UNLEASH Innovation Lab inspires water solutions

Reliable, onsite wastewater treatment in Australian outback

By Bill Hensley, Orenco Systems, Inc.

One of the most scenic places in Australia's Northern Territory, the Victoria River, is a good place to catch barramundi – a type of native sea bass known for its delicious, buttery flavor. As the river makes its way to the Bonaparte Gulf, it runs past Timber Creek, a very small settlement that is home to the Wirib Tourist Park. The park offers a variety of overnight lodging, from camping spaces to cabins and motel rooms. Amenities include a swimming pool, communal kitchen, laundry facilities, showers and bathrooms. The store sells fresh food, groceries, ice, and bait. Travelers can also buy gas, which is especially important because Timber Creek is approximately halfway along the 515-kilometer (320-mile) stretch of outback between the larger towns of Kununurra and Katherine.

The Wirib Tourist Park was earmarked as an ongoing sustainability project and is part of the government indigenous food security program and servicing three local indigenous communities, who rely on fish from a nearby creek as a source of food. Unfortunately, the park's existing AWTS was undersized and couldn't adequately treat the wastewater flows produced onsite, particularly during periods of high occupancy.

When the AWTS overflowed, the creek received untreated wastewater. This meant that popular Victoria River fishing spots were also potentially exposed to contamination. These smelly overflows not only caused serious potential health and environmental concerns but were also a cultural concern with the local aboriginal communities as a source of play and traditional culture. Local residents and community members raised a variety of complaints until the DOH stepped in.

The Aboriginal Investment Group (AIG) act as facilitators and park custodian for the indigenous tribal owners. In August of 2014, AIG received a notice from the DOH that the wastewater pollution

of Timber Creek must stop or the park might have to be closed.

AIG began to search for a technology that would effectively fix the current problem and also provide an opportunity for future expansion. Due to the park's remote location and the lack of skilled maintenance personnel in the area, AIG needed a highly reliable onsite wastewater treatment solution that was robust, easy to operate and maintain, and financially sustainable.

AdvanTex® solution

ENVIRA Holdings were the successful tenderers, offering an innovative design that called for the existing AWTS to be converted into a primary septic tank followed by an Orenco® AdvanTex® AX100 Treatment System for advanced secondary treatment and filtration. And an Orenco Biotube® pump vault would be installed so that the primary-treated wastewater could be pumped to the new treatment system.

The pump vault houses the filter, the pump, and the float switches. The Biotube filter consists of 3-millimeter (1/8-inch) mesh, which prevents the discharge of any larger solids. Orenco's lightweight effluent pump is made of stainless steel and engineered plastics. It has a life

The park's existing AWTS was undersized and couldn't adequately treat the wastewater flows produced onsite, particularly during periods of high occupancy.

expectancy of more than 25 years, similar to the effluent sewer systems across the ocean in Elkton, Oregon, United States.

The AdvanTex AX100 unit provides advanced secondary wastewater treatment by means of a highly efficient, lightweight textile that has large surface area and void space. Primary-treated wastewater is distributed over the textile in micro-doses throughout the day. This ensures an unsaturated environment while maximizing treatment performance.



Problem

The cabins and store at the Wirib Tourist Park located at Timber Creek in the Northern Territory of Australia were served by an Aerated Wastewater Treatment System (AWTS) that was aging, too small for peak flows and unable to handle the high-strength sewage of the site. This resulted in untreated wastewater being dispersed not far from a local creek and river system, creating health and environmental risks. This creek and river system is also a significant indigenous area and sacred site. The Northern Territory Department of Health (DOH) issued a notice to the park custodians that they must address the failing AWTS or risk having the park closed.

Solution

With plans to expand the park in the near future, the custodians needed a reliable system that could be installed in phases to accommodate their budget timing. Due to the remote location of the site, they also needed a system that was easy to operate and monitored remotely. They contracted with ENVIRA Holdings Pty Limited, who chose to incorporate an Orenco® AdvanTex® Treatment System into their design, because it fulfilled all requirements and could meet stringent treatment levels, despite high-strength wastewater and extreme variations in flow.

Treatment media in the AdvanTex AX100 is a uniform, engineered textile, which is readily serviceable and allows significantly higher loading rates than traditional recirculating gravel or sand filters. Photo by ENVIRA Holdings



Highly reliable and easy to operate, the AdvanTex AX100 was the best solution for this remote area that lacked skilled maintenance personnel. Photo by ENVIRA Holdings

Following AdvanTex treatment, effluent is dispersed through an ENVIRA treatment and disposal system known as an Integrated Transpiration System (ITS[©]). The ITS is a phytoremediation system using evapotranspiration beds planted with select vegetation. Any water not taken up through evapotranspiration or root uptake is routed through a disinfection unit and then dispersed to a sub-surface drip irrigation system.

Because the AdvanTex system is modular, the initial capital cost of this Wirib Tourist Park upgrade was minimized. Startup began in November 2016.

According to Matt McKennariey, the system designer and installer and director of ENVIRA, "In selecting the Advantex system as an integrated component of our overall solution, we were extremely impressed by the robustness of the AX100 textile filter as well as the engineering and quality of the Orenco solutions. Utilizing the Biotube pump vault made retrofitting the existing AWTS a relatively simple refit."

ENVIRA staff now monitors the system remotely year-round via Orenco's SCADA-compatible TCOM™ Telemetry control panel and visits the site bi-annually to perform routine operation and maintenance.

"With complex issues affecting our critical tourism asset and potential revenue flows, ENVIRA Holdings listened carefully to my needs," said AIG Chief Executive Officer Steve Smith, "and after consultation, came back with some innovative approaches to solving my technical and budgetary problems. The rest was easy, as they designed a two-stage approach to accommodate budget timing, commissioned their rigorous risk-based engagement process, and dealt with the regulators

When the AWTS overflowed, the creek received untreated wastewater. This meant that popular Victoria River fishing spots were also potentially exposed to contamination.

managing the approval processes." And, the company also managed construction in such a way that allowed the park to continue trading – "which was extremely important to our business," Smith added.

Covering an area of approximately 13,000 square kilometers (5,000 square miles), the Wirib Tourist Park is home to red-rimmed cliffs, plunging gorges, and ancient Boab trees. And now, thanks to an innovative design that includes an AdvanTex Wastewater Treatment System, the park can continue serving all those passing through the outback on Highway 1 who need a place to rest and rejuvenate.

Author's Note

Bill Hensley is an international project manager for Orenco Systems, Inc. In his primary role, he manages engineered projects outside of the US and Canada. The author is based in Portland, Oregon, US.

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by researchers at the University of Tennessee, Knoxville. The study demonstrated that the BLEST AEC was able to remove over 99 percent of total PFOA and PFOS from the feed stream using a single treatment stage.

Interestingly, Phase I test results also showed that PFOA and PFOS were not present in the AEM or CEM Chambers above 30 ppt after treatment, suggesting that they are either being chemically modified, bound on the membrane, decomposed by the AEC, or a combination of those outcomes – a hypothesis that BLEST is currently assessing. Testing also showed that the AEC technology is able to concentrate other heavy metals and suspended solids, removing them from the treatment stream.

BLEST's initial work successfully established that the AEC could remove high concentrations of PFAS in a continuous flow-through device, producing two streams: a PFAS-free stream as well as a highly concentrated PFAS stream ready for subsequent treatment by methods like advanced oxidation.

The AEC technology has potential to significantly reduce the cost of water treatment in a full-scale application, creating the potential for widespread implementation of PFAS treatment systems for wastewater and reducing the chemicals' accumulation in the environment and aquifers.

"We believe a solution to the PFAS crisis is directly in line with our mission, knowledge, and experience," BioLargo, Inc. President and Chief Executive Officer Dennis Calvert commented on the commercial implications of the AEC. "We plan to get the technology field tested and launched commercially as soon as possible."

Future funding for further testing

BLEST submitted an application for additional EPA funding to accelerate its work under a Phase II SBIR grant. In the proposed project, the team will create a pilot

Humans are exposed to PFAS on a daily basis in items such as clothing, food, personal care products, cookware, food containers, and wrappers.

unit to field test the technology in commercial and industrial settings at a small commercial scale. They are in the process of selecting the partner communities that will act as the test sites.

"We believe we have made a strong case in our application to the EPA for additional financial support under the Phase II SBIR grant program. Our team has decades of experience delivering engineering and science-based solutions," Randall Moore, president of BLEST, said. "Our goal is to deliver a low-cost, low-energy technology that will reduce the threat PFAS poses to people worldwide."

Authors' Note

Director of Strategic Marketing and Business Development Tonya Chandler and Director of Corporate Communications at BioLargo Engineering, Science, and Technology (BLEST) co-authored this article. The company is headquartered in Westminster, California, US.

For more information on this study and the work done by BLEST, the EPA has published the full Phase 1 report on their website at https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/10966/report/F. BLEST encourages anyone who is interested in PFAS treatment to read the study and contact by email: tonya.chandler@biolargo.com.

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