Lake Erie Water Users Group

Lake Erie Data for Water-Quality Insights:

New Tools for Utilities

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Cleveland Water Alliance

Matt Kennedy
Water Quality Manager

City of Cleveland Water — At Your Service

Agenda:

- About CWA
- About the Smart Lake Erie Watershed
- CWA’s Data-as-a-Service
- Filling in the Gaps
- Cleveland Water Case Study
- Demo
- Wrap Up

About CWA

CLEVELAND WATER ALLIANCE

- Smart Lake Erie Watershed
- Data-as-a-Service
- Water Technology Testbeds
- Open Innovation Challenges
- Seed Fund

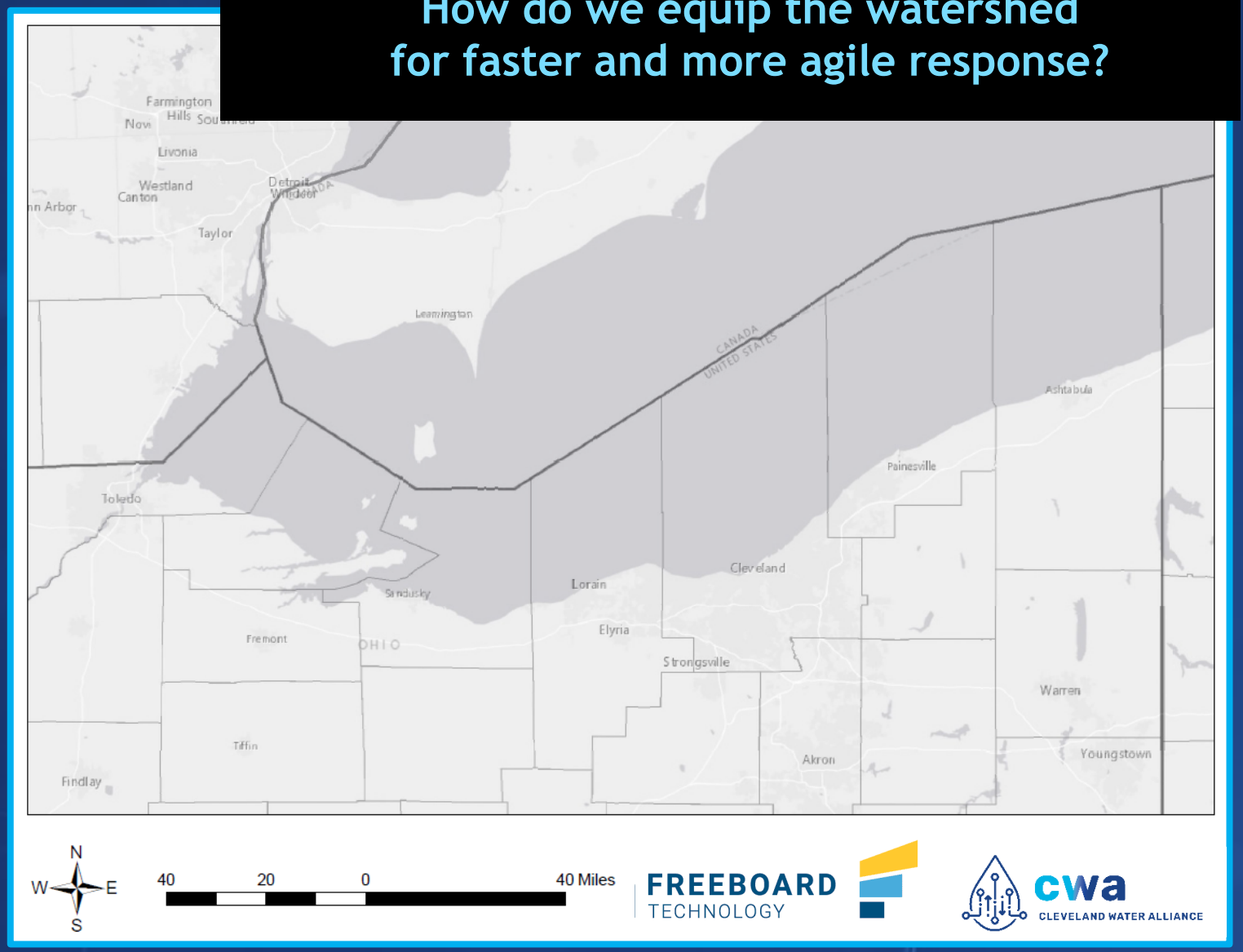
CWA centrally connects 100+ Water Industry Partners, 30+ Utility Partners and 23 Research Institutions

About SLEW

The Smart Lake Erie Watershed

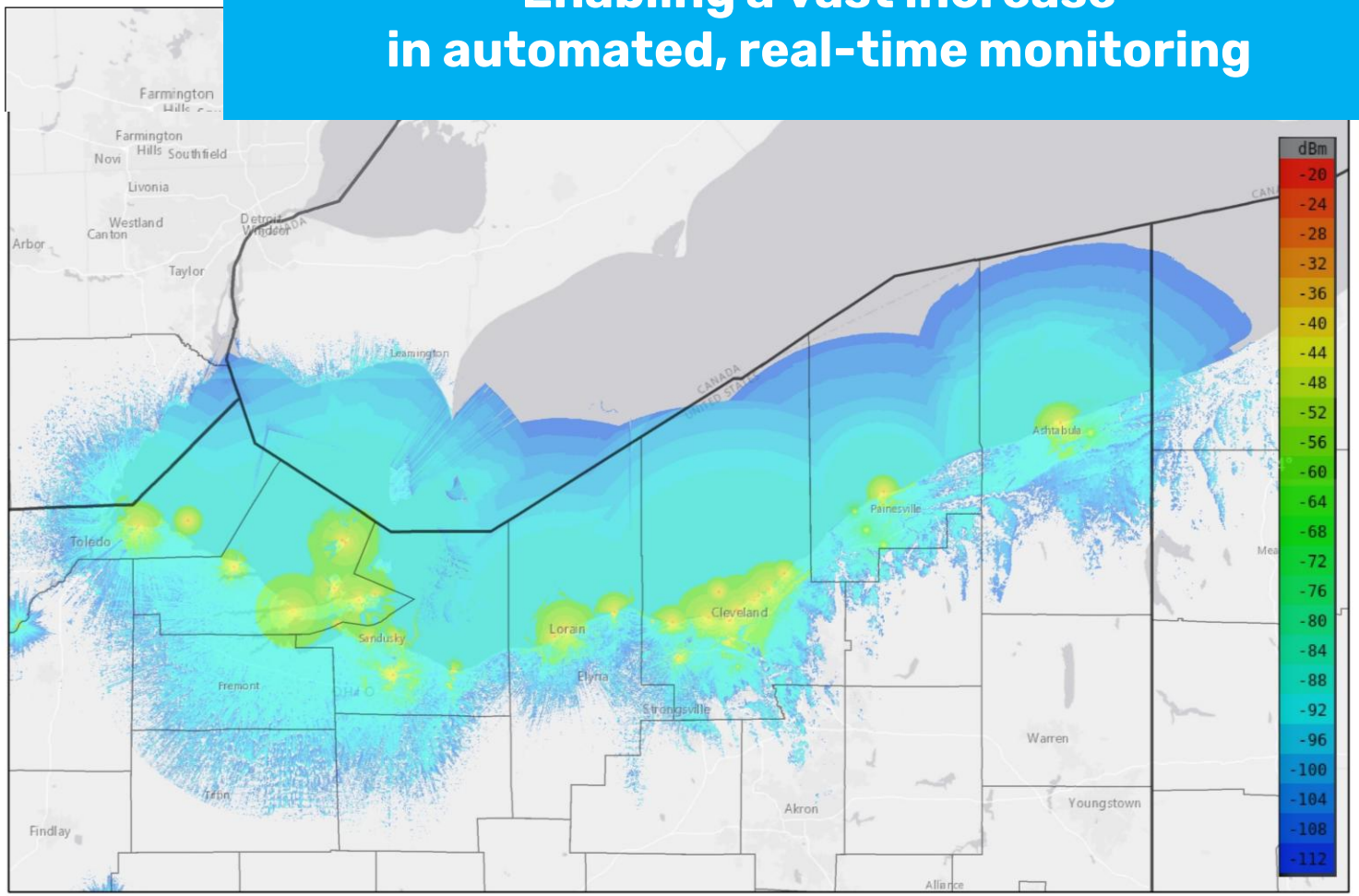
clevelandwateralliance.org

How do we equip the watershed for faster and more agile response?



Source: David Ruck

Enabling a vast increase in automated, real-time monitoring



Over 7700 miles² of Telecommunications Coverage

Source: David Ruck

CWA deploys 200+ IOT devices annually

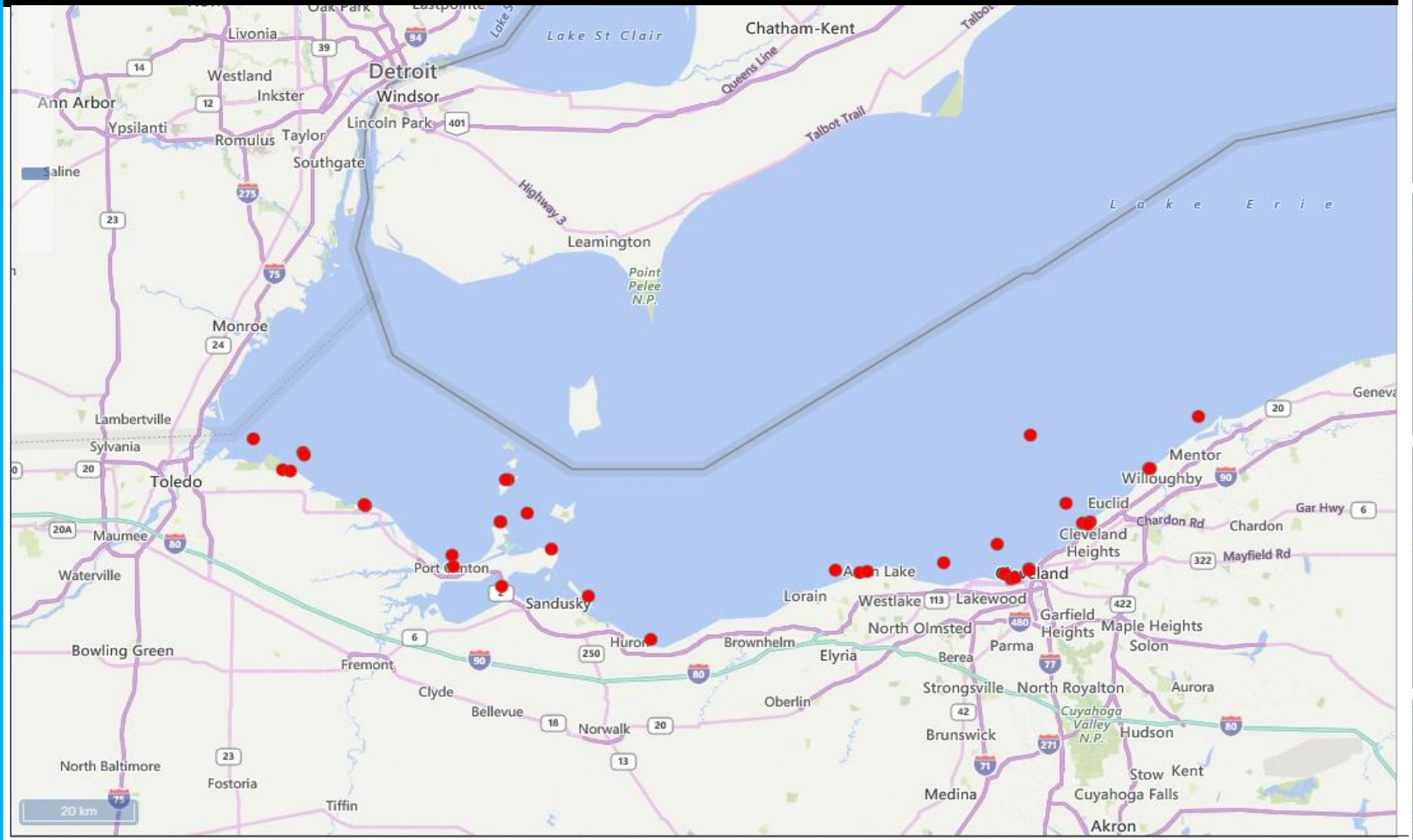
Nearshore Buoy (4)	Offshore Buoy (1)	Value Water Quality Buoy (4)
Temperature/Conductivity	Temperature/Conductivity	Turbidity
Turbidity	Turbidity	Chlorophyll
Chlorophyll	Dissolved Oxygen	
	Temperature profile	

LoRaWAN Sensor Kit (20)	Stormwater Kit (15)	Water Quality 3 Parameter Kit (15)
GPS	Rainfall	Dissolved oxygen
Water level	Soil moisture	Turbidity
Temperature	Soil temperature	Conductivity
Relative humidity	Air temperature	
	Relative humidity	
	Solar radiation	
	Water temperature	
	Conductivity	
	Water level	

LoRaWAN Outdoor Kit (20)	LoRaWAN Indoor Kit (20)	LoRaWAN Outdoor Soil Kit (10)
Water Level	Door Sensor	Soil moisture
Temperature	Temperature	Soil pH
Humidity		
Motion detection (PIR)		

aWAN Sensors (20)
Sensor (motion detection (PIR), on/off magnet switch, accelerometer, g-force
t, light detection, temperature, humidity)
ture
perature

“Smart Lake Erie Watershed”



N W E S

40 20 0 40 Miles

FREEBOARD TECHNOLOGY

cwa CLEVELAND WATER ALLIANCE

Monitoring Stations

45200

Little Cedar Point, OH

Last Update: 11:00 PM EDT, September 21, 2023 (>1 week ago)

45202

Port Clinton Buoy

Last Update: 11:40 PM EDT, September 21, 2023 (>1 week ago)

45201

Erie Islands Buoy

Last Update: 11:40 PM EDT, September 21, 2023 (>1 week ago)

45203

Huron Buoy

Last Update: 11:40 PM EDT, September 21, 2023 (>1 week ago)

45204

Sheffield Buoy

Last Update: 11:40 PM EDT, September 21, 2023 (>1 week ago)

45196

Rocky River Buoy

Last Update: 11:30 PM EDT, September 21, 2023 (>1 week ago)

45205

Edgewater Beach Buoy

Last Update: 11:40 PM EDT, September 21, 2023 (>1 week ago)

45176

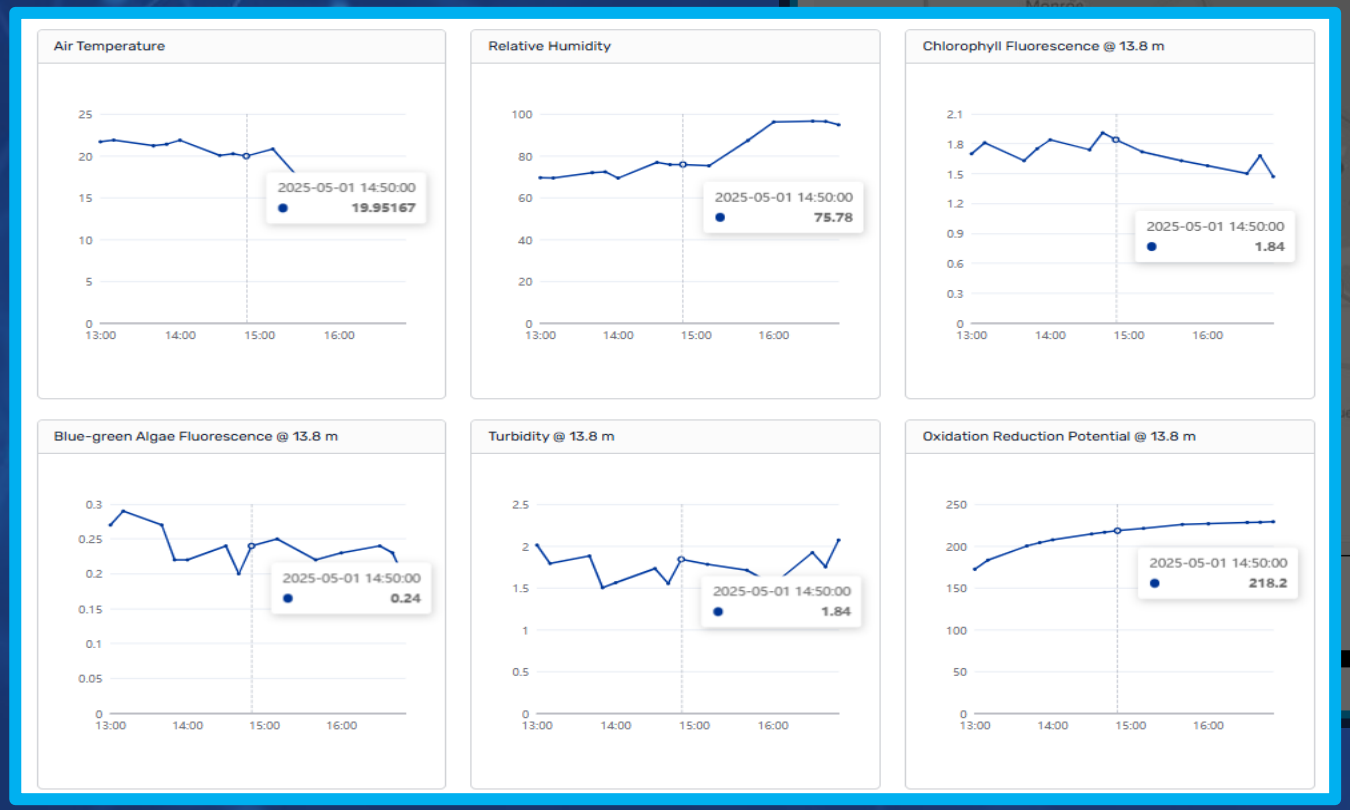
Cleveland Crib Buoy

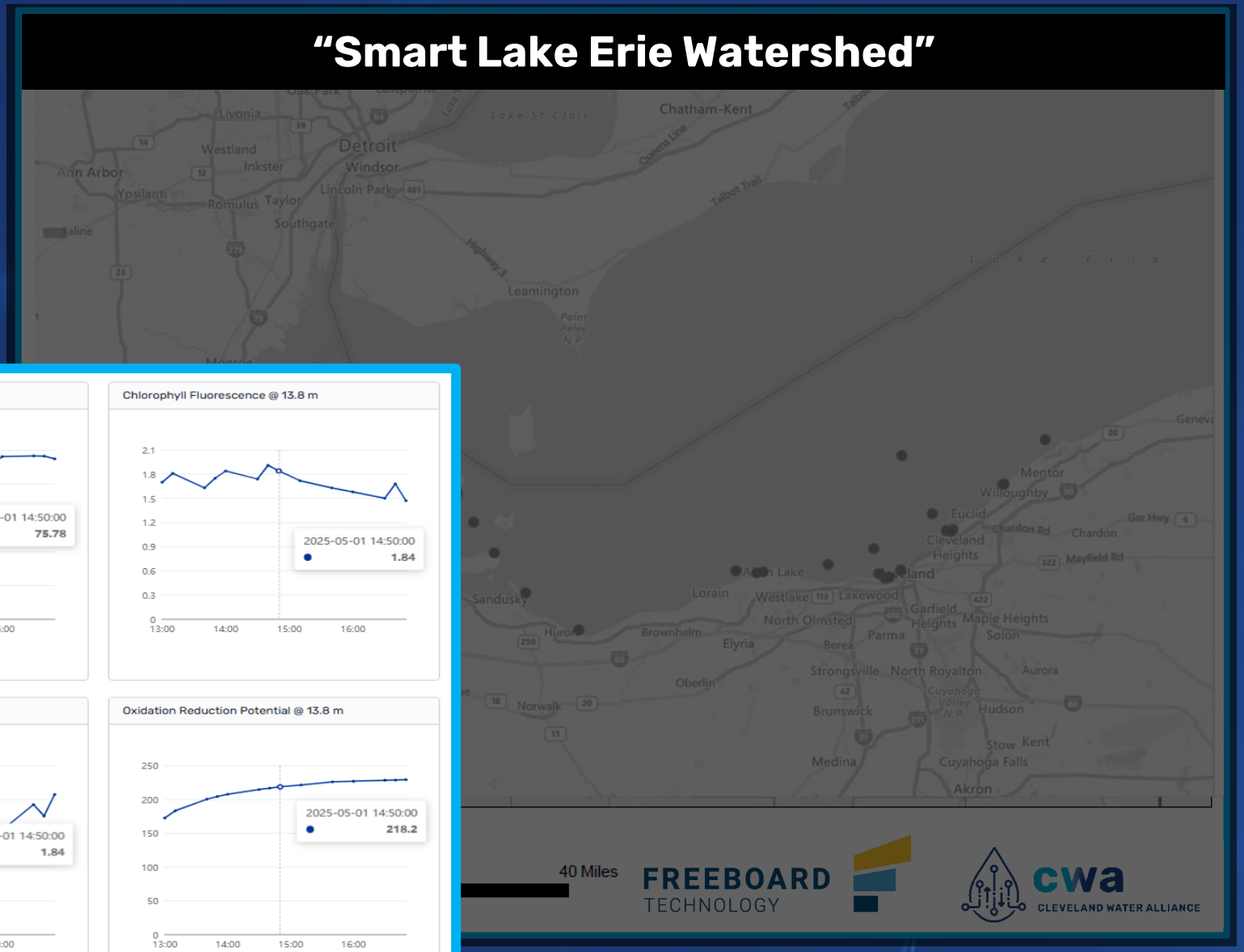
Last Update: 11:40 PM EDT, September 21, 2023 (>1 week ago)

CWA DaaS

Data-as-a-Service

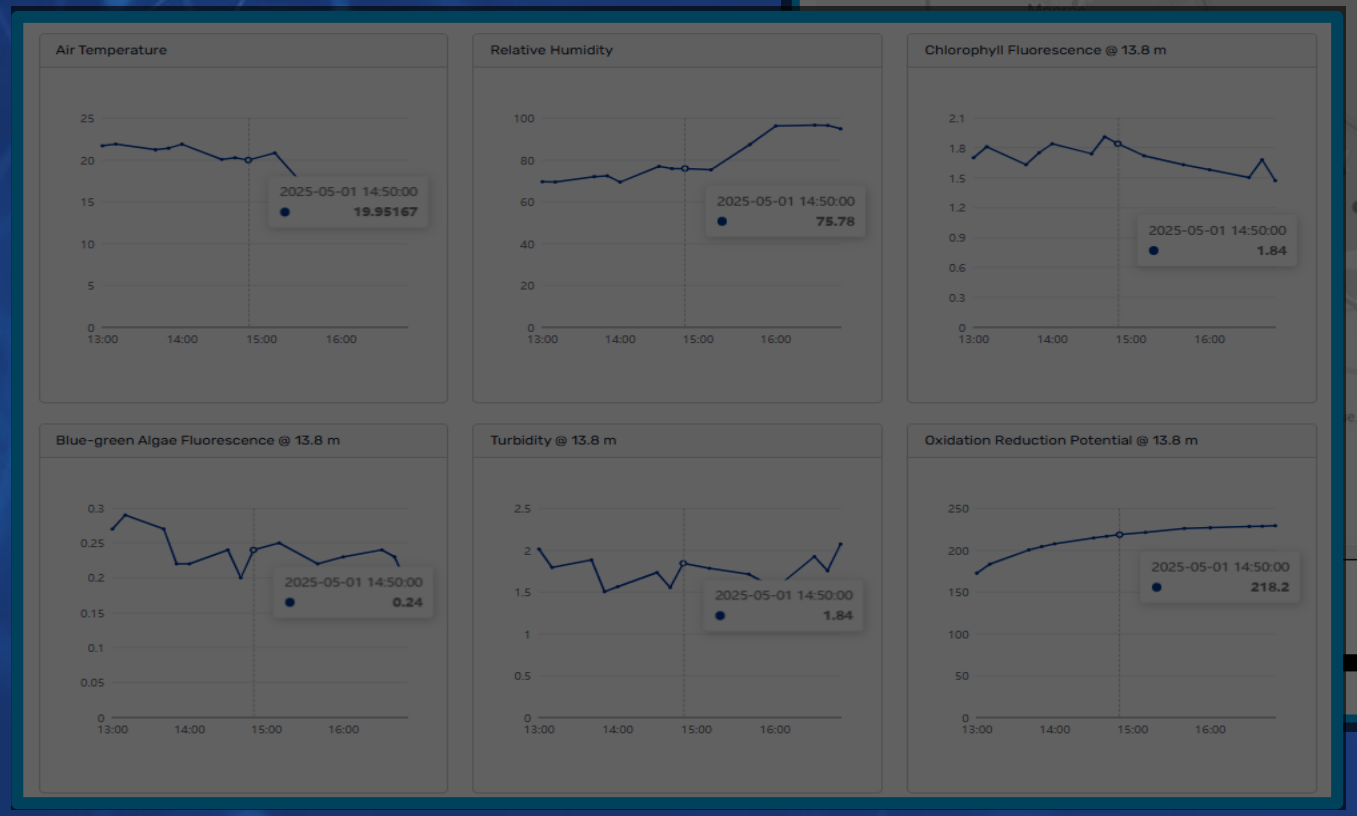
The Smart Lake Erie Watershed infrastructure is the backbone of the CWA DaaS program





- ✓ 1 Million+ baseline data points / year
- ✓ 4th year / DaaS: ~4 Million data records to date

“Smart Lake Erie Watershed”



Insights relevant to treatment, management & response, such as:

- ❖ weather conditions
- ❖ wave levels and currents
- ❖ atmospheric conditions
- ❖ water quality parameters

40 Miles

FREEBOARD TECHNOLOGY

cwa CLEVELAND WATER ALLIANCE

TIER 1 Parameters:

- Wind Speed
- Wind Direction
- Wave Height
- Wave Period
- Air Temperature
- Dew Point Temperature
- Relative Humidity
- Sea Level Pressure
- Surface Temperature
- Specific Conductivity
- Turbidity
- pH (as available; all stations in 2026)
- Chlorophyll (as available; all stations in 2026)
- Blue-Green Algae (as available; all stations in 2026)

Plus additional parameters as available, such as:

- Solar Radiation
- Dissolved Oxygen
- Water Depth
- Fluorescent Dissolved Organic Matter
- Oxidation Reduction Potential
- Refined Oil in Water

TIER 2 Parameters (beginning in 2026):

- Wind Speed
- Wind Direction
- Surface pH
- Surface Chlorophyll
- Surface Blue-Green Algae

Filling in the Gaps…
Evolving for Utility Needs

Scouting & Innovator Pilots

Other Parameters & Specialty Sensors:

- Hydrocarbons
- Magnesium
- Nitrous Oxide
- Methane
- E. coli
- Metals
- Hydrocarbons
- Chemicals
- Homeland Security Toxin Priorities
- :
- :

Reinvesting to Evolve Support

- Alerts
- Diversity of parameters
- Location, depth and density of devices
- Analytical Tools
- Forecasting

Cleveland Water

How We Use DaaS

CWD Hypoxia Buoy Data

Managing water quality events relies on models for prediction, buoys for actual lake conditions, and lab analysis of water in the treatment plant

- **Once we pick things up in the plant, it can be too late**

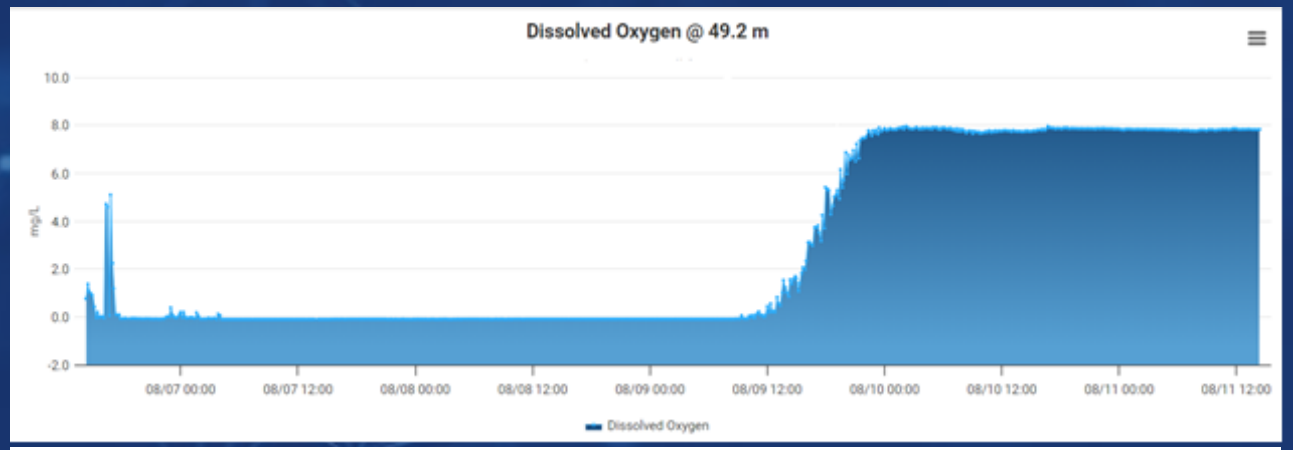
Potassium permanganate is most efficient in treating manganese when feed rates match changes in Mn concentration

CWD Hypoxia Buoy Data

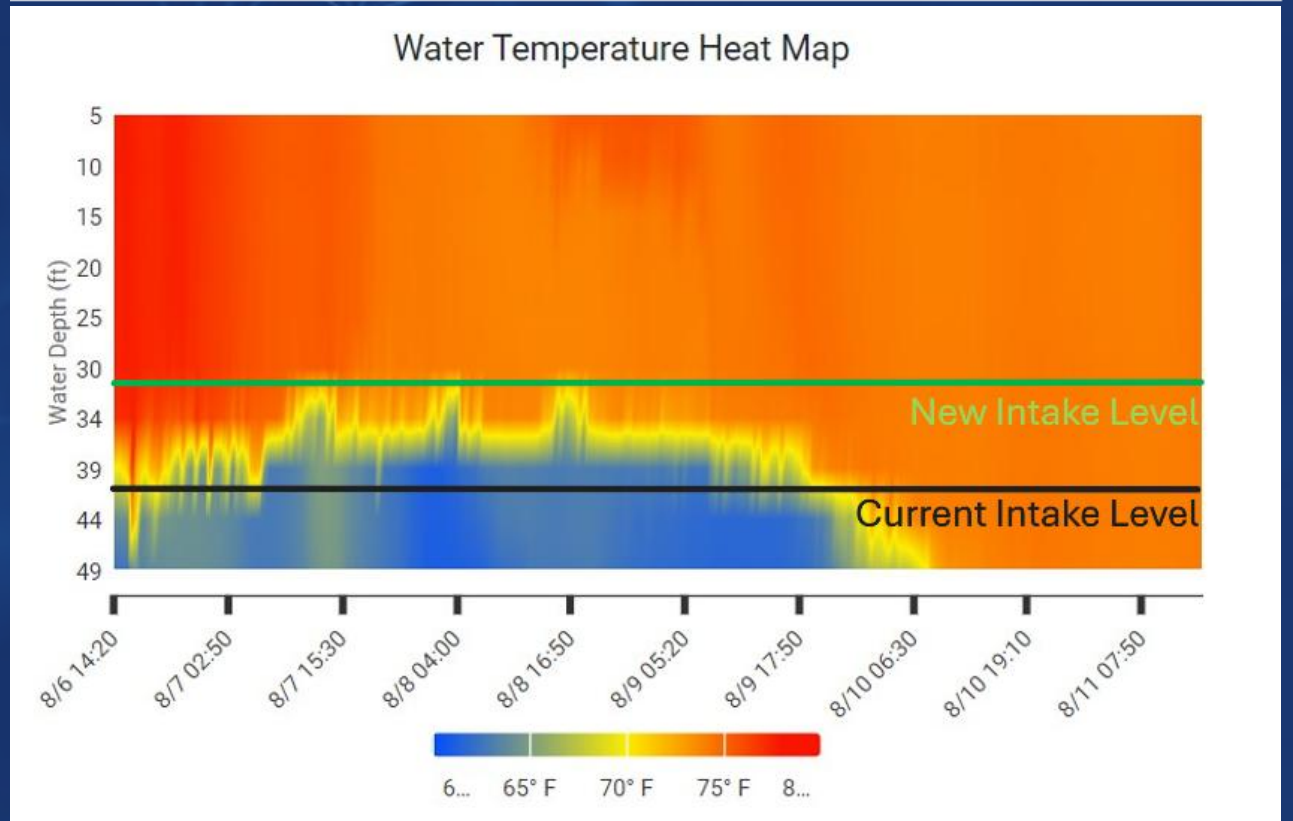
- Models can be nice for trends and predictions, but they can be incorrect **so *in situ* monitoring is essential**

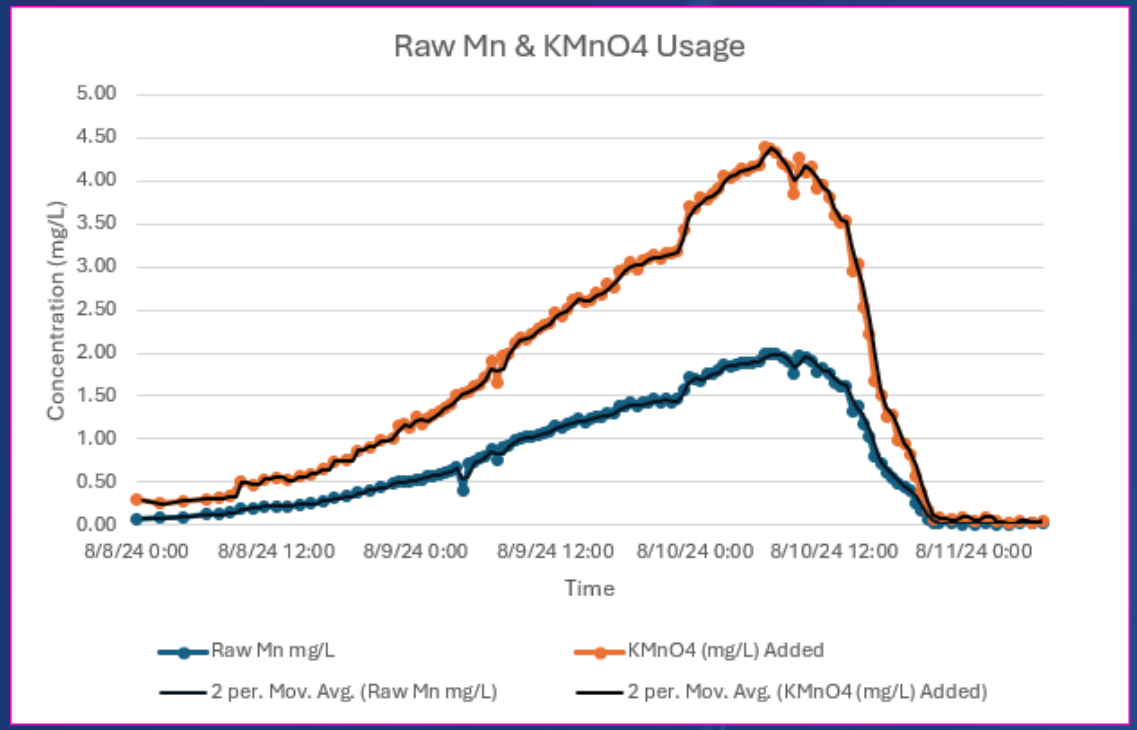
- **Buoys give us real-time data before water enters the intake giving us additional reaction time to adjust treatment (~4-7 hours between intake and initial treatment depending on pumpage)**

- August 2024 “traditional” hypoxia event where hypoxic water comes from deeper and is associated with a true thermocline
- NE wind direction moved hypoxic water to intake and WNW winds moved it away



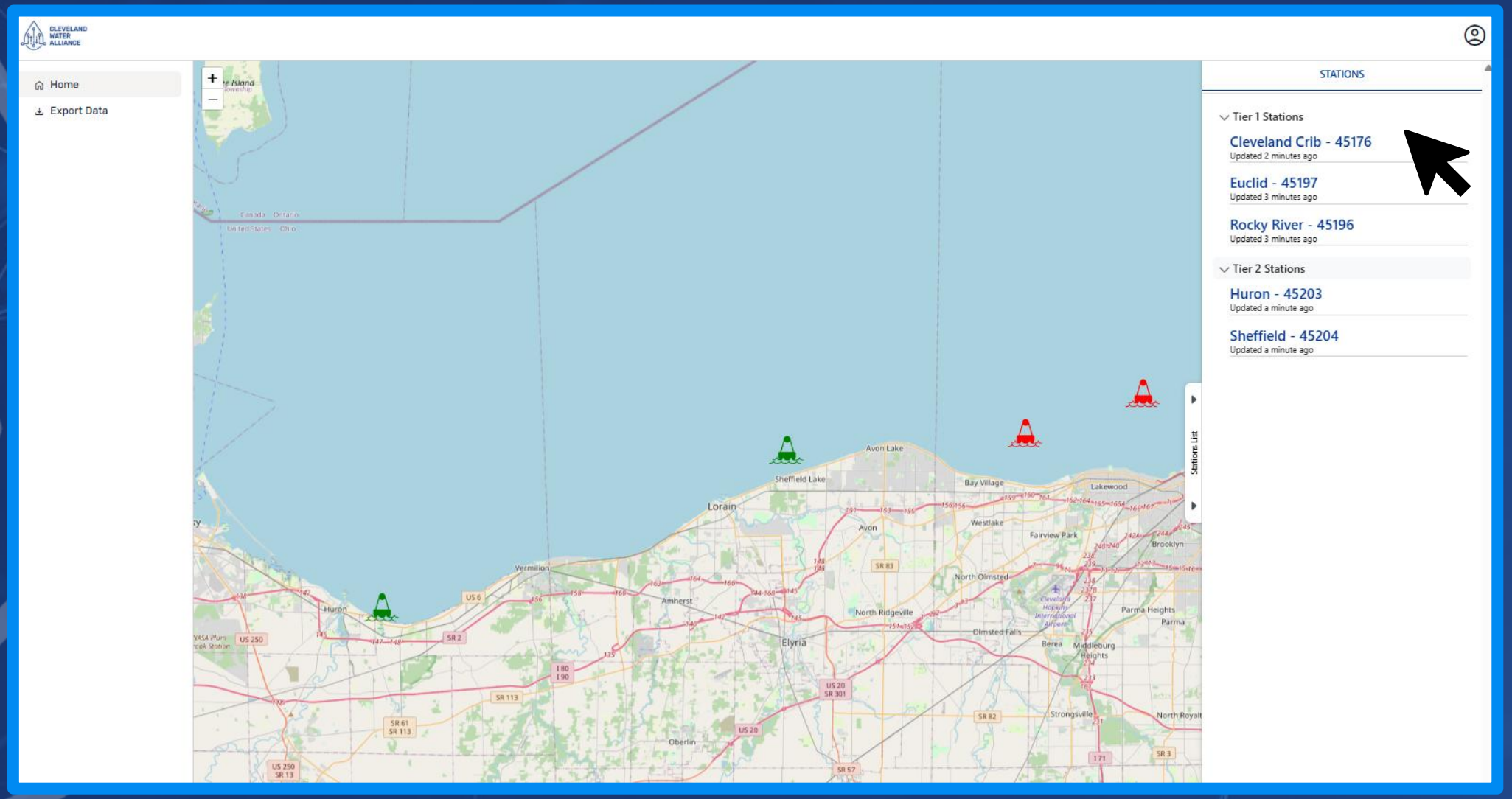
Record Mn levels (~2.0 mg/L) but no negative impacts in tap water quality due to proper potassium permanganate treatment





Take a Look...

Homepage


CLEVELAND WATER ALLIANCE
Home
Export Data
STATIONS
Tier 1 Stations
Cleveland Crib - 45176
Updated 2 minutes ago
Euclid - 45197
Updated 3 minutes ago
Rocky River - 45196
Updated 3 minutes ago
Tier 2 Stations
Huron - 45203
Updated a minute ago
Sheffield - 45204
Updated a minute ago
Stations List
Lorain
Avon Lake
Sheffield Lake
Bay Village
Lakewood
Westlake
Avon
Fairview Park
Brooklyn
Vermilion
Amherst
Huron
North Olmsted
North Ridgeville
Elyria
Olmsted Falls
Berea
Middleburg Heights
Parma Heights
Parma
Strongsville
Oberlin

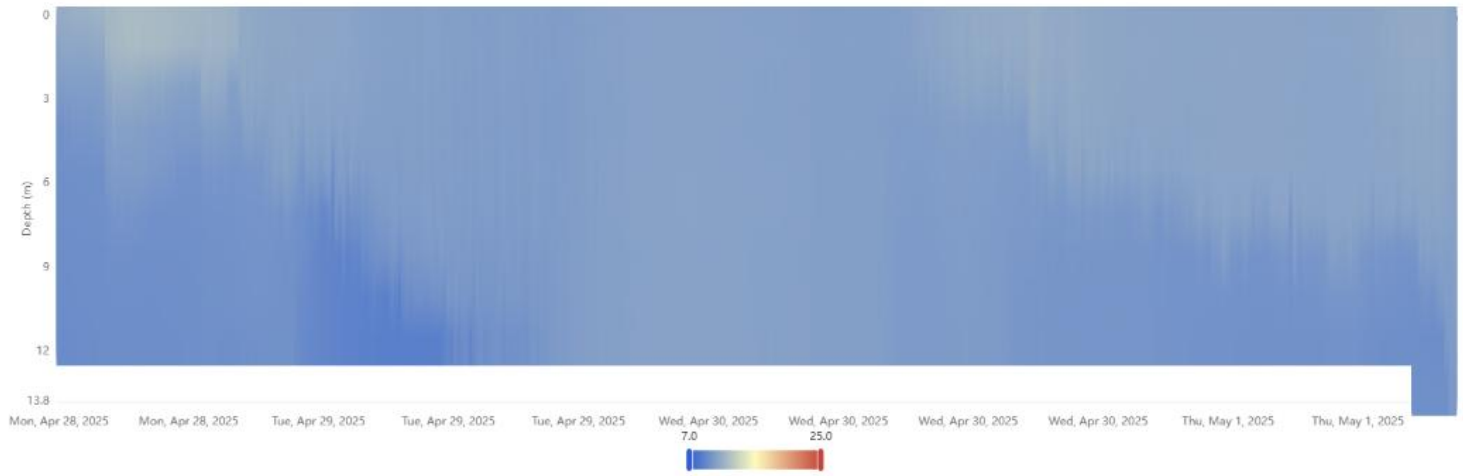
Tier 1 Data

Rocky River - 45196

Dashboard | Data Explorer

Water Temperature

1 Week Heatmap



Water Quality

Dissolved Oxygen @ 13.8 m	Blue-green Algae Fluorescence @ 13.8 m	Chlorophyll Fluorescence @ 13.8 m	Dissolved Oxygen at Saturation @ 13.8 m
13.87 mg/L	0.24 RFU	1.50 RFU	123.73 %

Oxidation Reduction Potential @ 13.8 m	pH @ 13.8 m	Specific Conductance @ 13.8 m	Turbidity @ 13.8 m
228.12 mV	8.01 pH	192.31 uS/cm	1.92 NTU

Water Depth

Tier 1 Data

Rocky River - 45196

Dashboard | Data Explorer

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Water Depth
13.82 m

Weather

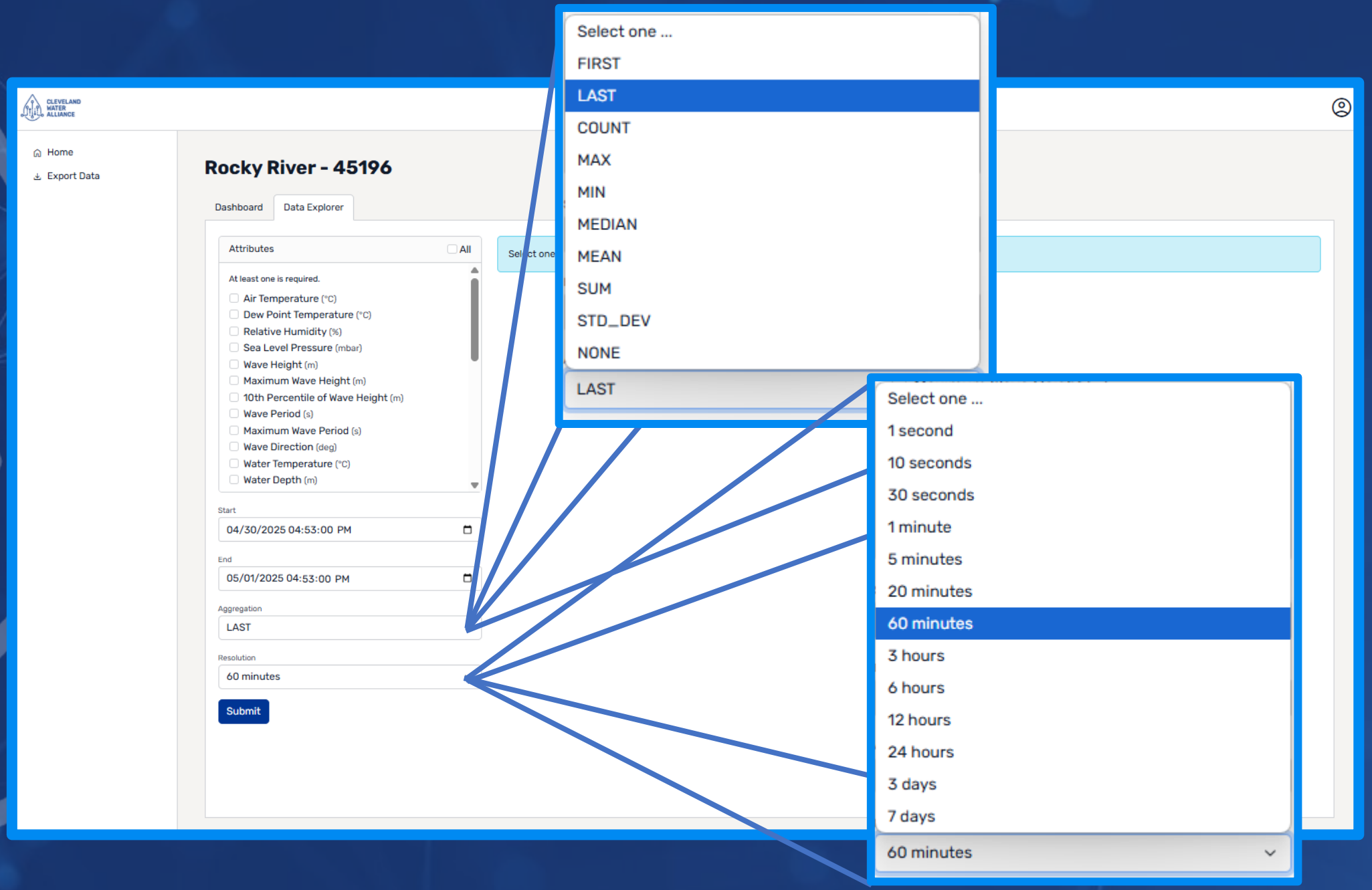
Air Temperature	Dew Point Temperature	Photosynthetic Active Radiation	Relative Humidity
14.37 °C	13.84 °C	136.18 $\mu mol \cdot m^{-2} \cdot s^{-1}$	96.53 %

Sea Level Pressure
1,007.12 mbar

Wave

10th Percentile of Wave Height	Maximum Wave Height	Maximum Wave Period	Wave Direction
0.81 m	1.02 m	4.93 s	248.80 deg

Wave Height	Wave Period
0.64 m	3.71 s


CLEVELAND WATER ALLIANCE
Home
Export Data
Rocky River - 45196
Dashboard
Data Explorer
Attributes
All
At least one is required.
Air Temperature (°C)
Dew Point Temperature (°C)
Relative Humidity (%)
Sea Level Pressure (mbar)
Wave Height (m)
Maximum Wave Height (m)
10th Percentile of Wave Height (m)
Wave Period (s)
Maximum Wave Period (s)
Wave Direction (deg)
Water Temperature (°C)
Water Depth (m)
Start
04/30/2025 04:53:00 PM
End
05/01/2025 04:53:00 PM
Aggregation
LAST
Resolution
60 minutes
Submit
Select one ...
FIRST
LAST
COUNT
MAX
MIN
MEDIAN
MEAN
SUM
STD_DEV
NONE
LAST
Select one ...
1 second
10 seconds
30 seconds
1 minute
5 minutes
20 minutes
60 minutes
3 hours
6 hours
12 hours
24 hours
3 days
7 days
60 minutes

Rocky River - 45196

Dashboard | Data Explorer

Attributes — All

At least one is required.

- [x] Air Temperature (°C)
- [ ] Dew Point Temperature (°C)
- [x] Relative Humidity (%)
- [ ] Sea Level Pressure (mbar)
- [ ] Wave Height (m)
- [ ] Maximum Wave Height (m)
- [ ] 10th Percentile of Wave Height (m)
- [ ] Wave Period (s)
- [ ] Maximum Wave Period (s)
- [x] Wave Direction (deg)
- [ ] Water Temperature (°C)
- [ ] Water Depth (m)

Start: 04/28/2025 04:53:00 PM

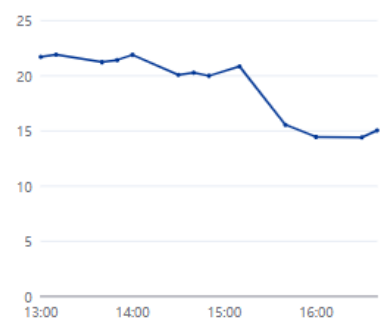
End: 05/01/2025 04:53:00 PM

Aggregation: LAST

Resolution: 1 second

Submit

Air Temperature



Relative Humidity

Wave Direction

Export to CSV

Time	Air Temperature	Relative Humidity	Wave Direction
Thu, May 1, 2025, 1:00:00 PM	21.67333	69.50333	44.28
Thu, May 1, 2025, 1:10:00 PM	21.85833	69.31499	44.01
Thu, May 1, 2025, 1:40:00 PM	21.185	71.92166	188.3
Thu, May 1, 2025, 1:50:00 PM	21.38	72.29834	192.5
Thu, May 1, 2025, 2:00:00 PM	21.85	69.29	186.7
Thu, May 1, 2025, 2:30:00 PM	20.035	76.825	193.1
Thu, May 1, 2025, 2:40:00 PM	20.24	75.74833	193.1

Rocky River - 45196

Dashboard | Data Explorer

Attributes — All

At least one is required.

- [x] Air Temperature (°C)
- [ ] Dew Point Temperature (°C)
- [x] Relative Humidity (%)
- [ ] Sea Level Pressure (mbar)
- [ ] Wave Height (m)
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- [ ] Wave Direction (deg)
- [ ] Water Temperature (°C)
- [ ] Water Depth (m)

Start: 04/30/2025 04:53:00 PM

End: 05/01/2025 04:53:00 PM

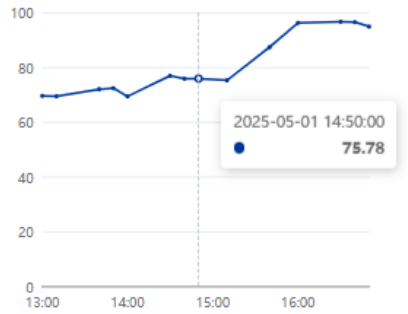
Aggregation: LAST

Resolution: 1 second

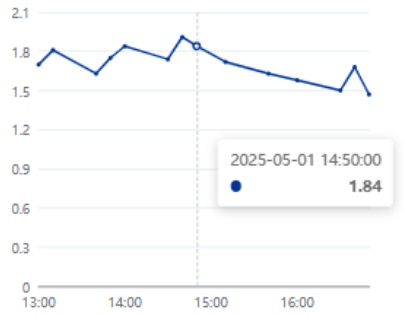
Submit

Air Temperature

Relative Humidity



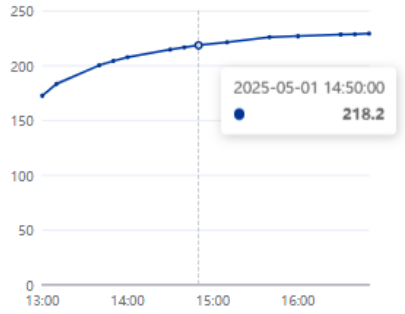
Chlorophyll Fluorescence @ 13.8 m



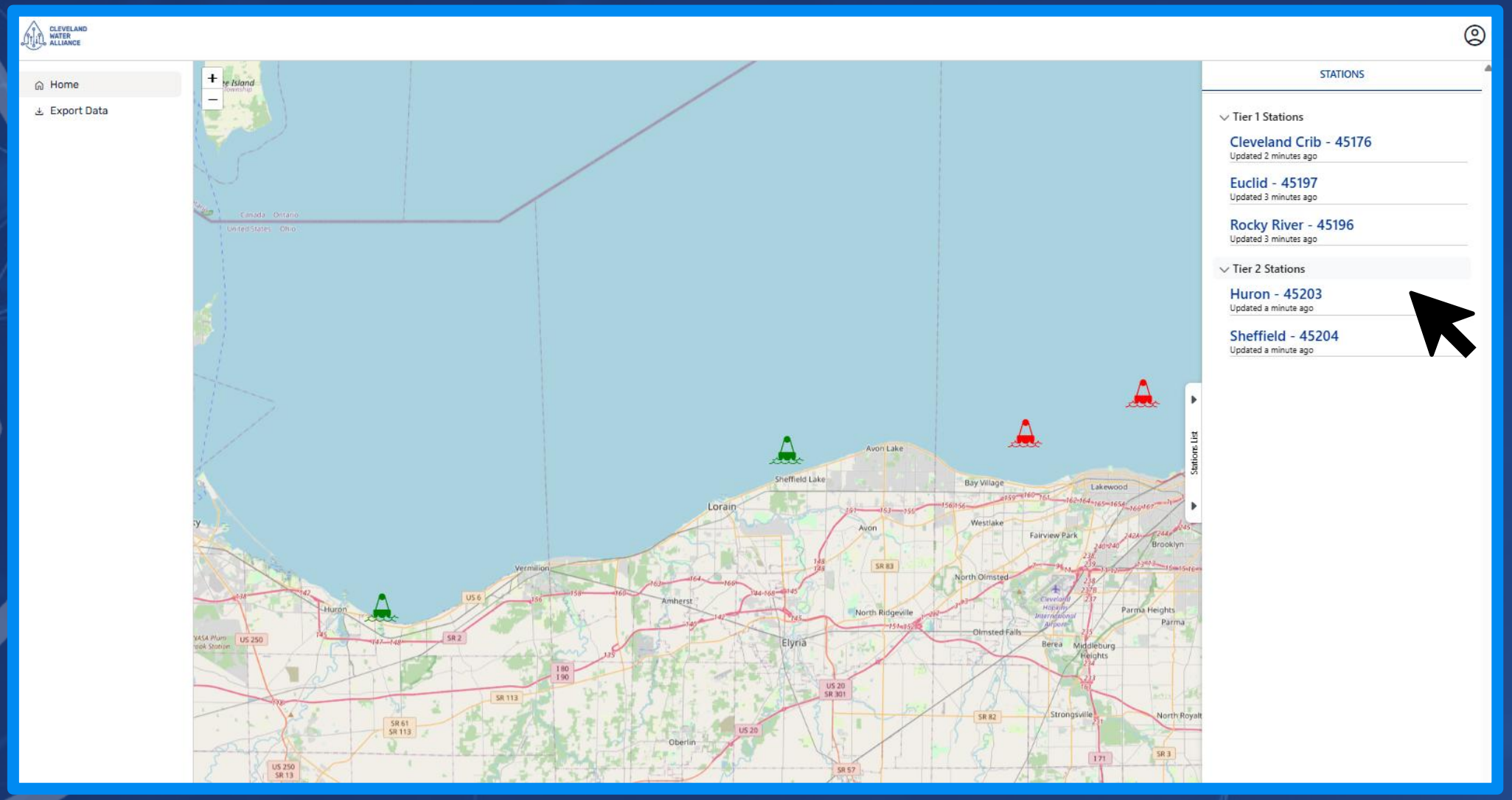
Blue-green Algae Fluorescence @ 13.8 m

Turbidity @ 13.8 m

Oxidation Reduction Potential @ 13.8 m



Homepage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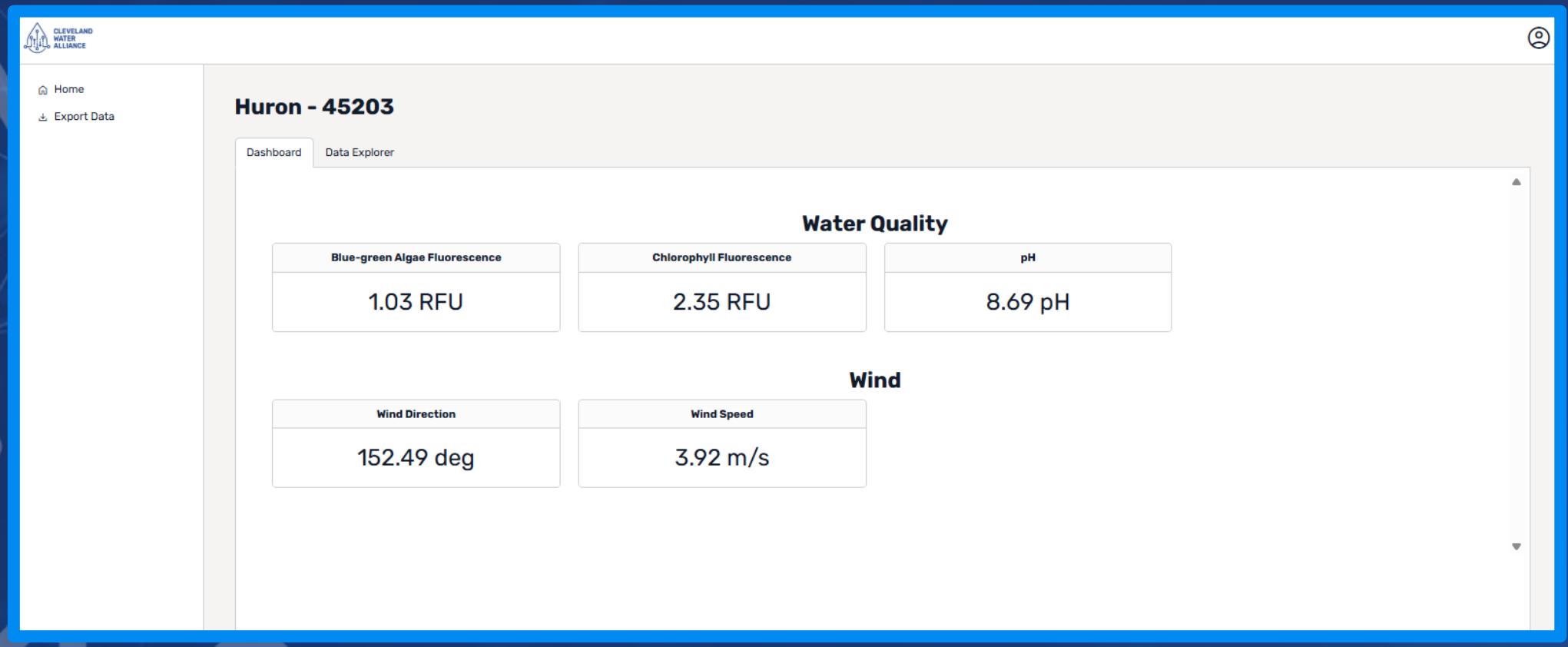
North Ridgeville
Olmsted Falls
Elyria
Berea
Middleburg Heights
Parma Heights
Parma
Strongsville
Oberlin

Tier 2 Data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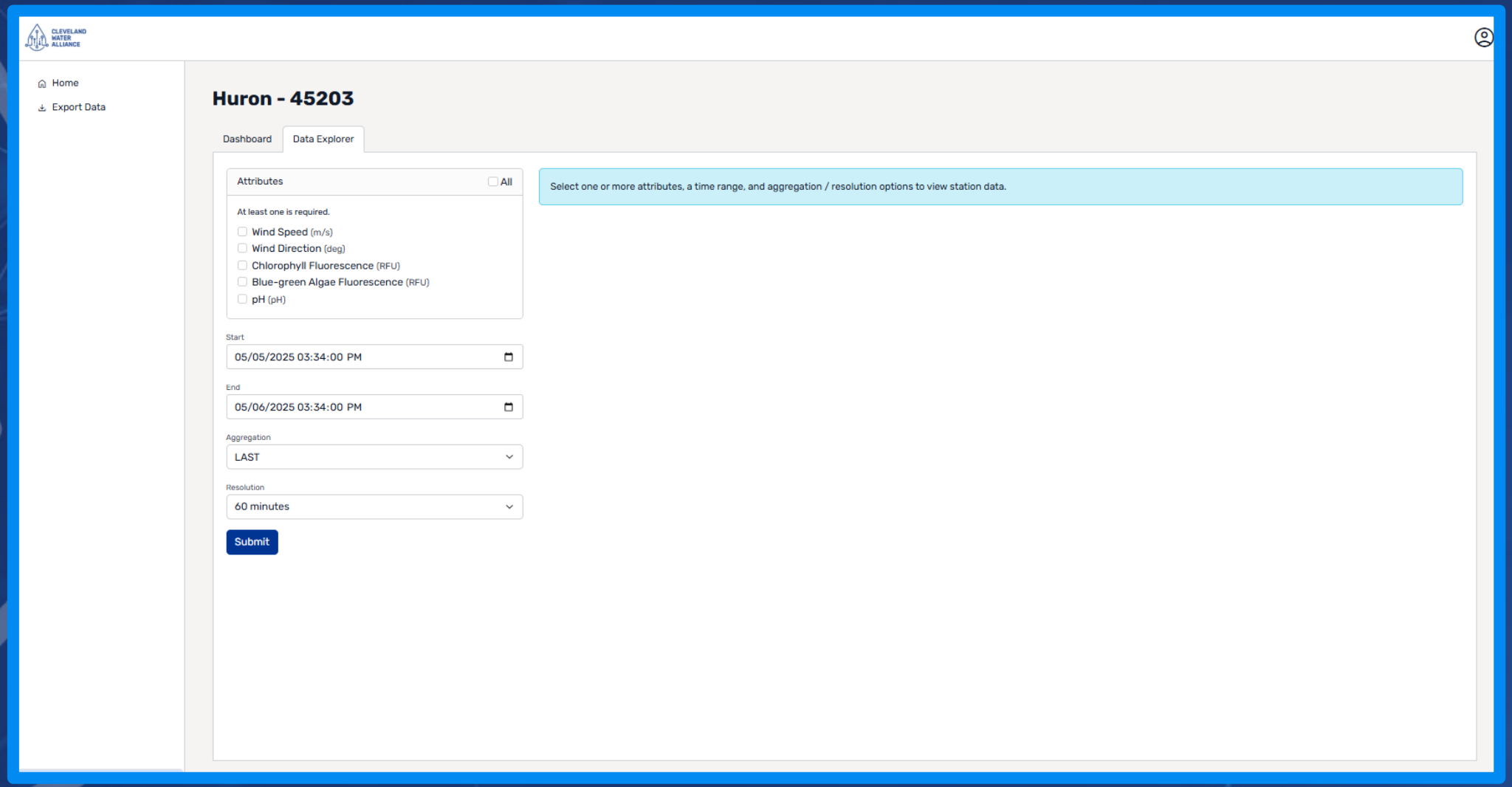
Home
Export Data
Huron - 45203
Dashboard
Data Explorer
Water Quality
Blue-green Algae Fluorescence
1.03 RFU
Chlorophyll Fluorescence
2.35 RFU
pH
8.69 pH
Wind
Wind Direction
152.49 deg
Wind Speed
3.92 m/s

Tier 2


CLEVELAND WATER ALLIANCE
Home
Export Data
Huron - 45203
Dashboard
Data Explorer
Attributes
All
At least one is required.
Wind Speed (m/s)
Wind Direction (deg)
Chlorophyll Fluorescence (RFU)
Blue-green Algae Fluorescence (RFU)
pH (pH)
Start
05/05/2025 03:34:00 PM
End
05/06/2025 03:34:00 PM
Aggregation
LAST
Resolution
60 minutes
Submit
Select one or more attributes, a time range, and aggregation / resolution options to view station data.

Why DaaS?

Hypoxia

HABs

Frazzle ice

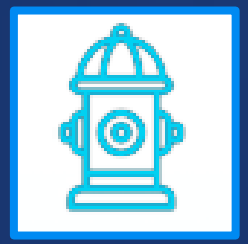
Fish kills

Other adverse events…

One day of mishaps can translate to…

Extra testing and treatment adjustments

Notifying superiors, elected officials, and regulators



Deploying crews and equipment to flush hydrants

Paying fines and/or distributing bottled water under EPA direction

Navigating an influx of customer complaints and media sensationalism

Adverse events pose a material risk with the potential for far-reaching consequences and unplanned expenses.

Significant service disruptions

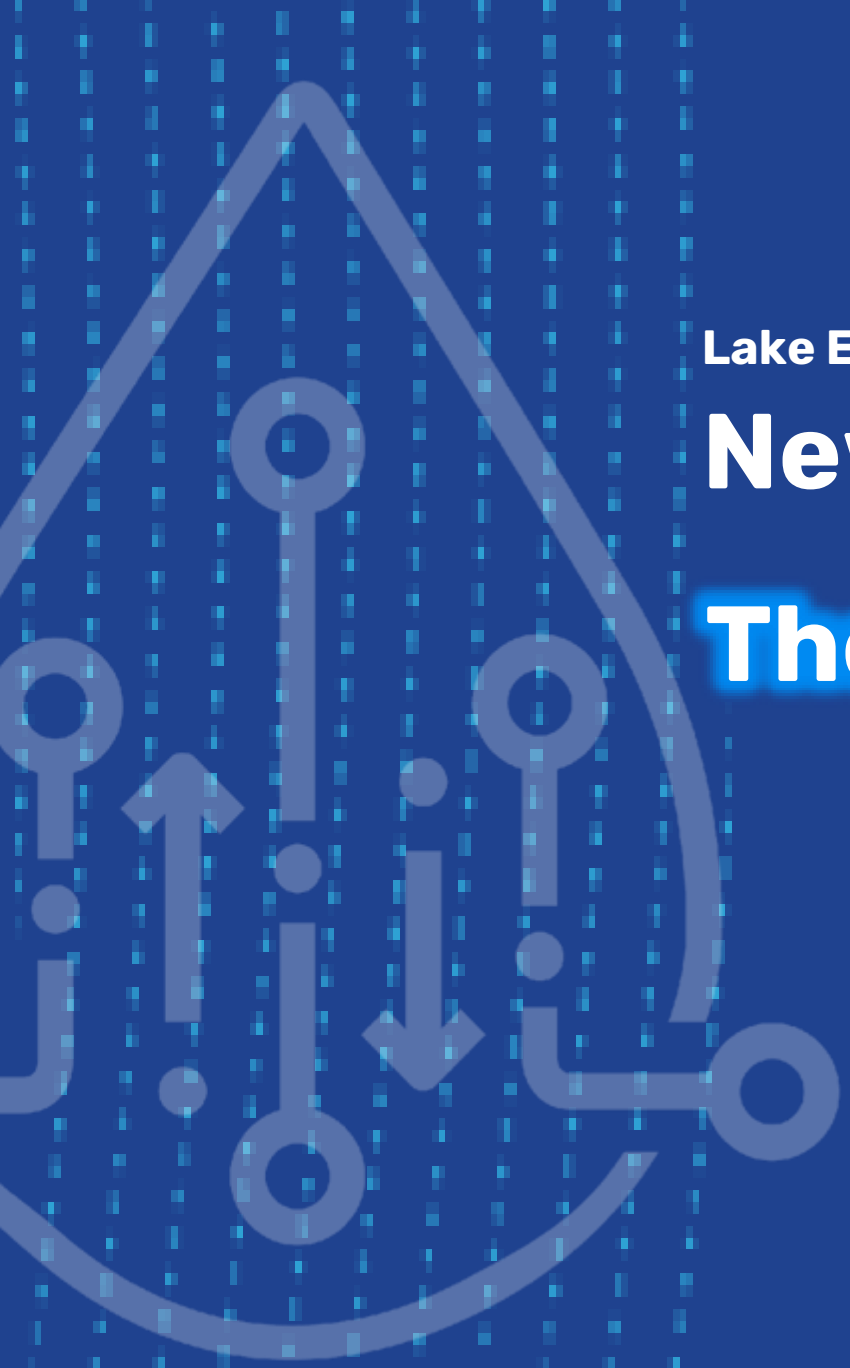
Response & remediation costs

Potential fines

Customer trust and reputational damage

DAAS SUPPORTING LAKE ERIE UTILITIES

- ✓ Providing data 24/7
- ✓ Dependable data in uncertain times
- ✓ Protecting budget, time and reputation
- ✓ Streamlining the data you need and trust
- ✓ Empowering you to be proactive, not reactive
- ✓ Promoting regional collaboration and resilience



Lake Erie Data for Water-Quality Insights:

New Tools for Utilities

The CWA DAAS PARTNERSHIP

LEARN MORE

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DaaS@clewa.org