# Automated plant delivers pristine water, saves millions in costs

A new water treatment system helps the popular Cape Cod vacation town of Falmouth meet state regulations while significantly reducing operating costs. Michael Quirk of Rockwell Automation reports on how its automation system enables the facility to meet fluctuating water demand with one staff shift.

When the summer arrives in Falmouth, Massachusetts, United States (US), so do the tourists. And the water department for this small coastal town in the idyllic Cape Cod region suddenly needs to increase its output to service from approximately 25,000 permanent residents to a summer population of up to 120,000 people. This influx of out-of-towners can multiply the town's water demand by as much as five times.

Until recently, a pump station that had been in use since 1898 provided most of Falmouth's water supply throughout the year. While the water that the station provided was safe, it wasn't filtered. This approach could give the water a cloudy appearance and an unpleasant taste and smell, making it less than ideal for both residents and summer visitors.

That's why the Massachusetts Department of Environmental Protection mandate to improve certain water-quality measures may have been a blessing in disguise. The mandate led to the town building a new US$42-million water treatment and filtration plant that has significantly improved both the water supply's taste and quality. And using the latest control and information technologies, the state-of-the-art plant can be minimally staffed to help keep operating costs and hiring demands down.

### Quality and staffing challenges

Chlorine is essential to providing safe drinking water, but when it mixes with organic material such as algae, it creates chemical-compound byproducts known as trihalomethanes. The EPA's maximum allowable annual average level for total trihalomethanes (TTHMs) is 80 parts per billion (ppb). Most sampling sites in Falmouth regularly measured below this level, but in some instances, tests did exceed 80 ppb.

These findings spurred the need for a new treatment and filtration plant that would remove algae from water prior to treating it. Removing the algae would lower the water's TTHM levels and reduce the use of chlorine to provide more pristine, better-tasting water to the town's homes and businesses. However, state laws regarding water treatment plants created concerns about staffing it.

"According to state regulations, you must staff these plants whenever they're running, unless you get a waiver for it to run unmanned in certain hours," says Steve Rafferty, water superintendent for the town of Falmouth.

Staffing the plant continuously simply wasn't feasible. For 8 months out of the year, the plant would only need to be staffed one shift per day to meet the public's water-supply demands of approximately 284 to 341million liters (mL) per month (75 to 90 million gallons). But during the busy summer, it would need to run and be staffed 24 hours a day to meet demand that can exceed 946 mL per month (250 million gallons).

"I would have needed a minimum of eight more highly skilled operators if the new plant were manned 24/7 instead of just a single shift," Rafferty says. "You have to consider the town's cost of staffing those highly paid positions. Also, it's extremely difficult to find, attract, and retain that many skilled workers."

The only option was to meet the state's waiver requirements by building a highly automated, highly resilient, and remotely connected plant that could meet any month's water demands with just a single staffed shift.

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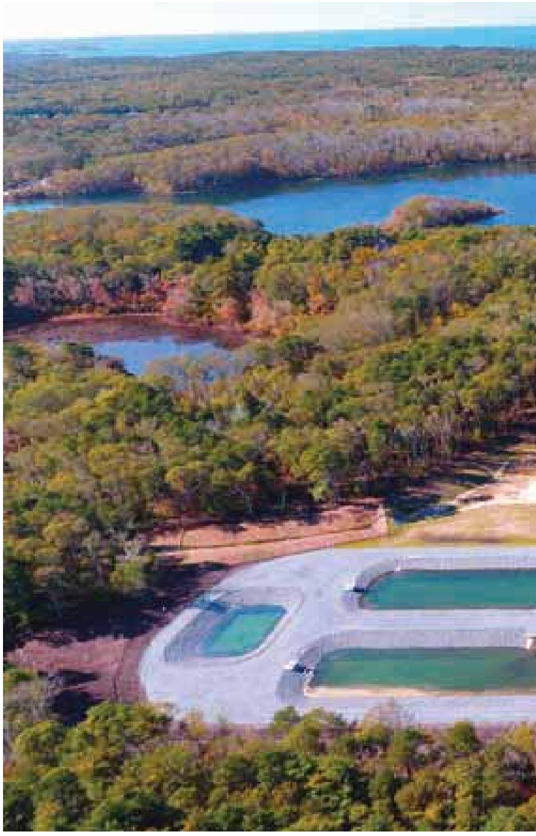
>
> **Steve Rafferty, Town of Falmouth, Water Superintendent**

### Creating a reliable control and information architecture

The new plant would draw water from the town's primary water source, Long Pond, and treat it in four separate processes: algae removal, ozonation to improve taste and odor, activated carbon filtration, and sodium-hypochlorite disinfection.

Rafferty worked with R.E. Erickson, a systems integrator that specializes in water and wastewater treatment, and consultant Tata & Howard to develop the plant's control and information architecture. During this process, maintaining the plant's availability was paramount.

"We started with a good, conventional SCADA system design for the new plant," Rafferty says. "But it was only 99 percent reliable, meaning that we could have a downtime event about three times per year. That wasn't good enough."

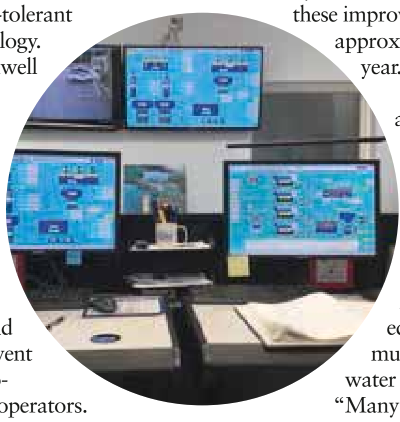


**Right: Aerial view of the new advanced water treatment and filtration facility, situated next to Long Pond, in the coastal town of Falmouth, Massachusetts, United States.**

**Top right: SCADA screens in the Long Pond treatment facility.** All photos by Town of Falmouth

To boost that number to 99.99 percent, R.E. Erickson incorporated Stratus virtual servers with VMware software into the system design. The servers are fault tolerant with no failover time and are continuously monitored by Stratus, an Encompass Product Partner in the Rockwell Automation PartnerNetwork program.

The plant's two ControlLogix controllers from Rockwell Automation provide redundant control and are connected on an EtherNet/IP network architecture that uses a fault-tolerant device-level-ring (DLR) topology. NorthEast Electrical, a Rockwell Automation Authorized Distributor, provided local support and installation.



R.E. Erickson chose FactoryTalk Historian software for logging and analyzing plant data and generating on-demand reports. XLReporter software from SyTech helps with on-demand reporting, and alarms-and-event software from WIN-911 provides critical information to operators. Both SyTech and WIN-911 are Rockwell Automation Encompass Product Partners.

The FactoryTalk View HMI software and ThinManager thin-client software were chosen to give operators in the plant access to information on both HMI thin clients and mobile tablets. The ThinManager technology is also used to provide remote access to the plant over an encrypted VPN connection, allowing on-call operators working remotely to monitor operations and address issues that arise outside normal plant hours.

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### Reliable, pristine water

The new water treatment and filtration plant became operational in October 2017. It met the state's requirements for an automated treatment plant and is running today on a single shift, even in the busy summer months. Rafferty estimates these improvements are saving the town approximately $1.3 million per year.

The highly reliable plant also hasn't experienced a single interruption to date – even following a severe storm that disabled one of the plant's servers. The plant's TTHM levels are in the low 20s and dropping. And that decline has coincided with praise from the community for the town's improved water quality.

"Many people have commented on the quality," Rafferty says. "In fact, I got a call from a scientist who has always used water filters in his home. He changed his filter this spring and accidentally left it in bypass mode. He said he couldn't believe the great water he was getting was from our plant."

The plant's modern control and information architecture has helped reduce the demands that the much more sophisticated operations have put on operators while also improving system performance through real-time visibility into the production process.

"The Historian software has allowed us to automate our reporting to the state, which previously was paper-based," Rafferty says. "We're also using the Historian for more advanced trending to help operators make better decisions. For example, they can monitor ozone demand by tracking the rate of change on the plant's oxidation reduction potential (ORP) analyzers. As values trend one way or another, operators can increase or decrease the ozone dosage as necessary."

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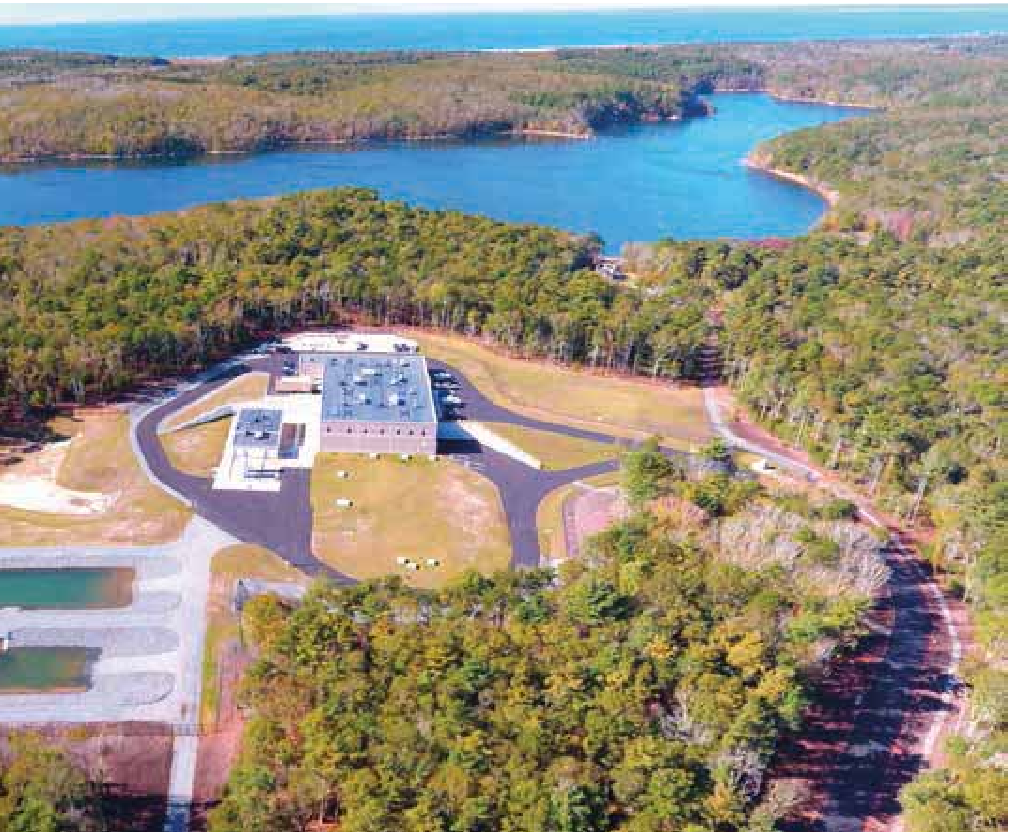

Rafferty is also exploring opportunities to use plant data for preventative maintenance to further improve the plant's availability. For example, he's exploring integrating data from the plant's power-monitoring and SCADA systems into the overall maintenance management plan for major pieces of equipment. This approach could help him and his team proactively identify issues such as a change in pump efficiency so that they can be addressed before a failure occurs.

"The area where we've done the most work so far is our chemical feed systems," Rafferty says. "These are the systems where the department is the leeriest of something going wrong in an automated plant. Through the Historian, we track actual runtimes on our peristaltic pumps and see the hours of operations before we need to change tubing. This will give us a predictive model on how to change tubing out."

Rafferty is also encouraging operators to simply explore what's possible with analytics. "I tell them to invent a parameter they want to measure," he says. "Then we can build it out through the Historian and make something run more efficiently."

The new plant has won multiple local awards, including an *ENR* New England Best Project award in 2017 and an Associated Builders & Contractors of Massachusetts Eagle award.

### Author's Note

*Michael Quirk is a sales engineer for water and wastewater applications at Rockwell Automation who is based in Marlboro, Massachusetts, United States. The results mentioned above are specific to the city of Falmouth's use of Rockwell Automation products and services in conjunction with other products. Specific results may vary for other customers.*