Water & Wastewater Successes
Global References & Case Studies
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Welcome to the modern HMI/SCADA system—where machines, data, insights, and people are connected. See how GE Digital customers have improved operator response, adhered to regulations, and reduced costs by implementing proven automation, industrial data management, and analytics solutions—based on decades of water and wastewater experience.

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Outcomes

**Improving availability and reliability**
Aging infrastructures and growing water supply demand make increasing availability and reliability crucial. Our HMI/SCADA, industrial data management, and analytics facilitate the corrective action to remediate a potential problem and ensure the right response.

**Minimizing risk**
Managing security and risk remains a top concern for utility operators. Our High Performance HMI/SCADA systems alert operators to out-of-spec events with superior alarm management and guides them through the right actions to take — whether routine or in an emergency.

**Reducing cost**
Operator errors, equipment failures, and excessive maintenance or chemicals all impact bottom line. Our HMI/SCADA allows utility operators to respond appropriately to events, such as storm warnings, and quickly resolve situations—minimizing additional costs.
Smooth Sailing at Bloomington/Normal Southeast Wastewater Treatment Plant

This story originally appeared in Treatment Plant Operator.
Photography by Bradley Leeb
Bloomington-Normal Southeast

When the Bloomington-Normal Southeast Wastewater Treatment Plant won a 2018 Plant of the Year award from the Illinois Association of Water Pollution Control Operators, team members were ecstatic.

Randy Stein, executive director and sports fan, likened it to winning the “Stanley Cup of wastewater.” On its way to the award (in Group 1 for plants larger than 7.5 mgd), the plant racked up 12 consecutive Gold Peak Performance Awards from the National Association of Clean Water Agencies.

The Bloomington-Normal Water Reclamation District was formed in 1919 and serves Bloomington, Normal, and the Village of Downs and subdivision of Crestwicke in central Illinois, with a total population of 134,000. The award recognizes safety, permit compliance, operations staff knowledge, and cleanliness and maintenance. A long-standing habit of excellence and effective planning set the plant up for the award.

Caitlin Raasch monitors secondary treatment air flows by way of the plant GE Digital’s SCADA software
Conventional activated sludge plant

The Southeast plant (7.5 mgd design) began operating in June 2005. Jake Callahan, director of operations, describes it as a “conventional activated sludge plant.” Preliminary treatment includes Spiralift screw pumps (Evoqua Water Technologies) and a Waste Tech Model 1300 bar screen with three-eighths-inch separation (Kusters Water, division of Kusters Zima Corp.) followed by a grit trap (Smith & Loveless) and grit washer (Parkson Corp.). The lift stations to the two primary clarifiers use three 125 hp Pentair - Fairbanks Nijhuis pumps. Each clarifier has a Toshiba sludge density meter.

Anoxic tanks are upstream of the five aeration tanks. “They help control the filaments in the activated sludge process,” Callahan says. “We run a higher solids retention time and get good nitrification in winter when the biology slows down. And we don’t observe any settling issues with the biological floc in our secondary clarifiers.” The anoxic tanks have Environmental Dynamics International FlexAir mini-panel fine-bubble diffusers. Blowers are 300 hp Turblex Model KA105V-GL210 operated with dissolved oxygen control.

Flow then goes to the two 115-foot-diameter center-feed secondary clarifiers for settling. Tertiary treatment consists of a traveling bridge filtration system. Media is anthracite coal on top, followed by coarse and then fine sand. Final effluent is disinfected by a TrojanUV UV4000 system. “This system has worked well, has been stable and is easy to maintain,” Callahan says. Final effluent is discharged to the Little Kickapoo Creek.

Solids are anaerobically digested to Class B standards, thickened and dewatered. Employees apply the material to farmers’ fields within about 30 miles of the plant. “We haul it and we spread it,” Callahan says. “That way they know where it’s been applied and the application rate is correct. Things are going pretty smoothly.” One reason is the GE Digital SCADA software interfaced with WIN-911: “A lot of thought was put into our WIN-911 software, which dials out to the on-call operator when there’s a problem.”

The plant also has a unique post-disinfection treatment stage: An experimental constructed wetland removes nutrients from about half of the plant’s discharge. The wetland has hiking trails and bird-watching sites that make it a getaway for area citizens.

Plant managers sent Jon Outlaw, operator, and Tom Anderson, chief mechanic, to run the plant when it started up in 2005. Stein notes that the plant was designed to run with just one operator and two maintenance people. The operator and maintenance person sent to run the plant in 2005 are now nearing retirement.
The Southeast plant is a one-operator, five-days-a-week, eight-hours-a-shift gig. It has an advanced SCADA system — GE Digital — that talks to the West plant via radio telemetry. Operations and maintenance staff are always on call for extreme weather or upsets. The SCADA system can alert the on-call operator when the plant is not staffed, and operators can respond to many alarms via their cellphones without having to report in.

In the first six months of 2019, the district hired three new operators and amped up its training. “We’re trying to get some of the younger staff exposure at the Southeast plant,” Callahan says. “We want them to become familiar with the treatment systems there and have more opportunities to make decisions on their own.” This is where the two-week rotations help.

The rotations and cross-training also help with communication and information transfer among operators. “Communication and collaboration have been important to our success,” Callahan says. “They’ve taken ownership and strive to find information and work together. With three new operators hired in six months, our senior operators have taken the initiative to coach up new operators.”

“Communication and collaboration have been important to our success.”
— Jake Callahan, Director of Operations

The district regularly sends operators offsite and even out of state for advanced training. “We encourage taking advantage of educational opportunities,” Stein says. “We send people out all the time, including to the University of Wisconsin-Madison. Their programs typically last four to five days and cover topics of interest to the district. We’re not afraid to spend money on education.”

The staff is active in professional organizations. Stevens is past president of the Illinois Association of Water Pollution Control Operators; Magerl is president of the Central Illinois Professional Wastewater Operators organization. Stein and Callahan regularly attend meetings of the Illinois Association of Wastewater Agencies, a manager-level organization.

Critical training

In 2019, the district began rotating three of its experienced operators to the Southeast plant two weeks at a time so they could learn the process. Six operators cover the Southeast plant and West plant, the larger of the district’s two plants.

The West plant site has two treatment plants that discharge to Sugar Creek. One is a two-stage fixed-film plant with rock filters for BOD removal, nitrifying towers for ammonia removal, deep-bed sand filters and UV disinfection. The other is a conventional activated sludge plant with low-head traveling bridge sand filters, UV disinfection and post-aeration.

The district’s operations and maintenance team, in addition to Outlaw and Anderson, includes:

- Josh Stevens, West plant chief operator
- Mason Willis, operations foreman, and wastewater operators Ian Magerl, Caitlin Raasch, Jason Beach, Matt King and Matt Mink
- Brian Romine, solids foreman
- Southeast plant maintenance staff members Brant Ladick and Tyler Graf

Caitlin Raasch uses a solids meter (YSI, a Xylem brand) to measure mixed liquor suspended solids levels in an aeration basin.

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Coaching them up

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The staff has also reduced the electric power bill at the Southeast plant. As the local electric utility’s largest customer, the district has worked with utility staff to find a win-win on high-demand summer days when power consumption for air conditioning is high and the electric utility wished the treatment plant would use less power.

The district tied a 2 MW, diesel standby engine-generator (Caterpillar Inc., Electric Power Division) into its SCADA system. When the electric utility tells the district to shed the treatment plant’s electric load for the next four hours, an operator enters the changeover times into the SCADA system.

**Rate savings**

At the appointed moment, SCADA fires up the generator and performs a closed-transition transfer of demand to it. At the predetermined time to switch back, SCADA returns the power draw back to the electric utility and shuts the generator down.

Using the standby generator for primary power for those four-hour peak demand periods gets the district a substantial electric rate reduction throughout the year. The district had to modify the standby generator to produce lower emissions and comply with air-quality regulations affecting primary power sources.

The district is considering a new blower system for the Southeast plant that will use less horsepower and allow operation with lower dissolved oxygen values. The flow train through the secondary process will also change. “We’re parallel plug flow now, but we’re capable of serpentine flow in series,” Stein says. “We could possibly have a split serpentine flow through five aeration basins.”

There are also plans to nitrify and denitrify in the aeration tanks.

“We’re already investigating the software our SCADA system will require to do this,” Stein says. Some methods that might be used to remove phosphorus at the Southeast plant have been piloted at the West plant.

An innovative measure is in place to control influent at the Southeast plant. Although the plant’s collections system is a separate sanitary sewer system, excessive inflow and infiltration during sustained wet weather has shown the potential to flood the plant grounds.

To prevent that, a 54-inch interceptor lies in a mostly flat grade approaching the plant for temporary influent storage. Flow travels from the three communities about 6 miles to the plant, and there are virtually no connections in the final 3 miles.

With the aid of a highly accurate electrohydraulic actuated sluice gate (REXA) for surge control in the almost-flat interceptor, roughly 1.23 million gallons of influent can be stored there and throttled slowly into the plant. “It works well,” Callahan says.

Stein observes, “When we have a 3-inch rain overnight, I don’t get nervous about flooded pump stations.”
Borås - Water and Sewage

New SCADA system for the town
The operators carry on as normal

Novotek took the challenge to bring the configuration from the old system into the new iFIX operator system from GE Digital.

“At Novotek we have developed an efficient method to treat the old configurations and transfer them from the old system to the new. The accurate migration has among other things meant that it has not been necessary to test each and every signal, a great advantage,” says Magnus Linnér who was responsible for the architecture at Novotek.

All information present in the plant was migrated into a new error free configuration. At the same time the old base for the communication with all the control systems was replaced with a modern and easy to maintain Ethernet based communication.

The new process pictures and operator screens are very similar to the old ones. This means that the operators can work in a similar manner as they used to. All operators in the different plants can see each other’s plants. They have also been able to trust the information in the pictures all from the start.

Continuity and future proofing

The SCADA system installed by ABB many years ago started to create problems.

• The capacity was too low according to Lars Jonasson
• But there was another side too. The system started to get outdated and the number of people that could master it was greatly reduced. We wanted a new system that could preserve old well working functions and at the same time add new technology and be open towards the future.

Solutions

• Operator and SCADA system
• Alarm distribution
• Logging of historian data
• Environmental reporting
• Remote diagnostics

Products

• 2 iFIX SCADA servers
• 2 iFIX main work stations with double screens
• 2 iClient Terminal servers for up to 20 simultaneous logged in users
• New network

Advantages

• An integrated operator and information system
• Fast to learn
• Environmental reporting according to legal requirements
• Standard communication over Ethernet, easy to maintain
• Increased capacity and expansion possibilities
• Open system that gives flexibility when choosing supplier
• One of the world’s largest SCADA system suppliers means future proof

The water supply in Borås is safeguarded with a new SCADA system from Novotek.

The town of Borås has a population of 100,000 people. Drinking water is produced in 8 water treatment plants that produces 8.8 million cubic meters of water every year. Nine sewage treatment works takes care of 15 million cubic meters of sewage water per year.

New SCADA system for the town of Borås

In addition to the water treatment works and sewage treatment works there are 37 pressure step up stations, 16 reservoirs, 97 sewage pumping stations and about 1520km of water and sewage pipes.

It is needless to say that the operation and supervisory of the water and sewage system for an entire town is a complicated task.

We have in total about 100 PLC-systems with a total of 20,000 signals. Novotek has delivered the supervisory system that handles our entire operation, says Lars Jonasson, responsible for the process computer system at Borås W&S.

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An extension project with a continuation

The new system handles a great number of different functions. It consists of the SCADA and HMI system iFIX and Proficy Historian for archiving of signals. The system handles all start and stop of equipment, all control loops, alarm distribution via text messages to mobiles, remote diagnostics from all connected PCs, reporting of environmental data to the authorities, logging of trends, own analysis in Excel, etc. The personnel have become more flexible since they now can log in via Internet and web-interface where ever they are. They can see the same operator screens if they are at home on call or if they are at work.

“Novotek got the assignment since they were able to show us how they could migrate data in a secure way from the old system and because they could provide us with an open and future proof solution,” says Lars Jonasson.

“We can now maintain the system much on our own. If we have an emergency we can always contact Novotek who provides us with a 24/7 service agreement. Usually if there is a problem or there is something we want to have done this can be done over an Internet VPN-connection.”

Borås W&S worked out a future proof solution that preserves past experience and combines it with new technology.
City of Chandler, Arizona, and Carollo

Decreased time and labor with faster, easier reporting
City of Chandler, Arizona, and Carollo

Challenge

Action
Implemented Dream Report with GE’s CIMPLICITY HMI/SCADA for easy setup of report templates for EPA compliance and internal reviews. One-button web portal setup.

Result
• Faster, easier reporting – saving time and labor
• New reports created in minutes versus days
• Short learning curve with fast technical support
• Anywhere, anytime access – even from smart phones – for improved collaboration and decision making
Cincinnati’s “Smart Sewer” reduces overflows and cuts costs from $0.23/gallon to $0.01/gallon
Metropolitan Sewer District of Greater Cincinnati

The Metropolitan Sewer District of Greater Cincinnati (known as MSD) protects public health and the environment through the safe and efficient collection and treatment of wastewater for 43 of the 49 political subdivisions in Hamilton County, Ohio, and small parts of Butler, Clermont, and Warren counties.

MSD’s service area encompasses 290+ square miles and serves a population of more than 850,000. MSD maintains about 3,000 miles of sanitary and combined sewers and operates seven major wastewater treatment plants, more than 100 pump stations, two package treatment plants and several high-rate treatment facilities. About 160 million gallons of wastewater is treated daily.

Challenges

Compliance with federal mandate
Increase existing sewer system efficiency to address Consent Decree (federal mandate) to keep raw sewage mixed with stormwater out of waterways when it rains.

Solutions

A wet weather operational program for monitoring and control
Using iFIX HMI/SCADA and Proficy Historian from GE Digital in a Wet Weather Operational Optimization system, Greater Cincinnati MSD monitors flow levels and controlling gates and valves to direct flows, allowing the utility to store flows inside large interceptor sewers, storage tanks, and high-rate treatment facilities in different parts of the sewer system. The software also delivers the visibility for operators to make informed decisions and optimize the use of the interceptors, avoiding overflowing systems that are at capacity.

Results

“Smart Sewer” optimizes operations
- Reduced costs to about $0.01/gallon of overflow volume, as compared to about $0.23/gallon for green stormwater controls and about $0.40/gallon for larger pipes and storage tanks
- Reduced sewer overflows by more than 400 million gallons per year
- Decreased new capital projects needed to reduce the overflows, such as larger sewers and storage tanks
- Anticipated to save tens of millions of dollars in capital investments in projects to control sewer overflows
Formellino Wastewater Treatment Solutions for the Water Industry

“We used [GE Digital] products in this plant for the first time, and despite the complexity of the logics and the installations, we encountered no problems at all.”
Alberto Tabanelli, Novanet Technical Manager

Results

- All plant data is collected and used for predictive calculations and for optimizing process efficiency
- Improved water purification process and 30% energy saving
- Improved water quality and better control of crucial river habitat parameters

The Formellino plant purifies 1000 m³/hour of water, diverting it from water flowing to the Lamone river.
Water is cleaner with GE Digital

The Formellino Wastewater Treatment plant at Faenza is managed by Hera Imola—Faenza S.r.l. It is a medium-sized installation, which purifies 1000 m³/hour of water and runs 24 hours a day, seven days a week. The plant must ensure that all of the water produced by the purification treatment process meets or exceeds the required quality regulations.

The purification treatment process

The Formellino Wastewater Treatment plant diverts the water flowing into the Lamone river, splits the flow onto two parallel lines, and directs the two flows to the treatment tanks. The water is pumped back downstream into the river after the purification treatment process. The activated sludge purification system is a biological type where organic substances and ammonia are oxidized in the presence of oxygen by the activated sludge. The nitrate products, typically eutrophying nutrients, are later removed in absence of oxygen. Consequently, the oxygen content, the active sludge concentration, the nitrates, and the ammonia are key data inputs of the plant process control system. The first steps upon entrance into the plant are grit removal and deoiling (not managed by the control system). The first active step of the plant follows: the equalization and primary decantation tanks form a vessel for controlling the sewage flow rate into the various tanks by means of sluices (a simple level gauge is used for this).

Then sewage reaches the oxidation and pre-denitrification tanks where the level of oxygen in the slurry is measured at the inlet and at the outlet. The nitrates and suspended solids are also measured in these tanks (by means of turbidimeters, which are designed specifically for measuring turbidity by implementing optical techniques), along with the phosphorous and ammonia contents, the level of decanted sludge, and the inlet and outlet water flow rate. Some of the output sludge is recirculated back to the inlet and reintroduced to improve the biological processes. After oxidation, the water flows to the secondary decantation tanks where the sludge deposited on the bottom is collected and conveyed to the thickener. Here, the sludge is prepared for drying and disposal. The clarified water is instead released into the river.
Plant criticalities

The water treatment plant is, due to its intrinsic nature, subject to seasonal variations determined by rainfall. Consequently, one of the process criticalities is that the quality of the water to be treated cannot be determined beforehand. Furthermore, the plant collection basin includes a number of industries, which introduce large amounts of waste, thus the water chemistry and flow varies greatly. Another criticality of a plant like this, with such an extensive coverage, is that it is always on. This is essential to prevent the risk of releasing polluted water into the river and to prevent being fined by the water quality monitoring authority.

Before and after

The old plant was run according to a fixed time logic. This consisted of making the sewage water stand in the various vessels for a predetermined length of time and controlling the operation of the process-related machines (aerators, blowers, pumps, etc.) according to dissolved oxygen measurements and laboratory test data only. The goal set by Giovanni Tedioli, Water Treatment Manager of Hera Imola—Faenza, was to use the data collected by various sensors to control the transit times of the sewage in the tanks and machine operation according to the values of oxygen, ammonia, suspended solids, and nitrates to improve plant processing and energy efficiency. Furthermore, the new control system had to allow an operator to work at the plant as well as relaying data to the control room from where all Hera plants are monitored. The plants are manned during the day, but the control room alone monitors the operation of all water treatment plants during the night.

Massimo Zanoni, Electrical Maintenance, Automation and Remote Control Manager of Hera Imola—Faenza S.r.l., recollects the project start-up: “When we decided to refurbish the plant, we asked ourselves how to make sure that the new automation system would guarantee our peace of mind. The water treatment plant releases water into our own rivers and this implies additional responsibilities towards society: we need to guarantee faultless operation, for ourselves and for our environment.”

The “peace of mind” Zanoni mentions was then to be translated into high plant availability and reliability, data access by operators, and improved process management in terms of better results and more efficient use of energy resources. In order to reach these goals, Hera called Pastorelli’s Environmental Engineering firm to establish the project guidelines. The system was made by Novanet, a company based in Emilia-Romagna, Italy, with major expertise in the construction of large control and automation systems. Hera asked Novanet to use GE products for implementing the control system. These products are standard at Hera Imola—Faenza plants because they are reliable, competitively priced, the construction technology is good, and assistance in case of need is prompt and conclusive.

The water flow through the various stations of the water treatment plant is adjusted by controlling sluices.
The control system

The “brain” of the system is a PACSystems RX3i (now available from Emerson) in redundant hot backup configuration, which interfaces with all the field instruments on a Profibus network (part optical fibres and part copper wires); there are several new and old sensors in total, amounting to approximately 600 controlled tags. The two redundant CPUs ensure the high plant availability required by the application criticality. The PAC Controller establishes the standing times of the slurry in the various stages of the plant. By means of a direct Modbus/TCP link, the PAC communicates data to the Hera control room, where they are stored in a SQL database and concisely displayed so that the operator (present 24 hours a day) can be warned of faults and act accordingly.

At the Formellino plant, a local computer running CIMPLICITY from GE Digital, part of the HMI/SCADA suite, monitors and displays information and data in the form of trend or log, in addition to alarms, which may be silenced or not by the users according to their access levels. Ten profiles corresponding to ten different operative and data access levels have been created according to the privileges established for each user class.

The application allows for set up and program control parameters (the plant has been running only for a few months and the control logic is still being fine-tuned). Many fault detecting functions have been implemented in program running at the water treatment plant today to signal measurements deviating from expected values and to collect and use self-diagnostic data from the field sensors.

Novanet, the company who implemented the water treatment control process, was new to GE, despite having made control and automation systems for years.

“We used [GE Digital] products in this plant for the first time and, despite the complexity of the logics and the installations, we encountered no problems at all,” said Alberto Tabanelli, Novanet Technical Manager. “The PLC hot backup function provided default hardware redundancy, which avoided us further complications, and the system performance allowed us to introduce a predictive control, which has greatly improved plant performance.”

The data collected from the field is used to carry out a predictive control and therefore optimize machine use.

Intuitive displays show the plant status to operators at any given time.

The data collected from the field is used to carry out a predictive control and therefore optimize machine use.
The results

The new system collects plant data for constantly monitoring everything in detail. Predictive control, sensor data collection, and use and control system response rapidity have been exploited to optimize machine running times and consequently decrease energy consumption while keeping the water quality high. Before installing the new system, for example, the water was over-oxygenated, and this was pointless from a microbiological point of view. The Formellino Water Treatment plant automation system has been running for only a few months and the implemented logics are still being optimized. After only 50 days, an energy consumption of 30% has already been observed. The plant was shut down for approximately half an hour to allow the new system to be installed. Personnel training was swift, thanks to intuitive, self-explanatory graphic displays, and was carried out over several shifts to account for staff turnover.

Future developments

New actuators, which will be controlled continuously instead of in steps, will be added in the future. They will be installed on the Profibus field network and controlled directly by the PACSystems Rx3i. These improvements will provide the best results where the processed matter is kept moving: i.e., in oxidation and sludge recirculation tanks.

About Hera

The Hera Group was established in 2002 following the merge of eleven public utility companies from Emilia-Romagna. Other companies were acquired during the merging process, including Agea, based in Ferrara in 2004, and Meta in 2005. This completed the first Italian merge of listed stock multiutility companies. The Hera Groups works in approximately 180 towns in the provinces of Bologna, Ferrara, Forlì-Cesena, Modena, Ravenna, Rimini, and in some towns in the provinces of Florence and Pesaro-Urbino. It is split into seven Local Operative Companies, one of which is Hera Imola Faenza, which is responsible for managing water, gas, electricity, remote heating systems, and environmental hygiene over an area of 23 towns.

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www.gruppohera.it

About Novanet

NOVANET is a system integration and engineering firm specialized in building automation, management, supervision, remote control, and home automation.

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Tel. +39 0542 25594 | Fax +39 0542 610546
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The City of Haverhill Water and Wastewater Division

Meeting critical needs and maintaining high quality
The city of Haverhill, Massachusetts, keeps a close watch on its water infrastructure, operating both Water and Wastewater Divisions.

The city’s Water Division provides drinking water to 58,000 Haverhill residents and businesses, and produces two billion gallons of water on average each year. The plant itself is manned 24 hours a day, seven days a week, to ensure the highest quality water is delivered each day to the city’s residents. Water quality is constantly monitored to make sure that it meets both state and federal drinking water quality standards at all times. Water treatment processes include conventional surface water treatments such as coagulation, flocculation, sedimentation, filtration, disinfection, and pumping.

The city’s Wastewater Division maintains the wastewater treatment plant, which provides both primary and secondary treatment for the city’s wastewater. Within the Wastewater Division there are two groups—one monitoring wastewater collection, and the other overseeing wastewater treatment, which includes bringing water and routing wastewater into various facilities from multiple points across the city.

As part of its duty to safeguard the city’s water supply, the Water Division is also responsible for monitoring, water maintenance, and water treatment, which includes protecting water resources. The city of Haverhill is currently supplied with water from Kenoza Lake, Millvale Reservoir, Round Pond, and Crystal Lake.

The facilities themselves are 32-years-old, however, the control strategies they have in place today have put them well ahead of other facilities of similar size and operation—thanks in large part to tools becoming more readily available, accessible, and connected.

Benefits of working with GE Digital

- GE Digital has put the city of Haverhill’s Water and Wastewater Divisions well ahead of other facilities of similar size and operation
- They now have the ability to use advanced analytics to model high-flow scenarios—and better prepare the plant for potential weather-related issues
- Plant’s knowledge base was captured, reducing training overhead
John D’Aoust, Plant Manager for the city of Haverhill’s Water Division, has been with the city for 18 years, and has been leading the charge to harness the power of the Industrial Internet. He began many years ago by teaming with GE Digital to automate many of the processes that his team had manually documented in order to follow standard operating procedures (SOPs), including state-mandated emergency response plans (ERPs).

D’Aoust’s first step was to implement GE Digital’s iFIX. It quickly became a real asset in maintaining water quality. Next, the Haverhill team added GE Digital’s Proficy Workflow, a software platform for measuring and managing the efficiency of plant operations. It was an immense performance improvement over their documented processes. Moving to a computerized process environment allowed D’Aoust and his team to have a cohesive system to follow procedures, and respond to events in a consistent and sequenced manner.

He took his connected environment even further, and purchased Dell Latitude laptops for his on-call operators. Allowing them to be untethered from the facility, but still access GE Digital’s software to maintain control of operations from any location. The on-call people are the first responders for after-hour issues—maintaining pumps, monitoring chemical levels in the treatment plant, and even keeping a watchful eye on the plant itself as the post-9/11 era raised awareness for new safety concerns.

With GE Digital’s iFIX you can connect to the plant—get it set up and you don’t have to watch it as closely. It was all manually controlled before—all hardware based, and it took a lot of attention by the team to maintain,” he said.

"With GE Digital’s iFIX you can connect to the plant—get it set up and you don’t have to watch it as closely. It was all manually controlled before—all hardware based, and it took a lot of attention by the team to maintain,” he said.

The laptops were equipped with GE Digital’s software and cellular dongles to access water facility operations. Each laptop had to be maintained and manually updated. The benefits of being remote and still being able to access iFIX were clearly visible. So much so that D’Aoust put GE Digital’s mobile app to work and swapped out his pool of laptops for a single Apple iPad connected over wireless LTE. The plant’s team is alerted to any issue through a series of alarms that have been established, and they can use related products, such as troubleshooter programs to conduct flow chart decision-making for their wastewater operations.

“They have all the features of the control room in their hands.”

John D’Aoust, Plant Manager for the city of Haverhill’s Water Division
According to John D’Aoust, “The upside of moving from three laptops to an iPad is that there’s only one machine to maintain, and the price per iPad is considerably less than having to purchase multiple laptops. There’s a time savings, and it lowers the complexity of our system."

The one technical hurdle that he had to overcome in his move to become more mobile was to ensure the security of the network. In order to get the iPad onto their internal network, they had to reevaluate their VPN connection. Ultimately that involved a change of provider.

One of the unanticipated benefits of this newly-connected world was the ability to capture and transfer knowledge easily between senior members of this staff and new hires.

“One of the biggest project benefits of putting the data model together has been capturing our knowledge base,” said Fred Haffty, Wastewater Facility Manager. “We have people who have been here since the plant started more than 30 years ago, and when they retire, they take that experience with them. So when new operators come in, they are able to know how the system works—to be able to adjust the treatment process for swings without impacting quality.”

The move from a manually-intensive operation to a much more efficient software-based mobile operation has afforded the plant with much more flexibility, and resulted in cost savings. The team is able to see everything that’s happening at the plant from a remote location, and be alerted to changes in the water operations without a strain on human capital.

Just recently, the team started using advanced analytics to model data for high flow situations—such as potential threats brought about by severe weather. Using GE Digital’s Proficy CSense, a powerful analytical tool that utilizes leading-edge techniques to extract knowledge from historical processes and plant data, the team is able get a real sense of how the plant will perform under certain conditions.

For example, if the plant exceeded X-number of gallons a day, what is the likely result? Previously, the team had to refer back to historical data that was fixed and not fluid. Information was logged into an Excel spreadsheet—it was a very manual process with no modeling capability. Now they have five key performance indicators to monitor operational performance much more effectively. GE Digital’s Proficy CSense can have a fundamental impact on present time.

It’s been 12 years since John began working with GE Digital to transform the city of Haverhill’s water operations from a fixed hardware-based manual operation to one that’s leading-edge in his industry. His experience continues to be a positive one.

“We’ve been working with [GE Digital] for the past 12 years now, and it’s been a great relationship,” said John D’Aoust. “We’ve made those 2 a.m. calls to our reps, and they’ve been right there to answer—whatever we’ve needed. Our philosophy is that you pick a good company up front to meet your needs, and you stick with them. We haven’t been disappointed.”
Herning Vand gathers valuable knowledge with their historical data

Based in Denmark, Herning Vand strives to efficiently deliver clean water to its customers

Going Beyond Big Data

"Big Data" has become a buzzword and everyone agrees that it is worthwhile to explore the large volumes of data. Herning Vand has invested in an advanced calculator that can help to interpret their process data and already in the first project they came across particularly valuable knowledge.
For years, Herning Vand has recorded and saved a large amount of process data that is collected online from Herning Vand’s 14 purification plants.

The data is logged with the clear intention to make Herning Vand wiser and therefore better equipped to optimize processes and the overall operations. However, for that to happen the large volumes of data must first be sorted, analyzed, processed, evaluated and thoroughly compared so that the important correlations and trends can be localized.

"We have achieved some excellent results with our first project and we see a great future optimization potential with the tool."
— Jan Ravn, Chief Operating Officer at Herning Vand

However, Proficy CSense shall, just like other simulation tools, be used shrewdly and Herning Vand, together with process consultants from COWI who were responsible for the initial consultancy, gained some valuable experience. COWI assists Novotek, a GE Digital partner, with process technical advice in connection with the use of Proficy CSense.

"A spreadsheet can be used to handle relatively large amounts of data, but it will not work when there are too many parameters in play simultaneously. Therefore, last spring we invested in Proficy CSense software solution, which is dedicated to finding and using mathematical correlations of large amounts of data."
— Jan Ravn
“I see Proficy CSense as a closed box that is filled to the brim with advanced calculation routines. We just feed the box with the data we want it to compute and then we tell it what parameters we want to observe.

Proficy CSense finds the right mathematical description of the data stream and can then show two curves of the same data stream. One curve contains the actual data and illustrates the process as it was in reality. The other curve is generated by the mathematical model that Proficy CSense has set and therefore shows a simulated process.

When the program is fed with multiple data streams at once, it automatically locates the possible relationship that exist between the different data and that is exactly what we are after.”

— John Sorensen, Senior Project Manager for water and wastewater at COWI.

When CSense has found the mathematical models and correlations, the user can then determine which parameters to focus on and what to look out for. Just like when you insert different values into an equation. Here it is just an automated solution to an almost unlimited number of equations.
"We can find correlations that we did not know existed and our theories can be confirmed or dismissed. Once we have located the significant correlations, we can begin to optimize the process based on this new knowledge."

"If, for example, I want to have output A as high as possible, how should I then set inputs B, C and D?"

—Jan Ravn

*Figure 3: Proficy CSense has identified the parameters that have the greatest influence on a given run-off result.*
The first project, which was the optimization of the gas production that is based on sludge from the purification plants, gave an output improvement of as much as 20%.

The gas is used for electricity production and according to Jan Ravn the increase corresponds to an annual additional production of approximately 400,000 kilowatt hours, which earns Herning Vand approximately DKK 500,000.

Herning Vand is now engaged specifically in a series of small defined projects that will ultimately achieve the goal of making Herning Vand energy neutral.

"We knew roughly which buttons we had to press to achieve this gain and so CSense should not take all the glory. However, the tool makes it much easier for us to check the accuracy of our assumptions and it can also show us the way to the process-related correlations that we cannot find ourselves."

— Jan Ravn

The Art of Definition

The advice from Jan Ravn and John Sorensen is that you have to be good at defining the amount of different data that CSense works with and you get the best and fastest results if you have relatively robust process knowledge.

The more data you put in means you get more answers out at the other end. However, there is of course an upper limit, and too many parameters in play can make it difficult to understand the results.

As Jan Ravn explained, "Our advice to new users is that you start simple and carefully consider both what it is you want to have answers to and also what parameters are likely to affect these answers. If you do not know exactly which parameters affect your focus area, you can gradually reduce the number using Proficy CSense as you test each one. When the data streams are recorded and analyzed they fit together mathematically, so when you adjust each parameter up and down with the mouse, you see how the other parameters are affected to either go up, down or remain unchanged. When you have isolated the relevant parameters there is the option to activate the tool to simulate towards an optimum process within a given framework."

The first project is only the tip of the iceberg in relation to what we expect to achieve with Proficy CSense. We have an ambition that the tool will be used regularly for small and large projects, and therefore assist us to pick all the low-hanging fruit that would otherwise be missed during a busy working day,”

The findings are instantaneous and the application potential is great.”

— Jan Ravn
Mekorot: High Availability, Connected Control Solution Virtually Eliminates Downtime
Challenge

Mekorot, Israel’s National Water Company, provides 70% of all water, and 80% of the drinking water for the country. Mekorot sought to reduce production costs through improved energy efficiency and tighter process control.

By leveraging GE Digital’s software and GE’s hardware automation solutions, Mekorot is now using real-time data to automatically monitor and control devices from a single control room. This has created a connected environment in which minimal intervention by operational staff is required. Full redundancy was also employed to virtually eliminate downtime and to simplify controller backup.

Background

In an arid climate such as Israel, water is an especially valuable commodity. Frequent droughts and a dramatic increase in demand have made securing a reliable source of high-quality water a national priority.

Lake Kinneret, also known as the Sea of Galilee, is a key source of water for the Mekorot system. To improve the quality of the water pumped from Lake Kinneret and address Israel’s decades-long water shortage, Mekorot built a state-of-the-art filtration plant controlled by GE Digital’s state-of-the-art high-performance automation solutions. The Central Filtration Center at Eshkol in Northern Israel is currently the only one of its kind in Israel, and one of the largest in the world.

Lake Kinneret is 212 meters (695 feet) below sea level, so most of the water filtered at the Eshkol plant is pumped 152 meters (498 feet) above sea level, and then flows through pipes and open canals to the Eshkol Site. At the plant, it is treated and filtered before being distributed to urban, industrial, and agricultural customers.

“We aim to achieve high energy efficiency and process efficiency, so that we can facilitate cost reduction in the production of water. To achieve this, we have to leverage operations support systems and programming tools, which enable real-time decision-making. The GE control system at the plant performs automatic monitoring and control of the devices from a single control center.”

Nuriel Meraro, Command & Control Engineering Manager of Mekorot’s Jordan Valley Division
Solution

During the filtration center’s planning and construction, Mekorot worked with GE’s channel partner General Engineers, which specified and provided GE solutions to control and monitor the plant.

Mekorot chose GE’s process control products for their ability to meet three critical customer needs:

1. Efficient, connected operation with fewer shifts and personnel
2. High availability
3. High and proven reliability

Simplifying operations

GE Digital’s automation solutions monitor and manage the Eshkol plant from a single control center. Dozens of monitors visualize and track the plant’s systems with minimal intervention from operational staff, dramatically increasing operational efficiency and minimizing costs.

Securing water

As a critical system, the Eshkol filtration plant operates 24/7, except once a year, when water flow is stopped for maintenance and upgrades that can’t be performed when water is flowing. Otherwise, GE’s control system allows upgrades to the system while in process, allowing Mekorot to maintain a steady flow of water to its customers.

The control system installed at the Eshkol Filtration Center features the PACSystems High Availability solution (now available from Emerson), which provides true redundancy and enables full backup of the controller. The control and monitoring system has identical modules which work independently, and have full backup to help ensure the continuous and reliable operation that is of critical importance to Mekorot. Operations support system and programming tools enable real-time decision-making.

The system features 7 pairs of PACSystems RX3i controllers, controlling 6,000 I/O points with redundant architecture at all control layers—I/O to end devices, controllers, and HMI system. It is wired with fiber optic cables to ensure the fastest failover communication.

GE Digital’s CIMPILCITY HMI/SCADA software monitors the control system. The software was customized to the requirements of Mekorot, enabling optimal control of all facets of the filtration processes.

“PACSystems controllers along with [GE Digital] CIMPILCITY HMI/SCADA system provide the highest flexibility in their implementation, as well as cost reduction for the end customers.”

Hertzel Perry, Technical Manager for Control and Communication Systems of General Engineers
Benefits

With hardware controls and GE Digital’s software solutions, Israel National Water Company met its goals for the Central Filtration Center:

- **High availability**
  The plant runs 24/7, even during system upgrades

- **Increased efficiency**
  The connected plant can run with fewer shifts and personnel than similar-sized operations

- **Reduced cost**
  Less unplanned downtime and greater operational efficiency has reduced operational expenses

- **High reliability**
  True system redundancy enables continuous operation

Building on the success at the Eshkol Filtration Center, soon additional screens will control and monitor the plant’s sludge treatment process. This process cycles sludge created by the filtration process back through the system, saving water, enhancing the overall efficiency of the water filtration process, and reducing costs.

“Mekorot faced challenging targets in the last seven decades of the Israeli water market. We feel proud to be part of turning these challenges into reality with our advanced solutions and our engineering expertise.”

Zachi Stromza, Automation and SW Solution Division Manager of General Engineers
City of Orangetown

GE solution lowers costs, increases control capabilities at municipal sewer department
Getting Rid of Waste

Running, maintaining, and upgrading a sewer system is challenging enough when a municipality has the luxury of unlimited funding for such projects. However, when funding is tight and a manufacturer no longer supports the existing control equipment or can provide a reasonably priced alternative, the job is that much harder.

The Orangetown Department of Environmental Management & Engineering, which is responsible for the sewer system that serves about 50,000 people in New York’s southern Hudson River Valley, faced this problem. Orangetown’s existing system was comprised of 41 remote sewage pump stations, only 11 of which it could afford to network via radio telemetry. After receiving a grant from the State of New York to upgrade the controls and connect all 41 stations, the municipality discovered that the supplier of its existing control and telemetry equipment no longer supported it, and the only alternatives from that company were much too expensive for Orangetown’s budget. Robert J. Beckerle, Director of the Orangetown Department of Environmental Management & Engineering, sought a reasonably priced solution with more robust capabilities that would integrate with the company’s LAN and that would be supported by the manufacturer throughout its lifetime. GE’s CIMPILICITY HMI/SCADA and Emerson’s VersaMax PLC, integrated into the plant by Optimum Controls Corporation (OCC) of Reading, PA, emerged as the clear choice.

Results

- Cost-effective controls upgrade
- Zero downtime
- Easy installation and maintenance
- Greater data availability and documentation
- Scalable solution accommodates three differently sized pumping stations
- Highly reliable
- Outstanding service and support
- Integration with existing operating system

“The GE CIMPILICITY solution gives us more complete information at a better price than our previous control system.”

— Robert J. Beckerle Director Orangetown Department of Environmental Management & Engineering
Bringing CIMPLICITY to a Complex Project

With pump stations that run the gamut from small and simple (20 hp submersibles on float balls) to large and sophisticated (1000 hp (4,250 Hp pumps) with VFDs and ultrasonic level controls), Orangetown can accommodate a tremendous range of applications.

However, for continuity and ease of maintenance, each of Orangetown’s 41 remote sewage pump stations are configured in a similar manner. Each station’s control logic and cabinet are designed in one of three ways, which vary greatly in size to accommodate the diversity of applications. One features two pumps with float controls, another incorporates three pumps with float controls, and the final is comprised of three pumps that receive analog signals from ultrasonic indicators. The pumps are controlled through variable speed AC frequency drives that match the pump speed to the inflow. The common component in each configuration is a VersaMax PLC, which monitors and controls such performance indicators as alarms, wet well levels, pump speed/inflow, and status points.

The PLC at each station transmits pump data via a wireless network to a CIMPLICITY SCADA system in the plant. Information received through the system is distributed to four stations through an internal LAN. One station features a CIMPLICITY server that provides the status of each pumping station and alarming functions. The other three stations are clients that enable plant personnel to monitor the pumping stations from their desks.

A Clean Performance

With the exception of a few pump stations that have not yet been incorporated into the network, the new control system is fully operational, and Beckerle has been pleased with its performance.

“We receive more complete information about each pumping station at a better price than we did with our previous solution,” he says. “And the system has been very reliable—we have experienced zero downtime since installing this equipment.”

The installation itself, according to Beckerle and Terry Campbell of OCC, was relatively easy, and the equipment is user-friendly.

But good technology doesn’t sell itself. Beckerle was very impressed with the knowledge and expertise of his GE representative, who explained, among other things, how Beckerle could upgrade from his existing software and hardware configuration to this new GE solution through a cost-effective upgrade program.

The next step that Orangetown Department of Environmental Management & Engineering is taking to further upgrade its pump station automation is the addition of a CIMPLICITY mobile notification system, which notifies a user when an alarm situation occurs, allowing faster response time.

With all of these features, the new system is paying off for Orangetown. The upgrade was cost effective, and the system has experienced zero downtime. Easy installation and maintenance have added to its benefits. At Orangetown, it looks like the grant from the state has been used well—without any “waste.”
The City of San Luis Obispo Improves Efficiency and Productivity with iFIX
The City of San Luis Obispo

The City of San Luis Obispo’s Water Department consists of five divisions that move water to and from the city. The divisions consist of a water treatment plant, wastewater treatment plant, wastewater collections, water distribution system, and a reservoir.

Challenges

Five divisions, five separate SCADA systems

The city was managing its water divisions in siloed systems that weren’t capturing all the necessary data needed on how the water equipment is running. The systems also did not include any alarming or trending capabilities, so the city often relied on its customers to notify them of any issues.

Solutions

Standardizing iFIX for optimal plant processes

Results

Real-time monitoring for immediate operator response

The City of San Luis Obispo was able to increase operator efficiency and improve reliability, as it serves residents and businesses with clean, safe water with GE Digital’s iFIX HMI/SCADA solution.
Vandmiljø Randers

Optimized IT Processes Management and Power Consumption
Vandmiljø Randers

Challenge

- Replace aging HMI/SCADA system
- Improve their way of working
- Optimize IT process management and power consumption

When Vandmiljø Randers (The Department of Water, Randers Municipality) decided four years ago to replace their aging HMI/SCADA system, they were not aware that the project would lead to both positive technical and personal changes.

“We deliberately sought to get away from the old way of working, and the decision to change our HMI/SCADA system was taken, among other things, because our old system could not be forced, by hook or by crook, to work in the new way. But neither of us had anticipated that the change would be so total and so positive for the whole company. And if I am to be honest, I am extremely proud of everything we’ve achieved so far”, says Michael Sønder Jensen, Production Manager at Vandmiljø Randers.

Action

- Novotek, a GE Digital partner, proposed iFIX from GE Digital, a proven and innovative HMI/SCADA solution that enabled Vandmiljø Randers to generate all needed reports without manual data entry
- Provide the right tool to generate KPIs, improve decision making by being closer to the processes, and optimize processes

There are calculation tools installed in iFIX that can combine automatically logged and manually entered data in order to generate reports.

“We have received a solution configured so that we ourselves can generate all the reports we want, with or without manually entered data, and that option is worth a lot of money for us,” says Michael Sønder Jensen.

“For example, if we want to optimize the aeration in our tanks, we need to know how many cubic metres of water that run through the plant and how many kilowatt hours we use on our compressors. In less than ten minutes, iFIX can create a report that shows how many kilowatt hours we use per cubic meter of water, and in that way we can work efficiently to optimize that specifically.”

“Having acquired the right tool to generate the KPIs we need, enables us to see exactly what happens when we push the different buttons. In that way, we have moved much closer to the processes that we are responsible for managing and optimizing at Vandmiljø Randers. It is something that can really be seen on the bottom line.”

Result

- Increased efficiency of working methods and managing processes more effectively
- Optimizing processes continuously and reducing power consumption

“The shift to our new iFIX HMI/SCADA solution has in many ways been like moving from one reality to a new and better one. In our new reality, we get more good process optimizing ideas than we did in the old one. At the same time, the ideas are much easier to realize, which is not least due to our new HMI/SCADA solution.”

The list of benefits, efficiency improvements and new opportunities that Vandmiljø Randers has achieved with their new HMI/SCADA solution is long. Most importantly, however, iFIX has brought the employees in closer contact with the processes that need to be managed and, if possible, optimized.

“Our goals are now evident to everyone, and this has helped us to constantly improve and, among other things, continuously use less and less power”, says Michael Sønder Jensen.
Waterford Township Department of Public Works

Standardized Workflows Improve Process Consistency and Efficiency
To link its iFIX SCADA, Computer Maintenance Management Systems (CMMS) and Document Management Systems (DMS) and to standardize workflow procedures to mitigate the loss of institutional knowledge due to workforce retirements, the Waterford Township Department of Public Works (DPW) implemented Proficy Workflow from GE Digital.

Located in the center of Oakland County, Michigan, Waterford Township is known as a Lakeland Paradise for its 34 lakes that surround the area, which covers 35.3 square miles. Over 71,700 Waterford residents rely on the DPW for service on a daily basis. DPW assets include 360 miles of water main and appurtenances and an overall water/sewer infrastructure that exceeds 80,000 features that require maintenance and work orders.

RESULTS

Effective integration of institutional knowledge and expertise

• Improved process consistency due to electronic standard operating procedures
• Greater efficiency with automatic work order generation
• Faster identification and proper correction of process deviations
• Better operational responsiveness with the ability to manage by exception
• Significant time savings of staff with automated step-by-step work processes
Waterford’s Challenges

Like many of its counterparts across the country, Waterford Township has been faced with losing a significant number of DPW staff, some with more than three decades of water and wastewater knowledge, to retirement.

“We were looking for a solution that would link real-time operational data in our SCADA system to our CMMS and DMS to create Standard Operating Procedures and work orders automatically when conditions were met in defined workflow procedures,” said Bill Fritz, P.E., Director of Public Works, Waterford Township.

“With SCADA continually sending real-time operational data through defined workflow procedures, the system automatically identifies abnormalities in operations and creates an Electronic Standard Operating Procedure (eSOP) and work order to ensure proper and timely correction.”

Bill Fritz, P.E., Director of Public Works, Waterford Township

Proactive Approach with Defined Processes

Fritz added that eSOPs also provide added benefits of “capturing the best institutional and professional methods for resolving the problem, which aids significantly as our workforce retires and becomes less experienced,” he said.

“One key aspect of the project was to get operating procedures standardized and in a format where DPW staff in the field, who might not be familiar with the system, could go in and follow the steps necessary to correct the issue,” Fritz said.

Now, any time an event occurs, assigned DPW staff is presented with a step-by-step list of instructions on how to resolve the issue. Because the process is electronic, it also captures and logs the process for future reference and evaluation.

To Fritz, Proficy Workflow provides a “middleware” solution that works in conjunction with iFIX from GE Digital – Waterford’s SCADA system and Azteca Cityworks-Waterford’s CMMS. Waterford also uses Proficy Historian from GE Digital. Integrating these systems together was an important operational improvement providing a crucial bridge between the SCADA and CMMS platforms, Fritz said.

Linking these platforms together also provided the benefit of automatic work order generation based on SCADA data that flowed automatically into Workflow. Prior to the Workflow install, DPW staff had to manually look through operational data for conditions that may have presented a problem, which alarming didn’t address. Once identified, work orders would be generated with very little, if any, eSOP to correct the problem. With Workflow, the SCADA data is continuously monitored and when deviations occur, appropriate workflows and work orders are automatically created saving valuable staff hours.

By utilizing real-time SCADA data and Workflow, Fritz said DPW staff are directed in a focused manner to resolve obscure operational problems and their root cause instead of never identifying the problem and/or root cause because that is the way it has always operated.

“Defined events are flagged automatically and consistently, forcing DPW staff to resolve them in a timely manner consistently,” Fritz said. “If you have a sewer pumping station with multiple pumps and one is starting a lot more than another, you have to first be aware that it is happening and then ask yourself ‘Why?’ Workflow does this and creates an eSOP and work order automatically to correct the problem. The same is true for pump runtimes and required maintenance on pumps when they reach runtime maintenance thresholds. This system ensures that we are proactive instead of reactive in nature.”
## BY THE NUMBERS

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<th>Waterford Township Department of Public Work’s Assets:</th>
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<td>Customer Leads</td>
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<td><strong>230</strong></td>
<td>Vehicle Fleet</td>
</tr>
<tr>
<td><strong>3,500</strong></td>
<td>Gate Valves</td>
</tr>
<tr>
<td><strong>3,400</strong></td>
<td>Fire Hydrants</td>
</tr>
<tr>
<td><strong>7,000</strong></td>
<td>Water Main Segments</td>
</tr>
<tr>
<td><strong>11</strong></td>
<td>Water Treatment Plants</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Elevated and Ground Storage Tanks</td>
</tr>
<tr>
<td><strong>24,000</strong></td>
<td>Customer Water Leads</td>
</tr>
<tr>
<td><strong>8,300</strong></td>
<td>Sewer Manholes</td>
</tr>
<tr>
<td><strong>8,500</strong></td>
<td>Sewer Main Segments</td>
</tr>
<tr>
<td><strong>64</strong></td>
<td>Sewer Pumping Stations</td>
</tr>
</tbody>
</table>
The Project

The DPW implemented Proficy Workflow from GE Digital to provide the department with the ability to apply logic to SCADA values for work order generation, employ eSOPs and to create inspection forms for data collection.

The goal of the project was threefold:

01 Integrate SCADA workflows with Cityworks by utilizing Cityworks Work Order API

02 Employ eSOPs to provide a method for documenting proper process and transference of institutional knowledge

03 Provide auto task generation by creating a workflow component for SCADA

The first phase also included the integration of the Work Order API to fully automate work order generation.

Phase two of the project includes the integration of the DPW’s DMS, which provides staff with seamless links to documents, drawings, agreements, manuals, etc., that are archived and used to develop additional workflows.

Manage by Exception

The Workflow integration included creation of four main components – the equipment model, events, Workflow templates, and schedules. Creation and utilization of these components create a process-driven workflow for managing by exception.

The DPW first modeled its system in Workflow by linking relevant database tags from the SCADA system. This allowed data to flow in real time from SCADA into defined workflows.

A trigger event was then created to initiate a defined workflow based on conditional expressions or time-based factors.

Condition-based events utilize transferred real-time iFIX tag values such as pump starts and stops, pump runtimes, water levels increasing or decreasing out of range, or changes in flow. These events use values stored in the equipment configuration to evaluate expressions to automatically determine whether action is needed.

Managing by exception enables DPW to act quickly based on real-time data, using condition-based events to automatically determine whether action is needed.

With condition-based logic, events can be triggered based on multiple sets of criteria varying from sub-set to entire categories that must be met for a workflow to be triggered. Logical expressions can also be designed to evaluate criteria defined in the Workflow process such as is one already running for the same event.

Another type of event trigger is time. Time-based events use a data/time expression to determine when an event should be triggered, such as sewer station inspections at set time intervals such as every two weeks.
Automated processes

The next step was to create Workflow templates that contain the procedures and steps for DPW staff to follow when completing the workflow. The procedures and steps can be executed automatically such as having a pump turn on or off or manually through interaction by the user. These procedures and steps can be modified by the workflow authors, and services can be added by the administrator to refine the process.

Finally, schedules are created by defining time-based activities within the Workflow template, if necessary.

When a workflow is triggered, an email is sent to appropriate DPW staff to alert them of the workflow and to provide them with the work order, if defined to be automatically generated. DPW staff can then begin to process the workflow and view all of the details involved.

Real-time SCADA data related to the workflow can also be displayed to aid DPW staff in resolving the event as well as specific eSOPs and documents such as operational manuals.

The eSOPs outline steps to problem resolution in a numbered format and have a “comments” field for the operator to enter information.

The steps guide users through resolution of the issue and have expiration times in place. If a step is not completed in a certain amount of time, escalation processes such as supervisory notifications can occur.

At any time, DPW staff can get a list of completed workflows and check a workflow history to view its details. Managers can develop workflows based on functions of their group. They can also delegate work and see the status of operations by viewing pending workflows.

Additional Efficiencies Ahead

In the future, DPW staff will design workflows to assist in automation of preventative maintenance on equipment such as pumps.

Examples include pump-runtime-driven maintenance such as bearing lubrication and seal inspection. Instead of hoping DPW staff remembers to perform this critical maintenance at a manufacturer’s recommended runtimes, a workflow can automatically be created and a work order generated to ensure it will be done.

“Workflow is more about its potential than anything. If you have an operational process, it can most certainly benefit from a workflow designed to monitor abstract and varied functionality to ensure proper operation and efficiency. No doubt it takes work at the beginning to develop them, but when they are in place, hundreds of DPW staff hours are saved and effective and consistent operations are ensured.”

Bill Fritz, P.E., Director of Public Works, Waterford Township
About GE

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