Fairmont Chain of Lakes Water Quality Workshop

10/1/2026

Presenter Summaries

Common Carp – Ecology & Management

Przemek "Shemick" Bajer, PhD – Carp Solutions LLC

- Explained carp behavior and how bottom-feeding increases turbidity and internal nutrient loading.
- Discussed management strategies to reduce carp biomass and improve water quality.

A Comprehensive Biological Approach to the Fairmont Chain of Lakes

George Klug – Wilton Water Solutions; Verlyn Sneller – Terra Transitional Solutions

• Presented biological tools and strategies to enhance lake ecosystem health.
• Emphasized integrated, whole-lake management rather than single-intervention approaches.

Nanobubble Oxygenation & Internal Nutrient Loading

Jonathan Morales – Moleaer, Inc.

• Demonstrated how nanobubble technology increases dissolved oxygen and reduces internal phosphorus loading.
• Shared case studies showing 50–75% reductions in algae and improved water clarity.
• Outlined recommended next steps for Fairmont, including baseline monitoring and early agency coordination.

Easy Environmental Solutions, Inc. Cleans Lakes with Terreplenish & Easy NanoVoid Technologies

Mark Gaalswyk – Easy Environmental Solutions

• Introduced Terreplenish® microbial fertilizer and NanoVoid systems for nutrient reduction and algae control.
• Showed examples of rapid dissolved-oxygen improvements and odor elimination in treated ponds.
• Highlighted combining soil-health practices, fertilizer alternatives, and oxygenation for watershed-scale improvements.

How DNR Permits Aeration & Evaluates Emerging Technologies

Denise Elston – Minnesota DNR

Presentation Attached

• Reviewed aeration permitting requirements and evaluation criteria for new technologies.
• Emphasized the need for clear objectives, monitoring, and demonstrated ecological benefits.

Mechanical Harvesting of Curly-Leaf Pondweed
Dr. Ryan Wersal – Minnesota State University–Mankato
• Discussed harvesting techniques and their implications for nutrient release and lake ecology.
• Provided guidance on optimal timing to minimize regrowth and phosphorus release.

Overview of MPCA Projects for the Fairmont Chain of Lakes
Jeff Strom & Ben Lundeen – Minnesota Pollution Control Agency
Presentation Attached
• Reviewed the timeline of MPCA studies and TMDL development for the Chain of Lakes.
• Identified nutrient-driven impairments across all major lakes and presented required phosphorus-reduction targets.
• Shared effectiveness-monitoring results, including nutrient reductions from treatment wetlands and remaining watershed challenges.

Cyanotoxin & Cyanobacteria Monitoring in Fairmont's Source & Finished Water
Shelby Kassuelke – Minnesota Department of Health
Presentation Attached
• Reported persistent microcystin and periodic anatoxin-a in source water, with finished water remaining safe throughout monitoring.
• Noted Budd Lake's unusually high cyanobacteria biomass compared to other Minnesota lakes.
• Recommended ongoing, high-frequency sampling during bloom seasons.



How DNR Permits Aeration and Evaluates Emerging Aeration Technologies

Denise Elston | Aeration Program Coordinator

218-580-8646

DEPARTMENT OF NATURAL RESOURCES

Aeration Permitting Basics
Under MN Statute 103G.611 MN Rule 6116

- All aeration operations in a public water require an aeration permit (MN Rule 6116.0020 subp. 1).
- The operation of the aeration system will result in substantial benefit to the lake resource, AND the objectives of the system are compatible with natural resources management and public safety goals for the lake (MN Rule 6116.0030 subp. 2)
- Other permits or reviews may apply

DNR's Approach on Emerging Aeration Technology

- Interagency Task Force was formed to review and evaluate emerging aeration technologies.
- Taking a precautionary approach to prevent unintended harm to aquatic ecosystems, public safety risks, or interference with existing lake management strategies.
- Approval only for time-limited, pilot projects
- Required emerging technology application form must also be submitted

Emerging Technology and the Regulatory Standard

- Same Rules apply
- Sufficient lake-scale data demonstrating measurable and sustained water quality improvements is lacking.
- Natural lake systems are dynamic and complex ecosystems.
- Water sampling, monitoring and reporting are required.
- Data collected from pilot proposals is evaluated.

Before Moving Forward

- A permit is not an endorsement.
- A pilot proposal authorization does not imply long-term, system approval for your lake.
- Cost and Long-Term Commitments.
- Other permits and agencies may need to be involved.
- More resources available on the DNR Lake Aeration webpage

DEPARTMENT OF NATURAL RESOURCES

Questions?

Denise Elston | Aeration Program Coordinator

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218-580-8646



Image source: Chain of Lakes Yacht Club



Image source: Fairmont Convention & Visitors Bureau

Overview of MPCA projects for Fairmont Chain of Lakes

Jeff Strom and Ben Lundeen

MINNESOTA POLLUTION CONTROL AGENCY

CLEAN WATER ACT MINNE50TA YEARS

Agenda

Topics to cover

- Timeline of MPCA projects for Fairmont Chain of Lakes and lakeshed
- Summary of phosphorus total maximum daily load study (TMDL)
- Strategies to meet TMDL phosphorus load reductions
- Overview of Fairmont Chain of Lakes (Dutch Creek & CD28) 319 Grant & Effectiveness Monitoring Project
- Water quality trends and next steps for chain of lakes

Timeline of MPCA work in watershed and lakes

2006

- Fairmont lakes added to MPCA's Impaired Waters List (IWL)
- Dutch Creek added to IWL for fecal coliform and turbidity

2007

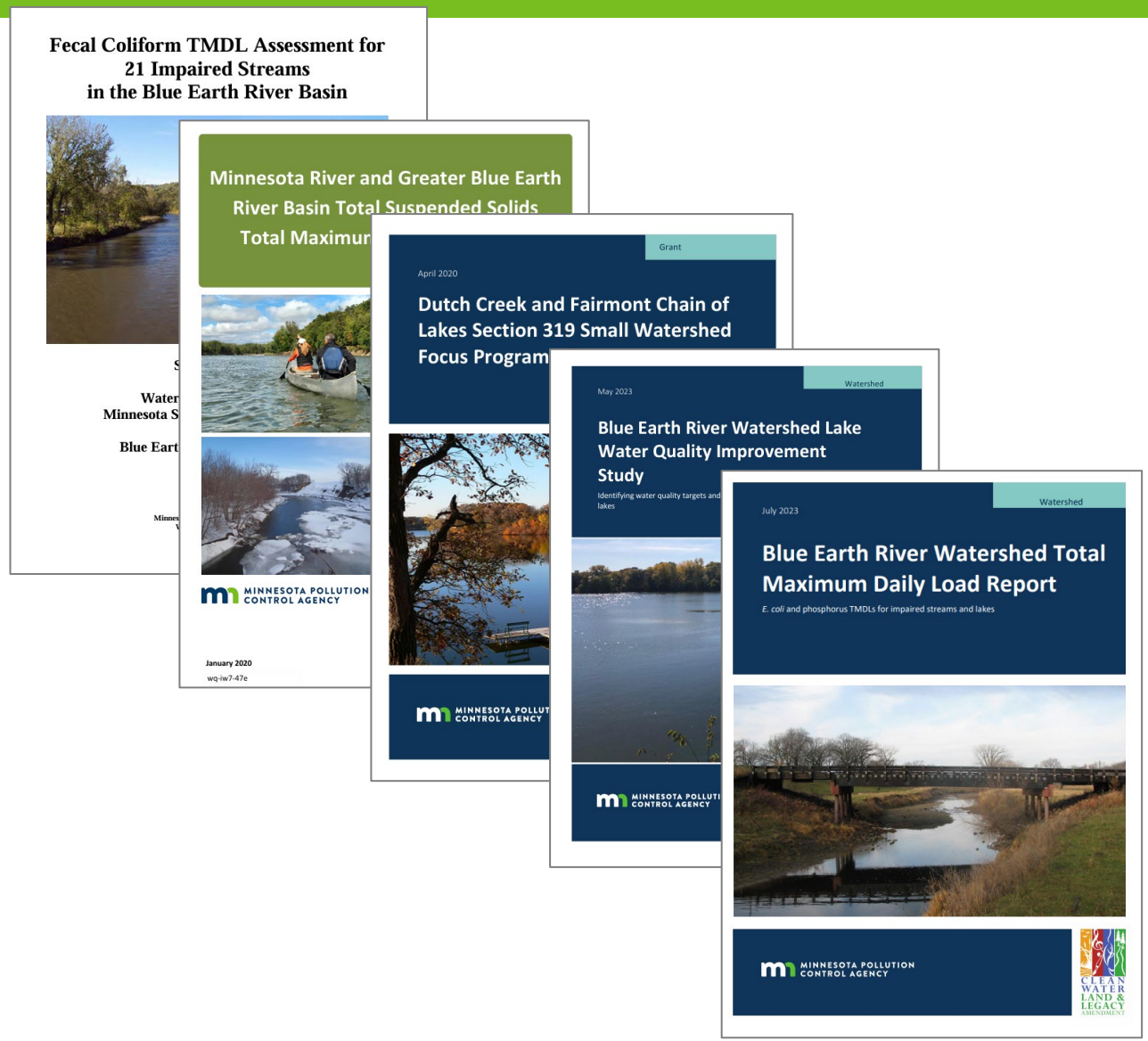
- Dutch Creek fecal coliform TMDL completed

2020:

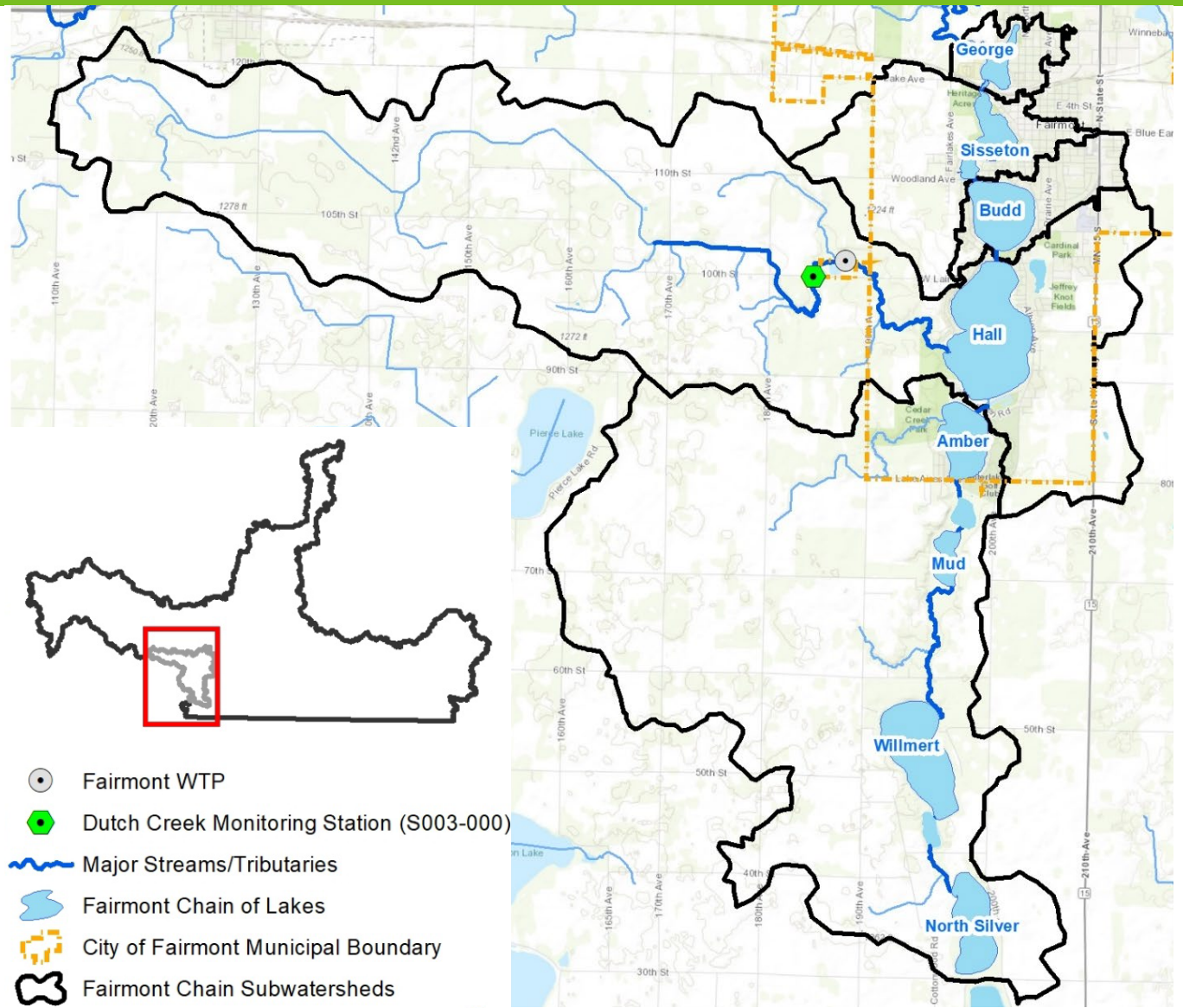
- Dutch Creek turbidity TMDL completed
- Dutch Creek & Fairmont Chain of Lakes Section 319 Nine Key Element Plan completed

2023:

- Fairmont Lake Water Quality Improvement Study
- Fairmont Lake TMDL study completed



Fairmont Chain of Lakes impairments



- All lakes impaired for aquatic recreation (2006)
- Candidate cause: high nutrients (phosphorus) → high algae
- Amber
- Hall
- Budd
- Sisseton
- George

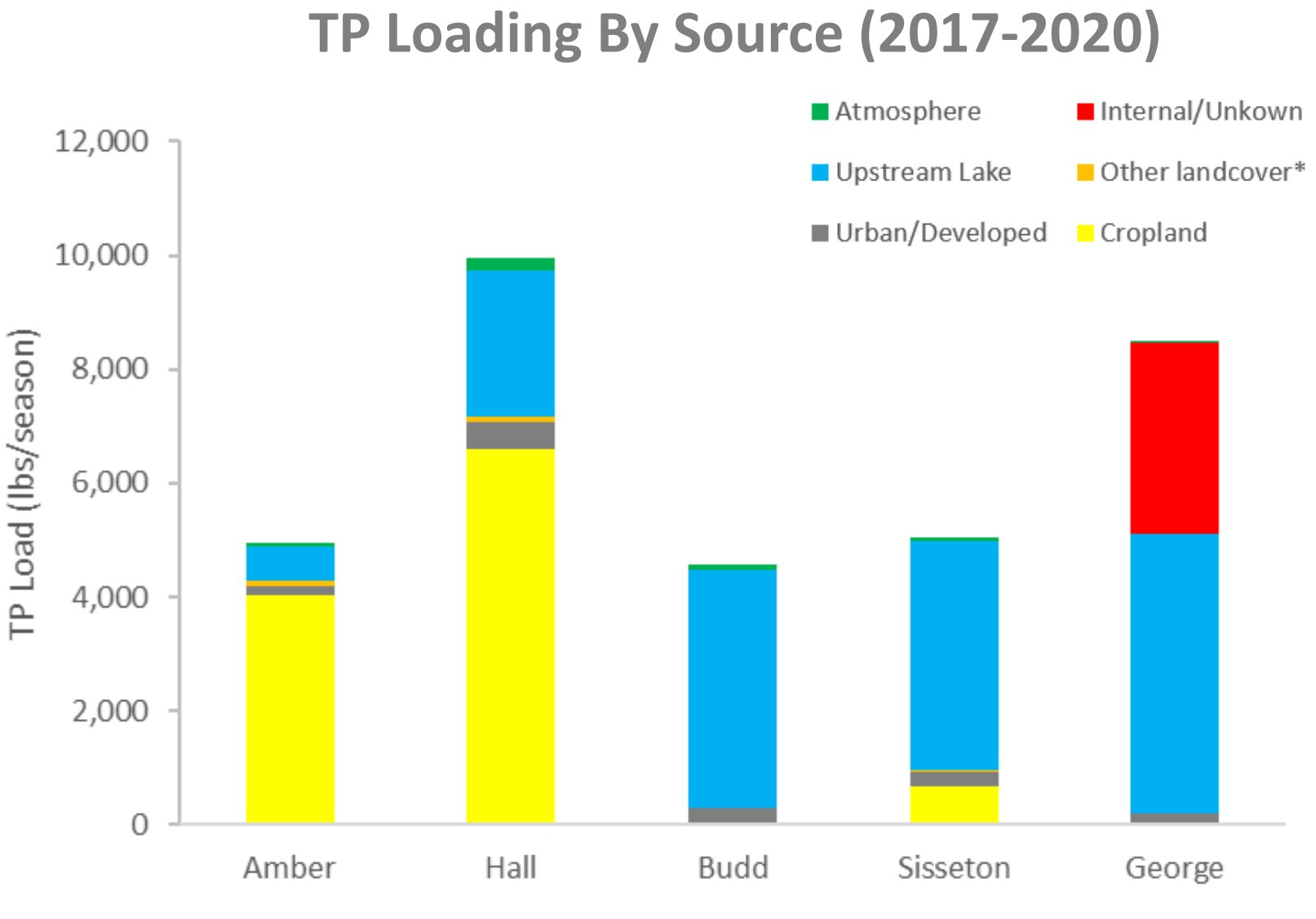
2023 Fairmont Chain of Lakes Total Maximum Daily Load (TMDL)

TMDL = the "math and the path"

Lake Name	Lake ID	TP (µg/L)	
		Observed	Target
Amber	46-0034-00	107	90
Hall	46-0031-00	79	65
Budd	46-0030-00	75	65
Sisseton	46-0025-00	85	75
George	46-0024-00	145	90

Fairmont Chain of Lakes TMDL – current conditions





Fairmont Chain of Lakes TMDL – phosphorus reductions

Lake	Reduction from city areas* (lbs/season)	Reduction from non-city areas (lbs/season)
Amber	78	1,009
Hall	132	1,726
Budd	115	--
Sisseton	146	66
George	64	--
TOTALS	**535**	**2,801**

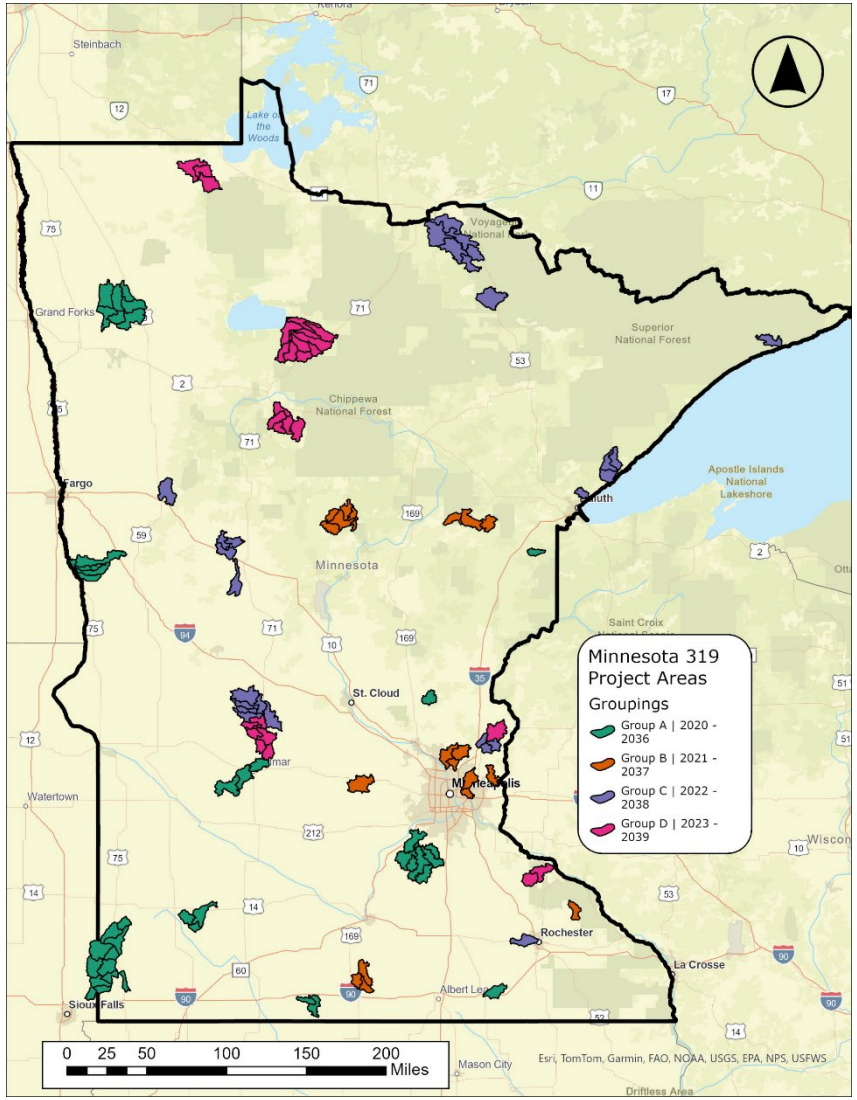
*landcover for city areas are currently ~51% cropland and ~49% developed

General strategies to meet TP targets and goals

Strategy type	Lake(s) and/or targeted location(s)
Offline treatment wetland	Mouth of Dutch Creek
Soil health (e.g., reduced tillage, no till/strip till, cover crops)	Prioritize critical areas in Hall Lake watershed identified in NKE plan
Livestock management (e.g., exclusion fencing, feedlot compliance)	Prioritize operations near riparian areas and where livestock have direct access to streams
Nutrient management (e.g., fertilizer rates and timed application, targeted nutrient management plans, manure management plans, manure crediting, manure testing and equipment calibration)	Watershed-wide
Conservation cover (e.g., wetland restorations, filter strips, maintain buffer compliance)	Prioritize critical areas in Hall Lake watershed identified in NKE plan
Agricultural BMPs (e.g., WASCOBs, grassed waterways, saturated buffers, bioreactors, controlled drainage)	Prioritize critical areas in Hall Lake watershed identified using the ACPF tool developed by Martin SWCD
Urban stormwater runoff control (e.g., rain gardens)	Prioritize developed areas within city of Fairmont with highest areal P loading rates
Internal phosphorus recycling (i.e., collect additional data and develop feasibility report within 10 years)	All priority lakes

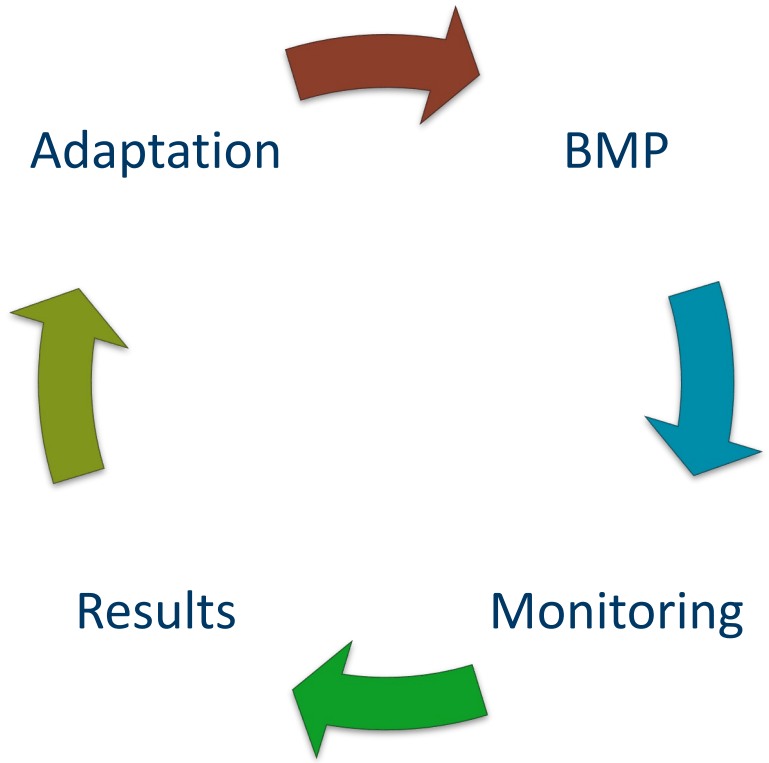
Minnesota's Unique Opportunity

- There are 35 Section 319 small watershed "projects" within the State:
  - Comprising 115 HUC 12 subwatersheds
- Phase roll-out of watersheds:
  - Group A | 2020 - 2036
  - Group B | 2021 - 2037
  - Group C | 2022 - 2038
  - Group D | 2023 - 2039

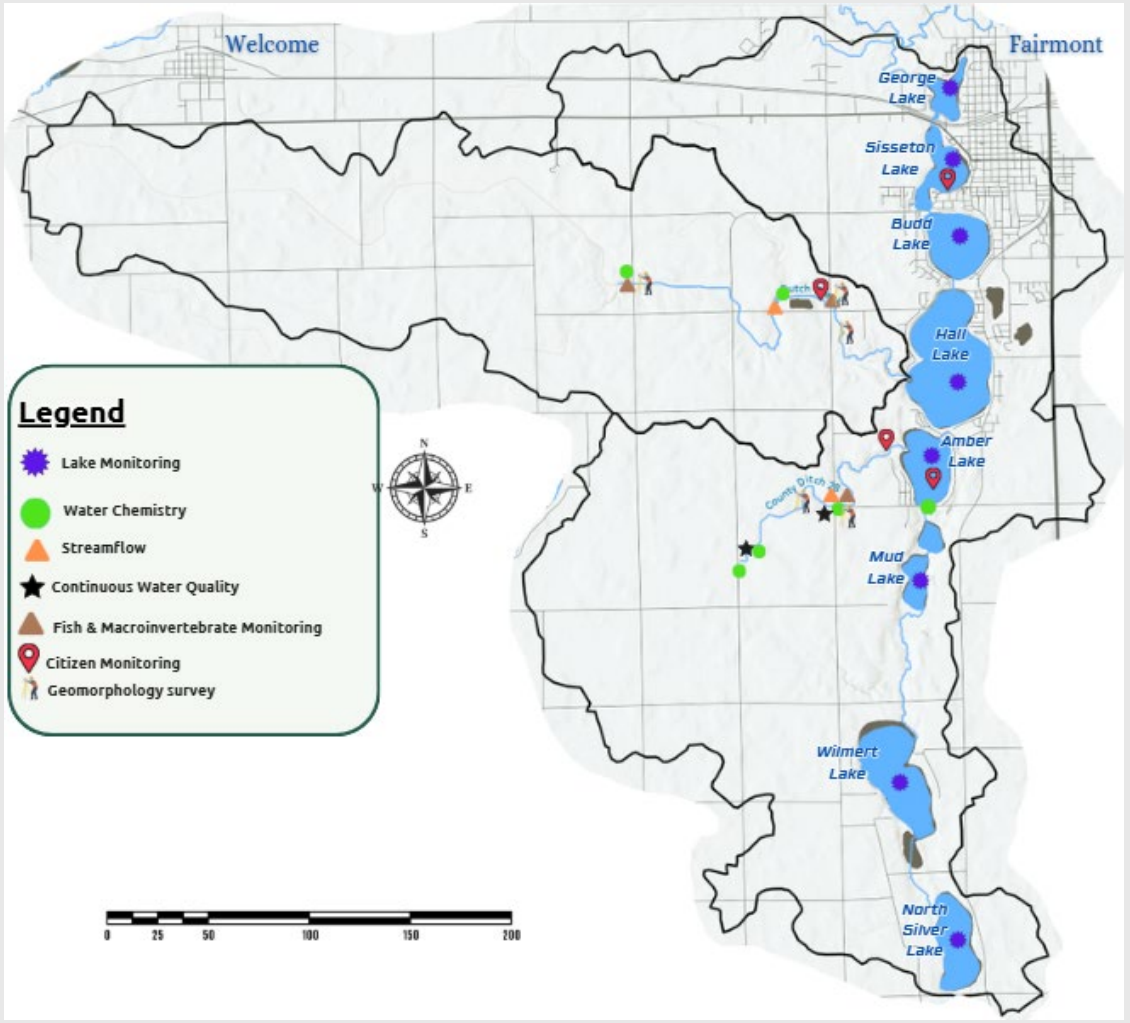


What is Effectiveness Monitoring?

- Tracks how Best Management Practices (BMPs) affect water quality, habitat, and biological integrity.
- Provides evidence base for adaptive management.
- Bridges the gap between implementation & environmental outcomes.

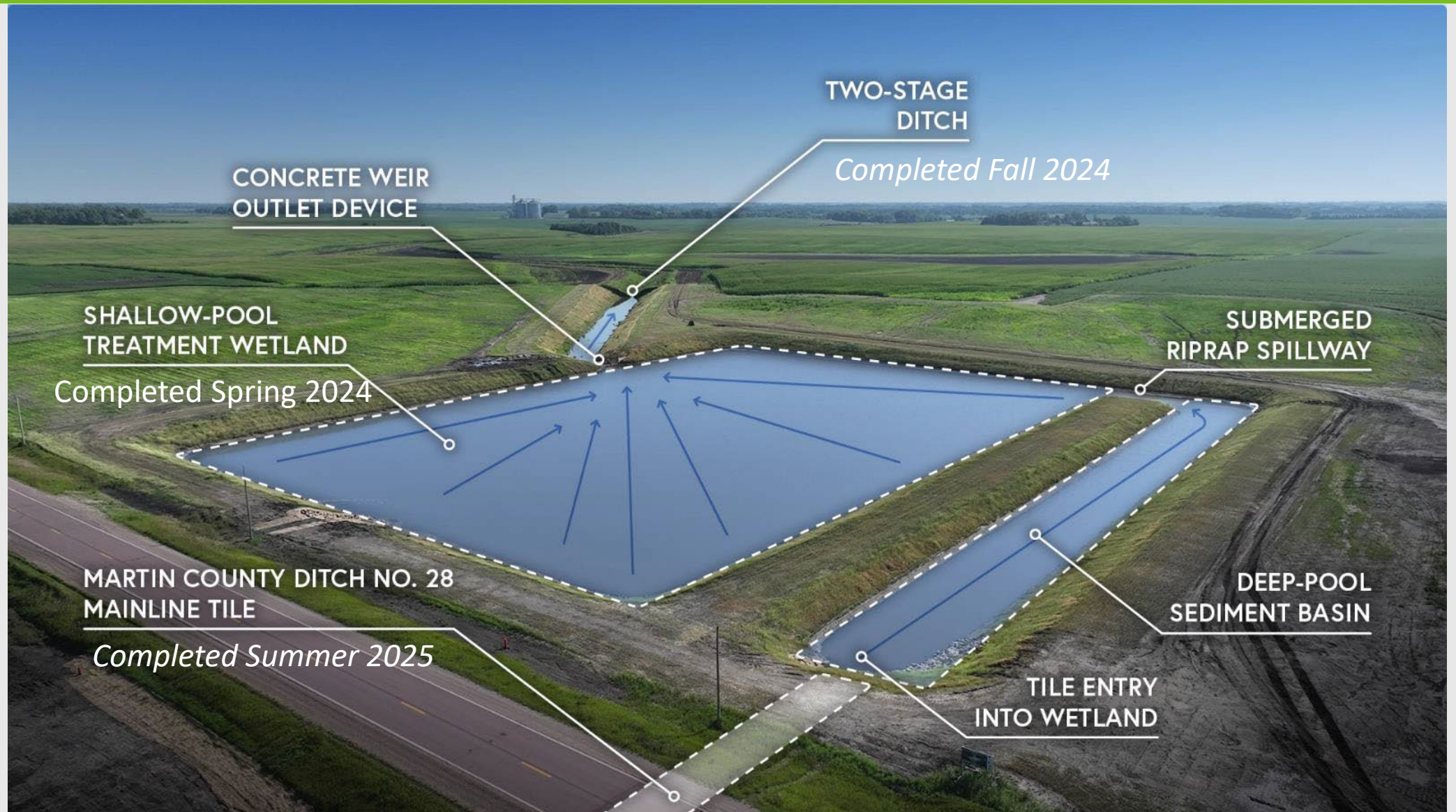


Fairmont Chain of Lakes 319 Monitoring Overview

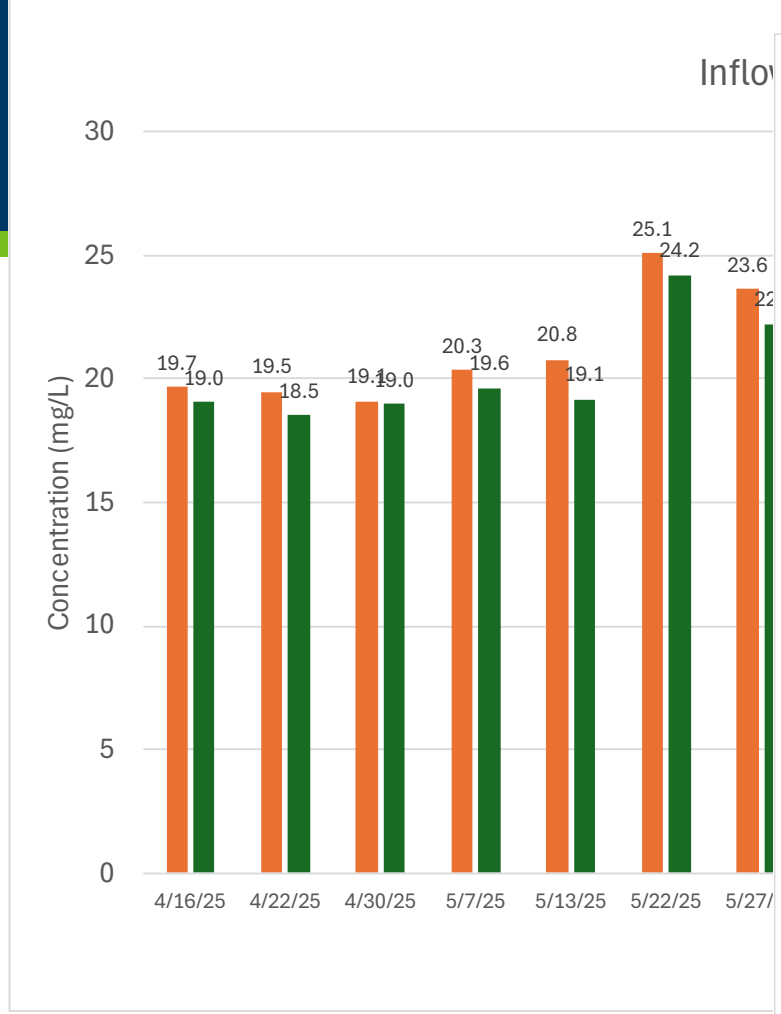


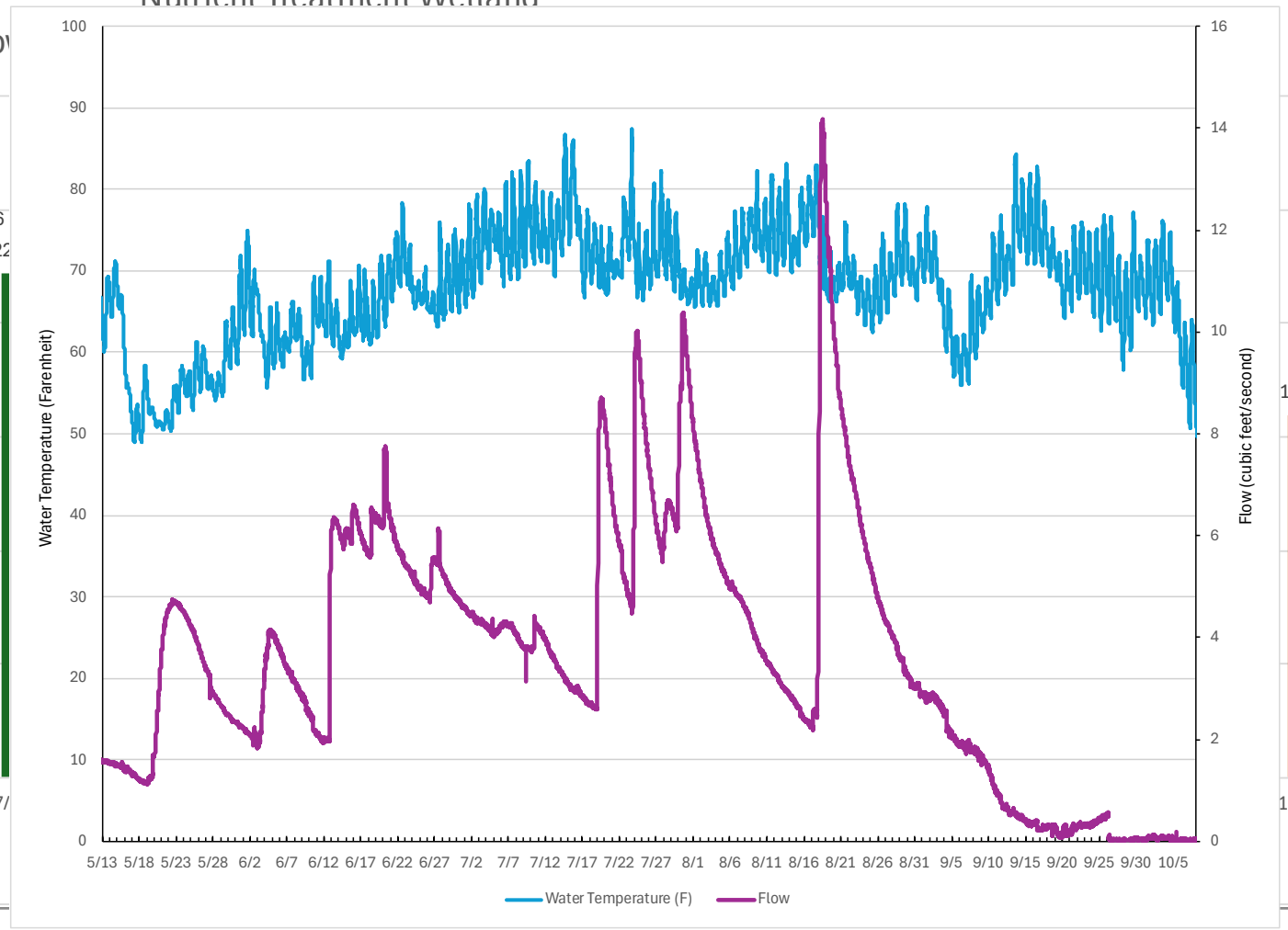
- Partnership of Martin SWCD, MPCA and MDA.
- Monitoring conducted by Martin Soil and Water Conservation District. 15-20 sample events/year.
- Samples analyzed for TSS, TP, DOP, NO2+NO3-N, TKN and E.coli at Minnesota Valley Testing Laboratory in New Ulm, MN.
- Biological monitoring (fish & macroinvertebrates) by Martin SWCD
- MPCA funding (319) for sample collection (Martin SWCD) and laboratory analysis (MVTL). Also providing flow measurements.
- Continuous flow and nitrate monitoring conducted through collaboration by MDA & MPCA.
- Time series data available through the MDA OneRain website.

Martin County Ditch Nutrient Treatment Train

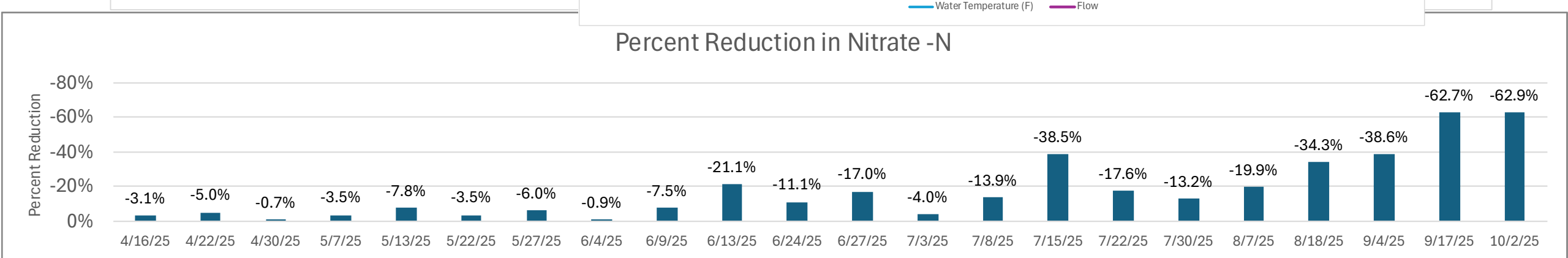


Source: ISG, Inc.

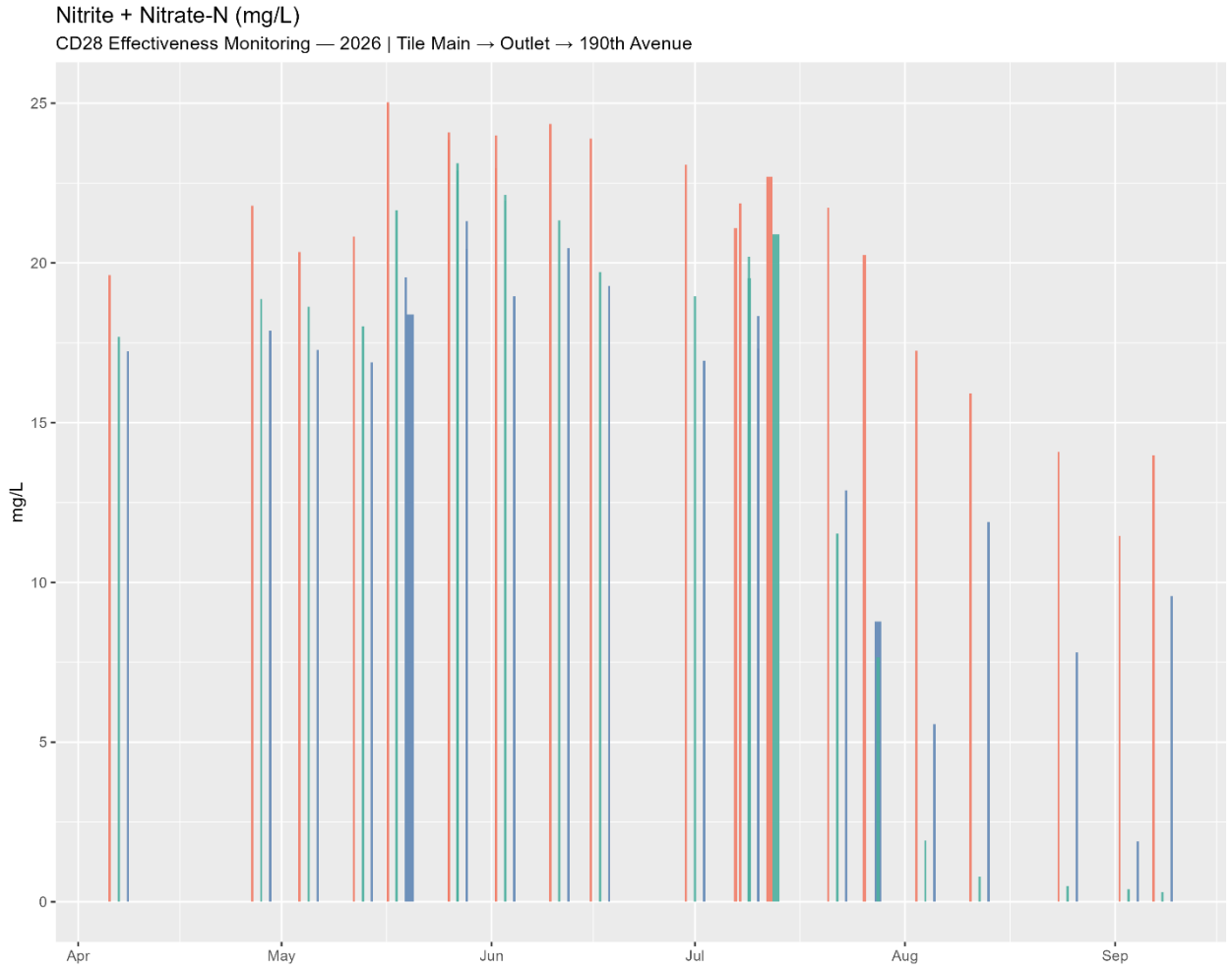

Inflo
Concentration (mg/L)
30
25
20
15
10
5
0
19.7
19.0
19.5
18.5
19.1
19.0
20.3
19.6
20.8
19.1
25.1
24.2
23.6
4/16/25
4/22/25
4/30/25
5/7/25
5/13/25
5/22/25
5/27/


Nutrient Treatment Wetland
Water Temperature (Farenheit)
Flow (cubic feet/second)
100
90
80
70
60
50
40
30
20
10
0
16
14
12
10
8
6
4
2
0
5/13 5/18 5/23 5/28 6/2 6/7 6/12 6/17 6/22 6/27 7/2 7/7 7/12 7/17 7/22 7/27 8/1 8/6 8/11 8/16 8/21 8/26 8/31 9/5 9/10 9/15 9/20 9/25 9/30 10/5
Water Temperature (F)
Flow


16.0
5.9
10/2/25

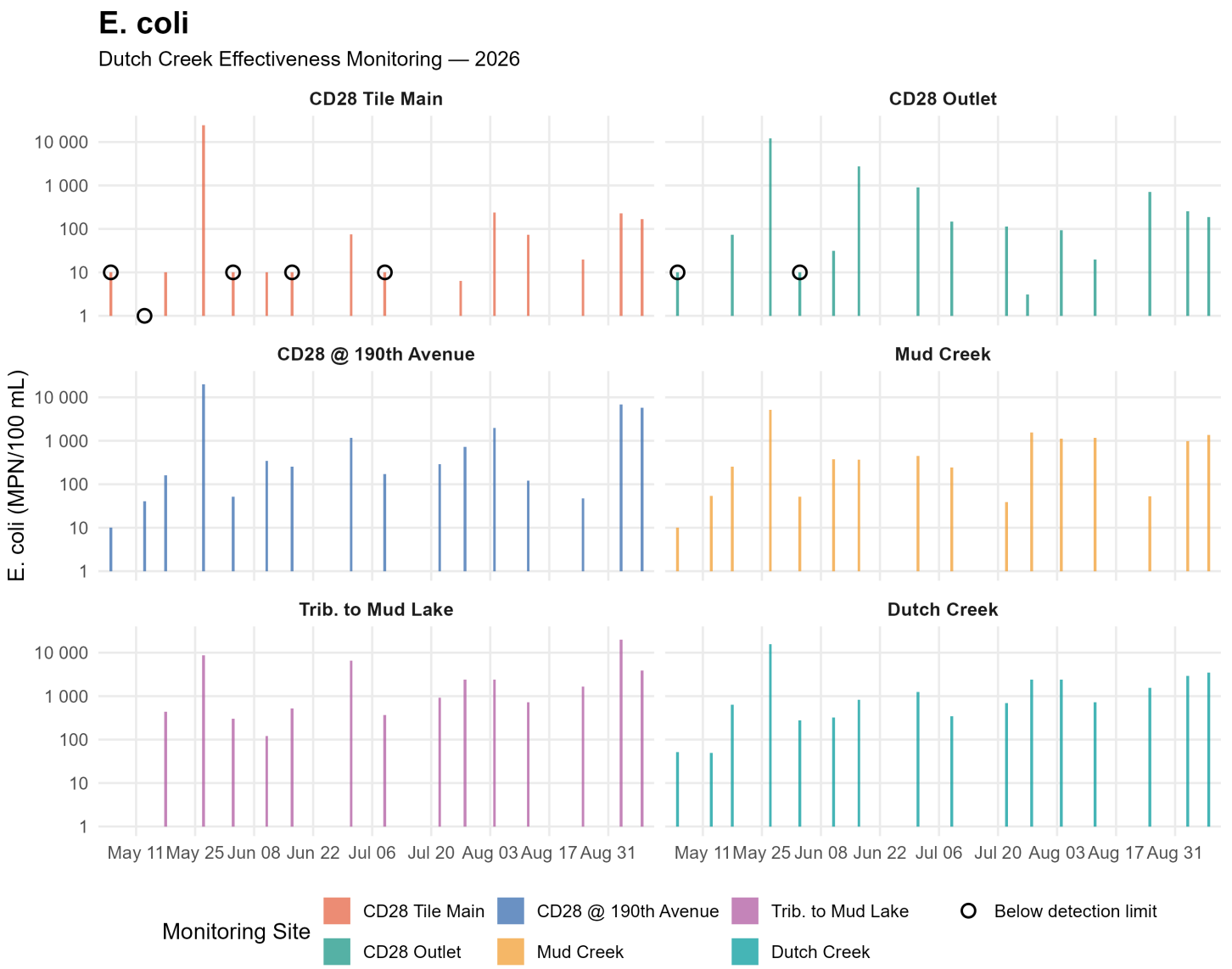

Percent Reduction in Nitrate -N
Percent Reduction
-80%
-60%
-40%
-20%
0%
-3.1%
-5.0%
-0.7%
-3.5%
-7.8%
-3.5%
-6.0%
-0.9%
-7.5%
-21.1%
-11.1%
-17.0%
-4.0%
-13.9%
-38.5%
-17.6%
-13.2%
-19.9%
-34.3%
-38.6%
-62.7%
-62.9%
4/16/25
4/22/25
4/30/25
5/7/25
5/13/25
5/22/25
5/27/25
6/4/25
6/9/25
6/13/25
6/24/25
6/27/25
7/3/25
7/8/25
7/15/25
7/22/25
7/30/25
8/7/25
8/18/25
9/4/25
9/17/25
10/2/25

CD28 | Following the Nitrate Signal Downstream

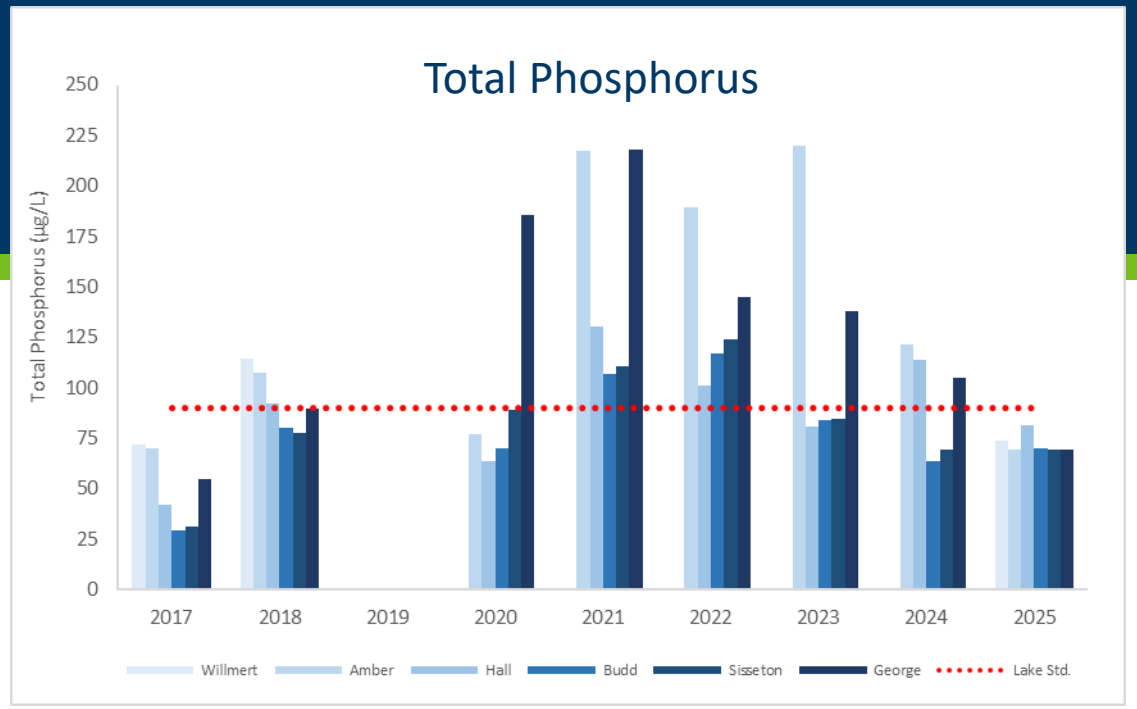


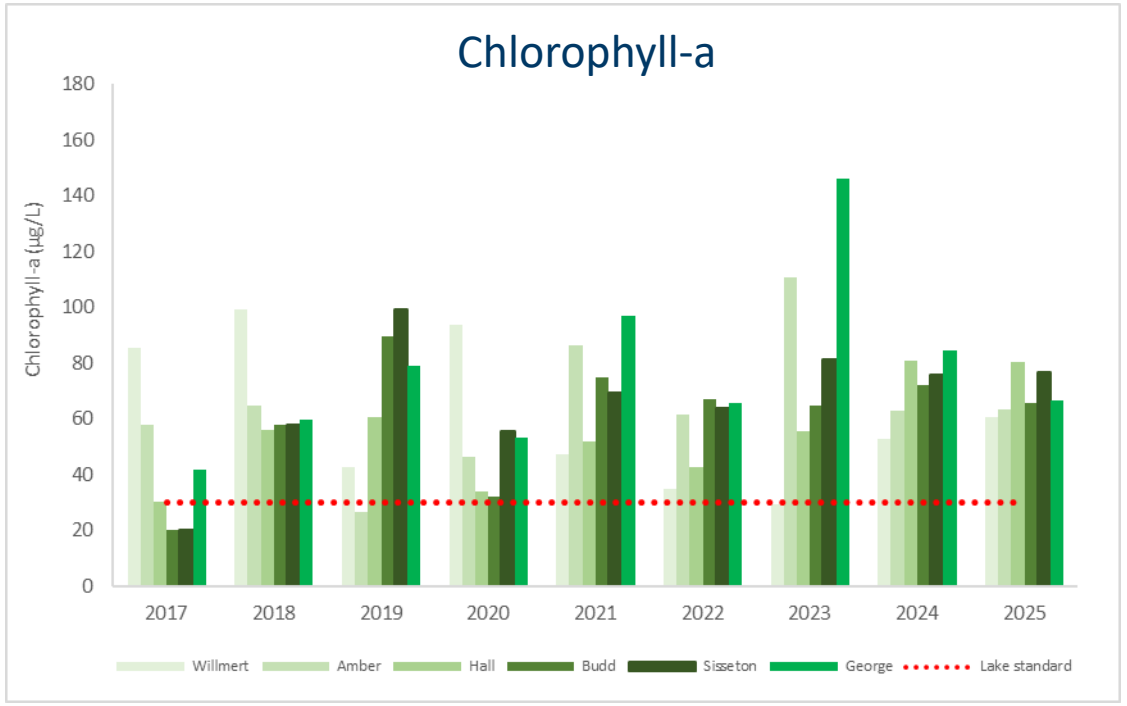


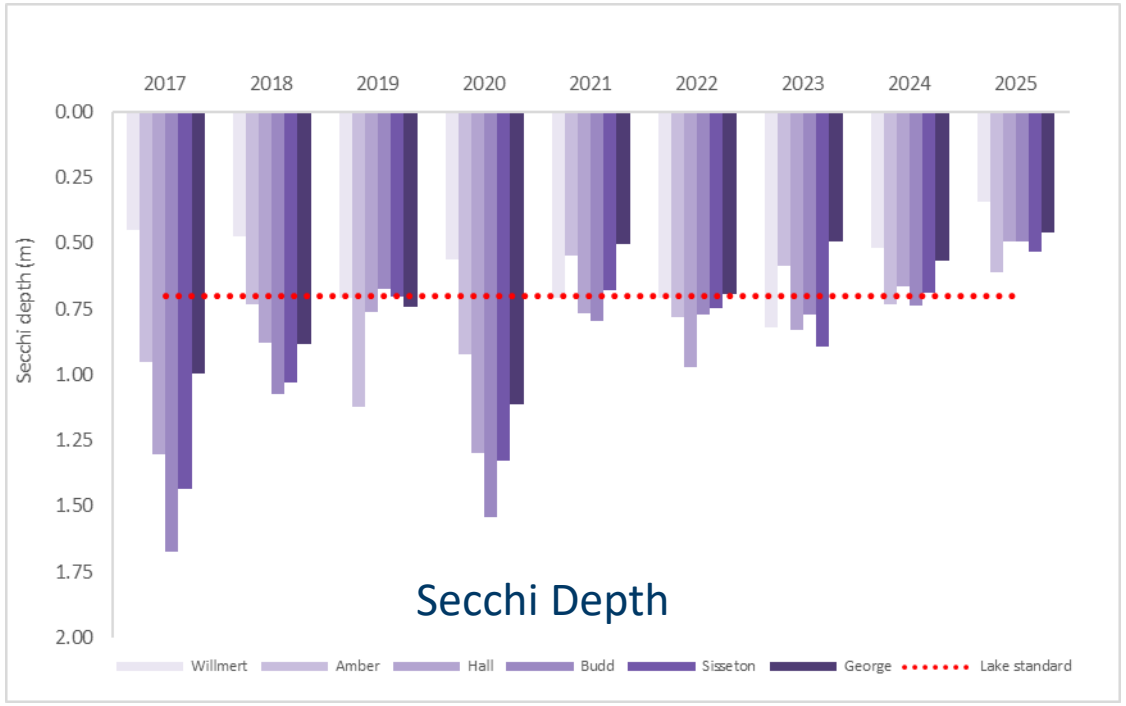
A New Concern



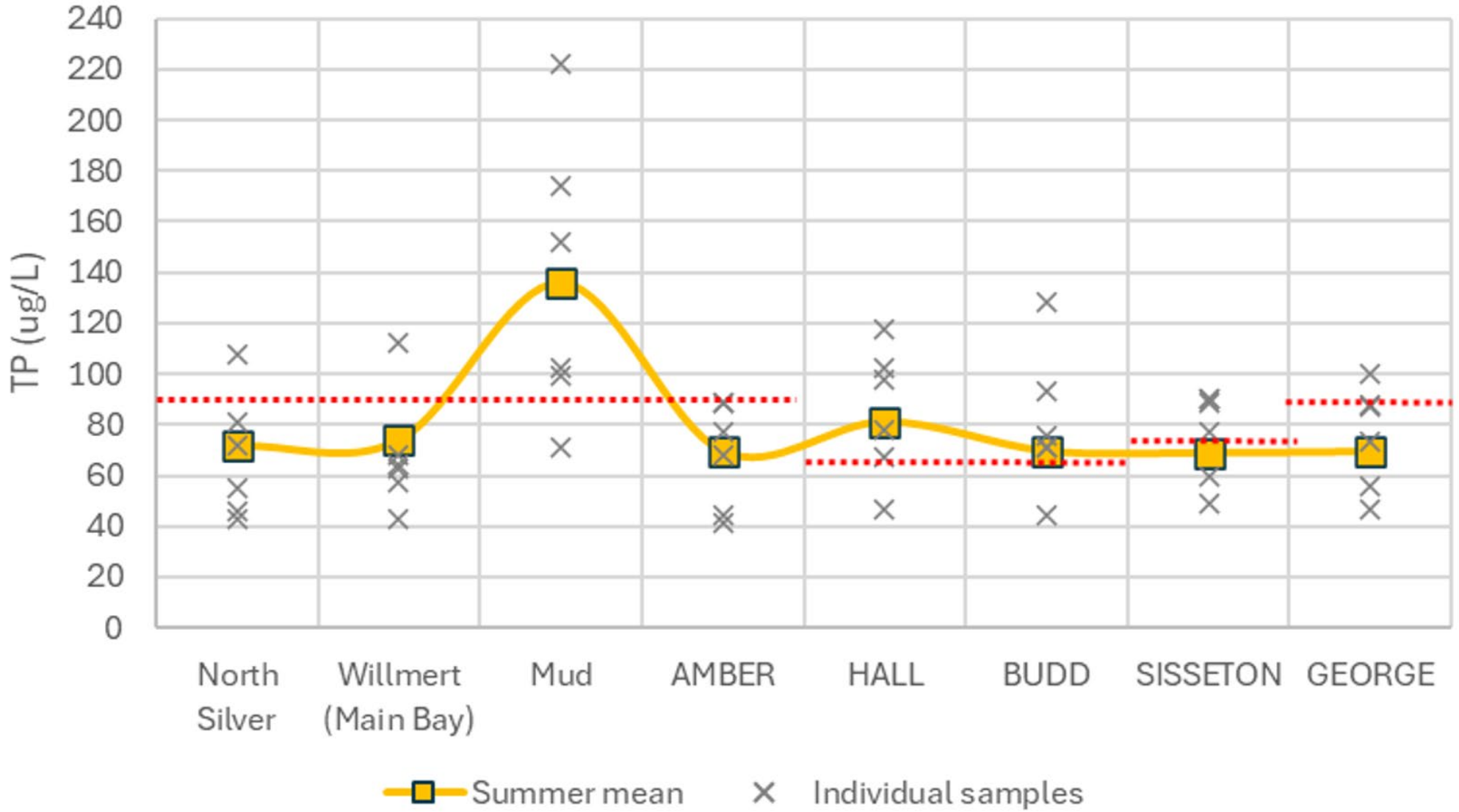
Historic data and trends



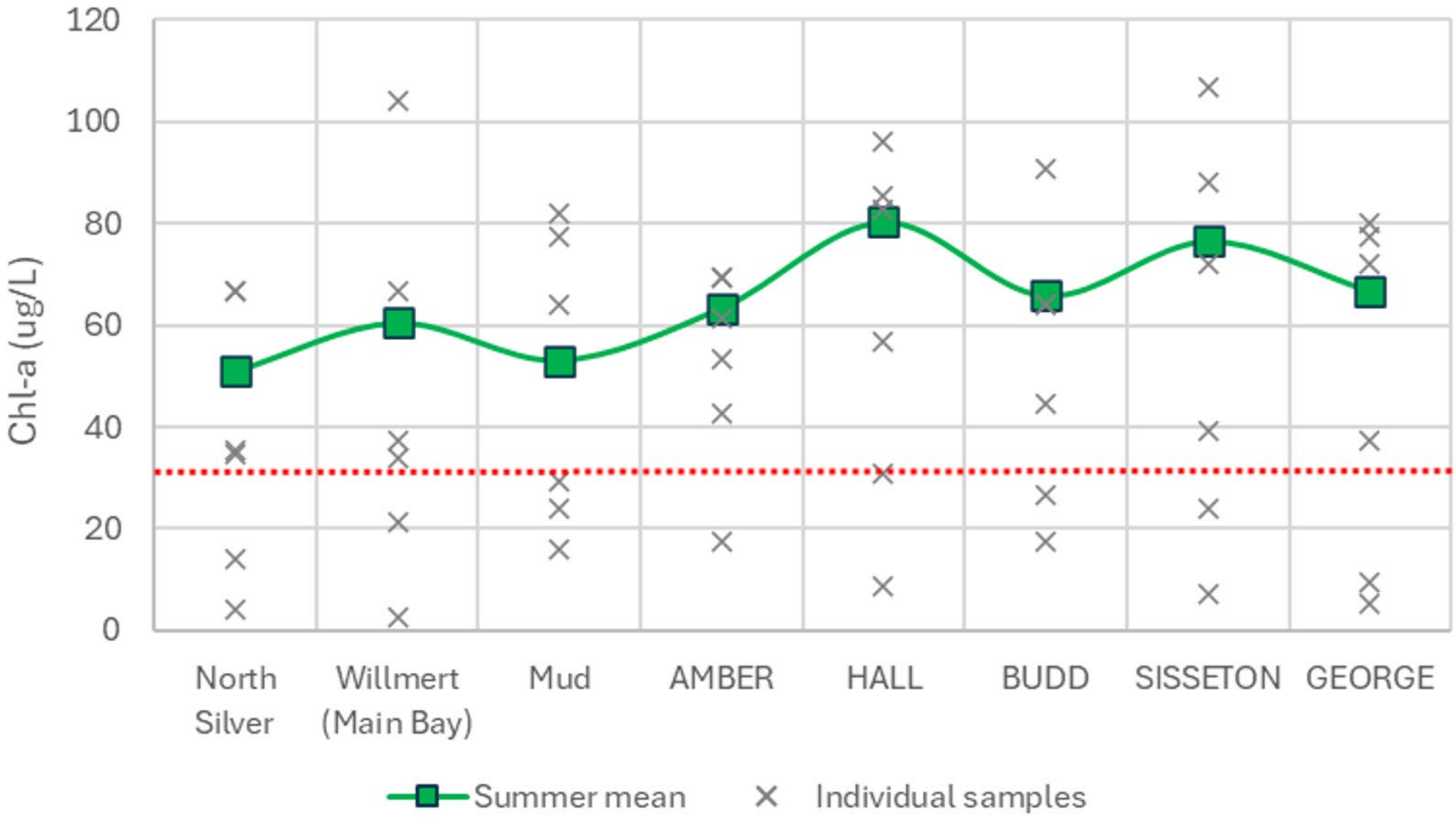




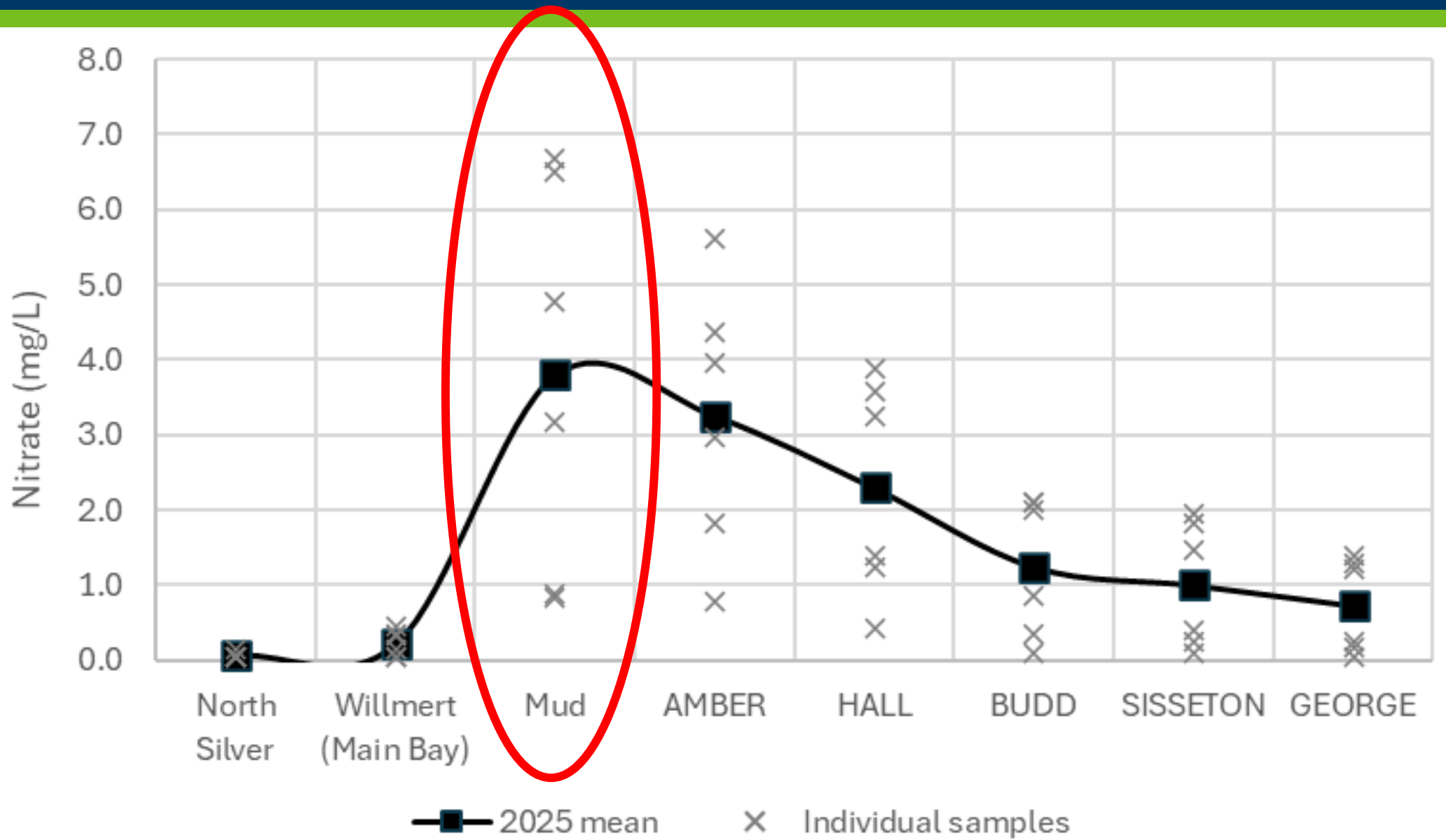
2025 Phosphorus



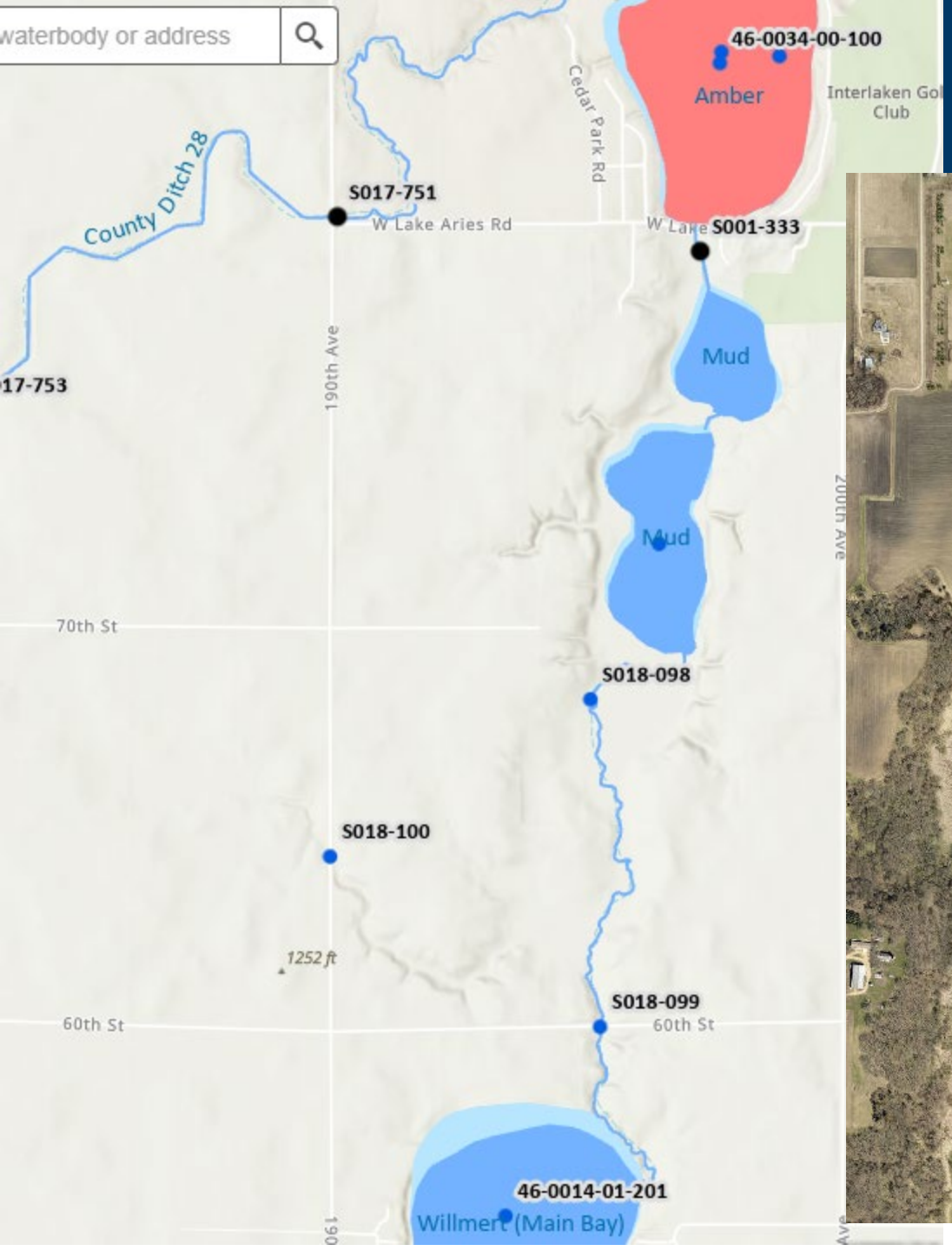
2025 Chlorophyll-a



2025 Nitrate



Mud Lake nitrogen sources





Next steps

- Currently reviewing and analyzing 2026 data
- Meet with local partners and agencies
- Figure out monitoring needs for 2027
- Explore in-lake nitrogen targets and reductions for the chain of lakes to reduce algae and eutrophication

Thank you!

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Ben Lundeen

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MINNESOTA POLLUTION CONTROL AGENCY



Cyanotoxin and Cyanobacteria Monitoring in Fairmont's Source Water and Finished Drinking Water

CLEAN WATER LAND & LEGACY AMENDMENT

YOUR Clean Water Fund AT WORK

Shelby Kassuelke – Hydrologist

Source Water Protection

DEPARTMENT OF HEALTH

Outline

- Overview of Drinking Water Ambient Monitoring Program (DWAMP)
- Background on cyanobacteria, cyanotoxins, and harmful algal blooms
- Fairmont data
- Comparison to other 2025 monitoring locations
- Summary and takeaways



Drinking Water Ambient Monitoring Program (DWAMP)

The goal of drinking water ambient monitoring is to establish ongoing, permanent capacity to:

1. address concerns about public health exposure to Contaminants of Emerging Concern (CECs)
2. support advanced decision making to secure long term water resource management, especially regarding drinking water sources

DWAMP Sampling Objectives



CEC Horizon Scanning



Follow up CEC sampling



Watershed-scale characterization



Surface water sampling

Harmful Algal Blooms

Excessive growth of algae or cyanobacteria

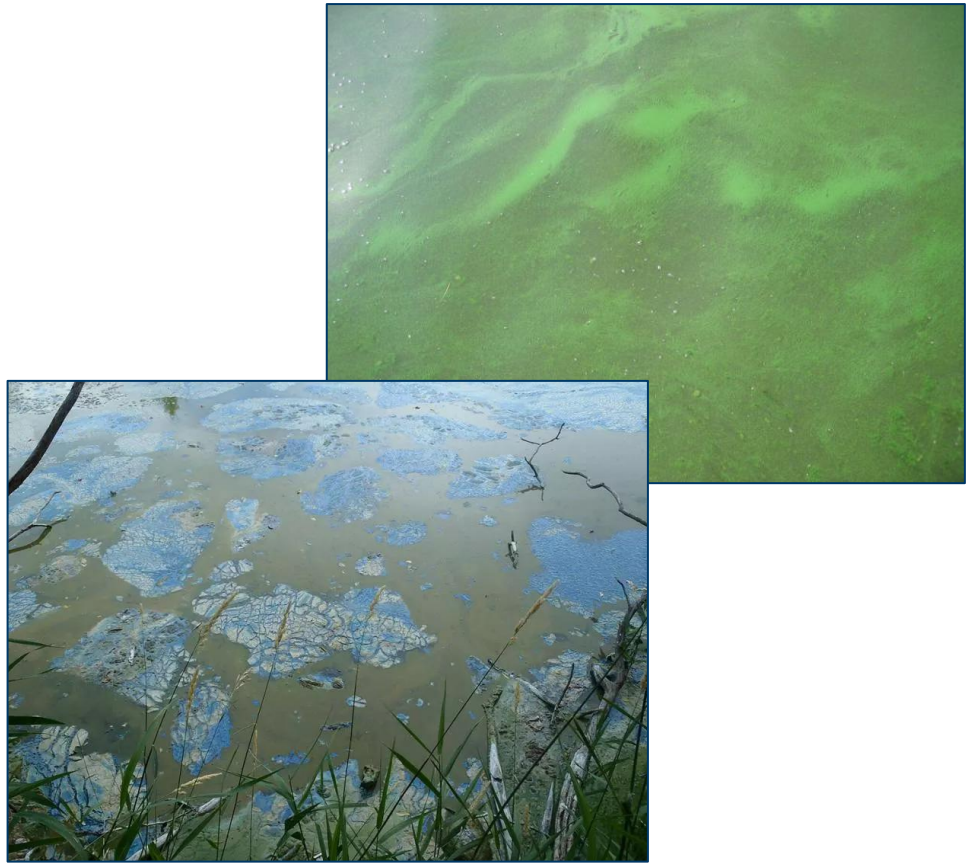
- Degrades water quality
- Can produce harmful toxins

Cyanobacteria blooms have both:

1. ***Cyanobacteria (living cells)***
2. ***Cyanotoxins (contaminants produced by the cells)***

Generally caused or exacerbated by:

- Excess nitrogen and/or phosphate
- Warm water temperature
- Low circulation



Cyanobacteria

- “Blue-green algae”
- Photosynthetic bacteria that live in surface water
- When **cyanobacteria** overgrow, they may contaminate water with **cyanotoxins**
- Cyanotoxins are thought to play a role in chemical defense, competition, and signaling
- Produced and stored in the cells of cyanobacteria, released when the cells die and rupture

Cyanotoxins

- **Microcystin**
- **Anatoxin-a**
- Cylindrospermopsin
- Saxitoxin



MPCA recommendations: Cyanotoxin levels for swimming advisories

Type of cyanotoxin	Swimming advisories (µg/L)*
Microcystin (-LR and total)	6
Anatoxin-a	7
Cylindrospermopsin	15**

Microcystin

- Hepatoxin (impacts the liver and kidneys)
  - Mild intoxication: nausea, vomiting, abdominal pain, headache
  - Severe intoxication: Liver damage, liver failure, death
  - Long-term low-level exposure: potentially cancer

- Health guidance
  - MDH HBV: 0.1 ug/L - microcystin-LR
  - EPA HAL: 0.3 ug/L (infants and toddlers); 1.6 ug/L (children and adults) – total microcystins

Anatoxin-a

- Neurotoxin
  - Tingling and numbness, loss of coordination, muscle twitches, convulsions, respiratory paralysis, death
- Health guidance
  - Added to third CCL in 2009
  - MDH RAA: 0.1 (ug/L)
  - Some states enforce their own values

State	Value Type	Value (µg/L)
Minnesota	Short Term (1-30 days) Risk Assessment Advice Level	0.1
Washington	Provisional Health Advisory Level (Do Not Drink)	0.3
Ohio	Do Not Drink Advisory – Sensitive Populations/Adults and Animals	0.3/1.6
Vermont	Drinking Water Guidance Value	0.5
California	Short Term/Acute Notification Level Recommendation	4/8
Rhode Island	Do Not Drink Warning	20
West Virginia	Drinking Water Guidance Value	20

Monitoring

Analytes:

- Cyanotoxins (collected surface water from intake and drinking water from treatment plant)
  - Anatoxin-a
  - Total Microcystins
  - Cylindrospermopsin
  - Saxitoxin
- Cyanobacteria Biovolume (from intake only)
- Field Parameters (from intake only):
  - DO, SPC, temp, ORP, pH, PC, Chl

Fairmont Monitoring Schedule:

Biweekly April 2025 – March 2026

Weekly April 2026 – Current

Other systems monitored in 2025:
Duluth, Eveleth, Mankato, Moorhead, Biwabik, St. Paul, Minneapolis

Other systems monitored in 2026:
Two Harbors, Eveleth, East Grand Forks, International Falls, 4 non-municipal systems



Biweekly Data
April 2025 – March 2026

Full Year Summary of Biweekly Monitoring Data

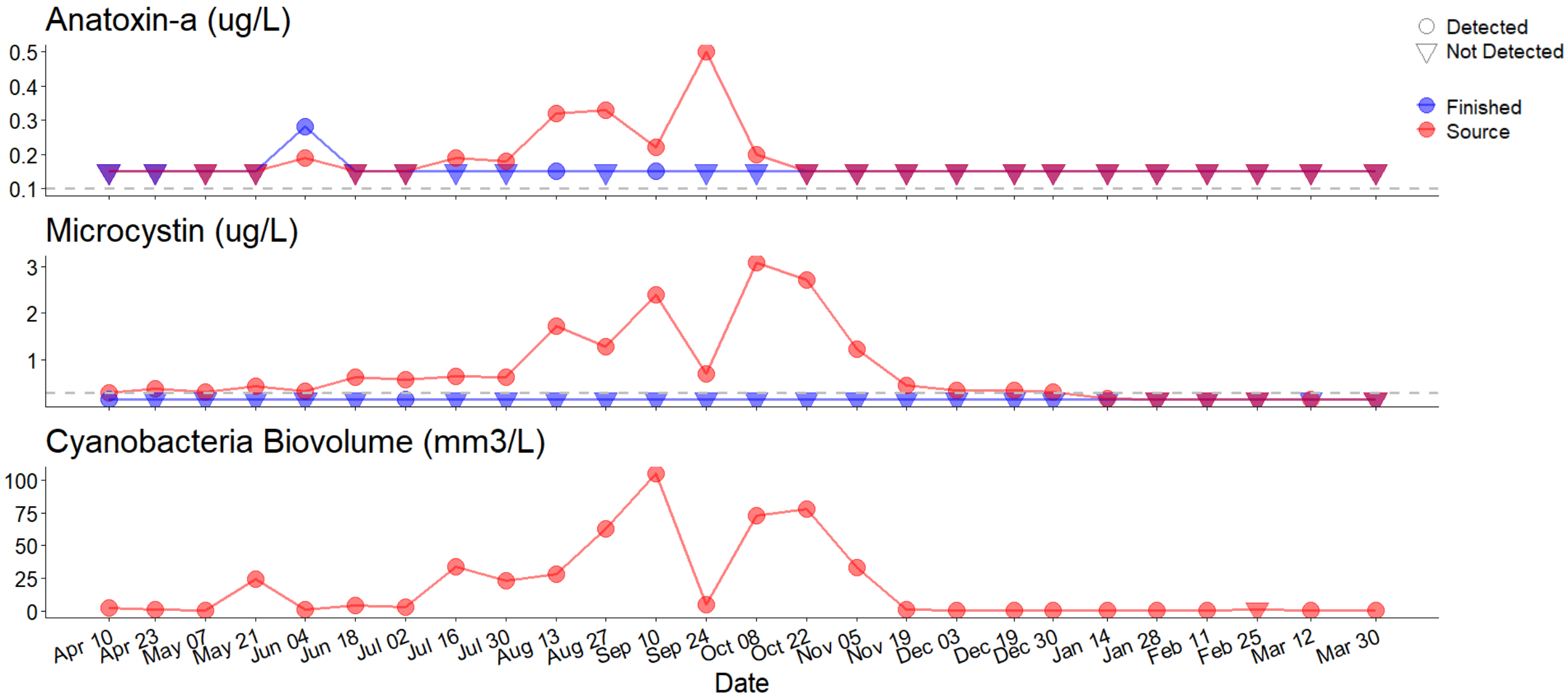
Fairmont Source Water

Cyanotoxin Compound	Detection Limit (µg/L)	Samples	Max Concentration (µg/L)	Detections	Detections Above Health Value
Anatoxin-a	0.15	26	0.50	8	8
Cylindrospermopsin	0.05	26	<0.05	0	0
Microcystin (total)	0.15	26	3.08	22	19
Saxitoxin	0.02	26	0.04	18	0

Fairmont Finished Water

Cyanotoxin Compound	Detection Limit (µg/L)	Samples	Max Concentration (µg/L)	Detections	Detections Above Health Value
Anatoxin-a	0.15	26	0.28	3	3
Cylindrospermopsin	0.05	26	<0.05	0	0
Microcystin (total)	0.15	26	0.16	2	0
Saxitoxin	0.02	26	0.02	3	0

Time Series of Biweekly Data





Weekly Data
April 2026 – August 2026

Summary of Currently Available Weekly Monitoring Data

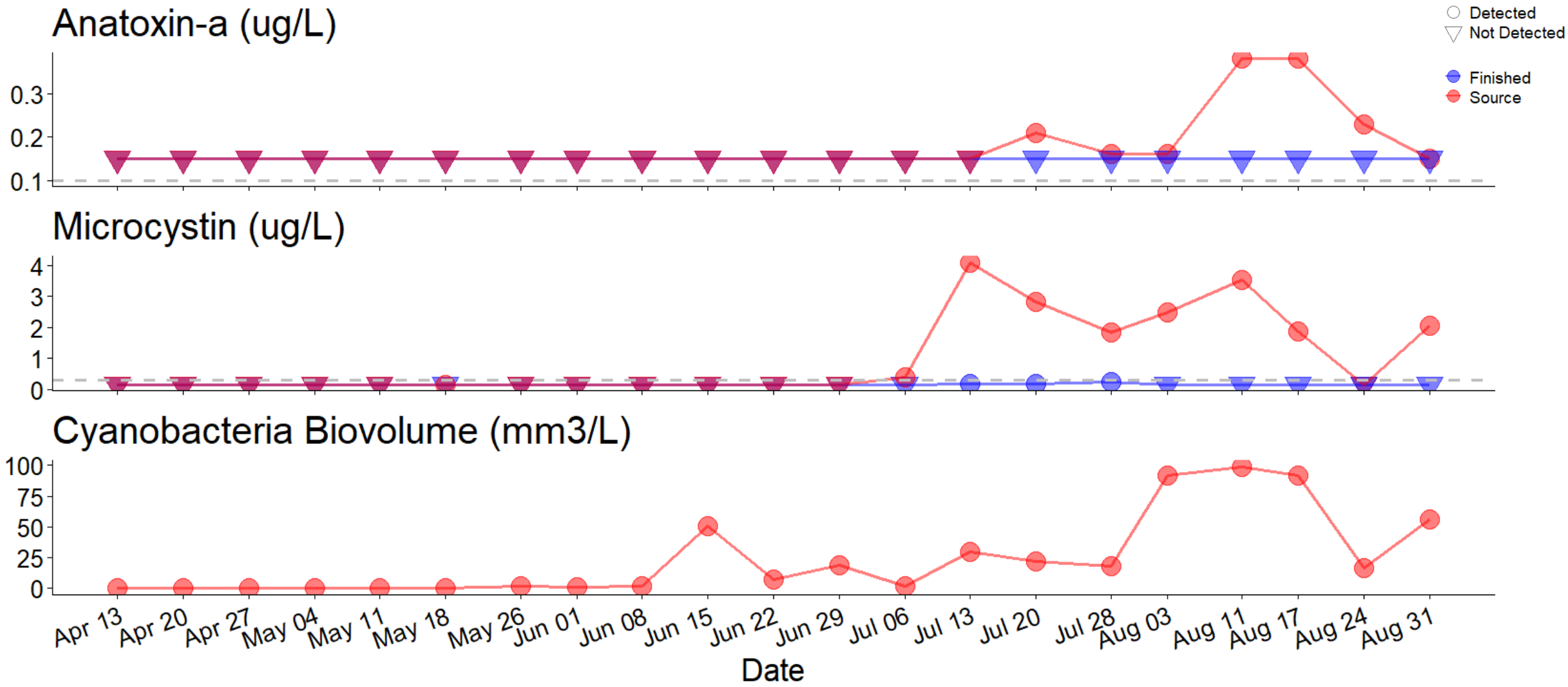
Fairmont Source Water

Cyanotoxin Compound	Detection Limit (µg/L)	Samples	Max Concentration (µg/L)	Detections	Detections Above Health Value
Anatoxin-a	0.15	21	0.38	7	7
Cylindrospermopsin	0.05	21	<0.05	0	0
Microcystin (total)	0.15	21	4.09	9	8
Saxitoxin	0.02	21	0.02	3	0

Fairmont Finished Water

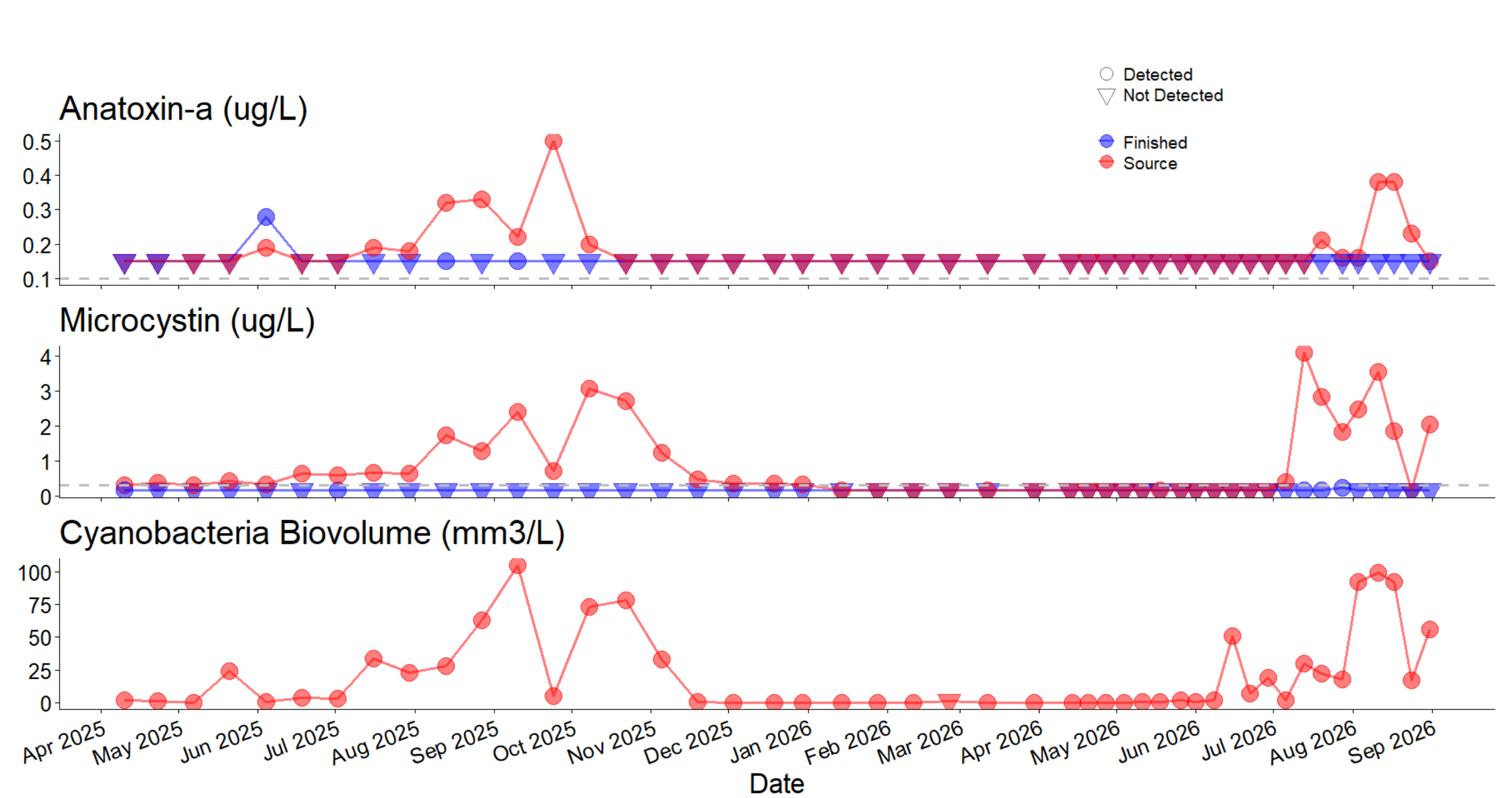
Cyanotoxin Compound	Detection Limit (µg/L)	Samples	Max Concentration (µg/L)	Detections	Detections Above Health Value
Anatoxin-a	0.15	21	<0.15	0	0
Cylindrospermopsin	0.05	21	<0.05	0	0
Microcystin (total)	0.15	21	0.22	3	0
Saxitoxin	0.02	21	0.02	1	0

Time Series of Weekly Data: April 2026 – August 2026

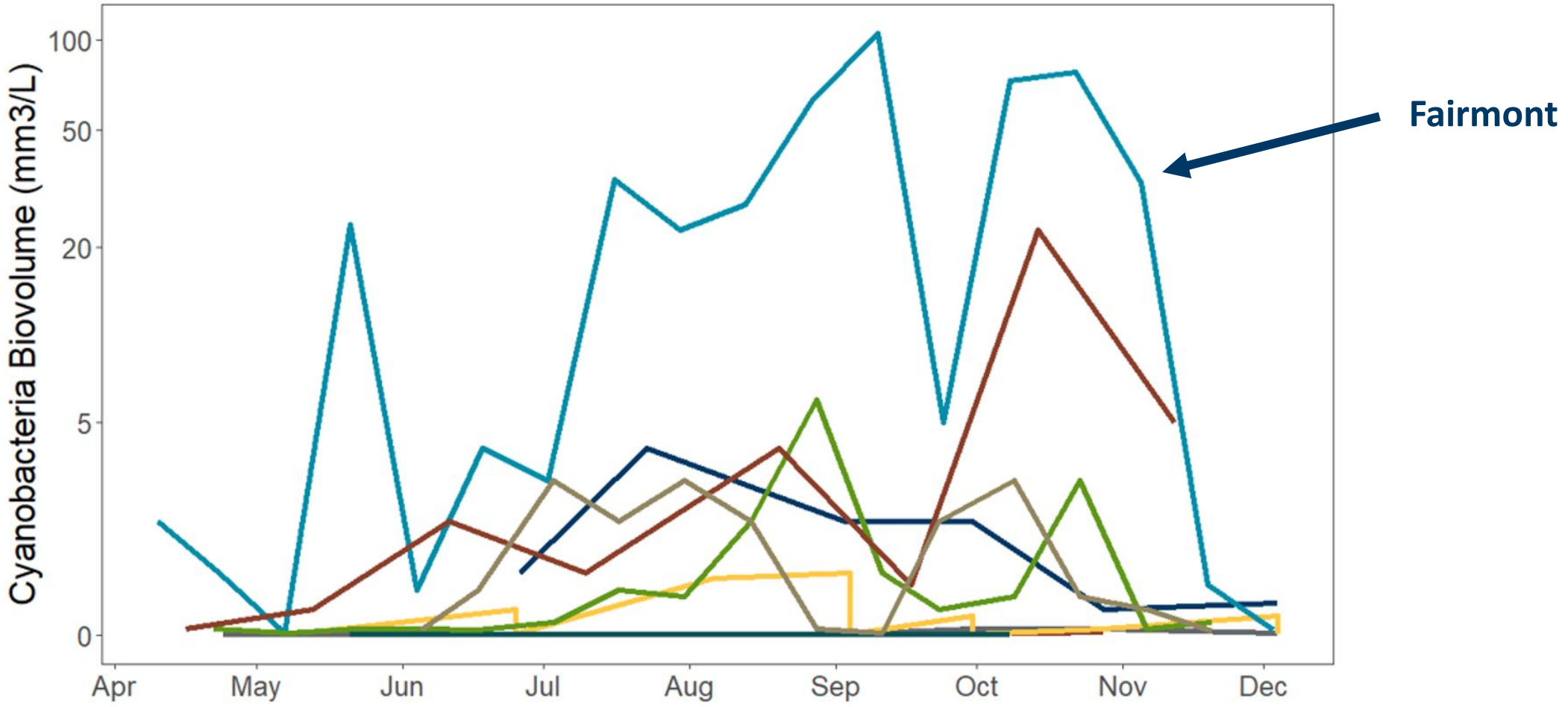




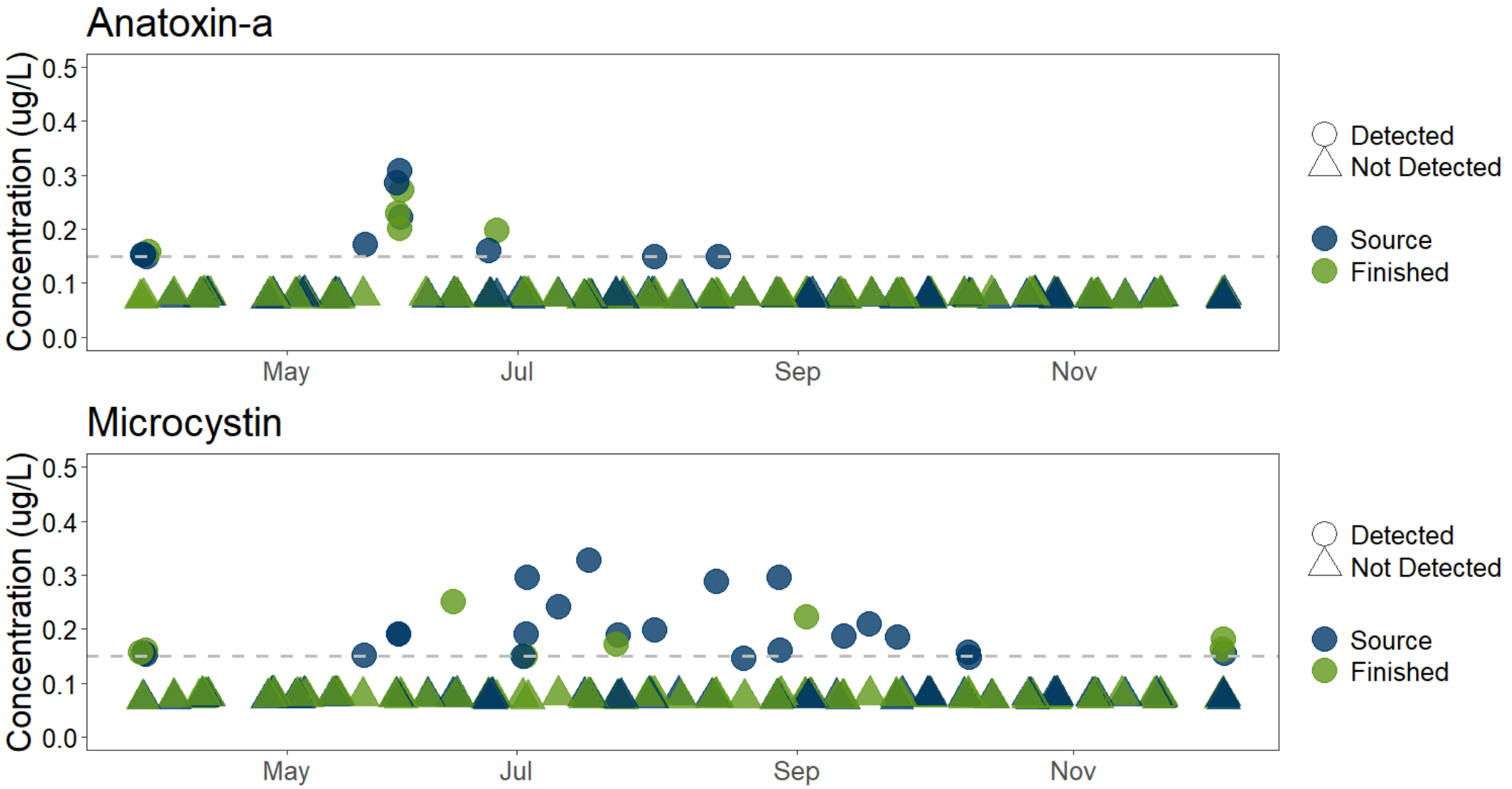
Summary of All Data


Detected
Not Detected
Finished
Source
Anatoxin-a (ug/L)
0.5
0.4
0.3
0.2
0.1
Microcystin (ug/L)
4
3
2
1
0
Cyanobacteria Biovolume (mm3/L)
100
75
50
25
0
Apr 2025
May 2025
Jun 2025
Jul 2025
Aug 2025
Sep 2025
Oct 2025
Nov 2025
Dec 2025
Jan 2026
Feb 2026
Mar 2026
Apr 2026
May 2026
Jun 2026
Jul 2026
Aug 2026
Sep 2026
Date

Cyanobacteria Biovolume: all 2025 systems

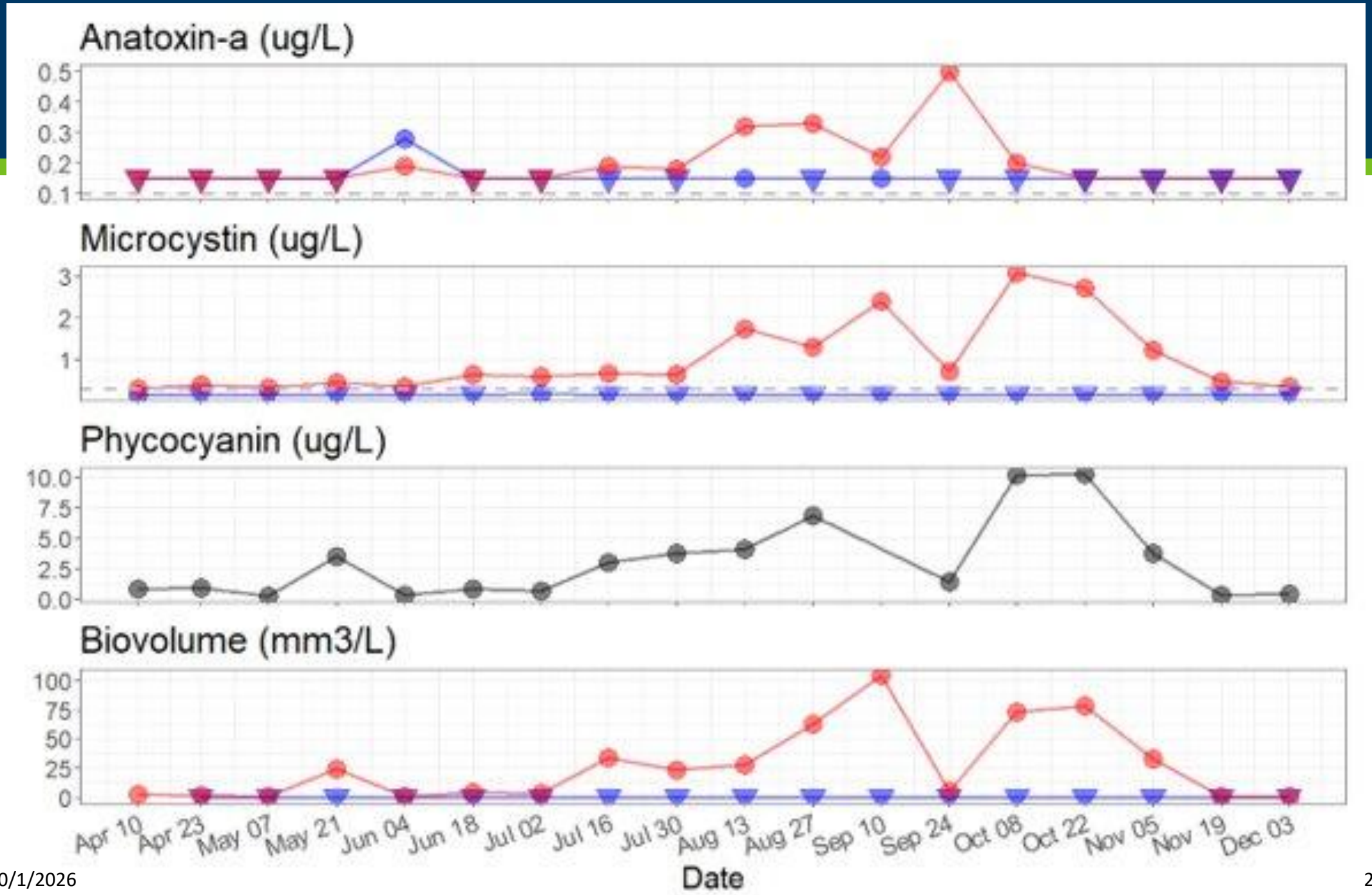


Anatoxin-a and Microcystin at 2025 monitoring locations (Fairmont excluded)



Takeaways

- Annual blooms may produce microcystin and anatoxin-a at levels above health values in Fairmont's source water (re: drinking water exposure)
- Current treatment has been effective at removing/reducing microcystin
- Breakthrough anatoxin-a detections in finished water have occurred (last on 9/10/25)
- High variability between bloom seasons in timing, magnitude, and pattern of cyanotoxins
- Cyanotoxin concentrations and detections roughly correlate with cyanobacteria biovolume
- Observed cyanobacteria biomass is high, but could be higher – sampling may be considered during future bloom events to ensure no breakthrough detections in finished water


Anatoxin-a (ug/L)
0.5
0.4
0.3
0.2
0.1
Microcystin (ug/L)
3
2
1
Phycocyanin (ug/L)
10.0
7.5
5.0
2.5
0.0
Biovolume (mm3/L)
100
75
50
25
0
Apr 10
Apr 23
May 07
May 21
Jun 04
Jun 18
Jul 02
Jul 16
Jul 30
Aug 13
Aug 27
Sep 10
Sep 24
Oct 08
Oct 22
Nov 05
Nov 19
Dec 03
Date

Thank you!

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