

Charlie Brown, plant superintendent, with two of the new 18 Gorman-Rupp pumps installed during the upgrade at the Shelby plant.



Beating Back Bypasses

A PLANT UPGRADE INCLUDING NEW PUMPS AND CONTROLS AND A PLANT-WIDE SCADA SYSTEM HELPS AN OHIO CITY SOLVE A LONG-STANDING PROBLEM OF COMBINED SEWER OVERFLOWS

By Jim McMahon

The Ohio city of Shelby recently upgraded its activated sludge wastewater treatment plant to double its capacity to 5 mgd while expanding capability to treat and disinfect combined high-volume stormwater and wastewater flows.

The project upgraded much of the plant from its original equipment installed in 1953. A major component of the upgrade was the replacement of 18 Gorman-Rupp pumps throughout the plant with new higher-performance pumps from the same company.

These included storm and raw wastewater pumps, return activated sludge and waste activated sludge (RAS/WAS) pumps, and digester recirculation pumps. (Many of the original pumps, although old, were still operating.)

TACKLING OVERFLOWS

Eliminating combined sewer overflows (CSOs) is a significant issue facing many clean-water utilities. They are a major water pollution concern for some 800 cities in the United States that have combined sewer systems, according to the U.S. EPA.

Driven by the Clean Water Act of 1972, communities that have CSOs must develop plans to mitigate their impact on the environment. The EPA's CSO Control Policy provides guidance on how communities with combined sewer systems can meet Clean Water Act goals as flexibly and cost effectively as possible.

Shelby, between Columbus and Cleveland in north-central Ohio, has a population of 8,900. The activated sludge wastewater treatment plant, fed by 70 miles of sewer lines, processes 1.9 mgd from 3,787 residential customers, 260 commercial businesses and 20 industrial facilities. The treatment plant's activated sludge process was built in 1953, and plant upgrades were completed in 1977, 1988 and 2005.

The service area is subject to flooding; a significant amount of the collection system lies within the floodplain of the Black Fork of the Mohican River, which flows through the downtown. The sewer system is susceptible to very high wet-weather flows that result in periodic sanitary sewer overflows (SSOs) and bypasses.

NEED FOR CAPACITY

The existing treatment plant lacked capacity to treat very high flows during wet weather; inflow and infiltration to the collection system was estimated at 0.5 mgd. The plant was old, with a number of outdated components that contributed to wet-weather bypasses.

"The plant was designed to treat an average daily flow of 2.5 mgd and a maximum daily flow of 5.0 mgd," says Charlie Brown, plant superintendent. "Flows in excess of 5.0 mgd would overflow to the plant's 2 million-gallon storage basin for temporary holding until the plant had available capacity."

When that basin fills completely, it overflows to a secondary 18 million-gallon storage basin. And when that basin fills to capacity during a storm event, it overflows untreated into the river. To meet the terms of its NPDES permit, the city was required to eliminate wet-weather bypasses and improve secondary treatment capacity.

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CHARLIE BROWN

To achieve that goal, the city in 2015 retained CT Consultants to prepare a comprehensive facility plan designed to identify plant shortcomings, review wet-weather treatment alternatives and develop an overall plant improvement plan.

COMPREHENSIVE UPGRADE

"We reviewed five engineering firms and asked them how they would upgrade the plant," says Brown. "Based on their suggested plans, we selected CT Consultants. It took approximately two years to engineer because we wanted to review a number of equipment options. We visited many plants in other cities within the state, looking at installed equipment and talking with



Super T Series self-priming pumps replaced submersible pumps in the stormwater pump station, making it safer, easier and more economical to perform routine pump maintenance.



The plant upgrade specified Gorman-Rupp products including multiple submersible pumps, this one used to transfer sludge.

plant operators and maintenance crews before we settled on a system design.”

The resulting plan encompassed improvements to multiple plant processes, with aims to enhance capacity, operability and reliability. These included:

- Replacing outdated headworks equipment
- Replacing storm and raw wastewater influent pumps
- Upgrading the primary settling tanks and aeration systems
- Adding a new final clarifier
- Replacing digester recirculation pumps and floating digester covers
- Replacing chlorination with UV disinfection
- Replacing the secondary RAS/WAS pumps
- Constructing a new septage receiving station

In addition to the pumping equipment and controls, Gorman-Rupp provided control technology that oversees complete operation of the plant. This included replacing the blowers with turbo and positive displacement blowers, and implementing a plant-wide SCADA system.

CRITICAL PUMPING

“We took a holistic look at the plant in its current state to deal with wastewater and stormwater,” says Chuck Hall, senior business development man-

ager with CT Consultants. “One major issue was equipment that had long since outlived its useful life. Some of the pumps and blowers dated back to 1953. They were still running but needed to be upgraded to handle higher capacity.

“The Ohio EPA wanted the overflows stopped or significantly minimized. To achieve that we increased the capacity of the stormwater intake pumps to maximize use of the stormwater basins. We also added a 60-foot-diameter third clarifier to increase the storm capacity of the plant and had the existing two clarifiers rebuilt and upgraded.”

In 2019, a bid to build the upgrade to the plant was awarded to NorthBay Construction. The company handled the electrical, mechanical and process mechanical work, concrete work, site excavation and all equipment purchases, installation and commissioning. Essentially, the project was a full plant upgrade.

“A critical aspect of the project was the pumping systems within the plant, which were all upgraded,” says Peter Manns, president of NorthBay.

DIVERSE PUMPING TECHNOLOGY

Some of the pumps at Shelby had been in continuous operation since 1953 and the rest since the 1977 upgrade. Brown observes, “One of the biggest reasons I pushed for Gorman-Rupp pumps was that our four major sewage and stormwater influent pumps had been running nonstop every day since 1977. The equipment was well maintained and the rear plates, rotating assemblies and impellers were routinely changed out, but if this rotary equipment lasted that long, it has proven performance capability.”

The plant upgrade specified Gorman-Rupp products including multiple submersible pumps (used to transfer sludge), one ReliaSource packaged pumping system and one general purpose, portable, engine-driven, priming-assisted dewatering pump.

“Influent pumps are critical to wastewater treatment plant operation because they control the flow of wastewater and stormwater into the plant,” says Hall. The four influent pumps were replaced with self-priming, centrifugal Super T Series 10-inch pumps.

The self-priming suction lift design of the pumps allows design engineers to physically locate the pumps where access is a non-issue and routine maintenance can be completed quickly and easily. The pumps’ solids-handling capability made them well suited for Shelby’s solids-laden influent. “We were able to provide better control of the plant’s influent pumping by replacing and upsizing all of those pumps,” says Hall.

A BOOST FROM SCADA

Every process in the facility where wastewater and stormwater flows was equipped with new pumps. “Our pumps are installed at the new influent and stormwater pumping stations, as well as in the clarifiers’ RAS/WAS systems,” says Vince Baldasare, sales manager for engineered systems at Gorman-Rupp. “We also installed sludge recirculating and transfer pumps in the anaerobic digester, and miscellaneous pumps throughout every process on the site.”

The new SCADA system for the first time enabled automated plant process operation. “The difference is like night and day,” says Brown. “The operation of the plant has been transformed from 1950s technology to state of the art. We now have readouts in real time on what is occurring with DO and pH levels, what equipment is running, and how well it is performing.”

Completed in 2019, these improvements have eliminated wet weather bypasses, addressed NPDES permit obligations, upgraded plant processes and infrastructure and improved treatment capacity. Replacement of the 1952-vintage blower turbines has led to \$6,000 to \$8,000 monthly savings on electricity.

“The quality of the effluent being discharged is definitely better,” says Brown. “DO and TSS, although within requirements before, are now improved. The digestion rate has improved 25%, with less solids going out to landfill.”

Best of all, long-term water quality benefits have been achieved with the reduction in untreated sewage bypassing the plant. **tpo**