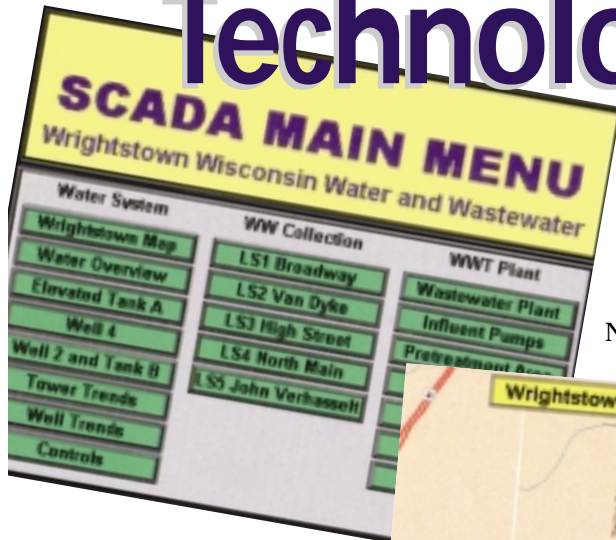## WASTEWATER TREATMENT

By Mary Turner

Small Town Finds Big Technology Affordable

Wastewater Treatment Challenge

The wastewater treatment facility Morrissey encountered in 1995 was vintage 1980.

The Wisconsin Department of Natural Resources (DNR) administers the Federal EPA National

C hiseled through the middle by the Fox River, the Village of Wrightstown covers about four square miles of rural east central Wisconsin, just 15 miles south of the city of Green Bay.

Just before Wrightstown's Director of Public Works Joe Morrissey arrived in 1995, the village had completed comprehensive planning that addressed future village growth. Wrightstown was gaining direct access to the newly redesigned US Highway 41.

"That was good for local business, industry and families, too," Morrissey said.

Recreation on the Fox River is a big draw in the area. "Our location is important for people working in Green Bay and Appleton, about 20 minutes away. A lot of people like the idea of raising their kids in a rural community," he said.

According to the U.S. Census, the population of Wrightstown grew significantly between the years of 1990 to 2000—a 53.2 percent increase—making water and wastewater utility operation a challenge and planning a priority.
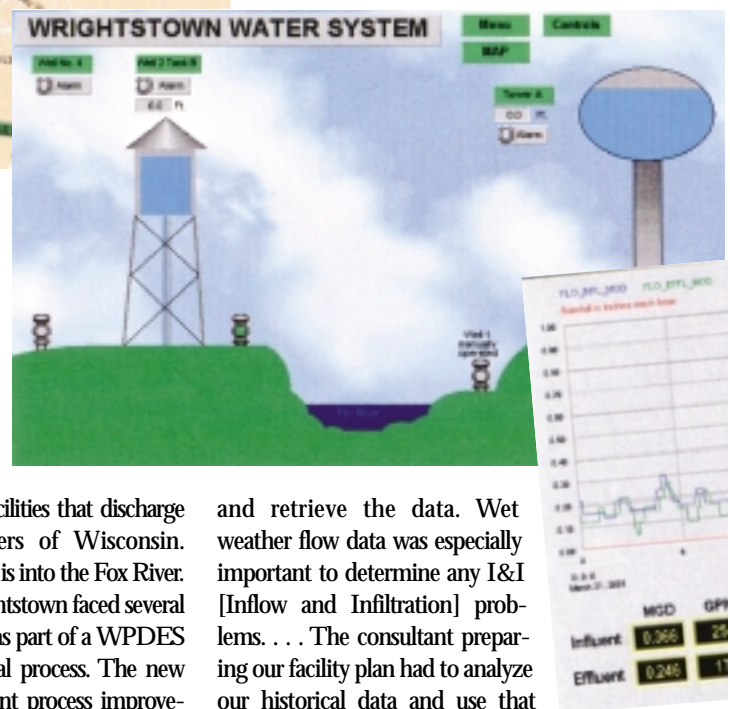
Pollutant Discharge Elimination System (NPDES) program in Wisconsin. The Wisconsin Pollutant Discharge Elimination System (WPDES) sets monitoring requirements and effluent limitations for all wastewater treatment facilities that discharge into the surface waters of Wisconsin. Wrightstown's discharge is into the Fox River.

The Village of Wrightstown faced several expensive requirements as part of a WPDES discharge permit renewal process. The new permit required treatment process improvements including a biosolids storage upgrade, disinfection upgrade and the addition of a phosphorous removal process. The DNR already had issued a compliance schedule.

"When I first arrived in Wrightstown, the village had not yet addressed the permit com-

pliance issues nor had they hired a consultant to start the facility planning process. I brought the situation to the attention of the Village Board in December 1995," Morrissey said, addressing these permit issues.

A facility plan was due to the state by the end of March 1996. The DNR set a date requiring all improvements be completed by May 1, 1998. Working with a consultant, the village filed for an extension to buy some additional time.

"We had lots of things to do. We had to go through all of our old treatment plant records for the past five years and retrieve the data. Wet weather flow data was especially important to determine any I&I [Inflow and Infiltration] problems. . . . The consultant preparing our facility plan had to analyze our historical data and use that data to estimate a future growth rate for the village. We also needed to monitor industrial discharges to determine organic loadings, since this loading has a significant impact on the design parameters for the treatment facility," Morrissey said.

The Wrightstown sanitary sewer collection system consists of more than 14 miles of a gravity sewer collection system and force main with five wastewater lift stations. All the waste from residential, commercial and industrial customers flows into the collection system and is pumped to the wastewater treatment facility.

"We had some previous data on our one major industry, the Nabisco Company, but we needed more data. We actually had to go into manholes on each industrial sewer line connected to the collection system and set up flow monitoring devices and portable samplers to determine flow and organic loading from each industry," Morrissey said.

Influent Loading Parameters (in Pounds)

BOD and TSS are plotted on the left Y axis. Phosphorus is plotted on the right Y axis.

BOD_INFL_LB (Avg)   PHOS_INFL_LB (Avg)   TSS_INFL_LB (Avg)

Planning the Future

"The state likes to see wastewater facility planning to get you through the next 20 years," Morrissey said. "We were at that point with a plant built in 1980."

In order to help plan for future needs, an engineering consultant, McMahon Associates, Inc., Neenah, Wisc., was hired to prepare a facilities plan. Wrightstown's WPCF plan called for adding a new headworks building with fine screening and grit removal. The plan also included effluent ultraviolet disinfection, equipment for biosolids thickening, a new phosphorous removal system and a PLC control system. Other renovations included reconditioning the final
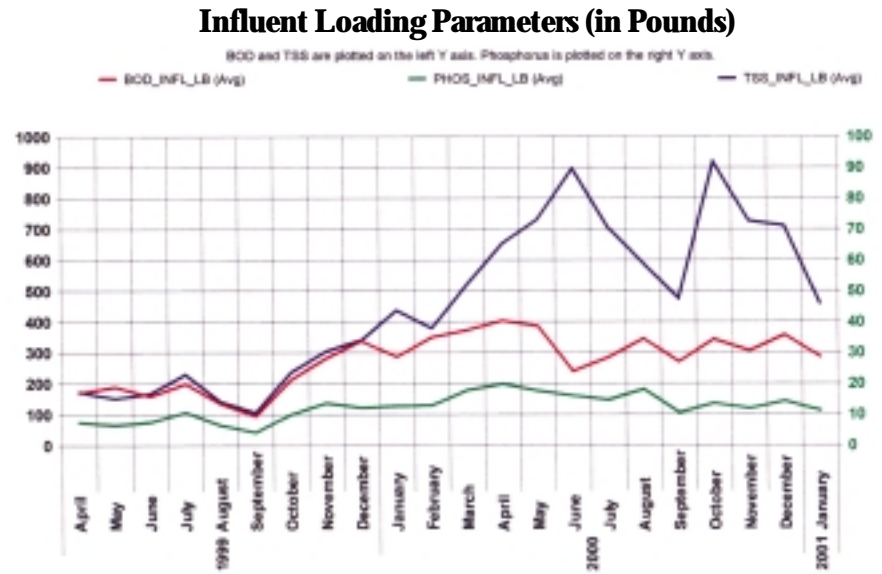
clarifier tank, sandblasting and recoating metal parts, plus replacing the center baffle and piping entering the clarifier from the aeration basin with stainless steel pipe.

In addition to the wastewater plan, a new water utility control system and a lift station telemetry project was being developed. This project included the addition of a new well, radio telemetry to all remote sites and replacement of some main distribution lines, valves, hydrants and services.
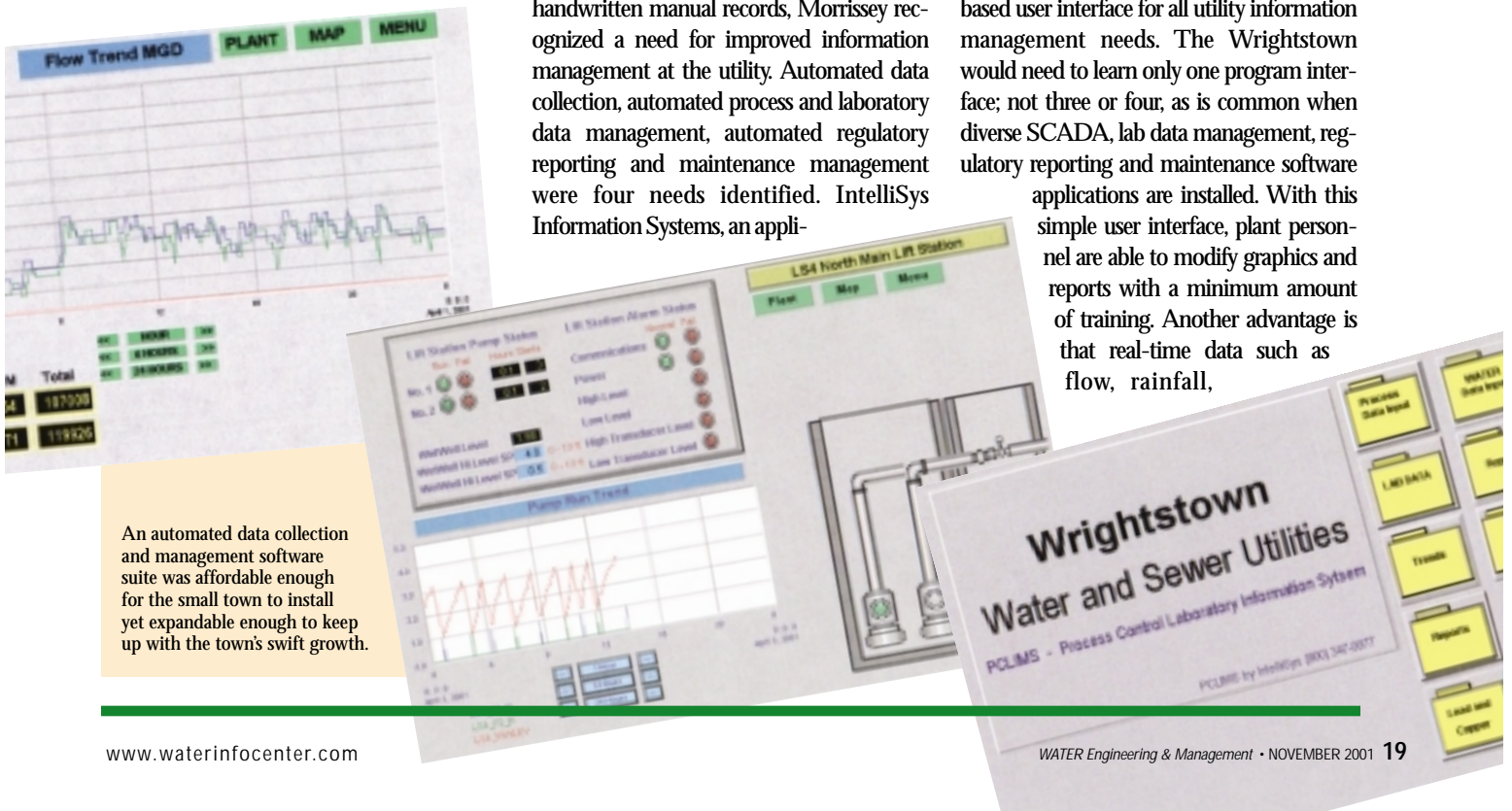
Technology Solution

After working with the village's engineering consultant and struggling for years with handwritten manual records, Morrissey recognized a need for improved information management at the utility. Automated data collection, automated process and laboratory data management, automated regulatory reporting and maintenance management were four needs identified. IntelliSys Information Systems, an appli-

cation and network service provider to the water resources industry, was contacted to discuss these needs. IntelliSys recommended the Integrated Plant Management and Control (IPMC) software suite.

While providing supervisory control and data acquisition (SCADA), the system also provides automated process data management, laboratory information management, regulatory reporting and maintenance management. IPMC also stores all data in a common engineering database that can reduce the cost of future engineering studies.
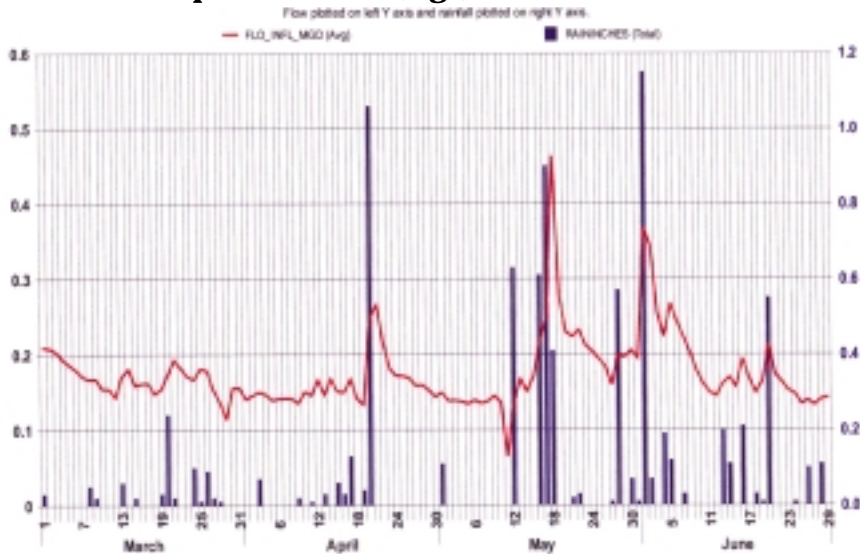
IPMC is an open architecture software solution that provides a single Windows-based user interface for all utility information management needs. The Wrightstown would need to learn only one program interface; not three or four, as is common when diverse SCADA, lab data management, regulatory reporting and maintenance software applications are installed. With this simple user interface, plant personnel are able to modify graphics and reports with a minimum amount of training. Another advantage is that real-time data such as flow, rainfall,
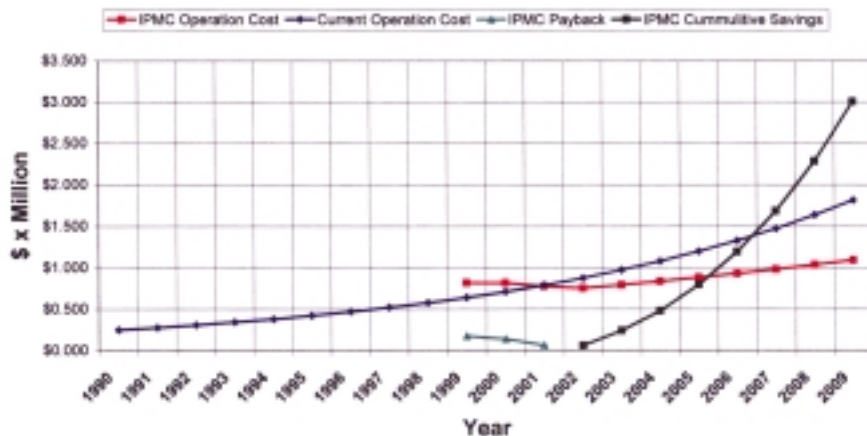
An automated data collection and management software suite was affordable enough for the small town to install yet expandable enough to keep up with the town's swift growth.

Pump Station Flow (mgd) and Rainfall in Inches

Utility Operation Cost with IPMC Automation Payback and Savings

Every day the totalizer reading was recorded and then the previous day's reading was subtracted to determine the flow. Manual readings such as rainfall also had to be taken.

"We'd read all the meters at the treatment plant, wells, pump stations and recorded all equipment run times and all the flowmeters. We had to check to make sure the wet well level controllers were working at the pump stations, check all the scales at each well and read the equipment hours. We recorded well runtime hours, chemical feed rates and weight on all the scales at each well. All this data was recorded manually on paper," Morrissey recalled.

Wrightstown also had to pay its consulting engineer to review, evaluate and enter all the paper-based data into a computer for analysis.

"Ten years ago, it wouldn't have been feasible for a town the size of Wrightstown to acquire an automated control system. Today the cost of technology is lower, and at the same time, operations and management costs have gone up," Morrissey said.

Today, an information management system is economical and feasible for even a small village. For years, only larger communities used this kind of sophisticated control system. The system gathers information around the clock and the information is accessible to the operators at any time.

"As a system operator, the most important part of the operator interface was to develop how the screens looked and to set up specific trends. Working as a team, the information system integrator and our staff developed the screens for our system," Morrissey said.

An intuitive user interface was designed, allowing virtual visits to process areas and remote facilities with the click of the mouse. The object orientated Graphical User Interface (GUI) allows design of realistic, life-like graphical views of plant processes and remote locations.

"Now, I can look at the computer screen and see what's going on everywhere…which pump is running, what the flow is coming into the plant…how much flow is leaving the plant. One feature I really like about the system is that I can trend and graph any flow, process variable or event," Morrissey said.

The Wrightstown wastewater project also has a new, automatic rain gauge measuring as little as 0.01 of an inch of rain. Hourly summary data saved to the IPMC

pump runtime and manual lab data are saved in one common, non-proprietary database. An Excel compatible spreadsheet report generator creates process, regulatory and engineering reports.

Many small utilities cannot afford to employ skilled information technology (IT) staff. Outsourcing IT support is a solution. The IPMC solution provides toll-free 800 telephone number support and dialup plant network access. If the plant staff needs help with a new trend or report, they can simply call the 800 number and get assistance over the phone or ask a technician to make a dialup connection to the plant network to assist them. Morrissey recognized that the availability of technical support service was crucial to the effective use of technology in his community.

Wrightstown's futuristic plan incorporated the installation of an IPMC system

designed specifically for water and wastewater facility management. The wastewater plant project came first and incorporated the initial IPMC components Wrightstown needed. The system allowed the village staff to manage current process, laboratory and maintenance information needs at the wastewater treatment plant and provided the flexibility to build on that technology to meet future needs.

Next, Wrightstown automated the water utility control system and collection system pump stations with installation of telemetry on two of its wells, a booster pump station, the two water towers and five wastewater duplex lift stations.

"Before we installed our new system, we did all manual data entry every day, onsite. Our flow records were daily circular charts with manually recorded totalizer readings, like the odometer on your car," Morrissey said.

database show how rain affects the flow entering the collection system through each lift station and total inflow to the treatment plant. Therefore, the system provides a simple, easy-to-use I&I analysis tool.

Saving Money, Time and Headaches

The essence of the system is data acquisition. IPMC enhances SCADA by automating management of acquired data. As a result of IPMC system installation, Morrissey predicts saving $20,000 to $30,000 in future engineering study costs alone.

"In the future, when we need to prepare another facility plan, there will be a big saving because we won't have to go back over years of daily flow charts and other hand written records. All of our information will be easily accessible to our consultant."

Now that the system is fully operational, Morrissey estimates that the process automation and IPMC software system for water and wastewater will pay for itself in about three years. Because the system allows existing staff to operate more efficiently, the utility's annual budget increases will be much less, saving the village millions of dollars in the next decade.

IPMC also saves administrative time. The database is designed to keep many years of data accessible and easily create reports and graphics. "I can be more precise and provide better and more accurate information to help the utility operate more efficiently. The system allows me to spend labor in areas such as preventive maintenance instead of trying to catch up on record keeping," Morrissey said.

Staffing is an area where the system has really helped control costs. Since 1995, Wrightstown has increased personnel by only one-half person.

Another important benefit of the system is that alarm situations often are avoided through trending equipment starts and predictive maintenance reports. Preventive maintenance extends the life of equipment, reducing capital costs associated with operating the Wrightstown facility. "We are more efficient with our time because of the information we're getting from the system," Morrissey said.

Expanding a Custom System

In the future, Wrightstown may add another pump station to accommodate village growth. "All we need to do is add telemetry to the new pump station, put an antenna on it and link it to the IPMC system using a copy of the current software. . . . Growth is a lot easier with a system already in place," Morrissey said.

Wrightstown's integrated system features open architecture hardware and software products considered crucial to implementing successful integrated plant management and control. The process control PLC and remote terminal units are Allen-Bradley hardware.

The computers use a Windows 98 workgroup network and Microsoft Office Suite applications. There are two computers on the network in the plant, and Morrissey also uses a notebook PC to access client IPMC applications and the plant network from home or other remote locations via a dialup telephone line network connection. The Integrated Plant Management and Control software suite consists of three off-the-shelf rapid application development (RAD) tools all powered by MQ Software Technology.

- System/View Operator Interface with SmartServer
- Report/View Database, Reporting and Analysis
- Maintenance/View Maintenance Management

Rapid changes in technology make it vital for small utilities such as Wrightstown to update their systems. IPMC software components make it easy to update, integrate and expand the applications. Nonproprietary software helps ensure that data will be available and usable with existing or future system software. Data preservation in an open architecture format allows for data migration to other software applications as may be required when working with an engineering consultant.

About the Author:
Mary Turner is a freelance environmental and industrial writer in Genesee Depot, Wisc.

For more information on this subject, circle 864 on the reader service card.