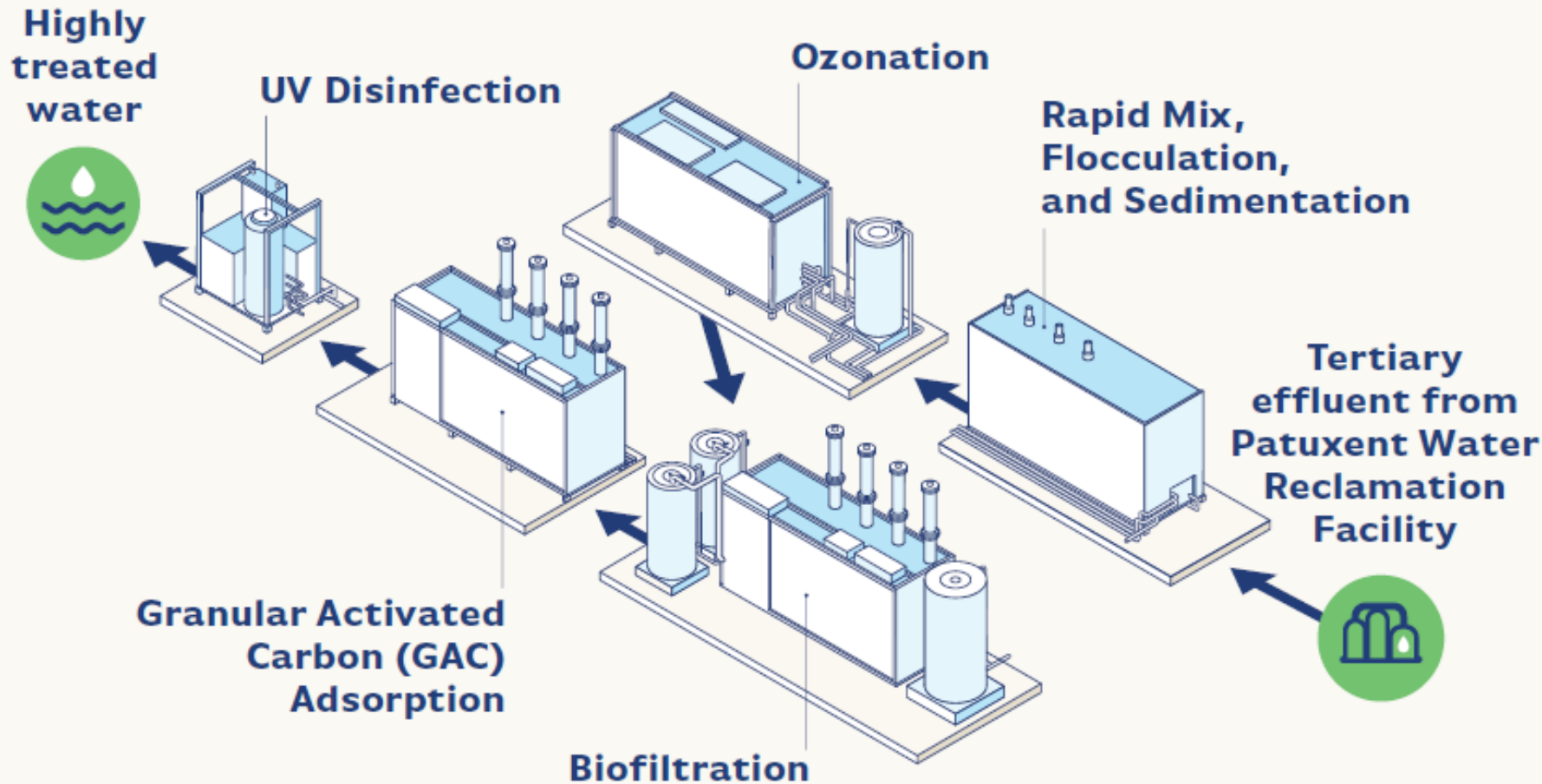


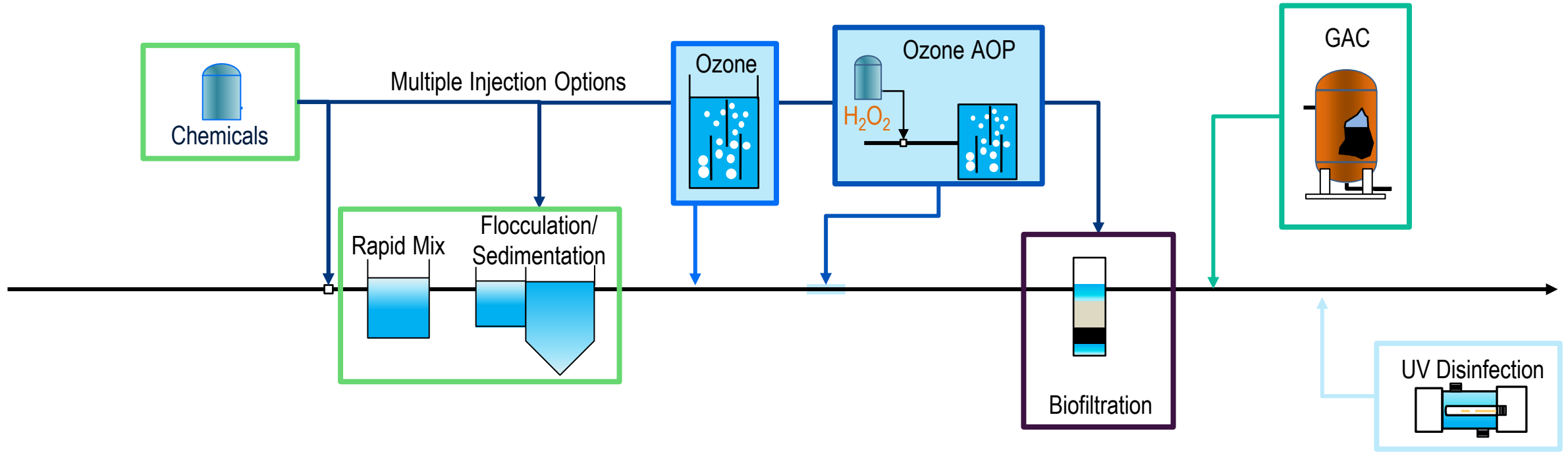


MAR Pilot



Converting high quality wastewater effluent to *beyond* drinking water quality

Carbon-based Treatment Train Selection



Chemicals/Rapid Mix/Floc Sed

- Pathogens
- DBP-FP
- Corrosion Control
- End Use Req.
- TOC/Turbidity

Ozone

- Pathogens
- CECs
- DBP-FP
- Bromate Formation

AOP

- Pathogens
- 1,4 Dioxane
- CECs
- DBP-FP
- Bromate Reduction

BAF

- Pathogens
- Turbidity
- TOC
- Iron/Manganese
- CECs
- DBP-FP
- NDMA

GAC

- Pathogens
- TOC
- PFAS
- CECs
- DBP-FP

UV Disinfection

- Pathogens

Our wAAtEr Treatment Goals for Piloting



Safe Drinking Water Act
Compliance

End Use Requirements
(TOC, Turbidity, Aquifer
Compatibility, Corrosion
Control, Microbial Risk)

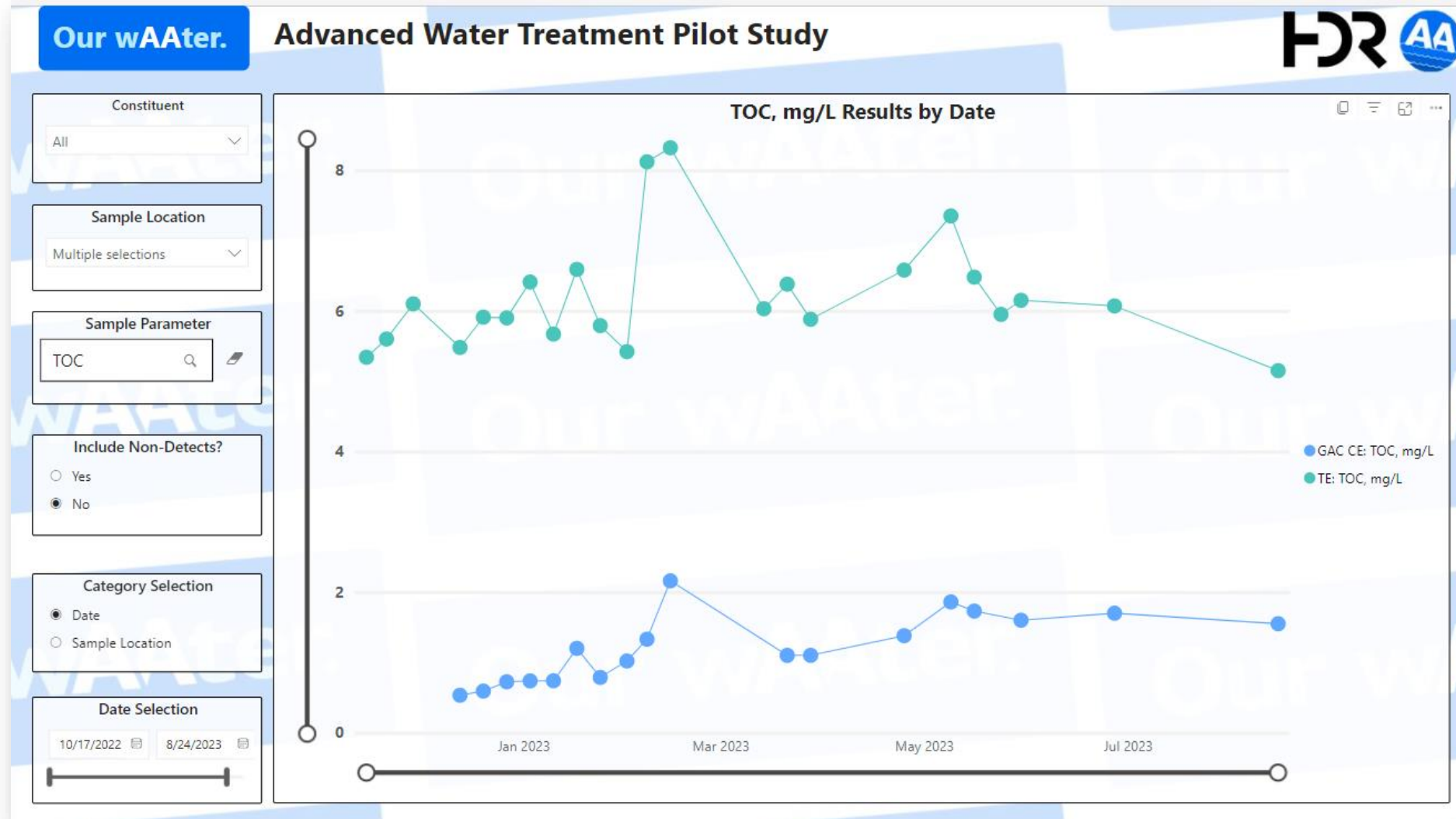
**Potable Reuse
Monitoring**

Pathogens (*Giardia*, *Crypto*,
Viruses)

Constituents of Emerging
Concern

Pilot Data Visualization Dashboard

- Tool developed by HDR
- Used for visualizing KPIs, online monitoring and process optimization
- Linked to pilot online data as well as lab data
- Can be used by the County for sharing data

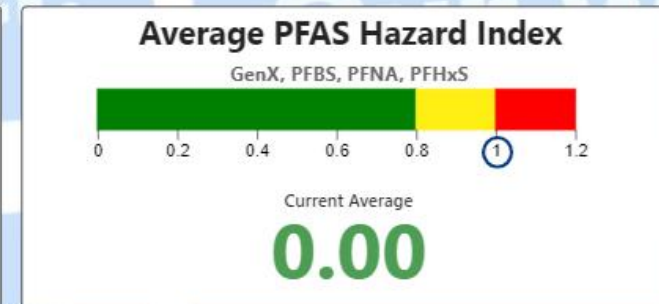
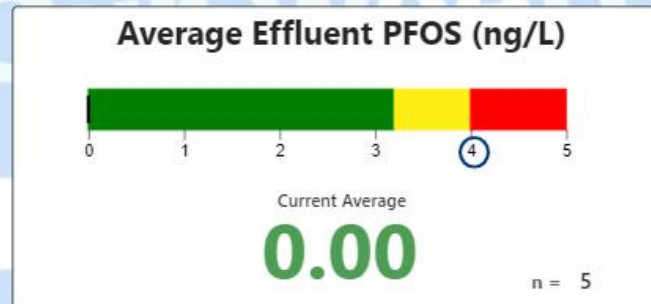
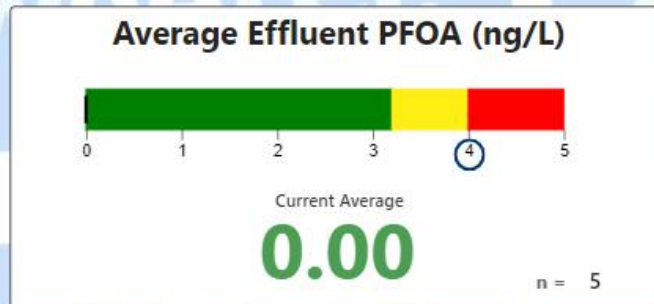
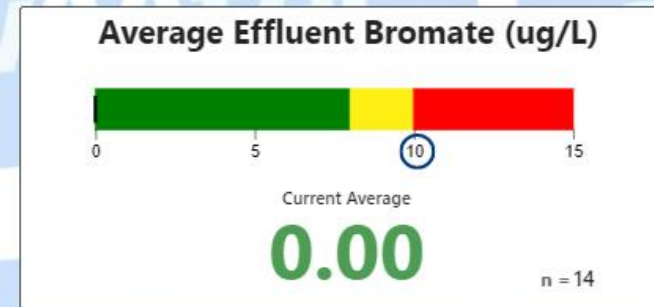
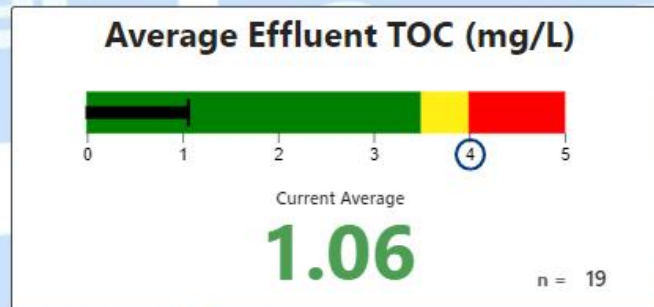


Pilot Key Performance Indicators

Shows real-time performance data

Our wAater.

Advanced Water Treatment Pilot Study



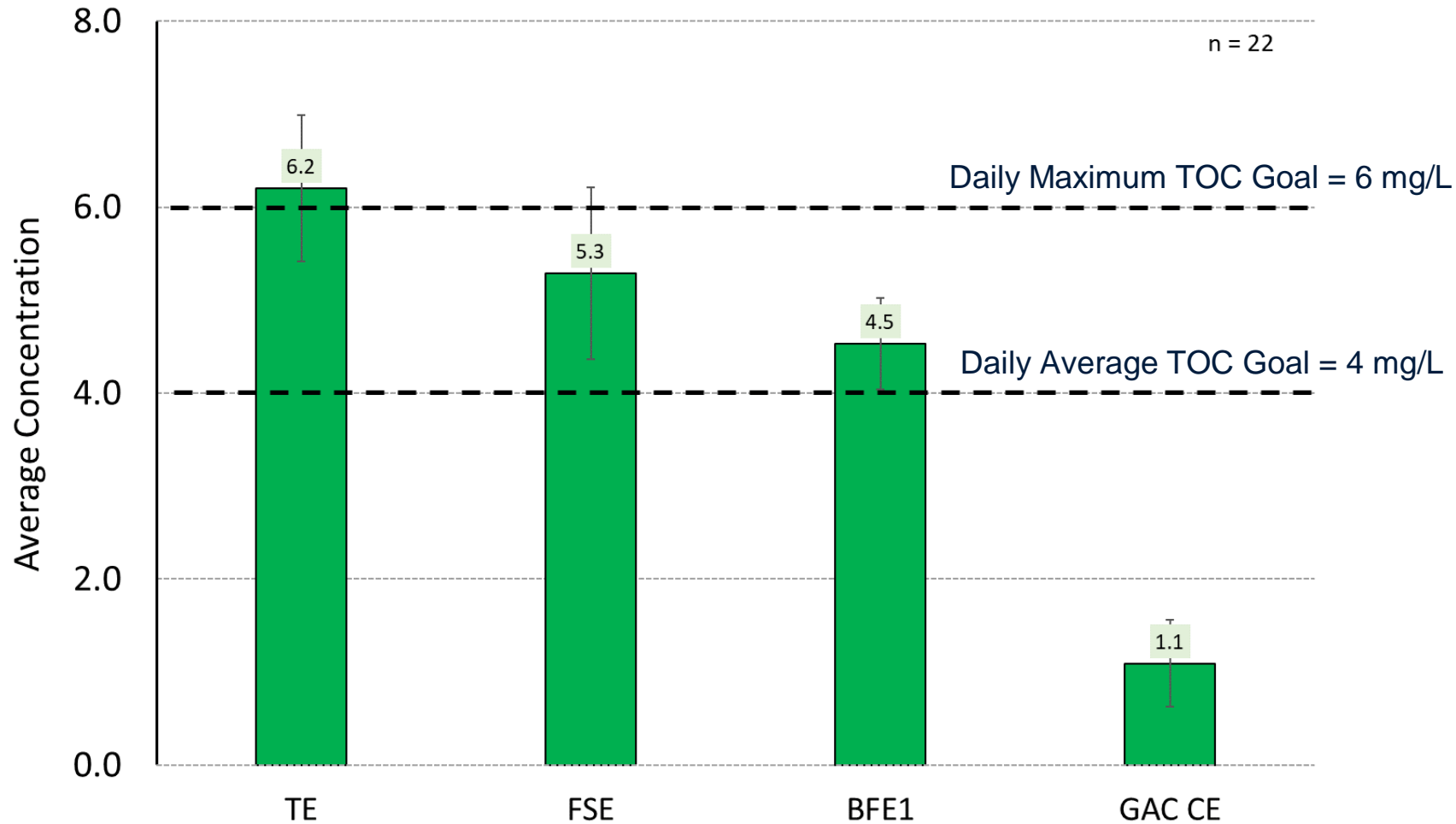
KPI Calculation
Average ▾

Pilot KPIs

Operational Parameters

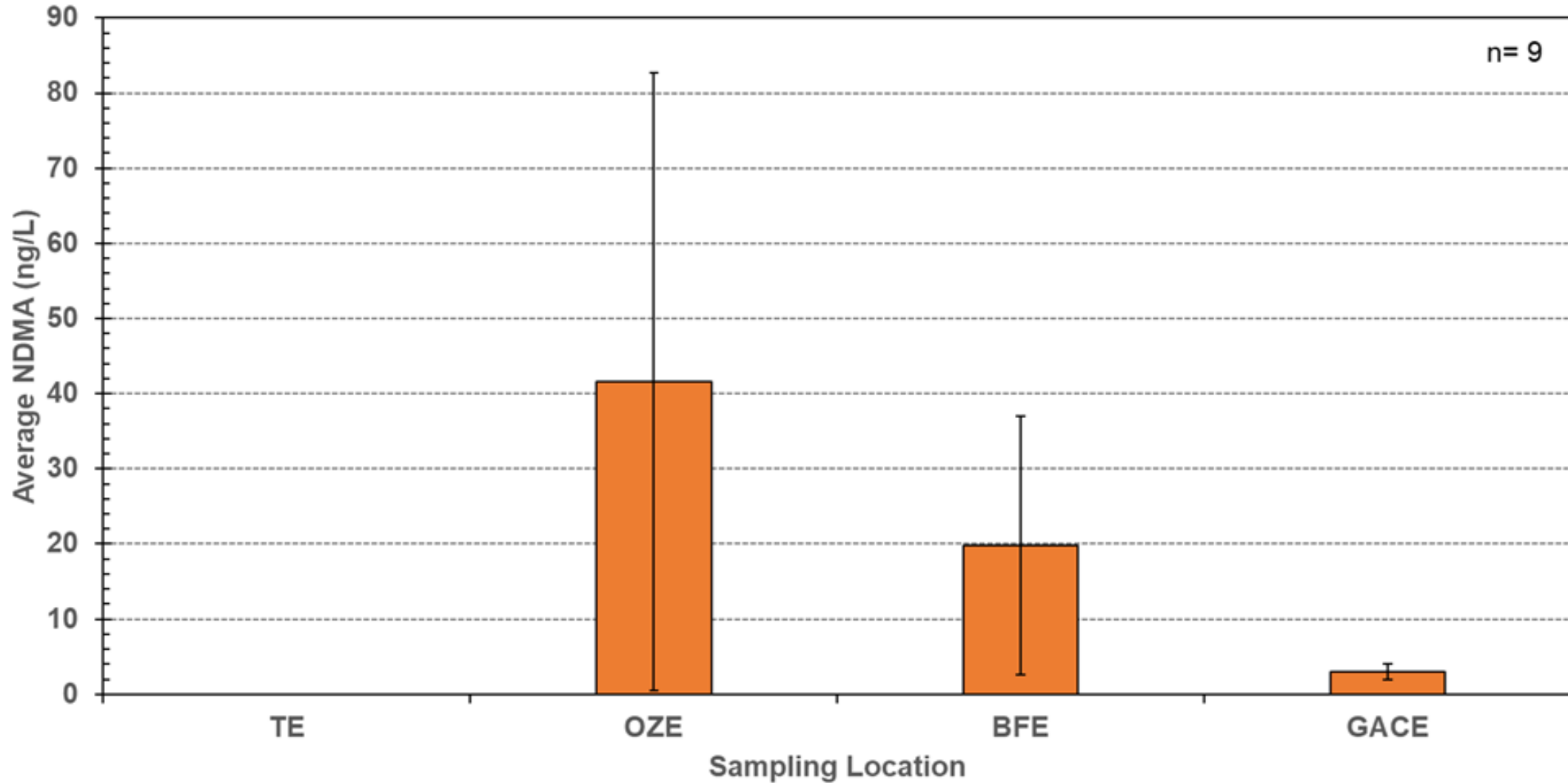
Turbidity KPIs

TOC Reduction Through AWT

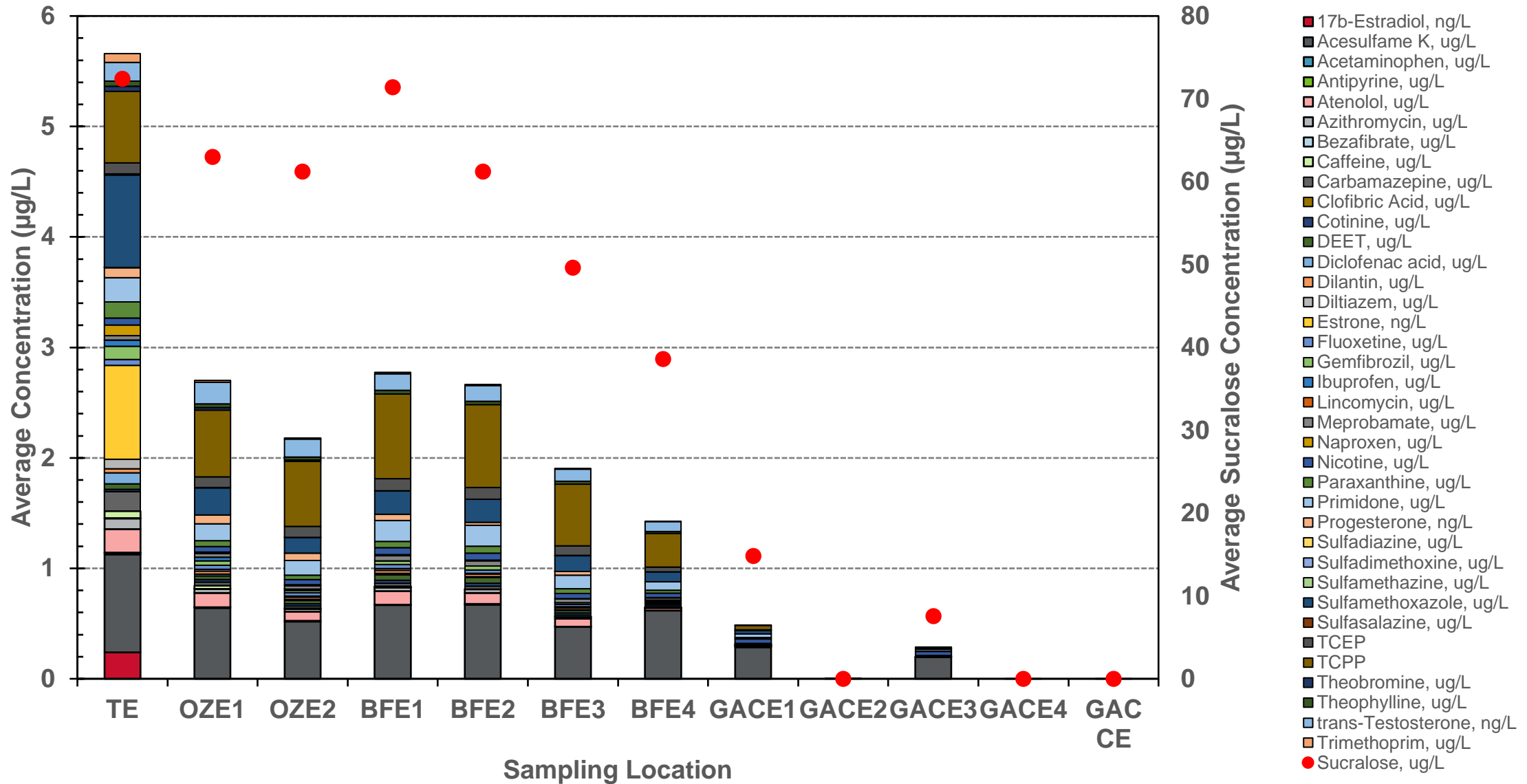


Location	TOC, mg/L (95 th percentile)
TE	8.1
FSE	7.3
BFE1	5.2
GAC CE	1.9

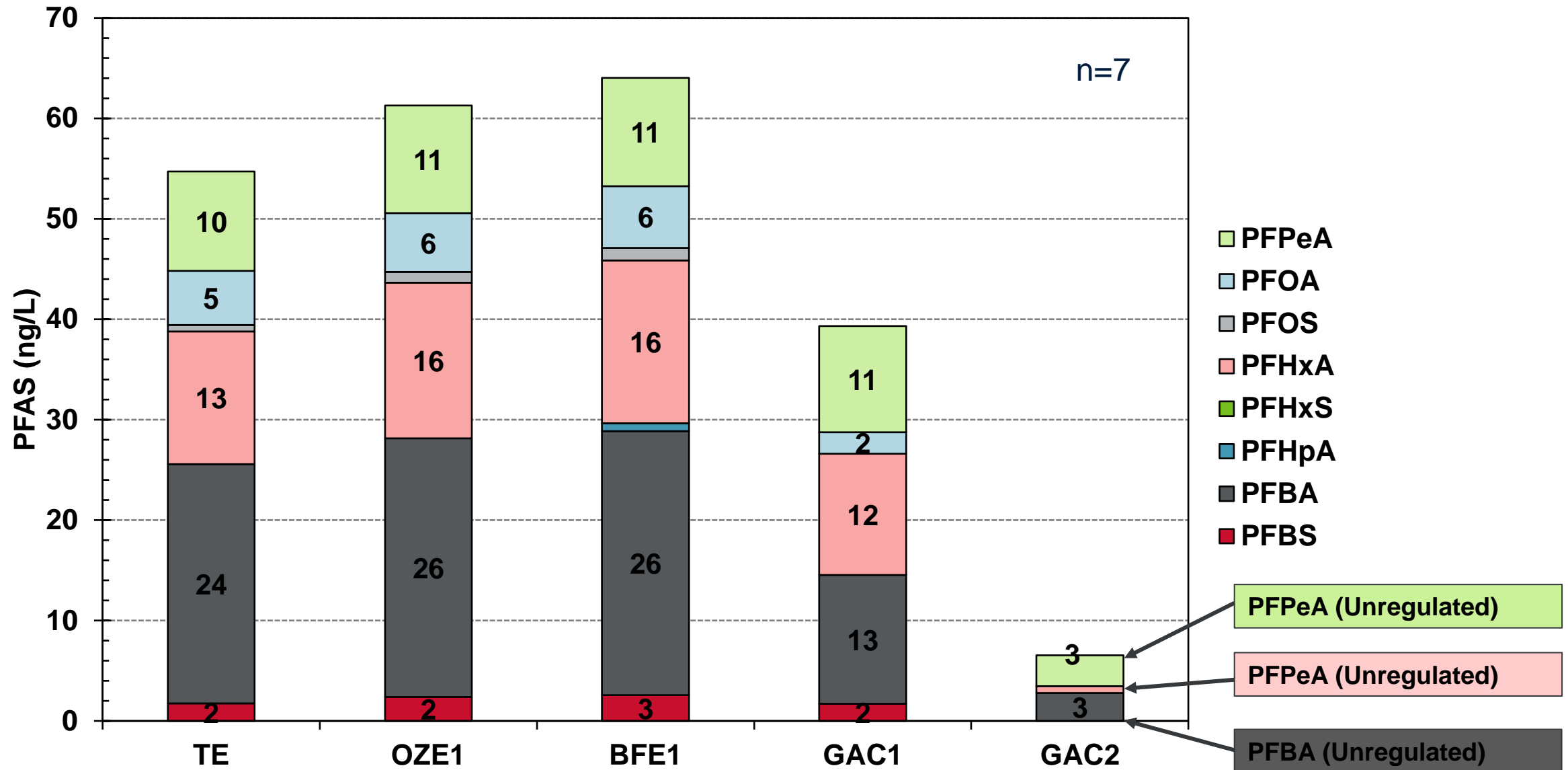
Disinfection Byproduct - NDMA



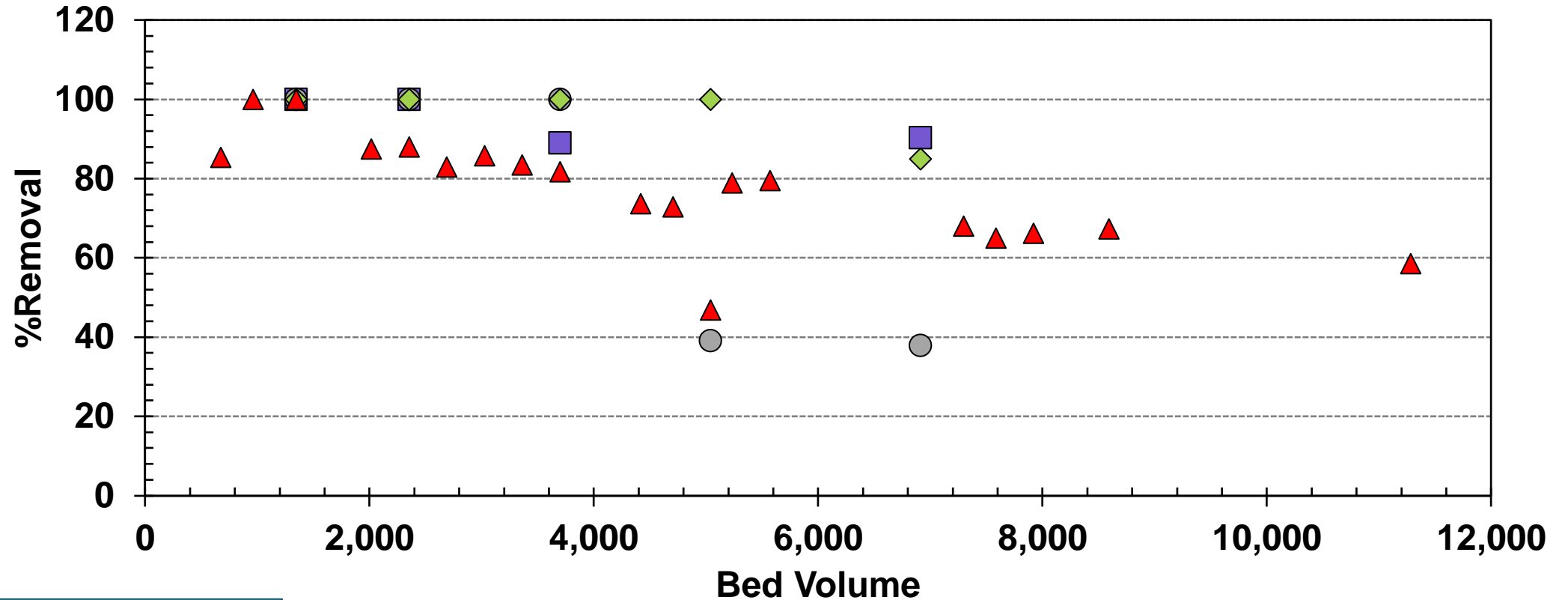
Pharmaceuticals and Personal Care



PFAS Removal Through the Treatment Process



PFAS and TOC Removal by GAC



• PFOA & PFOS – Proposed MCL 4 ppt
• PFNA, PFHxS, PFBS, HFPO-DA (GenX) – Proposed HI 1.0
Note: No regulated compounds have seen breakthrough

■ PFBA ● PFPeA ◆ PFHxA ▲ TOC
Short Short Long

Pathogen Data

Parameter	Log Reduction Credits						Total
	Floc/Sed*	BAF	Ozone (5-6 mg/L)	GAC	UV disinfection (200-300 mJ/cm ²)	Chlorine disinfection	
Enteric Viruses	0	2	3	0	4	3	12
Cryptosporidium	0	4	0	0	6	0	10
Giardia	0	2.5	1.5	0	6	0	10

*BAF log reduction credits include those achieved by floc/Sed. Floc/Sed contributes to log reduction credits only when it is in combination with biofiltration.

Microorganism	LRV
	12-10-10 Criteria Microorganisms
Enteric Viruses	Below Detection Limit in Feed Water
Giardia	Below Detection Limit in Feed Water
Cryptosporidium	Below Detection Limit in Feed Water
Other Microorganisms Frequently Tracked	
Coliphage	Below Detection Limit in Feed Water
Fecal Coliform/E. Coli	>3.38
Heterotrophic Plate Count	>2.11
Legionella	0.45 ¹
Pepper Mild Mottle Virus	>3.08
Total Coliform	>3.38

Notes:
 1. Legionella data requires additional testing due to contamination event during sampling.

- 12-10-10 pathogen removal credits through the AWT train
- LRV monitoring results to date
- UV target is 186 mJ/cm²

Independent Scientific Advisory Panel



- ISAP meetings were held remotely
- MDE had provided questions prior to sessions
- Basic Format for meetings
 - Presentations from the DPW Project Team
 - Questions from panel members
 - Clarifications on MDE questions
- Final Report May 2023
- Follow up in person meeting Sept. 2023



Anne Arundel County Managed Aquifer Recharge Pilot Project

Independent Advisory Panel Findings and Recommendations for Meetings 1 and 2 April 27 and May 26, 2022

Prepared for

Anne Arundel County Department of Public Works
2662 Riva Rd.
Annapolis, MD 21401

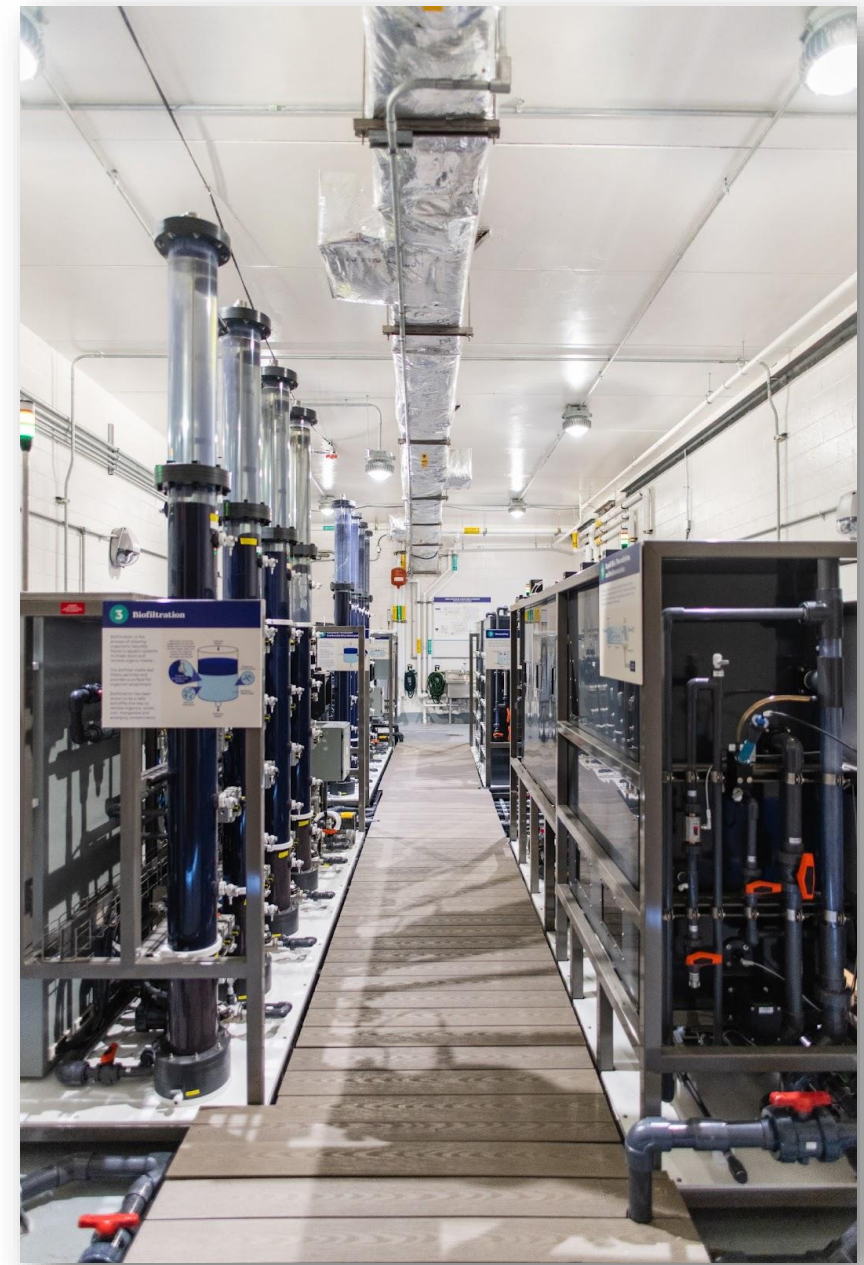
Prepared by

National Water Research Institute
18700 Ward St.
Fountain Valley, CA 92708

May 17, 2023

Next Steps

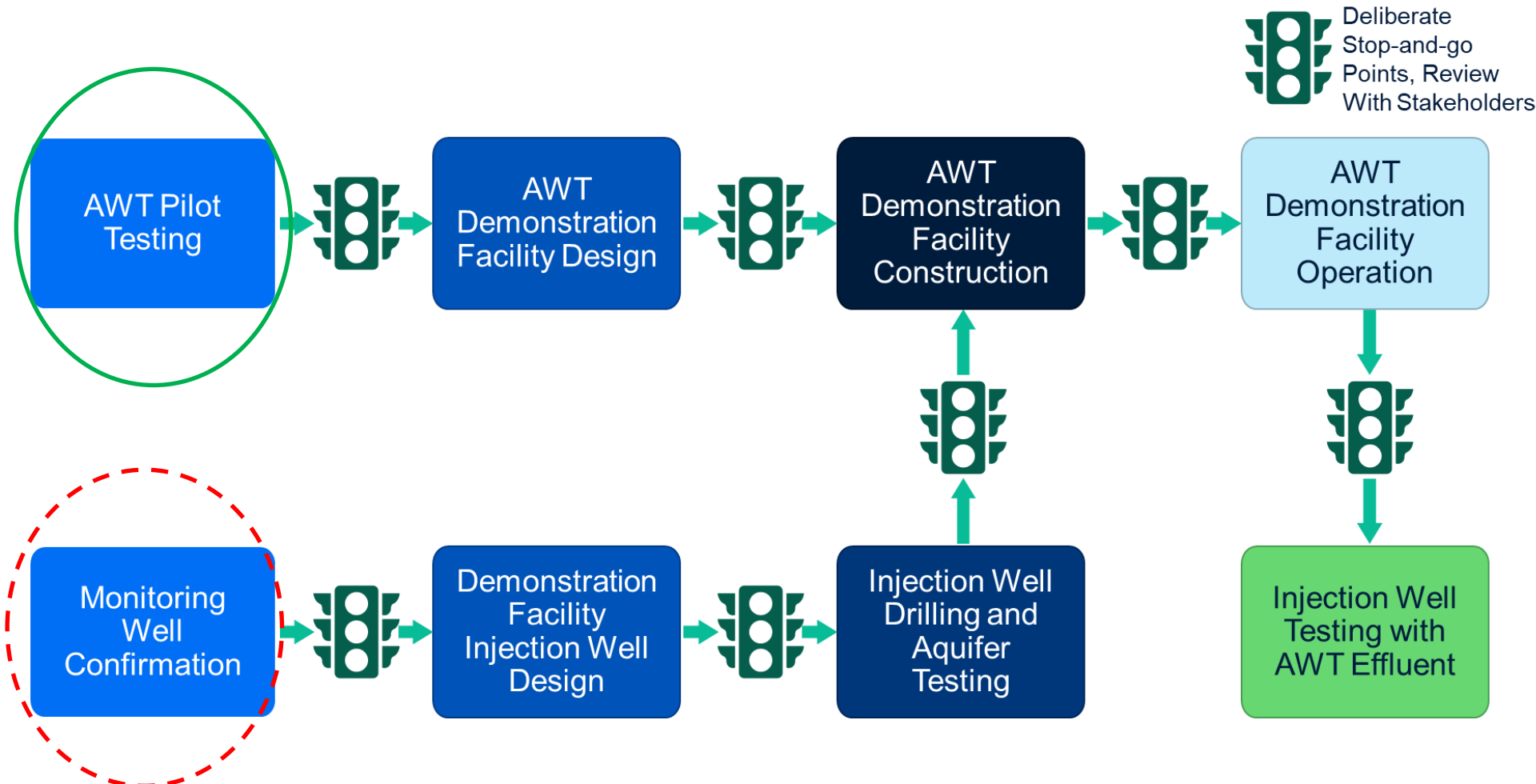
- Continue pilot operation and data collection/analysis to complete pilot validation and define critical control points and design criteria.
- Conduct a Rapid Small-Scale Column Test (RSSCT) for GAC media selection by evaluating various media for PFAS removal.
- Implement and test a novel UVLED technology to validate pathogen removal credits.
- Maintain engagement with internal and external groups to share findings/data and receive feedback.
- Provide additional opportunities for outreach and information through public tours.



Site Tours



Go Further / No Go Process for Testing



Multiple steps for review and confirmation prior to implementation

Testing is required to confirm suitability for implementation

Our Roadmap to Renewable Water

- Pilot
- ISAP review
- Demonstration concept
- MDE buy-in

- Pilot
- Demonstration procurement
- Regulation development

- Demonstration design
- Permitting

- Initial well drilling
- Demonstration construction

- Demonstration construction

- AWT demonstrated performance
- Well testing using AWT water

2023

2024

2025

2026

2027

2028

Requires collaboration, based on scientific research, between DPW staff, regulators, ISAP, and elected officials.

A person is silhouetted against a vibrant sunset sky, sitting on a white plastic chair on a wooden pier. They are holding a fishing rod that extends into the air. The sun is low on the horizon, casting a golden glow over the water and sky. The pier is made of wooden planks that lead towards the water.

Our wAAter.

THE ANNE ARUNDEL CLEAN WATER PROGRAM

Thank you!



DPW & YOU

— Making a difference, together —