



WWETCO

Simplified Wet Weather and Tertiary Treatment.

Simple - Effective



Satellite Treatment for CSO Control – from Concept to Construction

By Mark Boner



WESTECH

Agenda

- WERF and EPA ORD CSO Demonstration Testing in the 1990s in Columbus, GA
- Charleroi, PA CSO Program Development
- How Compressed Media Filter (CMF) Process Works
- Springfield, OH CSO Program Performance
- Satellite Design Considerations, Footprint & Costs

WWETCO FlexFilter CMF Technology



Columbus & Atlanta, GA

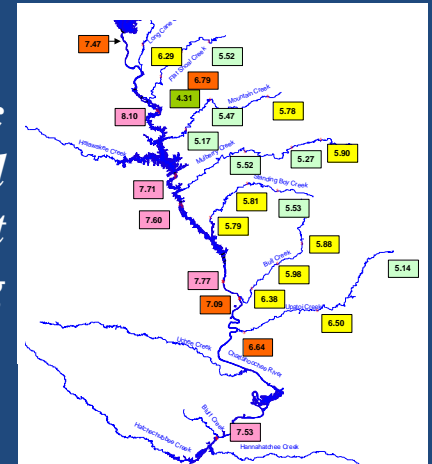
Regional Watershed Studies Examined Chemical and Biological Characteristics



**Middle
Chattahoochee
River
Watershed**



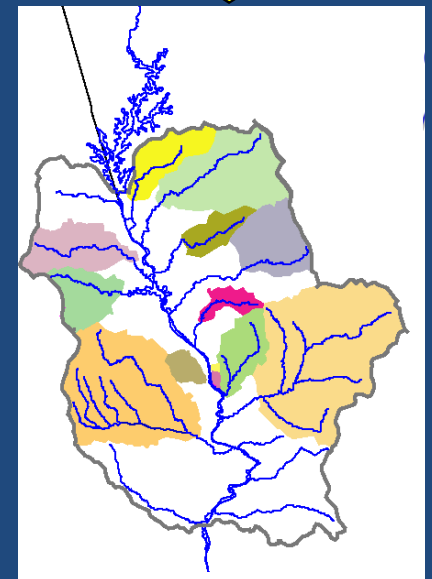
*Aquatic
Biology and
Habitat
Monitoring*



*Established
Linkages*

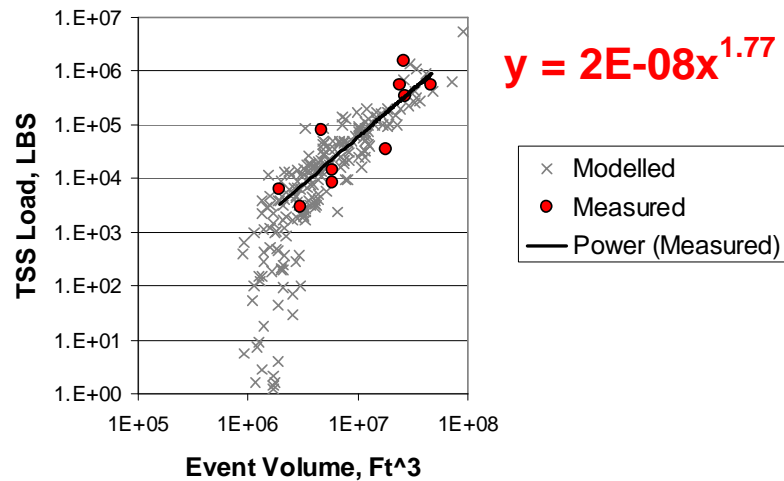


*Chemistry
Monitoring
and
Calibrated
BASINS
Modeling*

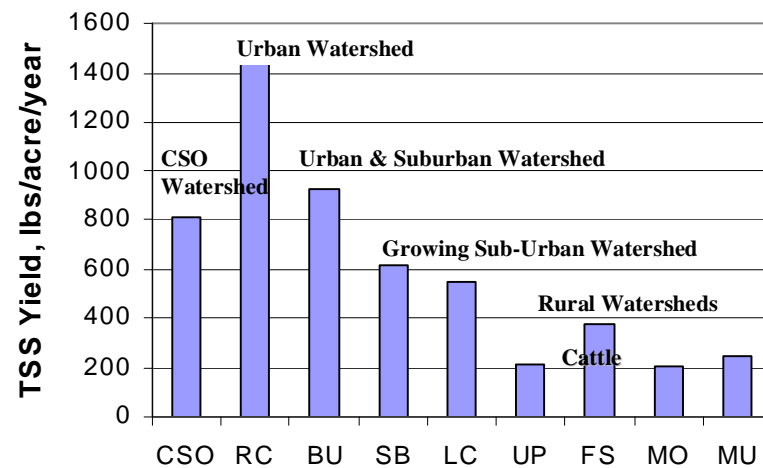


Watershed Characterization Findings

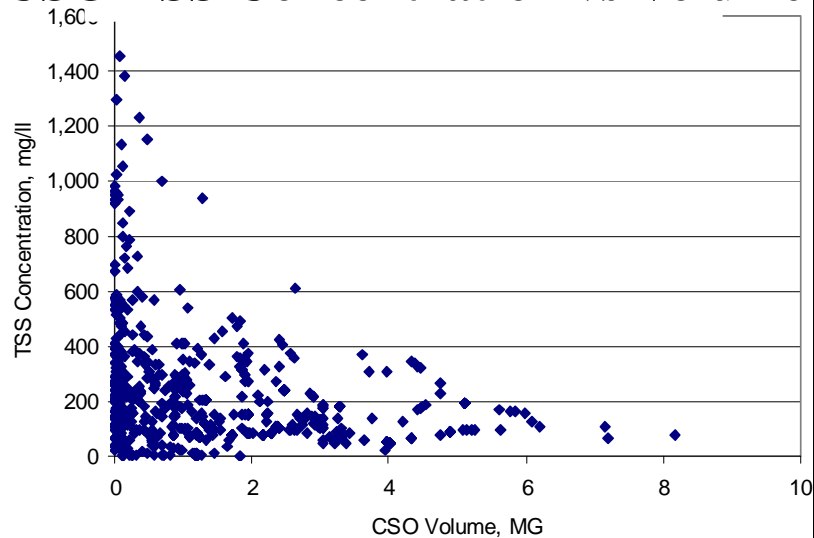
Calibrated BASINS Model



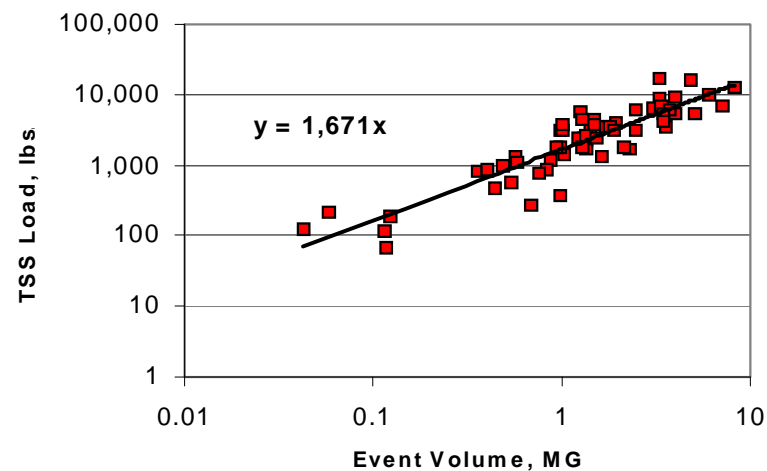
Pollutant Yields



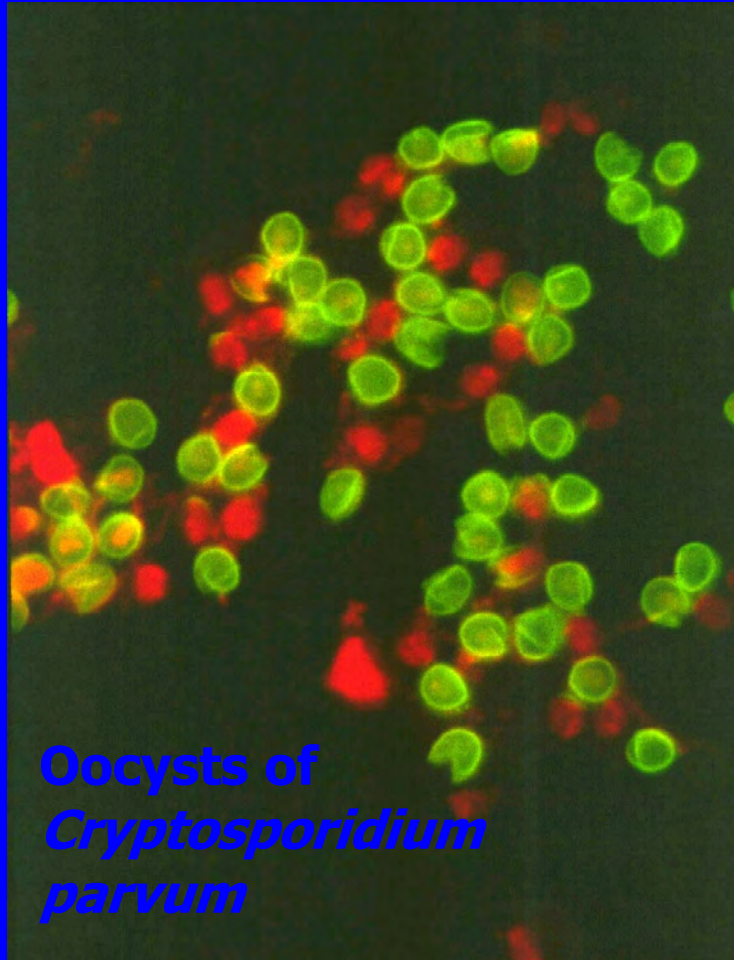
CSO TSS Concentration vs Volume



CSO TSS Load vs Volume

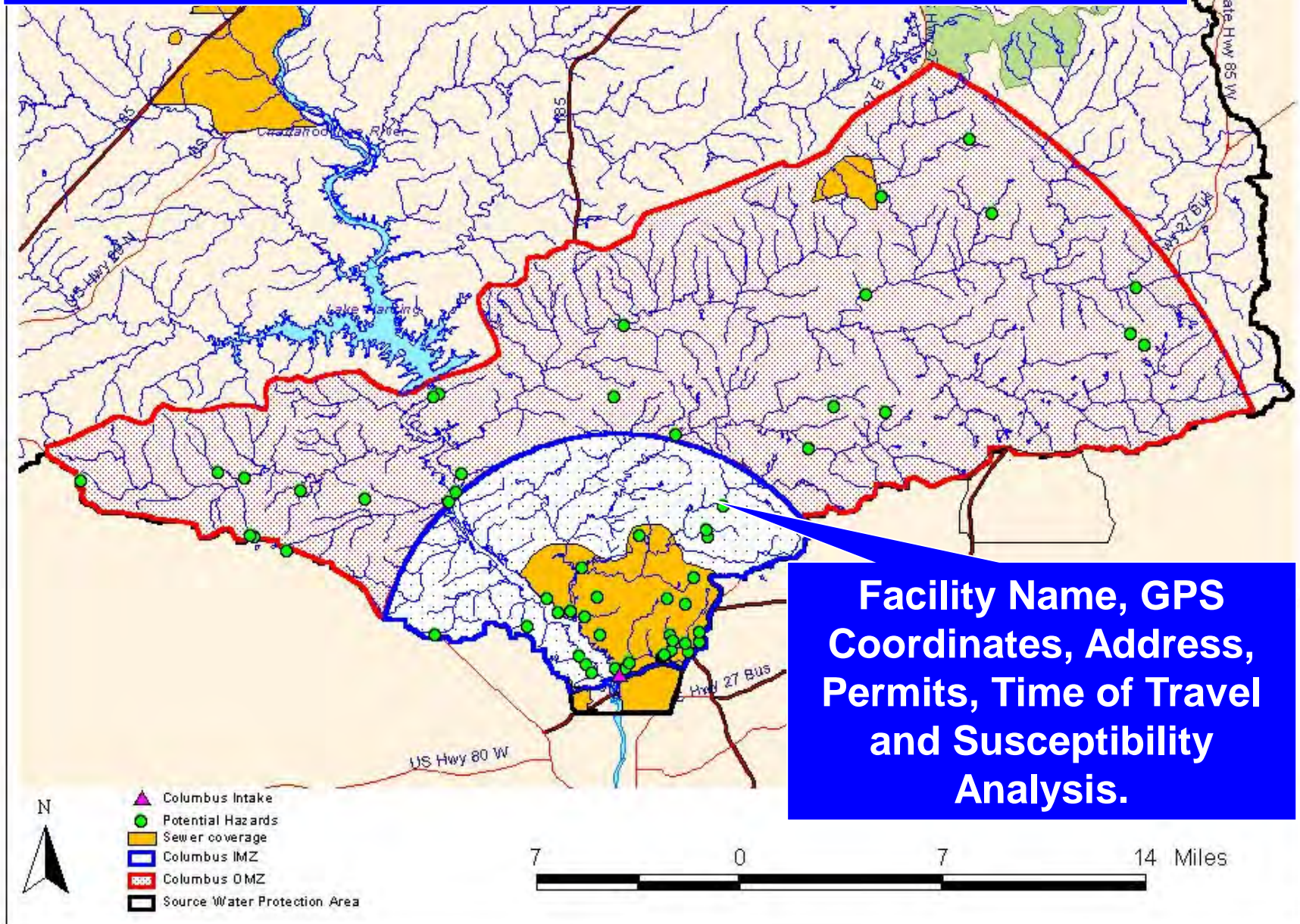


Cryptosporidium & Giardia Sampling



- 47 wet weather samples
- Analysis using ICR and EPA 1623
- Giardia detected in ~60 % of samples and correlate to indicator organisms
- Cryptosporidium detected in ~ 10 % of samples (most in urban watershed below drinking water intakes)

GIS Source Inventory Database



Uptown Park in Columbus GA

Satellite CSO Treatment - Operating since 1995

- WERF Peer Review
- EPA ORD QA
- EPA CSO Award

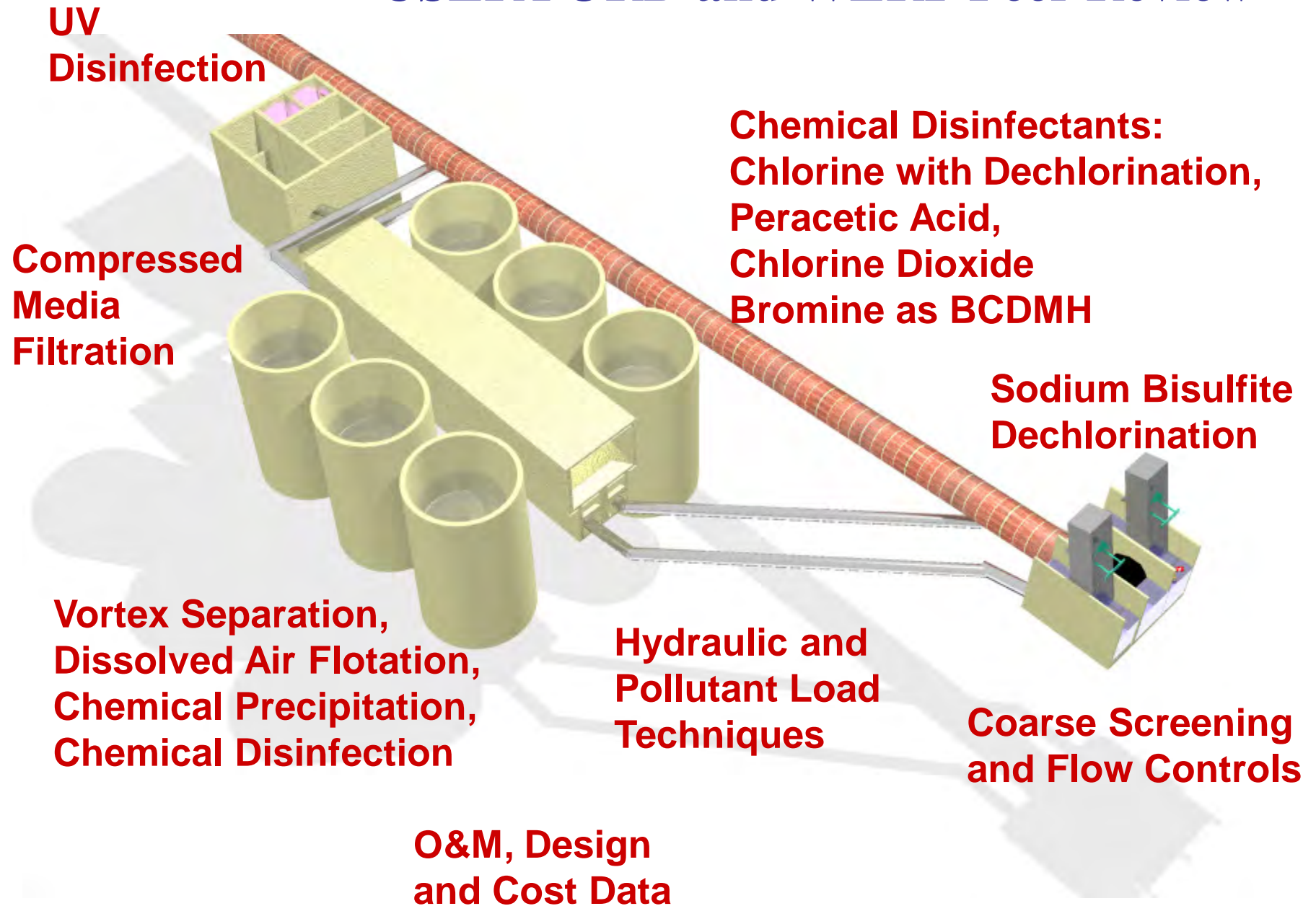


November 4, 2016

NJDEP | CSO / CMF

1st ever use of CMF for CSO treatment

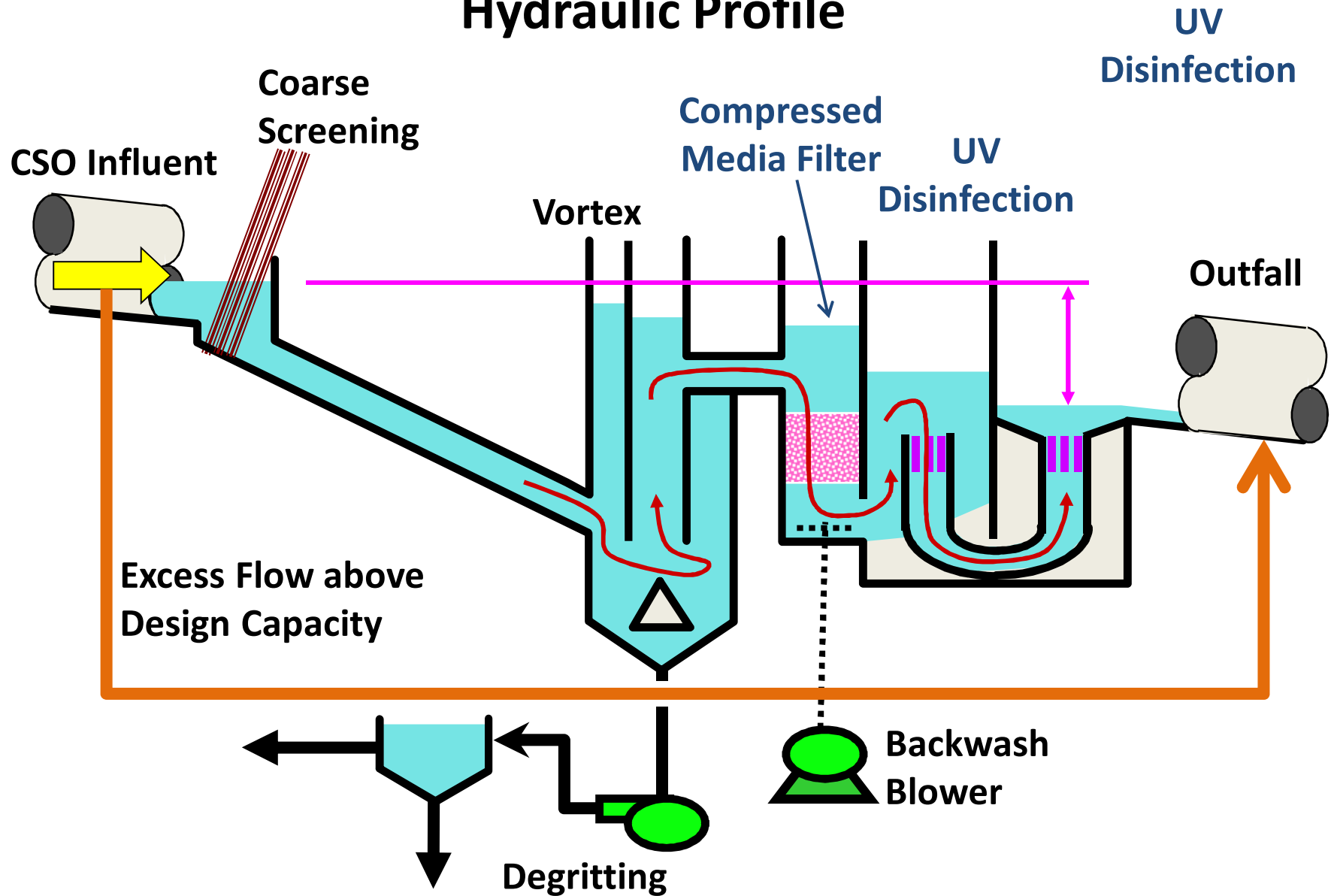
Technology Demonstration Testing under USEPA ORD and WERF Peer Review



Columbus, GA

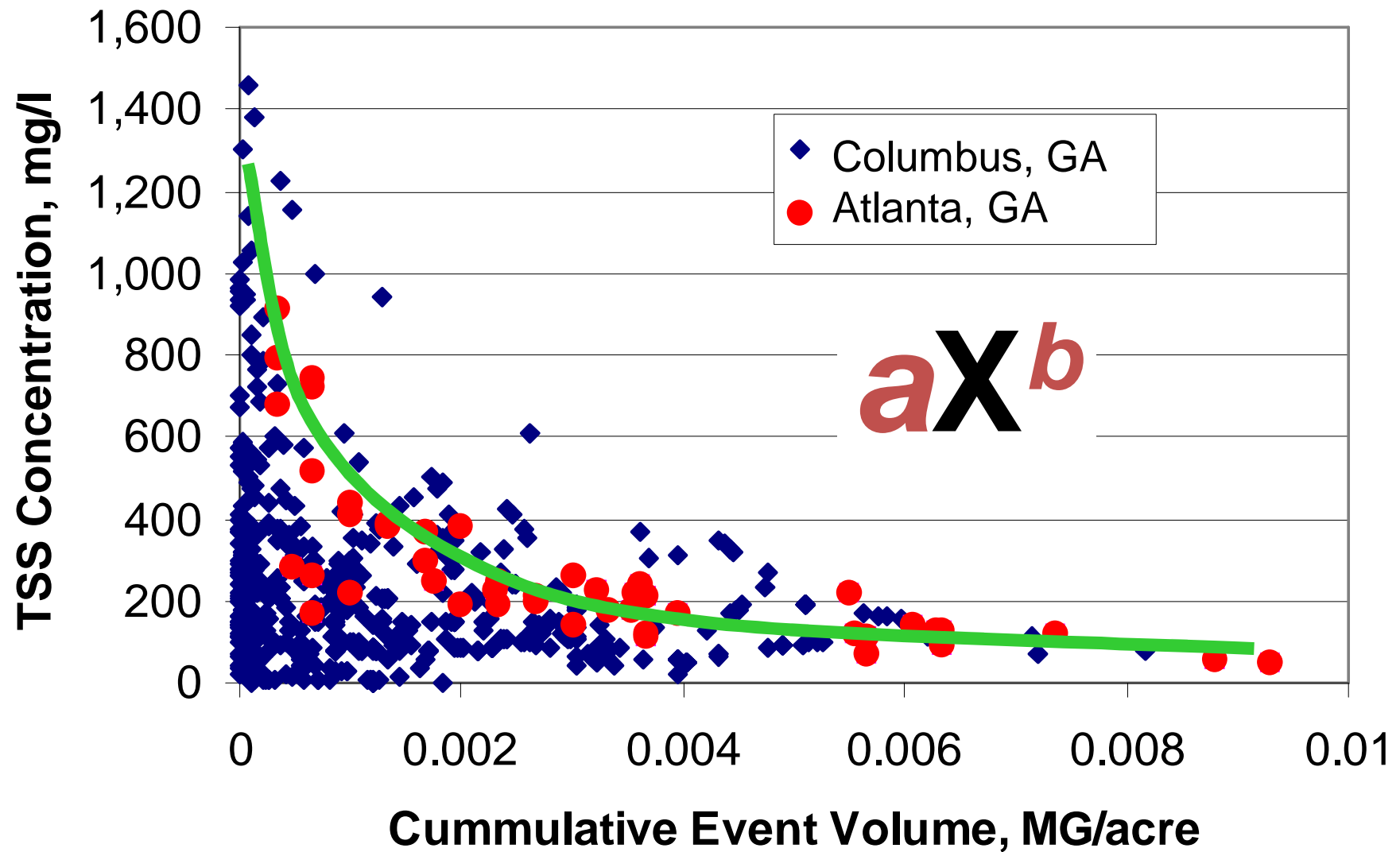
Satellite CSO Treatment Facilities

Hydraulic Profile



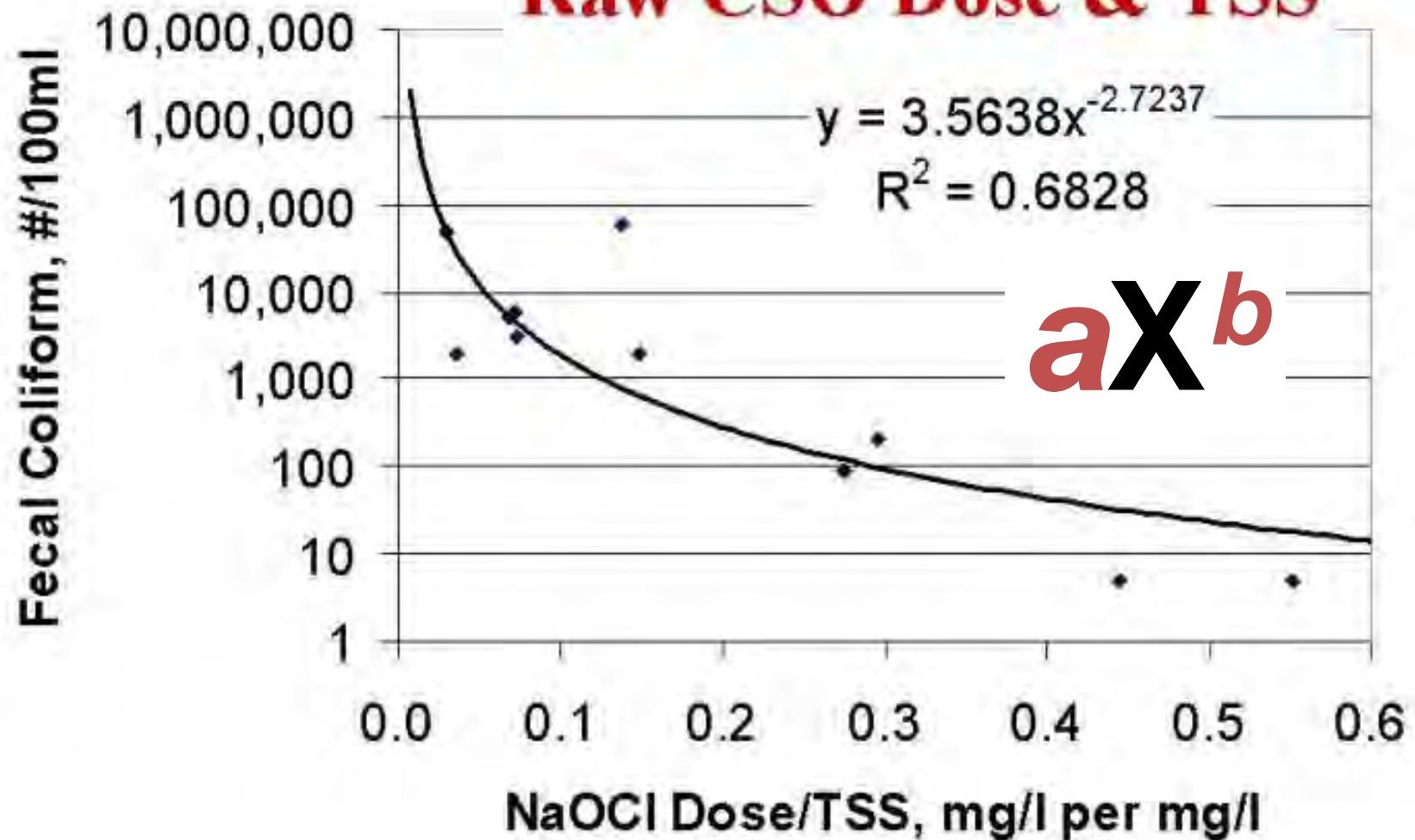
CSO Volume vs TSS Concentration, mg/l

Raw CSO Concentrations

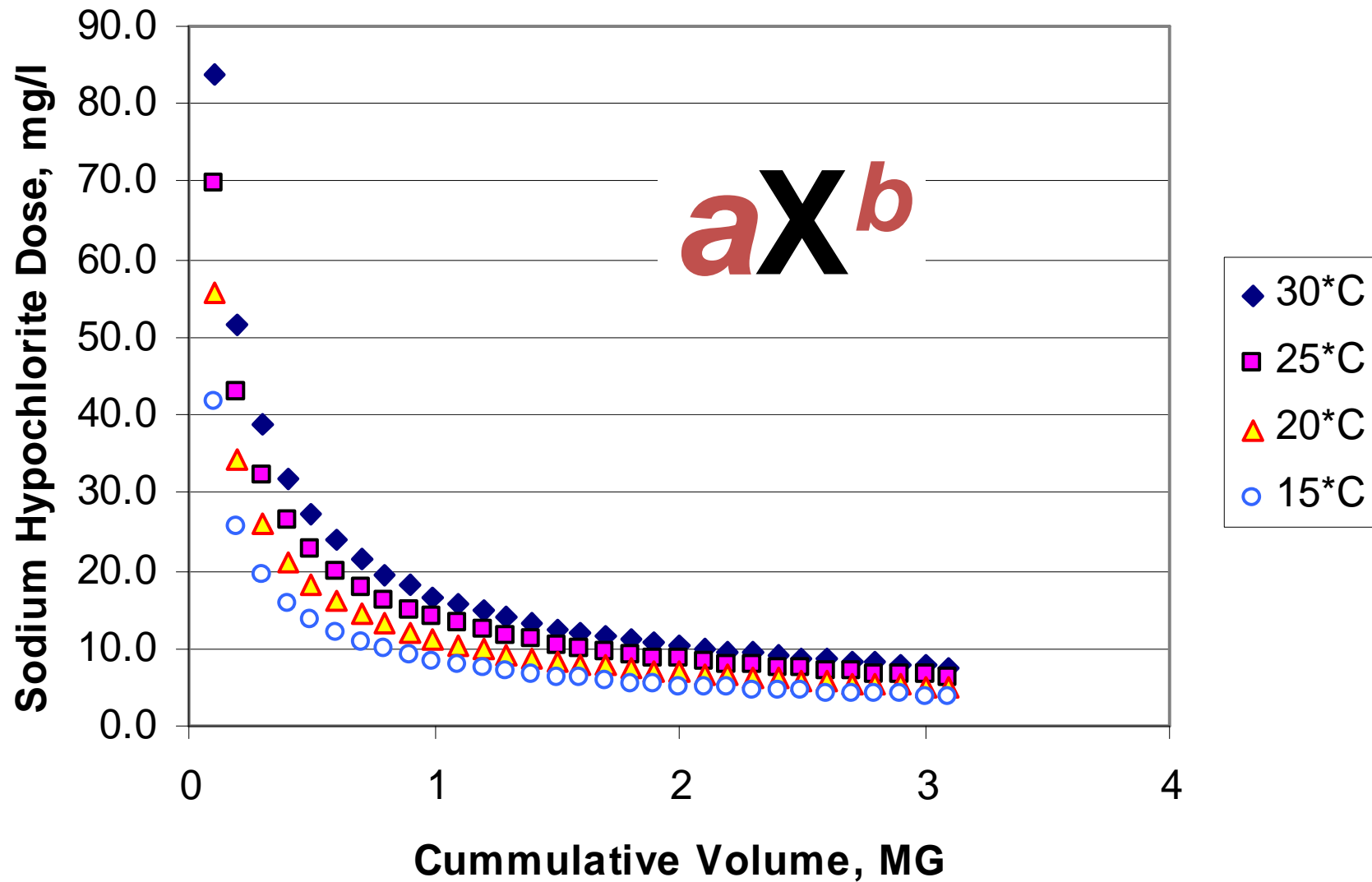


Dose-Response Normalized by TSS Raw CSO Samples

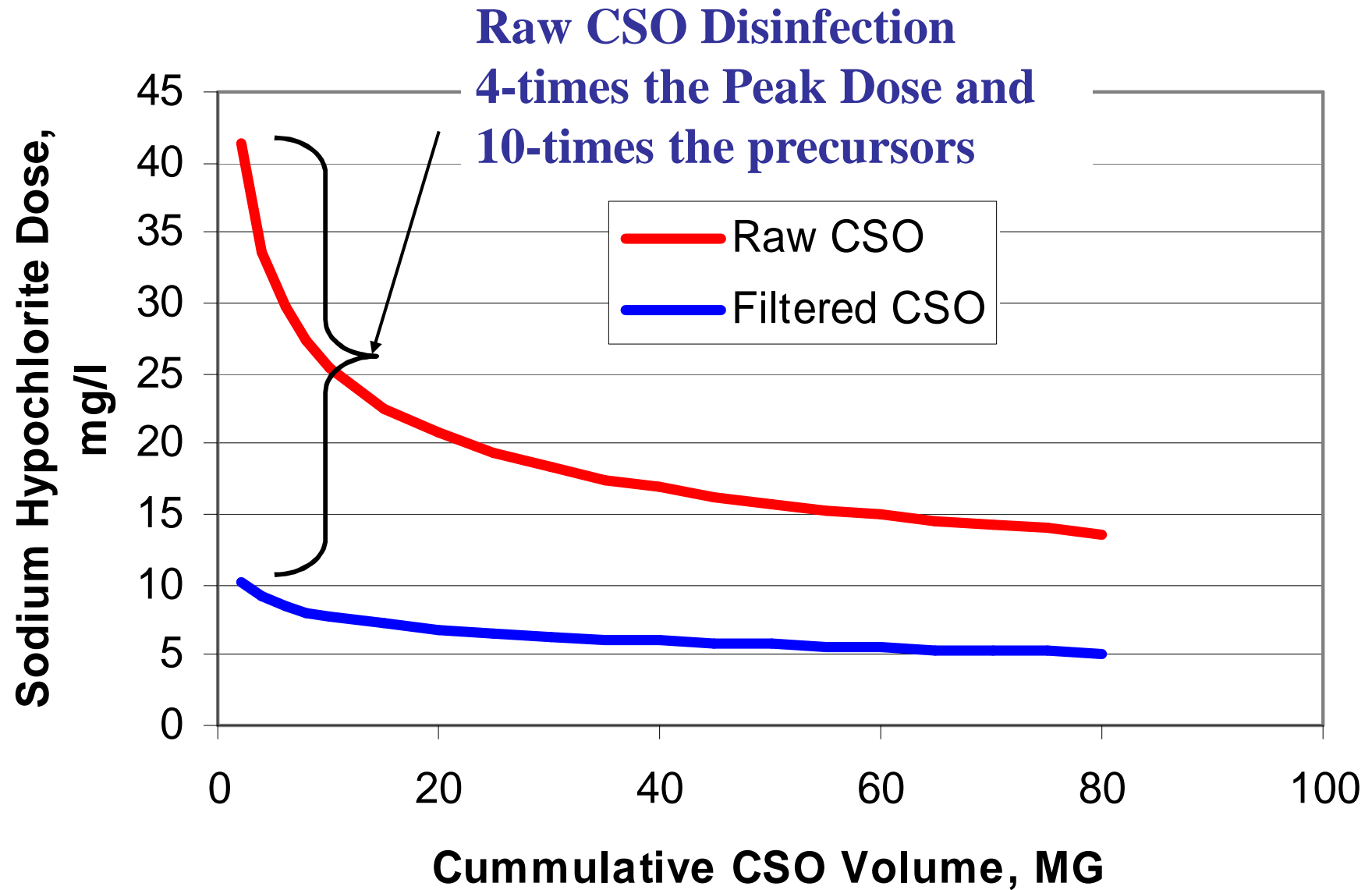
Raw CSO Dose & TSS



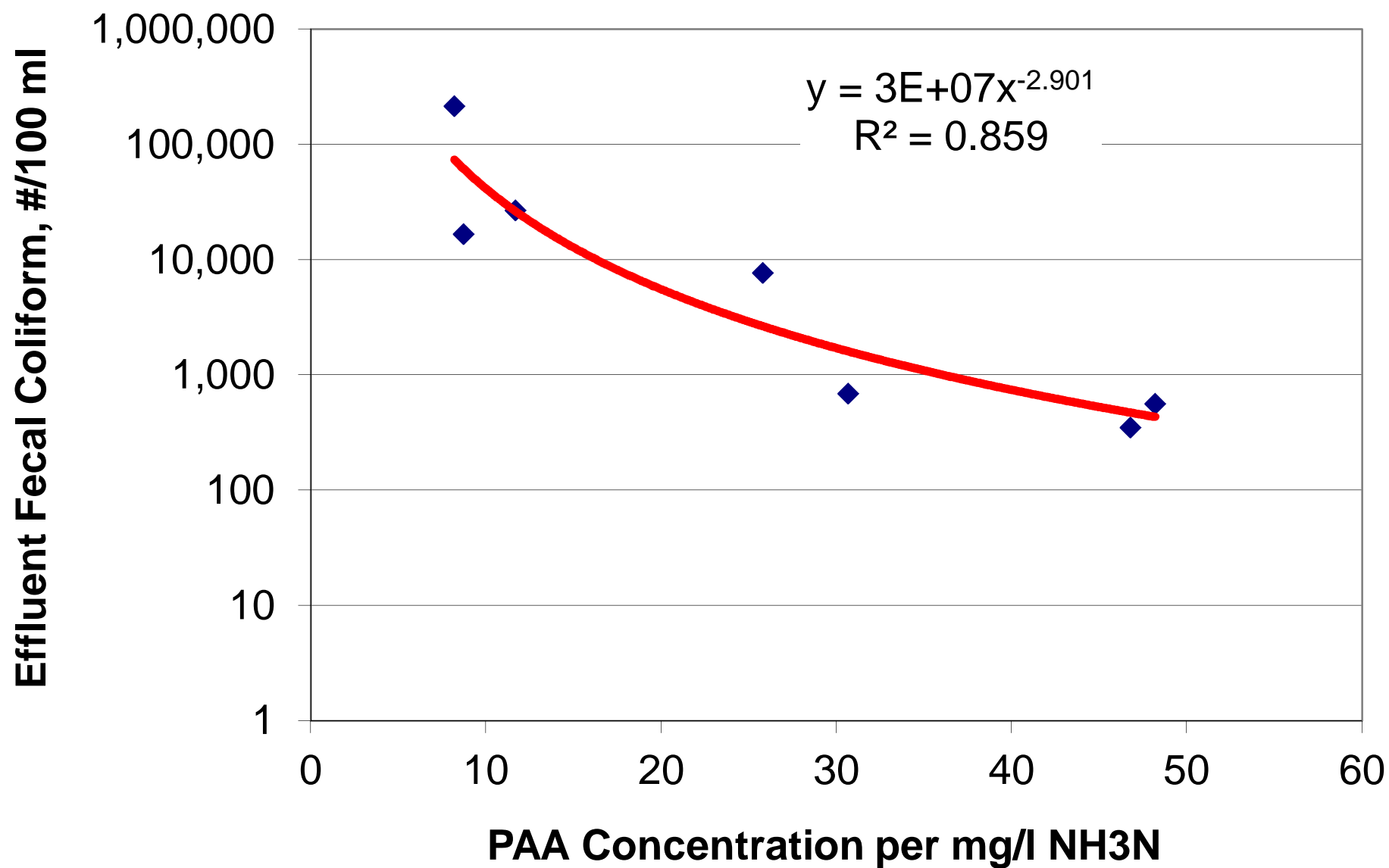
Dosing Feed Curves Based on Wastewater Temperature and Cumulative CSO Volume



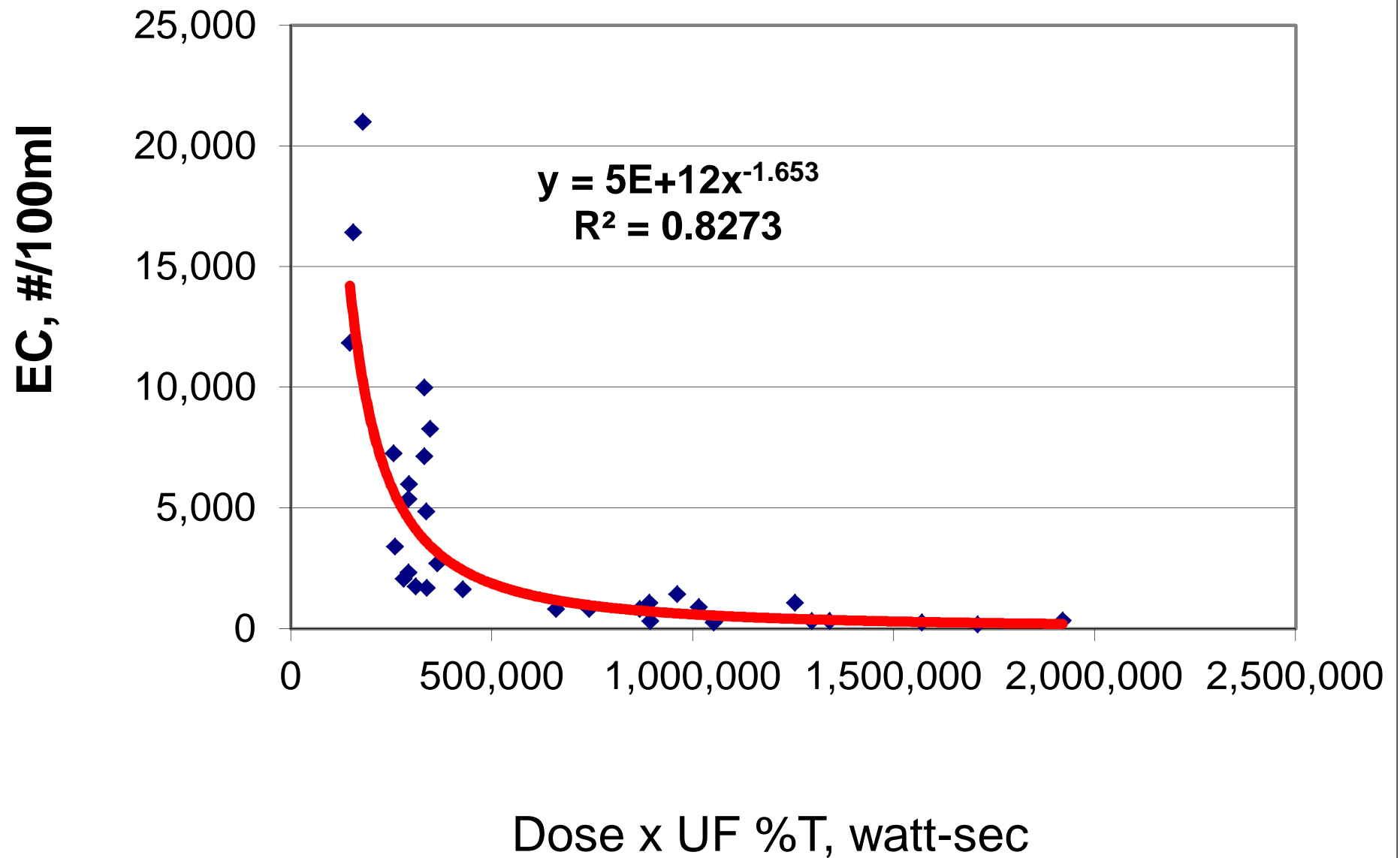
Dosing Feed Curves for Raw CSO vs Filtered CSO



Raw CSO PAA Disinfection Dose Response to Fecal Coliform



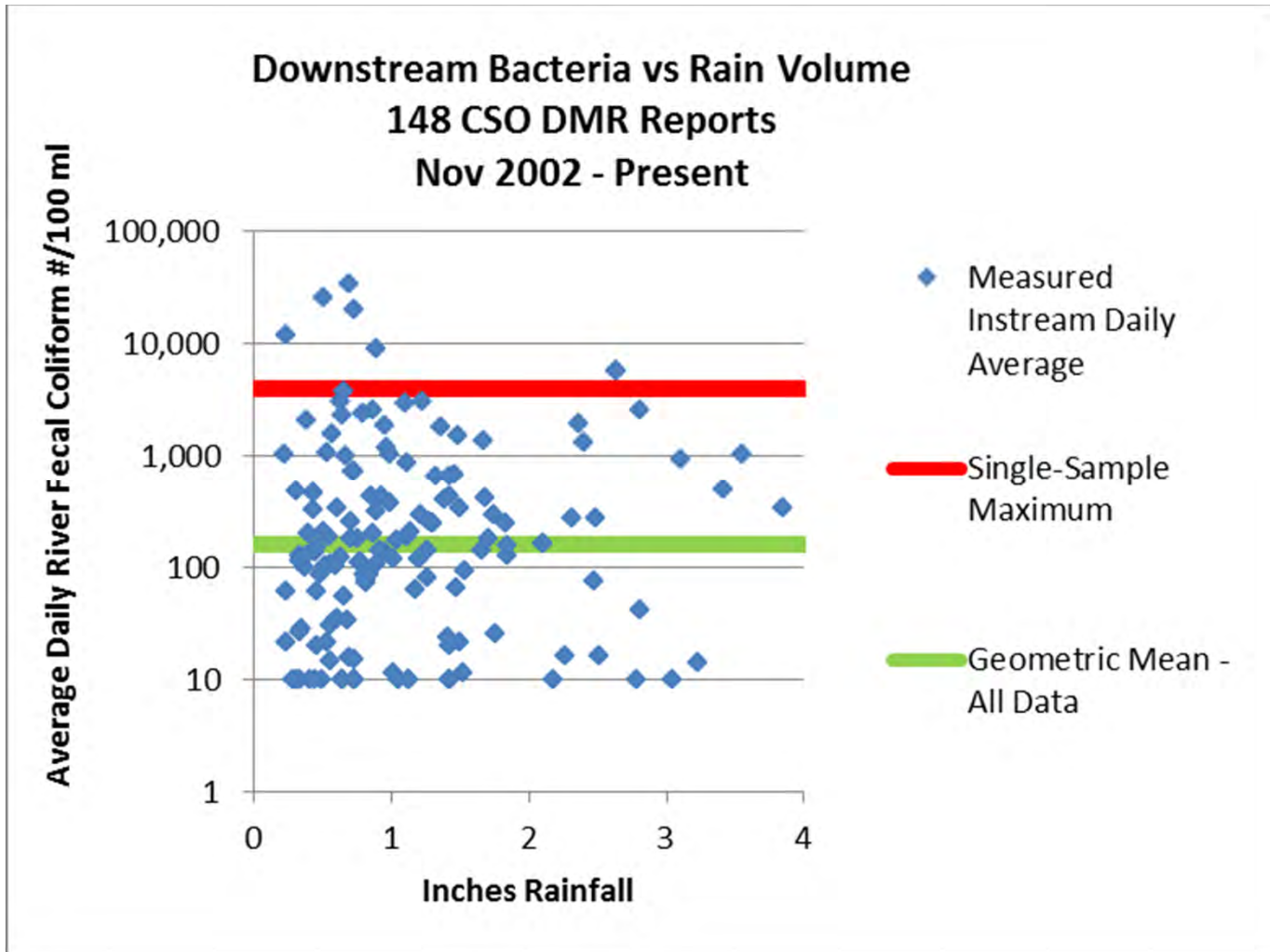
UV Disinfection Performance vs Dose x Light Transmittance



Disinfection Conclusions

- Chemical and UV disinfection can be defined as a function of wastewater quality and temperature.
- Wet weather quality is rapidly changing but predictable for disinfection control.
- Oxidant dose versus TRC can be used to control the dechlorination feed control.
- DBPs are a function of dose and quality.
- DBPs production can be reduced through precursor reduction and UV disinfection.

Columbus GA CSO Program Downstream Monitoring Results

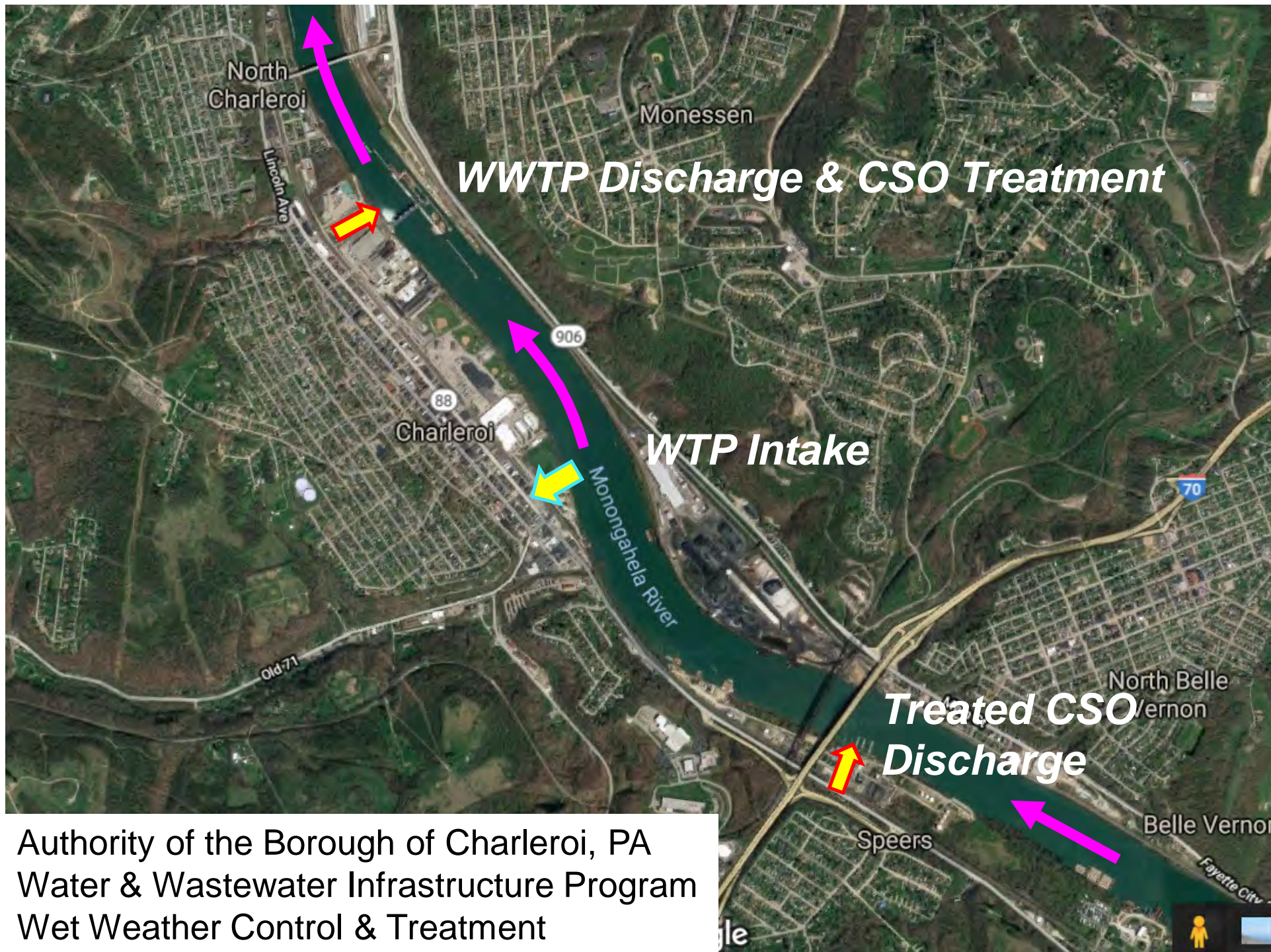


4% Digressions from the STV maximum day criteria. No Exceedances of Bacteria Standards with a 10% STV Frequency threshold in the same 30-day period.

WWETCO FlexFilter CMF Technology



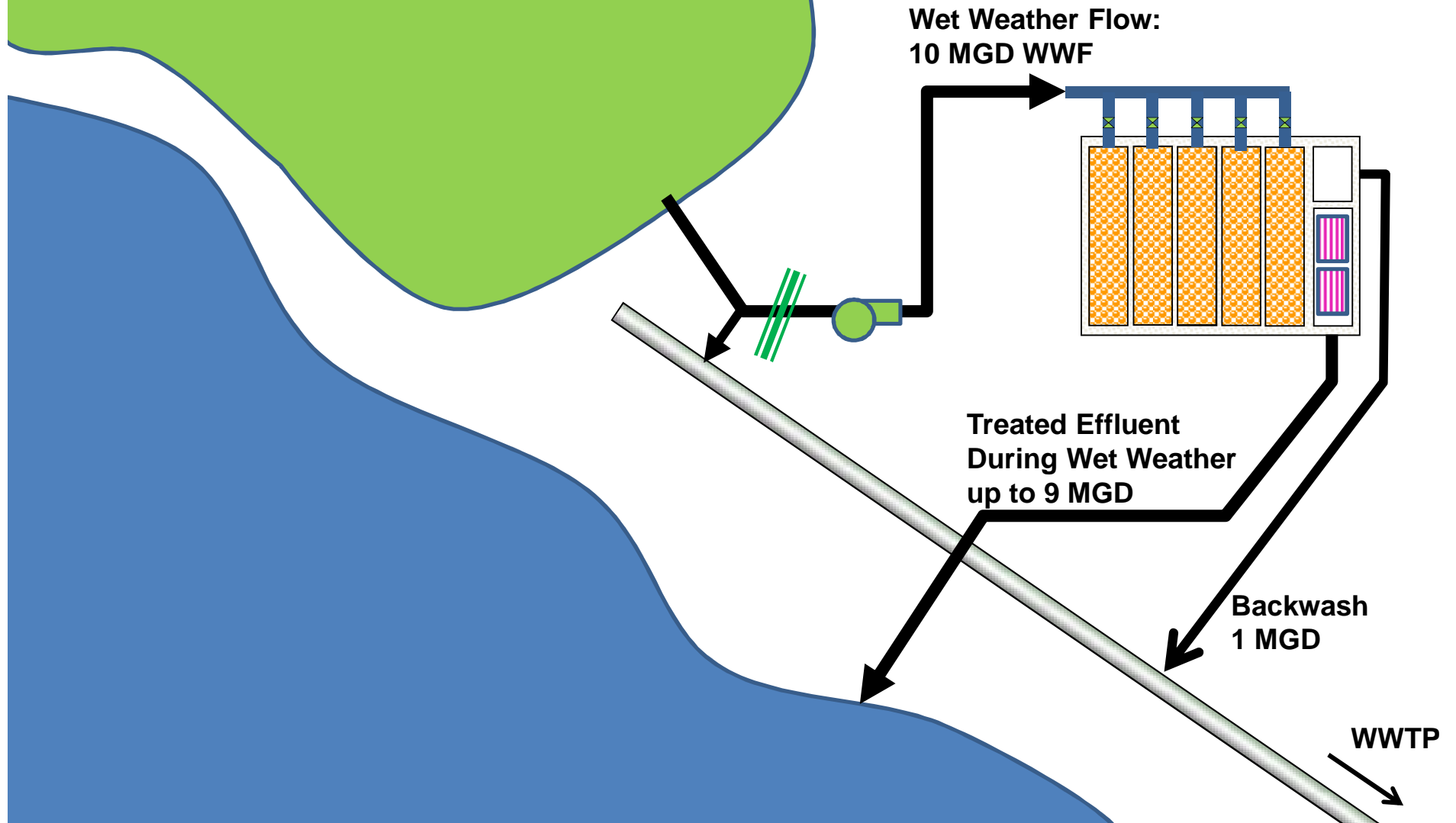
Charleroi, PA



Authority of the Borough of Charleroi, PA
Water & Wastewater Infrastructure Program
Wet Weather Control & Treatment

**Combined
Sewer System
Watershed**

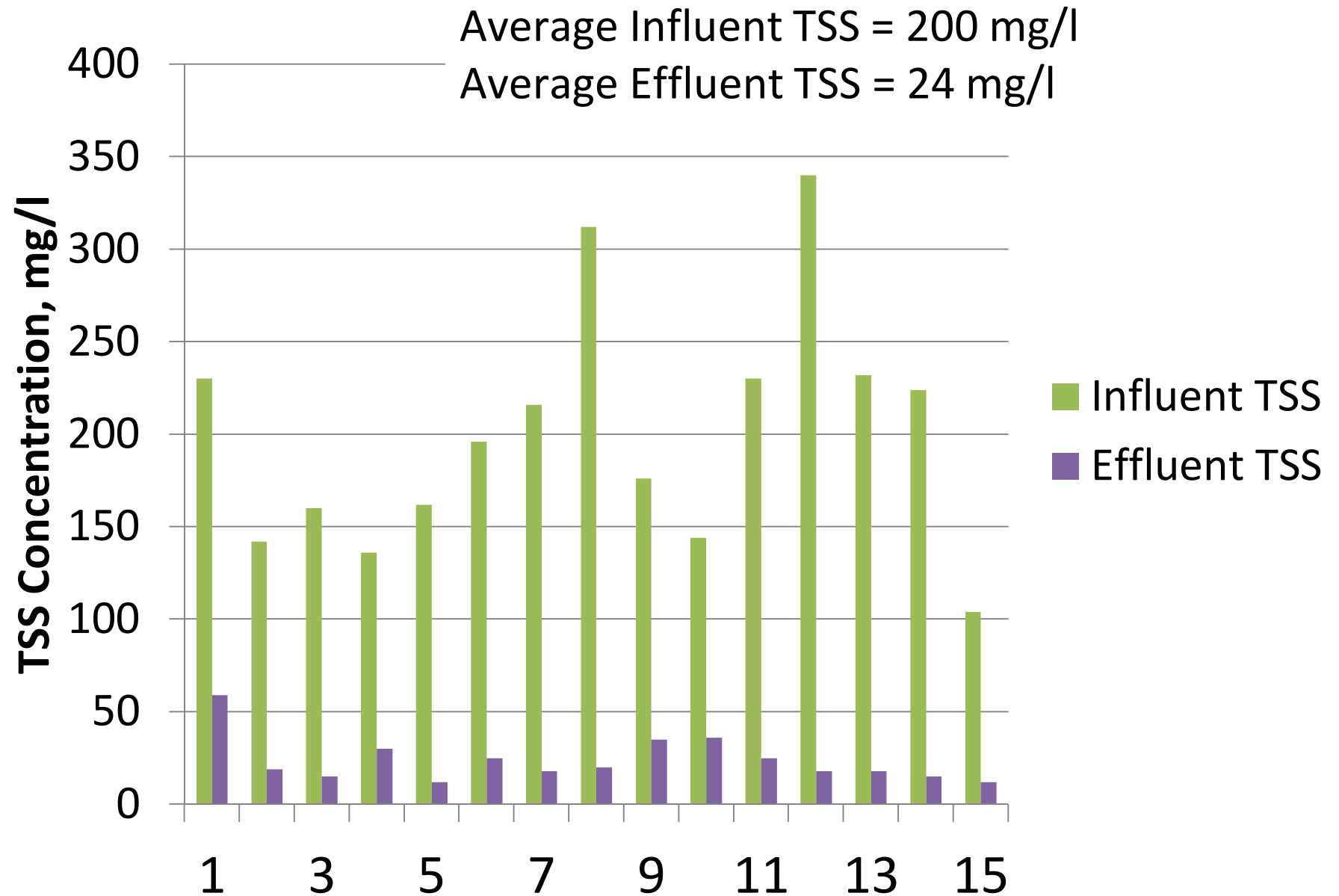
Charleroi, PA Satellite CSO Treatment



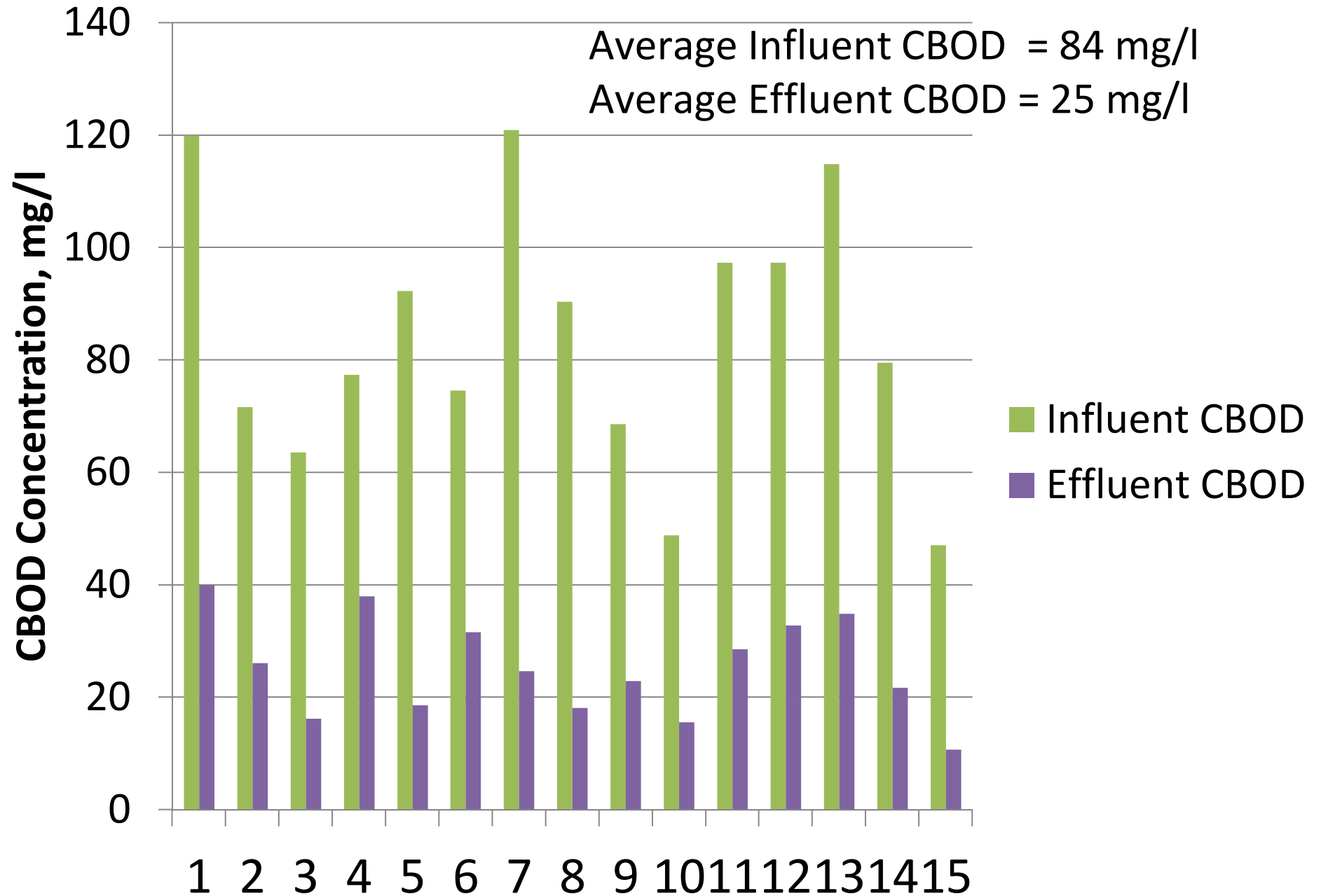




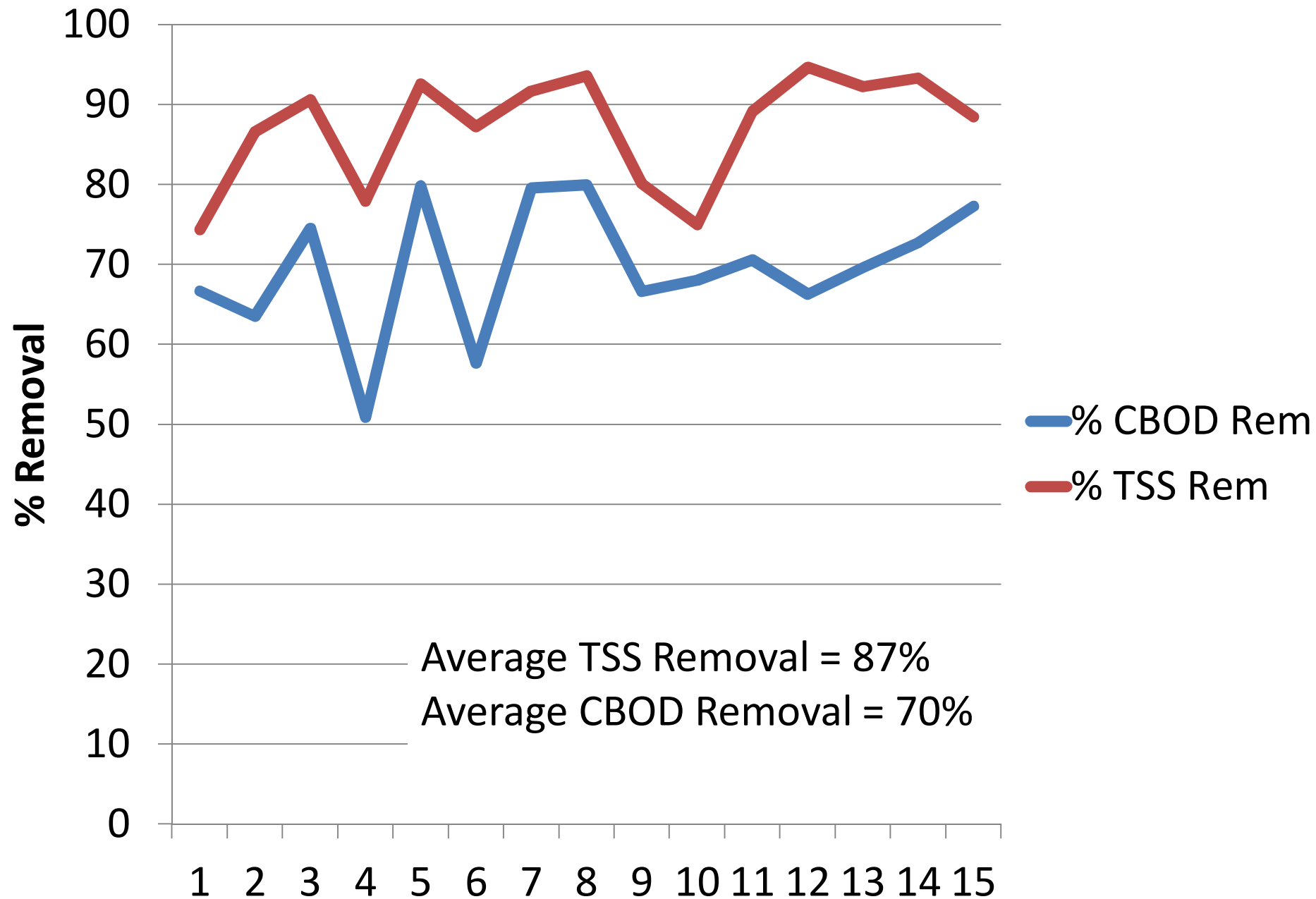
Influent & Effluent TSS



Influent & Effluent CBOD



% Removals for TSS and CBOD



UV Disinfection

Recycle Pumping

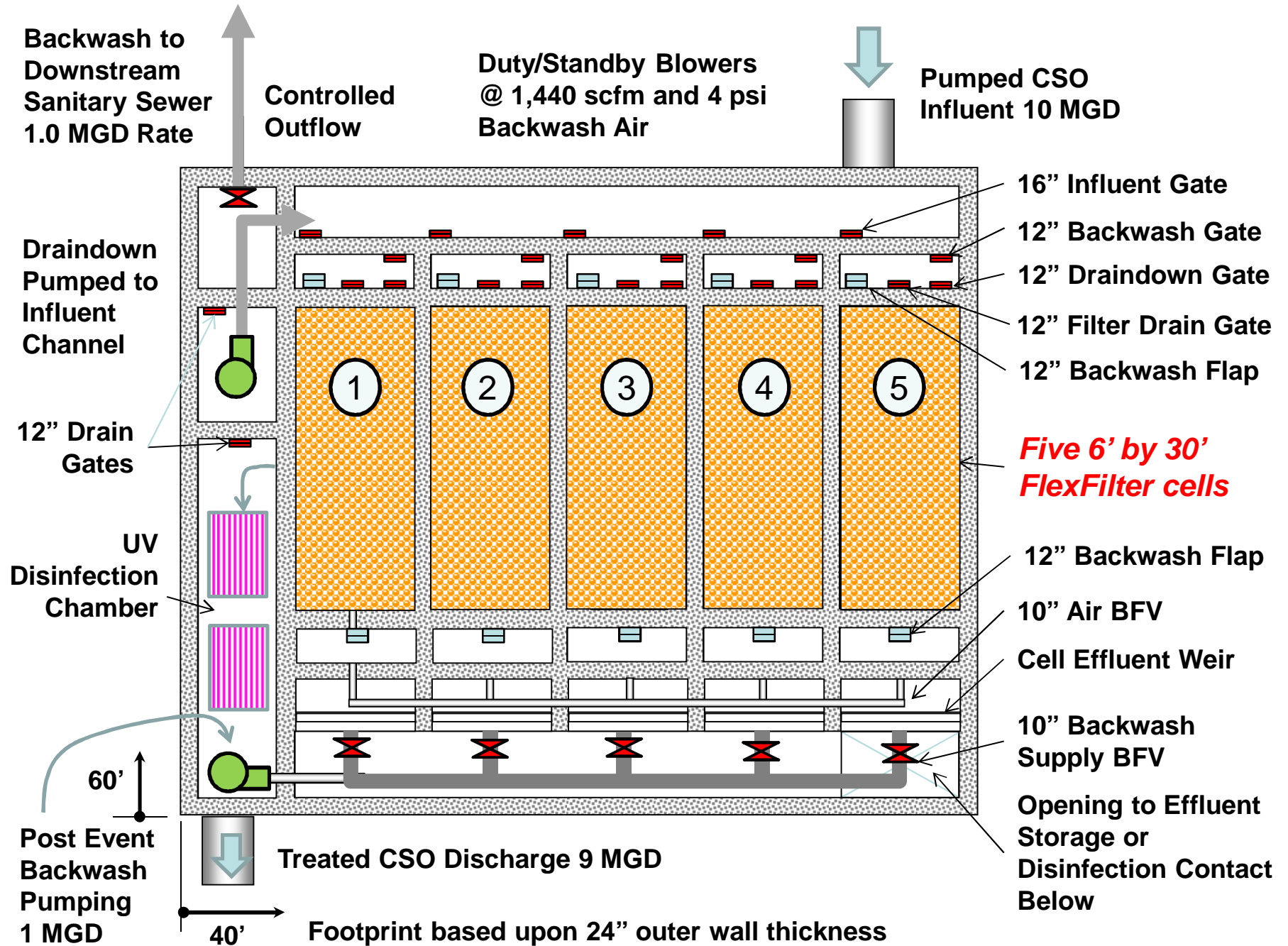
5-Cell FlexFilter Matrix

Backwash Blowers

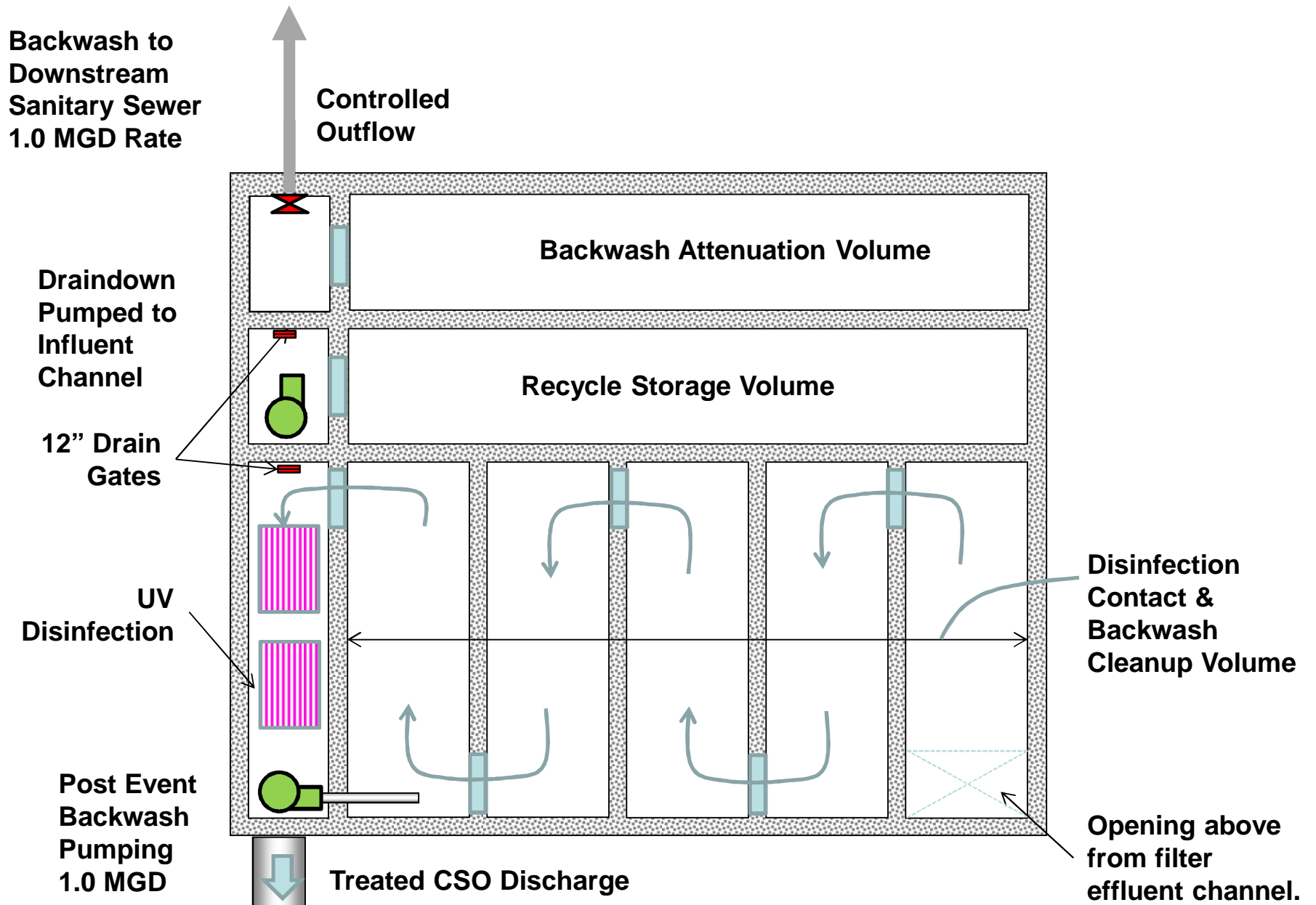
Post Event Backwash Pumping

Coarse Screening

WWETCO 10 MGD FlexFilter™ EHRT Satellite CSO Treatment – Upper Plan



Lower Plan



Charleroi, PA Satellite CSO Treatment Courtesy of McCrossin Constructors



Charleroi, PA Satellite CSO Treatment Courtesy of McCrossin Constructors

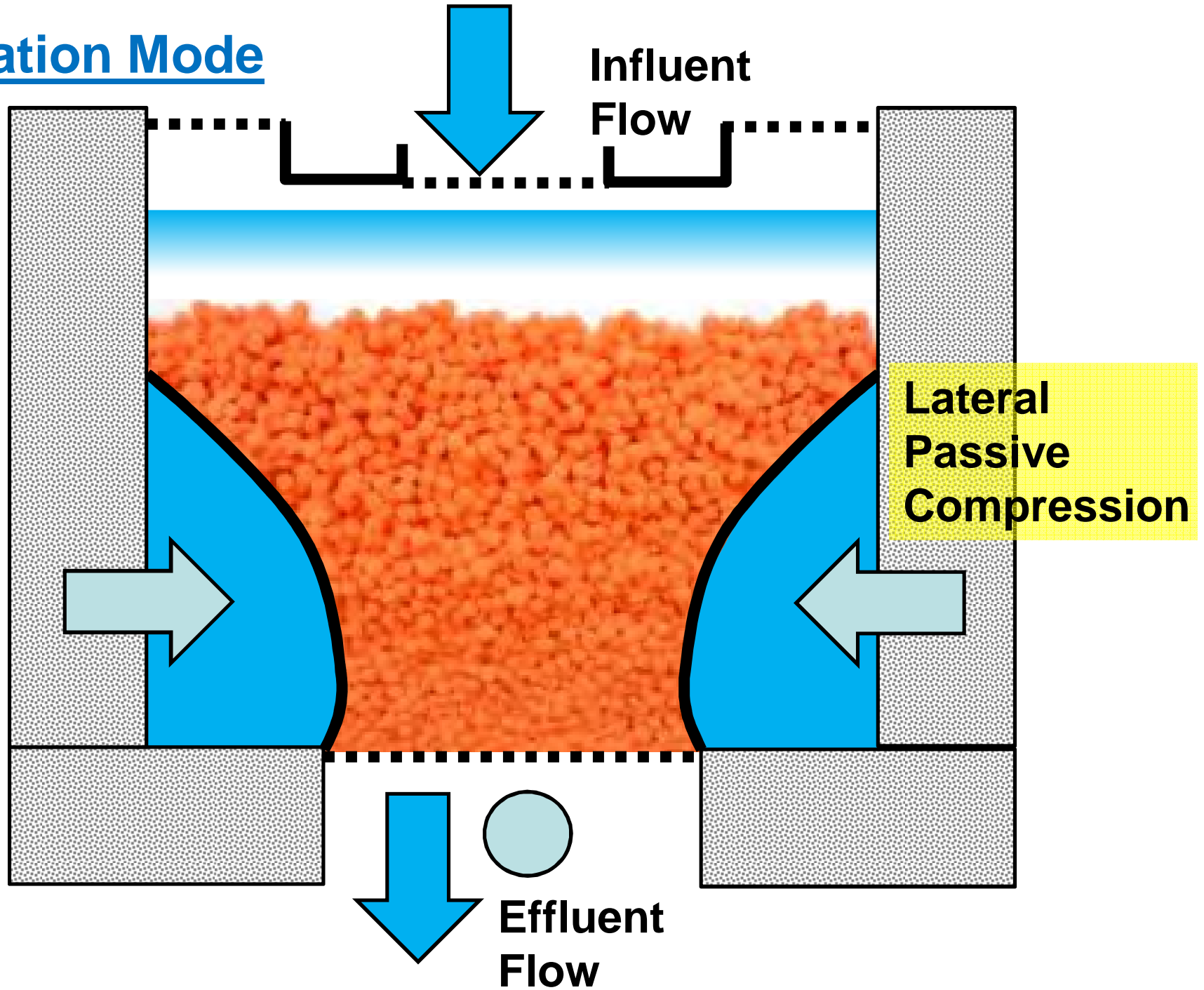


WWETCO FlexFilter CMF Technology

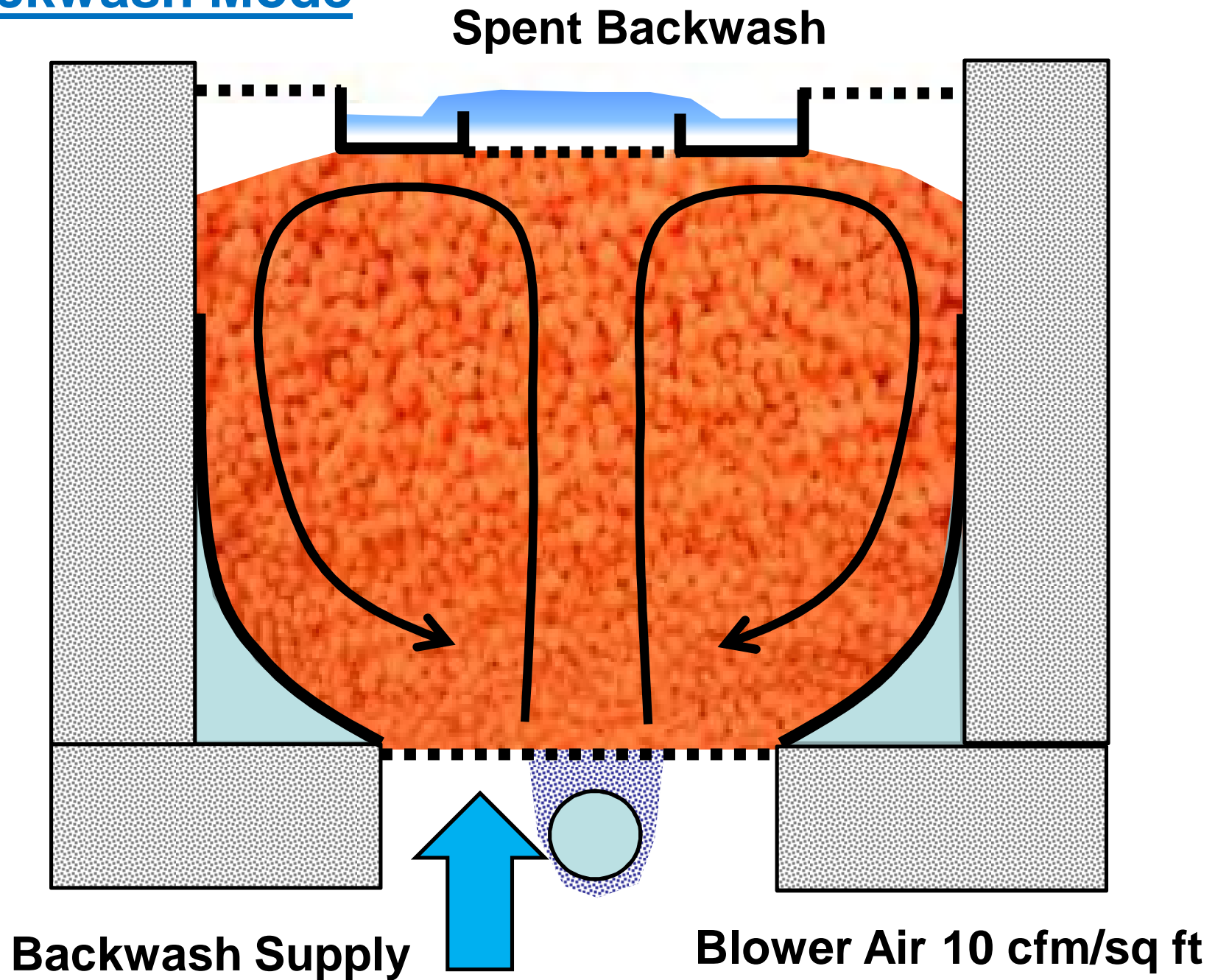


How CMF Works

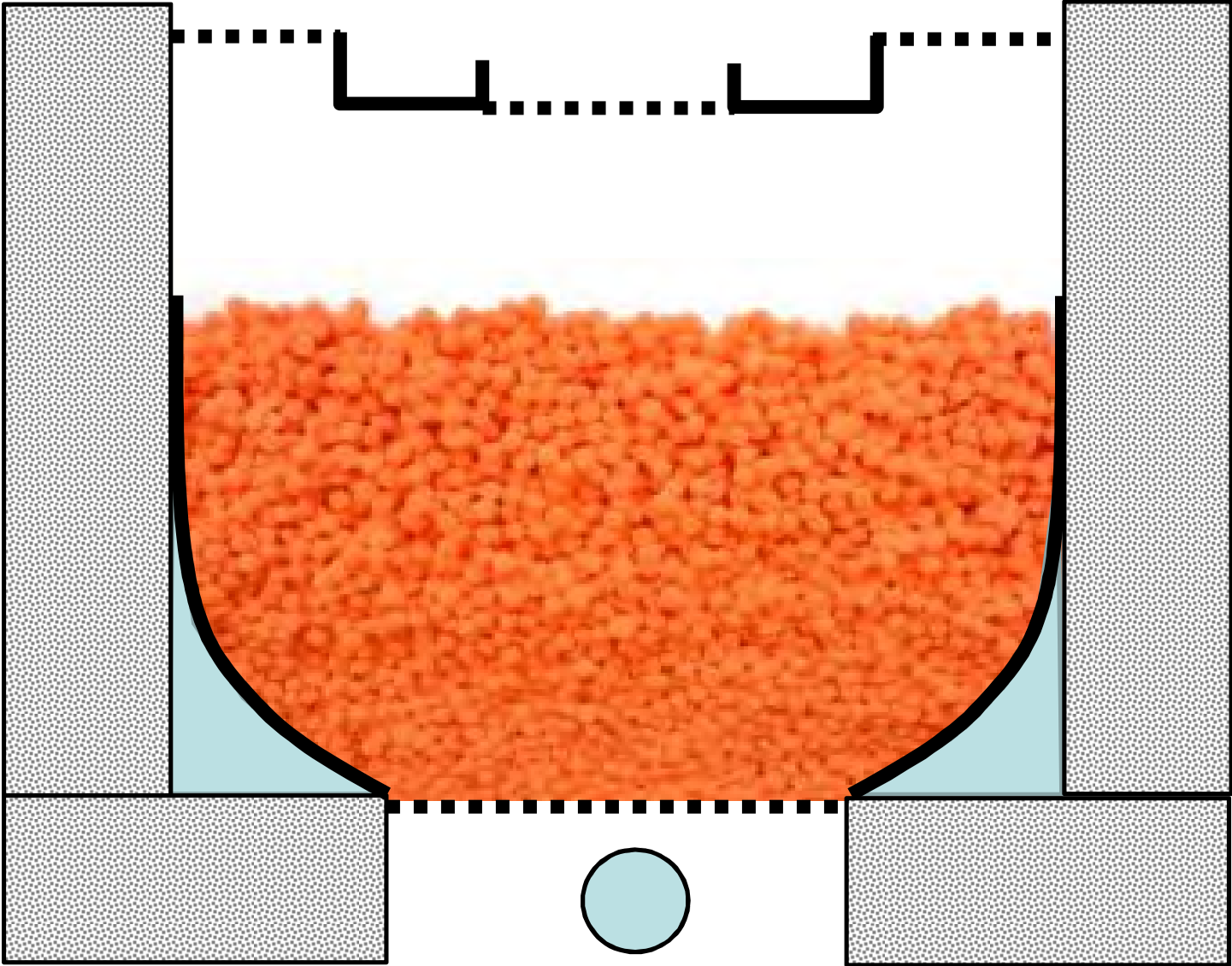
Filtration Mode




Backwash Mode



Drain Mode



A photograph of a large industrial tank containing a large pile of orange, granular filter media. The media is piled in the center of the tank, with some spilling onto the metal grates at the bottom. The tank walls are dark and metallic, and there are various pipes and structural elements visible. The text "Uncompressed Filter Media" is overlaid in the center of the image.

**Uncompressed
Filter Media**



**Compressed
Filter Media**

The image shows a large, dark-colored industrial tank or container. Inside the tank, there is a large pile of bright orange, granular material, which is the compressed filter media. The material is piled up in the center of the tank, with some spillage visible on the sides. The tank's interior is metallic and shows signs of wear. A horizontal metal beam is visible across the top of the tank, and several vertical metal supports are visible on the right side. The text "Compressed Filter Media" is overlaid in the center of the image in a bold, black font.



Real Time Filtration of Primary Influent at 250 to 300 mg/l TSS

A porosity gradient is created by the lateral compression of the media bed.

The result is the stratification and removal of large and small particles throughout the media bed.

This allows the FlexFilter™ to treat high solids laden waters.



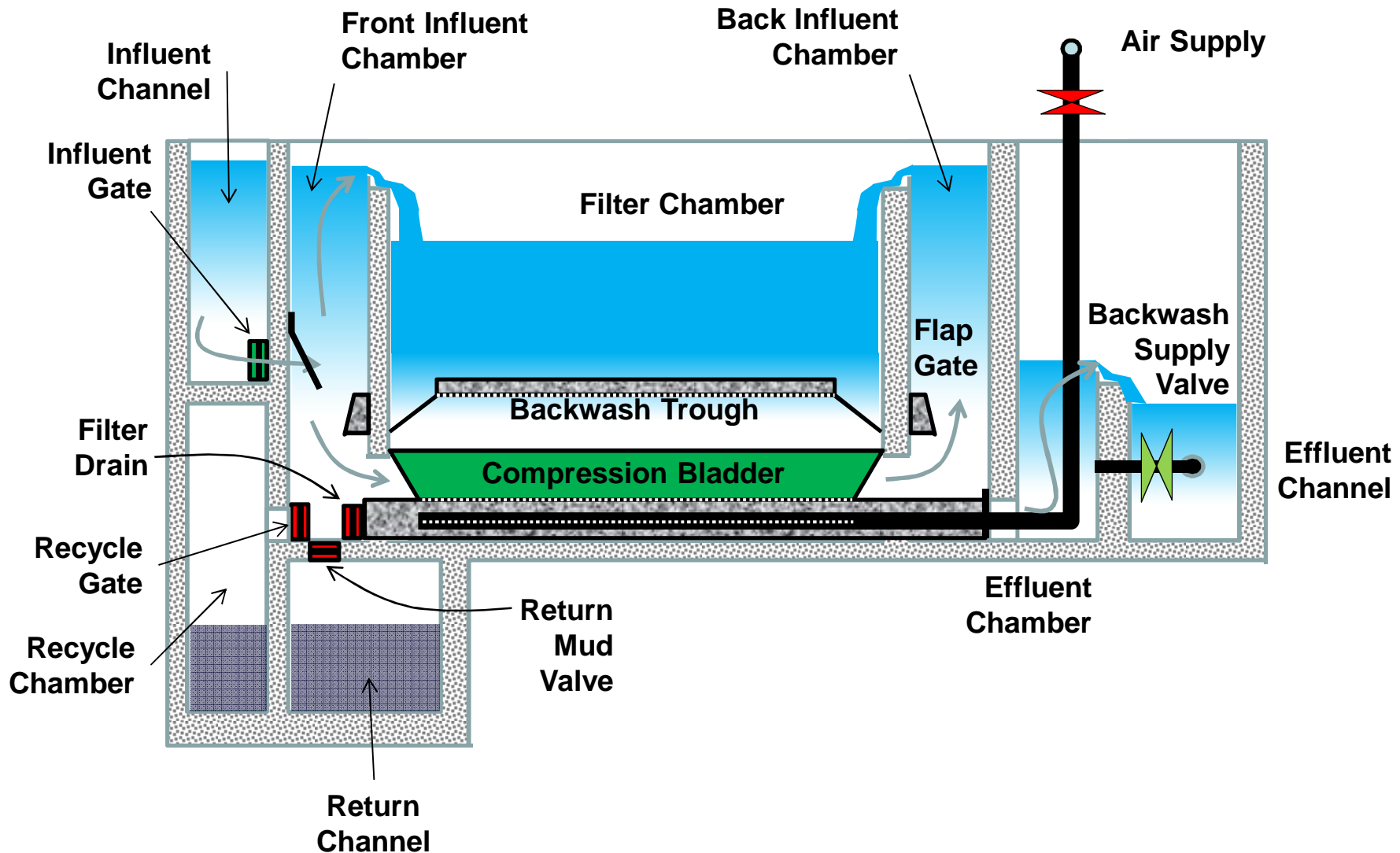
Time Lapse Video

Filter Cycle (Time Lapse of 2 hrs)

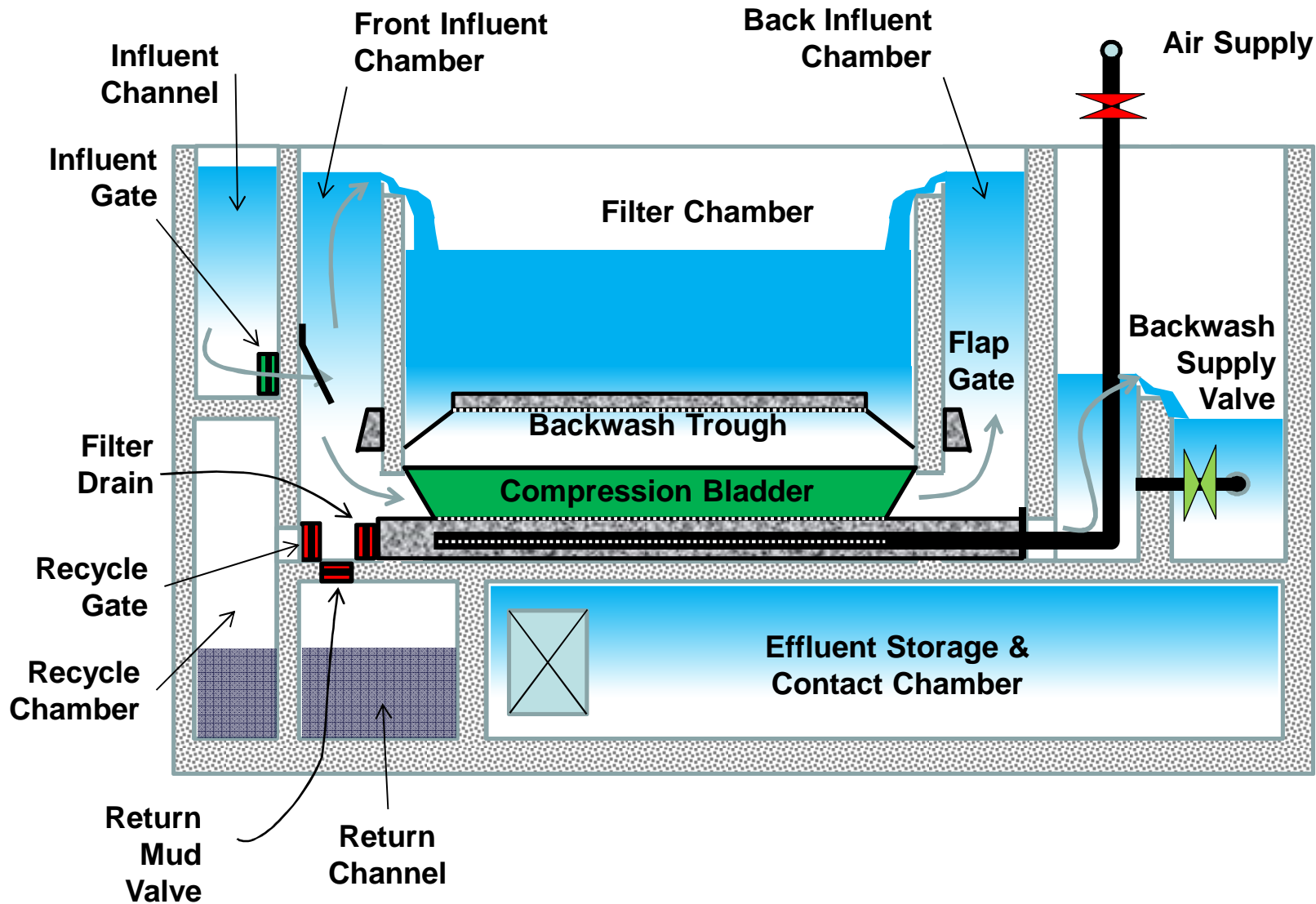
1. Backwash
2. Filter Drain
3. Fill and Compress
4. Filtration
5. Backwash Again

Filtration of Primary Influent
at 250 to 300 mg/l TSS

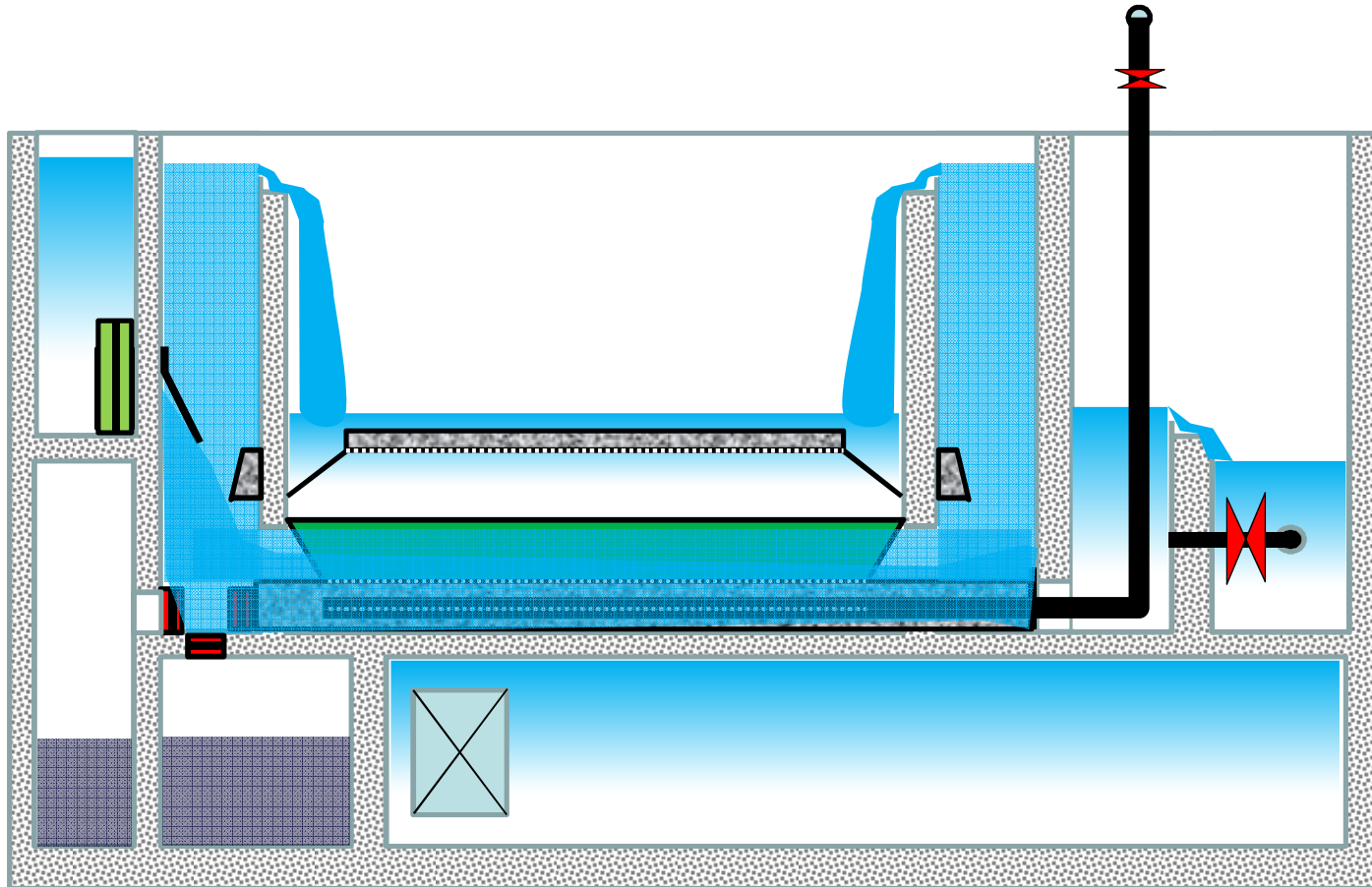
Cross-Section of a Typical Filter Cell



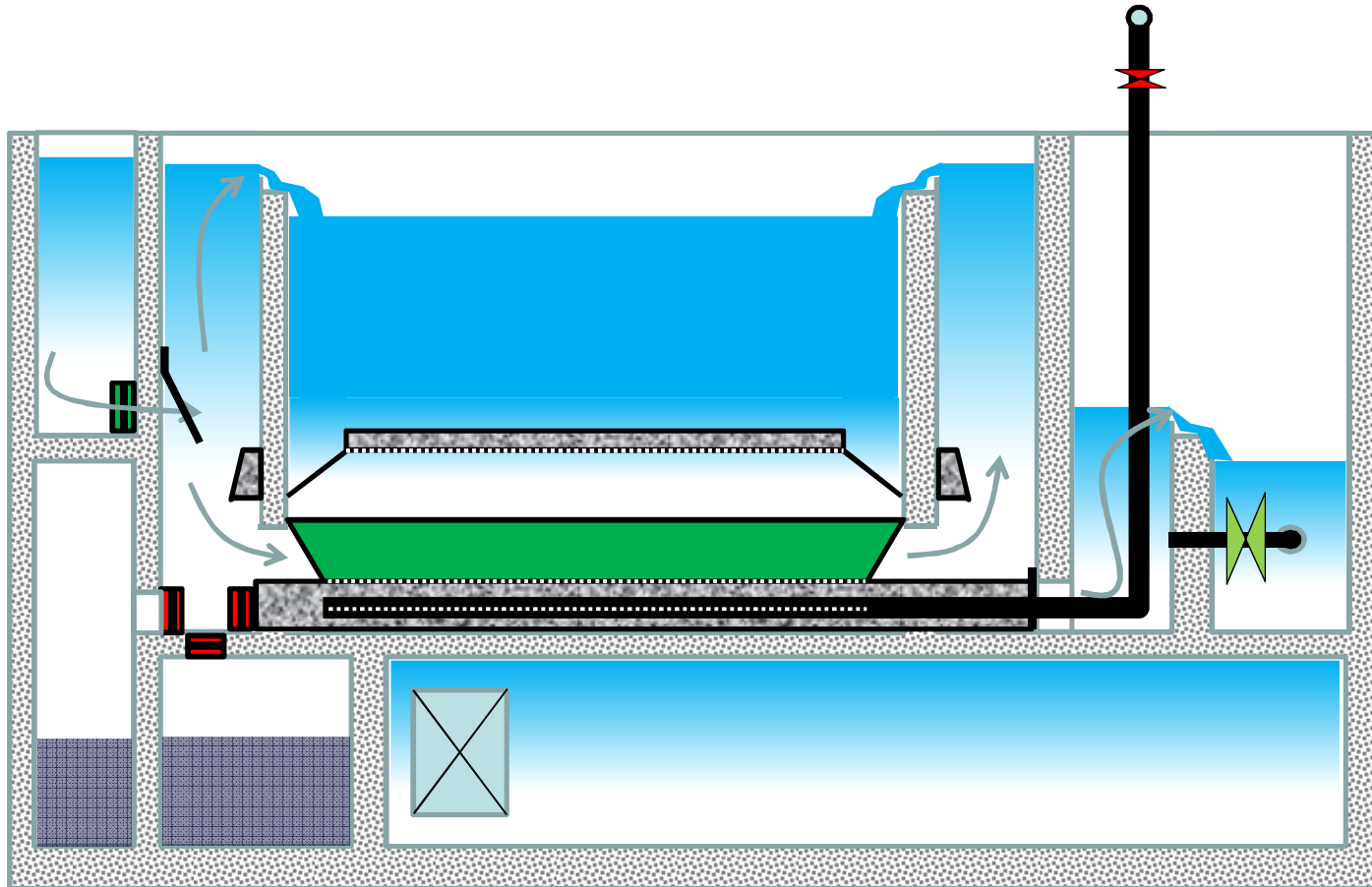
Cross-Section of a Typical Filter Cell



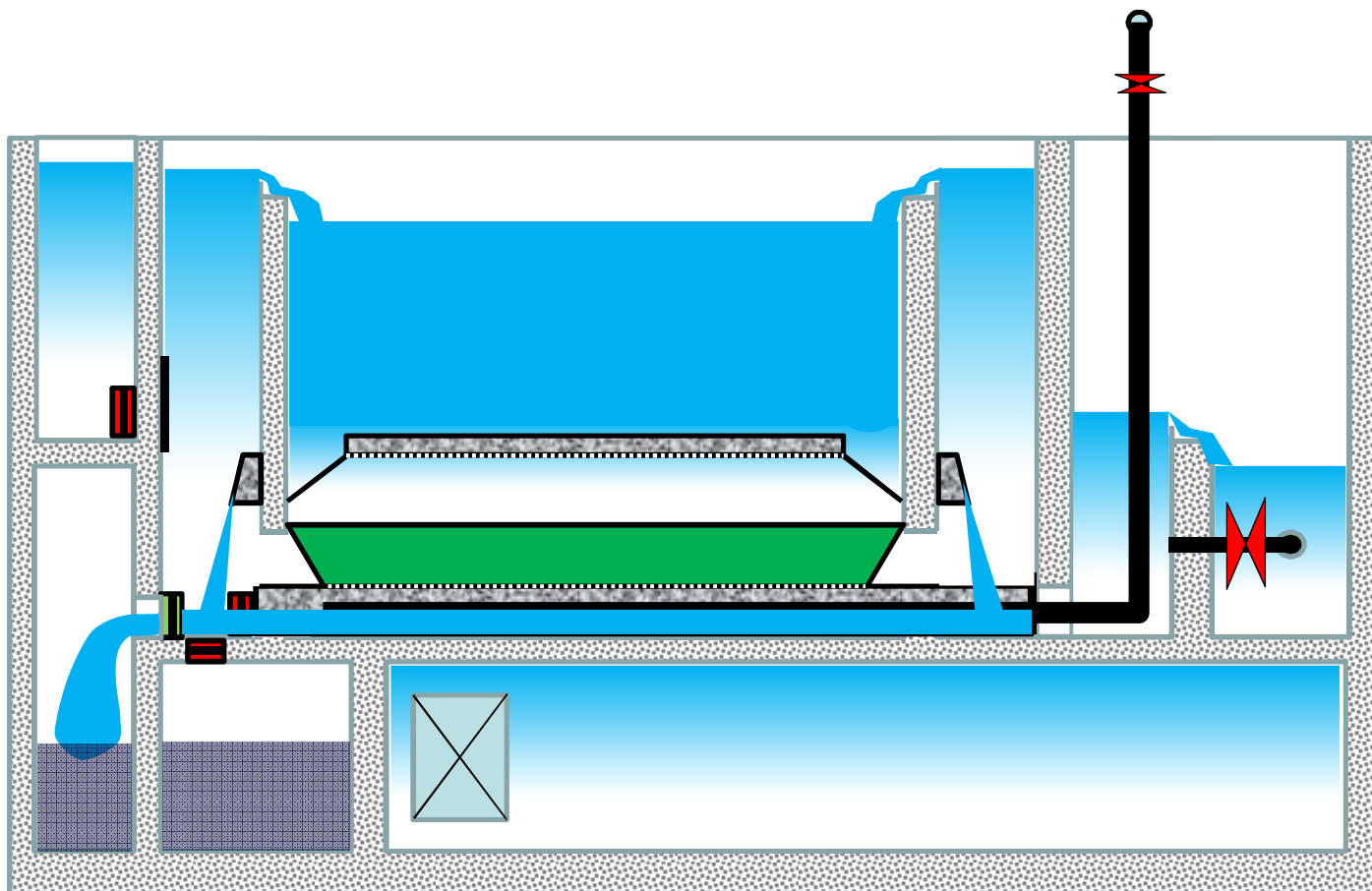
Cell called on-line – bladder compresses and filtration begins



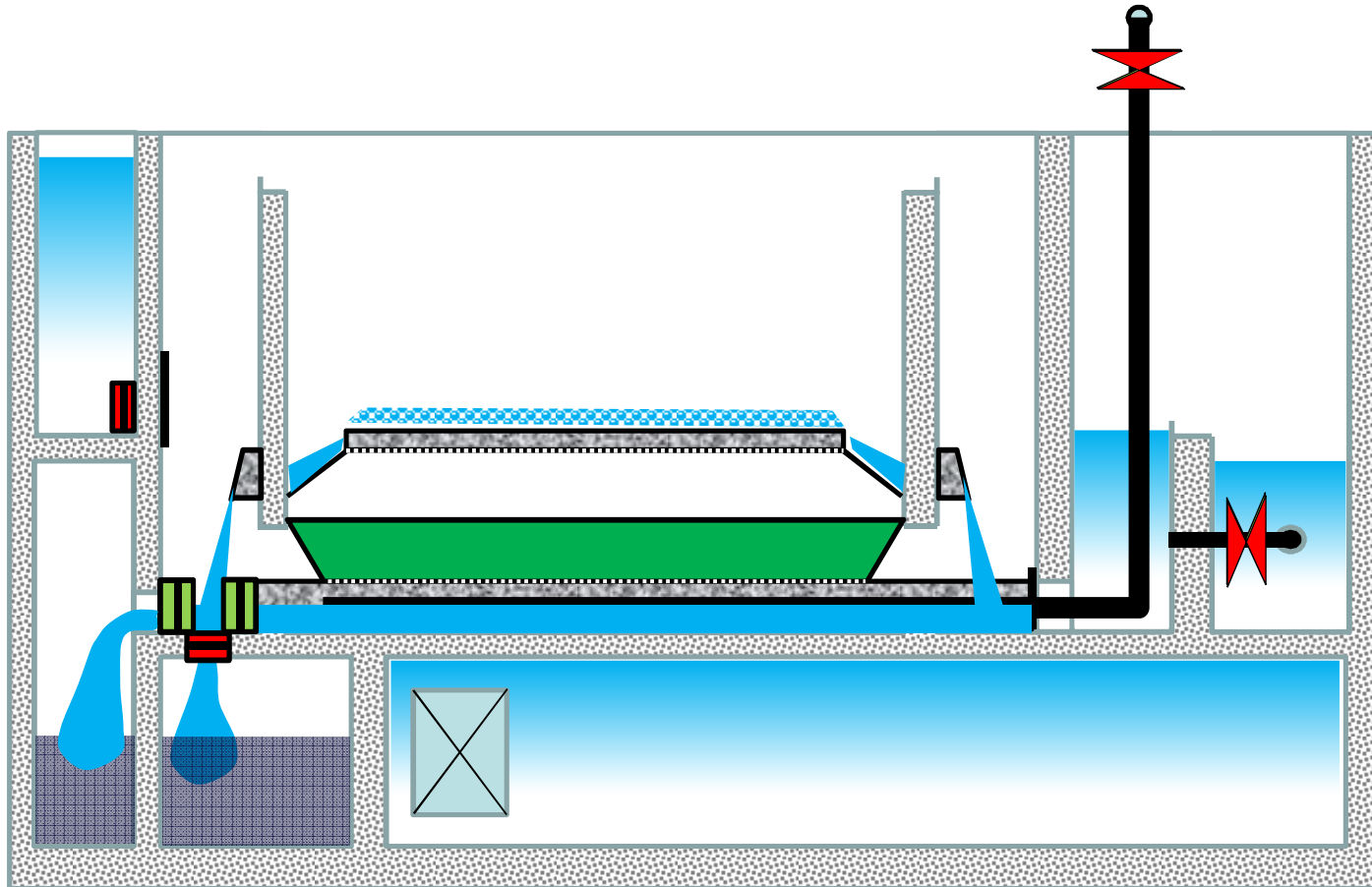
Filtration – As solids are removed head builds



Cell goes off-line and initial drain-down



Backwash and final drain-down

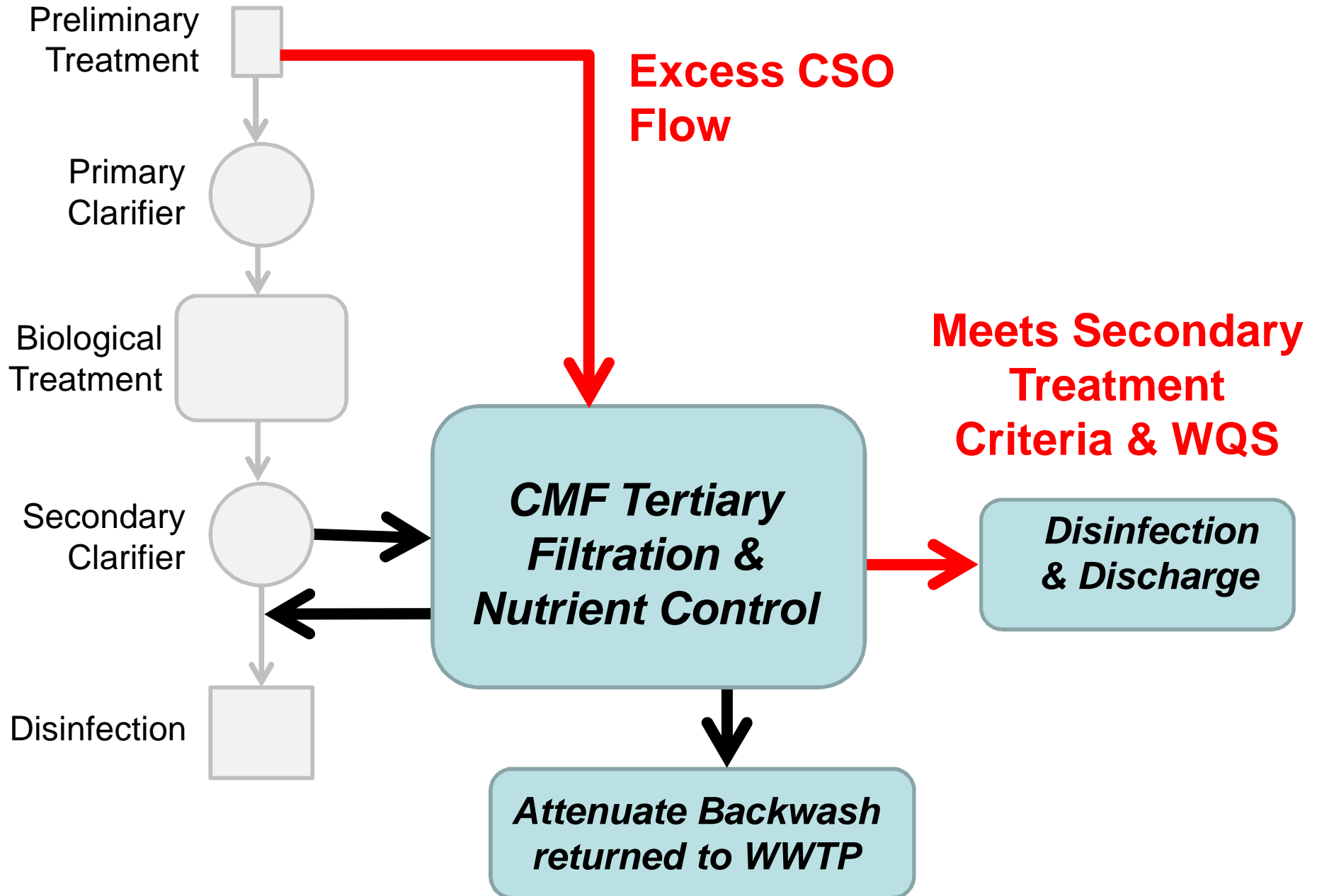


WWETCO FlexFilter CMF Technology



Springfield Ohio

Auxiliary Treatment



100 MGD WWETCO FlexFilter EHRT for CSO Treatment

Backwash

CMAS

Up to
100 MGD
CSO

Disinfection
& Post Air

Primaries

Secondaries

Trickling
Filters

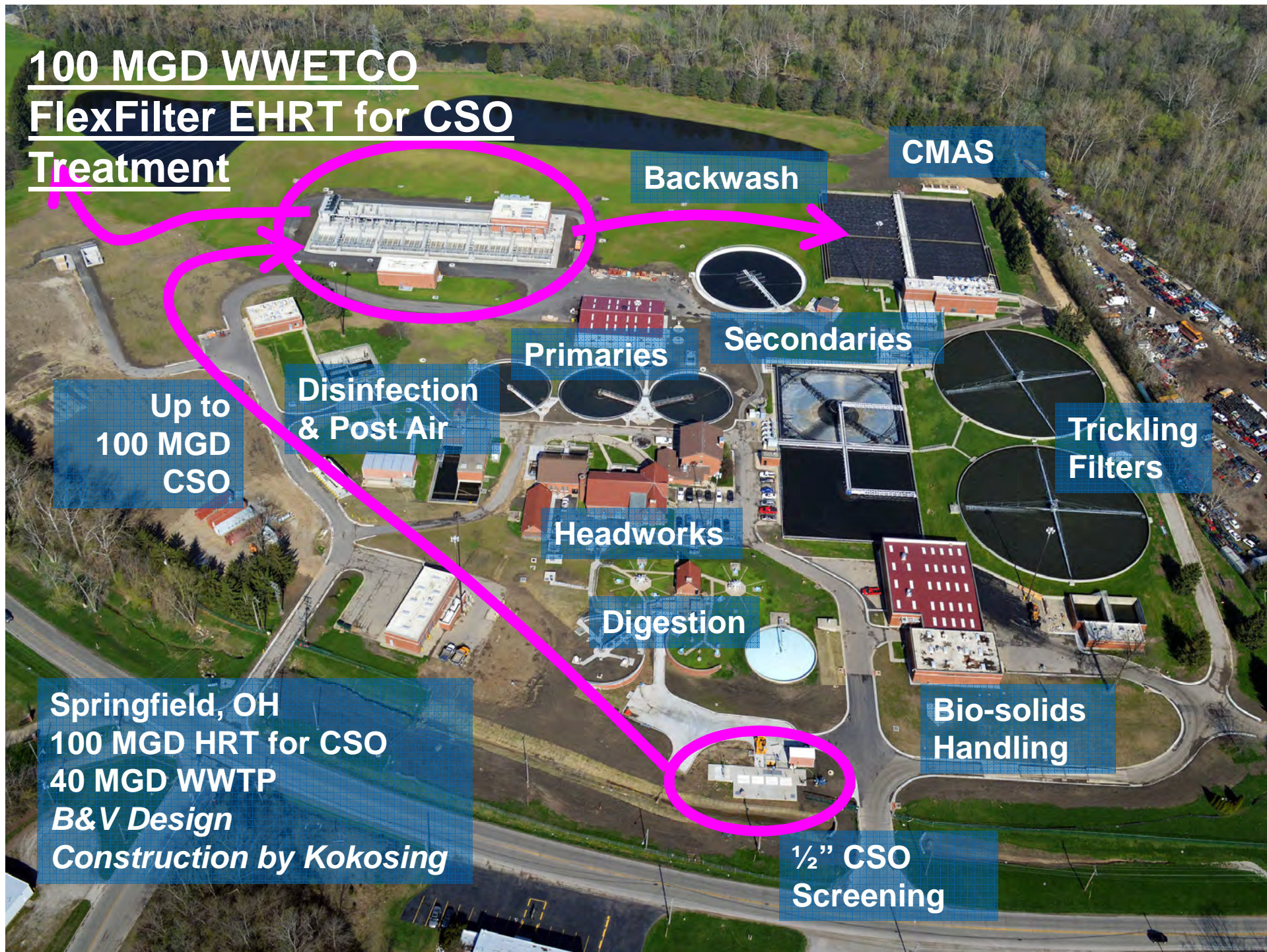
Headworks

Digestion

Bio-solids
Handling

Springfield, OH
100 MGD HRT for CSO
40 MGD WWTP
B&V Design
Construction by Kokosing

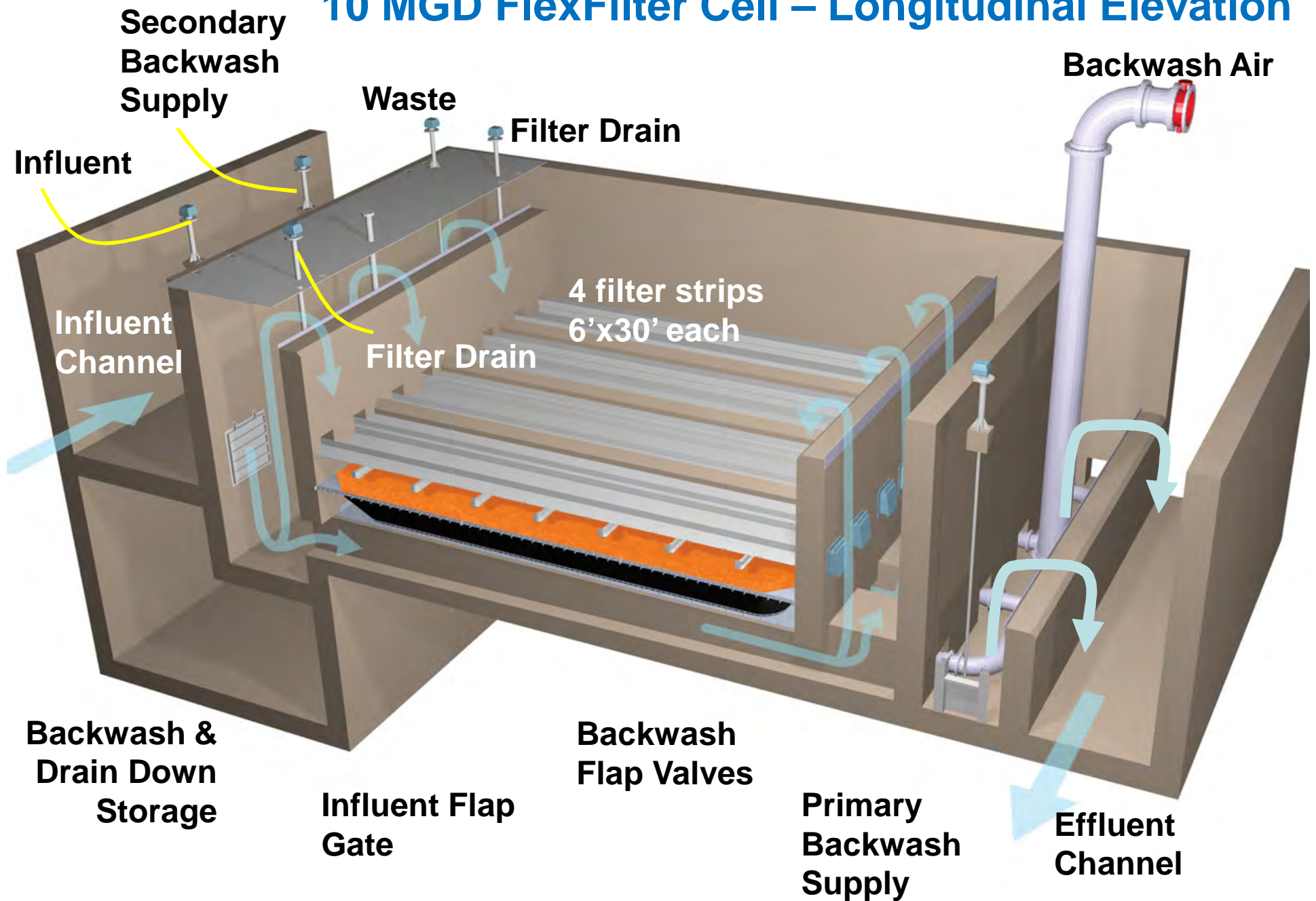
1/2" CSO
Screening



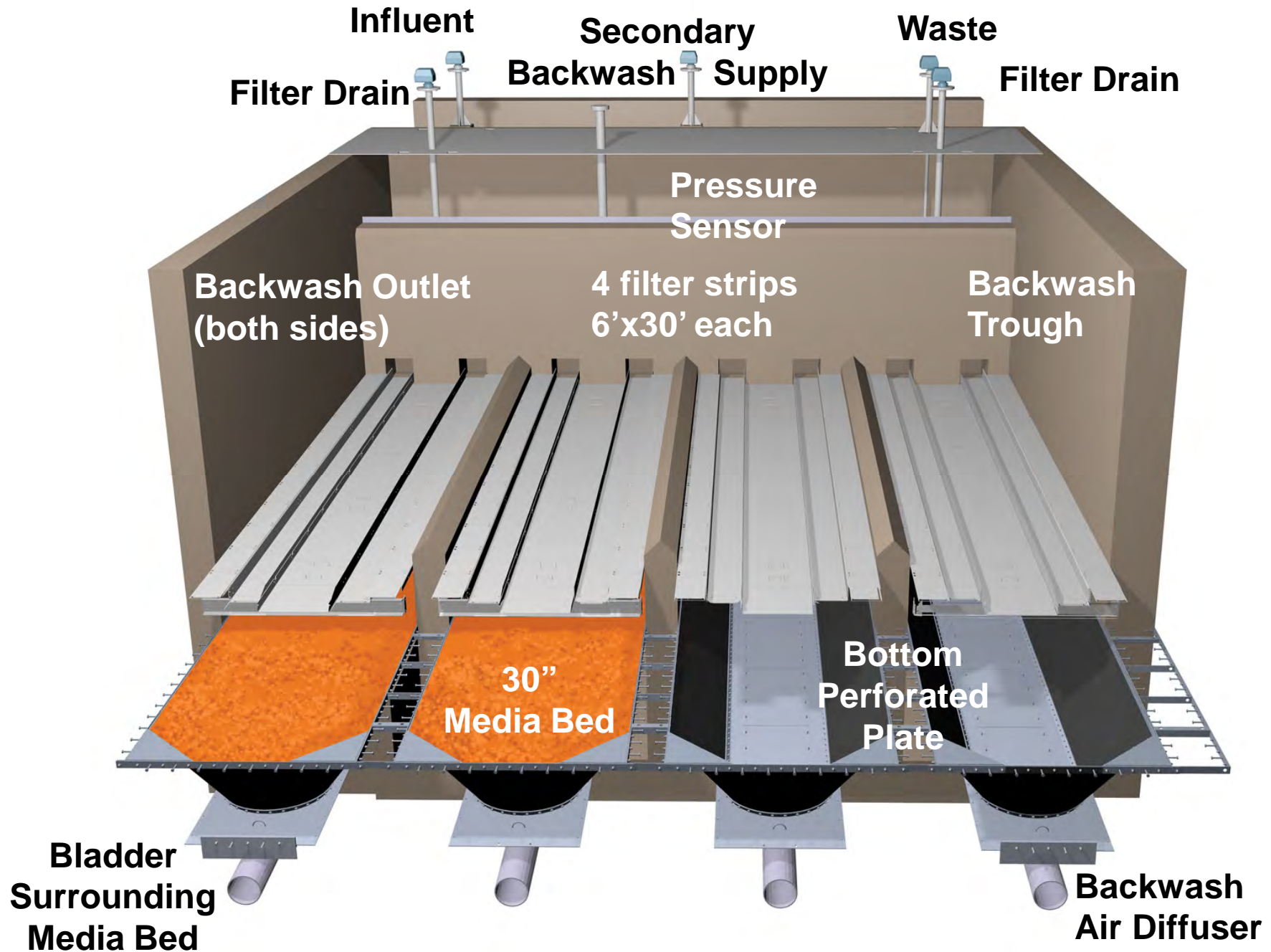
- High-rate / high-performance / small footprint
- No chemicals required to remove solids
- Operating power less than \$5 per million gallons treating CSO
- Operating power less than \$1 per million gallons when polishing

- Unmanned operation with simple flow and level controls
- Automated cleanup
- Scheduled & Operator initiated automatic exercise of gates and valves
- Can be placed underground & ideal for unmanned satellite

10 MGD FlexFilter Cell – Longitudinal Elevation



10 MGD FlexFilter Cell – Sectional Elevation



Video of Filtration Mode at Mid-level Over Filter





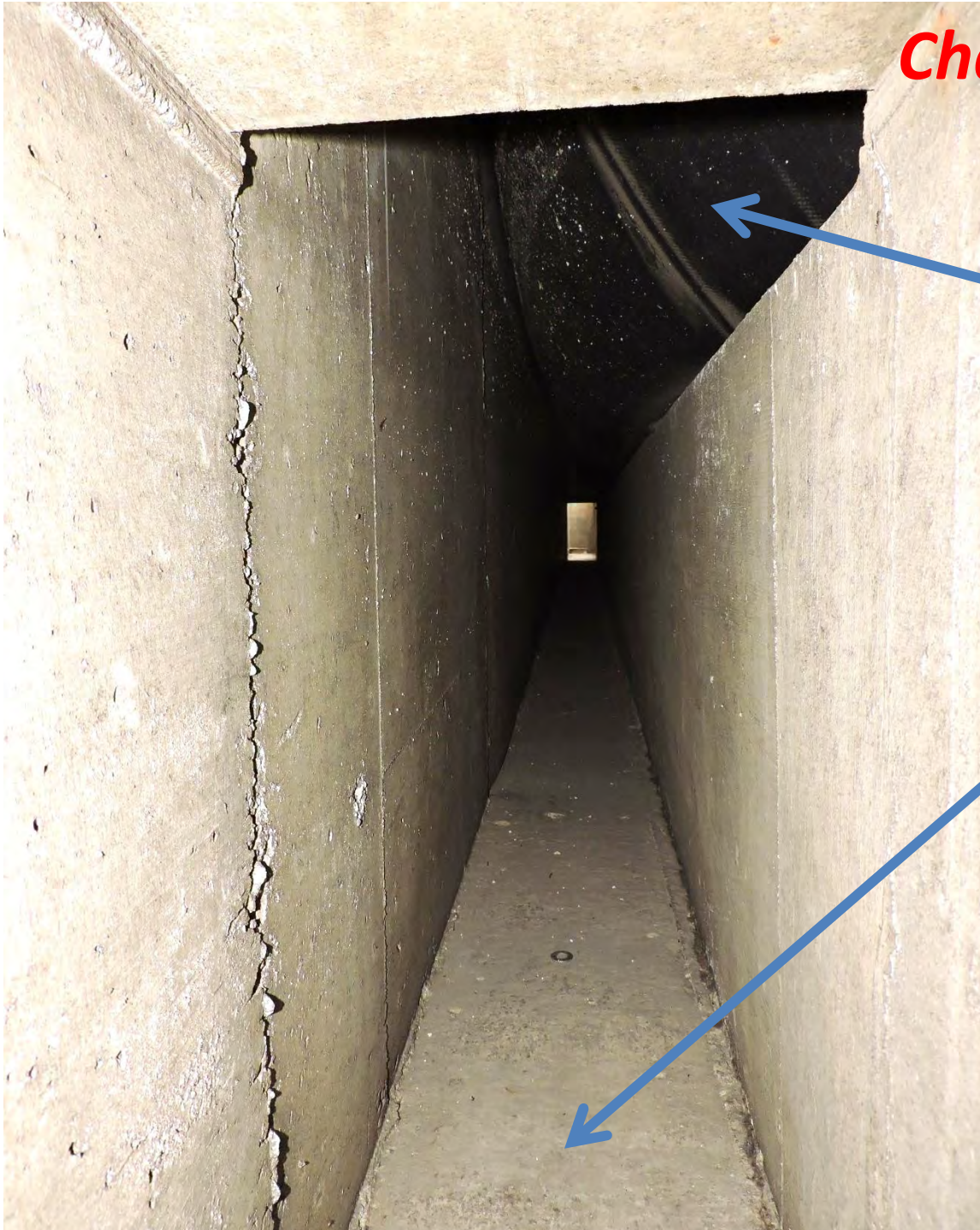
Video of Influent Chamber (East Side)



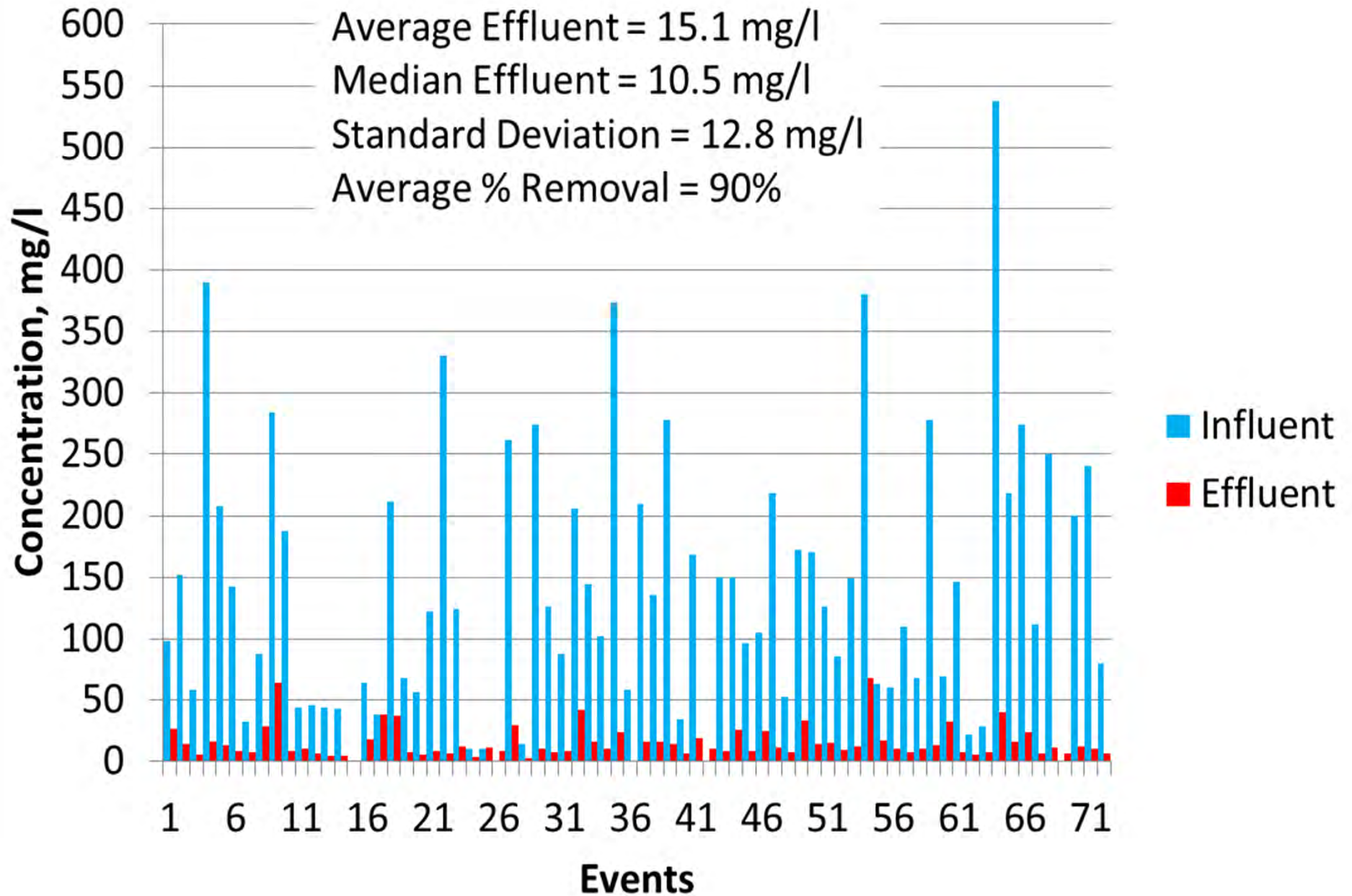
Channel Behind Bladder

**Compression
Bladder**

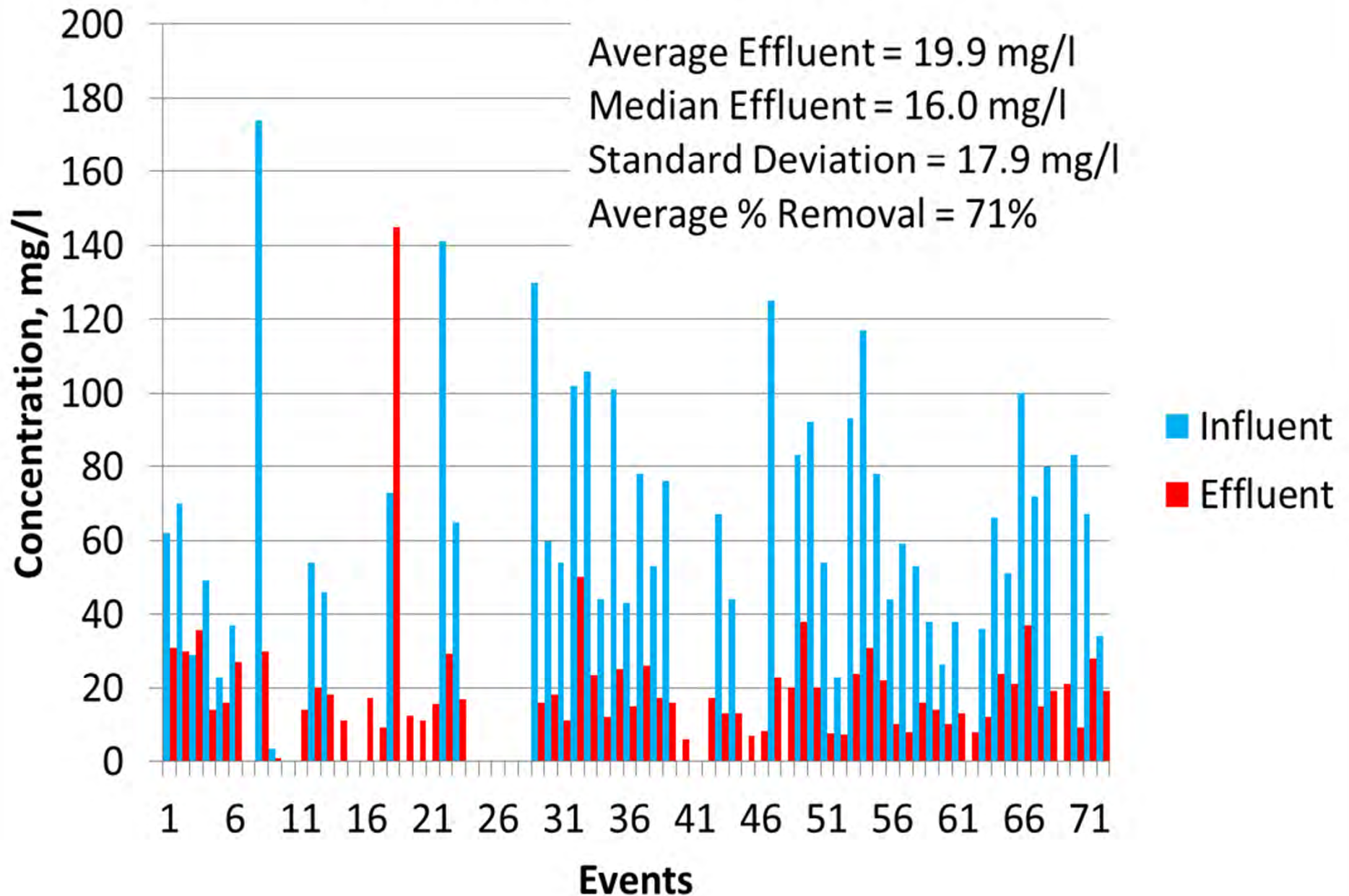
**After 10 months
of operation
bladder
compression
channels are free
of debris**



TSS Removal Performance



CBOD Removal Performance



Secondary Treatment Criteria (7:14A-12.2 & 40 CFR 133.105)

CBOD₅

25 mg/L Monthly Average

40 mg/L Weekly Average

TSS

30 mg/L Monthly Average

45 mg/L Weekly Average

TP

Incidental through solids reduction

Performance Summary Springfield, OH CSO HRT Event Composite Average

65 events

March 2015 to June 2017

CBOD₅ = 19.9 mg/L

TSS = 15.1 mg/L

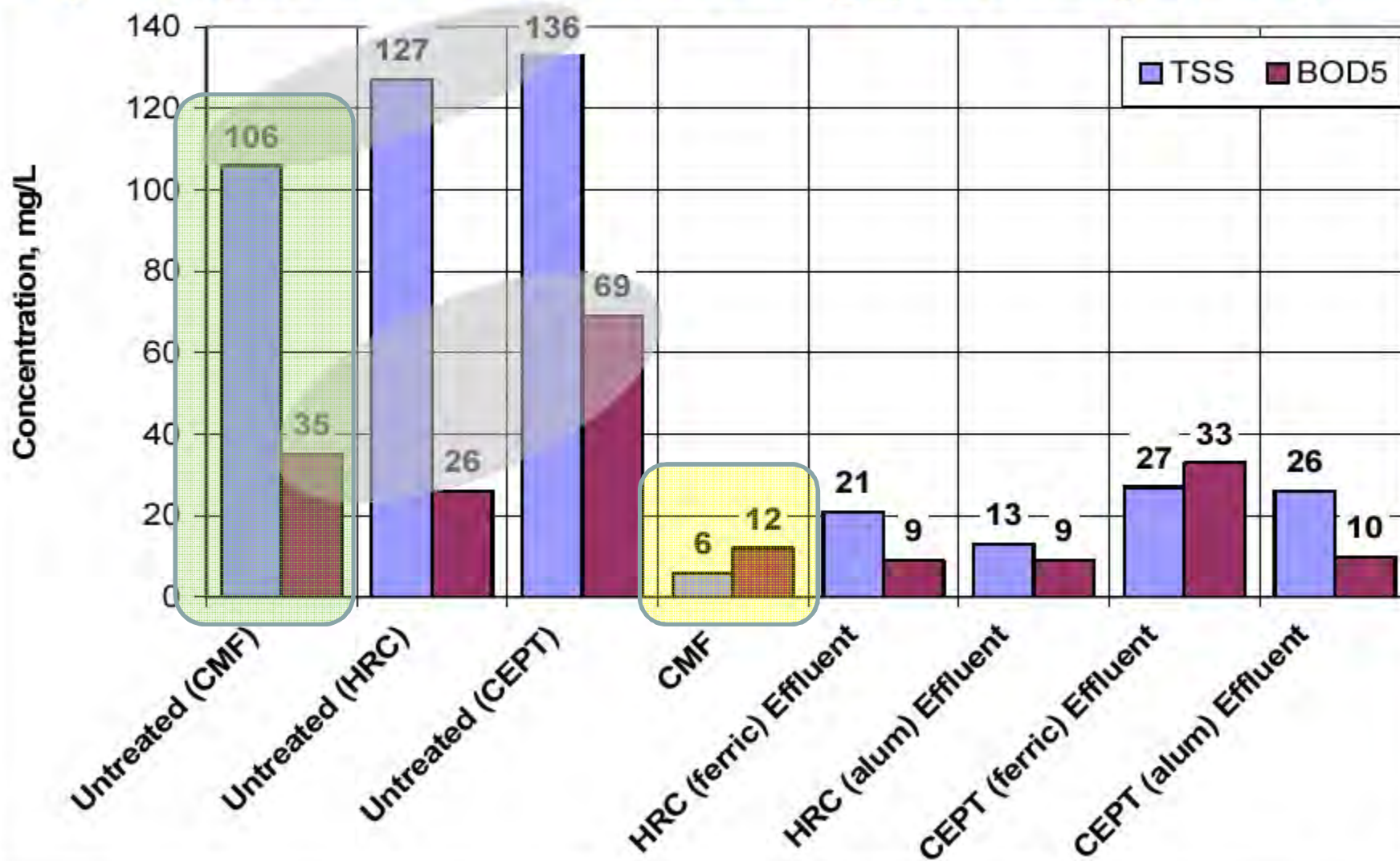
TP = 0.4 mg/L

NH₃-N = 2.2 mg/L

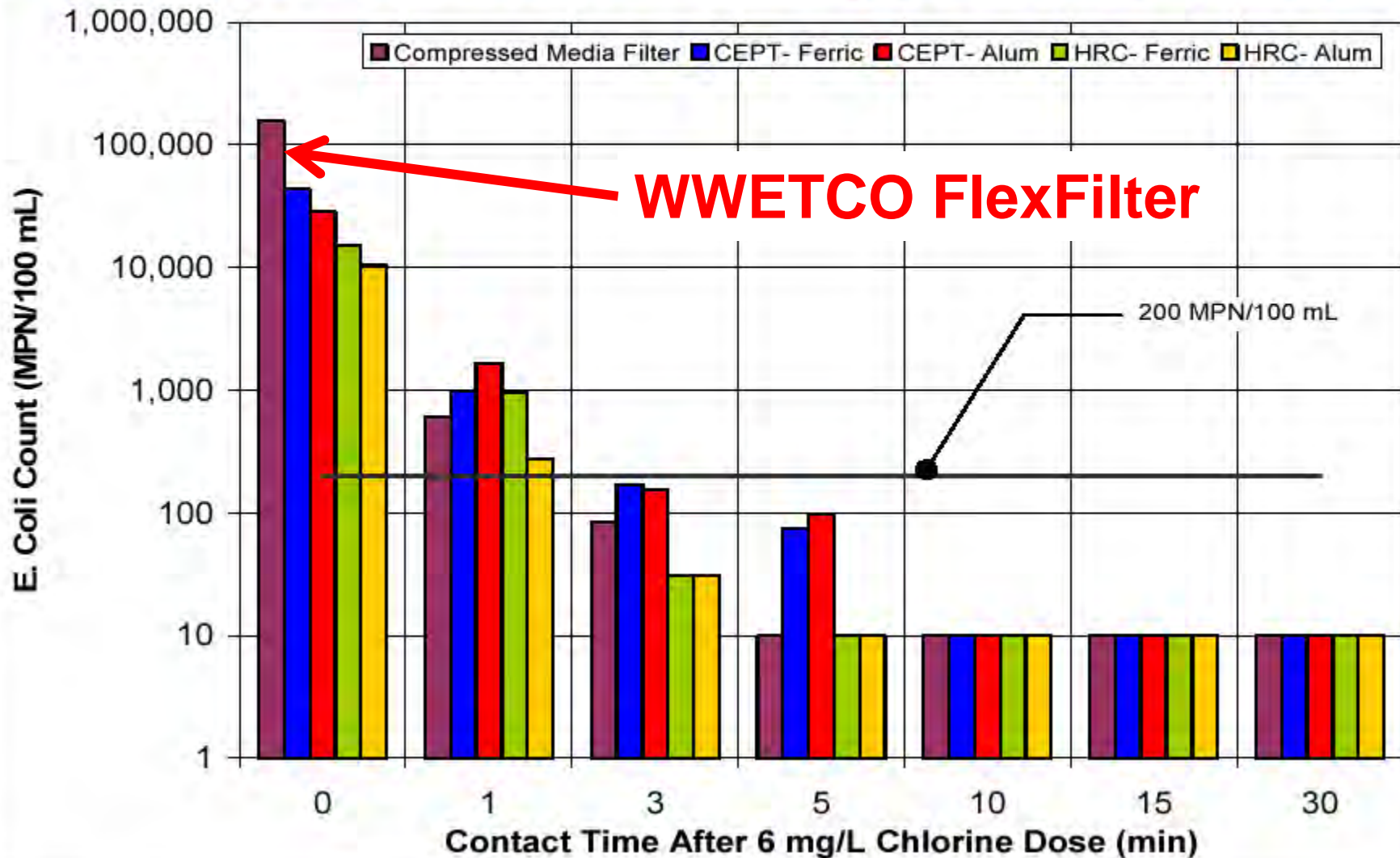
Other Benefits:

- Pathogen Indicators: Compressible Media Filtration produces an effluent with particle size equal to or less than 10 microns amenable to both chemical or UV disinfection, proven to meet Recreational criteria.
- 50% Discharge Volume Reduction: Treatment system captures small events and returns organics for uniform biological treatment.

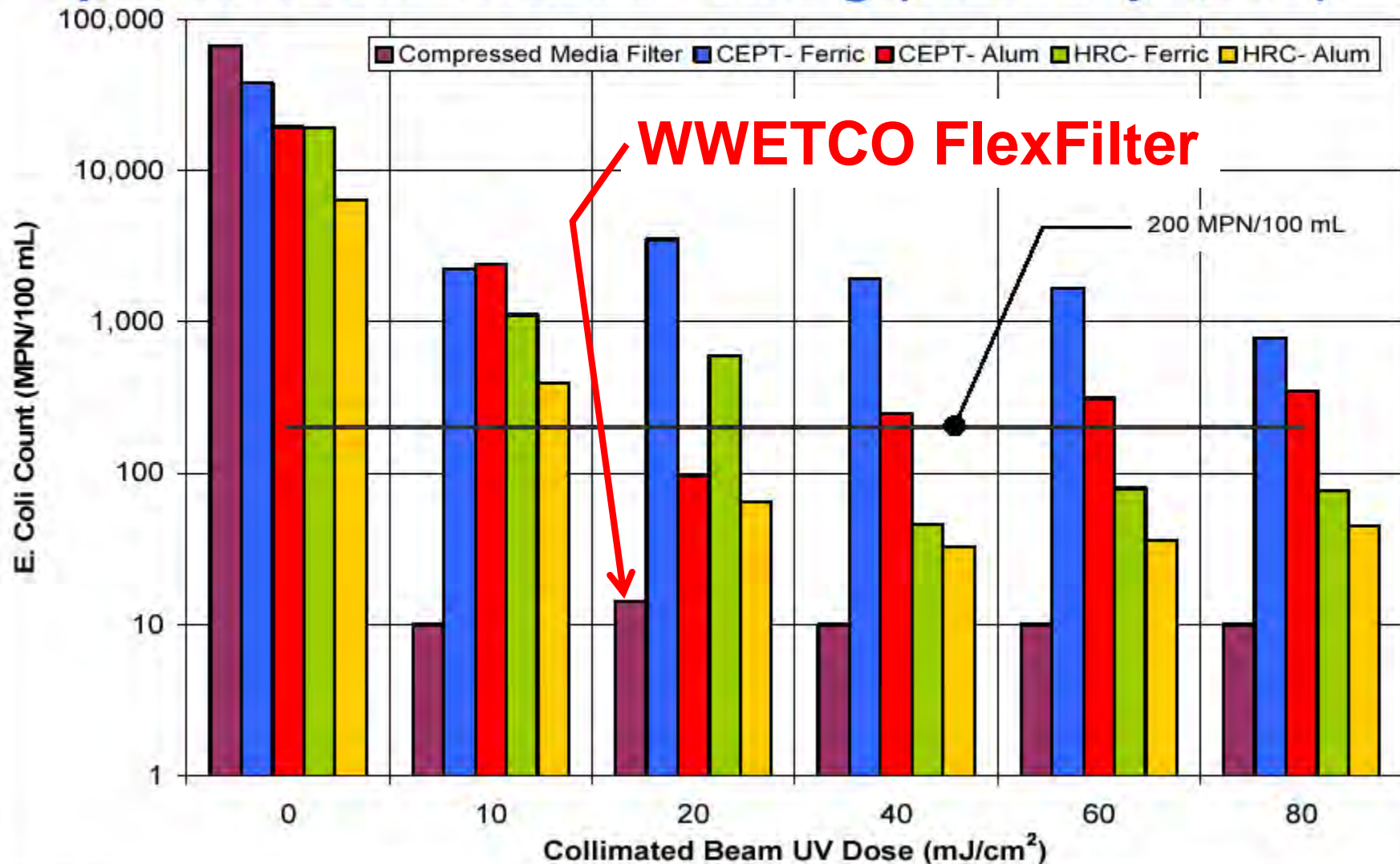
April 2009 Wet Weather Testing (St. Joseph, MO)



April 2009 Wet Weather Testing (St. Joseph, MO)



April 2009 Wet Weather Testing (St. Joseph, MO)



WWETCO FlexFilter CMF Technology



**Satellite Treatment &
Design Considerations**

REPORT

Wet Weather Flow Treatment and Disinfection Demonstration Project

Bayonne Municipal Utilities Authority
City of Bayonne, Hudson County, NJ

September 2017

[https://www.state.nj.us/dep/dwq/pdf/WWF
TDDP_Report.pdf](https://www.state.nj.us/dep/dwq/pdf/WWF_TDDP_Report.pdf)



This report was funded, in part, with Grants from the United States Environmental Protection Agency (USEPA) and the New Jersey Department of Environmental Protection (NJDEP). The report was developed and implemented in cooperation and in consultation with USEPA and NJDEP.

Multi-Year Study to test and evaluate specific satellite treatment

High-performance satellite end-of-pipe treatment can:

- Protect public health and aquatic biology
- Be a cost effective alternative
- Provide pollutant reductions meeting secondary criteria
- Capture more frequent small events
- Reduce sediment oxygen demanding loads
- Offer a foundation for green spaces & other community amenities

Satellite Treatment
facilities can be:

- Unmanned
- Odor free
- Adaptable to multiple locations
 - Small footprint
 - Below grade

Jointly Funded by USEPA & NJDEP

Project Collaboration: Technical Advisory Committee



The Trinity

Technical Advisory Committee Members:

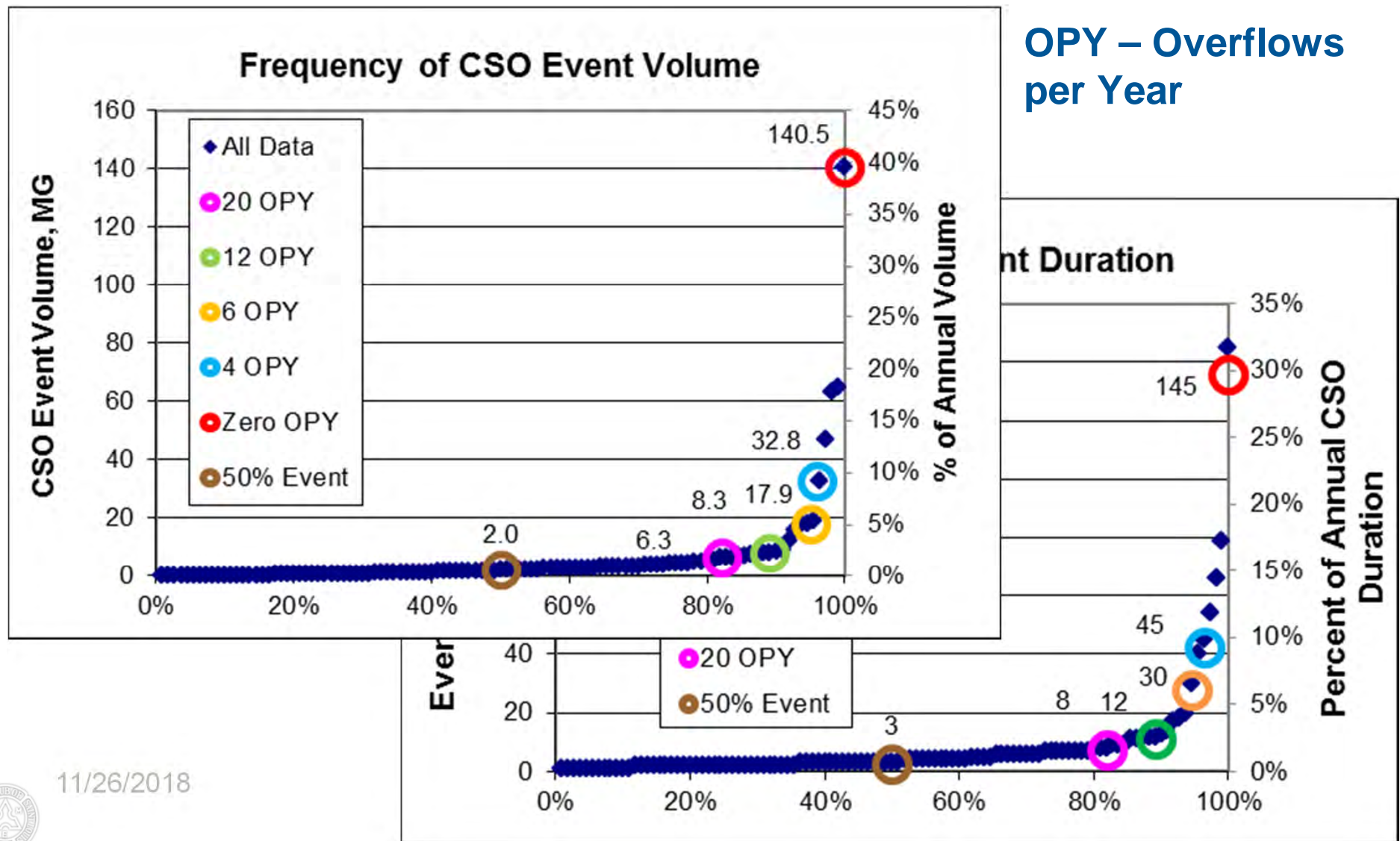
- **Daniel Murray, P.E. (EPA ORD)**
- **Richard Field P.E., D.WRE, BCEE (EPA ORD, Retired)**
- **Peter Moffa, P.E.**
- **Jurek Patoczka, PhD, P.E.**
- **Qizhong Guo, PhD, P.E. (Rutgers)**

Oversite Committee Members:

- **Stanley Cach, P.E., D. WRE BCEE (NJDEP)**
- **Shadab Ahmad, P.E. (NJDEP)**
- **Thomas O'Conner, P.E. (EPA ORD)**



The historical distribution of wet weather event contributions are evaluated with respect instream STV criteria to determine design treatment levels.



11/26/2018



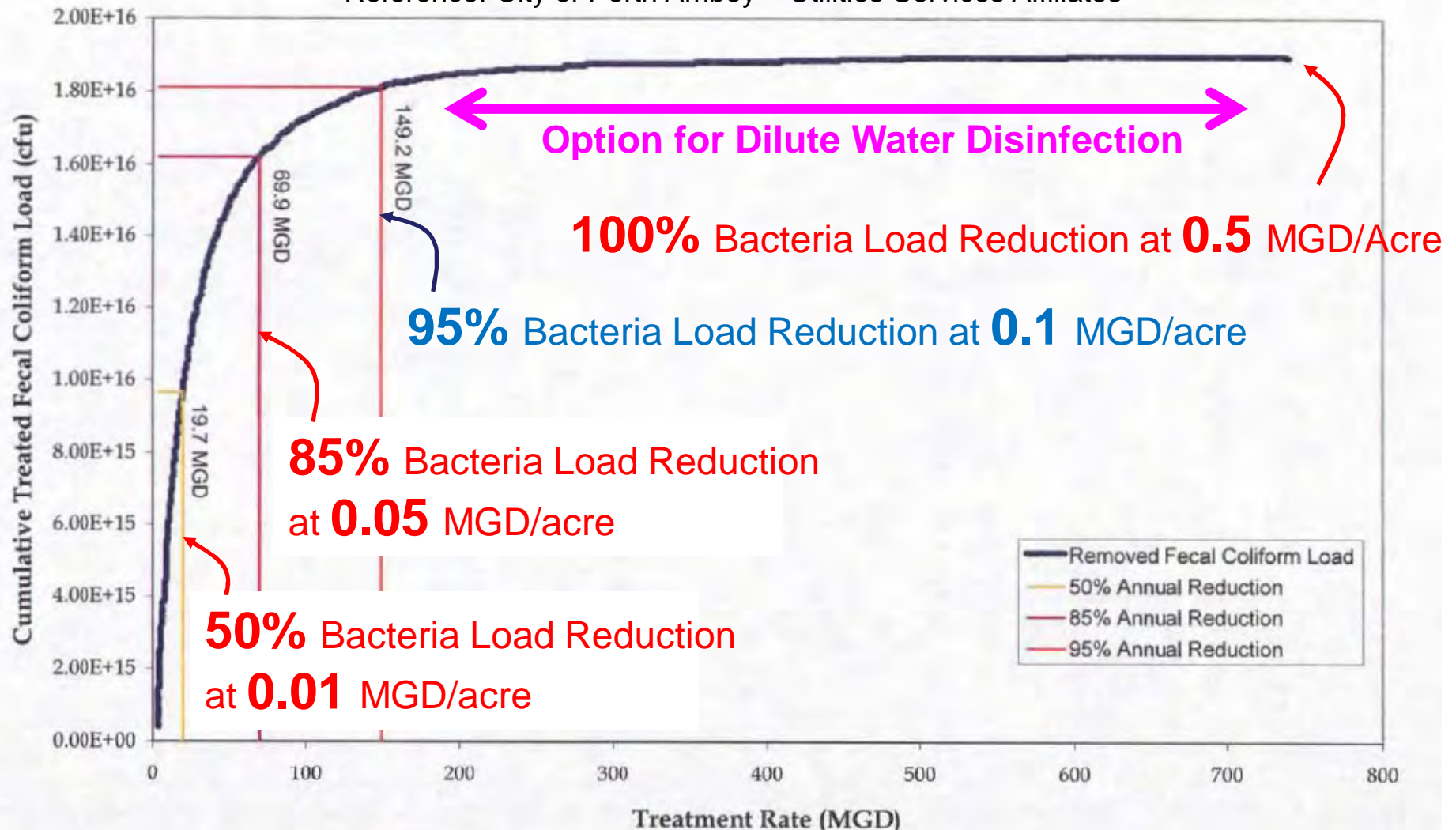
Design Approach to Solids Removal and Disinfection Satellite Treatment

Example shows treatment rate based upon 95% bacteria load reduction equates to 0.1 MGD per acre of combined sewer drainage area.

System Wide Removed Annual Fecal Coliform Loading at Varying Treatment Rates

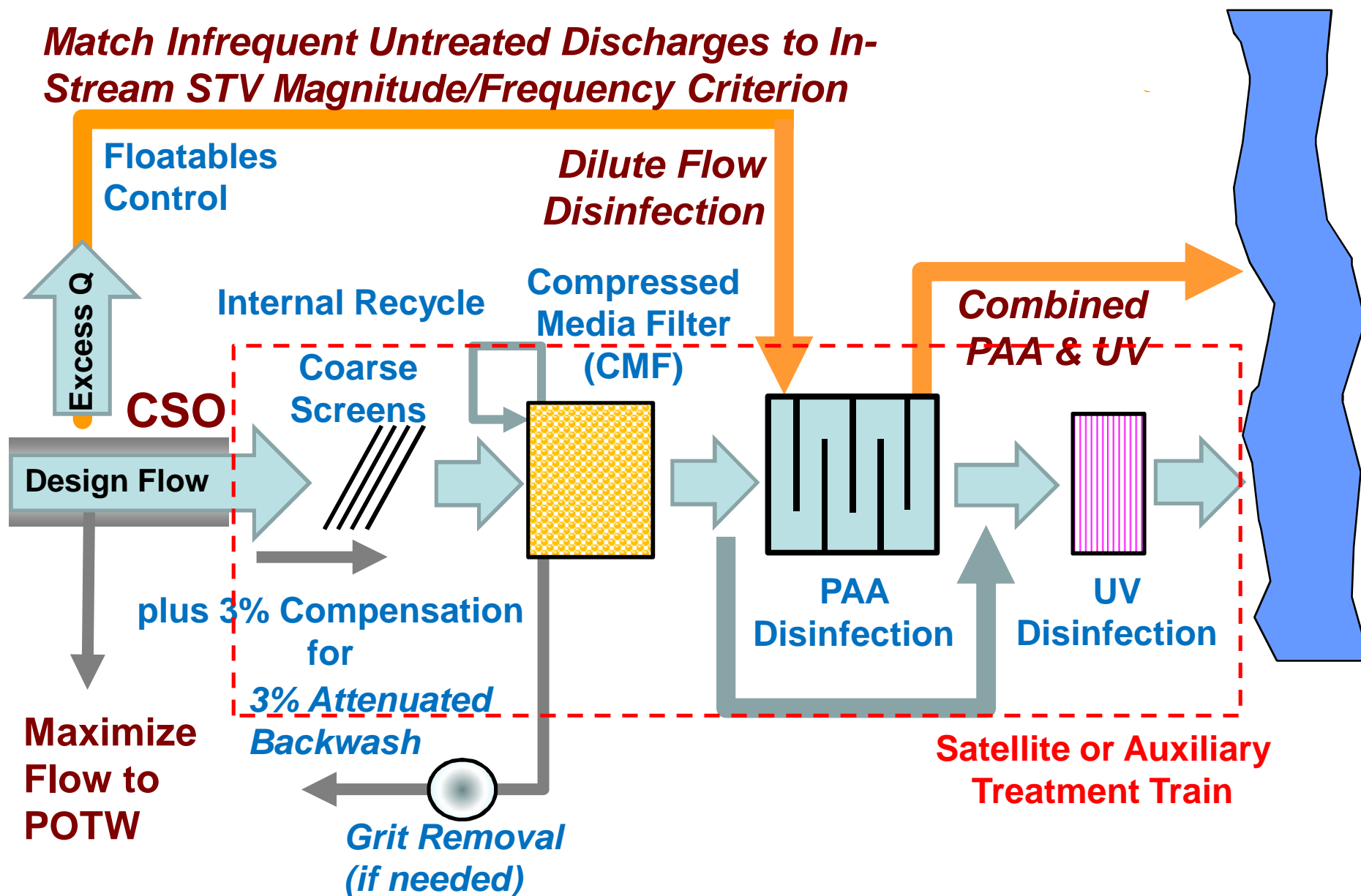
Based on JFK Airport Rainfall Record 1988

Reference: City of Perth Amboy – Utilities Services Affiliates

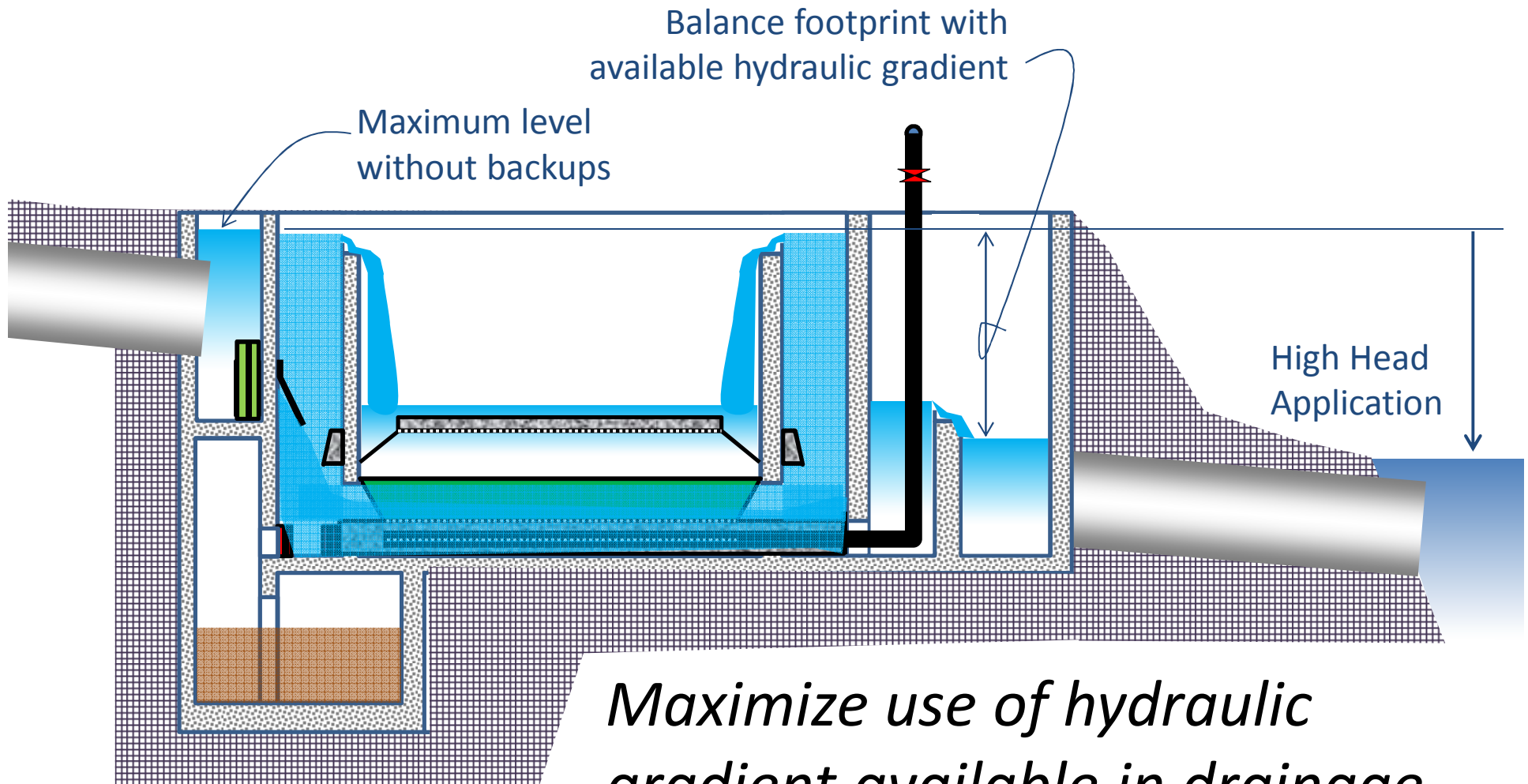


Staged Treatment Approach for Wet Weather Auxiliary & Satellite Facilities

Match Infrequent Untreated Discharges to In-Stream STV Magnitude/Frequency Criterion

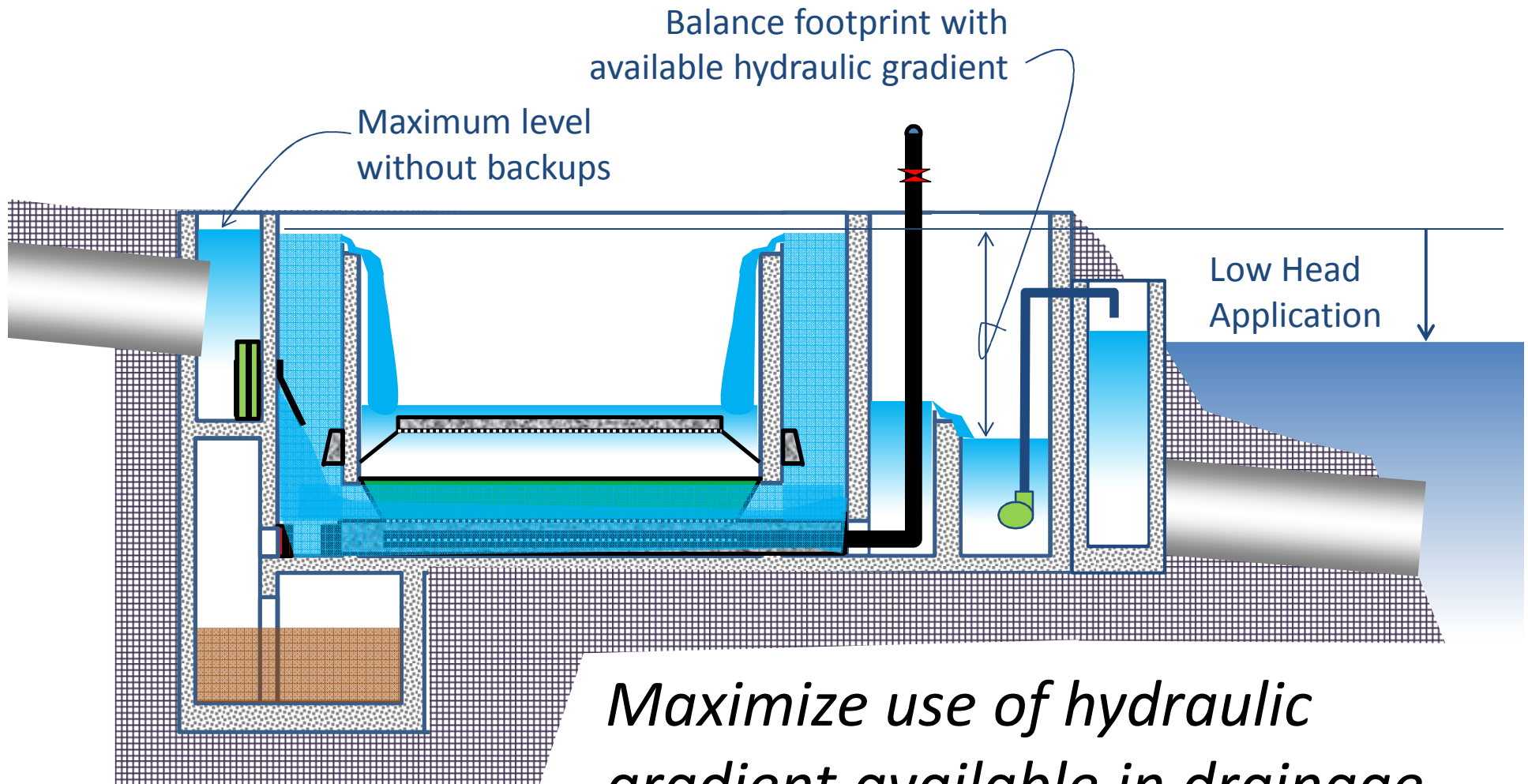


Satellite Facility Hydraulics



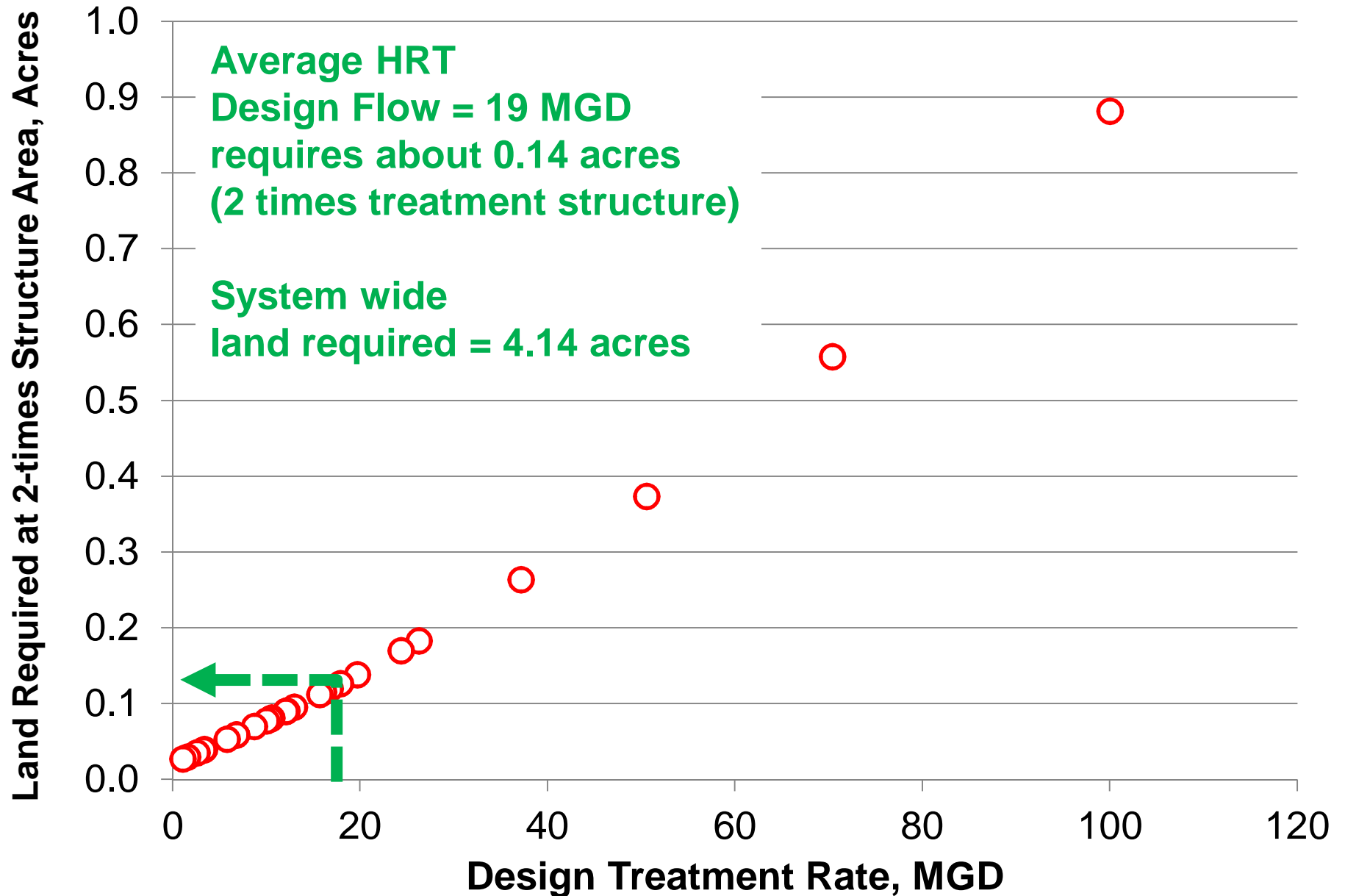
Maximize use of hydraulic gradient available in drainage system...

Satellite Facility Hydraulics

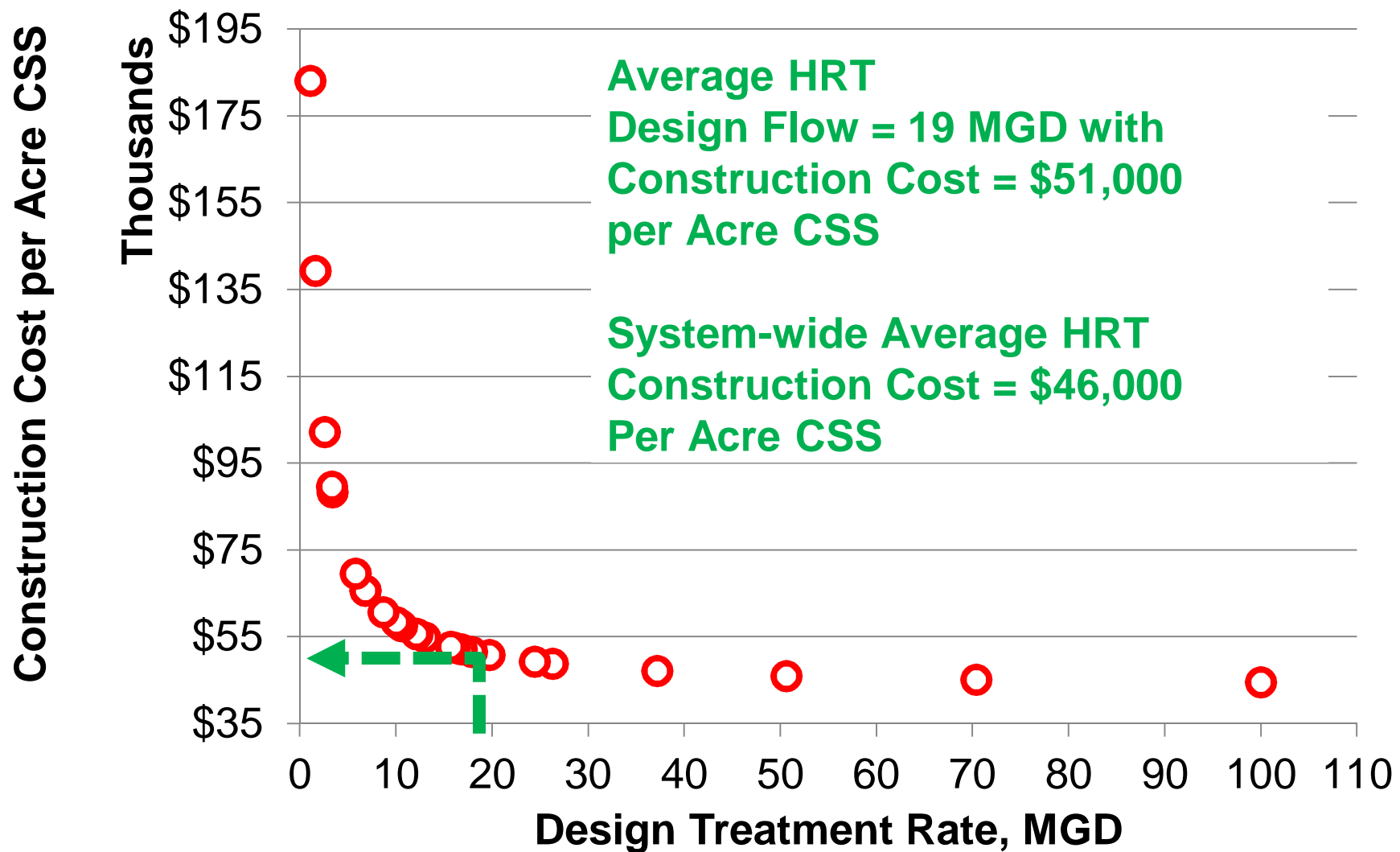


Maximize use of hydraulic gradient available in drainage system... low-head effluent pumping when needed

Land Requirements for 28 System Wide HRT Facilities at 95% Bacteria Treatment Level



Construction Costs for 28 System-Wide HRT Facilities at 95% Bacteria Treatment Level



Takeaway

- HRT facilities can be designed as satellite systems to treat episodic wet weather CSO events to protect the beneficial uses of receiving waters.
- CMF HRT facilities can meet secondary treatment effluent criteria and are amenable to disinfection by either UV or chemical disinfection.
- Auxiliary HRT systems at the WWTP can add significant dual function benefits as tertiary or enhanced primary treatment capacity.

A large, textured orange sphere, resembling a pom-pom or a fuzzy ball, is centered against a light blue background. The sphere is made of many fine, orange fibers. Overlaid on the sphere is the word "Questions?" in a bold, white, sans-serif font.

Questions?