Providing Measurable Results

Upgrading with the Times

The Plant City, FL, Water Reclamation Facility is no stranger to improvements. Between 1973 and 1997, the municipal plant, located just northeast of Tampa, underwent five upgrades to handle increased loading and flows, meet sludge regulations and federal requirements concerning the use of gas chlorine, and eliminate discharge to its receiving stream, among other objectives.

Despite all of the upgrades at Plant City over the years, there had not yet been any significant improvements to the biological treatment section of its 8-MGD wastewater treatment system. The system was not designed to meet some of the current regulatory requirements 100% of the time. In 2004 Plant City began design on an expansion of the facility, working with engineering firm Malcolm Pirnie (now Arcadis) and Encore/Matthews, a joint venture firm serving as contractor. After a pilot study for a fine bubble diffuser was conducted in 2005, Environmental Dynamics International (EDI) was selected to provide an aeration system set up in three oxidation ditches at the plant.

Since the completion of the expansion project in 2008, the facility has received multiple honors by the Florida Water Resources Assn. at the Florida Water Resources Conferences, and it cites EDI’s aeration system as vital to its success.

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The upgraded WRF is designed to treat 10 MGD with a peak flow treatment of 27 MGD, according to Patrick Murphy, chief plant operator for the city of Plant City. Wastewater is collected from the city via underground pipes and flows, or is pumped to the facility, where it is either treated for reuse or disposal. It enters the facility at the headworks, where it undergoes preliminary treatment using a mechanically cleaned fine bar screen, a backup manual bar screen and a grit removal system. Odor is also removed and treated using caustic soda. The water is then pumped to new, 130,000-gal anoxic tanks that excite nutrient-removing bacteria and trap heavier grit.

From the anoxic tanks, the water flows into three aeration basins, where four 400-HP Turblex single-stage blowers introduce dissolved oxygen to remove waste nutrients, and six Flygt mixers in each basin keep the flow pattern moving around the tank. It is here where 496 fine bubble diffusers from EDI are mounted to the floor of each aeration basin, for a total of 1488 diffusers installed. These diffusers provide vertical mixing and oxygen transfer in order to break down raw sewage constituents and destroy pathogenic organisms. EDI’s system was selected over several other manufacturers after the 2005 study found its diffuser tubes showed “excellent” air distributions and profiles.

The measurement of diffuser physical properties provides an indication of the type and magnitude of changes in the diffuser material itself that may occur during service,” said Murphy. “EDI provided three types of diffuser tubes for pilot
PLANT CITY, FL

CASE STUDY: PLANT CITY, FL

Mixed liquor suspended solids (MLSS) overflow the aeration basin through a splitter box, and ferric sulfate is introduced to induce phosphorous removal. The flow is then diverted to selected 1.2-MG secondary clarifiers, where suspended solids settle to the bottom of the tank and water overflows the top. Solids are pumped from the bottom of the clarifiers back around to the aeration basins, and scum is skimmed off the top and sent back for retreatment.

From the clarifiers, effluent flows via gravity to the Parkson DynaSand continuous upflow filter, and is immediately measured for turbidity followed by chlorine injection for disinfection. The effluent then passes into chlorine contact chambers.

Effluent meeting Florida Department of Environmental Protection (DEP) Part III of the Water Quality Standards for Reuse is pumped from the chambers into ground storage tanks, where it is redistributed to the facility’s reclaimed water customers. Any excess water is diverted to the East Canal after dechlorination and re-aeration. Water that does not meet reuse standards is automatically rejected into three, 2.5-MG reject storage basins, where it is re-entered into the treatment process.

SUCCESS STORY

Startup of the aeration system took place in 2007, and the upgraded Plant City WRF was placed into service February 2008. Since then the plant has been able to operate with only two of the three aeration basins running at a time, a remarkable feat according to Marc Salmi, regional manager at EDI. And despite the plant being designed for a flow of 10 MGD, it currently records an annual average flow of 4.715 MGD.

At the plant, nitrogen and phosphorus annual average levels in the wastewater discharge have been recorded between 0.8 to 1.4 mg/L and 0.09 to 0.14 mg/L, respectively—well below the 3 mg/L and 1 mg/L annual average limits. Using the Turblex single-stage blowers also resulted in an immediate cost savings from the previous system, which had required eight 100-HP mechanical mixers, all continuously running to introduce the oxygen required. With only one blower currently needed to satisfy oxygen requirements, the system’s energy usage is down to 400 HP from the previous 800 HP. The new process is also more efficient and automatically controlled by a nutrient analyzer mode, which reads ammonia, nitrate and phosphorous around the clock, or a dissolve oxygen mode, where HACH LDO probes read dissolved oxygen concentrations from two points in each air bay.

Plant City has garnered much attention since its 2008 upgrade, winning numerous awards, such as the First Place Earle B. Phelps, Advanced WWTF Award from the Florida Water Environment Assn. in 2012 and 2015; Runner-Up Earle B. Phelps, Advanced WWTF Award in 2013 and 2014; Outstanding Facility, WRF by the Florida Water & Pollution Control Operators Assn., Region 12, in 2014; and the 2009–2010 Water Resource Project of the Year by the American Public Works Assn.

“No wastewater plant is the same—some are strictly domestic, some have industrial contributions, all have different loadings and contaminants that need to be removed as efficiently as possible,” he continued. “Plant City’s utilities director had the foresight to have a pilot study performed to make sure the city ended up with diffusers that would work satisfactorily in our waste contributions,” Murphy said. “The training and operating manual documentation were done well and provided assurance of operating and maintenance procedures for sustainability of the equipment. The support provided from EDI and the sales representative (EnviroSales of Florida) has been superb.”