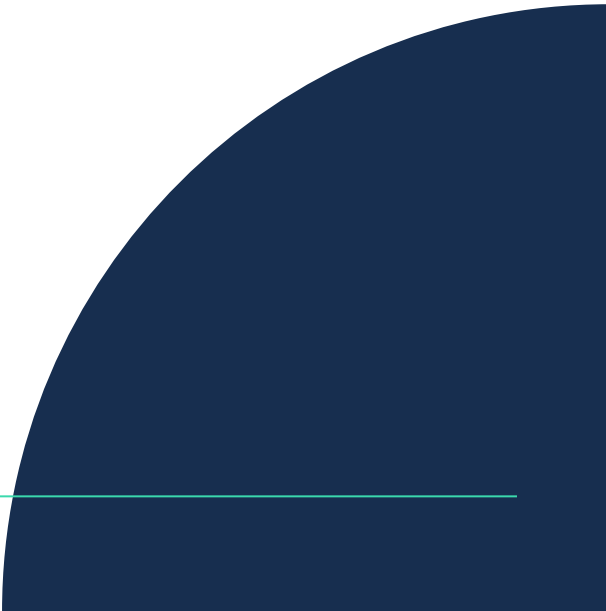


SCADA Applications in Water & Wastewater Systems

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SCADA Applications in Water Systems



Water System Applications

- Well Sites & Water Supply
- Ground Storage Tanks (GST)
- Elevated Storage Tank (EST)
- Booster Pump Station (BPS)
- Water Treatment Plants (WTP)



Well Sites & Water Supply

- SCADA systems are commonly used at well sites to monitor and control pumps that draw water from aquifers and groundwater sources
- Operators can monitor key data such as:
 - Pump status and runtime
 - Motor Amperage
 - Flow rate & Totalization
 - Chlorine levels (if disinfection is applied at the well site)
- In some systems, chemical treatment may occur directly at the well site before distribution
- Water from wells is typically pumped to:
 - Ground Storage Tanks
 - Standpipes or elevated storage tanks
- SCADA provides visibility into system performance and helps ensure reliable water supply and proper treatment

Ground Storage Tanks (GST)

- Ground Storage Tanks (GSTs) are used to store treated or untreated water
- SCADA systems monitor tank level using pressure transducers (analog inputs)
- Water Age and Water Quality can be managed by SCADA systems
 - Deep Cycling
 - Mixer Optimization
- SCADA may also monitor:
 - Pump status
 - Flow rates
 - Other site inputs
- In many systems, GSTs are:
 - Used to “level the load”
 - In a diurnal Cycle



Elevated Storage Tanks (EST)

- Elevated Storage Tanks store water and use gravity to maintain consistent system pressure
- SCADA systems monitor tank level using pressure transducers (analog inputs)
- Operators can view tank levels on HMI screens, including:
 - Full tower height
 - Bowl-only level display
- ESTs provide:
 - Consistent water pressure
 - Storage for peak demand periods
- Remote location are great for antennas, but difficult for wiring
- SCADA helps manage Water Quality, Emergency Flow and Ice Prevention



Famous Elevated Storage Tanks



Peachoid in Gaffney, SC



World of Fun Water Tower in
Kansas City, KS

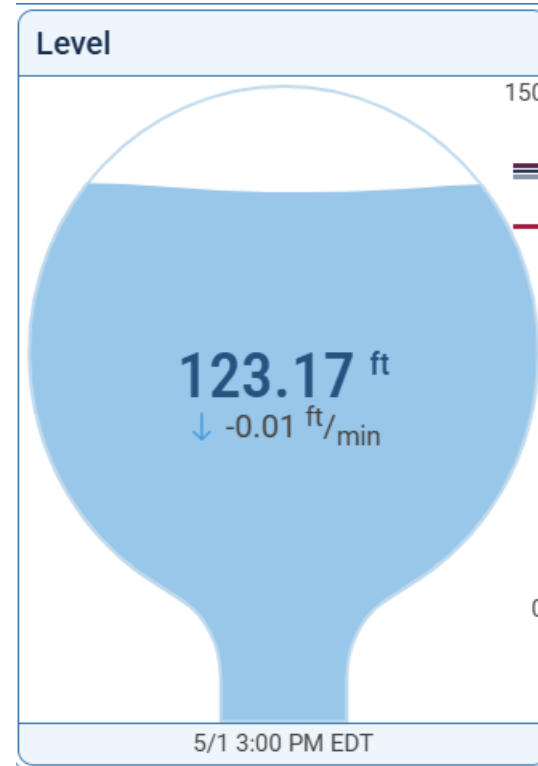


Cathance Water Tower in
Topsham, Maine

Water Storage Tank Monitoring

Operators monitor:

- Tank levels
- Fill/withdraw cycles
- High/low alarms
- Overflow prevention



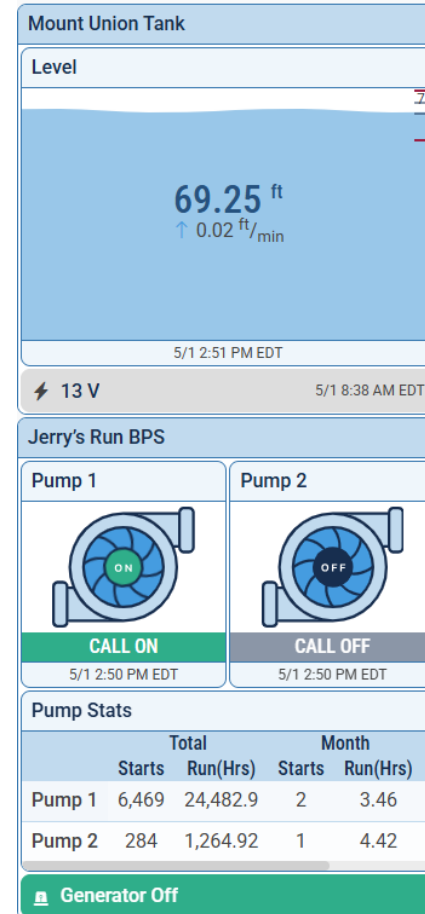
Booster Pump Stations (BPS)

- Booster Pump Stations use high-capacity pumps to move water through the system
- Commonly used to fill Elevated Storage Tanks or maintain system pressure
- SCADA systems are used to:
 - Control booster pump operation
 - Monitor suction and discharge pressure
 - Monitor tank levels (e.g., GST levels and EST levels)
- Protective control strategies may include:
 - Low Suction Cutoff – Pumps shut down if suction pressure is too low
 - Low Tank Level Cutoff (GST Cutoff) – Pumps shut down if tank level drops too low
- These safeguards help prevent pump damage and protect system reliability

Pump Station Control

SCADA supports:

- Lead/lag pump sequencing
- Runtime balancing
- Pressure maintenance
- Automatic pump start/stop



Water Treatment Plants (WTP)

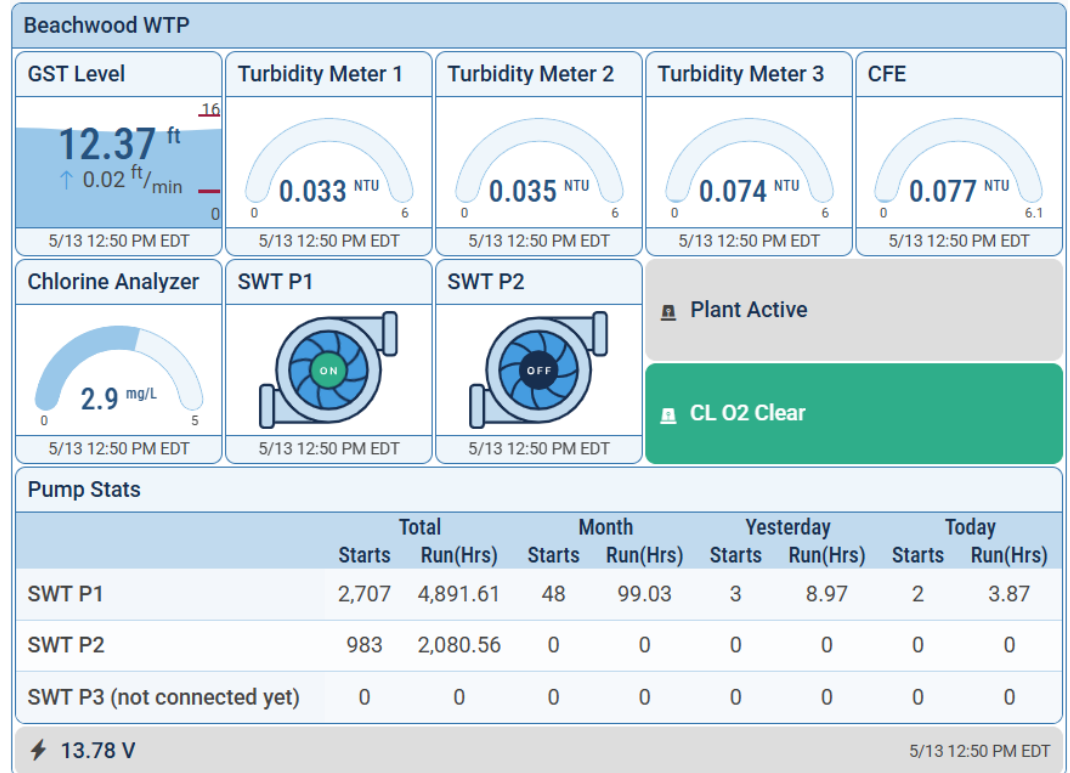
- Water Treatment Plants treat raw water through processes such as:
 - Coagulation
 - Flocculation
 - Sedimentation
 - Filtration
 - Disinfection
- SCADA systems support both monitoring and control of plant operations
- Common SCADA functions include:
 - Monitoring clearwell levels
 - Tracking process and system alarms (digital & analog inputs)
 - Monitoring system performance
- In some cases, SCADA may also:
 - Control pumps and treatment processes
- SCADA helps ensure consistent water quality and regulatory compliance



Distribution System Monitoring

Key metrics:

- System pressure
- Flow demand patterns
- Storage capacity
- Turbidity
- Pump efficiency indicators



Scenario Exercise

- **The Asset:** A 500,000-gallon elevated storage tank serving a residential pressure zone.
- **The Expected Behavior:** Usually, between 12:00 AM and 4:00 AM, water demand is near zero. The tank level should stay flat or rise slightly as the booster pumps "top it off" for the morning rush.

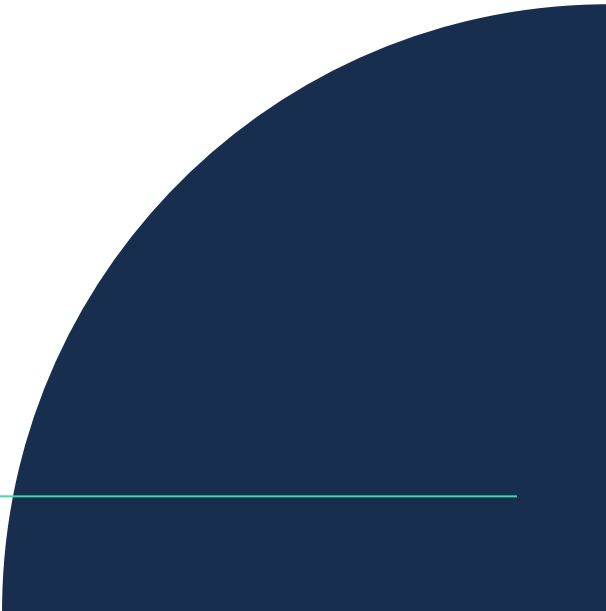
Scada Evidence A

Pressure sensors at the booster station show a massive drop in discharge pressure, while flow meters flow totals show "off the charts" volume.

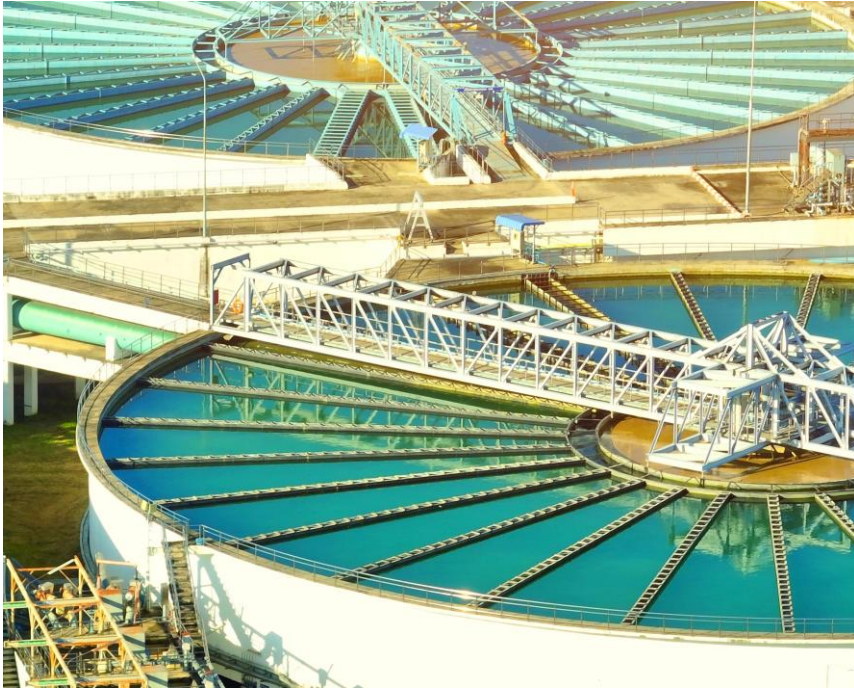
Scada Evidence B

Flow is high, but pressure remains stable. The tank is dropping steadily, not crashing. Flow totals for the night were higher than normal.

SCADA Applications in Wastewater Systems



Wastewater System Applications



- Lift Stations
- Wastewater Treatment Plants

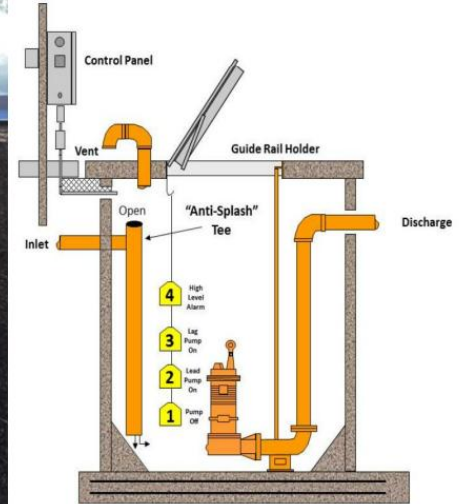
Lift Stations

- Wastewater from homes and businesses flows through pipes using gravity
- When gravity flow is no longer sufficient, wastewater is routed to a lift station (pump station) to be pumped to a higher elevation
- Typical lift station components include:
 - Wet well (holds incoming wastewater)
 - Two pumps (lead/lag operation)
 - Float switches or level sensors (control pump start/stop and high-level alarms)
- SCADA systems are used to:
 - Monitor wet well level
 - Track pump status and runtime
 - Generate high-level alarms to prevent overflows
 - Estimate flow based on wet well level and dimensions
- SCADA provides early warning of issues and helps prevent sanitary sewer overflows (SSOs)

Lift Station Monitoring

Operators monitor:

- Wet well level
- Pump runtimes
- Pump start frequency
- High level alarms



Wastewater Treatment Plants (WWTP)

- Wastewater treatment plants receive influent flow and remove solids and contaminants before discharge
- Key treatment processes include:
 - Screening & grinding – Removes or breaks down large solids
 - Primary clarification – Settles out solids from wastewater
 - Biological treatment (aeration) – Uses microorganisms to break down organic matter
 - Secondary clarification – Further separates solids from treated water
 - Disinfection (e.g., UV) – Reduces pathogens before discharge
- SCADA systems are used to:
 - Monitor flows, tank levels, and equipment status
 - Track blowers, mixers, and pumps
 - Monitor process indicators such as turbidity
 - Generate alarms for process upsets or equipment failures
- SCADA provides real-time visibility across the plant, helping operators maintain treatment performance and regulatory compliance

Wastewater Treatment Monitoring

SCADA commonly monitors:

- Influent flow
- Aeration systems
- Chemical dosing
- Sludge handling processes



Case Study

On Monday morning, the treatment plant operator notices that the total volume of water arriving at the plant is **20% lower** than usual, even though it rained over the weekend. However, there are no "High Level" alarms at any lift stations. Everything looks "green".

The Data:

- **The Pump Run-Time:** The pumps are running *more* often than last week.
- **The Amperage:** The motors are drawing **lower-than-normal amps**.
- **The Pressure:** The "Discharge Pressure" on the pipe leaving the station has dropped from 50 PSI to 30 PSI.