Enhanced Chlorination and Dechlorination for Wet Weather Treatment in Norwalk

Presented by:
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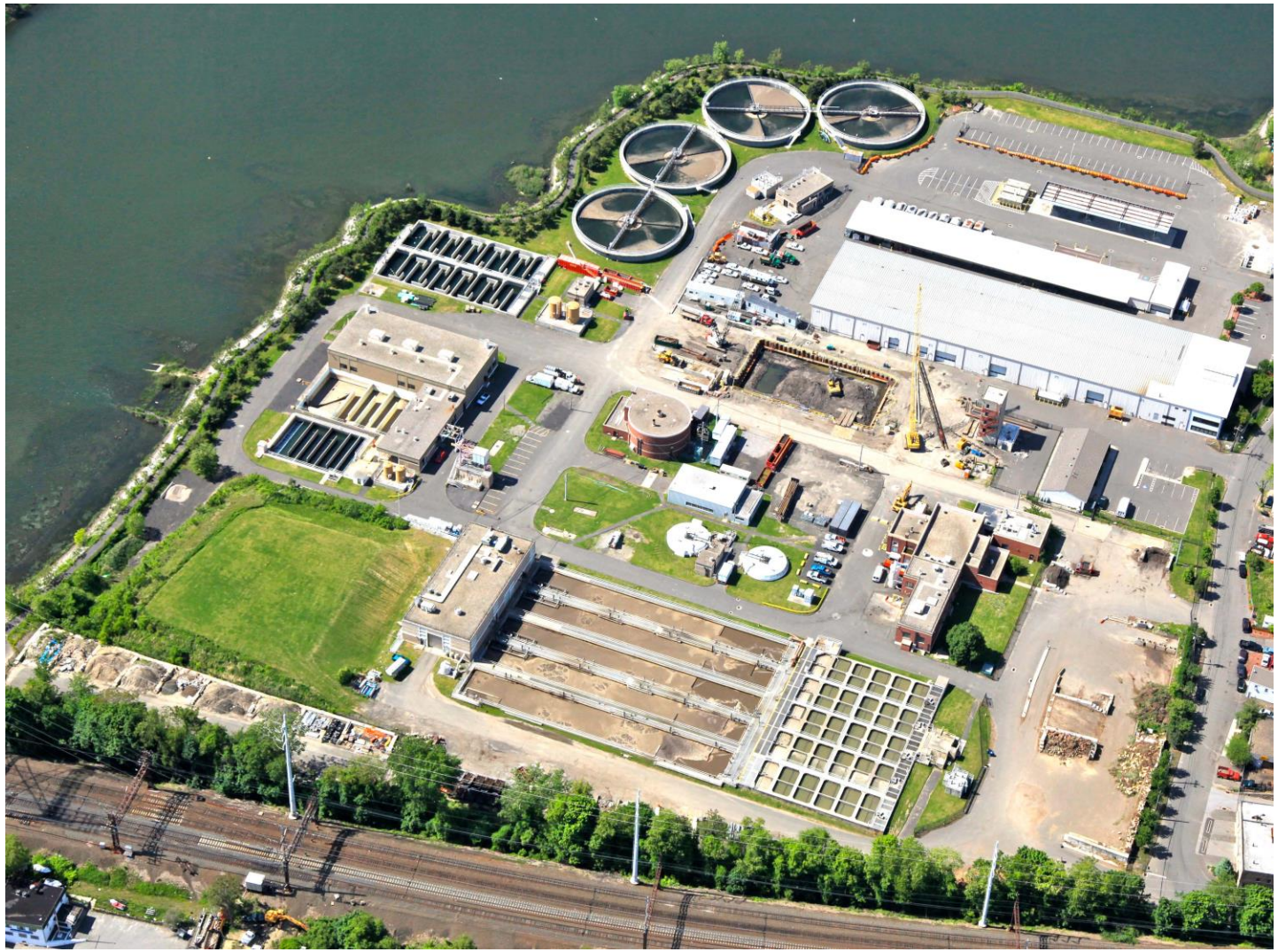
City of Norwalk

- Located along the Long Island Sound
- Approximately 40 miles northeast of NYC
- Population of ~90,000
- “Oyster Town” roots – largest producer of CT oysters in the late 1800’s
- High water quality a chief concern

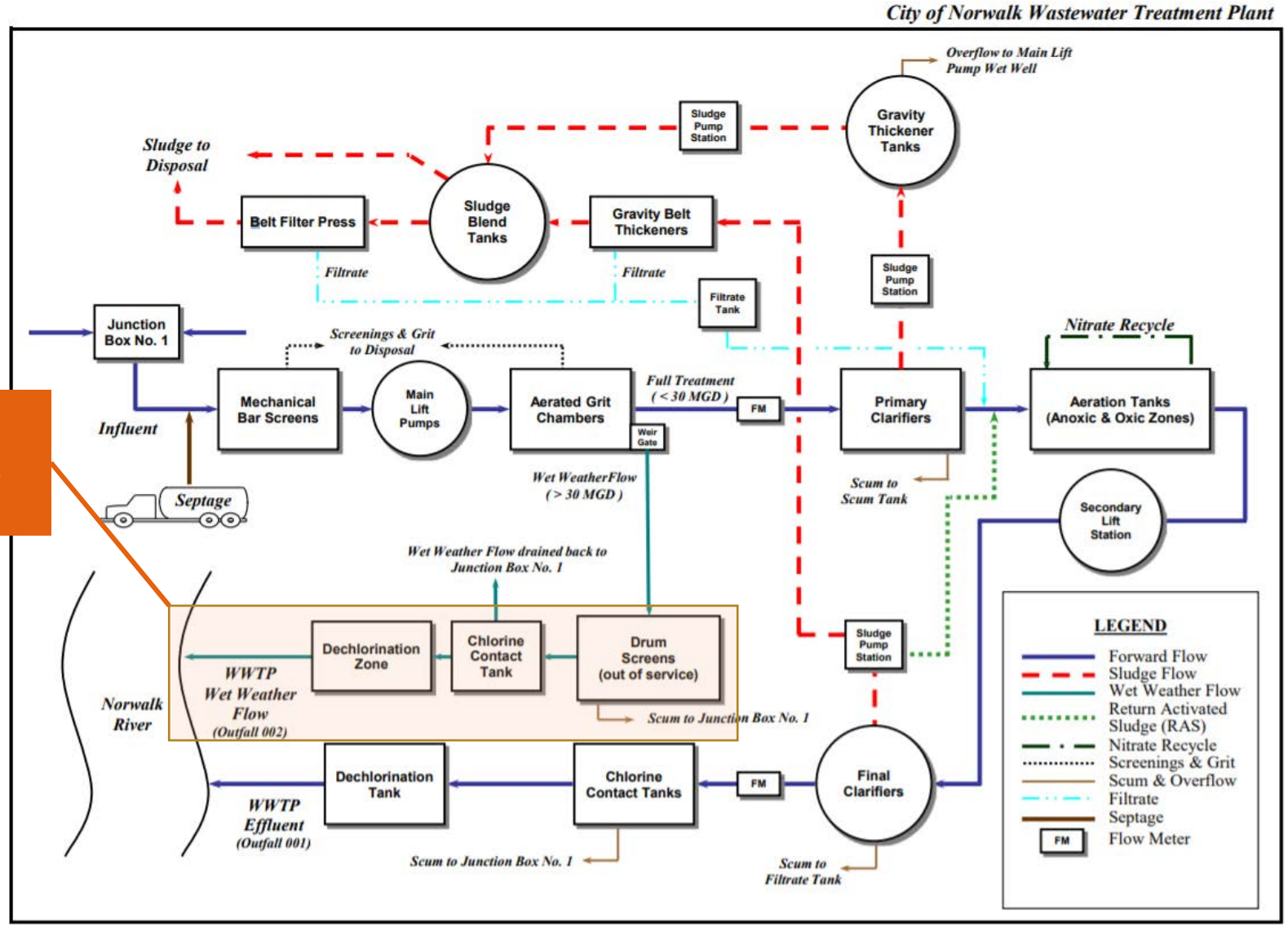
Norwalk Water Pollution Control Authority

- Norwalk WPCA: 180 miles of sewer, 22 pumping stations, and a secondary treatment water pollution control facility (WPCF).
- WPCF:
  - Regular treatment max capacity of 30 MGD
  - Wet weather treatment capacity of 65 MGD (for 95 MGD total)
  - Discharge into Norwalk River and ultimately into Long Island Sound



WPCF Process Flow

Supplemental Treatment (Wet Weather)



Wet Weather Treatment

- Flows above 30 MGD are diverted to the Supplemental Treatment Building after Aerated Grit Removal
- Drum Screens (out of service)
- Gravity feed of chlorine (Sodium Hypochlorite)
- Existing contact tank (CCT 2)
- No dechlorination

Project Driver: Consent Order

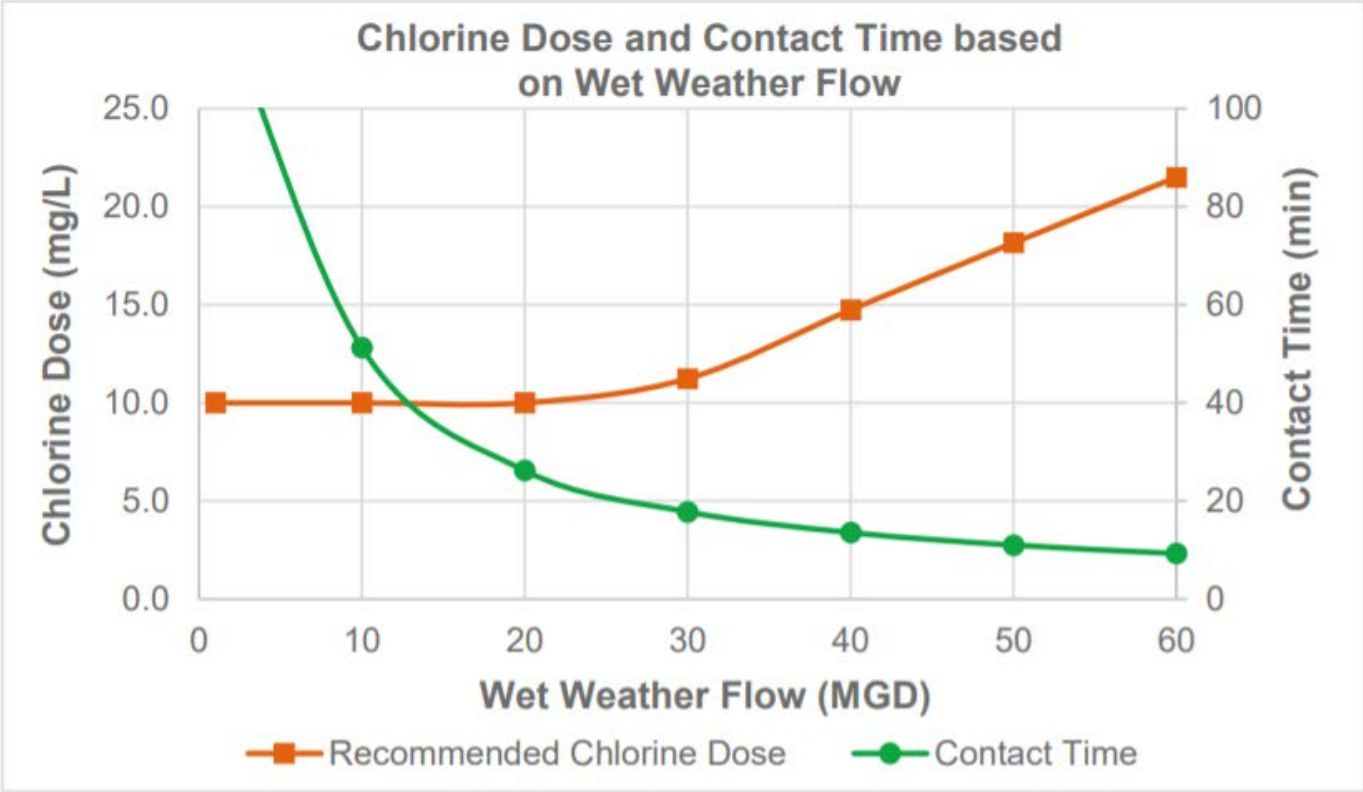
- Past exceedances of CT State Water Quality Standards (SWQS) resulted in a Consent Order from the US EPA
- NPDES permit states “Combined discharges from both the regular and wet weather outfalls shall not cause violations of SWQS”
- SWQS:
  - **Class SB Water Body** (waters with primary and secondary contact recreation and fishing/shellfishing)
  - Max concentration of Enterococci bacteria: **500 CFU / 100 mL**
  - Max concentration of chlorine residual: **13 µg/L**
- Sampling for wet weather events occurs 1 hour after initial discharge

Project Goals

- ✓ Upgrade the chlorine dosing strategy and dosing/mixing equipment to achieve High Rate Disinfection
- ✓ Incorporate a dechlorination zone within existing CCT No. 2
- ✓ New dechlorination dosing strategy and dosing/mixing equipment to achieve the chlorine residual discharge limit
- ✓ On-line instrumentation to support an automated control strategy for chlor. and dechlor. dosing
- ✓ Provide influent flow measurement within CCT No. 2 for accurate chemical dosing

Dosing Goals: Hypo

- Target chlorine CT value of 200 mg/L-min (100 – 200 mg/L-min typical)
- Increase chlorine (dose) as flow increases to meet target CT (as flow ↑ contact time ↓)
- Incorporate high-rate mixing which improves the disinfection performance of chlorine
- Goal residual of 1.5 mg/L
- Using online instrumentation, provide accurate dosing as bacteria concentrations change



Dosing Goals – Bisulfite

- Dose in 1.5 : 1 ratio for Bisulfite to expected chlorine residual (1.5 mg/L)
- TR-16 recommends sizing dechlor systems to achieve residual dosing of 9 mg/L for max flows (65 MGD) – more conservative
- Needed to minimize dechlorination zone size
  - Working with existing infrastructure
  - Dechlorination reaction occurs almost instantaneously
  - TR-16 recommends 2 min contact time at average flow
- Using online instrumentation, provide accurate bisulfite dosing to minimize impacts to DO and pH

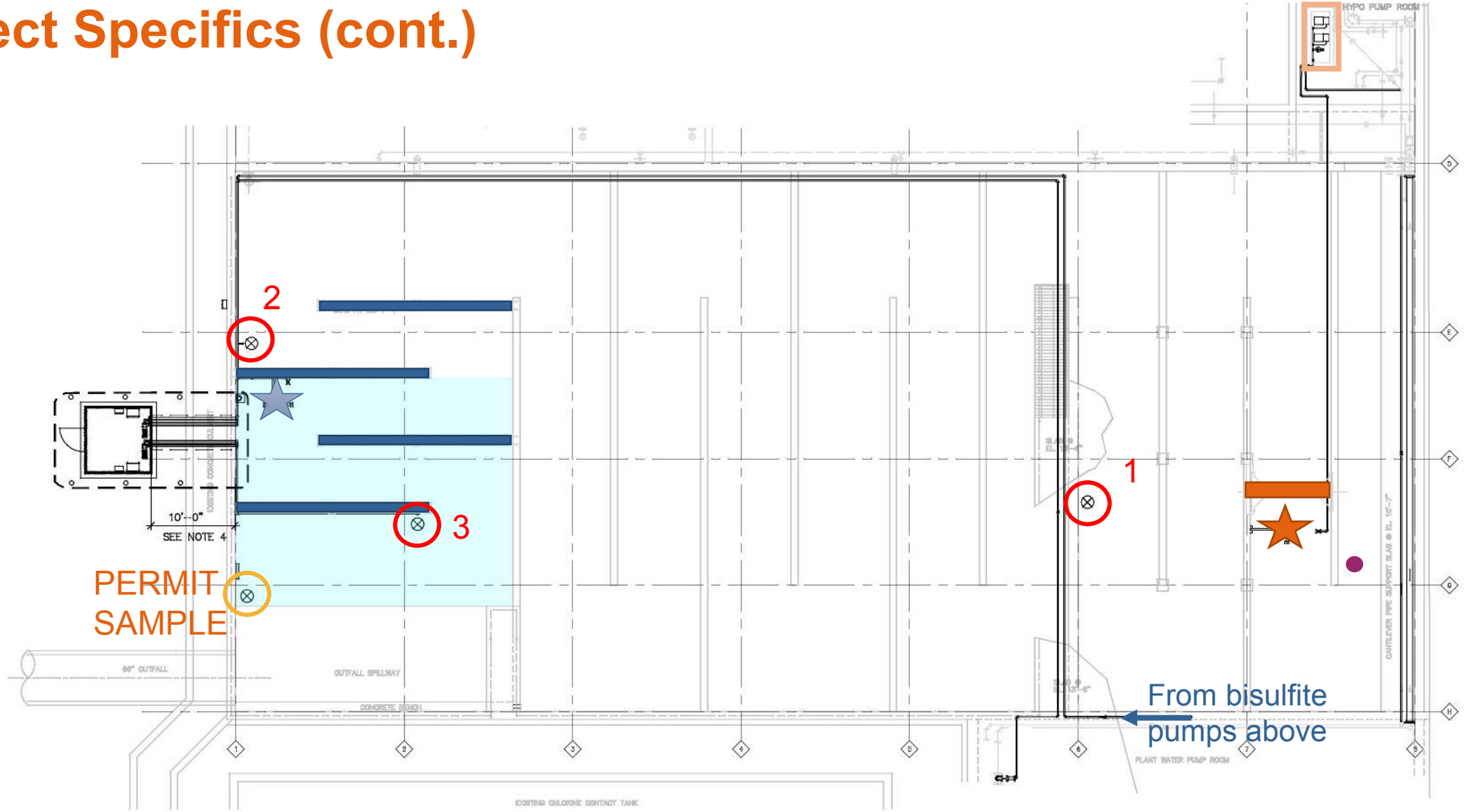
Pre-Project Planning

- Confirm existing chemical feed tanks are adequately sized for new dosing strategy (common chemical tanks)
- Confirm existing tank footprint can provide a dechlorination zone AND adequate chlorination contact time to achieve CT
- Confirm changes to tank would not impact upstream hydraulics

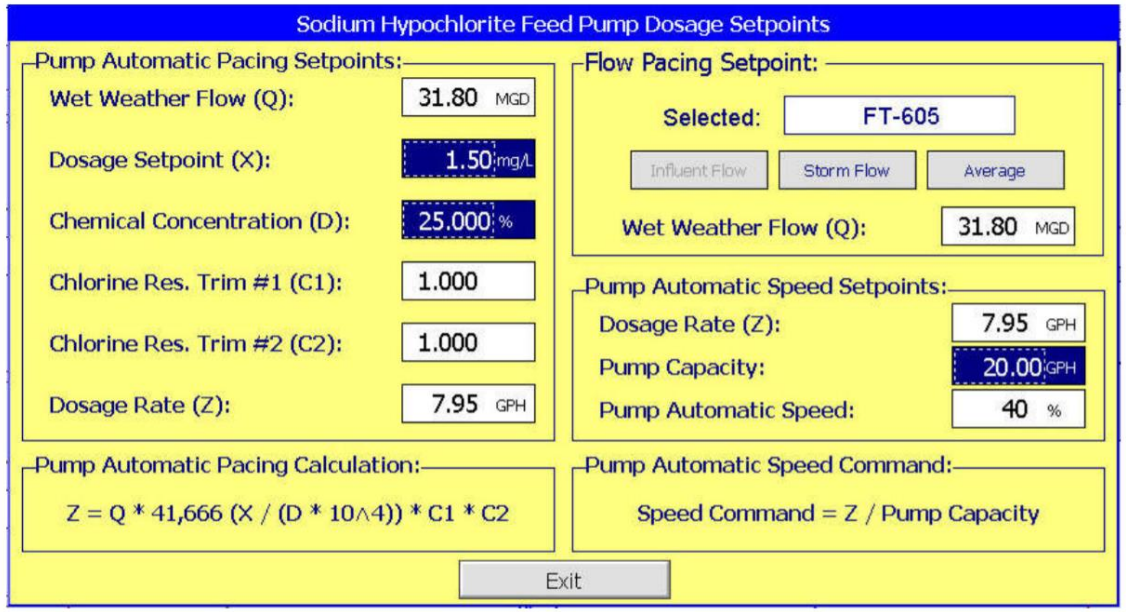
Project Specifics

- Chemical feed pumps (peristaltic style)
  - Hypo capacity: 380 gph
  - Bisulfite capacity: 50 gph
- Induction mixers
  - 20 HP for hypo
  - 15 HP for bisulfite
- 3 Sample Systems (centrifugal pump, chlorine analyzer)
  - After chlorination
  - End of chlorination zone
  - End of dechlorination zone
- Stop log weir with new radar level element
- Pre-cast baffle walls for dechlor zone
- Feedback Control Strategy

Project Specifics (cont.)



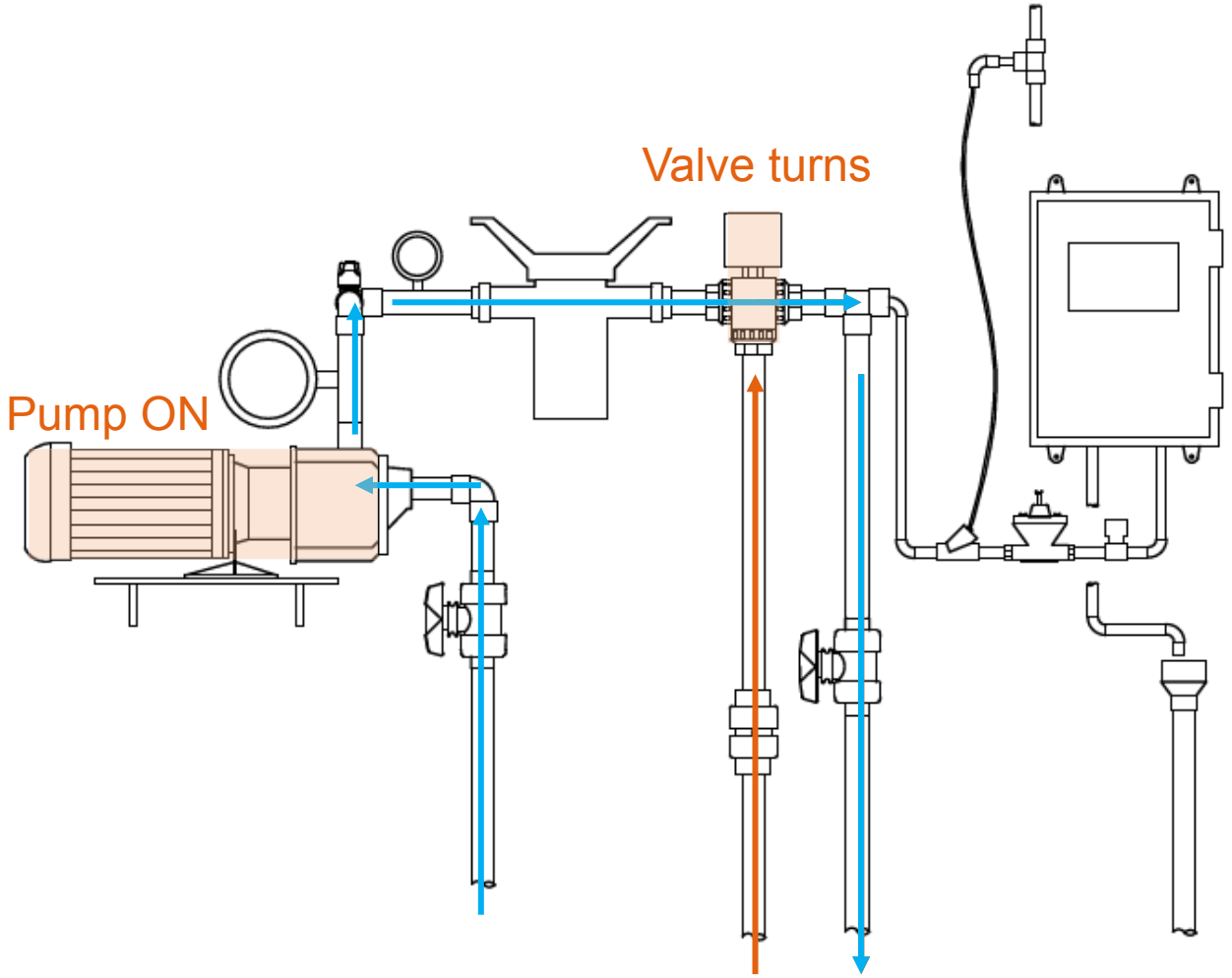
Control Strategy



- Hypo pump speed paced on influent wet weather flow rate and required dose (min. 10 mg/L)
- Hypo trim variables in dosing equation to ↑/↓ as required
  - Trim 1 from Sample Location 1 (TARGET: 4.5 mg/L)
  - Trim 2 from Sample Location 2 (TARGET: 1.5 mg/L)
  - Trim values are operator adjustable
- Bisulfite pump speed paced on influent wet weather flow rate and observed chlorine residual at Sample Location 2 (goal 1.5 mg/L)
- Bisulfite will increase if chlorine is detected at Sample Location 3
- Feed pump “ramp up” to clear aged chemicals
- Equipment start/stop based on tank level

Sample System

- During dry weather, plant water is maintained to the chlorine analyzers to maintain calibration
- During storms, centrifugal pump sends sample water to chlorine analyzer
- Valve will change positions when pump turns ON
- 3-way valve controls whether plant water or sample water runs to analyzer
- Without plant water, chlorine analyzer must be “mothballed”



Status of Project

- Construction completed & all equipment commissioned
- Tested with 4 storms in 2021 including “Elsa” and “Ida”
  - Elsa: 5 inches of rain. Storm flow activated for 22 hours.
  - Ida: 7.5 inches of rain. Storm flow activated for 26 hours. (*250-year storm)*
- No bacterial nor chlorine residual exceedances
- On-going system modifications to optimize sampling system
  - Minimize pressure/flow variations to analyzer
  - Additional strainers

Unique Challenges

- Intermittently operated (0-10 times per year)
  - Chlorine analyzer calibration
  - “Fully automated” system difficult to achieve
- Startup and testing challenges
- Equipment selection
  - High suction lift (sample pumps)
  - Large variations in flow (chem feed pumps)

Unique Challenges cont.

- Working with existing infrastructure – CCT and Chemical Tanks
- Difficult layout for maintain equipment access (partially covered tank, space classification)
- Tank needed for storms during construction (vacate in 8 hours notice)
- “High risk” scenario for storm testing

Lessons Learned

- Operations support is critical regardless of the level of automation
- Make a plan for startup during early design phases
- Consistent flow and pressure to chlorine analyzers is key
- Adequate training and communication with operations is key to success

Acknowledgements

Contact Us

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Thank you!