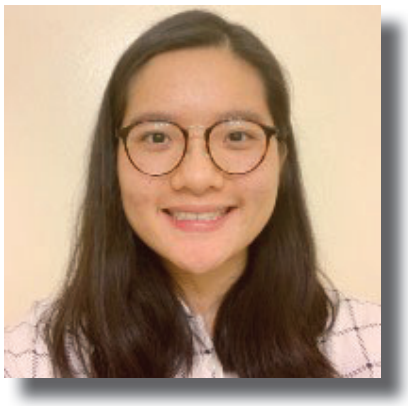
Otsego West WWTF



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Organization Background

The West Otsego Wastewater Treatment Facility is one of two municipal wastewater treatment facilities operated by the City of Otsego. The facilities were constructed in 2005-2006, collecting domestic wastewater from the surrounding area, serving approximately 2,000 households. The Otsego West facility is an activated sludge process receiving 0.4 million gallons (MG) of wastewater daily.

"It was a fruitful experience working with the West Otsego Wastewater Treatment Facility. I have developed a deeper understanding of resource conservation and wastewater treatment. It's amazing to see all the possibilities we discovered in the project and I am very grateful for this wonderful opportunity." ~ IC

Project Background

The project was conducted to explore the opportunity for greater energy, chemical, and operational efficiencies at the Otsego West Wastewater Treatment Facility. The objectives were to save cost on chemicals used in nutrient removal, protect local waters, and save energy through operational modification. These objectives were targeted by exploring the implementation of biological nutrient removal (BNR) at the site. The facility was designed for nutrient removal considerations however was challenged with current conditions requiring supplemental chemical additions.

Incentives To Change

The Otsego West facility is currently permitted to release phosphorus in their effluent at an average concentration no greater than 1.0 mg/L, and they meet this limit through application of approximately 15 gallons of ferric chloride solution per day. While this process provides sufficient treatment for phosphorus, purchase of ferric chloride is a continuous operational cost for the plant. In addition, iron salts are a safety hazard (the material is highly corrosive), they also consume alkalinity, and can stain UV bulbs, which reduces disinfection efficiency, and increases the energy demand of the system. In addition, while the facility does not currently have an effluent limit on nitrate, nitrogen compounds are known to exert deleterious effect on receiving water bodies, including far downstream in the Gulf of Mexico.

"[The] MnTAP internship program is a great resource! Guidance is provided by an Associate Engineer; technical resources are used throughout the process and the intern puts it all together. Ingrid made it easy, providing cost saving options to improve facility nutrient removal magnifying environmental benefits."

- Kurt Neidermeier, Utility Manager

Solutions

External Carbon Source Addition

Through use of the computer modeling software ASIM (Activated sludge SIMulation), it was found that the wastewater facility was limited in its ability to perform effective treatment for nitrate and phosphorus by the low amount of raw organic material in the influent. This organic material, often quantified as BOD (Biological Oxygen Demand), is an essential ingredient for the biological removal mechanisms of nitrate and phosphorus. Further simulations with the modeling software illustrated that a continuous addition of carbonaceous material to supplement the influent of the plant could facilitate effective biological phosphorus and nitrogen removal using the plant's existing infrastructure.

Construction of a New Anoxic Tank

Another potential change that was evaluated with ASIM was the construction of a new tank to serve as an anoxic zone, immediately preceding the oxidation ditches. This was found to be an alternative to external carbon source addition, and that the new tank would need to be at least 270,000 gallons in order to achieve the same effluent nitrate and phosphorus concentrations that were predicted with the external carbon source addition. This finding was informative in that it illustrated an alternative approach to facilitating biological nutrient removal; however, the construction of a new tank was deemed to be too expensive.

Increase Frequency of Gravity Belt Thickener Operation

At the beginning of summer 2020, the Gravity Belt Thickener (GBT) was operated twice per week at the Otsego West facility. The GBT serves to reduce the volume of sludge prior to digestion and storage. The supernatant generated from the process is sent back to the first tank in the facility. This supernatant stream was found to have a very high concentration of nitrate and phosphorus. During the summer, at the recommendation of the intern, GBT operation was increased from twice per week to five times per week. Tests on the supernatant before and after this operational change showed a 90% reduction in phosphorus and a 61% reduction in nitrate concentration in the supernatant attributed to the increased operation. This change will result in less nutrient content returning to the head of the facility, as well as a more enriched biosolids that will perform better as a fertilizer when land applied.

Recommendation		Annual Reduction	Annual Savings	Status
1a	External carbon source addition	40,000 lbs. Ferric Chloride 10,000 lbs Phosphate P 6,300 lbs Nitrate N	$13,000 from ferric chloride application	Recommended
1b	Construction of new anoxic tank		TBD	Not Recommended
2	Increase frequency of Gravity Belt Thickener operation	700 lbs Phosphate P 1,500 lbs Nitrate N	TBD	Implemented

MnTAP Advisor: Josh Kirk, Associate Engineer