Integrated Wet Weather Flow Management: Southerly Optimized Parallel Treatment

OWEA June 29, 2017

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Northeast Ohio Regional Sewer District

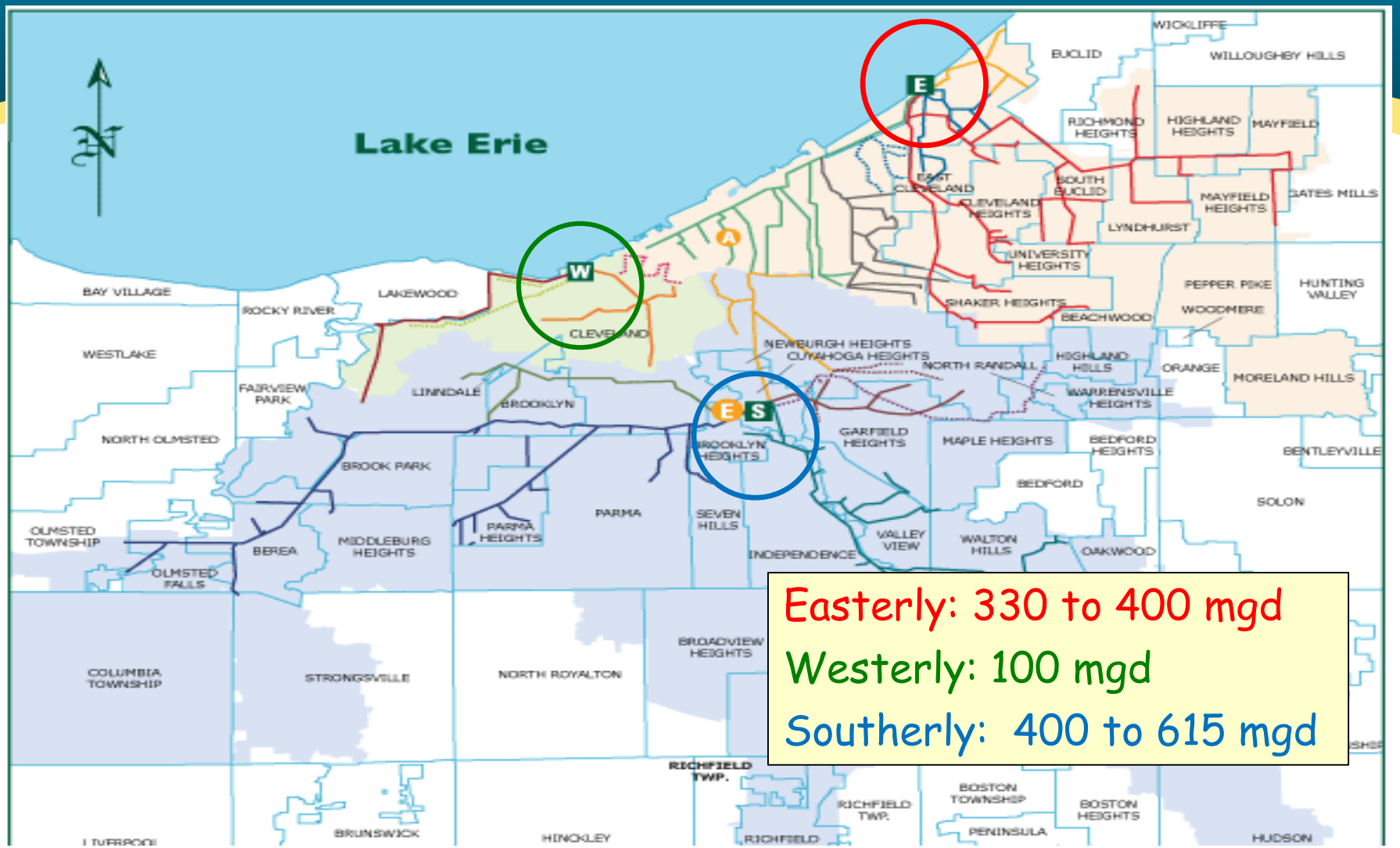
Northeast Ohio Regional Sewer District

- Who we are…
  - Regional wastewater utility created in 1972 by court order
  - Separate and distinct from the City of Cleveland and Cuyahoga County
- What we do…
  - Servicing all or part of 62 member communities
  - 1 million customers
  - 90+ billion gallons wastewater treated each year

Background

- NEORSD signed a Consent Decree to provide Wet Weather Treatment at three WWTPs
- $3 Billion dollar program - Project Clean Lake
  - Collection System Projects
  - Tunnel Storage Projects
  - Chemically Enhanced–High-Rate Treatment (CEHRT)
  - **Expand biological capacity of Southerly and Easterly WWTPs.**

Treatment Capacity



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Southerly Wastewater Treatment Facility

- 5- Major interceptors (3- C.S. areas, 2 S.S. areas)
- 125 MGD average daily flow
- Up to 1,200 MGD peak Wet Weather flow
  - Gravity feed to headworks w/ no plant raw bypass
  - Primary Effluent Bypass (PEB) gravity flow
  - Potential for flooding plant in high River conditions!
- Series secondary treatment 400 MGD peak flow
  - Gravity First Stage: Carbonaceous BOD and TSS
  - Pumped Second Stage: Nitrification

Background & Performance Objectives

Reduce existing PEB activations & pollutants

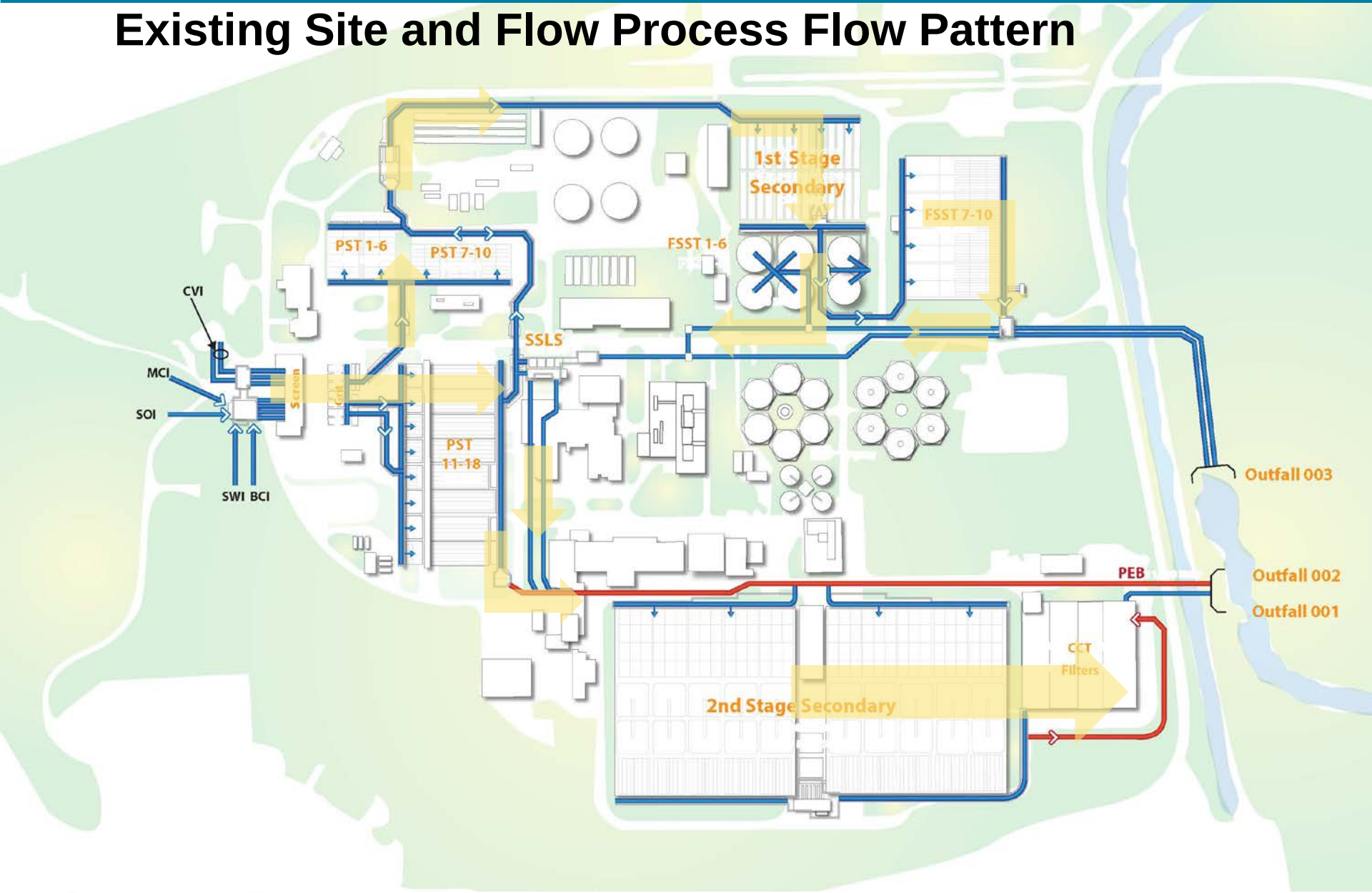
- Currently 11/ year in Typical Year w/ 335 MGD max
- Primary Effluent Quality, Not Disinfected

Expand wet weather secondary treatment discharge capacity with “dual outfall” via parallel operation

- 215 MGD First Stage + 400 MGD Second stage
- Reduce PEB to 1/yr in Typical Year w/ 120 MGD max
- CEPT + High Rate Disinfection to PEB to improve quality

Southerly Wastewater Treatment Facility

Existing Site and Flow Process Flow Pattern



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Southerly Optimized Parallel Treatment (SOPT) Objectives

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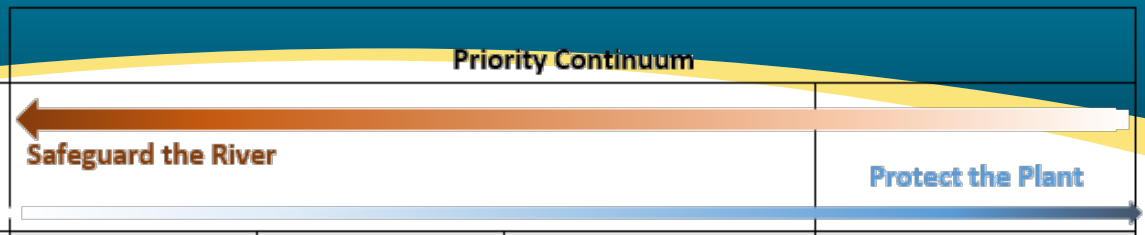
SOPT Overall Project Goals

- Safeguard the River
  - Meet Consent Decree Requirements
  - 400 MGD Second Stage Rated Capacity
  - 215 MGD First Stage Rated Capacity
  - Effluent meets NPDES Permit (mathematically blended)
- Protect the Plant
  - 480 MGD Second Stage Emergency capacity
  - 300 MGD First Stage Emergency Capacity
  - Emergency collection system relief systems

SOPT Overall Project Goals



Operation Scenario	Dry Weather	Typical Year Wet Weather	Design Maximum Wet Weather	Emergency Operation
Influent Flow Rates	0 – 200 MGD	201 – 735 MGD	736 – 1,200 MGD	1,200 MGD
River Level	Up to 25-Year	Up to 25-Year	Up to 25-Year	Up to 100-Year
Requirements CD	←	←		
10 State Standard (25 Yr Flood)	←	←	←	
Protect the Plant				↔
Process Mode	Series	Parallel	Parallel	Parallel
1st Stage Treatment Process (FSAS)	200 MGD	215 MGD	300 MGD	300 MGD
2nd Stage Treatment Process (SSAS)		400 MGD	480 MGD	480 MGD
Primary Effluent Bypass (PEB)		120 MGD	420+ MGD	307 MGD
Total Flow Rate objective achieved?	200 MGD ✓	735 MGD ✓	1,200 MGD ✓	**1,087 MGD** **(113 MGD) GAP**

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Protecting the Plant

River Level and Ability to Discharge from SWWT

1st Stage Treatment Process (FSAS)

300 MGD

New Pump Station

Up to 500 Year

2nd Stage Treatment Process (SSAS)

480+ MGD

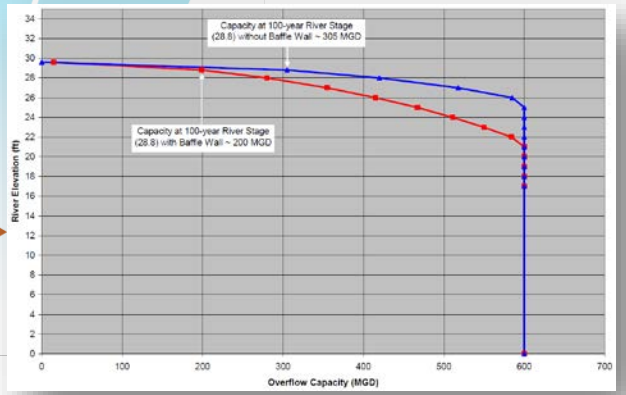
Existing 2nd Stage Lift Station

Up to 500 Year

Primary Effluent Bypass (PEB)

GRAVITY

	Discharge Shortfall
520 MGD	25 Year - None
305 MGD	100 Year - (115) MGD
0 MGD	500 Year - (420) MGD



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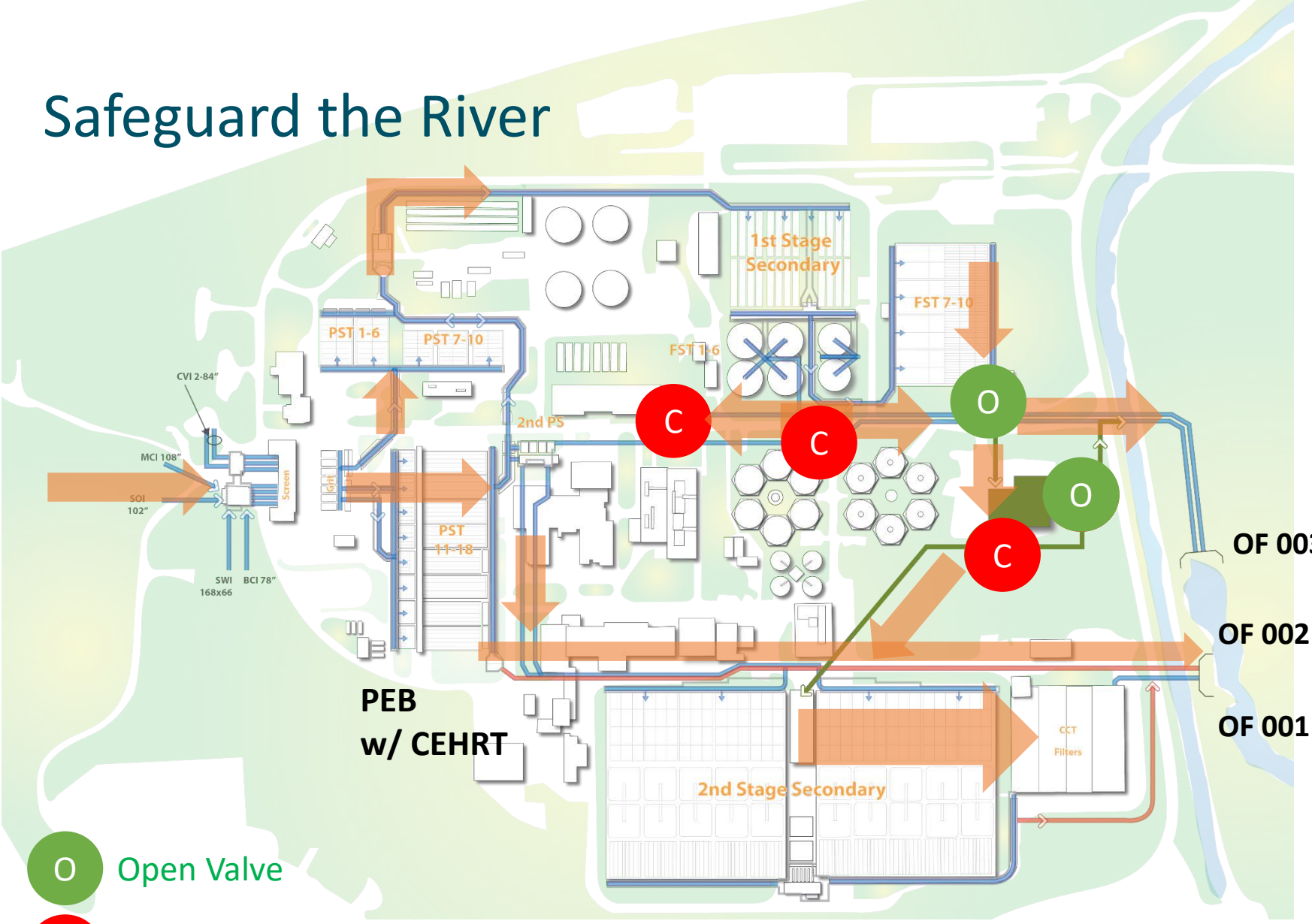
Safeguard the River



O Open Valve

C Close Valve

Dual Purpose PS Wet Weather Transition

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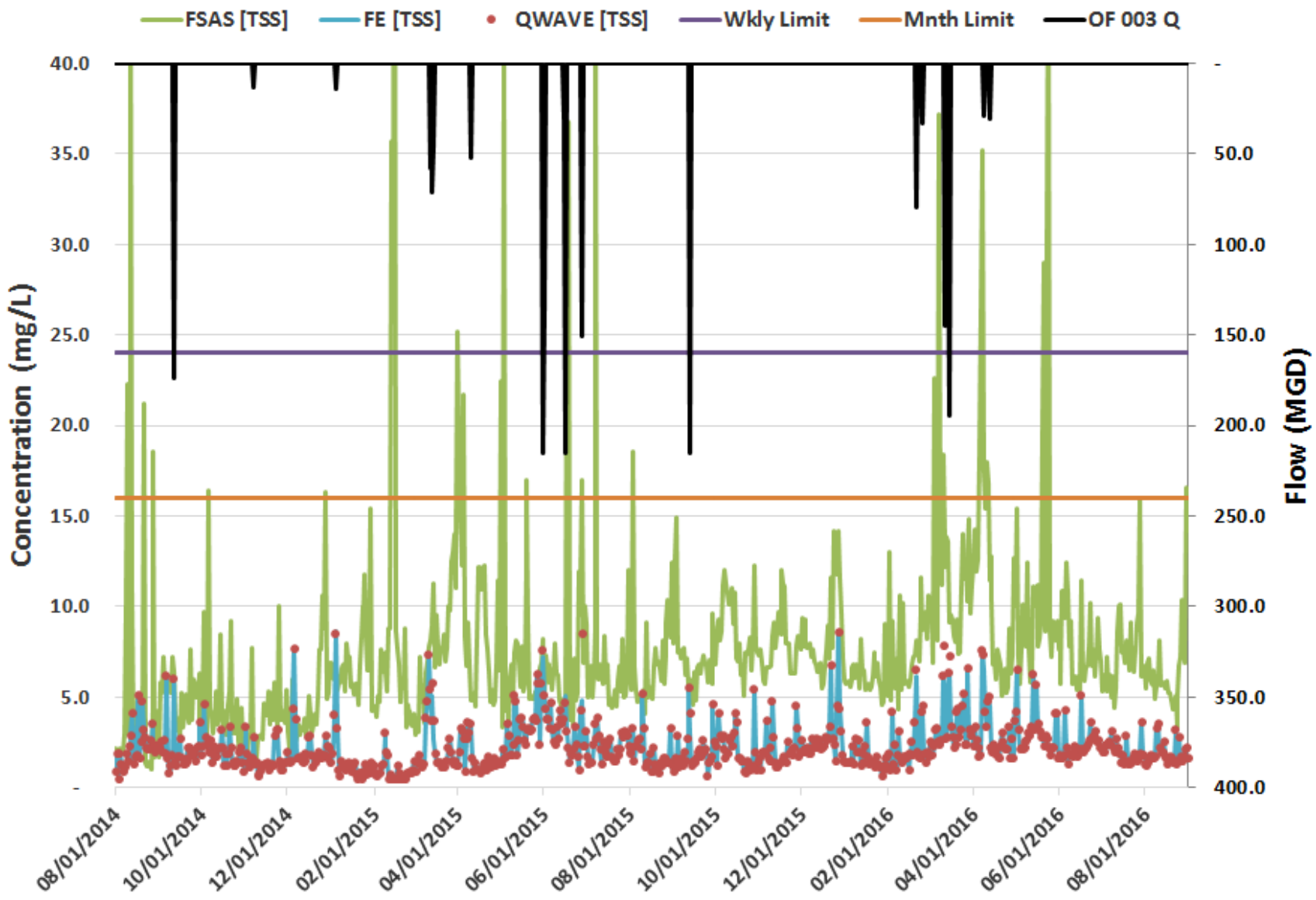
Effluent Blending TSS



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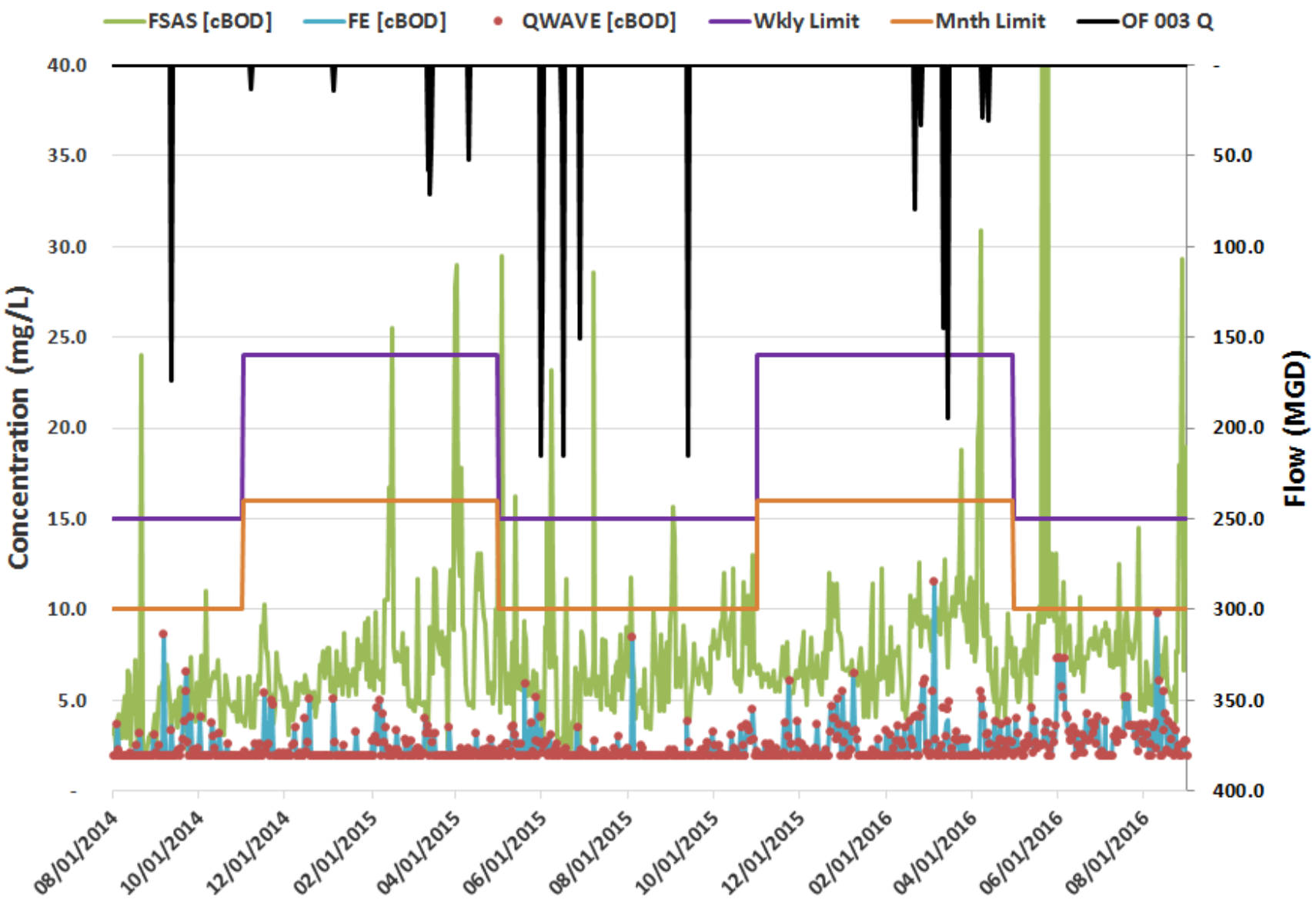
Effluent Blending cBOD



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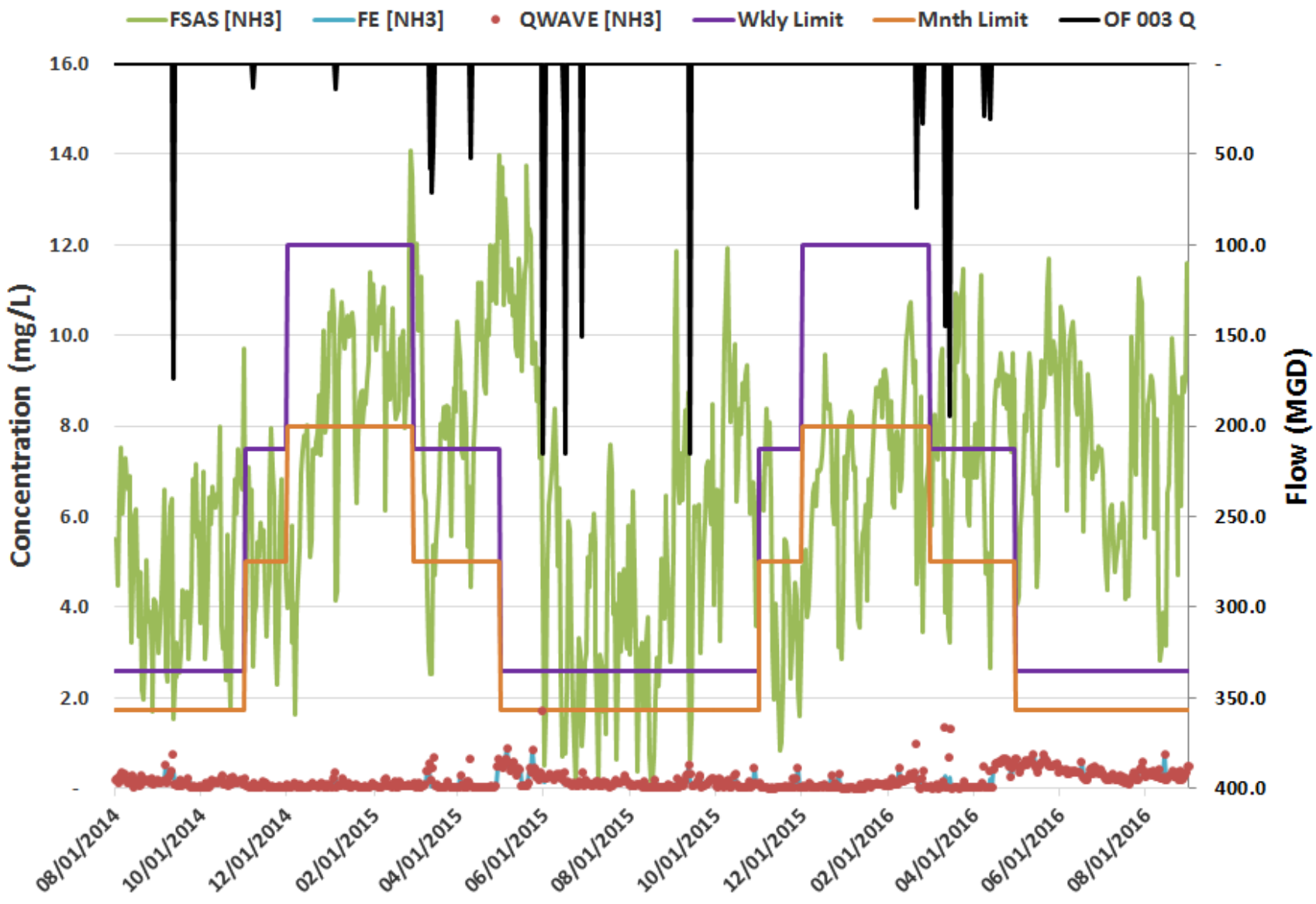
Effluent Blending NH3



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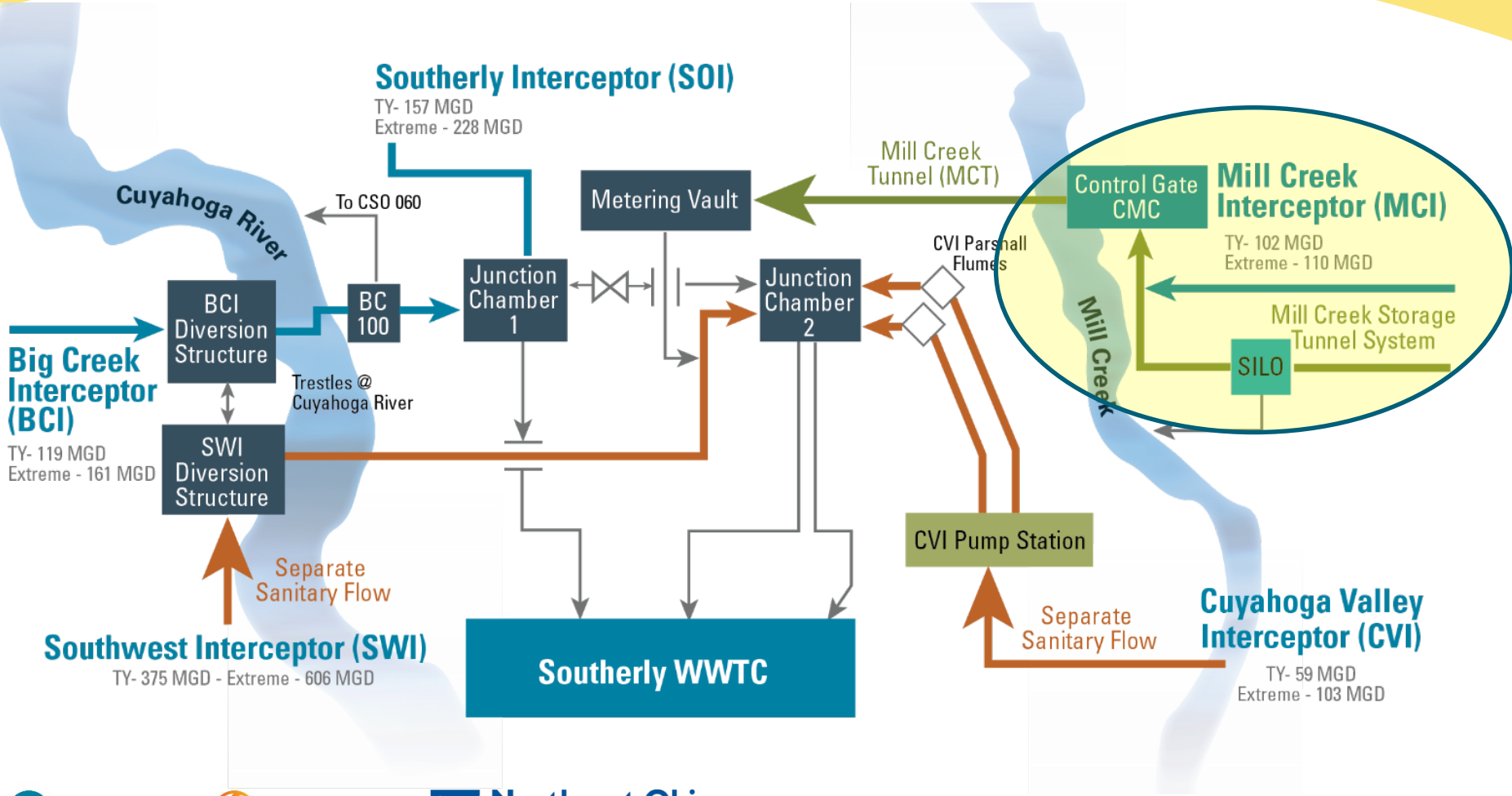
Managing Flows to the Plant



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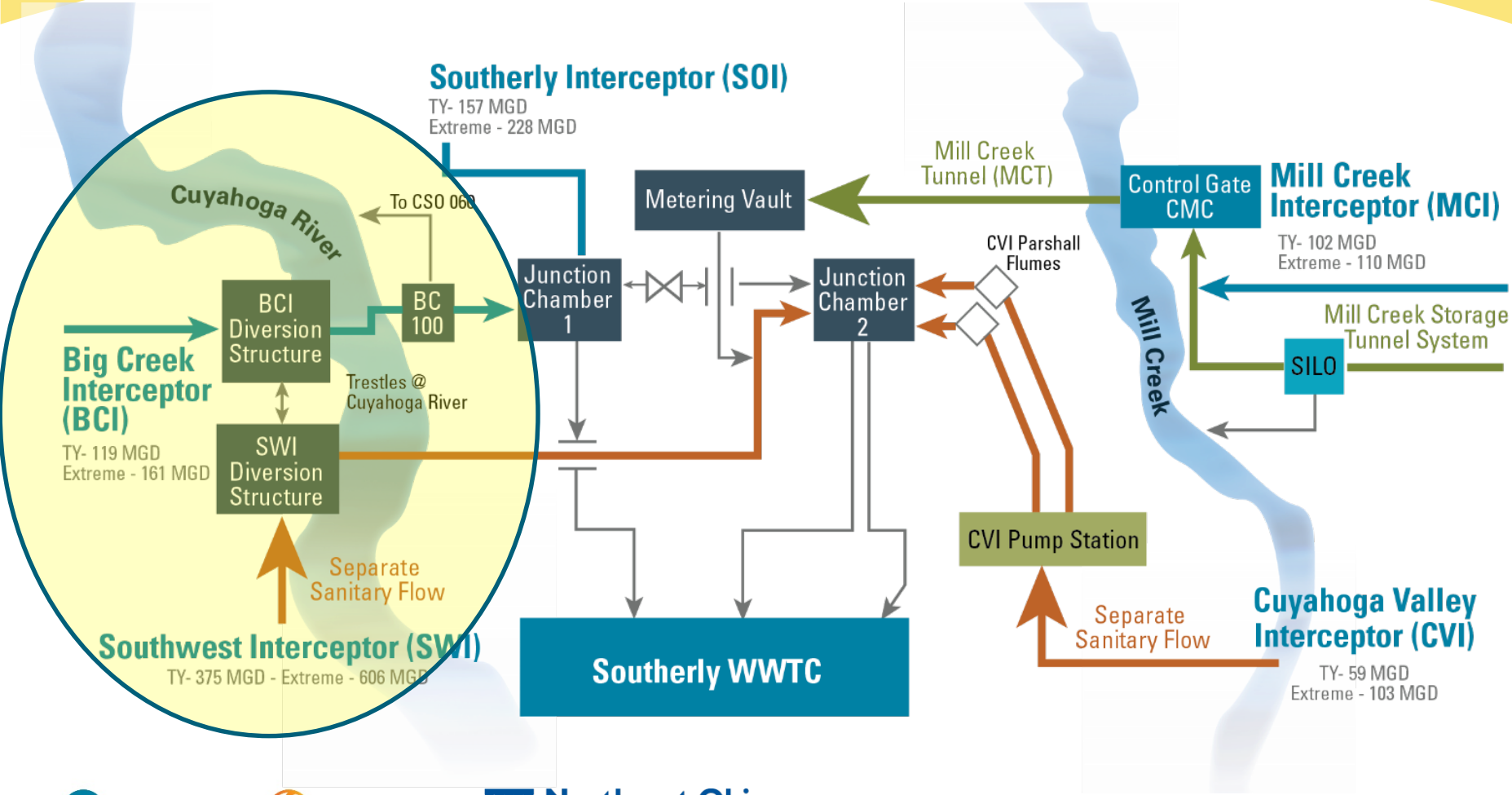
Offloading Additional Flows via Mill Creek Silo Can Reduce Plant Flows

- Complete gate closure reduced flow to plant by 109 MGD (all flow discharges via silo)
- Existing gates and silo

Managing Flows to the Plant



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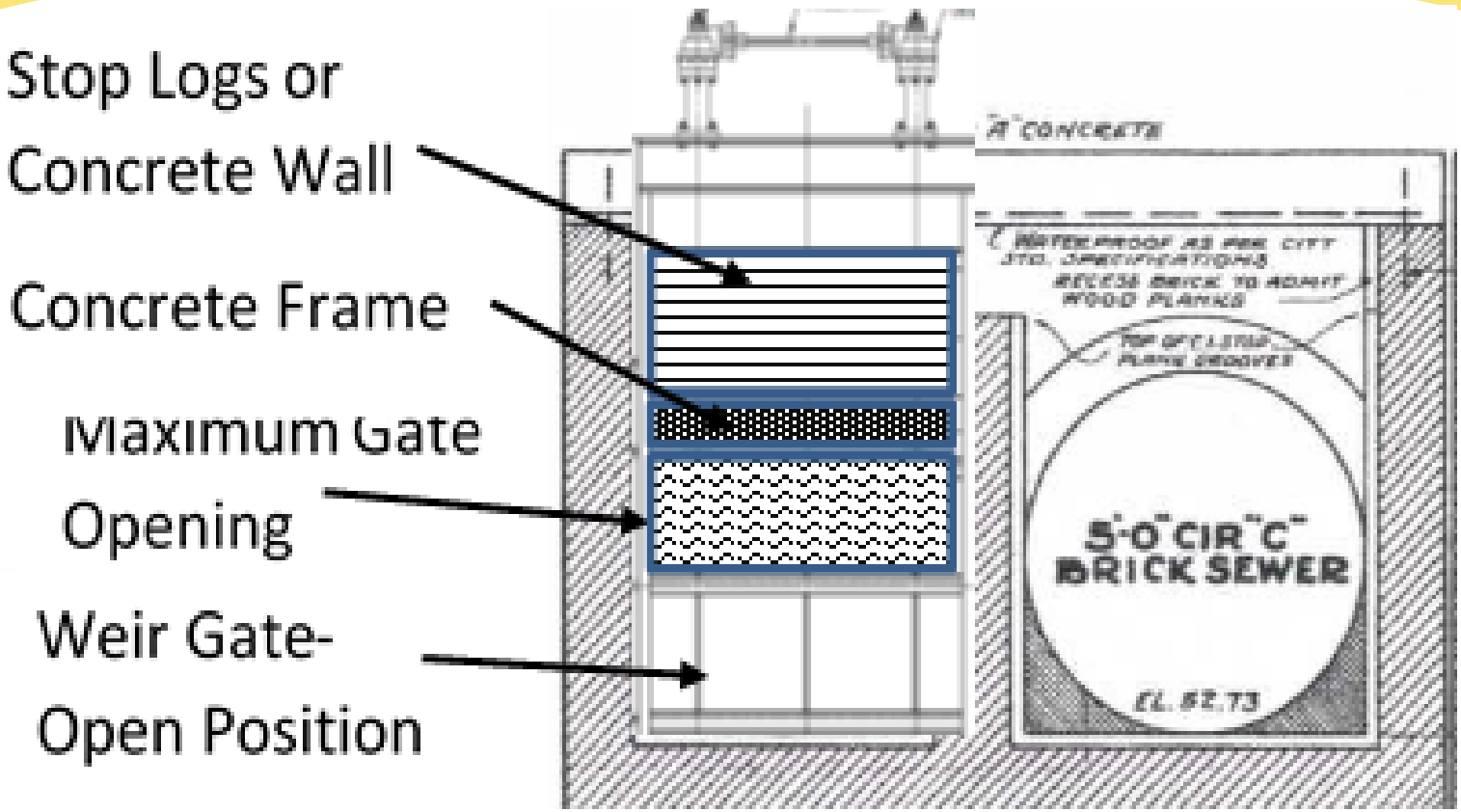
Retrofitting BC-100 with a Weir Gate Allows Relief of Big Creek Interceptor



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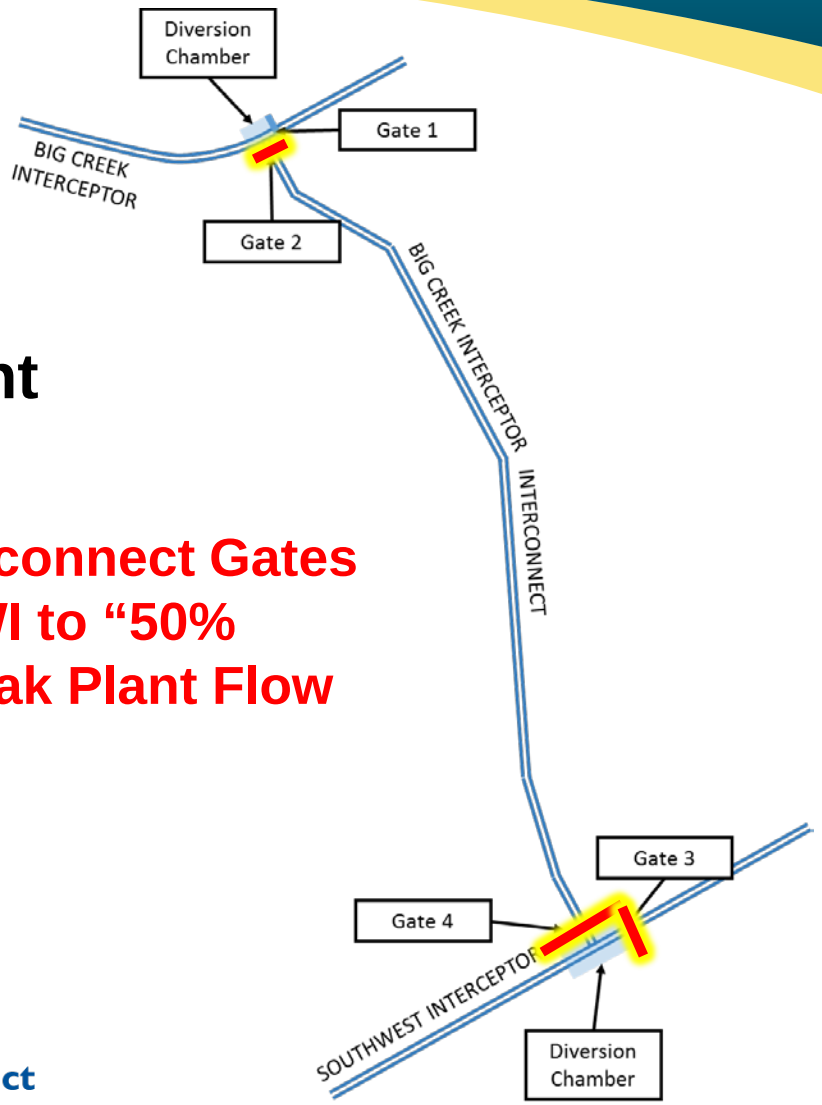
BCI-SWI Interconnect Increases Offloading Potential: Existing 48” CSO 060

All Gates to be motor operated
And remotely controlled at plant

Opening the Interconnect Gates and Throttling SWI to “50% Open” Lowers Peak Plant Flow by 109 MGD



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Early Warning System

Near Term

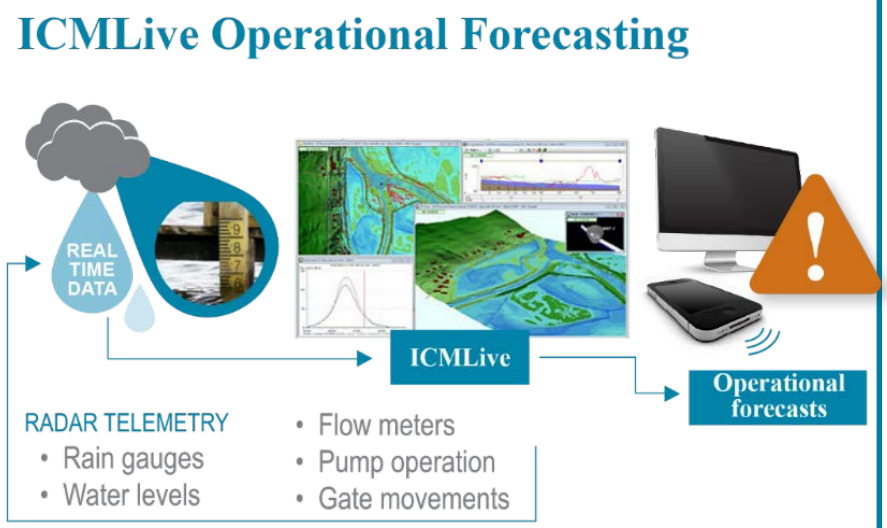
Real-Time Flow Monitoring

- 30-minute Advance Warning
- Cover sufficient tributary area
- Combine with Radar Rain Monitoring

Future Opportunities

Real-Time Operational Forecasting

- Real Time Rainfall & Flow
- Predictive Radar
- Forecast System Response



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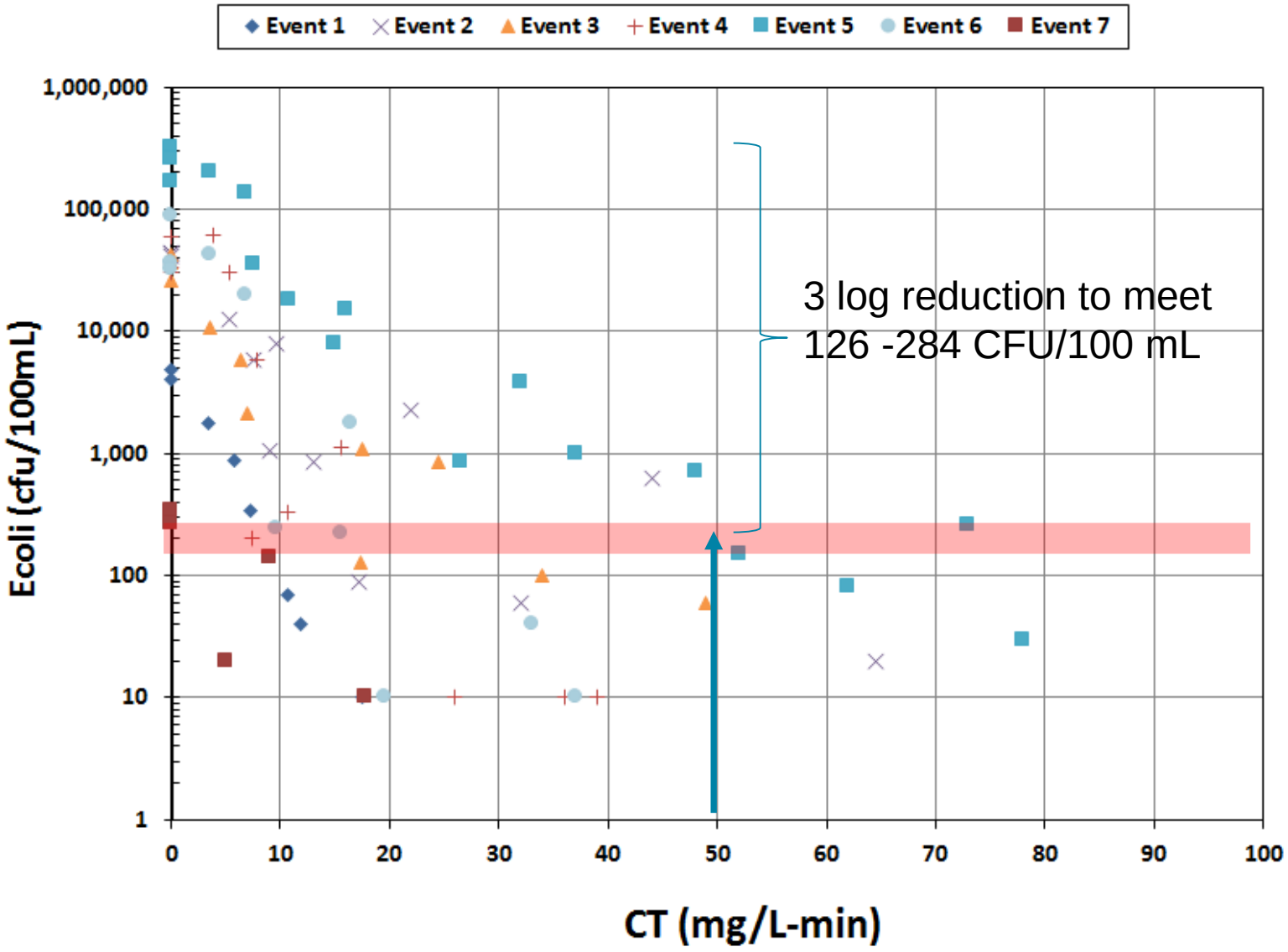
Basis of Design

- Pump and Disinfect First Stage Activated Sludge effluent to the Cuyahoga River Slough
  - 215 MGD nominal wet weather treatment capacity
  - Re-purposed Outfall 003
- Pump 215 MGD to Second Stage Activated Sludge
- Power & Standby Generators
- Protect the Plant during 25 – 100 year flood stage
  - Up to 300 MGD emergency hydraulic capacity pumping & disinfection

E. Coli vs CT



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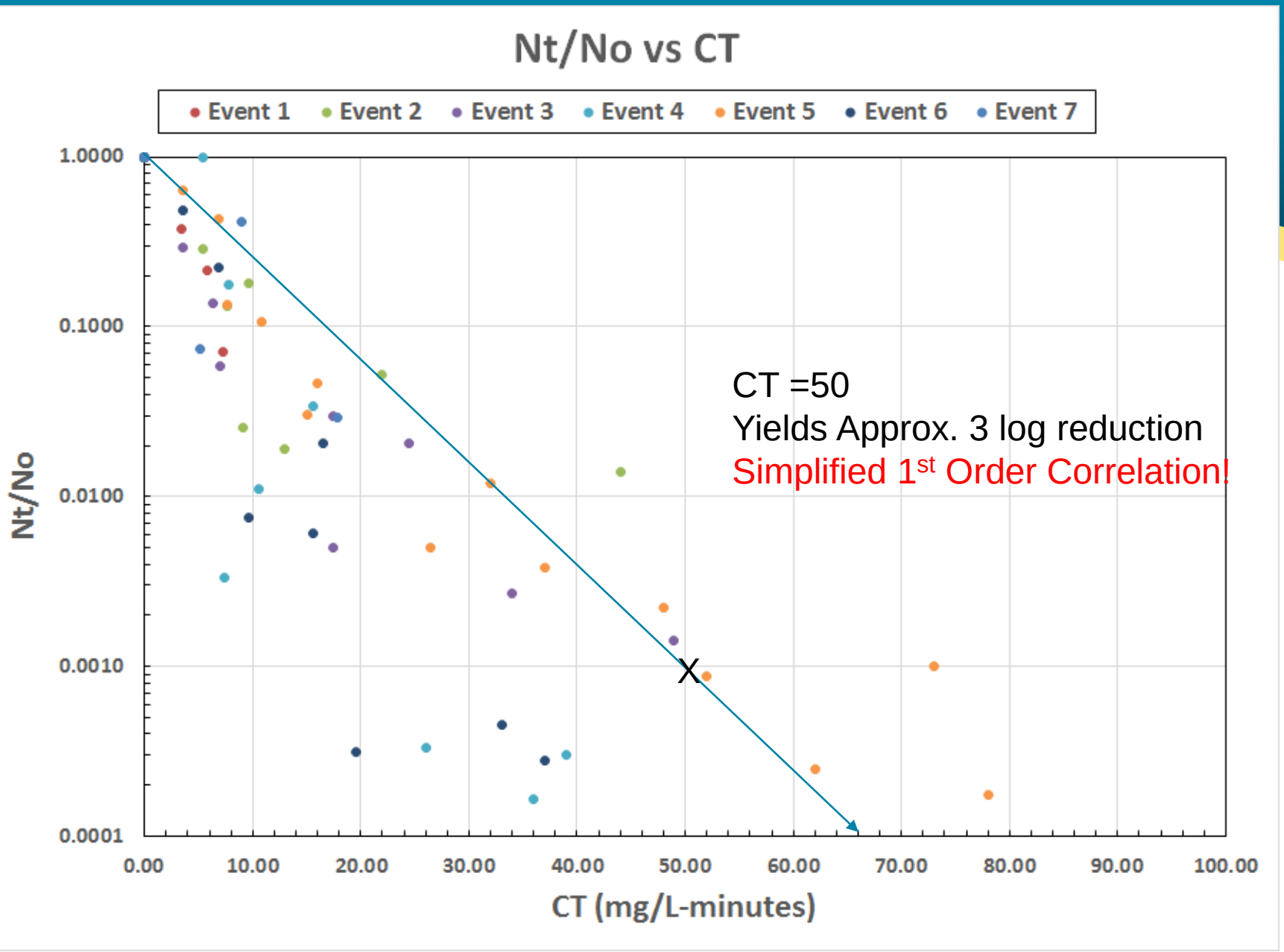

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Disinfection System Contact Tanks

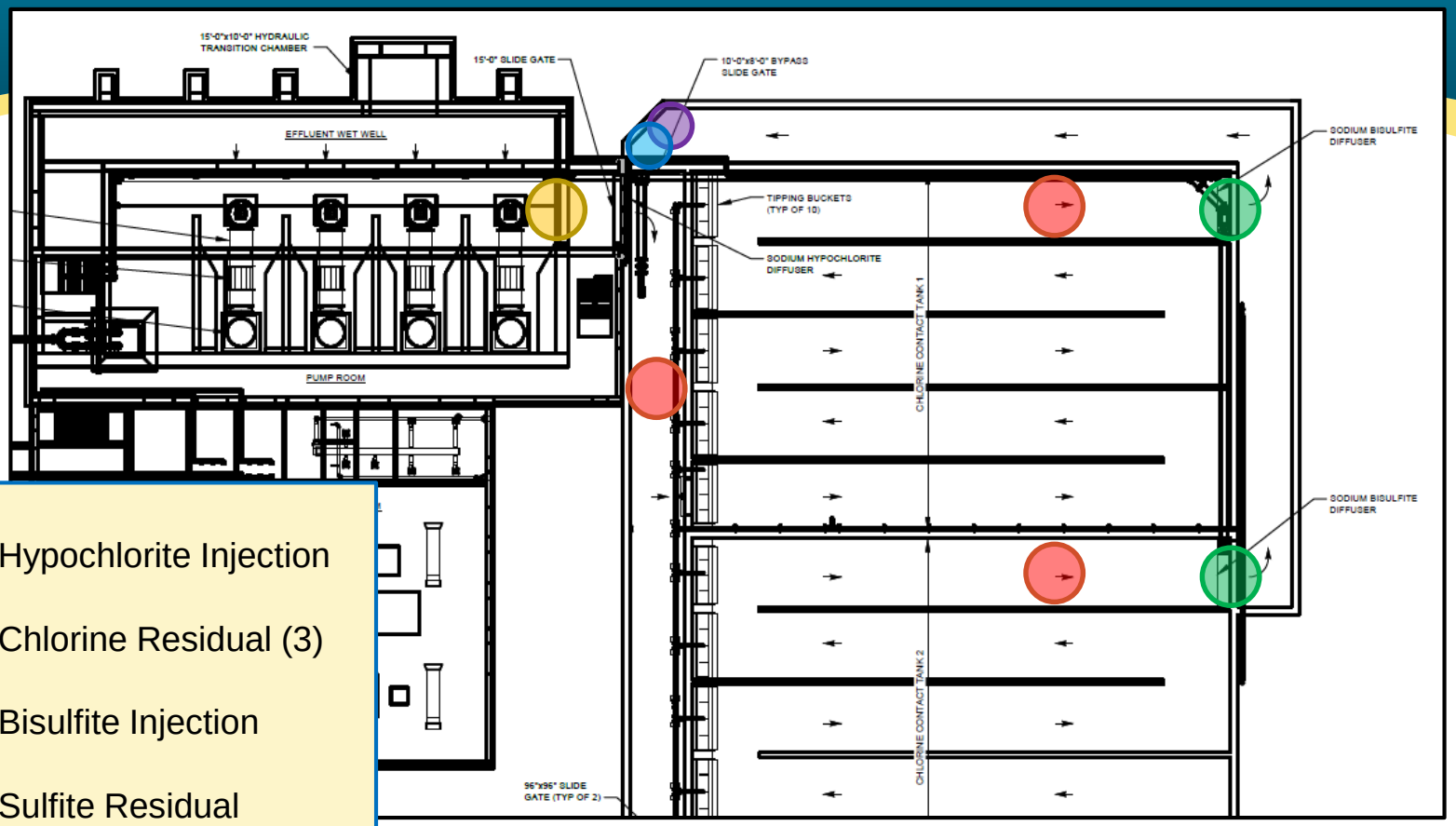
- 2 contact tanks
- Length:Width Ratio is 40:1 for each CCT
- 15’ Channel Width with 5, 120’ passes per tank

Disinfection Design Criteria Summary

- Need approximately 3 log reduction
- CT = 50 mg/L-minutes

Flow Rate (MGD)	Theoretical Contact Time (Minutes)	Efficiency (%)	Modal Contact Time (Minutes)	Residual Concentration Needed (mg/L)
215	16.0	84.0%	12.5	4.0
300	11.7	78.5%	8.9	5.6

Disinfection System



- Hypochlorite Injection
- Chlorine Residual (3)
- Bisulfite Injection
- Sulfite Residual
- NPDES Reporting
  DO, pH, temperature

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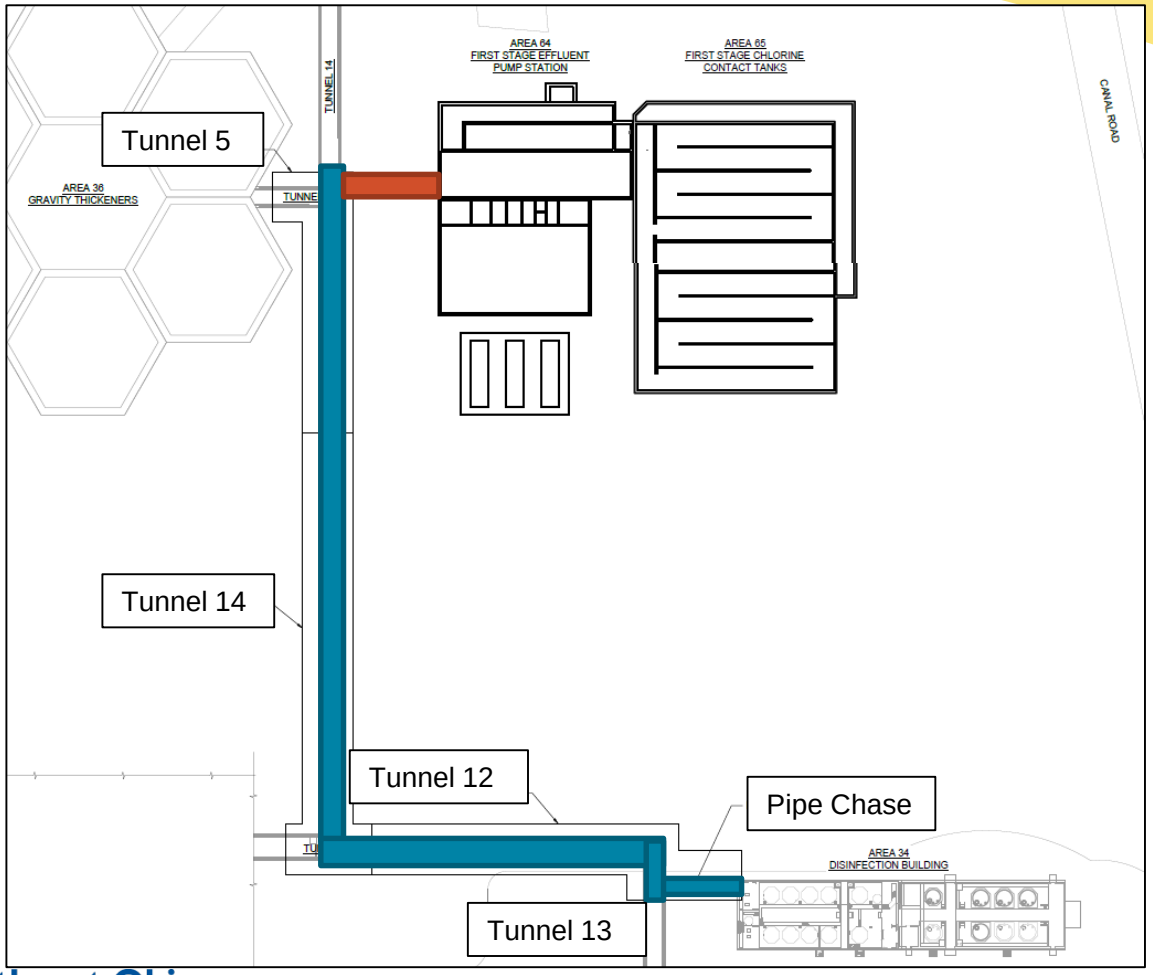
Disinfection Chemical Loop Piping

- BIS and NaOCl from Disinfection Building to FSE Pump Station and CCTs
- BIS and NaOCl piping through Tunnels 12, 13, 14, and new tunnel



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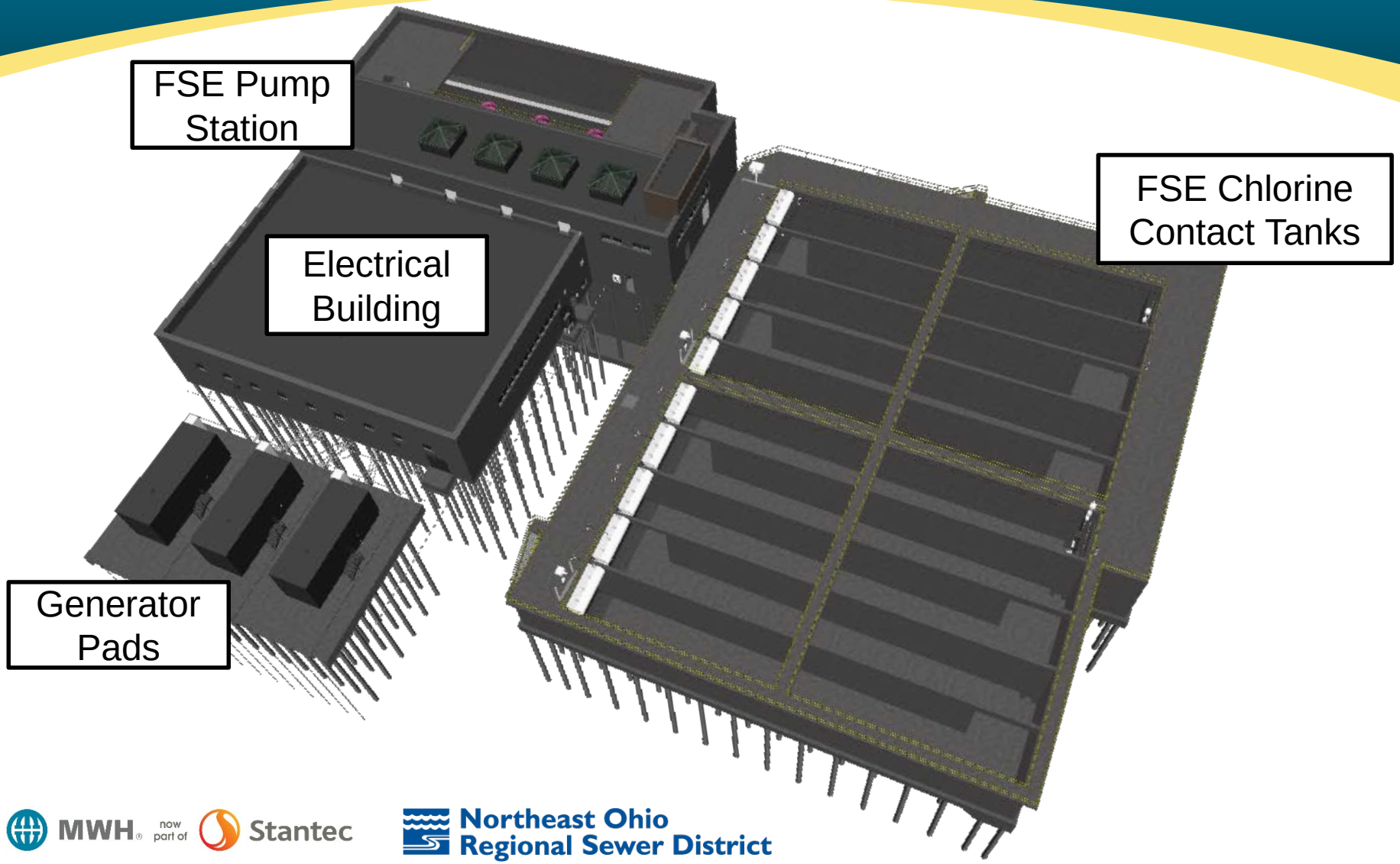
FSE Pump Station, FSECCTs, Electrical Building, and Generators



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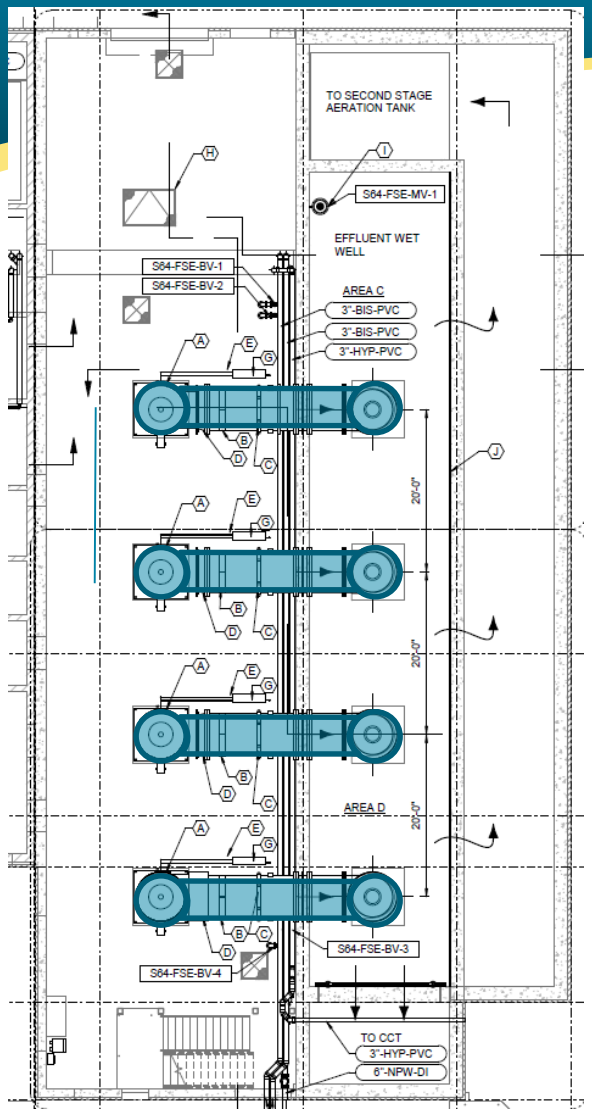
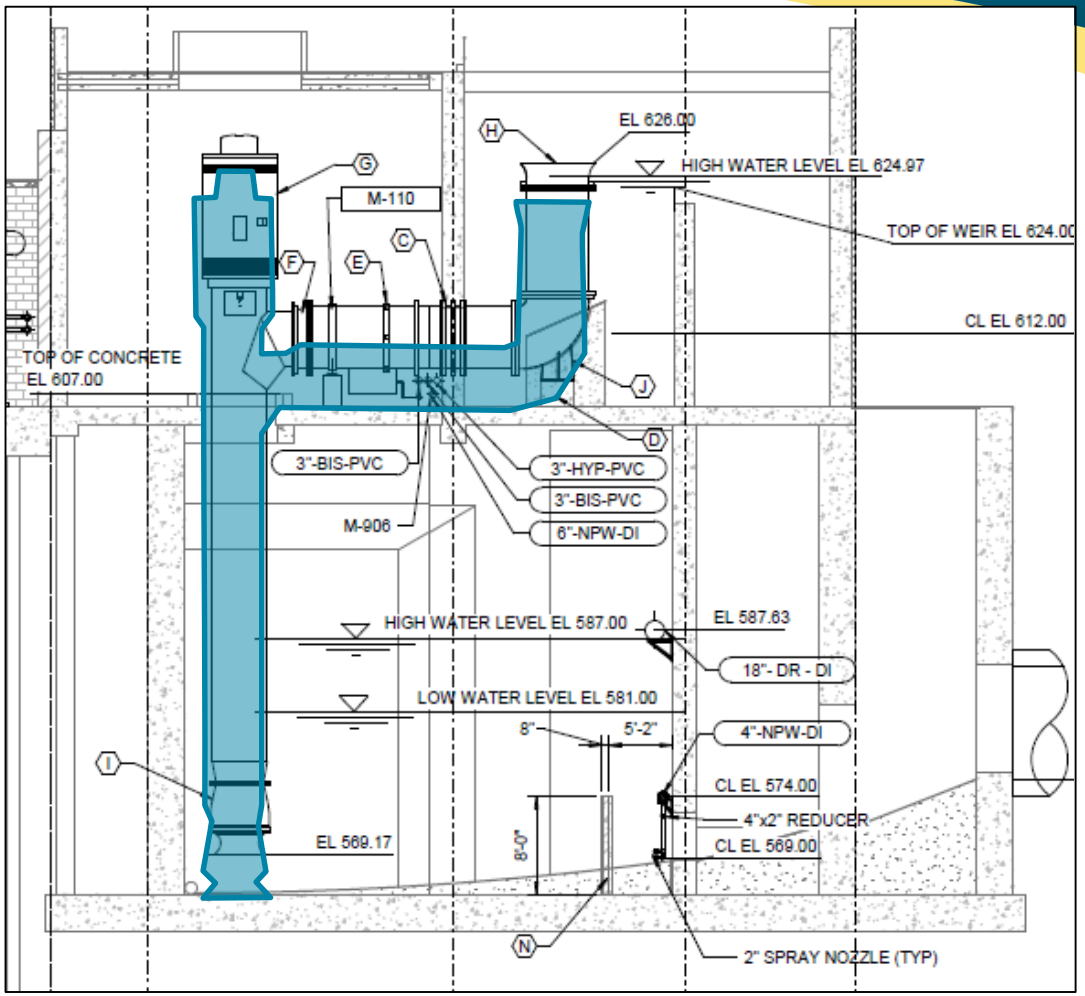
FSE Pump Station Pumps





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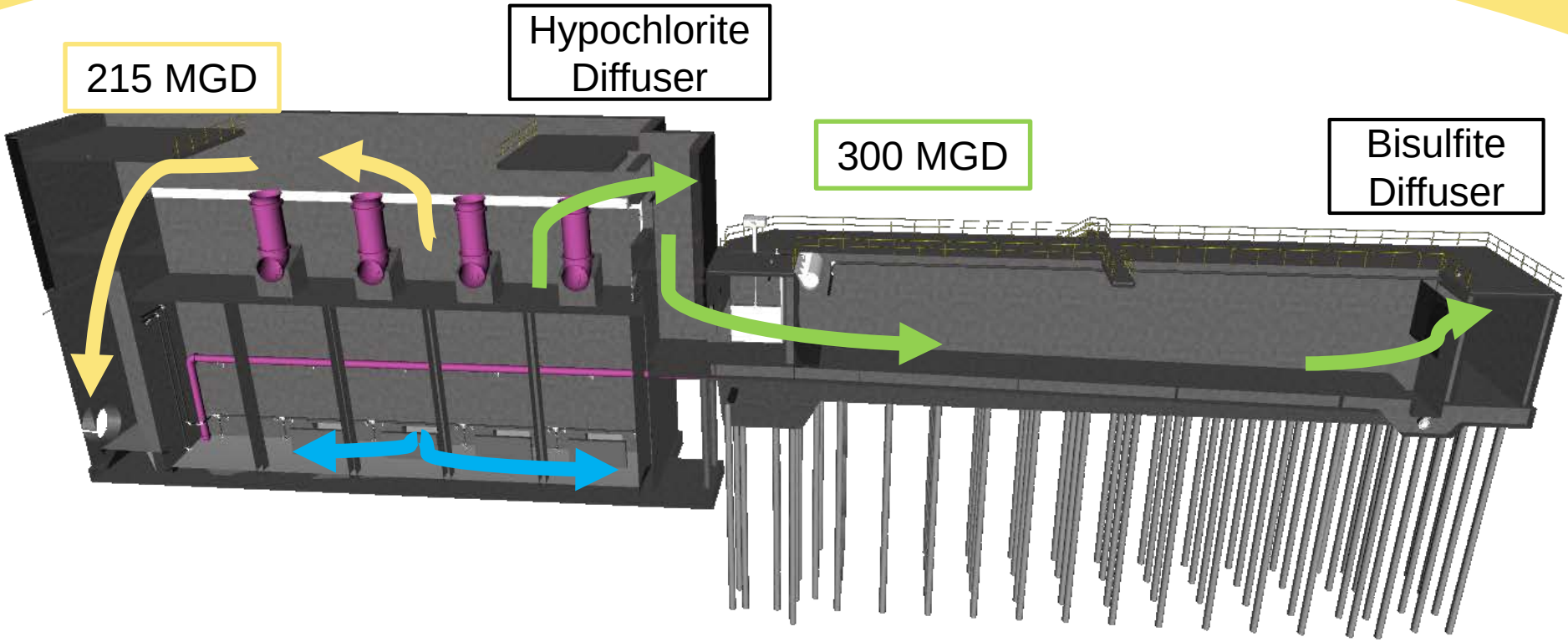
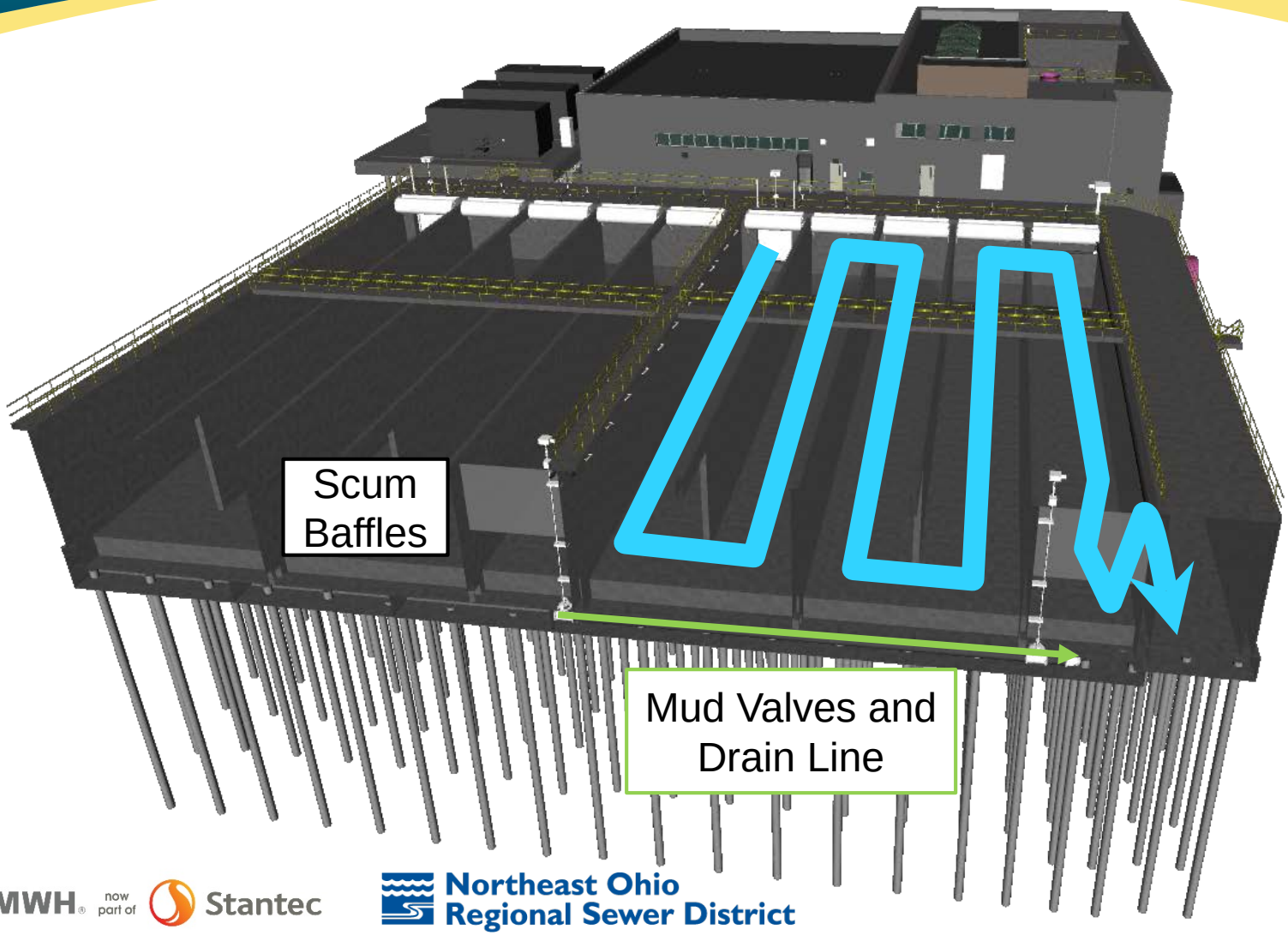
Cross Section of FSE Pump Station and FSECCTs



FSE Chlorine Contact Tanks – Section



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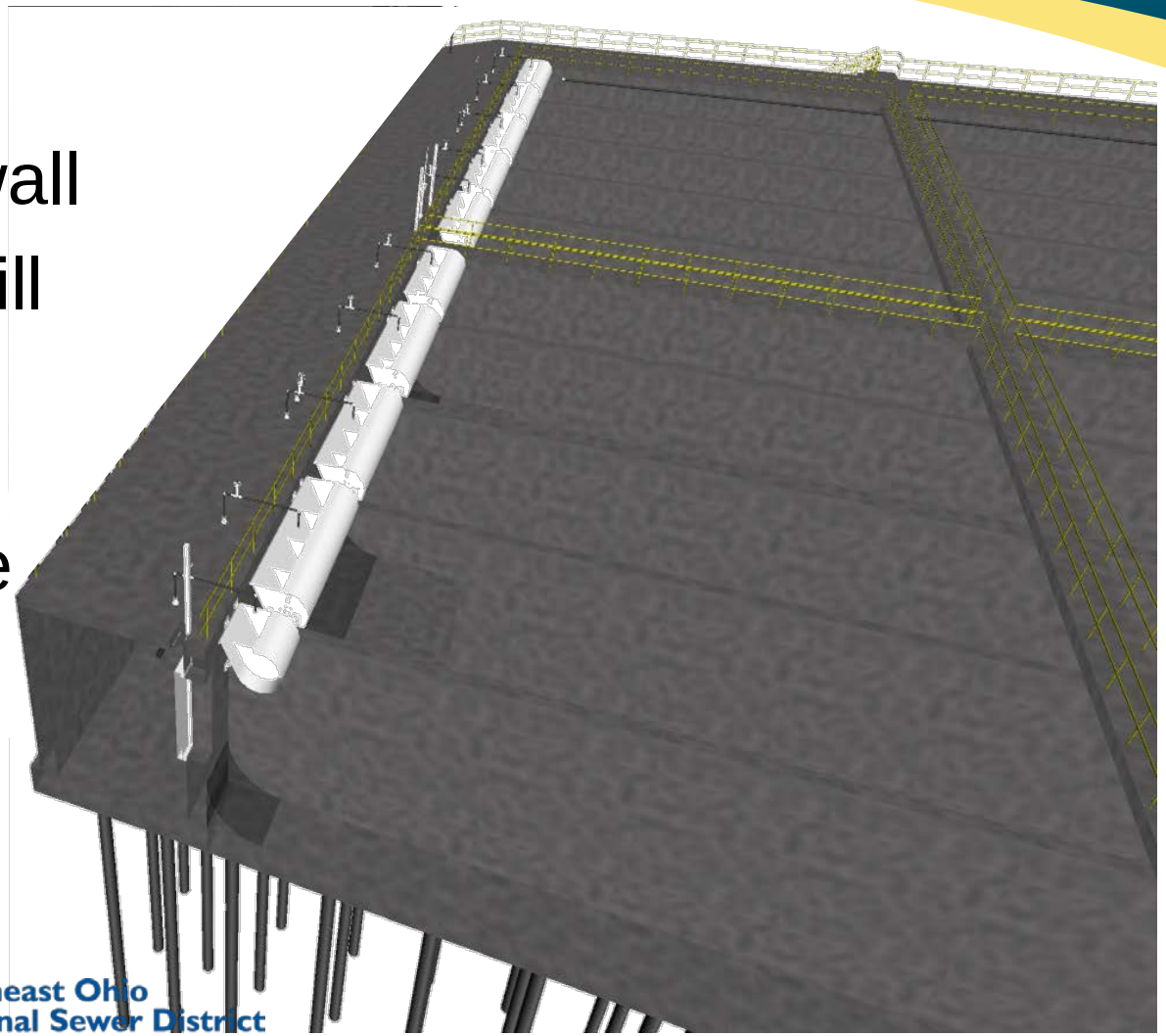
FSE Chlorine Contact Tanks

- Tipping buckets – mounted to back wall
- 2” NPW Piping to fill tipping buckets
- (2) 96” x 96” Slide Gates into Chlorine Contact Tanks



Questions?

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