



Redundant Fiber-Optic Network Helps Plant Meet Goals

Aging wastewater treatment plant slashes costs and downtime by adopting cutting-edge automation that gathers real-time data and reduces maintenance.

By Sheila Kennedy, Contributing Writer

The unglamorous yet crucial task of sewer and wastewater treatment has direct impacts on public health and the environment, yet rapid population growth is stretching the capabilities of the nation's water treatment infrastructure.

According to the 2017 Infrastructure Report

Card for Wastewater from the American Society of Civil Engineers (ASCE), more than 56 million new users will be connected to centralized treatment systems across the U.S. over the next 20 years.

One municipal wastewater treatment plant built in the 1970s is taking steps to enhance its capacity, operational efficiency and reliability. Located in a small, coastal U.S. city, the plant has 1.1 million gallons per day of processing capacity.

To address continually growing demand, the decision was made in early 2015 to incorporate a greater level of plant automation and control. The plant required modifications, including new instrumentation and controls (I&C) supported by a high-availability, mission-critical communications network and an extension of the plant's existing outfall.

The water district chose [Carollo Engineers](#) to design and engineer the solution, which leverages the [Converged Plantwide Ethernet \(CPwE\) Reference Architecture](#) developed by Rockwell Automation and its Strategic Alliance Partner Cisco. It features a robust, redundant, fault-tolerant fiber-optic communications network from Rockwell Automation Encompass™ Product Partner [Phoenix Digital Corp.](#) (PDC), as well as Rockwell Automation control system products the customer specified.

Core Challenges Limit the Options

Budgets are tight in small, municipal water treatment plants such as this one, which makes the operational efficiencies afforded by industrial automation highly desirable. However, any potential savings must be weighed against implementation and maintenance costs.

The plant sought access to real-time data and diagnostics to help improve decision-making, increase uptime and minimize manual processes such as paper-based charts and graphs. Fast, secure Ethernet connectivity was needed for the central control system to collect data and generate the required reports automatically. The underlying communications network needed to be cost-effective and industrially hardened — capable of providing fault tolerance and redundancy to help achieve maximum availability and reliability.



The network also had to be as immune as possible from electromagnetic noise. “Water treatment environments are prone to electrical noise and static due to electrical drives and other powered equipment, which have the potential to corrupt electronic communications. If a copper or metal conductor is introduced into that environment, it may pick up extraneous electromagnetic noise and interfere with a signal being transmitted through it,” explains Amit Sahdev P.E., senior I&C engineer at Carollo Engineers.

Another key consideration was the lack of IT personnel on staff who had the necessary skills to support a typical Ethernet network for the advanced control systems. The water district had no budget to outsource the role under a maintenance service contract, so installation and maintenance simplicity was a must for the new communications network.

Finally, to be adaptive and effective for the long term, the solution needed to be scalable, expandable and capable of accommodating future I&C and networking technologies.

Optimal Proposal Simplifies the Selection

The water district specified its preference for Rockwell Automation products in its request for proposals (RFPs). Carollo Engineers had a history of Rockwell Automation solution knowledge, having specified and worked with its technologies for more than 50 years.

Carollo also had a successful track record with the water district, including preparing the wastewater treatment plant’s facility plan. After assessing the RFP responses, the water district awarded Carollo Engineers the two-part, \$9 million project, which included both the plant modifications and outfall extension.

The solution Carollo proposed for installation at the existing water treatment plant was tailored to the plant’s skill sets and budget and provided all of the requested capabilities. The cost-effective, low-maintenance, energy-efficient solution was designed to help provide maximum availability.

Based on the Cisco-Rockwell Automation CPwE architecture (see **Figure 1**), it incorporated:

- An Allen-Bradley® programmable logic controller (PLC) platform, including [Bulletin 1756 ControlLogix® I/O](#) chassis-based modules and [Bulletin 1768 CompactLogix™](#) controllers.
- Rockwell Software® Studio 5000® environment for PLC programming.
- Rockwell Automation [FactoryTalk® View](#) software for human-machine interface (HMI) programming.
- Secure, noise-immune fiber-optic communications network from PDC that included its OCP module (see **Figure 2**).

New Solution Fits the Bill

PDC provided the network backbone for all of the Allen-Bradley PLCs, which included a full two-channel redundant fiber-optic network in the in-chassis CompactLogix platform running at a full gigabit and communicates with the Rockwell Automation process control system.

This product combination builds on years of success. PDC technology has been used in all of the automation platforms Rockwell Automation has offered, from the Allen-Bradley PLC-5® control system to ControlLogix products and now also CompactLogix. Multiple protocols for Rockwell Automation also have been supported — originally remote I/O and the data highway, followed by ControlNet® networks, and now Ethernet®.

PDC passes any version of Ethernet without software programming, setup or configuration. The average technician can install, troubleshoot and maintain the PDC network in minutes, without special certification, in a secure fashion.

The use of fiber cable has multiple benefits. “Fiber-optic cables are inherently immune from electromagnetic interference as they are nonconductive in nature and cannot pick up extraneous electromagnetic interference, making them a better solution in electrically noisy environments,” says Sahdev.

Because fiber provides redundant connections, not just one like traditional cable, the PDC solution provides a more robust system. It is not just resilient; it provides a truly two-channel redundant network. Fiber also operates at the speed of light.

“This is the perfect example of where Phoenix Digital and Rockwell Automation work well together; it’s the small-to-medium-sized municipality that needs the technology but struggles with the maintenance of the application,” says Tom Schaefer, president and CEO of PDC. “When Carollo presented us with the project requirements and the skill set of the local maintenance team, the PDC system was the natural choice.”

Plant Awaits Highly Anticipated Benefits

Carollo Engineers completed the engineering design in September 2016. Construction of the modification and outfall projects began in March 2017 and is scheduled to finish in January 2018. The engineering firm is providing quality management and construction support services throughout the implementation.

Once completed, the wastewater treatment plant will realize the many benefits of the new automation systems and a network designed for reliability. “Customers like the robustness of the full two-channel redundancy network,” says Schaefer. “Our network is designed to operate in zero-downtime service applications.”

Plug-and-play simplicity minimizes the time spent on network maintenance. A technician — not an IT-trained and -certified individual — can replace a unit if the PDC network goes down. “Replacements can be made in and out of a hot running network in 30 seconds, with no data loss, without a laptop or instruction manual; just set up the switches on the new unit the same way as the old one, and it fires up and goes,” adds Schaefer.

In addition, should a power outage occur, the PDC system will reestablish itself in less than 10 seconds. This allows for the automation devices and the PLC to come back online and become operational into an active running network. All of this allows a more robust solution that the water district doesn’t have to worry about because it can self-maintain.

Phoenix Digital Corp., based in Scottsdale, Arizona, is an Encompass Product Partner in the Rockwell Automation PartnerNetwork™ program. The company provides simplified, high-availability industrial networking for The Connected Enterprise, as well as fault-tolerant, self-healing, plug-and-play fiber optics for industrial control, process control and automation networking.

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