

Xylem develops Sanitaire aeration system for clean water plant

CASPERON solution brings process, operation and cost benefits to Michigan facility

For 15 years, plans to double the capacity of Michigan's Zeeland Clean Water Plant remained stalled as the City of Zeeland worked toward a joint wastewater treatment contract with two neighboring Ottawa County communities. As a result, maintaining efficient aeration control posed a challenge for the 1.65 million gallons per day (MGD) facility. A manually operated system combined with inadequate mixing capabilities resulted in over-aeration and wasted energy. When expansion plans moved forward in 2016, the city alleviated those problems with the Xylem Sanitaire CASPERON activated sludge solution process, which eliminated the use of lime to treat waste and significantly reduced the volume of biosolid residuals.

The Challenge

According to Zeeland Clean Water Plant superintendent Doug Engelsman, the facility, which was built about 100 years ago and last upgraded in 2009, was aging in almost every area but headworks. The plant needed to better control the treatment process to improve total nitrogen and phosphorus removal. Reducing energy and chemical consumption and wear on the blower were also important goals.



Primary sedimentation tanks which allow heavy debris to float to the bottom to treat wastewater.

CUSTOMER: Zeeland Clean Water Plant, Zeeland, Michigan

XYLEM SOLUTION: Sanitaire CASPERON process with Silver Series II membrane disc diffusers, OSCAR, YSI instrumentation and automated control valves

RESULT: The plant is now matching aeration to loading, providing stable effluent quality compliance within limits and energy savings of approximately \$22,000 per year

The new system design reduced the amount of lime needed to stabilize biosolids, resulting in savings of \$47,000 per year

CASPERON upgrade resulted in increased hydraulic capacity by 27%; increased Biochemical Oxygen Demand (BOD) load treated by 84%

With the OSCAR Process Performance Optimizer the plant realized 19% energy savings per lb BOD treated, and 70% alum savings

Benefit	Impact	
Energy cost savings	\$22,000/year	
Environmental impact in lime reduction	\$47,000/year	
Energy savings per lb BOD treated	19%	
Environmental impact in reduced polymer and lime chemical usage	70%	
Alum savings	70%	



In order to meet these challenges, the city contracted with Moore & Bruggink to provide construction engineering services for a major upgrade to the clean water plant. The construction project expanded the plant from 1.65 MGD to 3.5 MGD average flow. The added flow enabled the Holland and Zeeland townships to become wholesale sewer customers.

The Xylem solution

Moore & Bruggink engaged Xylem's Sanitaire brand to design a complete solution for Zeeland Clean Water Plant, including aeration systems for the aerobic tanks and a digester, six Flygt 4410 mixers and two Flygt 4630 mixers. The solution also included new blowers, air control valves, air flow meters and fiberglass baffle walls.

As part of the CASPERON solution, the Zeeland Clean Water Plant also was upgraded with an OSCAR performance optimizer control system with dissolved oxygen (DO), ammonium, nitrate and phosphate control.

"With the Bio-P (biological) process there is no need for the polymer and alum that was previously used," said Englesman. **"Any time chemicals are reduced from the treatment process it is a win for the receiving waters and biosolids disposal program."**

The CASPERON solution also enables the Zeeland Clean Water Plant to have a treatment process that is environmentally friendly and features efficient equipment that saves the community electric use, Englesman noted.

Adding automation

The expansion project included automation of the aeration system to increase efficiency. The adoption of online instrumentation has dramatically increased the DO measurement functionality. Modern online instruments are capable of measurements at a frequency, accuracy and reliability suitable for process control at a reasonable cost.

Strict control of DO is required in order to create the conditions necessary to achieve biological removal of nitrogen and phosphorus. Adding automation at the Zeeland facility has improved process performance, and minimized energy consumption and chemical usage throughout the plant. Ongoing monitoring of plant processes has resulted in an estimated cost savings of \$24,500 per year for the City of Zeeland.

To support real-time monitoring and control, YSI instruments were installed in the basins, including dissolved oxygen probes and VARIION ion selective electrode sensors, which measure ammonium, nitrate and potassium. The sensor control zones take readings and speed up or slow down the removal process to maintain optimum oxygen levels.



Crews install rebar on a tank during the expansion of the Zeeland Clean Water Plant.



Crews work on construction of a new primary tank during the Zeeland Clean Water Plant expansion in 2016.



View of a Flygt 4320 mixer inside the tank.



An aerial view of the Zeeland Clean Water Plant.

Plant staff can remotely control parts of the facility minimizing the need to access the system hands-on or come in during the night to address a problem. They can also monitor energy usage and identify conservation efforts.

Results

Today, the Zeeland Clean Water Plant has two primary tanks, six aeration tanks featuring CASPERON, the biological nutrient removal system, two final clarifiers, an ultraviolet disinfection system building, a RAS blower building, a laboratory building addition, two aerobic digesters, an odor control system and new integrated OSCAR SCADA controls.

The expansion allows the Zeeland Clean Water Plant to receive and treat an additional 1.1 million gallons of wastewater per day from Zeeland and Holland townships. Now, 2.2 million gallons of wastewater flow through the plant daily.

The OSCAR control system automatically controls blower speed and operation, and maintains stable DO concentration that the plant could not previously achieve with manual operation. As a result, the Zeeland Clean Water Plant has experienced improved total nitrogen removal and reduced energy consumption and wear on the blower. In addition,

the controller optimizes the process for biological phosphorus removal, resulting in effluent total phosphorus concentrations consistently below 1 mg/l with minimal to no chemical addition.

Since it began operation, the digester aeration system has also delivered significant energy savings and considerably reduced the total volume of biosolids residuals to be processed. At a 30 percent Volatile Suspended Solids reduction, that equates to 342,210 lbs. of solids per year that no longer need disposal. Improved VSS destruction in turn means a reduction in the amount of lime needed to stabilize the biosolids. The plant has realized a savings of \$47,000 per year in lime costs, as well as a \$20,000 per year decrease in biosolids hauling costs compared to its previous system.

As a result of the plant expansion project, the city of Zeeland has realized energy savings of more than \$22,000 per year. Aside from energy efficiency, Engelsman said more precise aeration control has resulted in more efficient use of staff. The installation of reliable, efficient equipment also has improved the quality of the effluent and provided a major reduction in chemical use.