

City of Detroit's Combined Sewer Outfall Facility Replaces Obsolete Control Systems to Help Protect Water Quality

Configuration Tools from Rockwell Automation Help Nation's Largest Wastewater System Reduce Design and Commissioning Time

Solutions

Rockwell Automation PlantPAx Process Automation System, which incorporated:

- Allen-Bradley ControlLogix programmable automation controllers to provide advanced processing capabilities, while continuously collecting critical operating data
- Tightly integrated HMI using FactoryTalk View SE to allow instant access to real-time information and operational trends
- PlantPAx Library, which includes the basic building blocks for the system, including HMI faceplates customized for specific plant roles, in addition to rich info-laden icons and full documentation
- Water Wastewater Accelerator toolkit helps rapidly deploy a project as it includes procurement specifications, a quick start guide, and sample controller and HMI configurations for common applications, such as lift stations, dosing pumps, head works and solids handling

Results

Reduced deployment time

- Resulted in a 50 percent reduction in design time, contract oversight, and post-contract documentation and support
- Provided process control with advanced networking and diagnostic capabilities
- Increased access to process data for better preventive and predictive maintenance

Reduced Engineering Hours and Costs

- Saved estimated \$120,000 in configuration and systems integration time
- Saved \$90,000 in factory-acceptance testing and startup/commissioning



The new system leverages the Rockwell Automation® PlantPAx Process Automation System – an integrated control and information solution.

Background

Detroit's Wastewater Treatment Plant is one of the largest in the United States, serving more than a third of Michigan's population. The plant's size and complexity are rooted in a convergence of three major forces: industry, water and weather.

The city's population exploded in the 1920s with the advent of automobile production. The newly minted "Motor City" continued to grow, ranking among America's top 10 major metropolises for the rest of the 20th century.

The city is also synonymous with water: Its name comes from the river that runs through it, which French explorers called Rivière du Détroit and translates to "River of the Strait." That strait – today's Detroit River – leads to Lake Erie and the rest of the Great Lakes.

Like many of America's urban waterways, the Detroit River and its tributaries were once badly polluted by raw sewage and storm water runoff. Construction of the city's treatment plant in 1939 and a major series of expansions and upgrades over the next 50 years significantly improved effluent water quality.

But a major problem remained: Heavy rains and snow melts sometimes overloaded the treatment plant, allowing polluted storm water to run into the Detroit River and the connecting Rouge River. The Rouge – which lies at the center of a large watershed in the metro Detroit area – was so polluted by chemically laden runoff that the river caught fire in 1969.

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To better protect the rivers from runoff, the city began building a network of combined sewer overflow basins 25 years ago. Today, the department operates eight such basins, strategically sited in places where storm runoff would otherwise reach the rivers. By capturing and substantially treating the storm water, the basins play a major role in protecting the surrounding watersheds, and the people and wildlife living there.

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In just the first three months of 2011, for example, the basins collected more than 5 billion gallons of runoff that would have otherwise escaped into waterways. While a third was pumped to the main plant for treatment, the rest of that water was treated in the basins.

Challenge

Each combined sewer overflow facility differs somewhat in size and design, but all basically apply the same treatment process: retaining the overflow, mechanically screening out solids, and disinfecting the water with sodium hypochlorite (bleach). Basins also have equipment that operators use to monitor flow rate and volume, collect samples, remove residual water from the basins, and clean them after a wet-weather event.

Despite their similar functions, the basins' process control instruments vary widely. That's partly because the basins were constructed over the course of the last three decades at a time when automated control technology was quickly evolving. Another factor: The comparatively slow pace of public works projects was also an issue. From concept to commissioning, each basin required several years to complete because of strict municipal codes requiring public planning, open bidding and official oversight. Meanwhile, federal and state water quality standards were becoming more stringent, adding another layer of complexity.

"Through the years, we've had to update the process control systems at various basins to comply with changing regulations," explained Anil Gosine, Process Control System Administrator for the Detroit Water and Sewerage Department (DWSD). The result is a "myriad of different process control systems at different locations. At one basin, we have process control equipment from four different vendors."

Such a hodge-podge of legacy equipment makes integration difficult or impossible. "The lack of a standardized platform also hampers troubleshooting and maintenance," Anil Gosine said. "Inventory is another problem, because we need to keep so many different spare parts on hand."

Solution

In 2004, DWSD hired a consultant to design new, more effective and efficient control systems for two existing Combined Sewer Overflow Facilities. DWSD engineers specified Rockwell Automation as the vendor for the process control systems after performing a life cycle cost analysis.

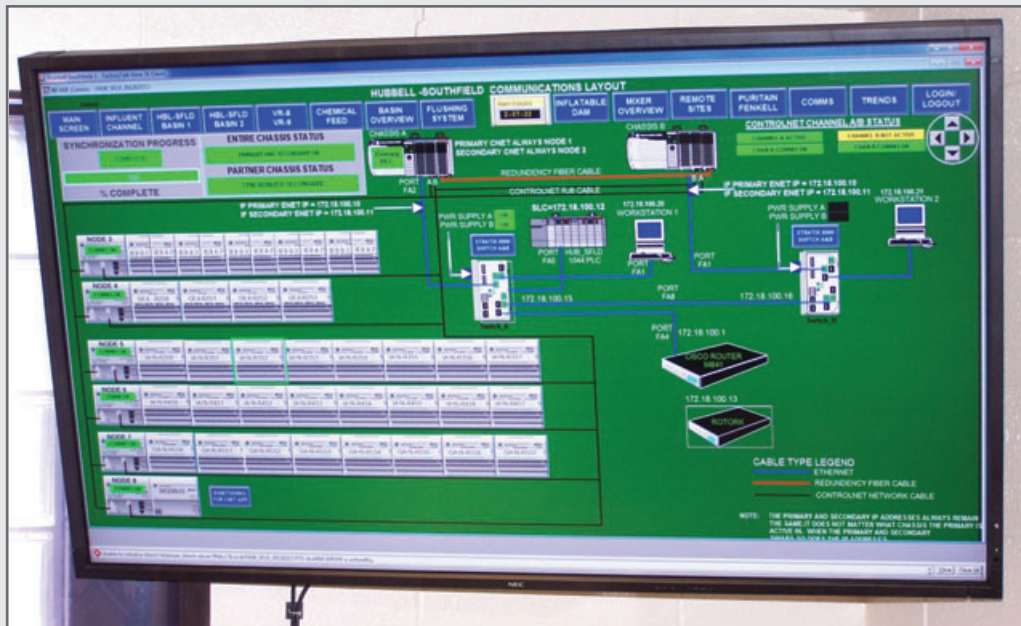
"We carefully compared the options that DWSD is standardizing on, looking at capital and lifecycle costs, found that the Rockwell Automation solution is the one of the best to go with," Anil Gosine explained. "We already use hundreds of their products, so we're familiar with the quality of their technology, maintenance tasks, troubleshooting techniques as well as their high level of technical support."

The new system leverages the Rockwell Automation PlantPAX™ Process Automation System, which is an integrated control and information solution that combines capabilities of DCS with pervasive access to process information to help achieve plant-wide optimization. This scalable, multidiscipline platform helps users who need both process and sequential control to achieve lower total cost of ownership and a plant wide view.

System integrator Process Control & Instrumentation (PCI), LLC, was awarded the contract for replacement of non-functional control system instrumentation at two DWSD CSO Basins. PCI, a control engineering firm with an office in Detroit, worked with DWSD on other recent projects, giving PCI engineers a good understanding of the DWSD overall SCADA system.

But PCI faced a dilemma when it received the contract to retool the basins. The company had strategically offered the lowest bid to win the project with DWSD, as well as partner with Rockwell Automation for the first time. However, PCI engineers were concerned that the total cost of replacing the obsolete control systems would exceed the agreed-upon contract amount.

Rockwell Automation engineers recommended a solution that kept the project within budget – its PlantPAX Process Library and Water Wastewater Accelerator toolkit. The process library is an innovative software application for the Logix Control Platform that includes an array of pre-engineered code that can be used in various applications. It also incorporates custom faceplates based on specific plant roles, rich information-laden icons and full documentation.



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The Water/Wastewater Accelerator toolkit customizes those elements to significantly reduce the time required to design, install, operate and maintain a wastewater project. The toolkit contains configured files, selection tools and examples of how to connect the Allen-Bradley® ControlLogix® controller to the facility's human machine interface (HMI) hardware and other devices over EtherNet/IP™ and DeviceNet™ networks. The toolkit also provides system architecture drawings, basic status, control and diagnostic logic, as well as faceplates for FactoryTalk® View Site Edition HMI software from Rockwell Automation used in the new Detroit basins.

The process library is an innovative software application for the Logix Control Platform that includes an array of pre-engineered code that can be used in various applications.

“The acceleration tools from Rockwell Automation are an absolute joy to work with for a programmer,” said PCI’s controls engineer on the DWSD basins project. “In the past, we’d have to program the HMI separately from the controller and then link them together. The toolkit comes with 80 percent of the necessary code, predefined and factory-tested. So you’re free to focus on customizing the machine control for the customer.”

The Rockwell Automation team on the project worked closely with PCI’s engineers on how to use the process library and the accelerator toolkit to custom configure the system for the Detroit basins.

“We needed to modify the toolkit to make the process-data presentation familiar to DWSD operating folks,” the PCI engineer explained. “Some graphic faceplate elements didn’t align with DWSD’s color and naming conventions. For instance, they were used to seeing a red light when a piece of equipment was turned on, instead of the green light built into the process library. So we made that change and others that created a special standard toolkit just for Detroit.”



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Results

The PCI engineer estimated that the process library and toolkit cut his work in half for both basins, saving around \$120,000 in programming and systems-integration time. Another \$90,000 was saved in factory-acceptance testing and startup/commissioning.

"Programming the first motor took two hours, but after that I just had to copy and paste the code," said the PCI engineer, who now is working on his fourth project using the process library and toolkit. "The cooperation I've gotten from Rockwell Automation has been amazing. I had the opportunity to interface with the original programmer of the toolkit to make the changes as needed."

The lead engineer on the toolkit was also among the Rockwell Automation experts who traveled to Detroit to demonstrate the advantages of the system, and later returned to conduct project workshops for city engineers and wastewater operators.

DWSD officials estimate the new tools from Rockwell Automation provided a 50 percent reduction in design time, contract oversight, and post-contract documentation and support.

"There's a much shorter learning curve for the operators with the PlantPax system," said Gosine, who helped oversee the project for DWSD. "We also have access to a lot more data in an integrated format at these two basins. That has really improved the diagnostics, allowing more preventive and predictable maintenance."

DWSD is in the process of standardizing two more basins with Rockwell Automation hardware and software, Gosine said. In the future, DWSD can make upgrades to the retrofitted basin controls using the process library, meaning engineers won't have to completely recreate process standards and codes – saving even more time and money

The results mentioned above are specific to the Detroit Water and Sewerage Department's use of Rockwell Automation products and services in conjunction with other products. Specific results may vary for other customers.

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