SHOWCASE PROJECT: THE CITY OF GRAND RAPIDS WATER RESOURCE RECOVERY FACILITY: INTEGRATED REAL TIME CONTROL OF THE WATER RESOURCE RECOVERY FACILITY

SOLUTION OVERVIEW

The City of Grand Rapids Water Resource Recovery Facility (WRRF) treats almost 1.5 billion gallons of sewage annually, with a daily average of 40 million gallons from the City of Grand Rapids, Michigan, and 11 surrounding communities. The WRRF staff are also responsible for 54 sanitary sewage lift stations, 9 storm water stations, 4 meter stations, 120 sanitary and storm sewer flow monitors, 14 rain gauges, 1,100 miles of sanitary sewer, 383 miles of storm sewer, and 17,800 catch basins. Previously, employees had to physically staff operating stands, with little to no connection between plant or process-information and the controls. To further improve efficiency, Grand Rapids sought to enable real-time, plant-wide process control.

As the City of Grand Rapids grew, the load on WRRF increased and biochemical oxygen demand (BOD) began to approach the agency's permit limit. In order to lower energy costs and smooth out peaks in BOD levels, the facility decided to work with energy technology firms to incorporate sensors and software into its existing Supervisory Control and Data Acquisition (SCADA) system. By installing sensors and monitoring them in real-time with new software, WRRF is now able to optimize supervisory control system-settings.

SECTOR TYPE

Industrial

LOCATION

Grand Rapids, Michigan

PROJECT SIZE

198,000 square feet

FINANCIAL OVERVIEW

$248,000

SOLUTIONS

The goal of the project was to deliver tools for:

- Data-driven real-time process management;
- Translation of data to process knowledge;
- Integrated planning;
- Maximum utilization of sensor data; and
- Sustainable methods.

Specifically, the functions targeted for integration with WRRF's SCADA as part of a cohesive control optimization strategy include:

- Control of upstream infrastructure;
- Optimization of aeration control to reduce energy consumption and maximize Ammonia removal;
- Enhancements to the aeration control system, such as most open valve controls within the air distribution system;
- Sludge age control;
- Biological Phosphorous Removal; and
- Pollutant Loading Control.

The vendor made an energy model of the facility and used it to run different simulations during the project implementation process, tweaking improvements as they went along. WRRF implemented changes relatively slowly, starting in July 2016, so as not to upset the legacy system. Most improvements were completed as of January 2018 but full implementation is not expected until January 2020.

OTHER BENEFITS

In addition to overall energy savings and better facility controls overall, an important benefit of the project is that it has helped WRRF staff better understand BOD loadings from the concentrated waste tank. The facility is now able to increase the volume fed during more of the "valley" times, such as overnight, so that there is as consistent of a loading as possible with no extreme ups and downs. This improves energy efficiency by preventing large demand spikes and enabling the aeration and other treatment equipment to operate closer to design points for optimum efficiency.

The implementation of a Real Time Ammonia Control system, which produces a variable dissolved oxygen set point based on real time ammonia measurements, has demonstrated particularly impressive savings. A train of aeration controlled by the real time controller demonstrated a 15% energy reduction compared with train operated with a static dissolved oxygen set point, representing annual savings of almost $20,000 per train. The system was installed on both the north and south trains, yielding annual energy savings of approximately 440,000 kWh and $40,000 per year.

The improved understanding of the system enabled by the real time controls has also given facility staff greater confidence to try other things – WRRF is currently constructing three bio-digesters to generate on-site energy. The first phase of the project will be completed in 2019.

Annual Energy Use

Annual Energy Cost

Energy Savings

Cost Savings

Aeration control 1

Aeration control 2

New blower

UV system