

Clyde, OH

Hydro-Jet® Screen Increases Screening Capacity by 16 MGD

Wet Weather Case Study - Project Profile

Objective

Heavy rainfall events were overloading the city's treatment plant and CSO overflows were polluting local waterways. The city needed a way to protect residents from being exposed to the untreated overflows.

Solution

Partial sewer separation was accomplished using a Hydro-Jet® Screen and a Hydro-Brake® vortex valve supplied by Hydro International in a satellite treatment application.

Clyde, Ohio (population 6,000) bills itself as "America's Famous Small Town" - but it is, in fact, a city with some urban characteristics. It is home to one of the world's largest home appliance plants: a Whirlpool Corp. facility that turns out roughly 20,000 top-load washing machines a day. Civil War buffs flock to the Clyde Museum and to the historical home of James Birdseye McPherson, the highest-ranking Union officer killed in the war.

This famous small community 90 miles east of Cleveland also faces the challenge of dealing with an urban issue common to many larger communities in the Midwest and Northeast – the pollution caused by its combined sewer overflows. Clyde has combined sewer systems which carry sanitary sewage and stormwater in the same pipes. During dry weather or light rain, the combined flows are conveyed efficiently to the wastewater treatment plant.

However, during heavy rains, the total combined wastewater flow may exceed the capacity of the treatment plant. One heavy downpour alone can deliver up to 10 million gallons of water per day (MGD) – which would overwhelm the treatment plant's maximum current capacity of 4.8 MGD. When heavy rains arrive, the CSOs discharge overflows into surface waters such as nearby creeks and streams.

This means that suspended solids and floatable matter — essentially untreated sewage and other debris — was being washed right into the water. Members of the community were concerned about the impairment and aesthetic degradation of nearby Raccoon Creek, which feeds into Lake Erie. Residents were also worried about the possible health effects to those in contact

"In our eyes, this was a no-brainer solution because it was cost-effective, it had a very small footprint, and it had no moving parts."

William Boyle, Senior Vice President
GGJ Consulting Engineers

Project Highlights

- The City chose partial sewer separation in conjunction with a satellite CSO treatment system
- The satellite treatment system included a Hydro-Jet® Screen and Hydro-Brake® Vortex Valve flow control
- The Hydro-Jet® Screen is self-cleansing but has no moving parts or power requirements
- The design enables the city to screen an additional 16 MGD than previously possible

with the water after a period of overflow or discharge. The Ohio Environmental Protection Agency mandated that all communities with CSOs, including Clyde, either eliminate or minimize the number of sewer overflows to prevent sewage from discharging into bodies of water untreated.

Clyde has embarked on a process of separating the wastewater and stormwater sewers in some spots. But separating the miles and miles of sewer lines would have been cost prohibitive and would have caused major disruptions from ripping up city streets. Not only would the project cost tens of millions of dollars but this time-consuming process would likely have involved obtaining property easements to install separate sewer systems.

Since the city could not separate all the sewers, it needed a way to handle the increased flows during heavy rains. One option would be to increase the capacity of the wastewater treatment plant from 4.8 MGD to 10 MGD to accommodate flows during a peak rain event. This investment would have run into the tens of millions of dollars.

Clyde officials hired GGJ Consulting Engineers of Eastlake, Ohio, to help resolve the city's CSO issues. GGJ conducted flow analysis to identify the worst contributors to extraneous flow, and targeted those as areas where the combined sewer system must be separated into conventional stormwater and sewer treatment systems. The city did this work at the same time as scheduled street reconstruction projects to alleviate costs as well as disruption to nearby residents. This reduced the volume of flow going to the



An integral airbrake siphon discharges screened water and provides the hydraulics for a self-backwashing mechanism that cleans the screen.

treatment plant. However, the city needed to go one step further to minimize sewer overflows, since one CSO outfall still remained.

To address this problem, GGJ chose to install a satellite treatment system consisting of a Hydro-Jet® Screen and Hydro-Brake® Vortex Valve flow control device from Hydro International. The Hydro-Jet® Screen removes pollutant-containing debris, and the vortex valve controls the water flow that is circulated back into the treatment plant.

Historically, municipalities have had to rely on mechanical screens to filter out debris. However, those have a host of problems. They require electricity to run, which causes problems because power outages tend to occur during large storm events. If the screening device went down during a storm that knocked out power, it would cause street flooding or basement backups.

Clyde's CSO does include an electrical component – to power a pair of large pumps that send excess water during a heavy rain up about 15 feet from one sewer to another. But the Hydro-Jet® Screen does not require electricity and has no moving parts, so it requires significantly less maintenance. The screen is self-initiating and self-cleaning; there's no human interface required with the exception of periodic inspections or cleanings. The Hydro-Jet® Screen provides a significant cost savings over conventional mechanical screens, according to William Boyle, senior vice president of GGJ.

In the Clyde system, sewage is conveyed to the treatment plant via two interceptors, 18" and 24" in diameter. The treatment plant supports up to 6 MGD. When the flow exceeds these levels, the excess flow is run through the Hydro-Jet® Screen to eliminate floatables. Excess flow from the 24"-interceptor moves directly into the screening facility, while excess flow from the 18"-interceptor is pumped up into the screening facility.

The Hydro-Jet® Screen encompasses three main components: screen panels, an airbrake siphon for discharging the screened water and providing the hydraulics for a self-backwashing mechanism that cleans the screen, and Hydro-Brake® vortex valve flow control that limits the flow in and out of the structure. Using

simple principles of fluid hydraulics, the Hydro-Jet® Screen creates an effective self-cleaning flow regime. During heavy rains, the build-up of water pressure in the screening chamber automatically initiates the operation of the Hydro-Jet® Screen. Debris and large solids are passively removed by the screen, recirculated into the waste stream, and sent downstream to the wastewater treatment plant while screened effluent is discharged into Raccoon Creek.

"The unique system that the Hydro-Jet® Screen employs allowed us to treat these CSO Events without the use on any moving parts. This assures us that these flows will always be treated," Boyle said. "In our eyes, this was a no-brainer solution because it was cost-effective, it had a very small foot print, and it had no moving parts."

The Hydro-Brake® Vortex Valve returns the collected screenings flow to the wastewater treatment plant. The Hydro-Brake® Vortex Valve restricts the flow of water as needed while operating passively on simple fluid hydraulics. Flow enters the volute tangentially through the intake. Under low-flow conditions, the Hydro-Brake® acts as a large orifice where water and debris pass directly from the inlet to the outlet. As flow increases and reaches the flush flow point, high peripheral velocities start to throttle. As pressure increases, an aerated core effectively restricts the flow through the outlet aperture.

This unique design enables the city of Clyde to screen an additional 16 MGD than previously possible. This solution has allowed the city to gain a preliminary treatment method during large storms, without a tremendous capital investment. Clyde, Ohio, serves as a model city for viable CSO treatment solutions. As the EPA continues to crack down on CSO communities with sewer discharges, the Clyde system provides evidence that satellite treatment solutions can address the need in an efficient, cost-effective manner.



The satellite treatment system includes a Hydro-Jet® Screen (pictured) and a Hydro-Brake® Vortex Valve flow control.



The Hydro-Jet® Screen removes pollutant containing debris and circulates it back to the treatment plant.



The screened effluent is discharged to nearby Raccoon Creek free of floatable debris.