

La Crosse WWTP

SCADA/PLC Latest Technology

System Control & Reporting

By:

Jared Greeno

Mark Kane

Mike Wettstein

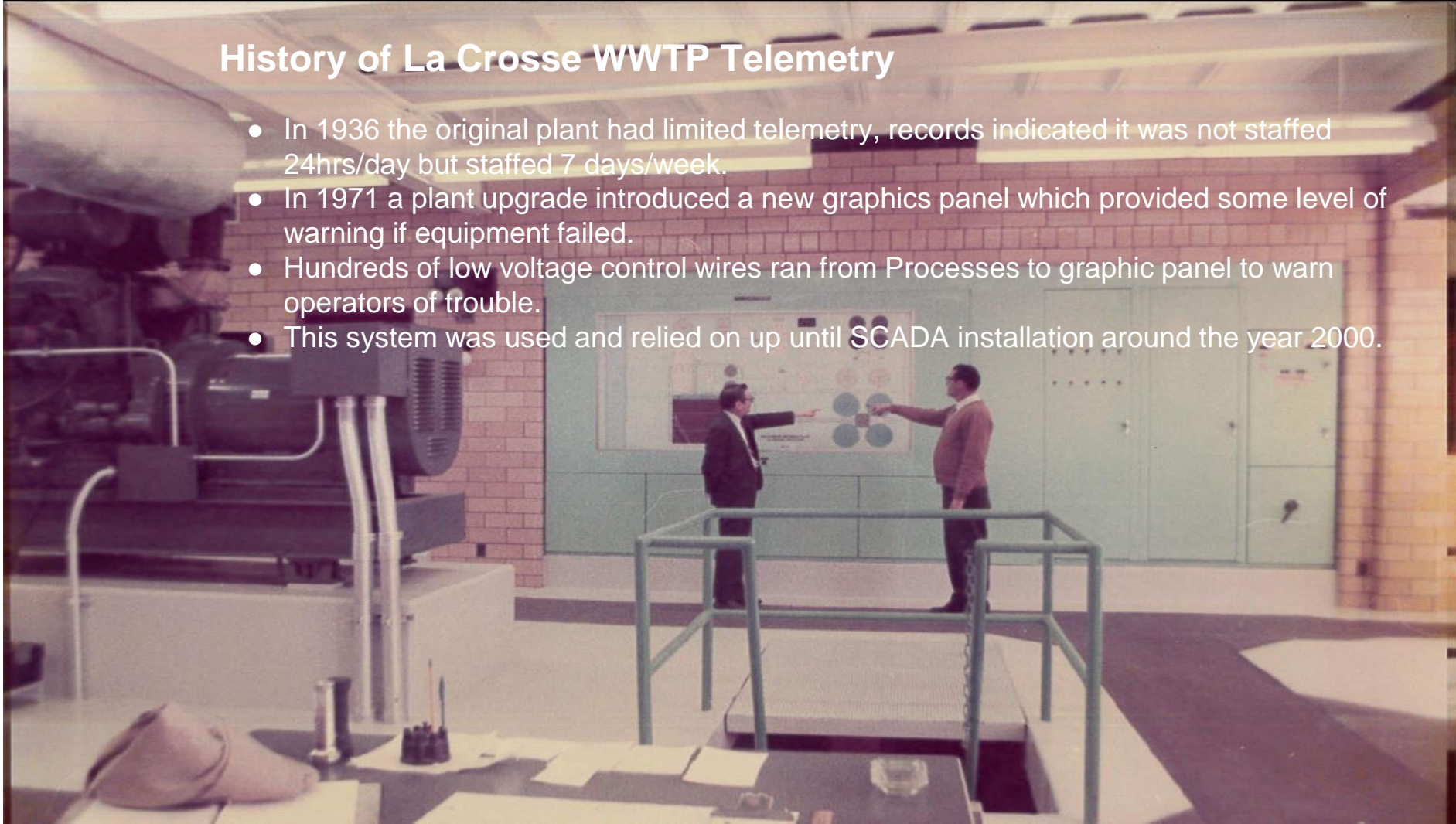


La Crosse WWTP (Plant Background)

- ❖ La Crosse WWTP was Constructed in 1936 with multiple upgrades over the years.
- ❖ Current Daily Average flow is 10.5 MGD
- ❖ Design Flow 20 MGD
- ❖ Regional WWTP.
- ❖ La Crosse operates a BNR system before discharging to Mississippi River.
- ❖ Anaerobic Digestion is used for processing solids.
- ❖ Digested sludge is thickened to 6% solids using a GBT.
- ❖ Currently La Crosse produces 12 MG/year of liquid Biosolids.
- ❖ Liquid injection is the method used to dispose of Biosolids.

History of La Crosse WWTP Telemetry

- In 1936 the original plant had limited telemetry, records indicated it was not staffed 24hrs/day but staffed 7 days/week.
- In 1971 a plant upgrade introduced a new graphics panel which provided some level of warning if equipment failed.
- Hundreds of low voltage control wires ran from Processes to graphic panel to warn operators of trouble.
- This system was used and relied on up until SCADA installation around the year 2000.



La Crosse WWTP SCADA History

- Off or Closed
- Fail or Alarm
- Run or Open
- Transition



- WWTP Plant
- Headworks H
- Primary Clarifiers P 1
- Primary Clarifiers P 2
- Settled Sewage Pumps
- Nutrient Removal N
- RASAVAS R
- Final Clarifiers F
- Ultraviolet Disinfect V
- Gravity Thickeners T
- Gravity Belt Thicken G
- Aerobic Digesters A
- Dewater Belt Press D
- Dewater Centrifuges D
- Biosolids Storage B
- Utilities U
- Main Menu

La Crosse Wastewater Plant

Primary Flow MGD	10,500	9943
Effluent Flow MGD	0.0	
Rainfall Today Inches	0.0	
Etc.	0.0	
Etc.	0.0	
Storm Conditions	<input type="radio"/>	

- ❖ In 2001 La Crosse Wastewater Utility started the process of Automating WWTP, at that time it required 30 employees to operate 24 hrs/day 7 days/week.
- ❖ By 2003 the majority of the WWTP was automated and staffing had shifted to 8h/day and down to 2 employees on the weekend to operate the plant. We eventually went to no operators on the weekends.
- ❖ Currently we have 14 employees that help operate the La Crosse WWTP, 26 Sanitary Lift stations, Including the Laboratory testing and Industrial Pretreatment.
- ❖ The system has served the Wastewater Utility well over the years.
- ❖ As years pass like other equipment PLC"s and Software need to be updated.
- ❖ Utility operated from 2001 to 2014 with the same software for system control and reporting with updates along the way.
- ❖ The PLC's were the original equipment from the installation in 2001.

What to do now??

- ❖ The software is outdated and needs to be upgraded.
- ❖ The PLC's have surpassed a 10 year life span some up to 14 years Old.
- ❖ How long should a PLC last?
- ❖ We knew the system served us well but realized we needed to get more current equipment and software.
- ❖ We needed to upgrade software first because time was running out on support for current software.
- ❖ We researched what we needed from a software package.
- ❖ With some help and input from others we selected software and put the project out for bids to install new system.
- ❖ Working with an integrator the new software system was installed in 2014.

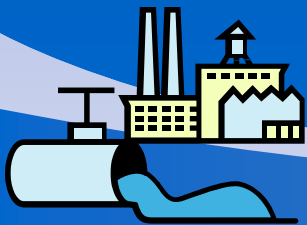
What 2 Integrators did working together that had a positive result for The City of La Crosse WWTP.

- ❖ One integrator took care of PLC installation and programming while another integrator installed redundant servers, SQL databases, and Operator Interfaces.
- ❖ Working together they provided the Utility a powerful system with real time status and control.
- ❖ Where is La Crosse WWTP today after the 2014-2015 upgrade?.
- ❖ Mark and Mike will now explain in a more detail how everything works??

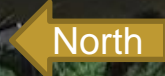


Wisconsin Wastewater Operators Association

La Crosse Wastewater SCADA Upgrades October 13, 2016



***Water & Wastewater Control
Solutions***



SLUDGE STORAGE

DEWATERING

DIGESTER

GBT

RAW SEWAGE

BFP

MTU ADMIN

BLOWER PLCS

SETTLED SEWAGE

UV





La Crosse Wastewater SCADA

So, what was involved in the upgrade?

- (PLC) Programmable Logic Controllers
- (OIT) Operator Interface Terminals
- Ethernet switches/fiber optic media converters
- Power supplies
- PLC programming
- Interface to existing HMI software
- Engineering and CAD Drawings
- Startup and Training





La Crosse Wastewater SCADA

What was installed originally?

- (PLC) Allen-Bradley SLC-5/05 ... SLC-5/03
- (OIT) Various Types – Serial Interface
- Fiber Optic Media Converters (Unmanaged)
- Multiple PLCs due to previous HMI limitations





La Crosse Wastewater SCADA

What were the challenges?

- New equipment needed to fit in existing spaces
- Needed to interface with existing I/O
- Needed to interface with wireless telemetry, RTUs, dialers
- Data structure compatibility with existing HMI
- Keep system running during switch-over



La Crosse Wastewater SCADA

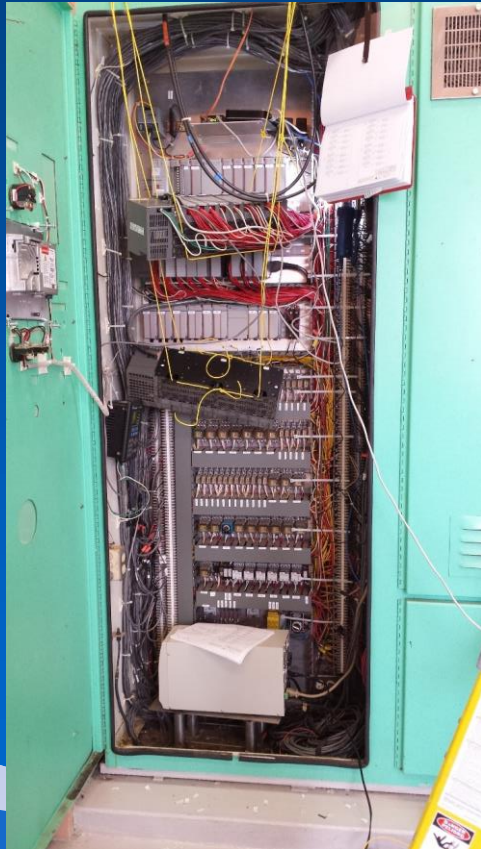


How did you design the new system, what did you use, what made the process successful?

- Allen-Bradley CompactLogix Automation Controllers
 - ✓ Maintain similar I/O structure for existing I/O
 - ✓ Provide cleaner and quicker installation, minimal downtime.
- N-Tron Ethernet Switches
 - ✓ Managed to control Ethernet traffic
 - ✓ Diagnostics for troubleshooting
- Programming structure to interface with HMI
 - ✓ Organize Automation Controller data for HMI interface
- Phased Approach
 - ✓ One PLC/SCC per week. Fully test with HMI integrator prior to install.
- Testing and Startup
 - ✓ Fully and completely tested at Altronex prior to installation.
 - ✓ Programmer and technician on-site during switchover



La Crosse Wastewater SCADA



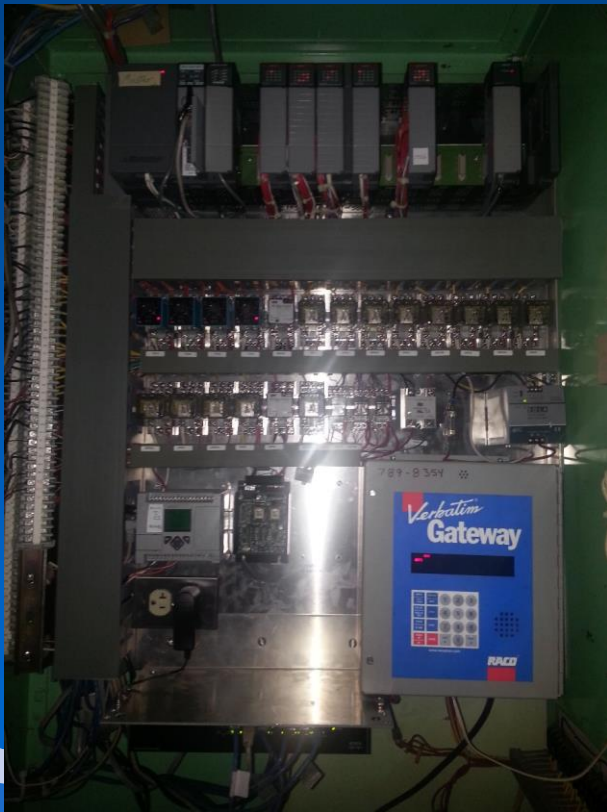
The Process

- Keep it all running during switch-over
- Develop backup control processes to minimize manual operation and downtime.
- Keep subset of alarms active at all times



La Crosse Wastewater SCADA

MTU - Remote Telemetry Panel



La Crosse Wastewater SCADA

Sludge Storage Building SCC



La Crosse Wastewater SCADA

Raw Sewage Building SCC



La Crosse Wastewater SCADA

Dewatering Building SCC



La Crosse Wastewater SCADA

Fiber Optic Switch Panel



Summary of La Crosse Upgrades

- Replaced PLCs with Automation Controllers
- Replaced various manufacturer OITs with Panelview Plus operator interfaces.
- Replaced unmanaged Ethernet media converters with managed fiber optic switches
- Worked with HMI software vendor to integrate new PLC equipment into existing HMI software.



SCADA/ HMI - Overview

WWTP SCADA is built on a web-based cross platform software application called Ignition by Inductive Automation

Application is deployed to clients from redundant servers for backup protection if hardware fails. In addition, a Store and Forward feature protects data if a database connection is lost for a period of time

The application is modular so it is expandable and scalable based on the increasing needs of staff

SQL Databases are a power component utilized to store and manipulate data for future decision making and reporting including the monthly DNR report to WI

SCADA/ HMI - System Configuration

Fourteen local OPC-UA Ethernet connected Allen Bradley Compact, Control, and Micro Logix devices

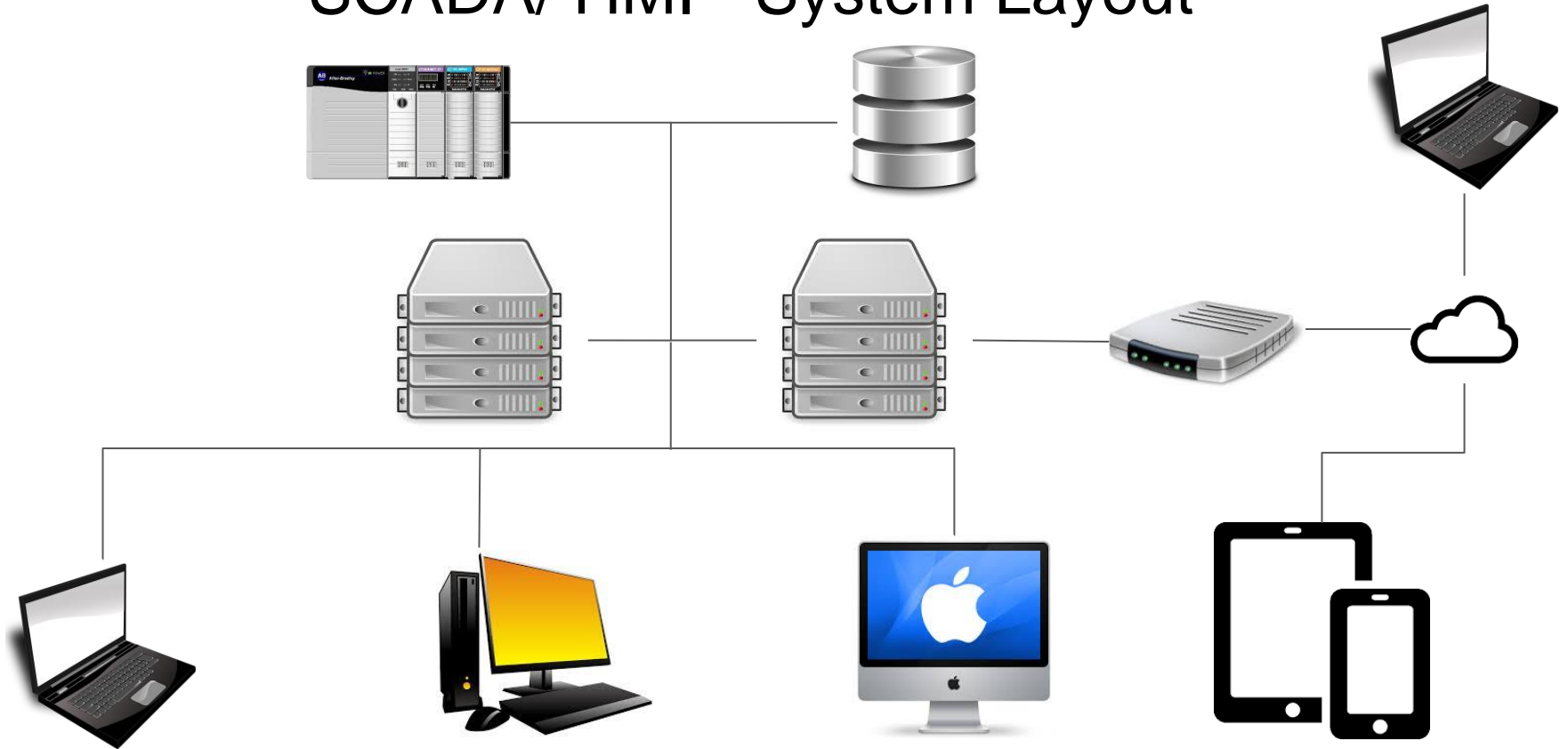
Approximately 10K tag connections queried between 2-10 seconds

Three major Database connections to MS SQL Server

Three primary client application with approximately 150+ screens

Mobile module application for Alarm notification and acknowledgement

SCADA/ HMI - System Layout

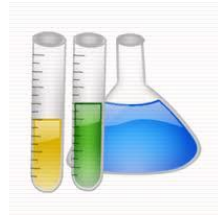


SCADA/ HMI - Applications

System Control



Laboratory - LIMS



Administration



This is where I would VPN into the wastewater treatment plant for a live tour of the SCADA system, most likely on my own PC.