Metropolitan Water Reclamation District of Greater Chicago

Welcome to the April Edition of the 2025 M&R Seminar Series

NOTES FOR SEMINAR ATTENDEES

- Remote attendees' microphones are muted at entry to minimize background noise.
  For attendees in the auditorium, please silence your phones.
- A question and answer (Q/A) session will follow the presentation.
- For remote attendees, please use "**Chat**" only to type questions for the presenter. For other issues, please email Pam to SlabyP@mwrd.org.
  For attendees in the auditorium, please raise your hand and wait for the microphone to ask a verbal question during the Q/A session.
- The presentation slides will be posted on the MWRD website after the seminar.
- This seminar has been approved by the ISPE for one PDH and approved by the IEPA for one TCH. Certificates will be issued only to participants who attend the entire presentation.

Steven C. Baytos, IV
Water Reclamation Facility Superintendent
City of Akron Water Reclamation Facility
Akron, Ohio

Steve Baytos has been a Certified Wastewater Operator since 1998. He was promoted to Plant manager in Elyria, where he achieved his Class IV Certification in 2012. He also has a Class III Water Supply Certification. Steve has a Bachelor of Science in Environmental Science from Youngstown State University and a Masters of Public Administration from Ohio University. Currently, he is the Superintendent of the City of Akron's Water Reclamation Facility.

Joseph M. (Mike) Starkey, P.E.
Project Manager
Burgess & Niple

Mike rejoined Burgess & Niple in 2017 as a project manager. He previously was a member of the Burgess & Niple team from 1997 to 2006, before moving to Iowa for 11 years. He has a Bachelor of Science in Mechanical Engineering from West Virginia Institute of Technology. His background includes the design of water and wastewater plant improvements, pump stations, rate studies, funding and collections and distribution systems. He is experienced with a wide variety of municipal water and wastewater projects. Mike served as the Technical Lead / Assistant Project Manager for the BioCEPT Improvements Project.

B&N
burgessniple.com

AKRON

Biological Chemically Enhanced Primary Treatment (BioCEPT) Compared to Traditional Activated Sludge Secondary Treatment During Wet Weather Flows

Steve Baytos
City of Akron

Mike Starkey, PE
Burgess & Niple

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

MONITORING & RESEARCH SEMINAR SERIES

APRIL 25, 2025

Agenda

- Background
- Project Scope & Design Approach
- Design & Construction Challenges
- Demonstration Testing
- Results

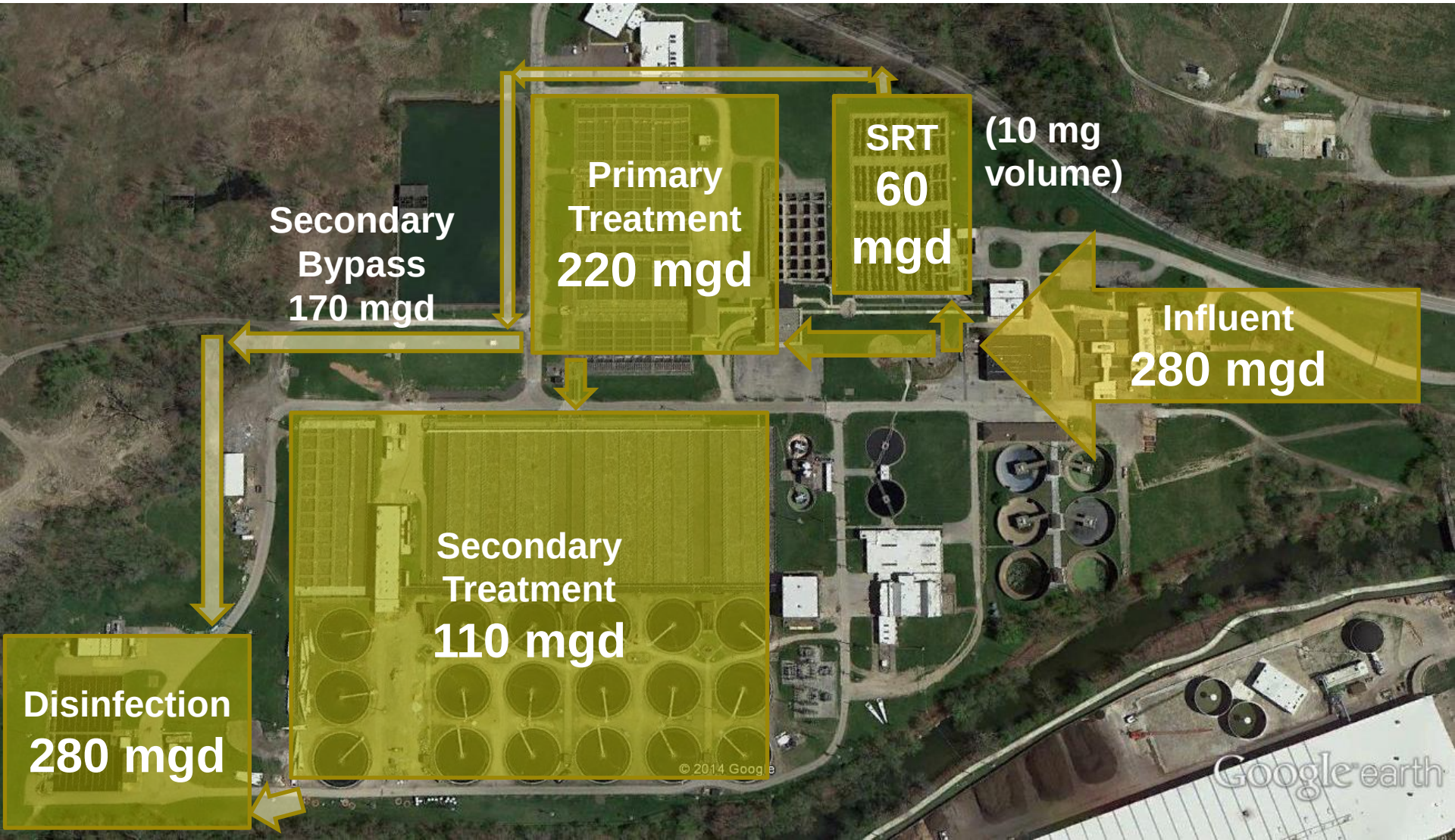
Consent Decree (CD)

- Akron is in the process of implementing its long-term control plan (LTCP) over a 19-year period to satisfy requirements of a consent decree by 2027.
- Estimated program cost is $1.2 billion.
- Akron was required to construct a high-rate treatment system with biological component.
- Provide equivalent secondary treatment for all flows up to 280MGD.

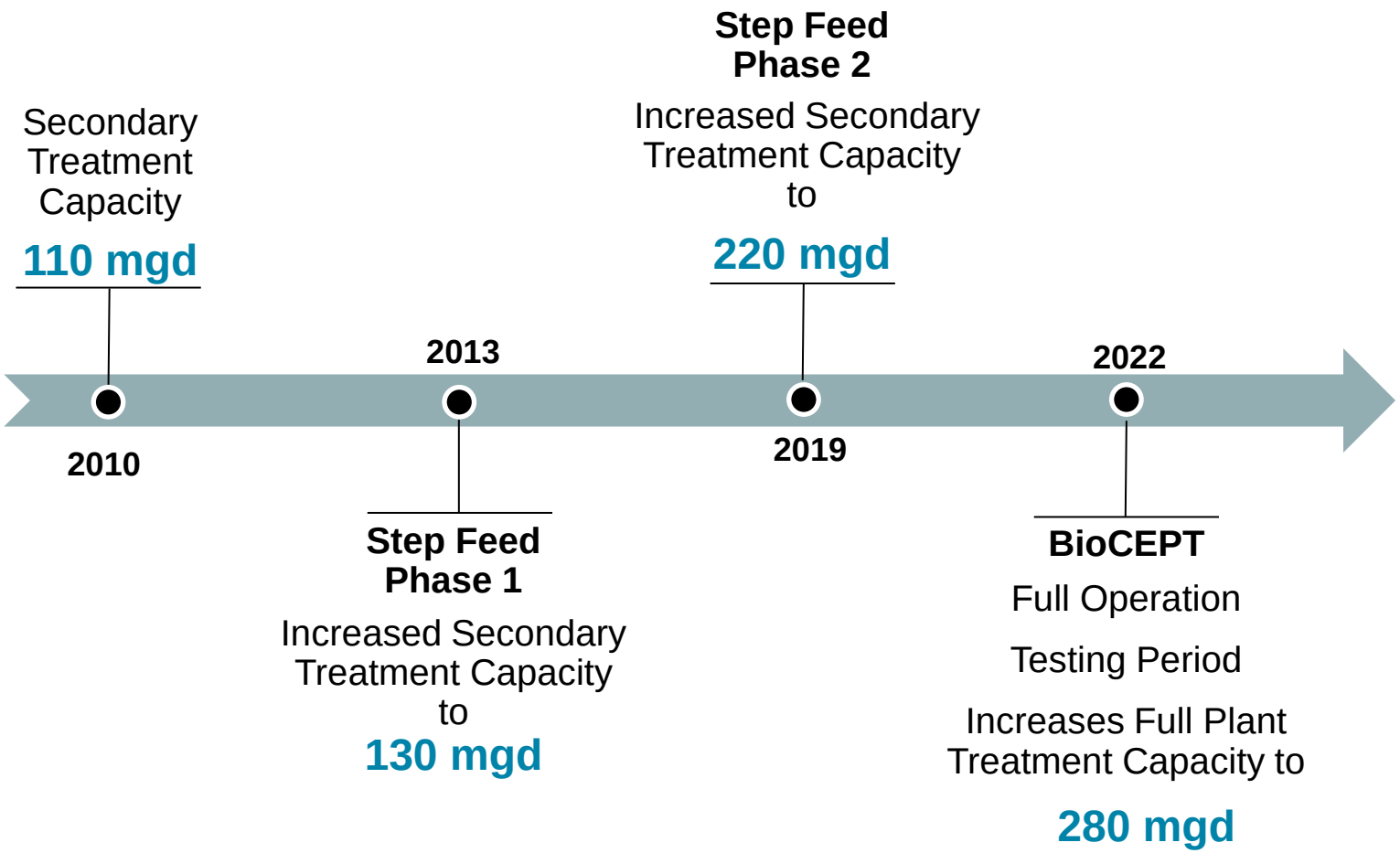
Consent Decree (CD)

- 25 of 27 projects are completed.
- Ohio Canal Interceptor Tunnel.
- North Side Interceptor Tunnel – being built.
- EHRT – Enhanced high-rate treatment facility at the end of the OCIT. Legal process with alternate projects.

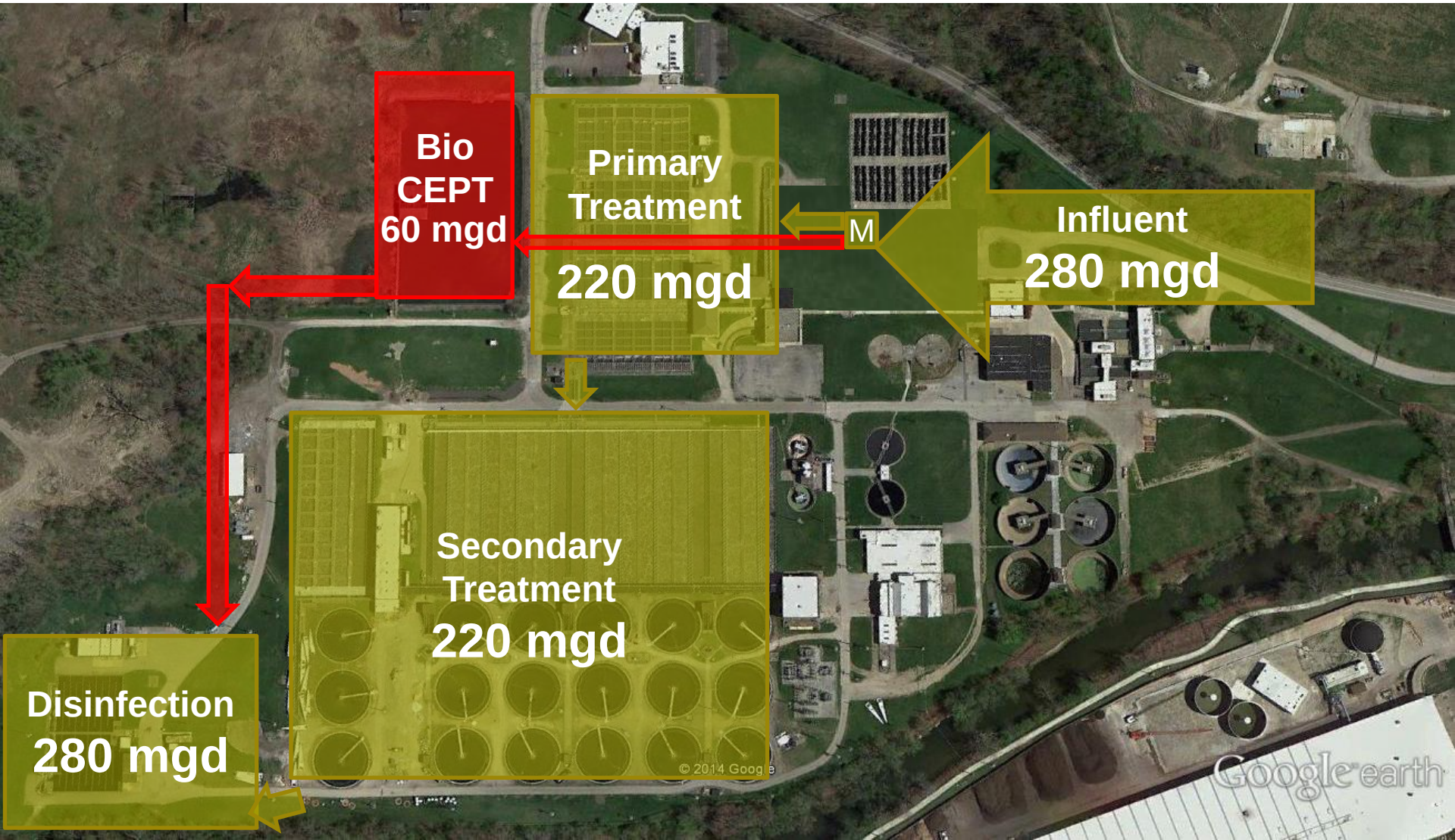
Original Treatment Capacities (2012)



A Phased Approach (at WRF)



Current Process Capacities (2022)



Program Impact on Secondary Bypass

Secondary Treatment Capacity (MGD)	Bypass Events (No./Year)	Bypass Volume (MG/Year)
Original Configuration (110 mgd)	36	962
Phase 1 Expansion: Minimum (130 mgd)	33	620
Phase 2: Enhanced LTCP (220 mgd)	5	41
BioCEPT (280 mgd)	0	0

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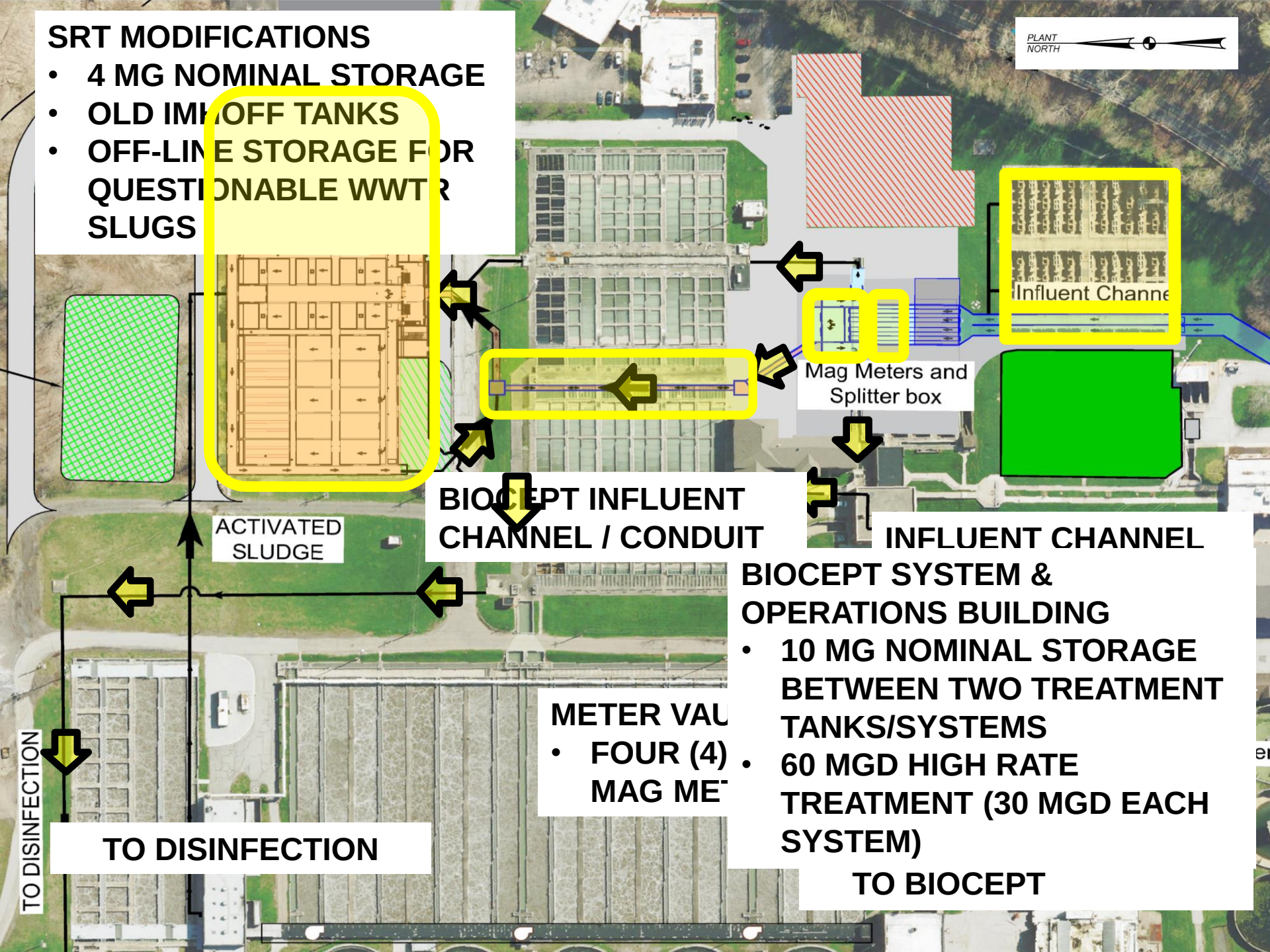
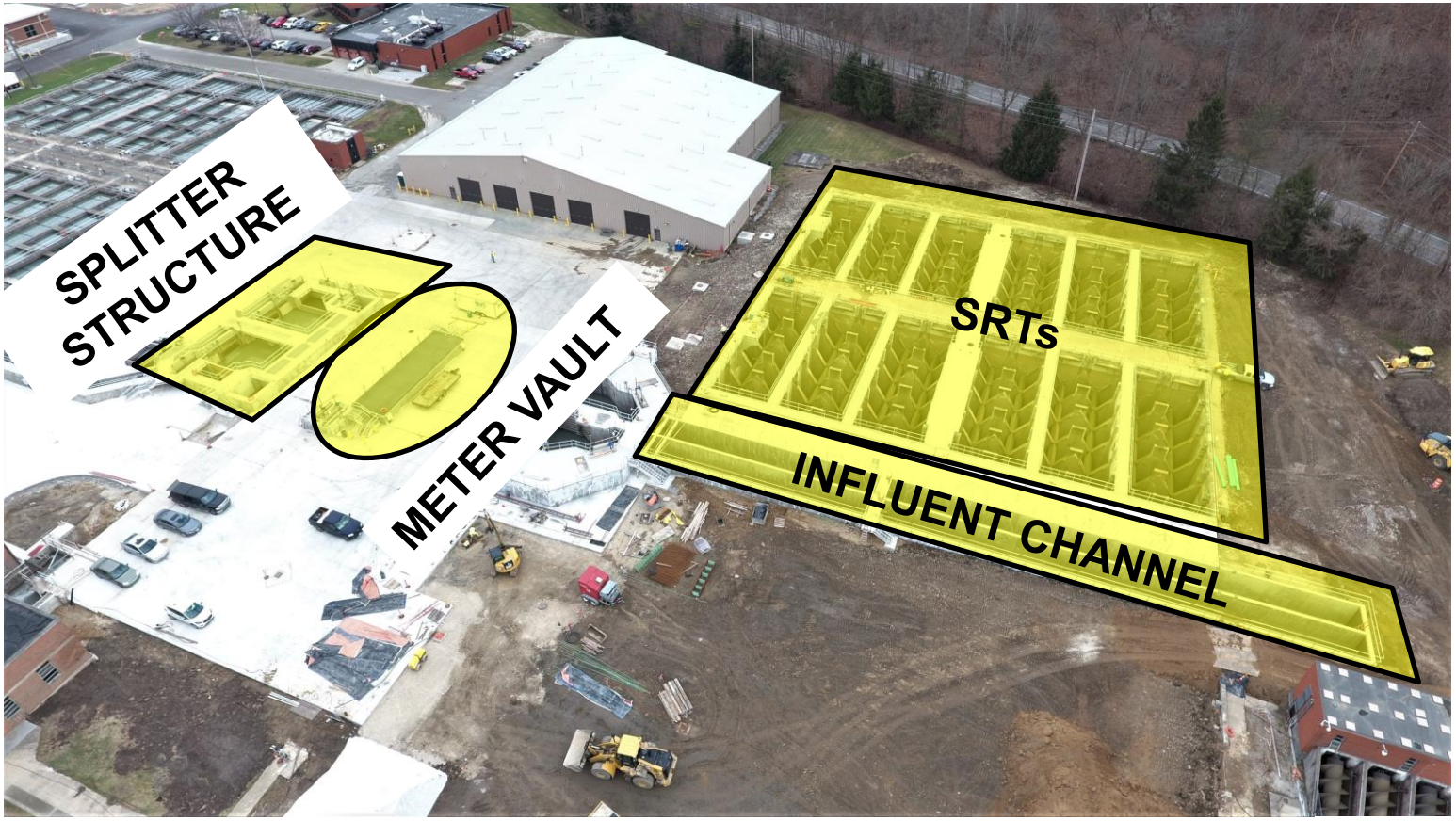
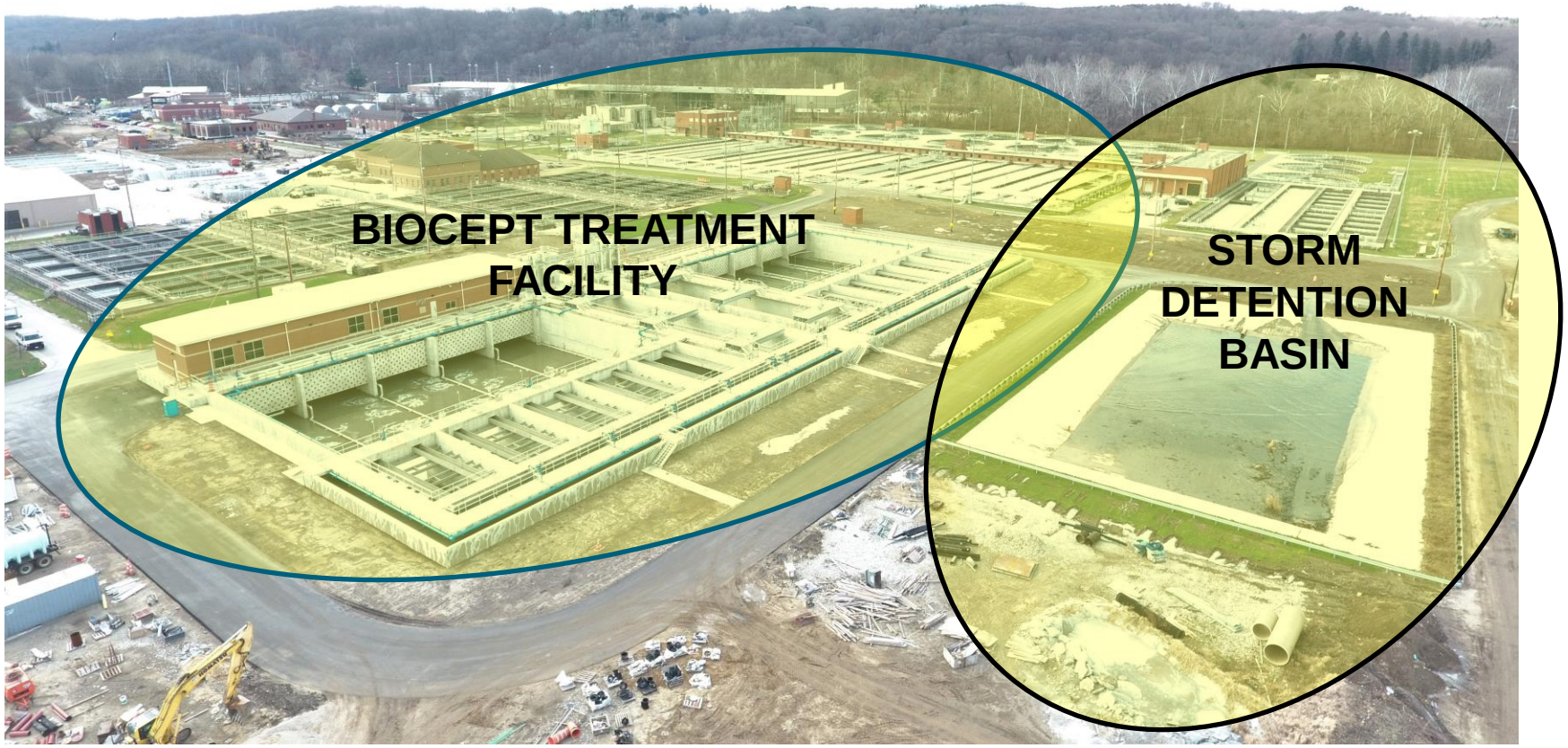

SRT MODIFICATIONS
• 4 MG NOMINAL STORAGE
• OLD IMHOFF TANKS
• OFF-LINE STORAGE FOR QUESTIONABLE WWTP SLUGS
PLANT NORTH
Influent Channe
Mag Meters and Splitter box
BIOCEPT INFLUENT CHANNEL / CONDUIT
ACTIVATED SLUDGE
INFLUENT CHANNEL
BIOCEPT SYSTEM & OPERATIONS BUILDING
• 10 MG NOMINAL STORAGE BETWEEN TWO TREATMENT TANKS/SYSTEMS
• 60 MGD HIGH RATE TREATMENT (30 MGD EACH SYSTEM)
TO BIOCEPT
METER VAU
• FOUR (4) MAG ME
TO DISINFECTION
TO DISINFECTION

South End: New Influent Channel, OLS Tanks, Influent Metering, & Flow Splitter Structure



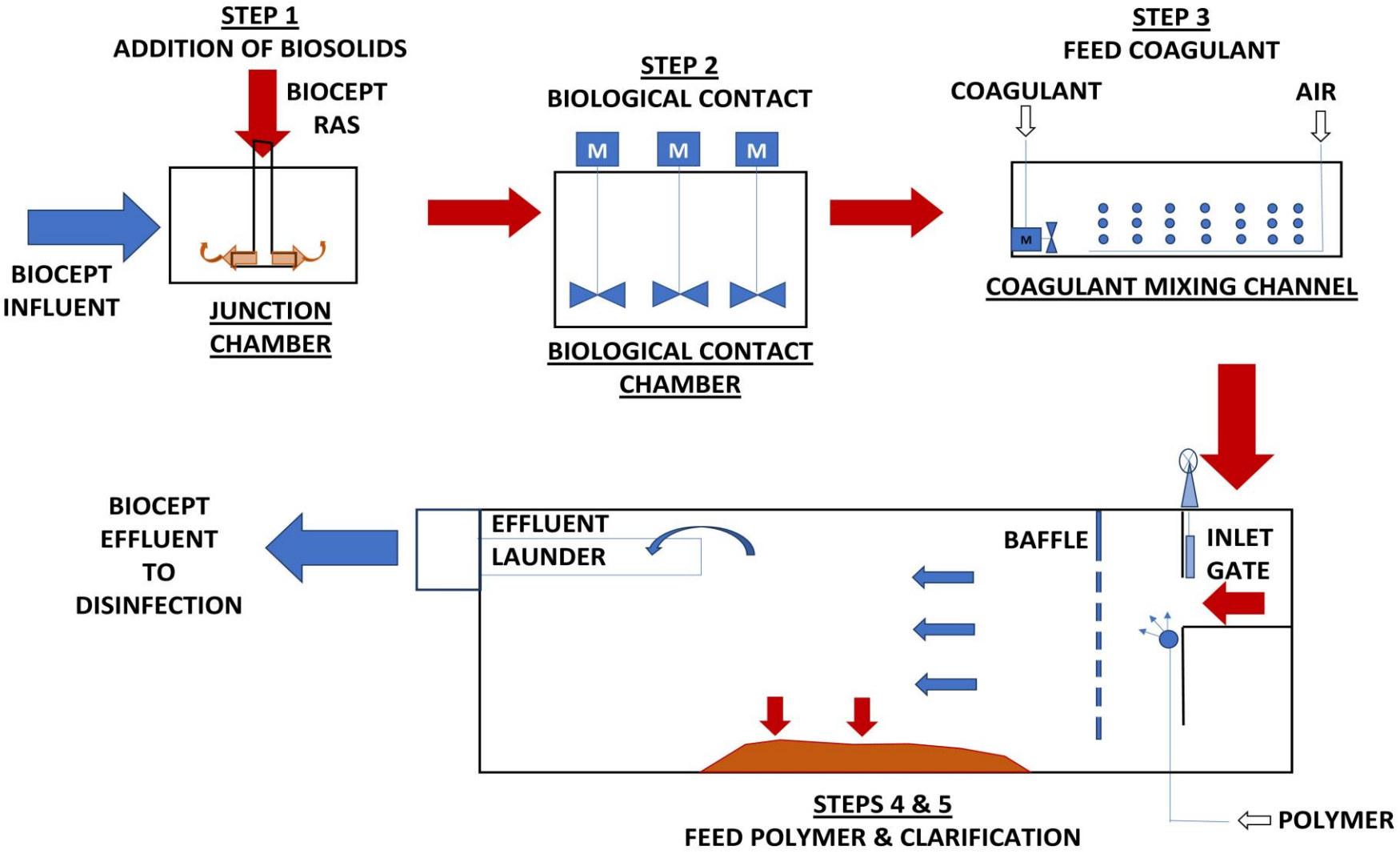
North End: BioCEPT Treatment Facility & Storm Detention Basin



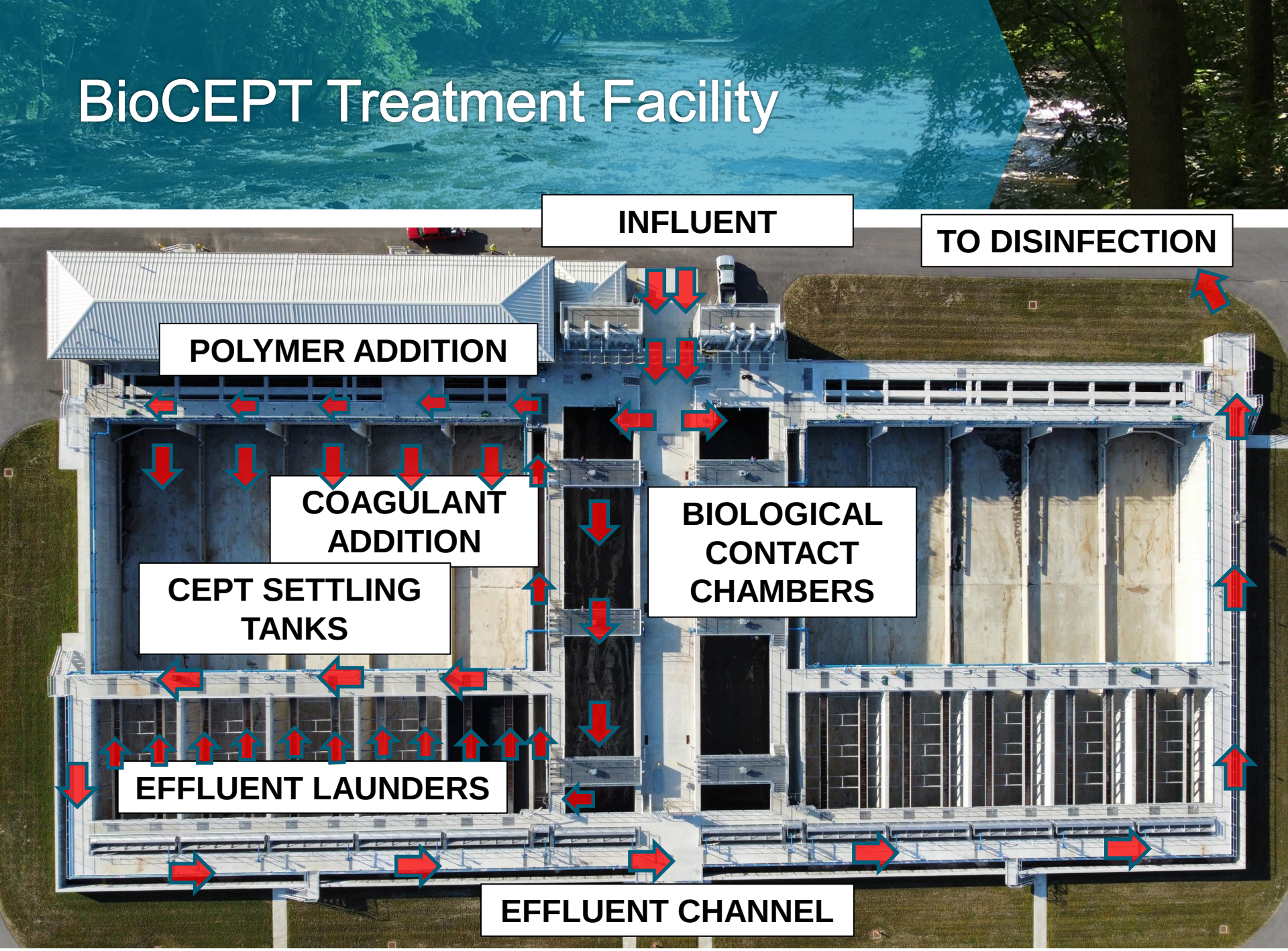
What is BioCEPT?

- BioCEPT is a high-rate, suspended growth contact wet-weather treatment process that combines:
  - Biological Contact Zone
  - Chemically Enhanced Primary Treatment (CEPT)
    - Primary settling with coagulant and polymer addition
    - Significantly increases effective surface overflow rate
- Goal is to provide treatment equivalent to Secondary Treatment.
  - BioCEPT Effluent Requirement per consent decree is 25 mg/L $CBOD_5$ and 30 mg/L TSS.
  - E.coli limit at plant outfall is 126 MPN/100 mL

BioCEPT – The Process



BioCEPT Treatment Facility



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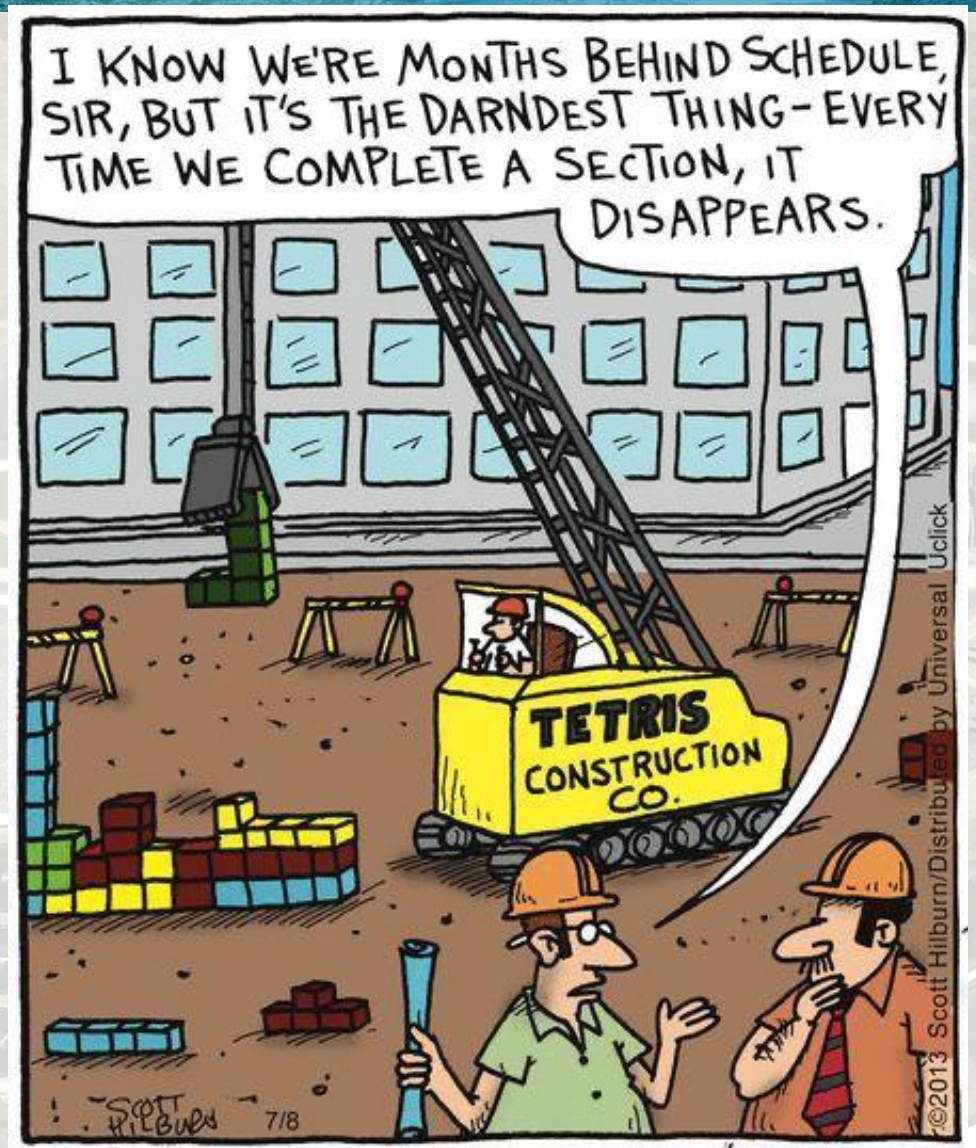
Design & Construction Challenges



Design and Construction Challenges

Design Challenges

1. Adding Biosolids ahead of CEPT
2. Building through the “HEART” of the Facility
3. Handling captured solids after an event

Construction Challenges

1. Expedited Schedule
2. Soil Conditions

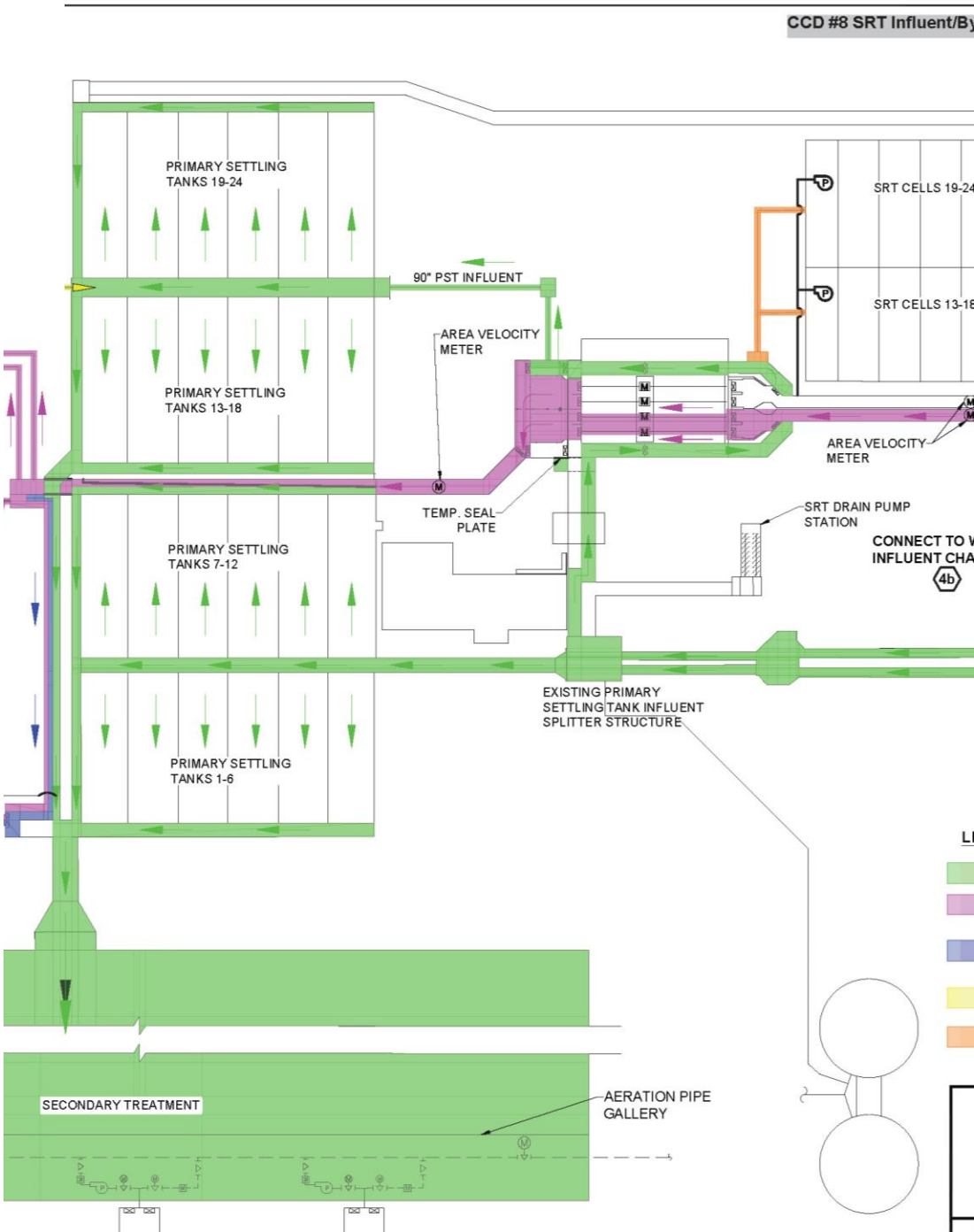
Design Challenges: Adding Biosolids ahead of CEPT

- Evaluation of MLSS concentration and detention time
- Limited Volume of RAS available for treatment of wet weather flow without impacting secondary treatment process
- Used BioWIN modeling and worked with process design engineers for Step Feed Phase 2 Project
  - BioCEPT = 500 mg/L MLSS, 40 min detention
  - ≤ 80,000 +/- lbs of AS can be pumped to BioCEPT before negatively impacting secondary

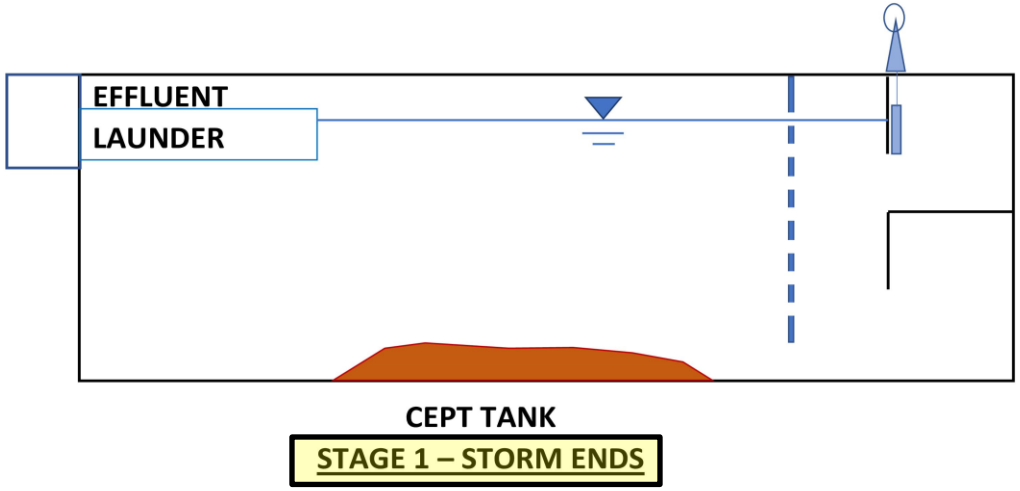
Design Challenges: Building through the "HEART" of the Facility

AN ORGANIZED & STAGED PLAN OF ATTACK

- 27 page of Sequence of Construction showing the 5 stages of flow through the construction project.
- Use of bulkheads and channel re-routes to achieve continuous flow through the plant during the different stages of construction.
- Coordination with Contractor

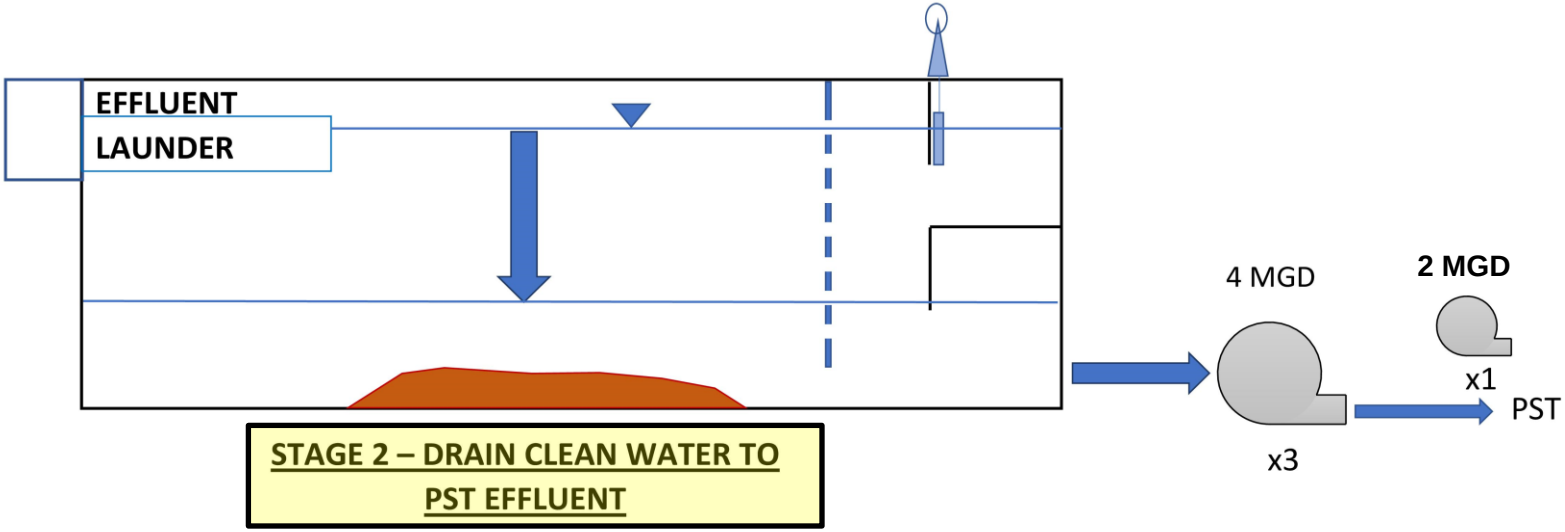


Design Challenges: Dealing with Accumulated Solids within the CEPT Tanks



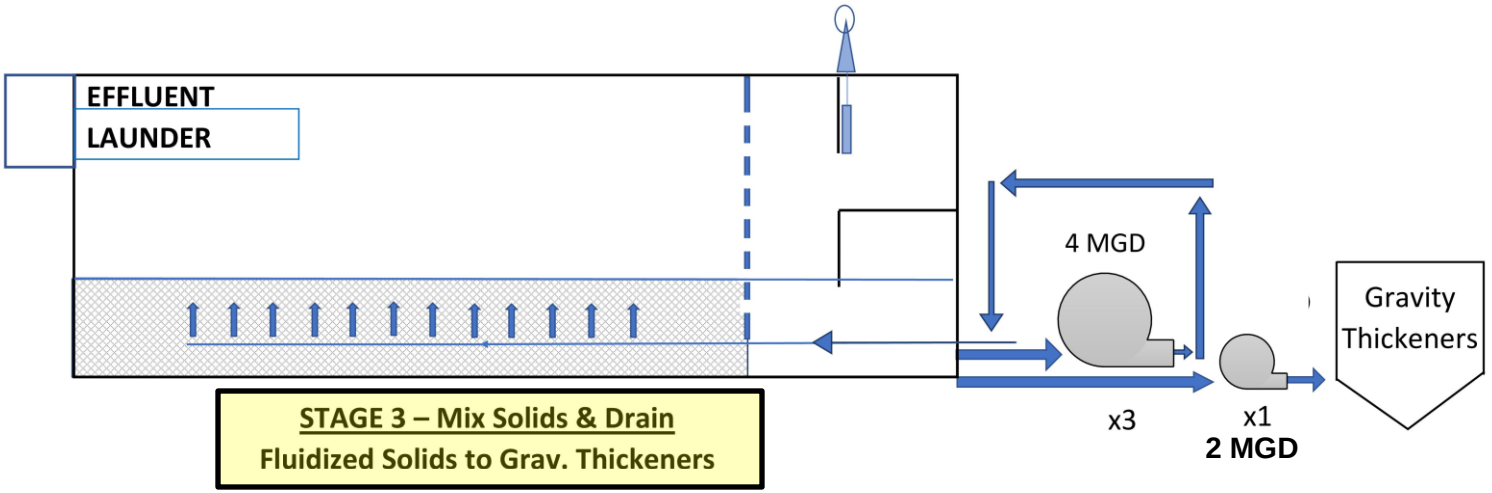
CEPT TANK

STAGE 1 – STORM ENDS

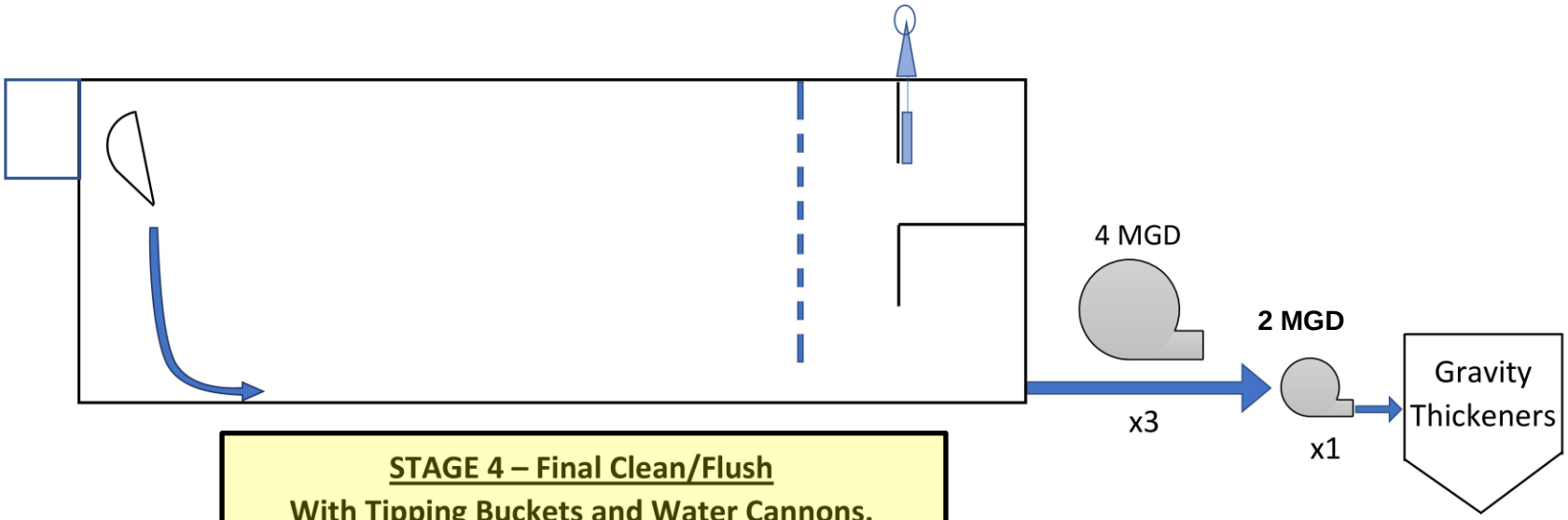


STAGE 2 – DRAIN CLEAN WATER TO PST EFFLUENT

Design Challenges: Dealing with Accumulated Solids within the CEPT Tanks



STAGE 3 – Mix Solids & Drain
Fluidized Solids to Grav. Thickeners



STAGE 4 – Final Clean/Flush
With Tipping Buckets and Water Cannons.

Tipping Buckets

AkronWaterways Renewed!

Tipping Buckets

AkronWaterways Renewed!

Tipping Buckets

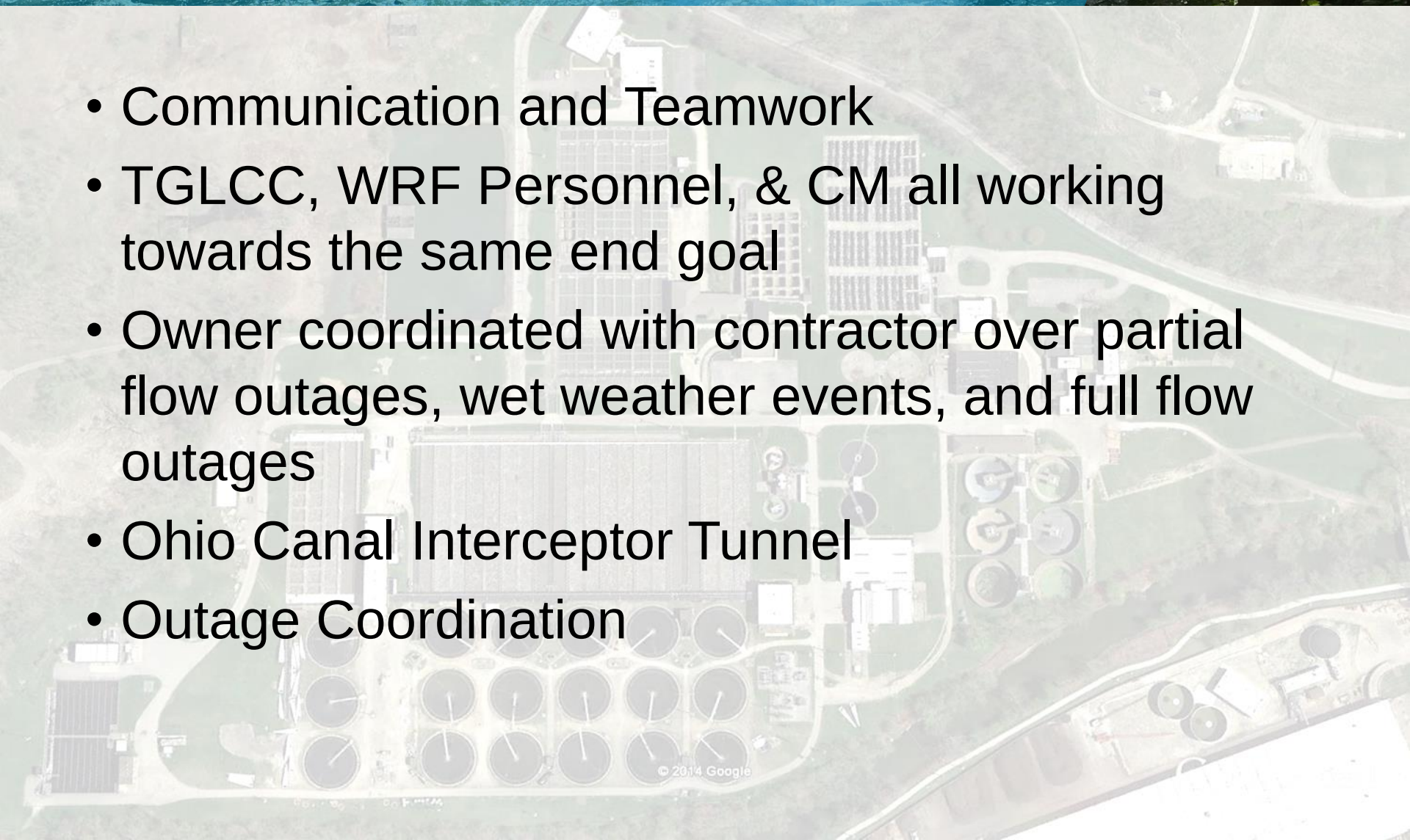
AkronWaterways Renewed!

Construction Challenges: Expedited Schedule

- Bid March 2019
  - Engineer's Estimate: $68.5 million
  - Bid: $60.8 million
  - Final Project Cost: $68.3 million (Soil Conditions)
- Contractor: The Great Lakes Construction Co.
- Construction Management Team:
  - Accenture (formerly Anser Advisory) – Lead Overall Construction Manager for Headworks & BioCEPT
  - G. Stephens Inc. – Construction Manager for BioCEPT
  - B&N – Design Engineer for BioCEPT
- Start Date: May 31, 2019
- Original Final Completion: Sept 29, 2021 (28 months)
- Fully Operational: December 27, 2021 (31 months)

Teamwork Makes the Dreamwork

- Communication and Teamwork
- TGLCC, WRF Personnel, & CM all working towards the same end goal
- Owner coordinated with contractor over partial flow outages, wet weather events, and full flow outages
- Ohio Canal Interceptor Tunnel
- Outage Coordination



Construction Challenges: Soil Conditions (increased Soil Anchors)

- Original Count: 540
- Original Design Load: 142 KIPS
- Final Count: 1,255 (added 715)
- Final Design Load: 80 KIPS
- Schedule Impact: 132 days
- Total Cost Impact: $2.9M

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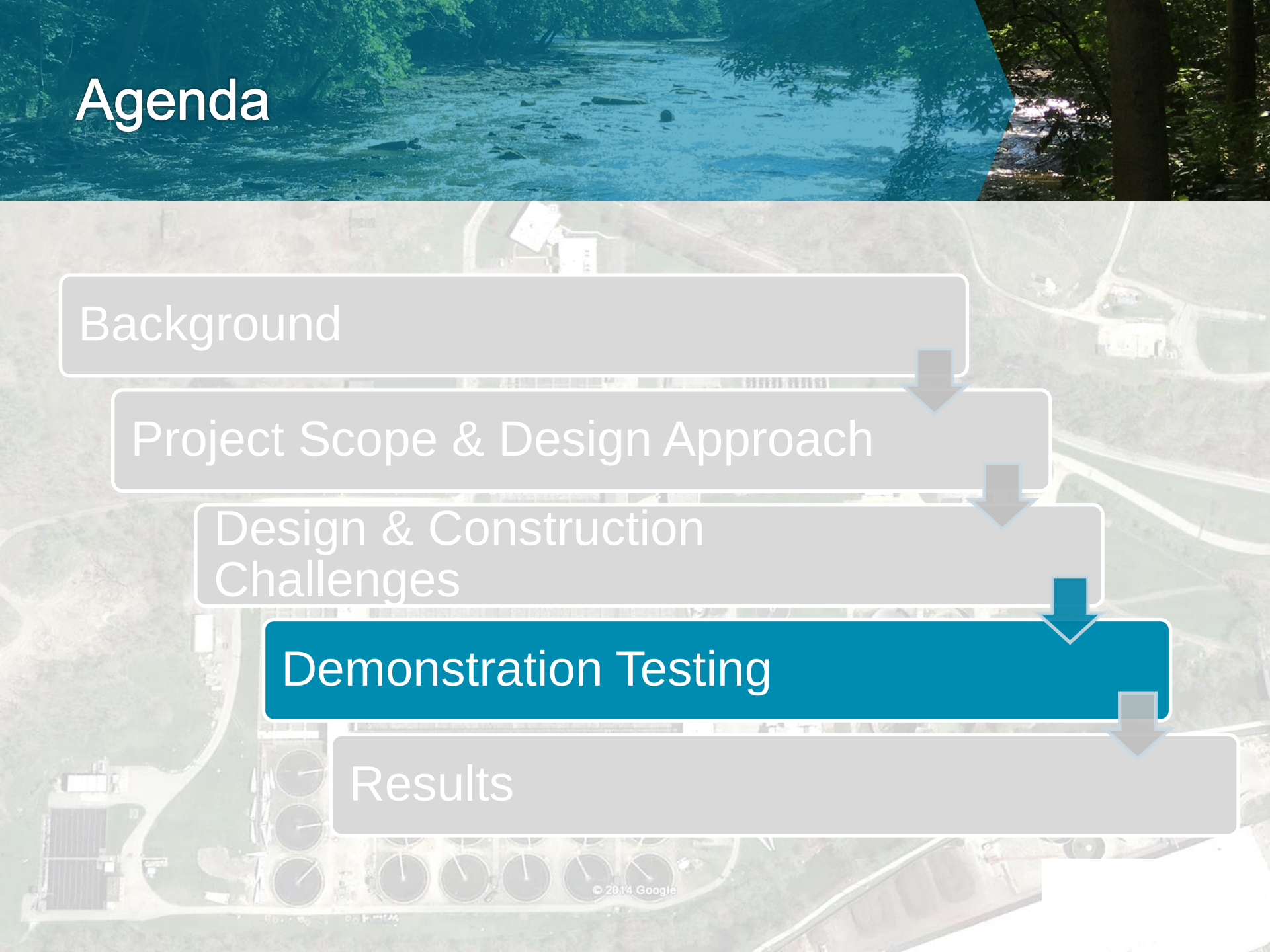


Demonstration Study

- Twenty (20) total wet weather events triggered when plant flow >110 MGD
- Treatment Effectiveness Study
- Comparative Study
- Interim Reports 48-hours following receipt of data.
- Final Report due 60 days following last event.

Demonstration Study parameters

Field Parameters

- Air Temperature
- Dissolved Oxygen (DO)
- Flow Rate
- pH
- Turbidity
- Water Temperature
- Total Chlorine Residual (as applicable)

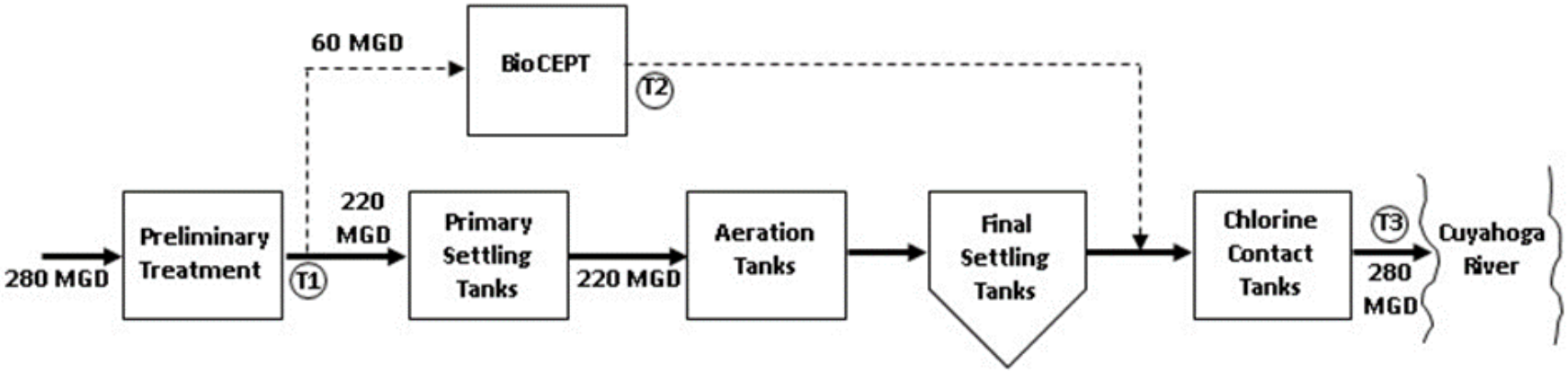
Treatment Effectiveness Study

- Total Suspended Solids (TSS)
- Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)
- E. coli

Comparative Study

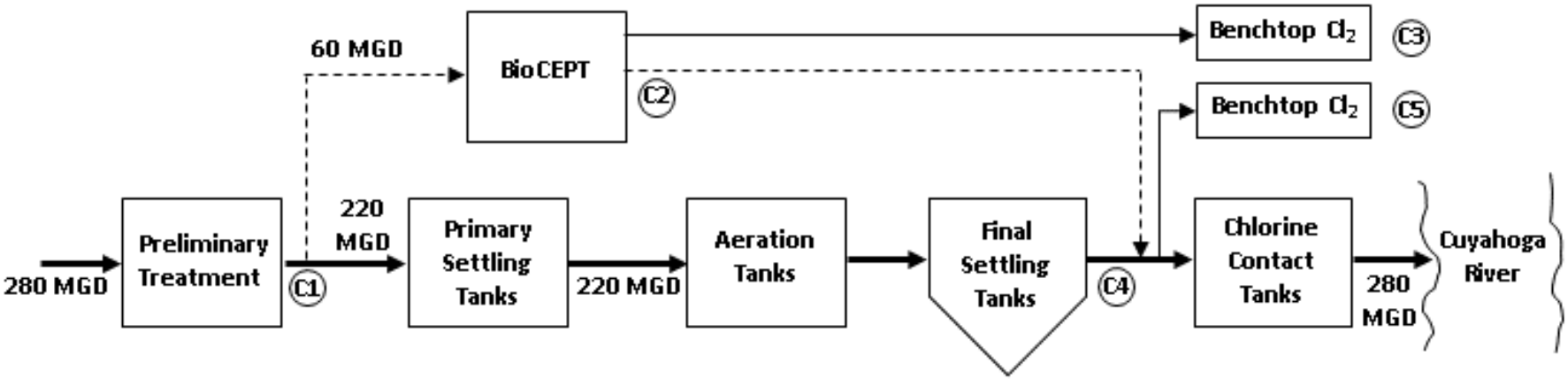
- Alkalinity
- $CBOD_5$
- Chemical Oxygen Demand
- E. coli
- Phosphorus
- Soluble BOD (sBOD)
- Total Suspended Solids (TSS)
- *Campylobacter*
- *Cryptosporidium* and *Giardia*
- *Salmonella*
- Fecal Coliform
- Enterococcus
- Coliphage

TREATMENT EFFECTIVENESS STUDY SAMPLING PLAN



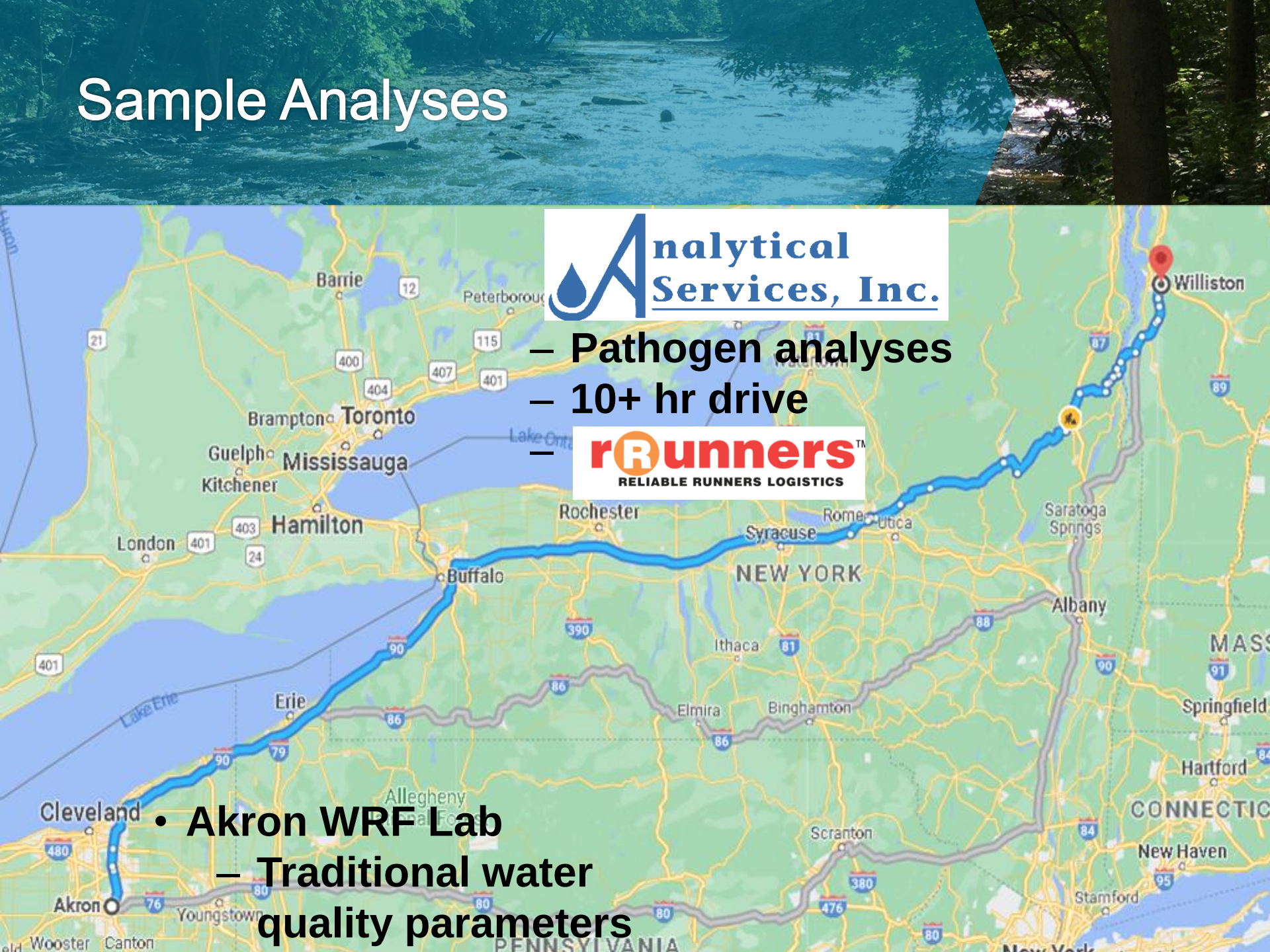
Sampling Location	Label Code
BioCEPT Influent / Main Plant Primary Influent	T1
BioCEPT Effluent	T2
Combined, Disinfected BioCEPT Effluent and Main Plant Secondary Effluent at Outfall 001 (Only during disinfection season)	T3

COMPARISON STUDY SAMPLING PLAN



Sampling Location	Label Code
BioCEPT Influent / Main Plant Primary Influent	C1
BioCEPT Effluent	C2
BioCEPT Effluent for bench top sodium hypochlorite disinfection	C3
Main Plant Secondary Effluent (602 location)	C4
Main Plant Secondary Effluent for bench top sodium hypochlorite disinfection	C5

Sample Analyses



Issues / Challenges

- Process a lot of samples in a short time.
- One full three round event produced 145 analytical results, in addition to 56 field data points.

Issues / Challenges

- 24/7/365.
- Storms seem to happen early evening that results in test events late evening, early morning.
- Pathogen lab not normally staffed after hours for sample delivery.

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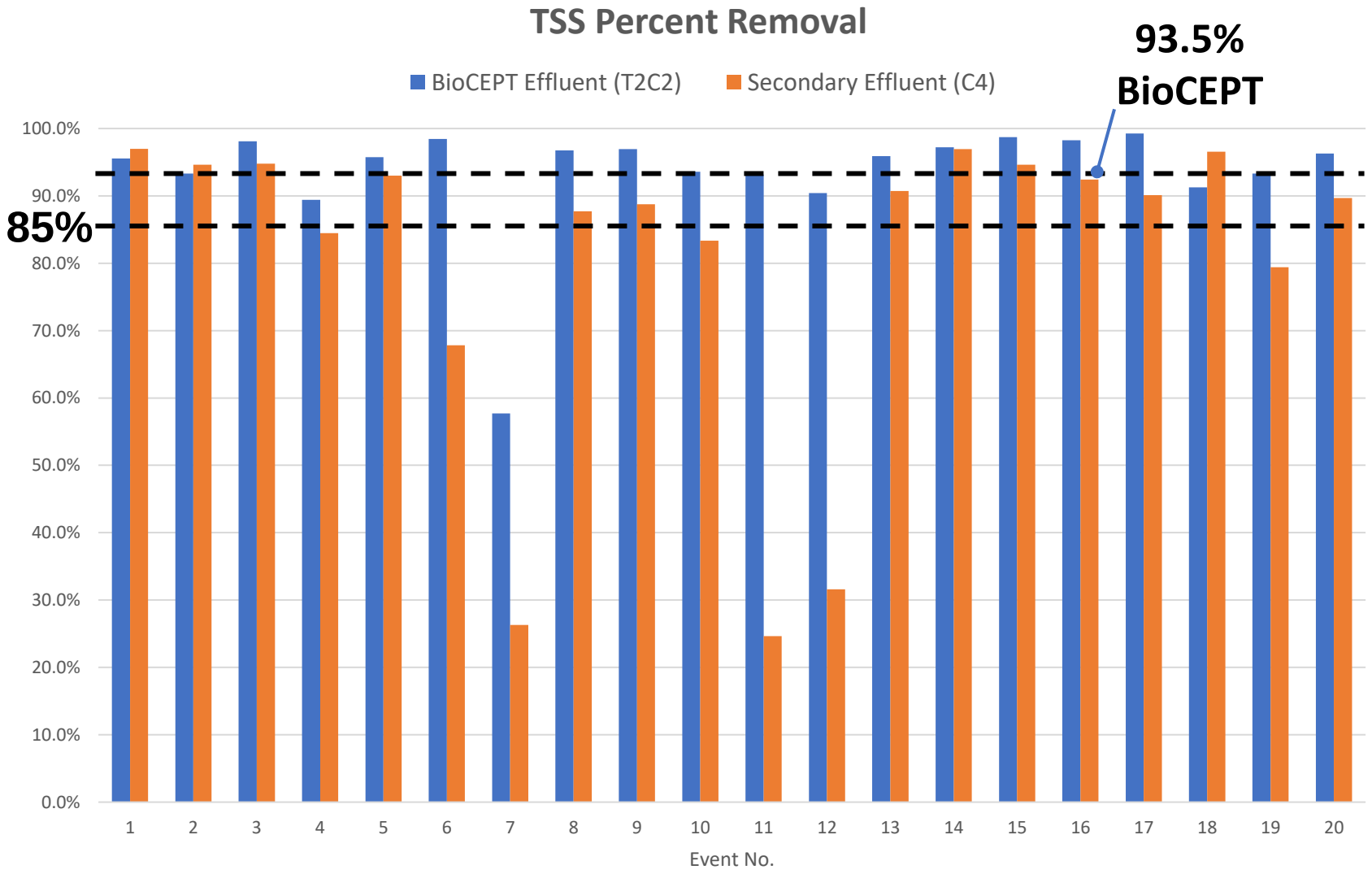
- **Results**

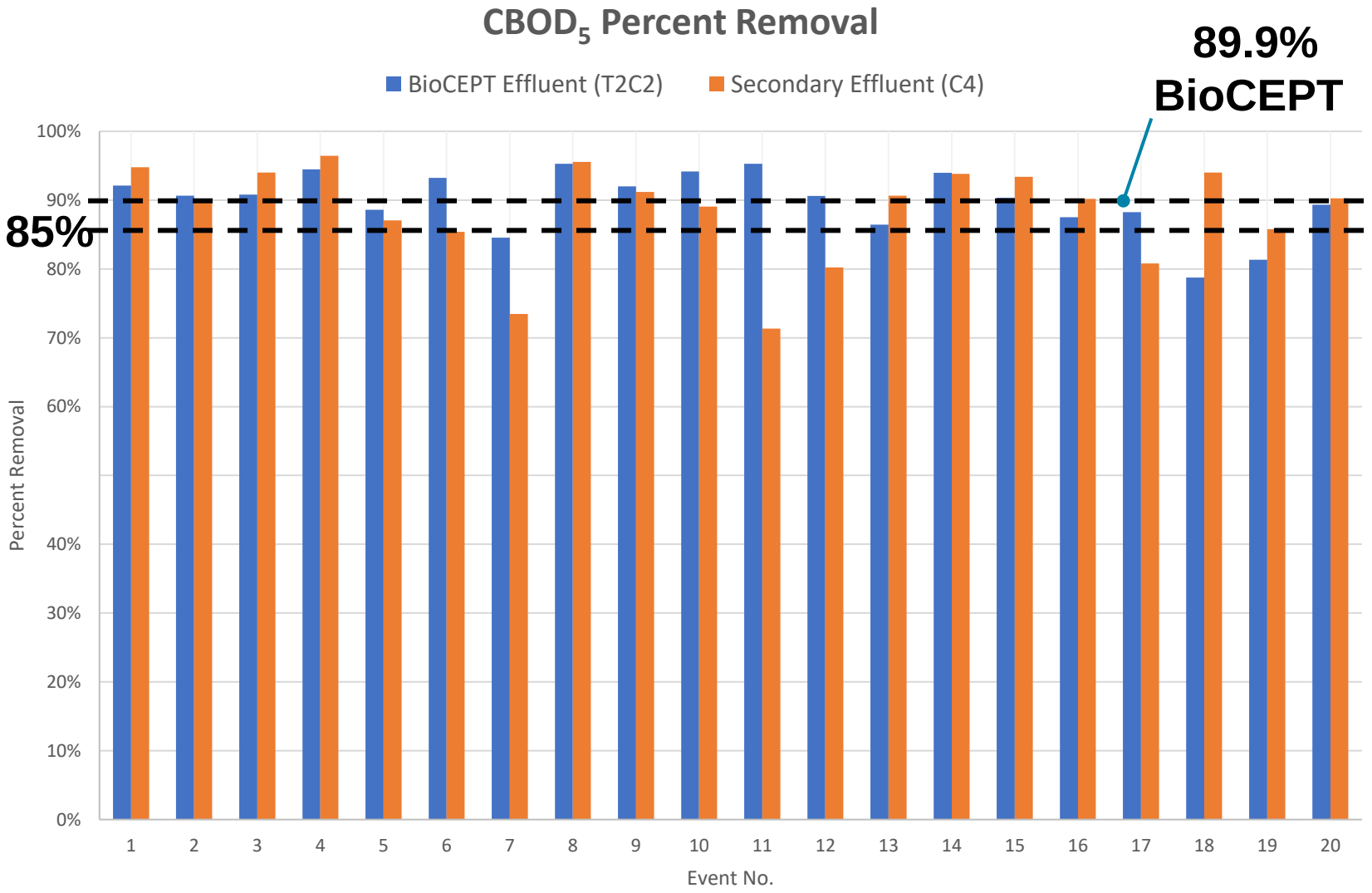
Results

Parameter	Row 18 Performance Criteria 30-day Average	BioCEPT Effluent Average thru Event #20
$CBOD_5$, mg/L	25	6.3
TSS, mg/L	30	6.5
E.coli, MPN/100mL	126	9.7 Geo Mean

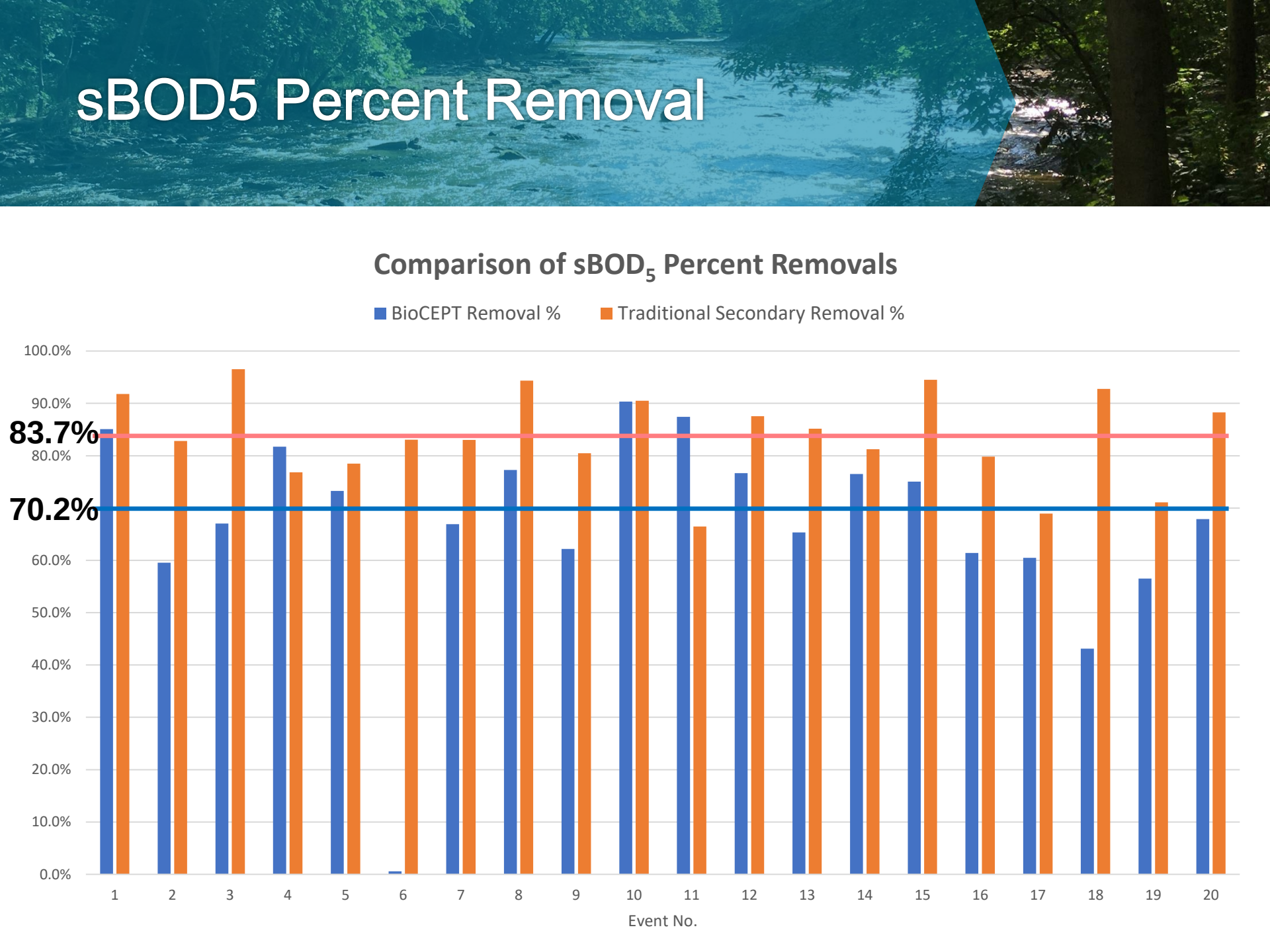
TSS Percent Removal



$CBOD_5$ Percent Removal

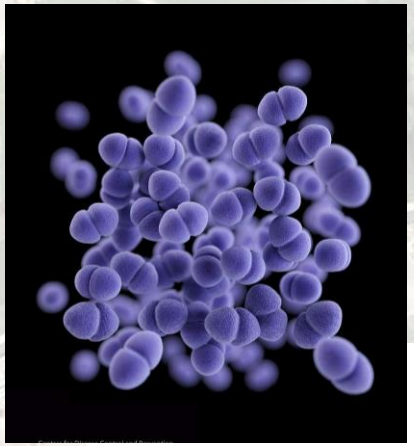


sBOD5 Percent Removal



Pathogen results

- Both disinfected BioCEPT and Secondary Effluent (SE) statistically reduced the pathogens analyzed, some as much as a 5-log reduction.
- BioCEPT “outperformed” the SE on coliphage, enterococci, *Cryptosporidium*, and *Giardia*.
- BioCEPT and SE performed similarly on *Campylobacter*, *Salmonella*, fecal coliform, and *E. coli*.
- Overall, the BioCEPT treatment system performed comparably to the parallel Activated Sludge Secondary Treatment process.



Enterococci

Miscellaneous Photos: Influent Channel, Offline Storage & Transition Structure

Miscellaneous Photos: Primary Settling and BioCEPT Influent Splitter Structure

Miscellaneous Photos: BioCEPT Inlet Gates & Mixer

Miscellaneous Photos: Polymer Feed Systems

Miscellaneous Photos: Coagulant (PAC) Storage Tanks

Miscellaneous Photos: CEPT Tanks Perforated Baffle Wall

Closing thoughts…

- Overall, BioCEPT performed comparable to the WRF's activated sludge secondary treatment process.
- Soluble BOD reduction is indicative of the biological treatment occurring within the treatment process.
- BioCEPT under the correct conditions is a HRT system capable of providing the equivalent of secondary treatment for intermittent peak flows.
- The largest benefit of BioCEPT is that it can be started/stopped quickly for wet weather events without concern of how to keep needed biomass alive until the next event.

THANK YOU!
ANY QUESTIONS?

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