

Typical Plant and Distribution Operation – Unexpected DBP Results

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Ohio AWWA Water Distribution Seminar
July 7, 2009

Disclaimer

The emphasis of this presentation is on presenting results for distribution system field studies of two surface water treatment plants.

If your source-interest is groundwater or chloramines, now would be a great time to take a napzzzzzzzzzzzz

Overview

- Project Scope
- Typical Operations
- Field Study Details
- Expected Results
- Unexpected Results
- Operation Considerations
- Stage 2 DBP Compliance

Project Scope

- Conducting System Specific Study (SSS) – Initial Distribution System Evaluation (IDSE) – Site selection guidance sound?
- “Typical” plant and distribution system operations and meeting Stage 2 DBP Requirements – Will we see expected impact-results?



“Typical” Operations

- Chlorine Dose Management – Balancing maintaining chlorine residual in distribution system with minimizing disinfection byproduct (DBP) formation
- Total-Dissolved Organic Carbon Reduction – Goal of reducing carbon available to react with chlorine and form DBP
- System Flushing – Improve hydraulic performance and chlorine residual



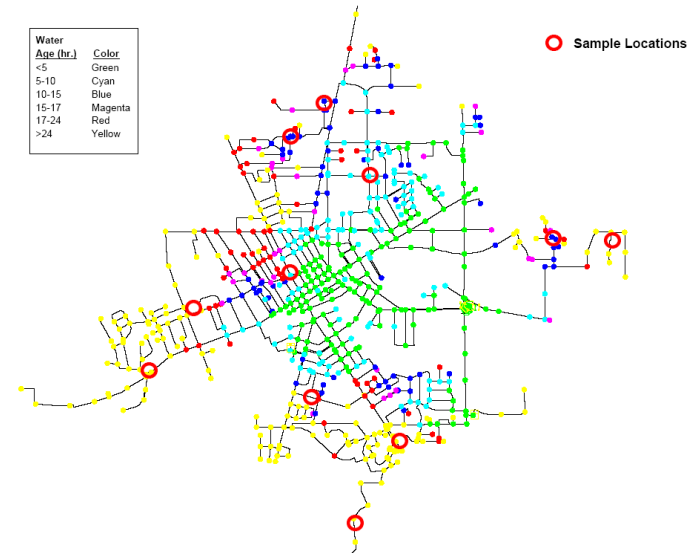
Field Study Details

- Two Northern Ohio surface water plants with chlorine disinfection
- Wanted model update/calibration for IDSE
- Field studies (12 sites)
 - SCADA data
 - Hydrant pressure recorders
 - Chlorine residual
 - DBPs
- Continuous Monitoring

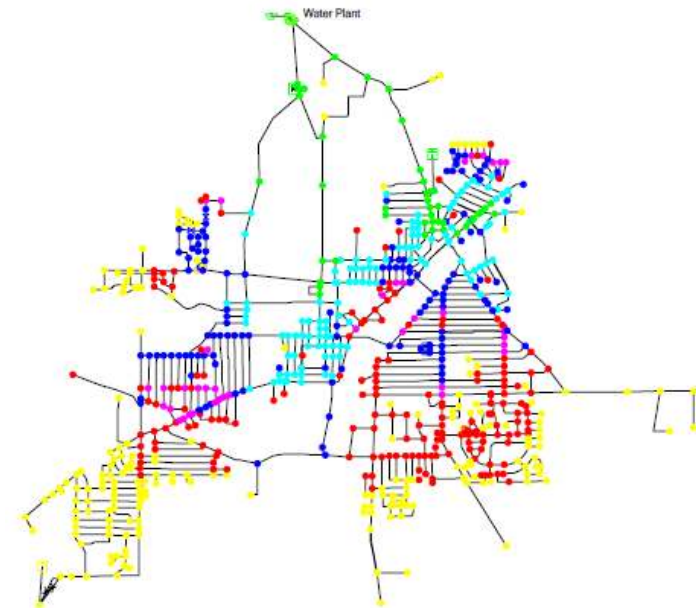


Field Study Details cont.

- Site Selection - followed EPA Stage 2 DBPR Guidance Manual
- Spatially diverse sites, THM sites with high water age, HAA with high water age plus chlorine residual ~ 0.3 mg/L
- Multiple samples during course of the day
- Studies conducted during peak DBP formation period

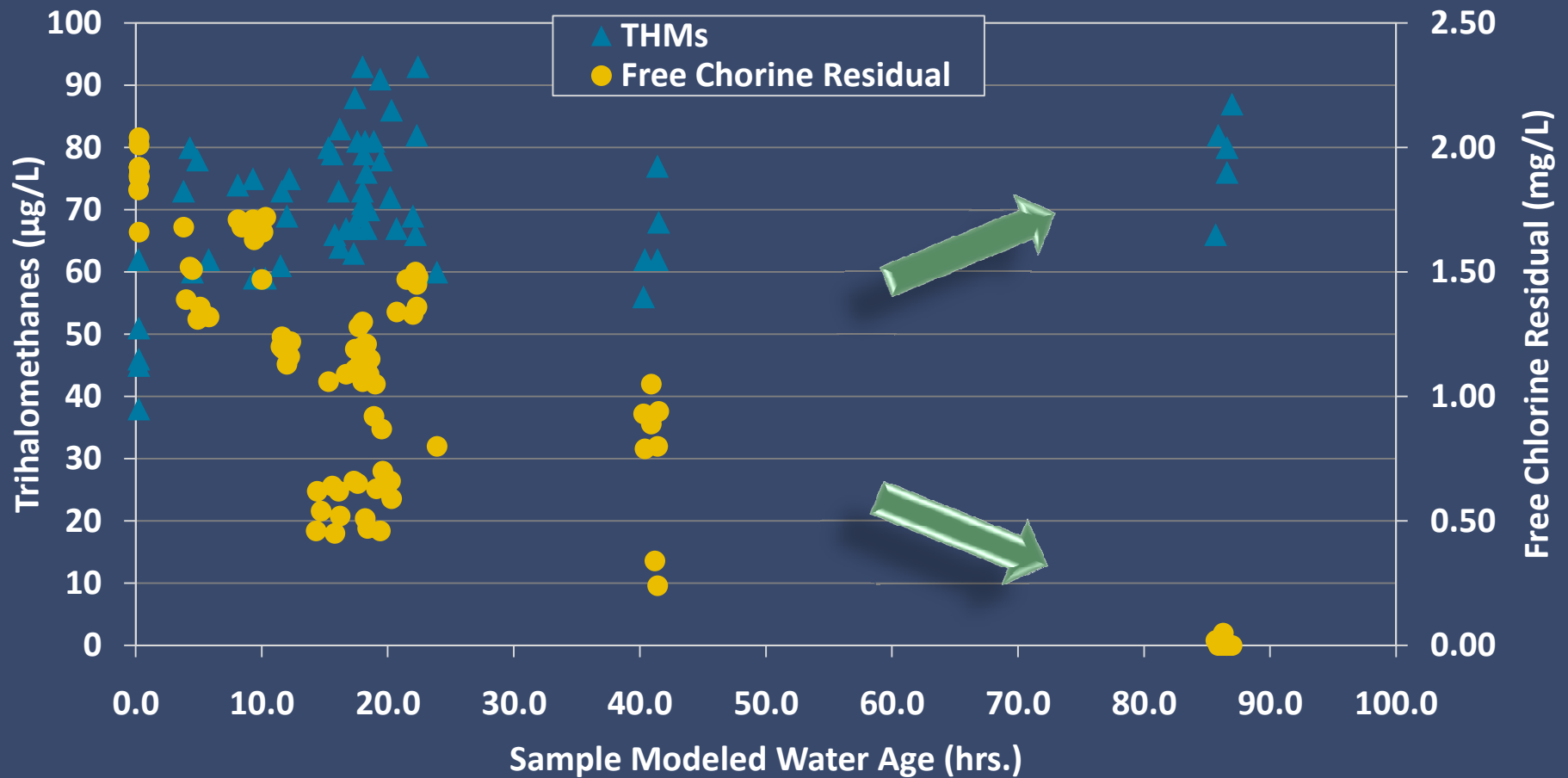


Preliminary site selection and water age simulation. Average Water age values calculated after simulation time of 504 hours using model last updated for USEPA Form 4 submittal.



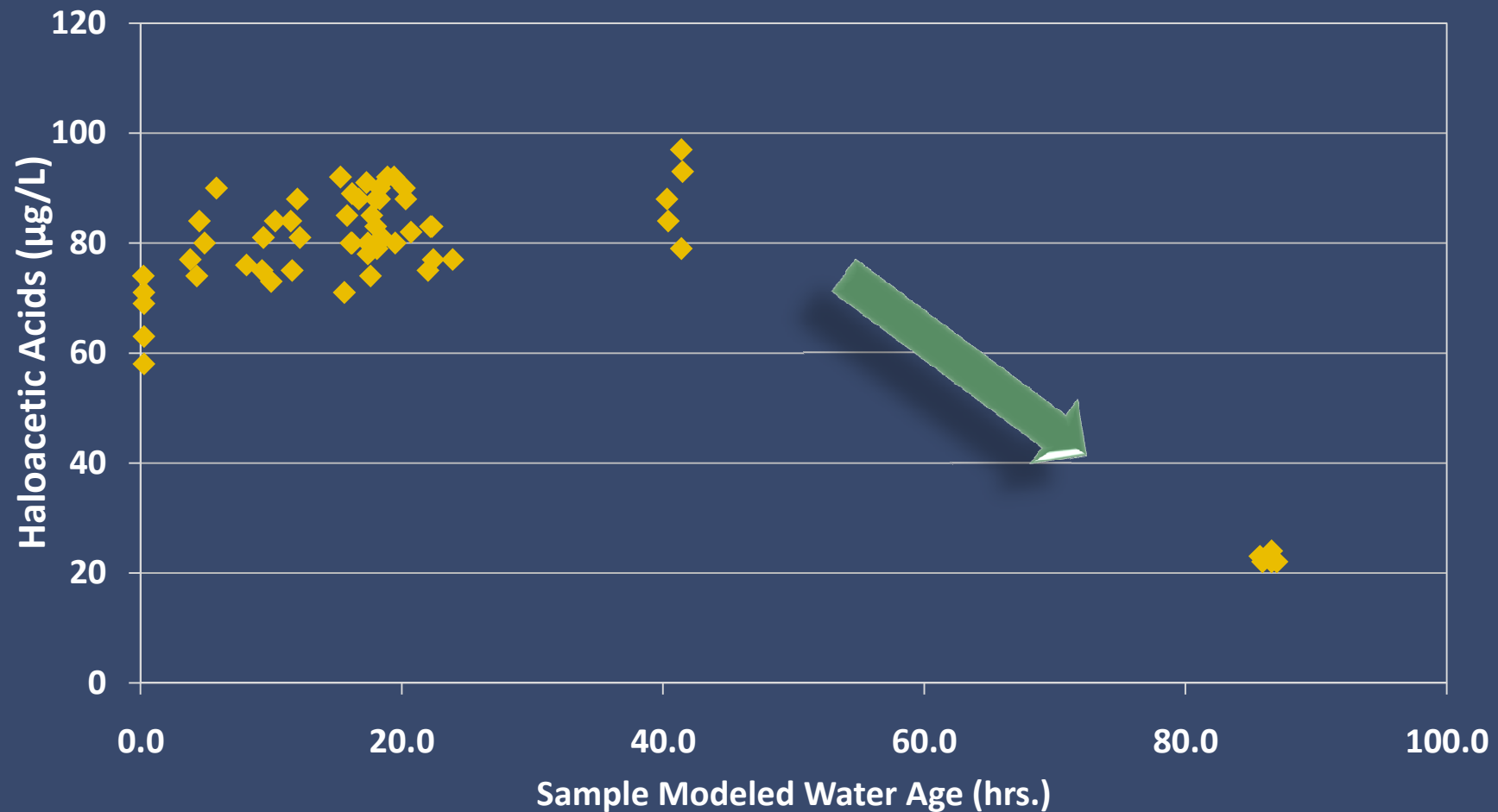
Expected Results

- High THMs and low chlorine residuals at high water age sites



Expected Results

- HAA decrease at low disinfectant levels (due to biological degradation?)



Expected Results

- System flushing improves hydraulic pressure and increases chlorine residual

From continuous monitoring data:

- Mixing groundwater into reservoir reduced TOC at plant

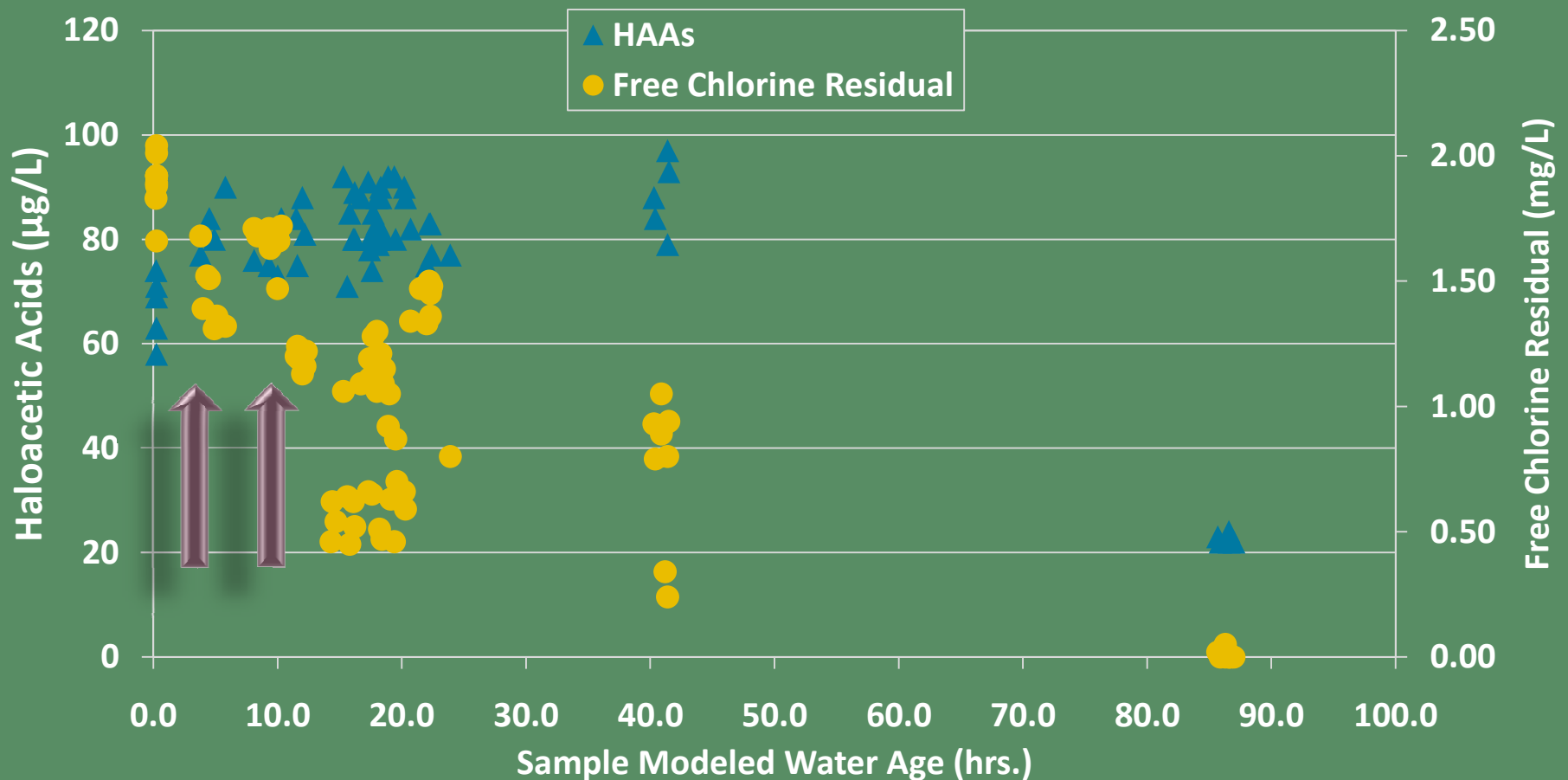
Unexpected Results

- Rapid HAA formation at very low water age



Unexpected Results

- High DBPs at WTP effluent into distribution system with a high disinfectant level



Unexpected Results

From continuous monitoring data:

- Mixing groundwater into reservoir reduced TOC at plant, however, THMs increased in the distribution system
- High HAA formation in the winter

Operation Considerations

- Total chlorine dose correlates well to total THM concentration
- The location of the HAA peak concentration in distribution system is sensitive to intermediate chlorine dose changes
- Watch adjustments to the intermediate chlorine feed rate – the peak HAA concentration location will shift.



Operation Considerations

- Changing source water characteristics will change DBP speciation (THM vs. HAA) and levels
- Mixing groundwater to reduce DBPs, may actually increase HAA formation
- Gradual groundwater flow rate increases



Operation Considerations

- Unidirectional flushing at near-scour velocities is important and necessary - however, increase in chlorine residual may increase HAA formation
- Schedule unidirectional flushing accordingly

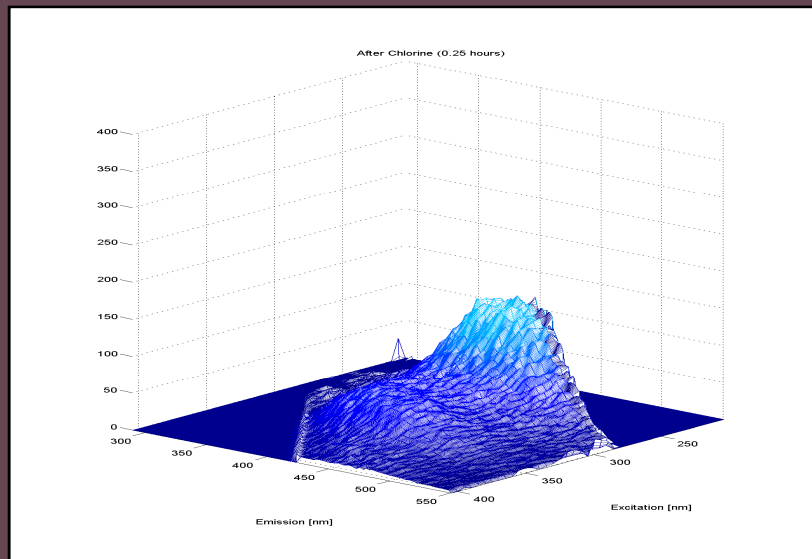
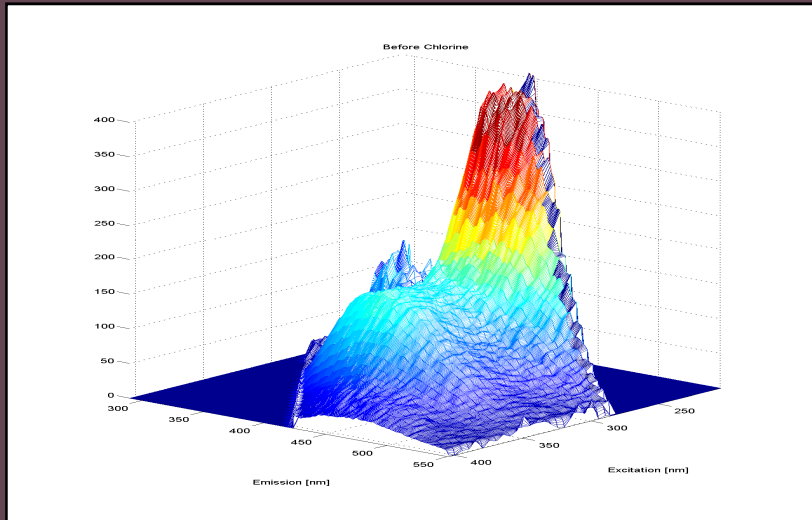


Stage 2 DBP Compliance

Our studies indicate HAA's may be problematic (levels exceeding 60 ppb), sensitive to chlorine dose strategy, and sensitive to source water characteristics.

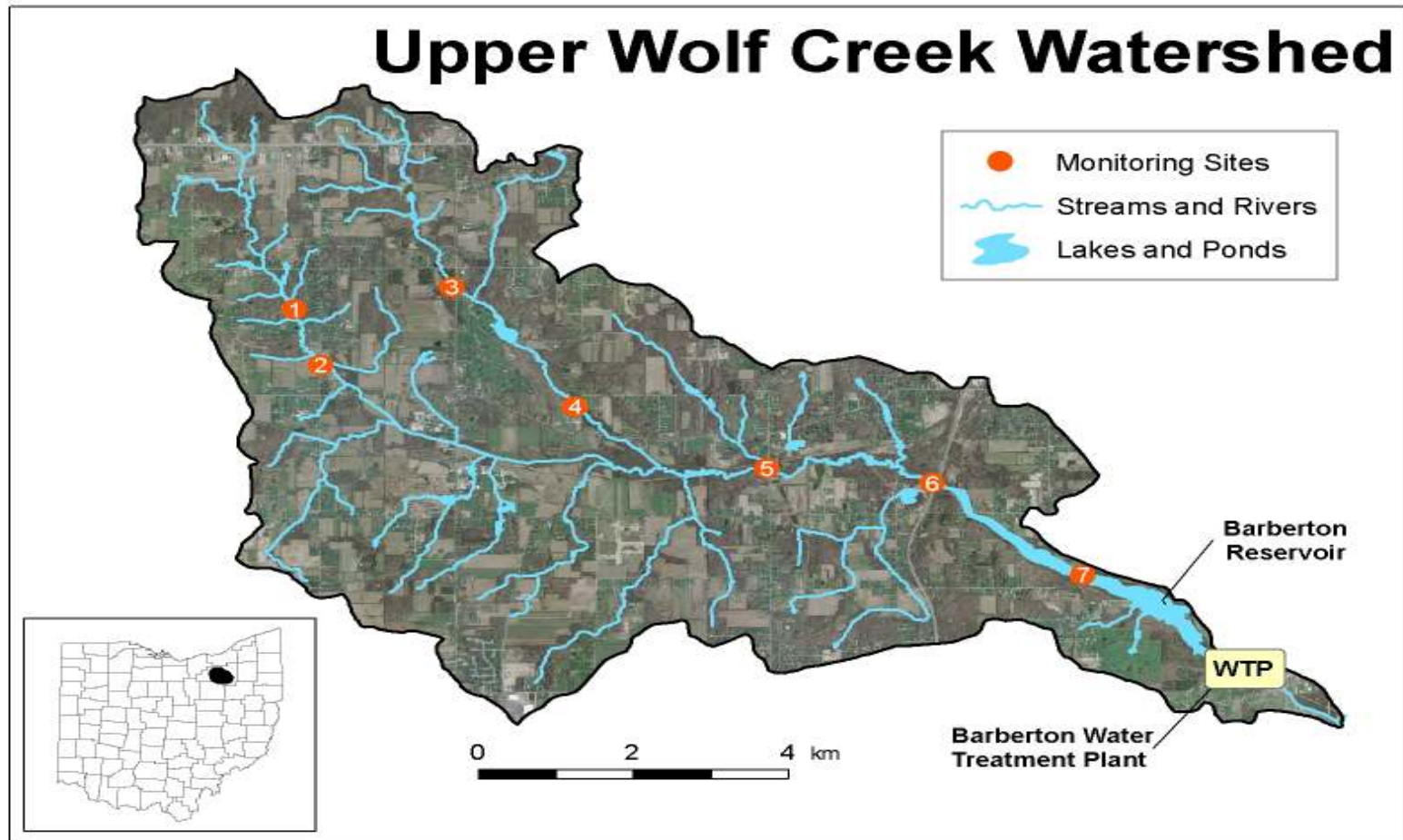
So what are we doing to address this?

Source Water Monitoring - EEM



- Excitation-Emission-Matrices (EEM)
- Sample before and after chlorination
- Change represents drop in active sites of carbon – potential DBP precursor?

Source Water Sampling



- Sources of carbon - DBP precursor?



Imagine the result

Imagine the result

Contact Information



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