Challenge
• Increase plant capacity while maintaining existing staff
• Replace control system to improve process control
• Simplify monitoring
• Reduce energy usage

Solutions
PlantPAx process automation system:
• Allen-Bradley® ControlLogix® programmable automation controller
• RSView®32
• Allen-Bradley® VersaView® 1700P

Intelligent Motor Control:
• Allen-Bradley® Smart Motor Controllers with IntelliCENTER®
• Allen-Bradley® PowerFlex® 700 variable frequency drives

Results
• Almost doubled capacity without increasing staff
• Streamlined site maintenance program
• Automatic EPA reporting
• Remote monitoring allows re-allocation of three field operators
• Energy savings using on-demand schedule

Background
Population increase, environmental concerns, and energy savings are motivating the water and wastewater industries to upgrade facilities with modern technology.

The City of Plano, in Plano, Illinois, took a pro-active approach to increase its plant flow capacity and to ensure it met existing environmental regulations, while also preparing for future regulations and growth to the community.

Population in and around Plano grew by more than 56%, from 5,633 residents in 2000 to more than 10,000 in 2009. By 2003, the water treatment facility was reaching capacity of its activated sludge plant at 0.95 million gallons per day (MGD) design average flow and 1.67 MGD design maximum flow. The City of Plano needed to increase capacity to 2.44 MGD to meet the population growth, and it also wanted to improve the plant’s nitrogen and phosphorus removal capabilities.

The City worked with its citizens and local environmental groups to design a water treatment plant that would meet everyone’s needs and also be economical for the City’s taxpayers.
In November 2006, the City of Plano completed the $13.6 million award-winning plant improvement project that increased flow capacity to 2.44 MGD at its water reclamation facility and addressed environmental issues.

The improvements included: extensive upgrades to the biological nutrient removal, a new secondary control building housing mixed liquor distribution to the final clarifiers, water reuse pumps, plant drainage/scum pumps, the internal return pumps and ultraviolet disinfection used in the water treatment and nitrification process.

As part of the improvement project, the City expanded its plant process control to an integrated SCADA system with intelligent motor control and networking that contributed to better system diagnostics, improved process control, data collection, and remote monitoring that helped reduce employee workload. Motor starters and variable frequency drives on the plant process motors also helped save energy for long-term return on investment.

**Challenge**

The City of Plano’s main challenge was to make the necessary improvements to increase plant capacity to 2.44 MGD within the City’s budget constraints and a tight schedule.

The plant expansion would require replacement of existing control systems with modern process controls, new motor controls, instruments and value actuators, which would use networked communications whenever possible. Process automation controls would also monitor the processes for nitrification to help meet environmental regulations.

The existing plant had very little instrumentation for process control and therefore very little data collection, historical trending and monitoring capabilities. The City wanted to improve its process control capabilities and reduce the time and work involved in these tasks, while maintaining existing staff levels.

“Getting this kind of information manually was really time-consuming,” says Darrin Boyer, Plant Superintendent for the City of Plano water treatment facility. “EPA [Environmental Protection Agency] reporting took two full days, and it took three field operators to constantly monitor the equipment.”

Remote operation and monitoring was another objective that would save time and help reduce the workload for staff. Boyer was often called back into work when there was an issue at the plant. “I’d get called in after hours to check on a problem that may or may not be urgent,” said Boyer. “Having to come in immediately to identify and resolve problems was a big time waster.”

To contribute to environmental upgrading, the City also wanted to use minimal energy to run its many industrial pumps used during the water treatment process.

**Solutions**

The City of Plano contracted Walter E. Deuchler Associates Inc. (WEDA) – Consulting Engineers in Aurora, IL, to plan and design the new plant.

WEDA’s design included biological phosphorous removal as well as the reuse of UV disinfected effluent on the plant site and at the nearby Cedar Dell Golf Course. The project included a new headworks building, a new blower building, the conversion of an existing packaged treatment unit to serially-operated aerobic digestion, and a new dewatering centrifuge. A new secondary control building houses the mixed liquor flow distribution valves to the final clarifiers, the non-potable water reuse pumps, the plant drainage/scum pumps and the internal-return pumps which pump mixed liquor to the anoxic selectors for de-nitrification.

WEDA worked with electrical engineering sub-contractor, Intelligent Design and Construction Solutions (IDCS), and with Complete Integration and Service (CI&S) System Integrator to design a state-of-the-art SCADA system to control the processes at the new facility. The team chose a PlantPAx (Plant-wide Process Automation Excellence) process automation system from Rockwell Automation that uses the core Integrated Architecture™ technologies and custom solutions for plant-wide control. The PlantPAx solution integrates all the process operations controls and motor controls into one system with access from remote telemetry/terminal units (RTU) at each of the seven main process buildings.

The heart of each RTU is an Allen-Bradley® ControlLogix® programmable automation controller (PAC or PLC) with redundant power supplies. ControlLogix PACs are fully-integrated with all aspects of the water treatment process, to help the operator access plant-wide production information for better management, decision making, and production automation and optimization. It offers real-time visibility into monitoring water quality, trending of loads, levels and clarity, and detailed alarming, data collection and automated reporting.
Each RTU also has its own HMI screen and is integrated with the other processes and the plant office via a high-speed, dual fiber-optic network. Wireless transmitting allows remote operation, data visibility, monitoring and control of any process from any location in the plant.

The main work station in the office runs RSView® 32, an integrated, component-based HMI with touch-screen operation using Allen-Bradley® VersaView® 1700P integrated display computers. EPA reports are now done electronically, through the PAC inputs and submitted to the State automatically.

CI&S also integrated intelligent motor control into the system to help manage the motor speed on the plant’s many pumps, fans and blowers.

It chose Allen-Bradley Smart Motor Controllers with IntelliiCENTER® to provide soft start and stop of the continuous-run motors, and provide integrated intelligence that connects to the rest of the PlantPAx process automation system. IntelliiCenter technology provides real-time diagnostics and MCC documentation to help maximize MCC and related equipment performance.

For motors that require varied speed, CI&S installed Allen-Bradley® PowerFlex® 700 variable frequency AC drives that also have integrated intelligence for additional monitoring, safety, and easy configuration and installation. The advanced motor control performance helps gather process information at the drive level and automatically disperse it to any part of the plant through the Integrated Architecture.

Intelligent Motor Control also contributes to plant sustainability by using the minimum power necessary to run a process; through the ability to program the system to automatically perform functions; and through remote access capability.

“One way that energy was saved was that the control system allowed the operator to run equipment on a demand schedule instead of a time schedule,” says Boyer. “For example, if we only need 5PPM oxygen in aeration, we will only run enough blowers to meet demand. We accomplish this through programming, because the plant is only manned forty hours per week.”

Results
The City of Plano water treatment plant improvement project was such a success that it received an Honor Award from the American Council of Engineering Companies of Illinois. The plant has almost doubled capacity to 2.44MGD while maintaining plant staff levels and was completed on schedule and within budget. The improved treated wastewater that leaves the plant confirms the City’s commitment to protecting the environment and our natural resources.

Three years later, Boyer sees significant changes and improvements in how the plant operates.

“The plant effectively handles more flow through the EQ basin,” says Boyer. “There is precise control of the bio-mass in the aeration tanks, accurate flow splitting to each final clarifier is achieved, and we have a controlled wasting schedule from the RAS (Return Activated Sludge) pumps.”

Boyer describes the new SCADA as “the eyes and ears” of the plant. The accuracy of automatic “smart” control improves performance of the process equipment and the precise monitoring of information like ORP (Oxidation Reduction Potential) in the aeration tanks is a valuable tool for operations staff to help reduce the risk of compliance issues.

“The regular EPA reporting has been cut from a two-day operation each month to little more than a click of a button,” says Boyer. “The daily flow data automatically populates the EPA discharge monitoring reporting form which then automatically uploads to the EPA site.”

The operators save time with the simplicity and flexibility of remote monitoring and control that gives them access to information about any process in the plant from any of the HMIs or the main office. Boyer estimates that the flexibility of remote monitoring of the equipment replaces the surveillance work of three operators in the field, so these resources can work on other important issues. They can now anticipate and detect a potential problem earlier, which allows time for a quick adjustment or small repair that could prevent catastrophic failure. This has contributed to a significant reduction in equipment downtime, says Boyer.

A major benefit has been remote monitoring from home at night or on weekends. It allows Boyer to determine if an alarm is critical or can be dealt with the following day. This has saved the cost and inconvenience of unnecessary callouts.

Manufacturer “dial in” functions have also saved downtime and expenses. The City can rely on quick inexpensive troubleshooting as each major equipment manufacturer can access the City of Plano system from their factory base and assess the situation without visiting the site. Often the solution can be implemented without any follow up from a service technician, said Boyer.

The PlantPAx process automation system provides the right information in real time to help The City of Plano meet its environmental and capacity goals. The new control system helps save energy, by allowing the operator to run equipment on a demand schedule instead of a time schedule. The City says there have been no effluent violations since the new plant was brought on line, and it has maintained plant staff levels while more than doubling its water treatment capacity.

The City of Plano estimates it received a return on investment in automation equipment within 2-3 years.

The results above are specific to the City of Plano’s use of Rockwell Automation products and services in conjunction with other products. Specific results may vary for other customers.