

Town of Huntsville Wastewater Treatment Plant

Application: Affordable and rapid packaged plant retrofit of existing WWTP

Capacity: 300,000 gpd (1,135 m³/d)

Location: Huntsville, Tennessee, USA

Commissioned: December 2004



Challenge

In the fall of 2002, a state-enforced sewer moratorium prohibited new sewer hookups until the town could solve overflow and washout problems at its conventional oxidation ditch wastewater treatment plant (WWTP). Constructed in 1989, the 150,000 gallon-per-day (GPD) (568 m³/d) WWTP was consistently meeting the treated effluent limits of its discharge permit. But with average day flows at almost 85 percent of capacity, the plant was unable to handle increased flows during wet weather or periods of high demand, which threatened the New River and the environmentally sensitive Big South Fork National River and Recreation Area.

Solution

The solution involved an innovative and affordable retrofit of the facility with a GE Water & Process Technologies, ZeeWeed* membrane bioreactor (MBR) package plant that doubled treatment capacity

to 300,000 GPD (1,135 m³/d) and can consistently deliver high quality effluent to the receiving rivers.

Working with consulting and engineering firm Jordan, Jones & Goulding (JJG) the Town of Huntsville selected MBR technology for several reasons including declining system costs, ease of operation, high quality effluent discharge, and a compact process footprint. With a steep slope at one side of the plant, and a nature trail on another side, membranes were the only way to expand the plant within the existing footprint. The retrofit began in October 2003, with the construction of a new influent line and new headworks. A new equipment building was also constructed for the blowers, pumps and control equipment of the ZeeWeed MBR.

Work continued without affecting the operation of the existing plant; however, the equalization basins were taken out of service, since they would be retrofitted to contain the new ZeeWeed membrane cassettes. A new concrete wall was poured in the center of the equalization basin to divide it into two separate membrane trains, and piping was added to accommodate the membranes.

The 110,000 gallon (416 m³) oxidation ditch became the new equalization basin. The larger volume dramatically increased the plant's ability to handle large volume flows during high use or wet weather. Construction was completed in the fall of 2004, and the new WWTP was fully operational in December 2004.

Process Overview

Incoming wastewater flow first passes through a 2 inch (50 mm) coarse bar screen to remove large debris, followed by a 0.08 inch (2 mm) continuous-belt band screen that removes finer debris. After screening, a high-flow diversion weir ensures that the incoming flow does not exceed the treatment capacity of the MBR. Flows greater than 0.5 MGD

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(1,892 m³/d) are diverted to an equalization basin, while the balance of the flow is equally split between the two process trains of the bioreactor.

Two parallel trains of anoxic and aerobic tanks make up the bioreactor and operate independently of each other to enhance process optimization and simplify cleaning processes. ZeeWeed membranes are immersed directly into the aerobic zone of the bioreactor and filter treated effluent from the mixed liquor. A slight vacuum is all that is required to draw water into the membrane fibers and filter out impurities.

Since ZeeWeed MBR removes solids by filtration rather than settling, the process is also much more effective than conventional treatments, and can operate at a much higher mixed liquor suspended solids (MLSS) concentrations. The Huntsville WWTP operates its bioreactor at an MLSS of 10,000 mg/L, compared to 3,000 to 5,000 mg/L for a conventional system, resulting in a relatively smaller plant footprint.

Membrane fibers are automatically cleaned with a clean-in-place backpulsing process that forces permeate water back through the membranes. This dislodges any particles that may adhere to the membranes. Aeration of the membranes is also used to scour debris from the fibers and provides mixing within the process tank to maintain solids in suspension.

When necessary, in-tank chemical cleaning can also be automatically performed if membrane fouling reduces permeability below a specified performance level.

The flexible two-train system gives operators the ability to schedule cleaning during periods of low demand, when one train can be offline, while the other continues operating.

The efficiency of the system and the automated processes has reduced chemical usage by 50 percent over Huntsville’s previous WWTP. The plant is also using the high quality effluent for wash water at the fine screens and washdown water in the sludge press, eliminating the use of treated municipal potable water for this purpose and saving about \$1400 per month.

Results

Effluent from the plant consistently exceeds discharge requirements specified by the plant’s National Pollution Discharge Elimination System (NPDES) permit.

Several businesses, residences, and an elementary school have already been connected to a sewer line to the east, and the Town expects to add new customers each year.

As we grow, we’re proud to know that we’re putting the best water that we can back into the river. We’re also confident that as NPDES standards continue to become more stringent, our MBR system will be able to handle virtually any discharge requirements for the foreseeable future. (Mayor Potter).

Typical Effluent for Huntsville WWTP		
Parameter	Treated Effluent	NPDES Limit
BOD (mg/L)	1.0	4.0
TSS (mg/L)	0.75	30
Ammonia (mg/L)	0.18	1.5

Process Flow

