2020 ANNUAL
CONFERENCE & EXHIBIT

NEWEA
WORKING FOR WATER QUALITY

ARCADIS
Design & Consultancy
for natural and
built assets

Monday January 27, 2020

SESSION 11 -
INNOVATION: ADVANTAGE, INNOVATION!
NEW TECHNOLOGIES TO SOLVE OPERATIONAL PROBLEMS

LEAVING OBSOLESCENCE BEHIND!
A CASE STUDY OF INNOVATIVE DESIGN-BUILD SCADA UPGRADES

PRESENTERS

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AGENDA

Why Design-Build for SCADA Upgrades

Procurement Approaches

Implementation Approach

Case Studies

Takeaways

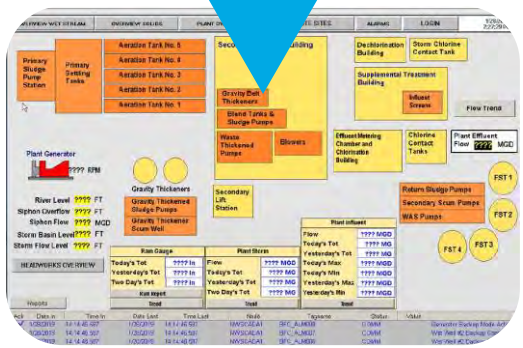
ARCADIS Design & Consultancy for natural and built assets

Why Design-Build for SCADA Upgrades

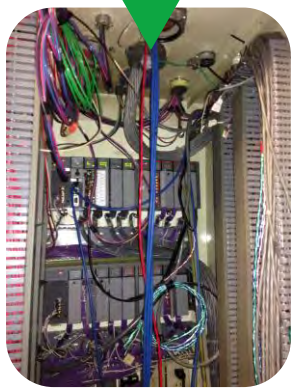
Project Drivers

Obsolete Equipment

Technology Improvements

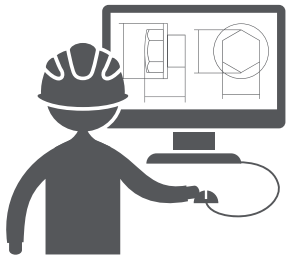


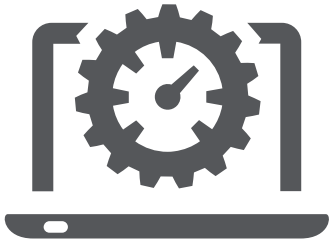
Process Control Enhancements



SCADA Continuum – the “Upgrade”

Planning for Successful Startup Begins During Design





ENGINEERING DESIGN

IMPLEMENTATION

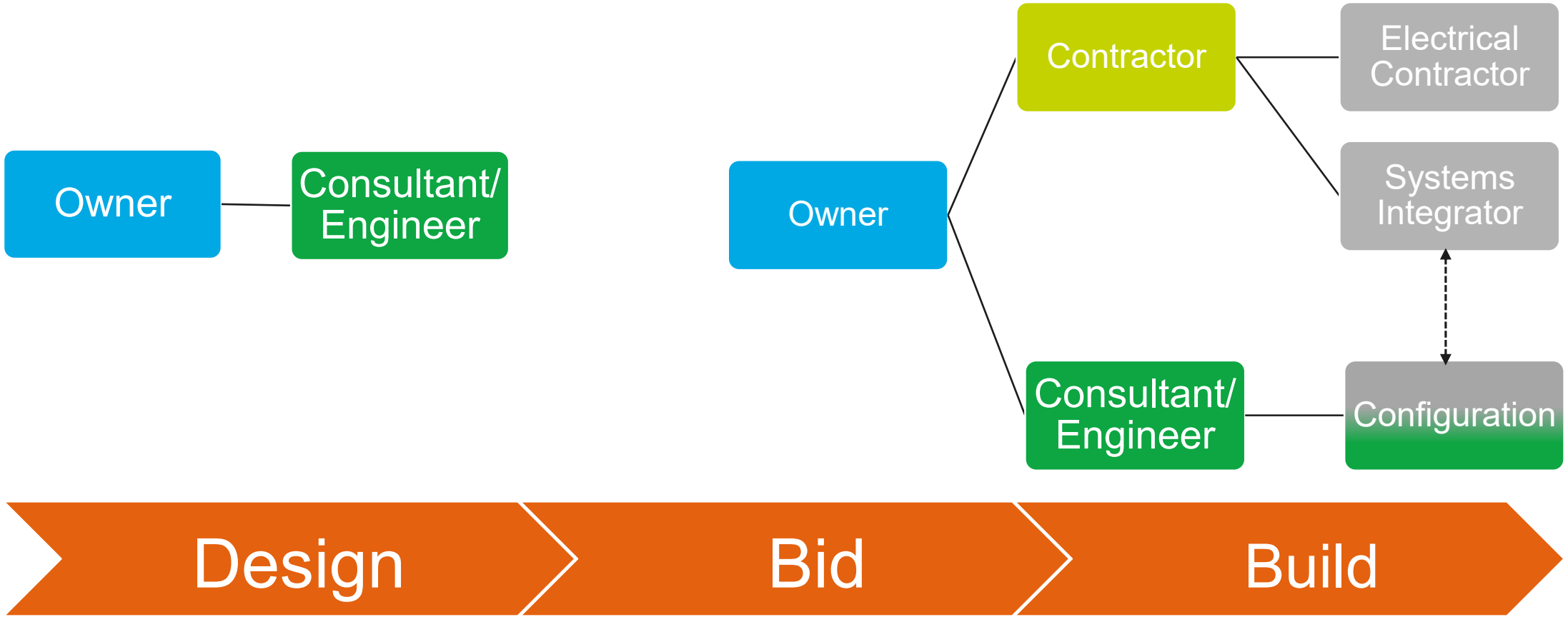
OPERATION

Design → **Configuration** → **Deployment** → **Startup**

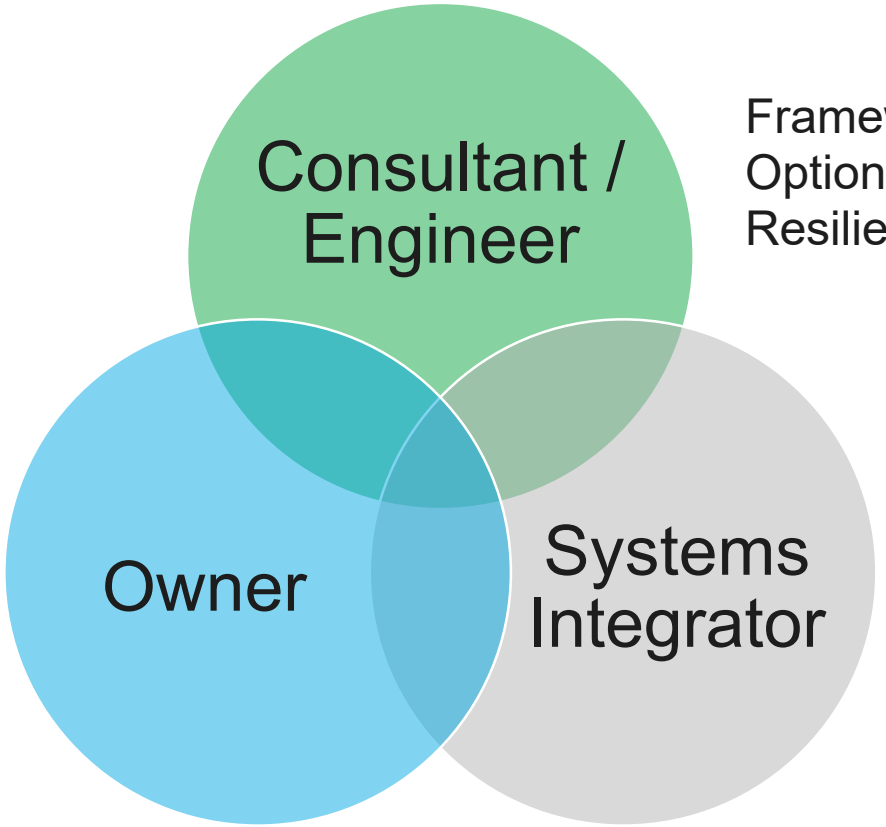
A “ONE TEAM” APPROACH LENDS ITSELF TO COLLABORATION

Procurement Approaches

Traditional Approach: Design-Bid-Build



The Turn-Key Procurement Approach



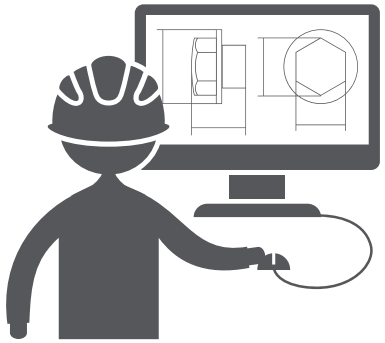
Framework for Design
Options for Equipment / Software
Resiliency Considerations

Vision for System
Participation in Workshops
Operations Insight

Implementation
Programming & Configuration
As-Is Documentation

Implementation Approach

The Process Under a “Turn-Key” Approach

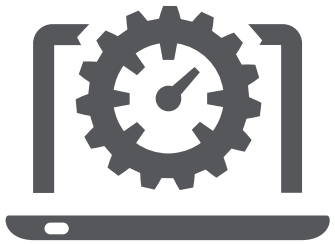


DESIGN

Establish Framework
Strategic Planning
Standardized Hardware
Selection of Platform

IMPLEMENTATION

As-Is Testing to Document Systems
Staging / Cutover Meetings
Screen Development
Deployment
Testing / Training

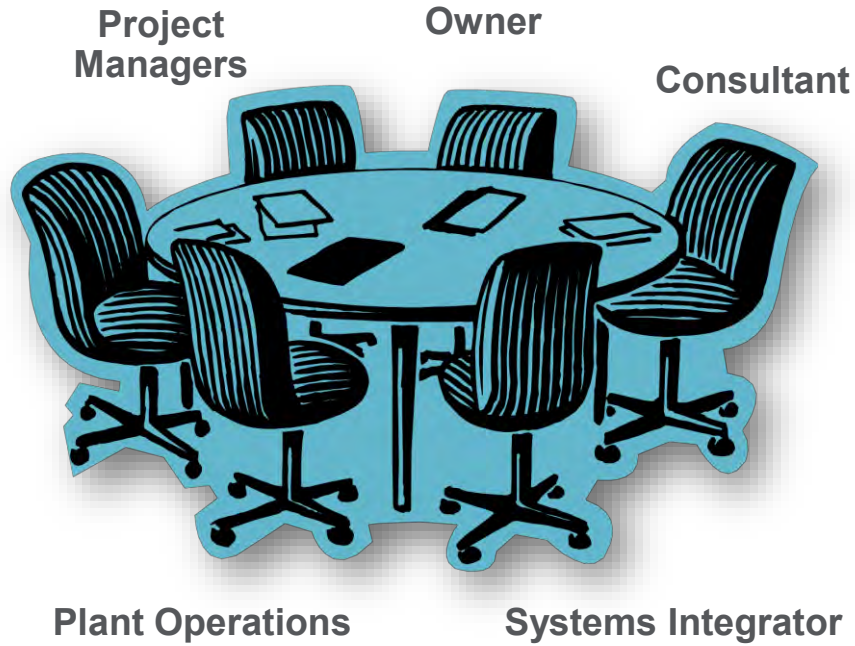


OPERATION

Enhanced SCADA Experience
Network Resilience
Optimized Alarm Management

Stakeholder Engagement

- Process Control Strategy Definitions / Revisions
- Alarm Management and Notifications
- Logic / SCADA Simulations
- Operator Training
- Cutover Planning / Staging Meetings
- Cutovers
- Post-Cutover Operator Training



ENGAGEMENT EARLY AND OFTEN DRIVES UNDERSTANDING AND PLANNING

Case Study: Norwalk, CT

Case Study: Norwalk, CT

Rated Capacity:

30 MGD through Secondary
95 MGD through Wet Weather

Project Drivers:

- Nearly 20 years old SCADA system
- Single server setup, no redundancy
- DH+ Network of PLCs throughout the Plant
- Antiquated Processors / Panel Indicators / Equipment
- Computer Operating System is obsolete and no longer supported by manufacturer
- IT Network Equipment is obsolete and unsecure

- SCADA Workstation
- PLC/Control Panel

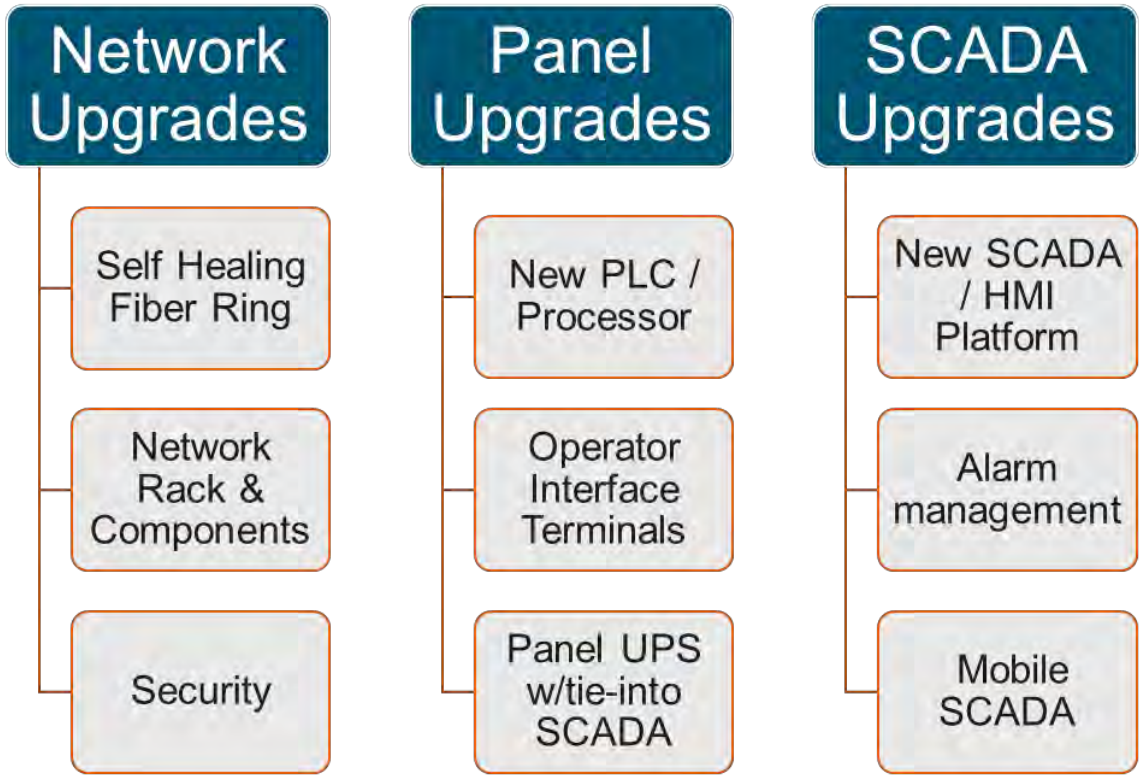
Norwalk, CT: Improvements

- Through site visits and process knowledge Process Automation Improvement Matrix was developed

Unit Process Automation Improvements Matrix

Location / System / Unit Process		Identified Item (Condition / Issue / Need)				Related Project for SCOPE OF WORK 2017-2020				
No.	Description	No.	Description	Software Need identified?	Hardware Need identified?	SCADA Upgrade	Further review needed	Secondary Aeration Upgrade	WW Supplemental Upgrade	Solids Upgrade
7.C	Blend Tanks		Solids Handling - Belt Filter Press information would need to be wired in, not in SCADA. However, a future solids project is coming that may convert this equipment. Accommodate the I/O for the			Only connect to Network				x
7.D	GBT		Part of upgrade			Only connect to Network				x
7.E	Sludge Disposal		Part of upgrade			Only connect to Network				x
7.F	Thickened Sludge		Part of upgrade			Only connect to Network				x
7.E	WTS		Part of upgrade			Only connect to Network				x
8	Dechlorination									
8.A	CCT / Chlorination Metering		Monitoring/Alarms are acceptable.							
8.B	Secondary Lift		NEED: Check if Secondary lift automatically restarts on power outage. Aaron had made some control changes to remove some permissives in order to allow this to happen		YES		x			
			NEED: Secondary Lift has its own PLC but communicates through Dechlor panel (hardwired). Upgrade & put PLC on the network.	YES	YES	x				
8.C	Sodium Bisulfite		Monitoring/Alarms are acceptable.							
9	Supplemental Treatment									
9.A	Screenings		Abandoned equipment. However the drum screens and the hypo equipment is used. No alarms are needed in SCADA. Install the backbone. The panel should be reviewed and replaced to remove all the		YES	Only connect to Network			x	
9.B	Storm Weir/ Control		NEED: Must keep the storm flow level over weir		YES	Only connect to Network			x	
10	Chlorination									
10.A	Hypo Tanks/Pumps		Adding chlorine analyzers HACH CL17 for internal monitoring prior to permit point. The hypo pump is flow paced. Possibly set up compound loop 50/50 flow/chlorine. Possibly use a OEDI 2000 W&T	YES	YES		x			
10.B.	Effluent Meter		NEED: Trend the flow value. Flow Meter totalization needs to be in SCADA. The analog value is coming onto SCADA. Currently the daily flow, however downstream is the plant water (1000gpm, 1.4MGD) that		YES	x				
11	RAS/ Final Settling Tanks									
11.A	RAS		NEED: Totalization on the RAS is required.	YES	YES	x				
11.B	Final Settling / Secondary Scum		NEED: 1 poly pump. Would like to have Polymer flow paced. Can it be tied into the effluent flow meter signal to flow pace the polymer? Need to review how to connect SCADA flow meter signal.	YES	YES		x			
11.C	WAS		Monitoring/Alarms are acceptable.							
12	Utilities									

- Factors affecting scope of work – Essential upgrades, Order of Priority, Reusability of existing infrastructure and Cost



Norwalk, CT: Network Upgrade Highlights

- Use existing DH+ cable routing in manholes and conduit for new Self – Healing Fiber Ring topology implementation
- Identify Staging of Panel Cutovers such that old DH+ network and Fiber network co-exist for the period of startup
- Design Network infrastructure to account for server redundancy, cyber security, future scalability and accessibility such as remote connections

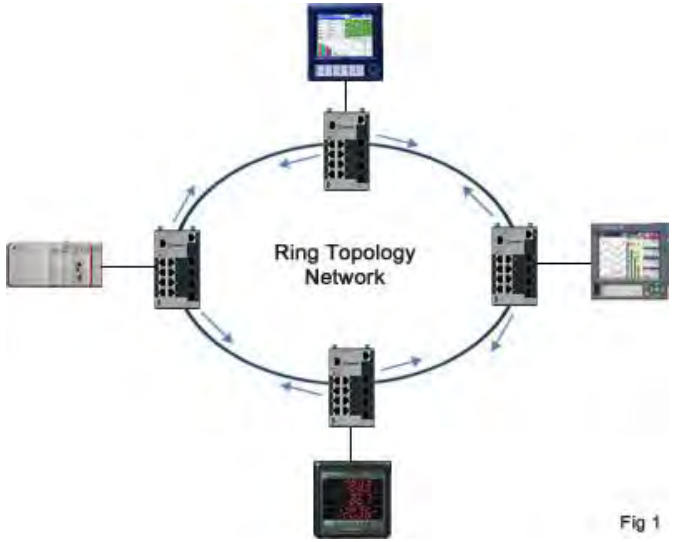
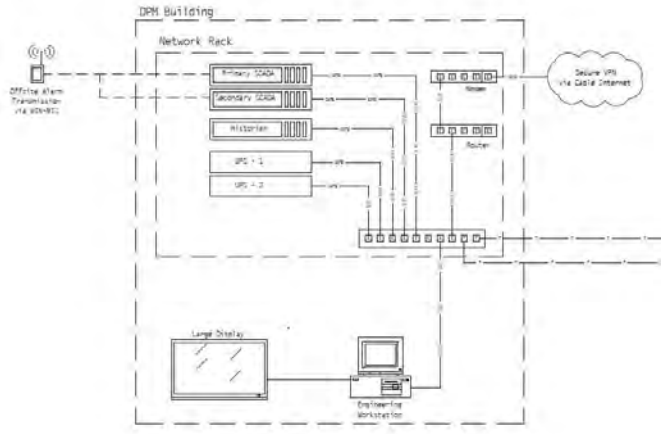
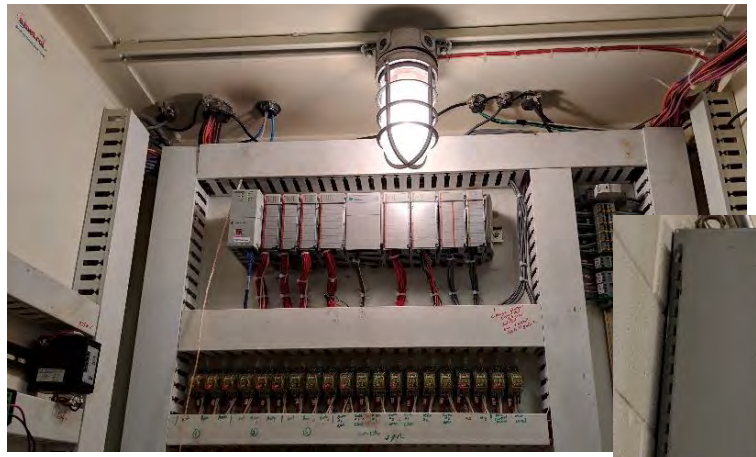


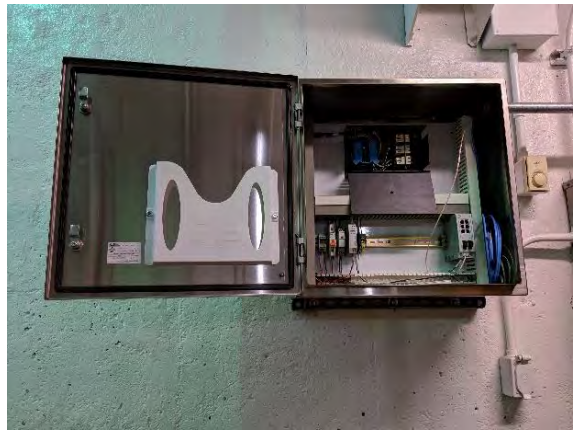
Fig 1



Norwalk, CT: Panel Upgrade Highlights

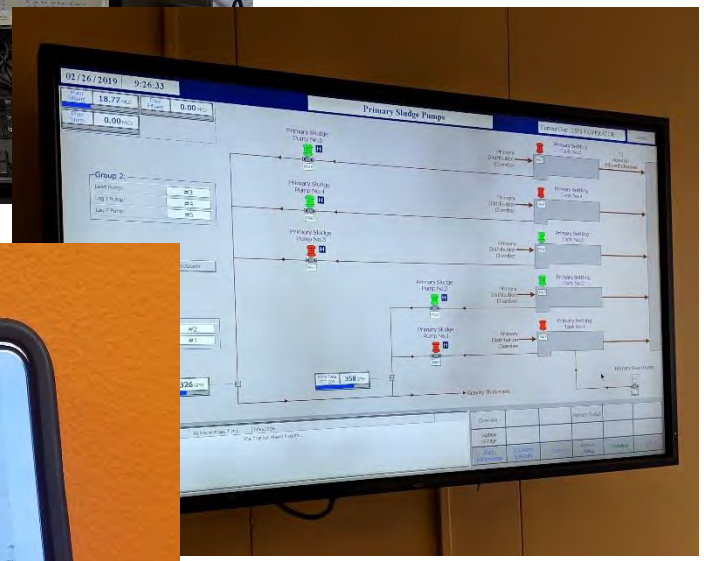
- PLC upgrade based on consideration of existing PLC form factor and processor conversion capabilities help reduce cost to greater extents
- As-Is Testing for each panel identify I/O s that can be removed
- Capabilities to include health monitoring of UPS and network switches
- Most existing panels have space constraints to include expansion racks and network components

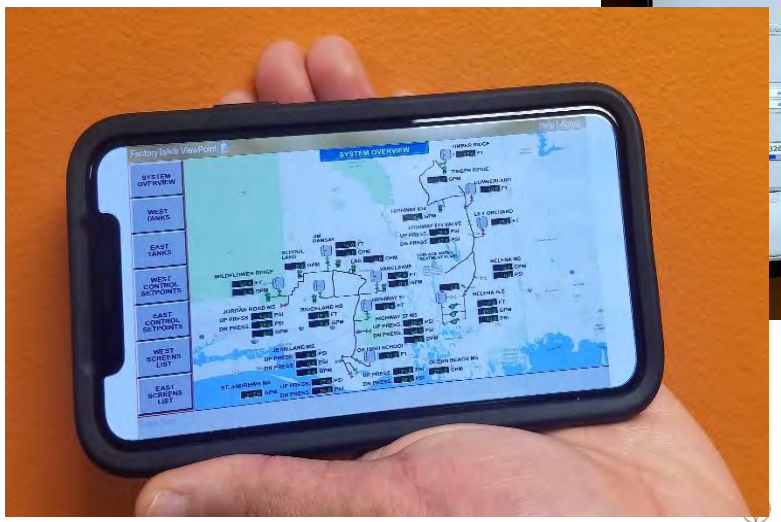




Norwalk, CT: SCADA Upgrade Highlights

- Determine IT Network and SCADA Network delineation
- Frequent SCADA workshops conducted to discuss mock screens, control strategy, alarms and all parties were involved early in the phase
- Regular Training to operators for transition from old system into new system
- Establish SCADA Asset Maintenance & Management Plan





Alarm Management

- Prior to each panel cut-over: Based on process philosophy and equipment conditions, alarms clean-up, addition of alarms and priorities were designated
- As-Is Testing helps identify equipment failure / performance / trips
- Assigning priorities identify severity and course of action - Critical alarms, Audible alarms, Operator Dial-out alarms
- Focus on hard-coded alarm setpoints that are blind to the operators

	PLC	Tagname	Priority	Alarm Description	Alarm Conditions	Time Delay	Setpoint	SCADA Adjustable Time Delay	SCADA Adjustable Setpoint	WIN911 Action	Status
44	SCPLC	SC147	LOW	Aeration Blower No.4 Bearing High Temp	Normally Open contact from temperature switch closes	None	None	Hardcoded	Hardcoded	None	
45	SCPLC	SC170	LOW	Aeration Blowers Low Suction	Normally Open contact from pressure switch closes	None	None	Hardcoded	Hardcoded	None	
46	SCPLC	SC117-2	LOW	Aeration Blower No.1 Low KW	When the analog reading for power (KW) falls below the setpoint and has remained below the setpoint for the specified time delay	300 Sec	75 KW	Hardcoded	Hardcoded	Email & Callout	
47	SCPLC	SC127-2	LOW	Aeration Blower No.2 Low KW	When the analog reading for power (KW) falls below the setpoint and has remained below the setpoint for the specified time delay	300 Sec	75 KW	Hardcoded	Hardcoded	Email & Callout	
48	SCPLC	SC137-2	LOW	Aeration Blower No.3 Low KW	When the analog reading for power (KW) falls below the setpoint and has remained below the setpoint for the specified time delay	300 Sec	75 KW	Hardcoded	Hardcoded	Email & Callout	
49	SCPLC	SC171	LOW	Aeration Blowers Not Called to Start	When none of the blowers have been called to start for the specified time delay	60 Sec	None	Hardcoded	Hardcoded	None	
50	SCPLC	SC316A	LOW	WTS Pump No.1 Malfunction	Normally Open contact from mixer MCC panel closes	None	None	Hardcoded	Hardcoded	None	
51	SCPLC	SC315	LOW	WTS Pump No.1 Discharge High Pressure	Normally Open contact from pressure switch closes	None	None	Hardcoded	Hardcoded	None	
52	SCPLC	SC317	LOW	WTS Pump No.1 Suction Low Pressure	Normally Open contact from pressure switch closes	None	None	Hardcoded	Hardcoded	None	
53	SCPLC	SC315-1	LOW	WTS Pump No.1 Seal Water	Normally Open contact from flow switch closes	None	None	Hardcoded	Hardcoded	None	
54	SCPLC	SC326A-1	LOW	WTS Pump No.2 Malfunction	Normally Open contact from mixer MCC panel closes	None	None	Hardcoded	Hardcoded	None	
55	SCPLC	SC325	LOW	WTS Pump No.2 Discharge High Pressure	Normally Open contact from pressure switch closes	None	None	Hardcoded	Hardcoded	None	
56	SCPLC	SC327	LOW	WTS Pump No.2 Suction Low Pressure	Normally Open contact from pressure switch closes	None	None	Hardcoded	Hardcoded	None	
57	SCPLC	SC325-1	LOW	WTS Pump No.2 Seal Water	Normally Open contact from flow switch closes	None	None	Hardcoded	Hardcoded	None	
58	SCPLC	SC412A	LOW	Sludge Disposal Pump No.1 Malfunction	Normally Open contact from pump MCC panel closes	None	None	Hardcoded	Hardcoded	None	
59	SCPLC	SC413	LOW	Sludge Disposal Pump No.1Disch. HI Pressure	Normally Open contact from flow switch closes	None	None	Hardcoded	Hardcoded	None	
60	SCPLC	SC411	LOW	Sludge Disposal Pump No.1 Seal Water Low	Normally Open contact from flow switch closes	None	None	Hardcoded	Hardcoded	None	
61	SCPLC	SC422A	LOW	Sludge Disposal Pump No.2 Malfunction	Normally Open contact from pump MCC panel closes	None	None	Hardcoded	Hardcoded	None	
62	SCPLC	SC423	LOW	Sludge Disposal Pump No.2 Disch. HI Pressure	Normally Open contact from flow switch closes	None	None	Hardcoded	Hardcoded	None	
63	SCPLC	SC421	LOW	Sludge Disposal Pump No.2 Seal Water Low	Normally Open contact from flow switch closes	None	None	Hardcoded	Hardcoded	None	
64	SCPLC	SC418A-1	LOW	Blend Tank No.1 Mixer Malfunction	Normally Open contact from mixer MCC panel closes	None	None	Hardcoded	Hardcoded	None	
65	SCPLC	SC428A-1	LOW	Blend Tank No.2 Mixer Malfunction	Normally Open contact from mixer MCC panel closes	None	None	Hardcoded	Hardcoded	None	
66	SCPLC	SC410-2	LOW	Blend Tank No.1 Low Low Level	When the analog reading for level (ft.) falls below the setpoint and has remained below the setpoint for the	30 Sec	2.00 ft.	Hardcoded	Hardcoded	None	
67	SCPLC	SC410-1	LOW	Blend Tank No.1 Low Level	When the analog reading for level (ft.) falls below the setpoint and has remained below the setpoint for the	30 Sec	3.00 ft.	Hardcoded	Hardcoded	None	
68	SCPLC	SC410A	LOW	Blend Tank No.1 High Level	When the analog reading for level (ft.) rises above the	30 Sec	20.50 ft.	Hardcoded	Hardcoded	None	

Page 1 Page 4

Working through initial alarm rationalization pre-deployment reduces alarm troubleshooting efforts during commissioning.

Case Study: Meriden, CT

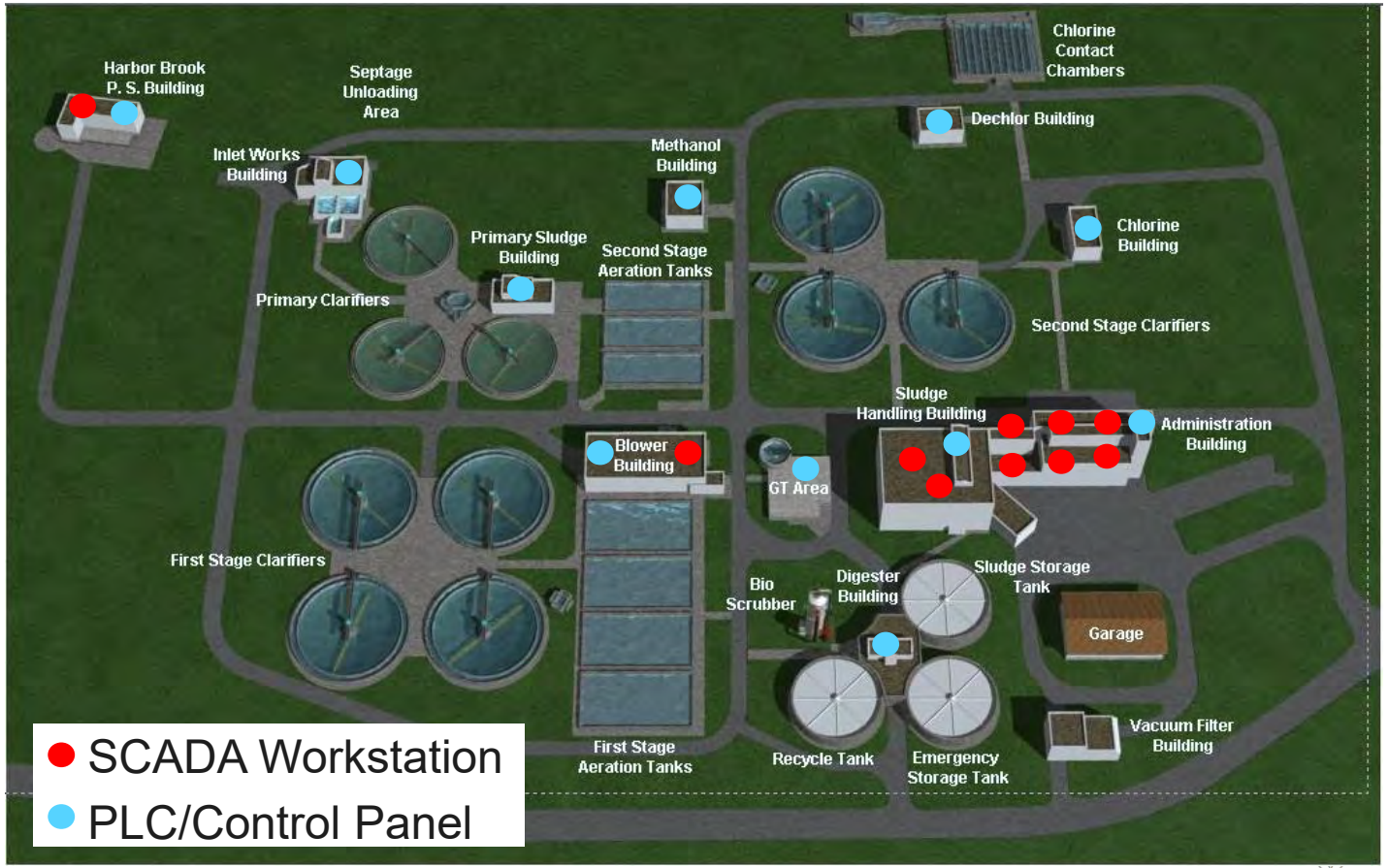
Case Study: Meriden, CT

Facilities Included:

6 Water Treatment Plants, 13 Remote Sites, 1 Wastewater Treatment Facility and 2 Remote Pump Stations

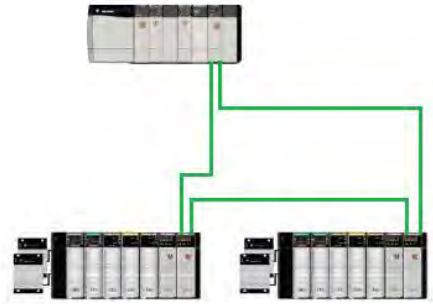
Project Drivers:

- Old Distributed Process Control System with no local customer support available
- Control Net based PLC network
- SCADA servers, Alarm Notification software, PLC Hardware, are end of life
- Failing network equipment and inadequate security

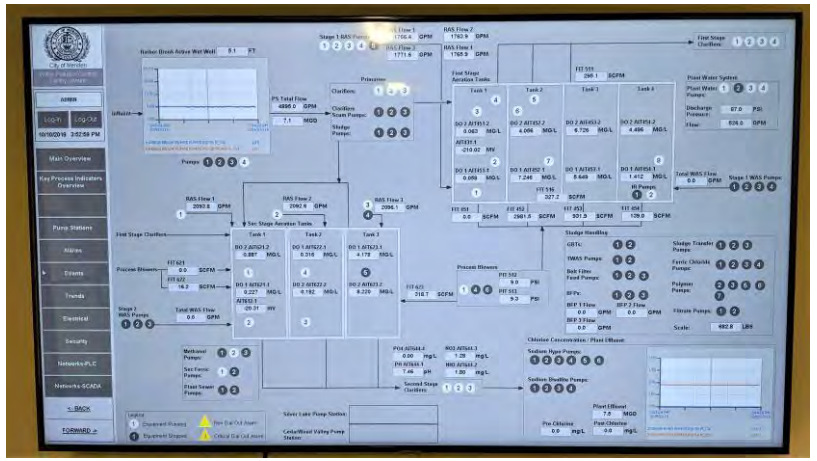


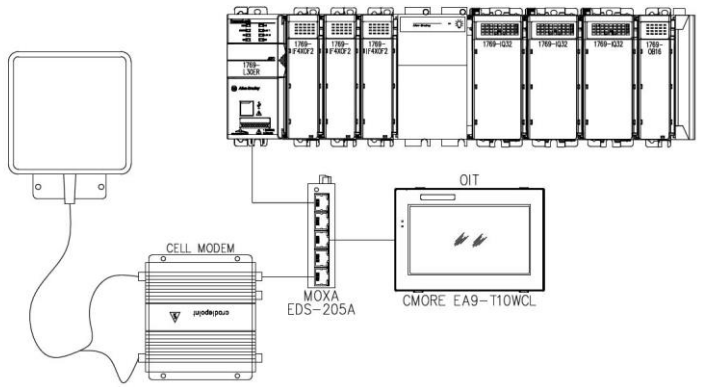
Meriden, CT: Key Improvements

- New PLC and SCADA platform
- Upgraded Fiber Network between WTP and WPCF
- Central Historian at WTP and WPCF acting as a redundant server to one another
- Disaster Recovery solution for effective backup and data recovery plan
- Cellular connectivity for remote stations
- Upgraded Ethernet-based Device Level Ring topology for PLC Network



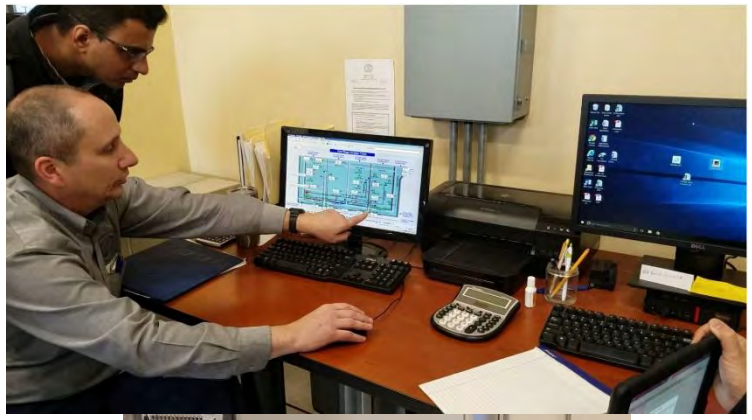
Remote ControlLogix Chassis with Redundant Power Supplies and I/O Modules

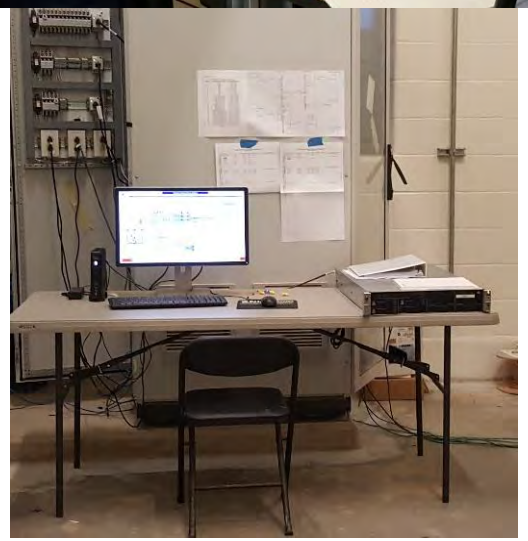




SCADA Simulations

- Witnessed software demonstrations help prior to startup
- All project **SCADA servers and PLC CPUs** brought into workshop
- **Live simulator HMI** developed and used to simulate all field I/O and strategy conditions
- **Initial equipment set ups** prior to testing (valves, lead/lag, OOS) essentially walkthrough of pre-commissioning setup
- **Scenario Matrix** – Stepped through Pump failures scenarios, alternation logic and control in all modes of operation
- Platform for **control strategy improvements**





Scenario simulation was the foundation for Functional Demonstration Testing procedures during start-up. It forced the team to review Key Operational settings.

Pre-Cutover Staging Meetings

- Pre-Test Results
- Summary of Work to be Completed
- Staging Matrix
- Work sequence
- Staffing
- Conditions for Cutover Abort
- Roll-Back Plan & Contingency Plans
- Known / Potential Impacts

1. **IO Points / Interlocks between DCU-15 and other processes:**

I/O Points			
S. No	**Signals**	**Affected DCUs**	**Comments**
1	Primary Sludge Pump Operation	DCU-13	1. Sludge Holding Tank High Level Interlock for Primary Sludge Pumps operation will be unavailable during the cutover. 2. Operator(s) required to manually keep track of the holding tank levels and stop the primary sludge pumps if necessary.
Interlocks: None			

2. **HMI Changes: None**

3. **Equipment / Controls:**

S. No	Equipment	Controls during the Cut-Over	Priority
1	Ferric Metering Pumps 1, 2, 3, and 4	Pumps need to be operated in Local (Start/Stop and Speed Control).	High
2	Sludge Holdir		
3	Belt Filter Pre		
4	Gravity Belt T		
5	Digester Com Dampers		
6	Sludge Remo 1, 2, and 3 + S		
7	Hopper Level, TWAS Pumps 1 & 2 and TWAS Flow	Pumps need to be operated in Local (Start/Stop and Speed Control).	Medium
8	Sludge Building Odor Control Fans No. 1 and 2 and Damper Valves	Both Odor Control Fans and Damper valves are needed to be operated in Local.	Medium
9	Polymer Blend Units Operation	Units need to be operated in Local.	Medium
10	Digester Building Recycle Tank Blower No. 1	No action required as per regular routine operations. If Blower is needed to be operated, it must operate in Local.	Low
11	Recycle Tank Operation (Tank Level, Pumps No. 1 & 2 and pumps discharge flow)	No action required as per regular routine operations. If pumps are needed to be operated, they must operate in Local.	Low
12	Filtrate Pumps 1 & 2 (Wet well Level and Discharge Flow)	No action required as per regular routine operations. If pumps are needed to be operated, they must operate in Local.	Low
13	Sludge Storage Recirculation Pumps No. 3 and 4	No action required as per regular routine operations. If pumps are needed to be operated, they must operate in Local.	Low
14	Emergency Tank operation (Tank Level and Dewatering Pump No. 4)	No action required as per regular routine operations. If pump is needed to be operated, it must operate in Local.	Low
15	Dewatering Building Odor Control fan	Fan needs to be operated in Local (Start/Stop and Speed Control).	Low
16	Bio-scrubber System	No action required.	Low
17	Miscellaneous (Gas Monitoring Stations, Eyewash, Generator, UPS, ATS, Fire Alarm, Intrusion etc.,) for Administration, Dewatering Building, Sludge Handling, and Gravity Thickener Buildings.	No action required.	Low

4. **Attachments:**
   - i. Panel I/O List that will be used for I/O verification during Cut-Overs.
   - ii. Alarm List for SCADA alarms and Dial-Out.
   - iii. Test Procedure.

Historical Data Migration

Q: What happens to Historical Data?

A: NOT LOST!

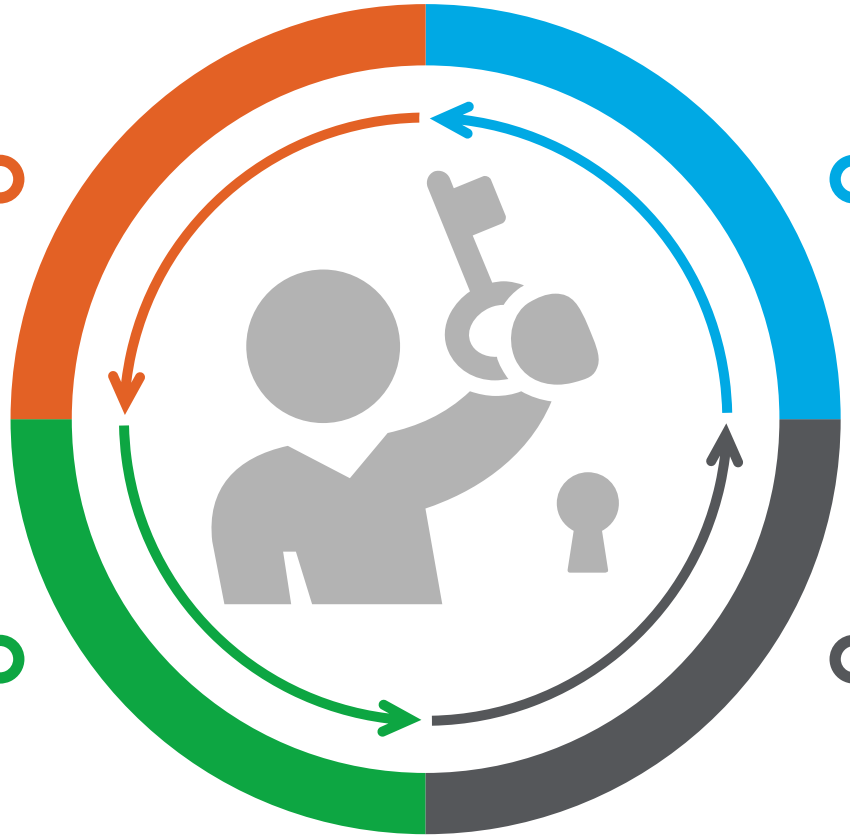
- ✓ Data from existing Historian server can be migrated into the new Historian server with very minimal or no data loss
- ✓ Back-filled 3 years of data into the new Historian server
- ✓ Factors to Consider - Number of data points to be migrated, time intervals, New Server capacity
- ✓ Guidelines - Data points essential for Trends , Reports, Equipment Runtimes
- ✓ Best time to clean-up data points and values

Takeaways

How You Can Leave Obsolescence Behind!

Investigate Alternative Procurement Approaches

Engage Stakeholders and End Users



Develop a Vision for the System and Project Goals

Proper planning allows seamless transitions

Acknowledgements

wpca NORWALK

CITY OF MERIDEN
CHARTER
PRO PATRIA
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Aaron Associates

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