



**Credit Valley
Conservation**
inspired by nature

Cyanobacteria Predictions and Mitigation Fairy Lake Case Study

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Real-Time Water Monitoring Workshop, NL
November 7th – 8th, 2023

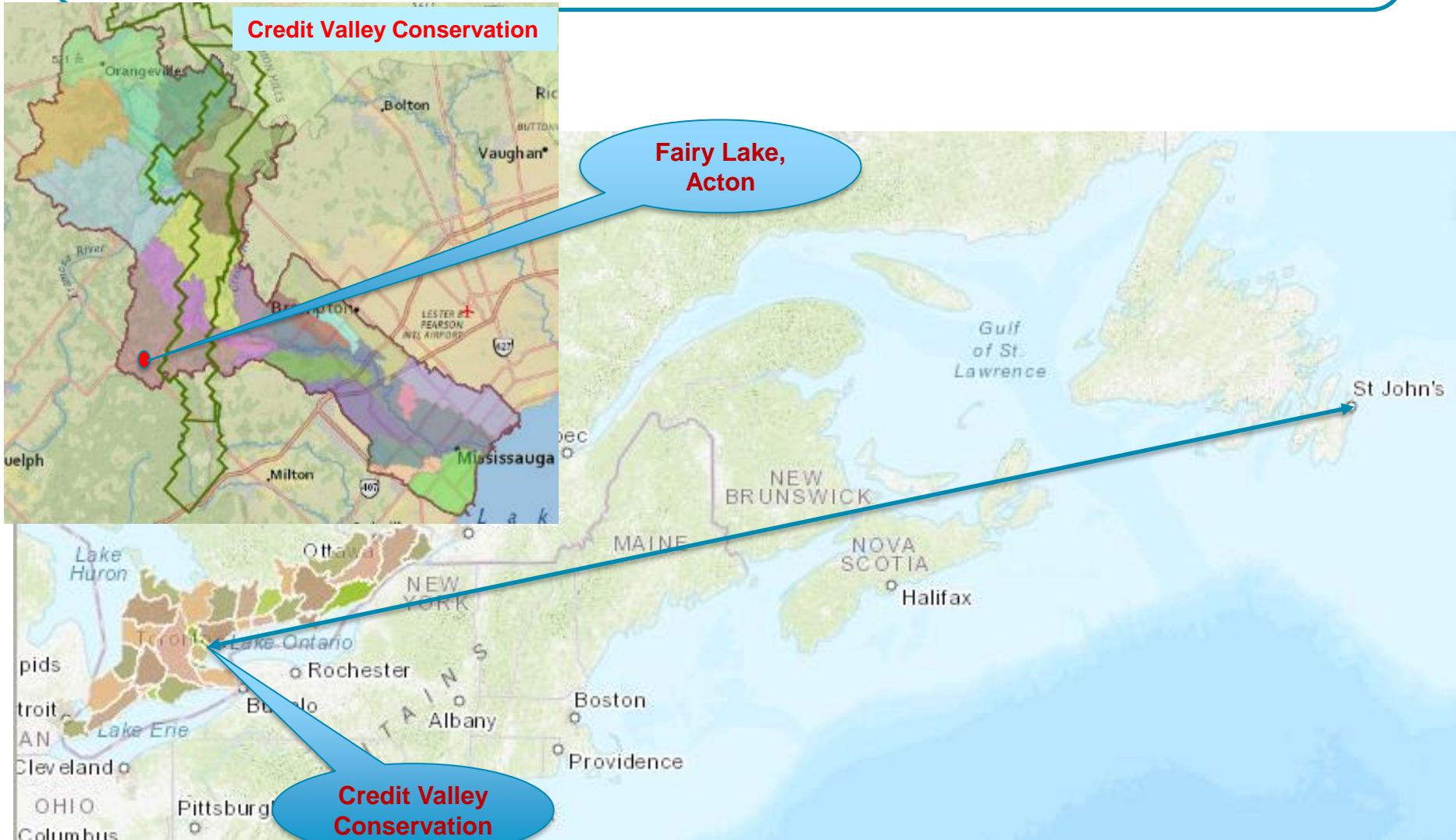


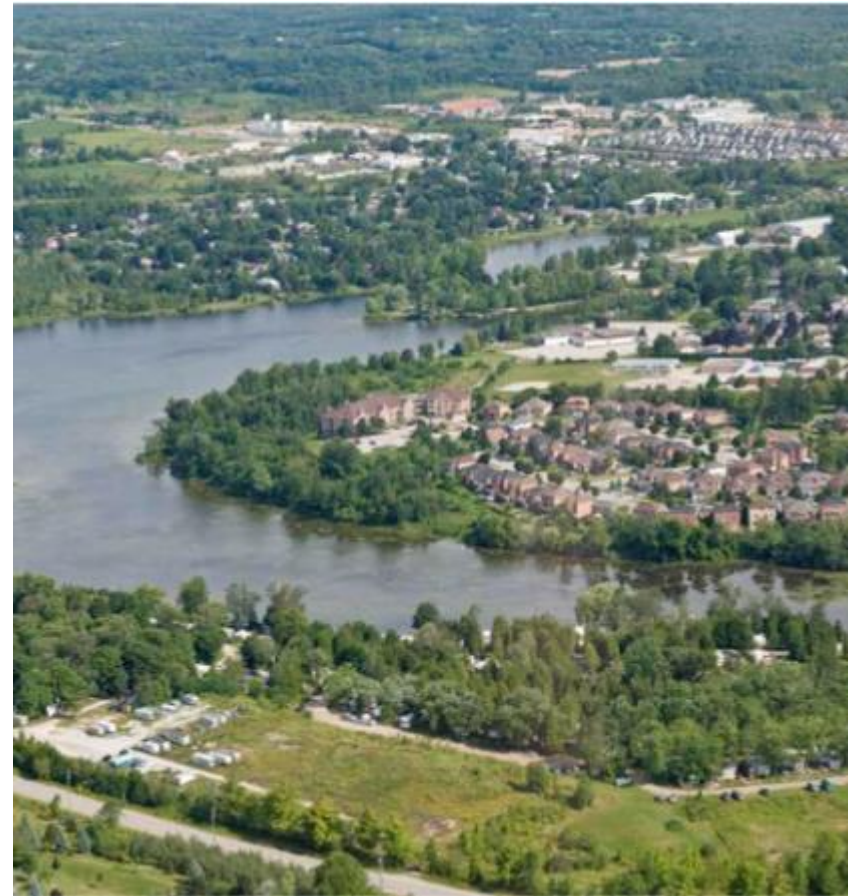
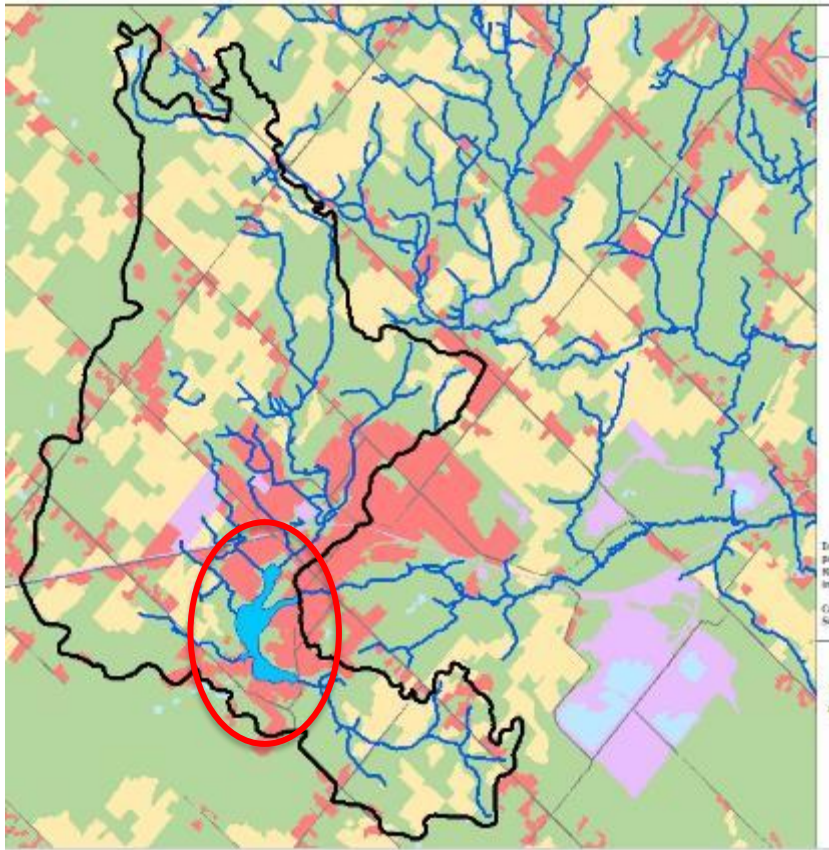
About Credit Valley Conservation (www.CVC.ca)

Credit Valley Conservation

**Fairy Lake,
Acton**

**Credit Valley
Conservation**





Fairy Lake, Acton
A Provincially Significant Wetland



Inland Lakes A Popular Recreational Venue

"Beach closures" E. coli and Cyanobacteria

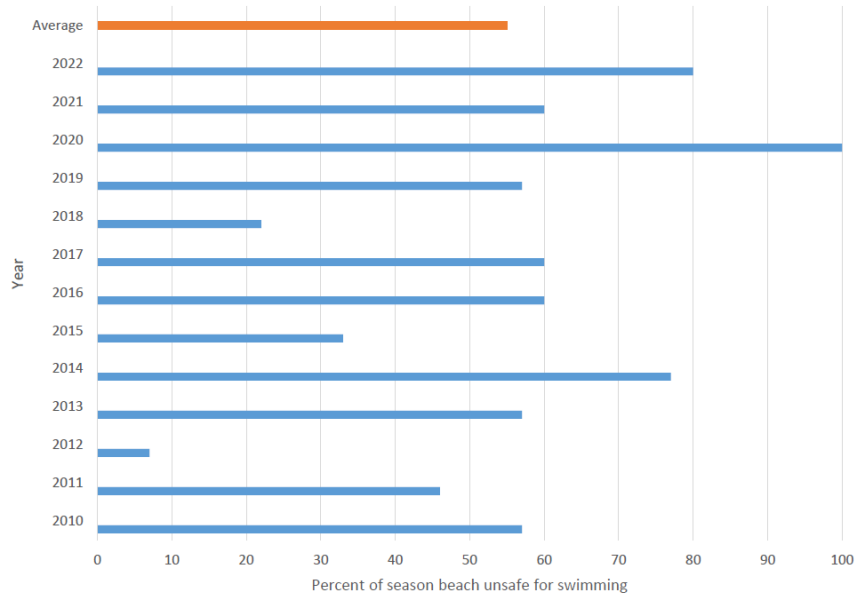


Concern of the Local Authorities - Prediction and Mitigation -



Stats of Beach Closures

Old Beach Water Monitoring Results



Cyanobacteria and Microcystin

Date	Time of Sampling	Cyanobacteria Observed (Y/N)	Microcystin Levels (µg/L)	Anatoxin-A (µg/L)
9/6/2018	18:35	Y	0.73	0.05
10/25/2018	11:01	N	0.1	0
5/29/2019	13:03	Y	0.15	0.2
8/6/2019	10:15	N	0.1	0.2
8/20/2020	17:35	N	0.1	0.2
9/24/2020	14:54	Y	0.11	0.2
8/24/2021	16:15	Y	1.08	0.2
8/24/2021	16:30	N	0.16	0.2
08/29/2023	13:08	Y		
10/18/2023	19:30	Y	1.72	0.2

Study Partners



**Credit Valley
Conservation**
inspired by nature



**NSERC
CRSNG**

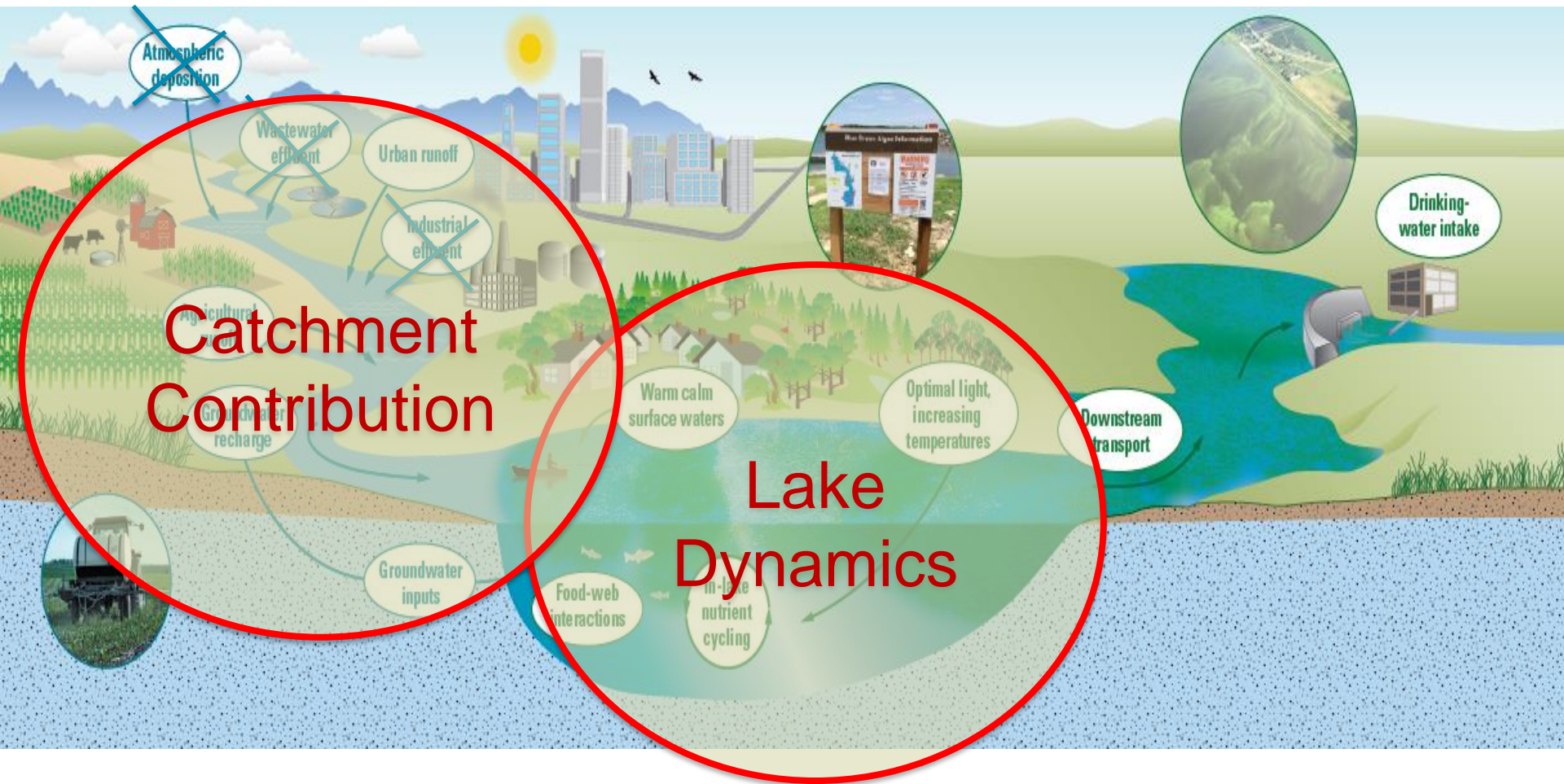


Study Objective



Focus only on Plankton Cyanobacteria

Modeling and Monitoring

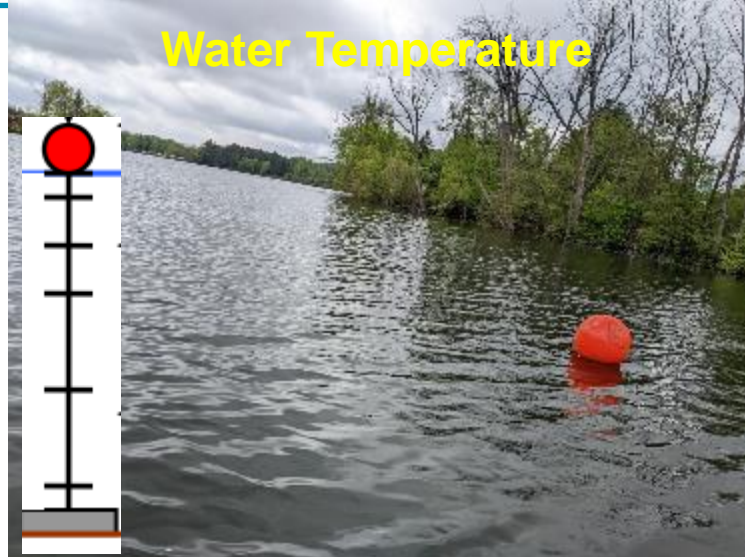


Monitoring: Traditional and Non-traditional

Water Chemistry



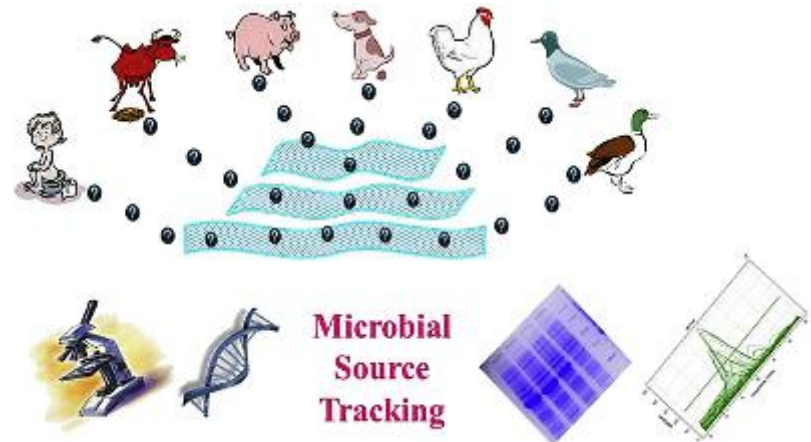
Water Temperature



Camera



e-DNA



What Did The Camera Capture



Staff and Students Enjoy Monitoring



Monitoring kicked off with something unique

- Drone based lake sampling-**



Escherichia Coli (cfu/100ml)



Wet Weather

Dry Weather

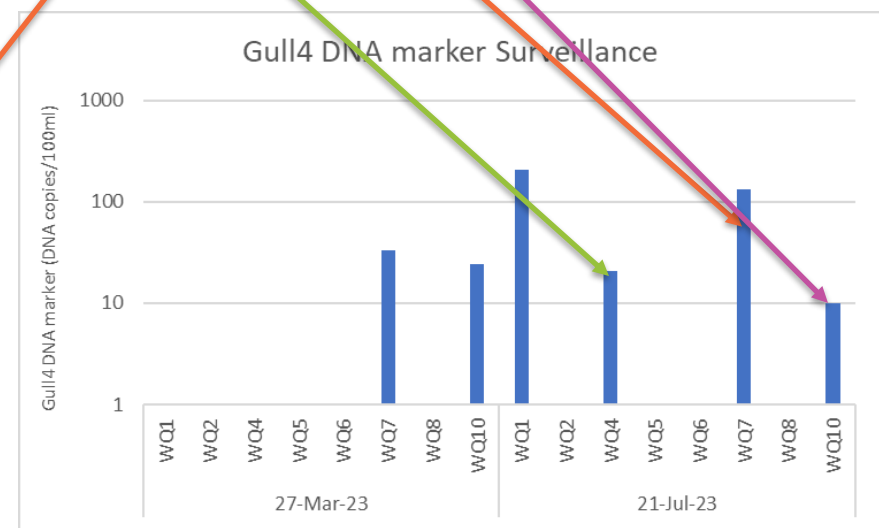
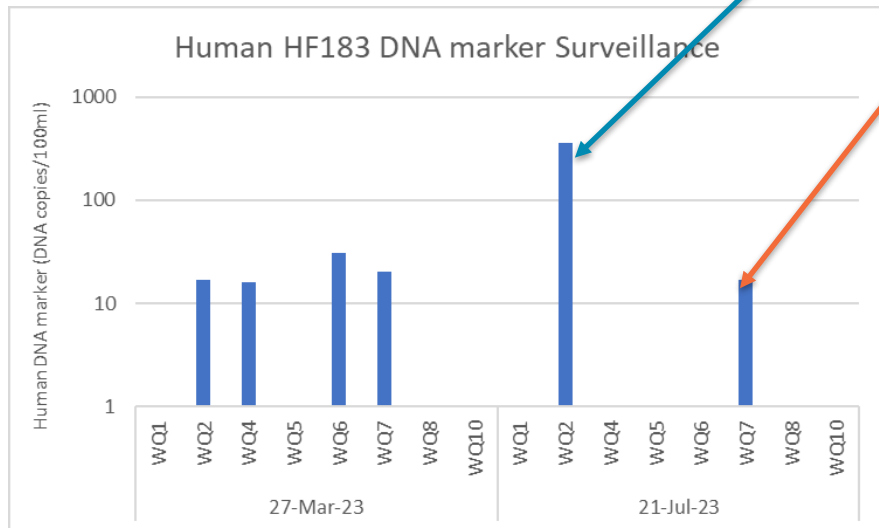
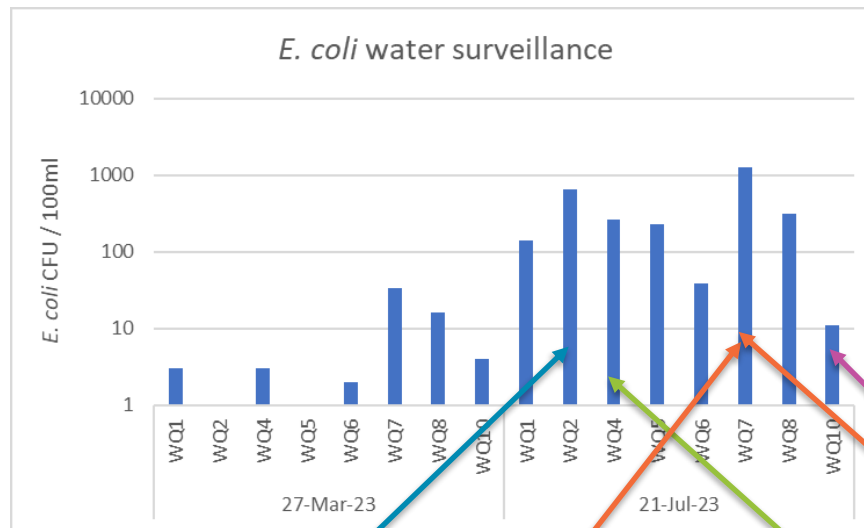
Total Phosphorus (mg/L)



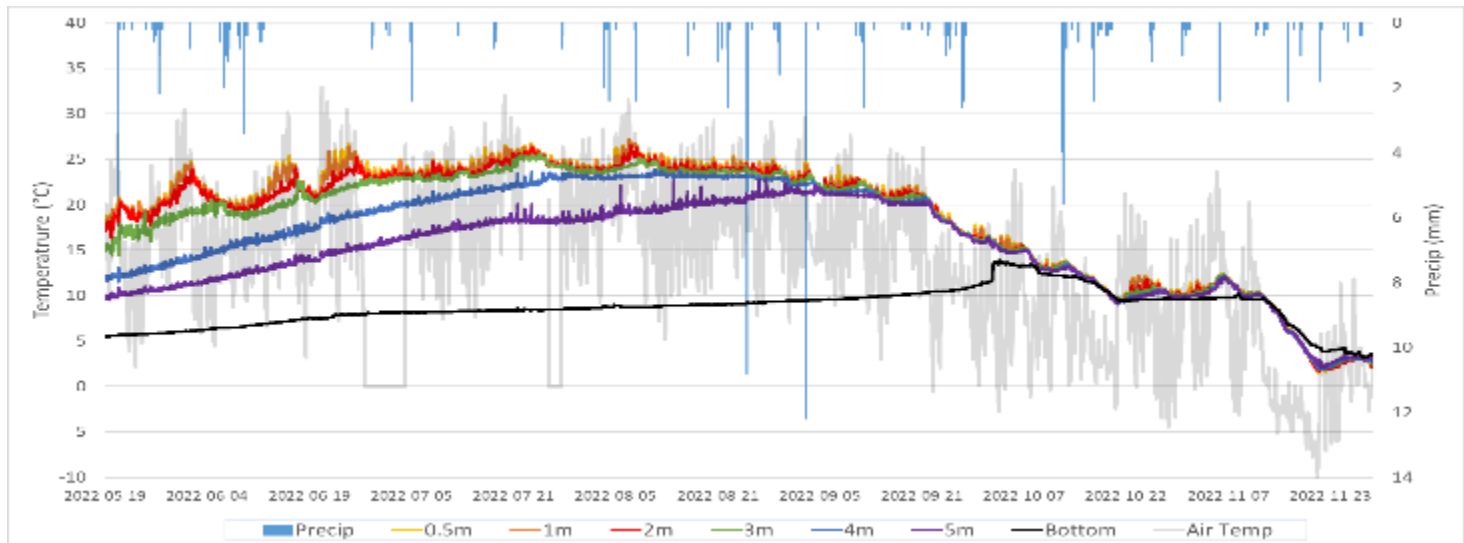
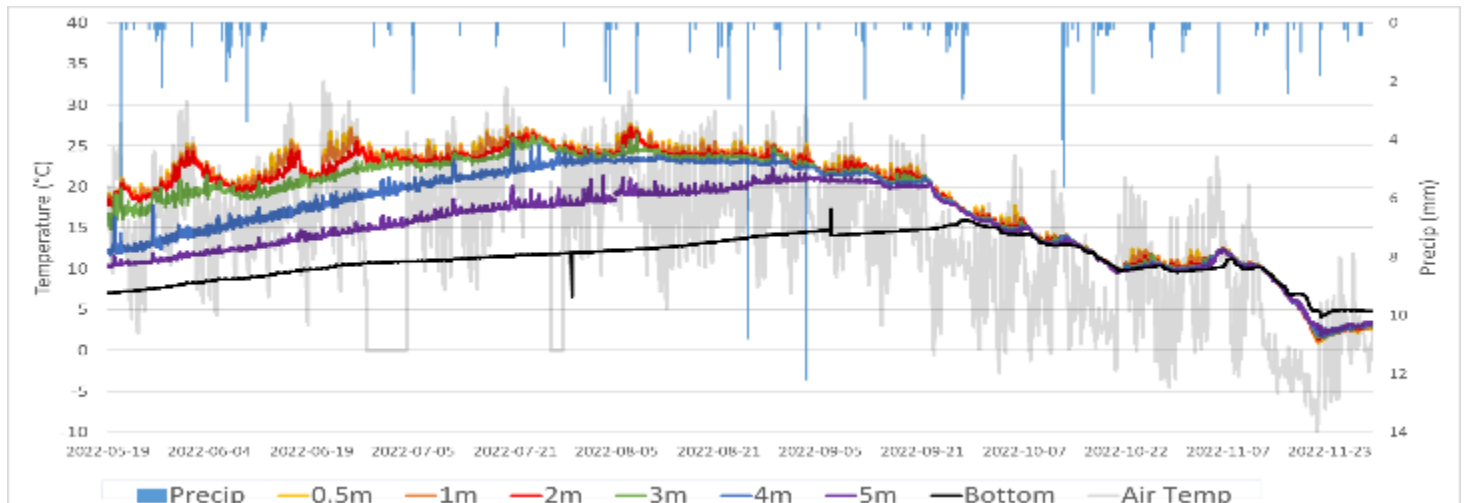
Wet Weather

Dry Weather

What did Microbial Source Tracking (MST) tell us



Temperature mooring data

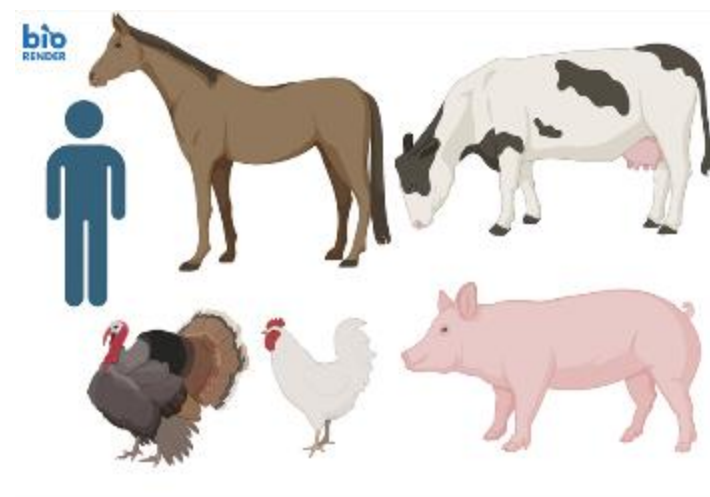


Fairy Lake: eDNA Confirmation

Species	Last Record	Comments	Detected with 12S?	Detected with COI?
Banded Killifish	2012	Likely still present	No	Yes (at <1%)
Black Crappie	2022	Report from local naturalist of seeing an angler catching them	Yes	Yes
Brown Bullhead	2011	Likely still present	Yes	No
Common Carp	~ 2010	Report from angler: likely still present	Yes	No
Golden Shiner	2011	Current status unknown	Yes	Yes
Largemouth Bass	2011	Likely still present	Yes	Yes
Northern Pike	2011	Likely still present	Yes	Yes
Pumpkinseed	2011	Likely still present	Yes	Yes
Rock Bass	2011	Likely still present	Yes	Yes
Yellow Perch	~ 2010	Caught by an angler (LGL staff person) ice fishing; current status unknown	Yes	Yes



All images obtained from:
[All About Birds](#)



Modeling

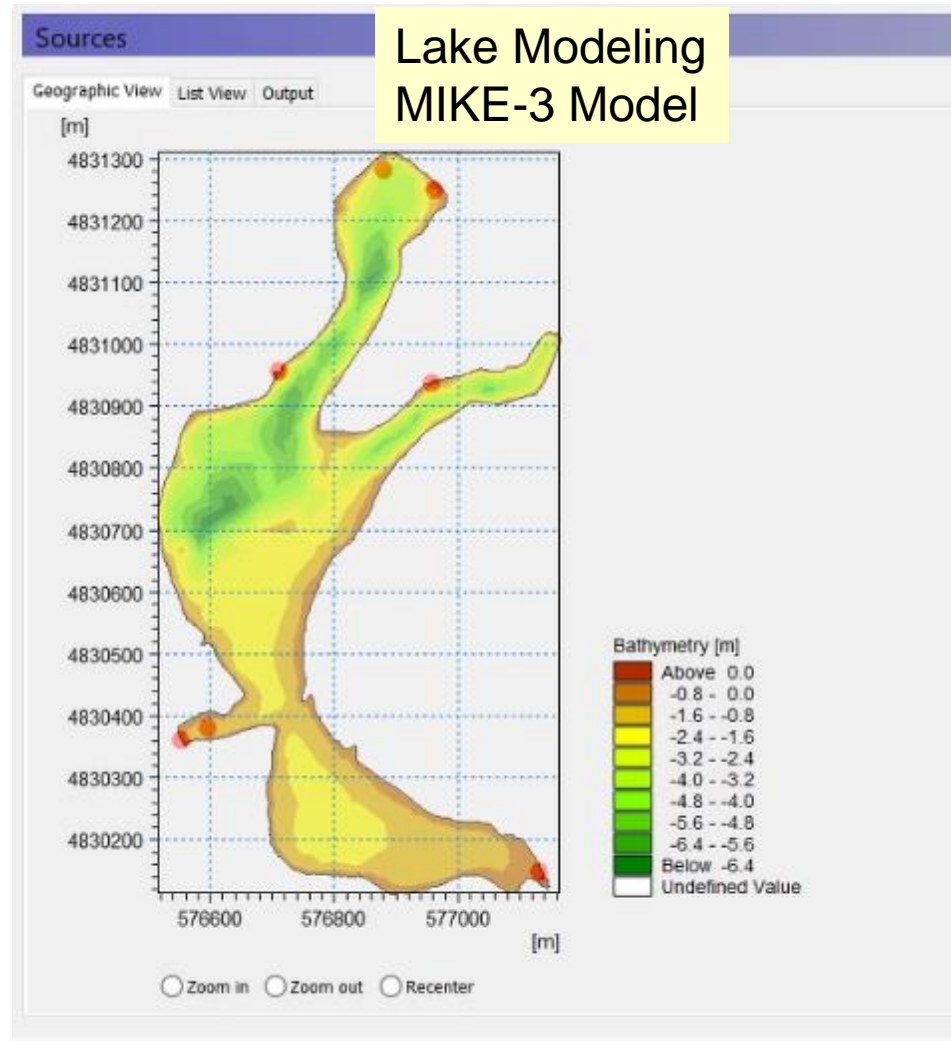


Catchment and Lake Models Setup

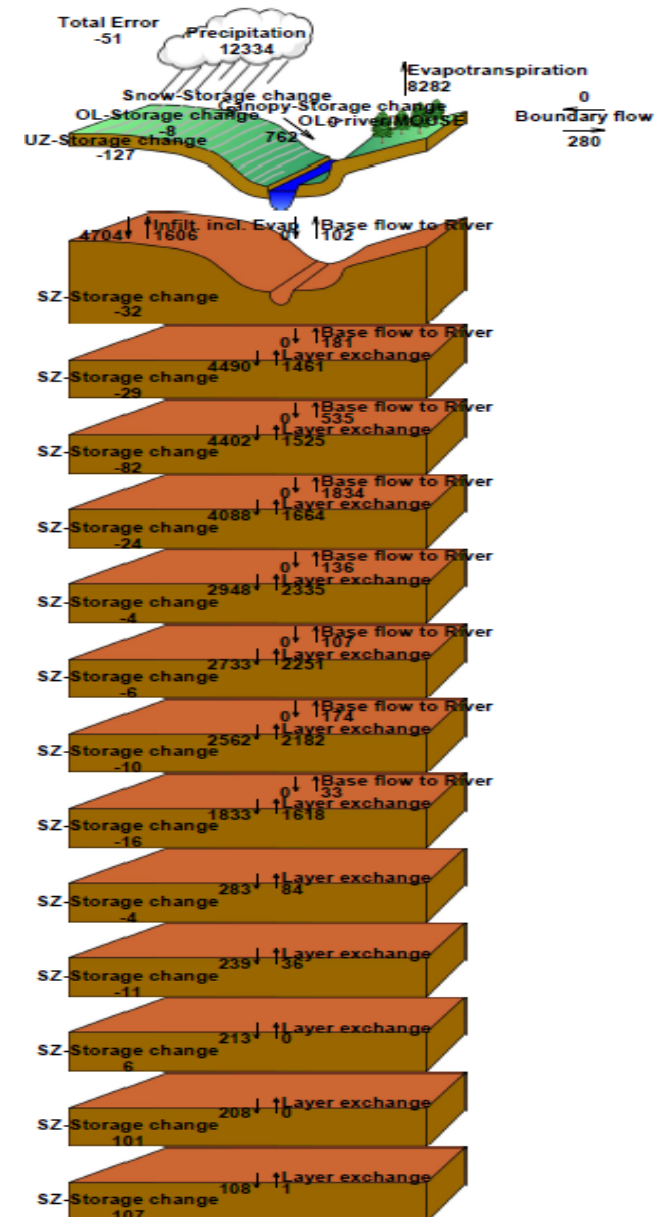
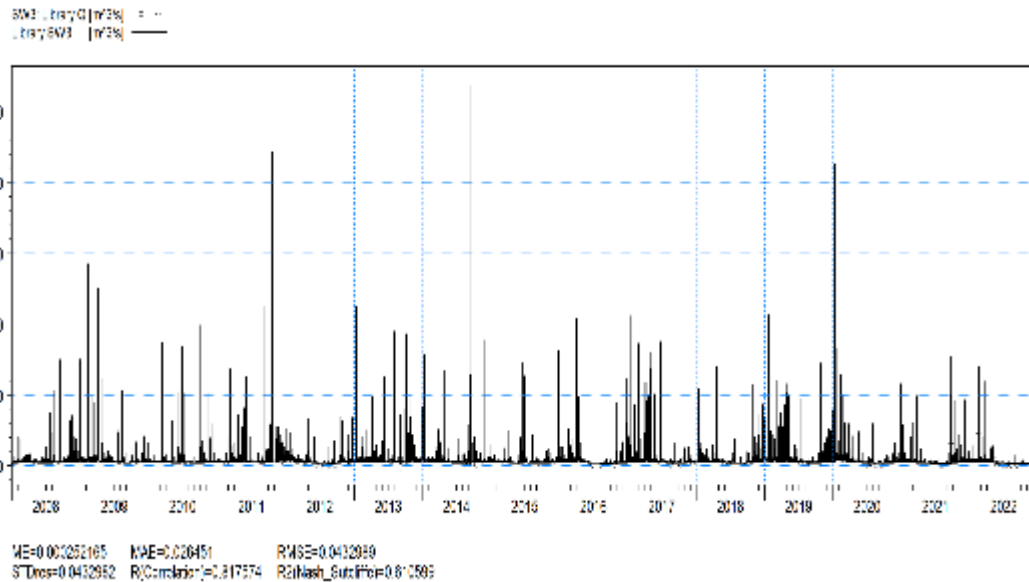
Catchment Modeling
MIKE SHE Model



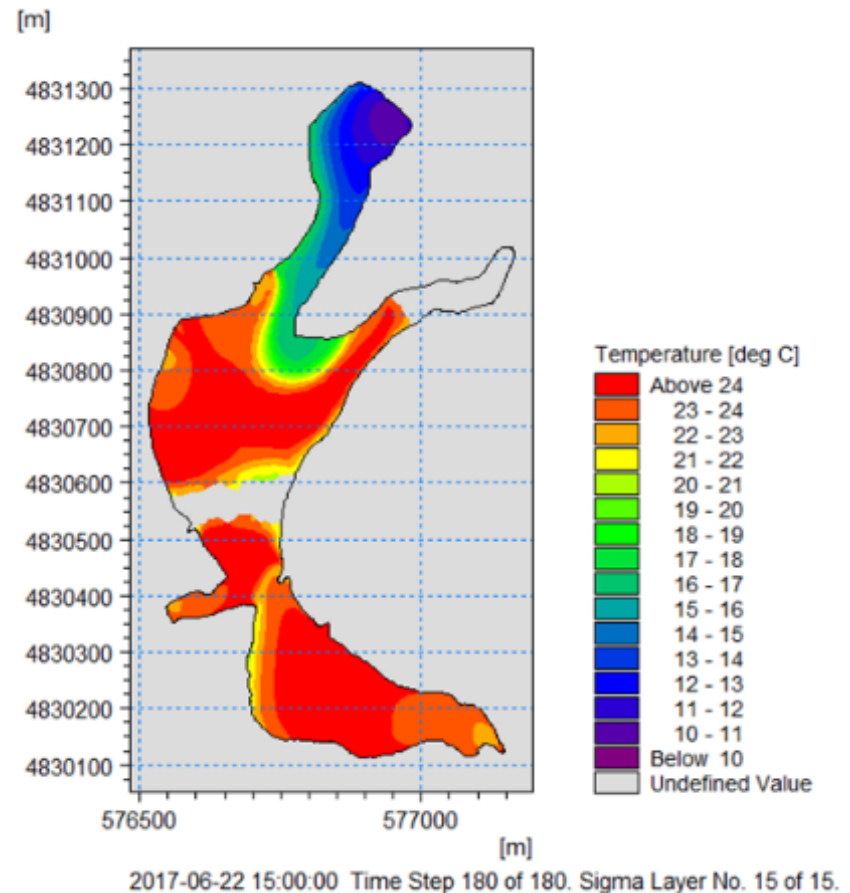
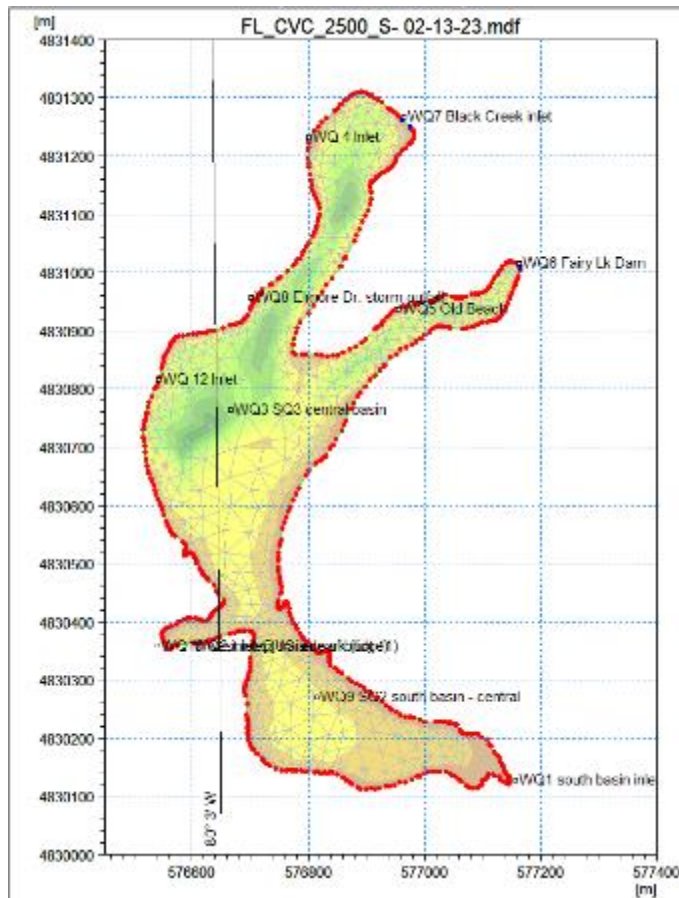
Lake Modeling
MIKE-3 Model



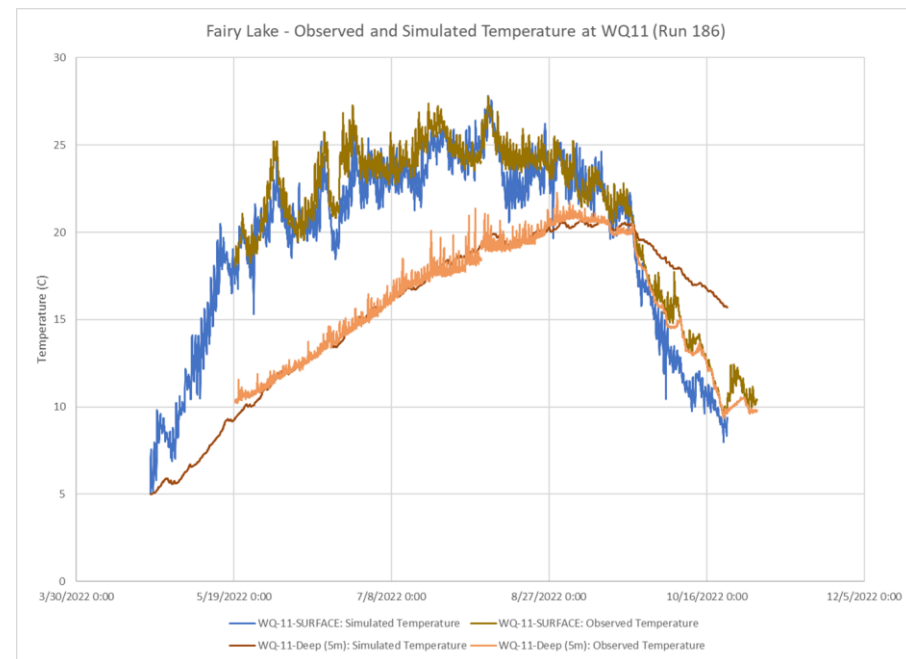
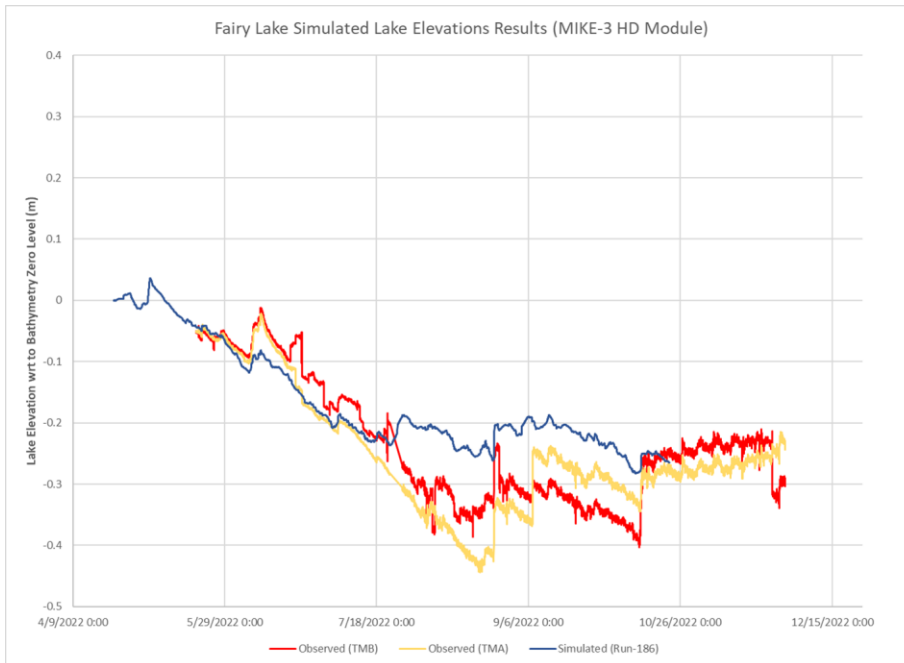
Catchment Modeling: Flow Calibration and Water Balance



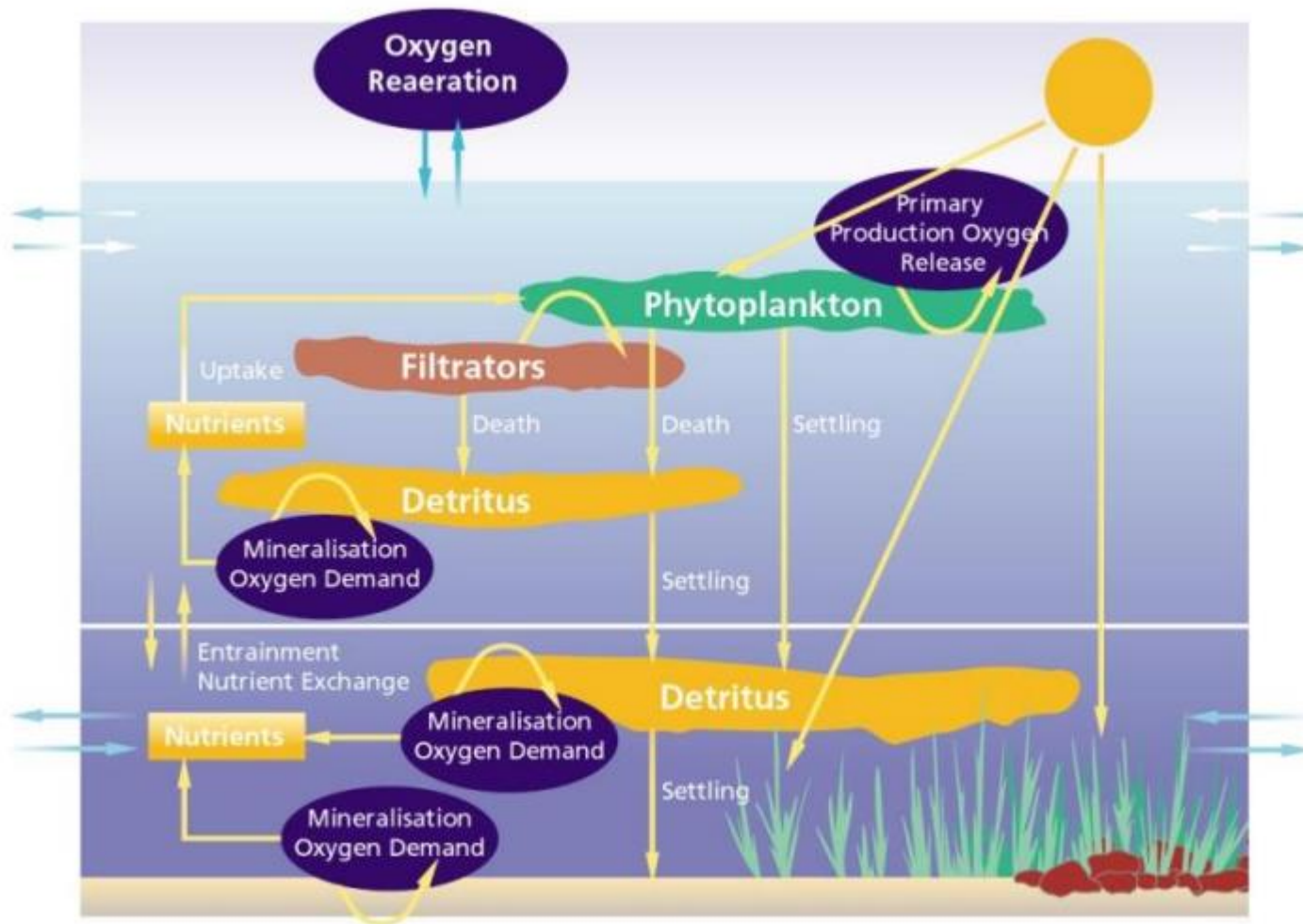
Lake Modeling: Model Setup and Temperature Simulation



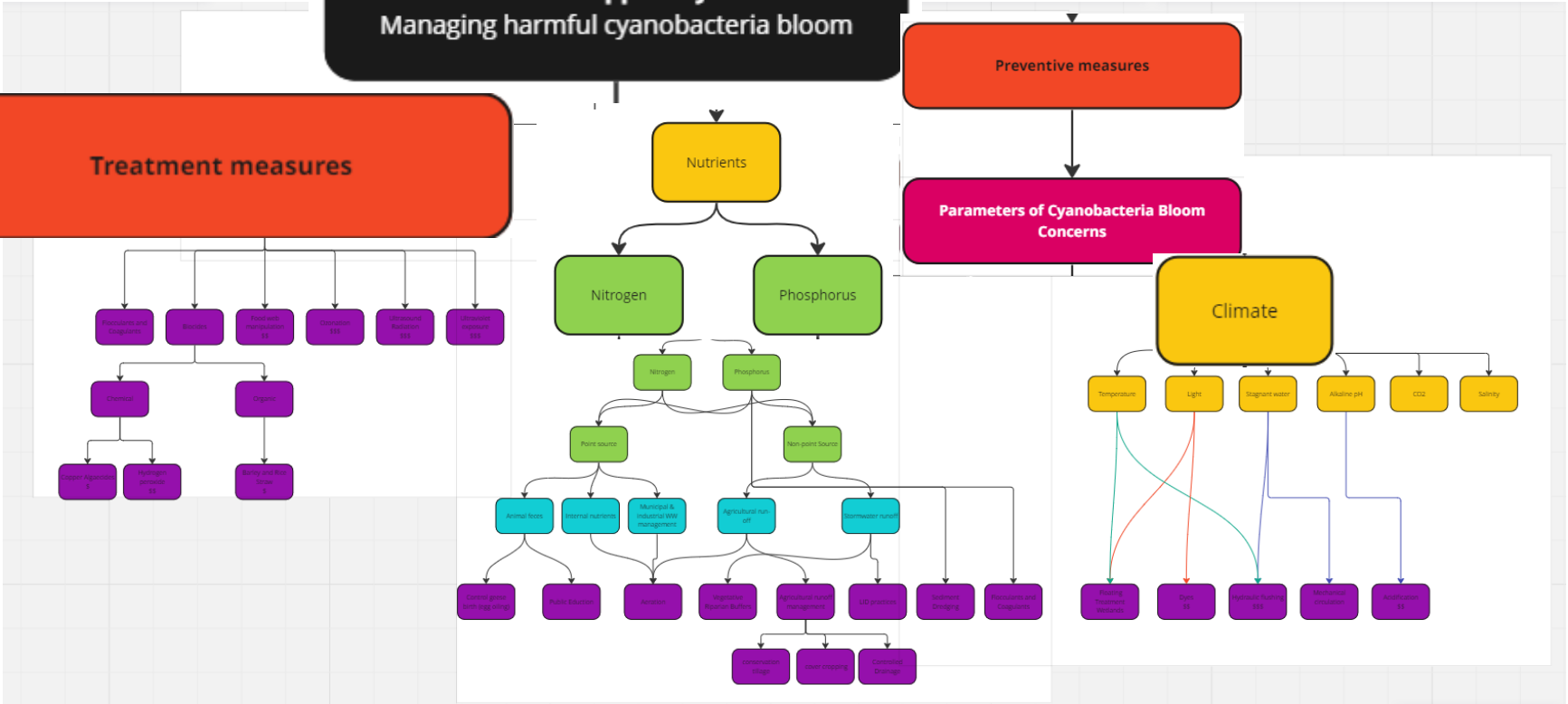
Lake Level and Temperature Simulations



Cyanobacteria Modeling- MIKE-3 + Ecolab



Final Product: Decision Support System



Simulation Complexities leading to Mitigation Challenges

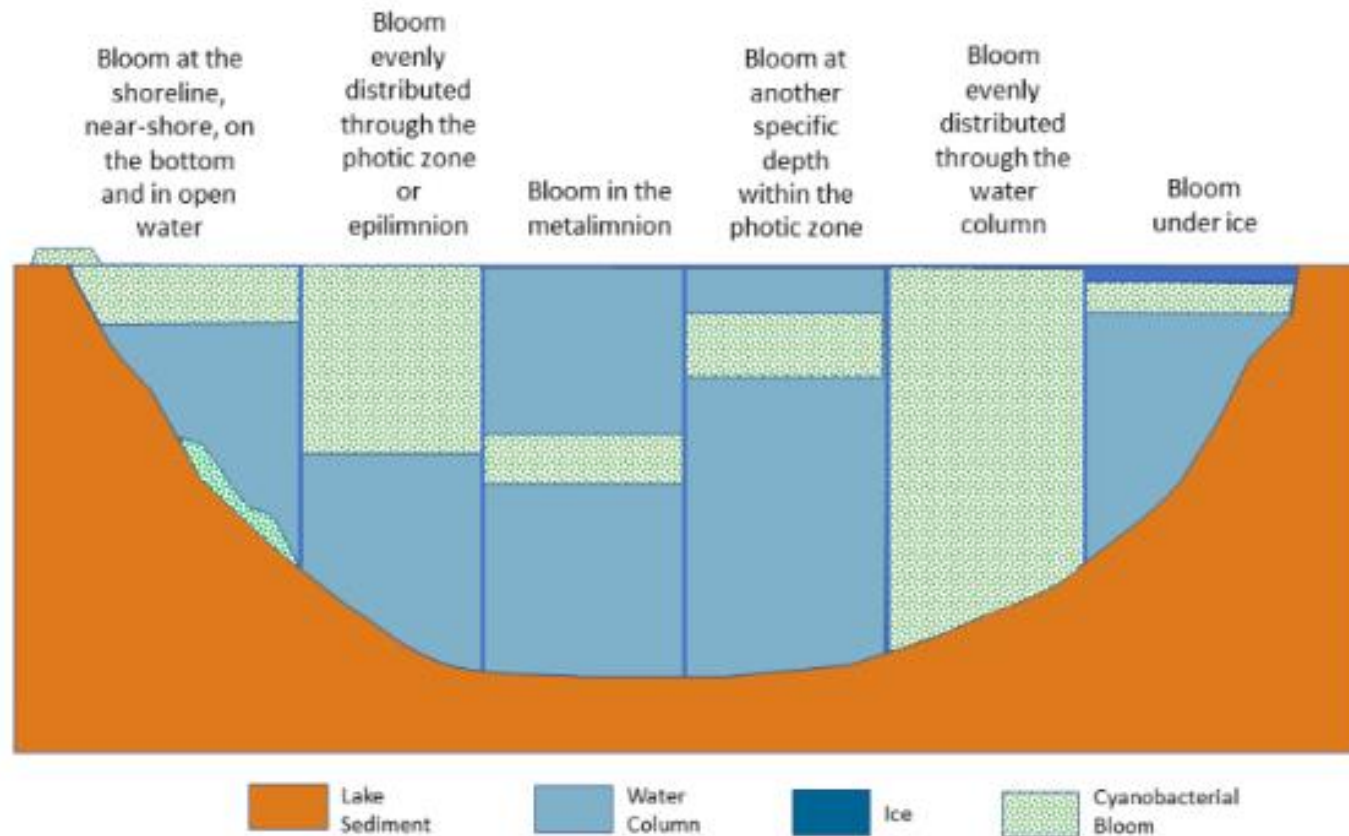


Simulation Challenges leading to Mitigation Efforts

- Combinations \propto list of parameters of concern
 - Two nutrients, water temperature = 6
 - + clarity = 24
 - + rain and drought = 720
 - + dissolved oxygen = 5040
 - 10 parameters = 3628800



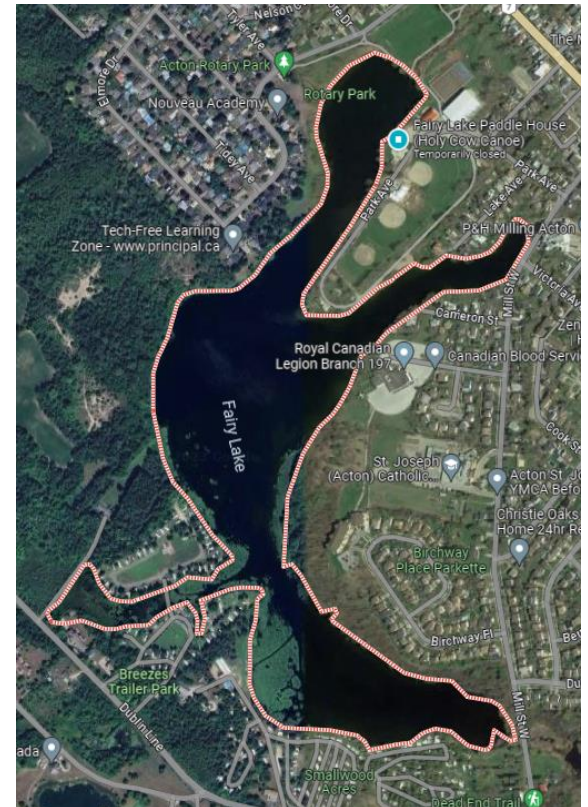
Cyanobacteria: Where, When, and Howmuch



Source: <https://hcb-1.itrcweb.org/monitoring/>

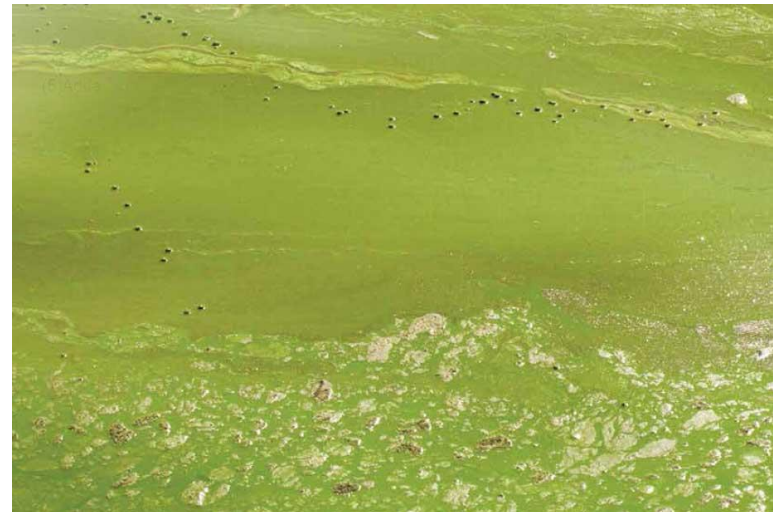
Lake modeling Challenges

- Hydrodynamics: Lake shape
- Water temperature: Stratification
- Water quality (inflow and in-lake nutrients dynamics)
- Competition with other forms of algae and other aquatic life



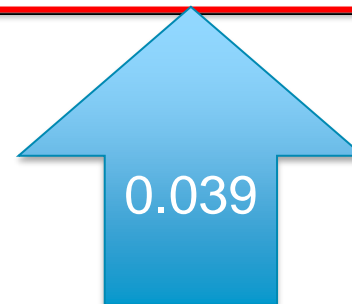
What is being monitored and what can be modelled and what is the correlation?

- Cyanobacteria vs Microcystins vs Chlorophyll-a



This will shock you, but it is reality

	UNITS	WQ1 SOUTH BASIN	MU	RDL
Inorganics				
Total Kjeldahl Nitrogen (TKN)	mg/L	0.75	+/- 0.12	0.10
Dissolved Phosphorus	mg/L	0.022	+/- <RDL	0.004
Total Phosphorus	mg/L	0.019	+/- <RDL	0.004



**We need data across Canada that is
consistently collected**



ARE YOU IN?

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questions?

