



DESIGNING A WIRELESS SCADA SYSTEM FOR A MUNICIPAL WATER PLANT





Abstract

A large water filtration plant was in need of a wireless control system for their 20 pumping stations scattered a few square miles apart from each other. Their previous system was failing and hardware was no longer being supported. Operators would run from pump to pump, hoping to catch any issues before they became bigger problems. Moreover, the growing forests and terrain made it difficult for the radios to communicate effectively. Neal Systems redesigned and built them a brand new system, migrating their system to the new one while keeping the existing one operating as possible.

Task

Their new system needed to control, record, and monitor data from their pumps i.e. flow, pressure, well depth, etc. Regulations require monthly pump data, so the ability to view historical data and generate reports is vital. The customer wanted to use wireless technology. Ethernet base licensed radio and cellular modems were used to communicate around terrain and forested areas.

Solution

With that in mind, NSI designed a communications network around terrain and trees, and set up radio communications. Elpro radios were used for the licensed radio communications, and Scadacore cellular modems were used where license radio communication wasn't usable. The communication protocol is DNP3, which allows the plant to view time-stamped data even when the network connection is lost. DNP3 is great for plants that have strict regulatory requirements. The Schneider Electric SCADAPak 474's were the control PLCs, and GeoSCADA was used for the scada system, allowing them to monitor and control the system and view historical data. XLReporter was used to create spreadsheet based reports from the GeoSCADA historical data. SCADACore system is used to monitor the system for alarm conditions and call plant operator(s) when alarms occur.

Conclusion

Neal Systems replaced all broken hardware and communication systems, while installing, testing, and programming all of the equipment. NSI also trained their operators on how to use the new system. Operators no longer have to run from pump to pump, as they can now monitor their systems remotely. Most importantly, they are able to record and monitor data with reduced failures. They are better able to see data in real-time, even off network, which reduces downtime. With Neal System's new design, the water filtration plant is better prepared to meet regulatory requirements with ease.

Example Screens

Well Pump Control

Legend:

- Stop/Off: Red
- Called to Run: Green
- Running: Yellow
- Called to Stop: Blue
- Failed: Purple

Suction Basin Level: 12.93 ft.

Level: 18.4

Suction Level / Well Control Setpoints

Position	Start Point	End Point
Lead :	11.00 feet	13.00 feet
First Lag :	10.00 feet	13.00 feet
Second Lag :	9.00 feet	13.00 feet
Third Lag :	8.00 feet	13.00 feet

LEAD: Stop
LAG1: Stop
LAG2: Stop
LAG3: Stop

COMMS MAP

DNP3 Connections: Enable All | Disable All

Device	Status	Last Update
Station 1	Online	03/09/2023 11:45:48
Station 2	Online	03/09/2023 11:45:00
Station 3	Online	03/09/2023 11:45:17
Station 4	Online	03/09/2023 11:45:35
Station 5	Online	03/09/2023 11:45:46
Station 6	Online	03/09/2023 11:44:24
Station 7	Online	03/09/2023 11:44:31
Station 8	Online	03/09/2023 11:44:38
Station 9	Online	03/09/2023 11:44:42
Station 10	Online	03/09/2023 11:44:42
Station 11	Online	03/09/2023 11:44:48
Station 12	Online	03/09/2023 11:44:55
Station 13	Online	03/09/2023 11:45:00
Station 14	Online	03/09/2023 11:45:12
Station 15	Online	03/09/2023 11:45:18
Station 16	Online	03/09/2023 11:45:24
Station 17	Online	03/09/2023 11:45:31
Station 18	Online	03/09/2023 11:45:36
Station 19	Online	03/09/2023 11:45:30
Station 20	Online	03/09/2023 11:45:26

MODBUS

BB1_Radio_Diagnostics: Radio Load 62%

WORPS_Radio_Diagnostic: Radio Load 55%

SBI1 Radio: Disconnected

CB1 Radio Diagnostics: Disconnected

CB2 Radio Diagnostics: Disconnected

Sensors:

- 1 Flow: 0.7 gpm
- 1 Level: 0 ft
- 1 Pressure: 0 psi
- 2 Flow: 0 gpm
- 2 Level: 0 ft
- 2 Pressure: 29.0 psi
- 3 Flow: 0 gpm
- 3 Level: 75.5 ft
- 3 Pressure: 0 psi
- 4 Flow: 0 gpm
- 4 Level: 75.5 ft
- 4 Pressure: 0 psi