Normandale Lake Water Quality Improvement Project

February 2021: Update on 2020 Water Quality and Project Results

Project Goals and Activities

Improve water quality and ecological health of Normandale Lake

From April 2018 Engineer's Report (and presentation to NMCWD Board):

Management Practice	Proposed Timing
Lake Drawdown	Fall 2018
In-lake Alum Treatment	Spring 2019
Herbicide Treatments with Endothall (2-5 successive years)	~~Spring 2019~~ started Spring 2020
Aquatic Macrophyte Harvesting (3 year test)	As needed, following 2-5 successive years of herbicide treatments
Oxygenation System	As needed, following 2-5 successive years of herbicide treatments

* 2018 Engineer's Report also recommended a fisheries survey to assess carp population

Project Goals and Activities

Improve water quality and ecological health of Normandale Lake

2018
Start drawdown

Fisheries assessment

2019
End drawdown

Alum treatment

Fisheries assessment

Monitor / Assess

2020
Carp survey (spring)

Carp harvesting (fall)

Curly-leaf pondweed spot treatment

Monitor / Assess

2021
Assess carp management needs

Monitor / Assess

Curly-leaf pondweed spot treatment

Assess monitoring need changes

2022
Curly-leaf pondweed spot treatment (?)

Monitor / Assess / Adjust

2023
Curly-leaf pondweed spot treatment (?)

Monitor / Assess / Adjust

Identify management needs for 2024+

2024
Curly-leaf pondweed spot treatment (?)

Monitor / Assess / Adjust

Monitoring for Project Effectiveness

Water quality improvement

- Total phosphorus
- Algae (chlorophyll a)
- Water clarity

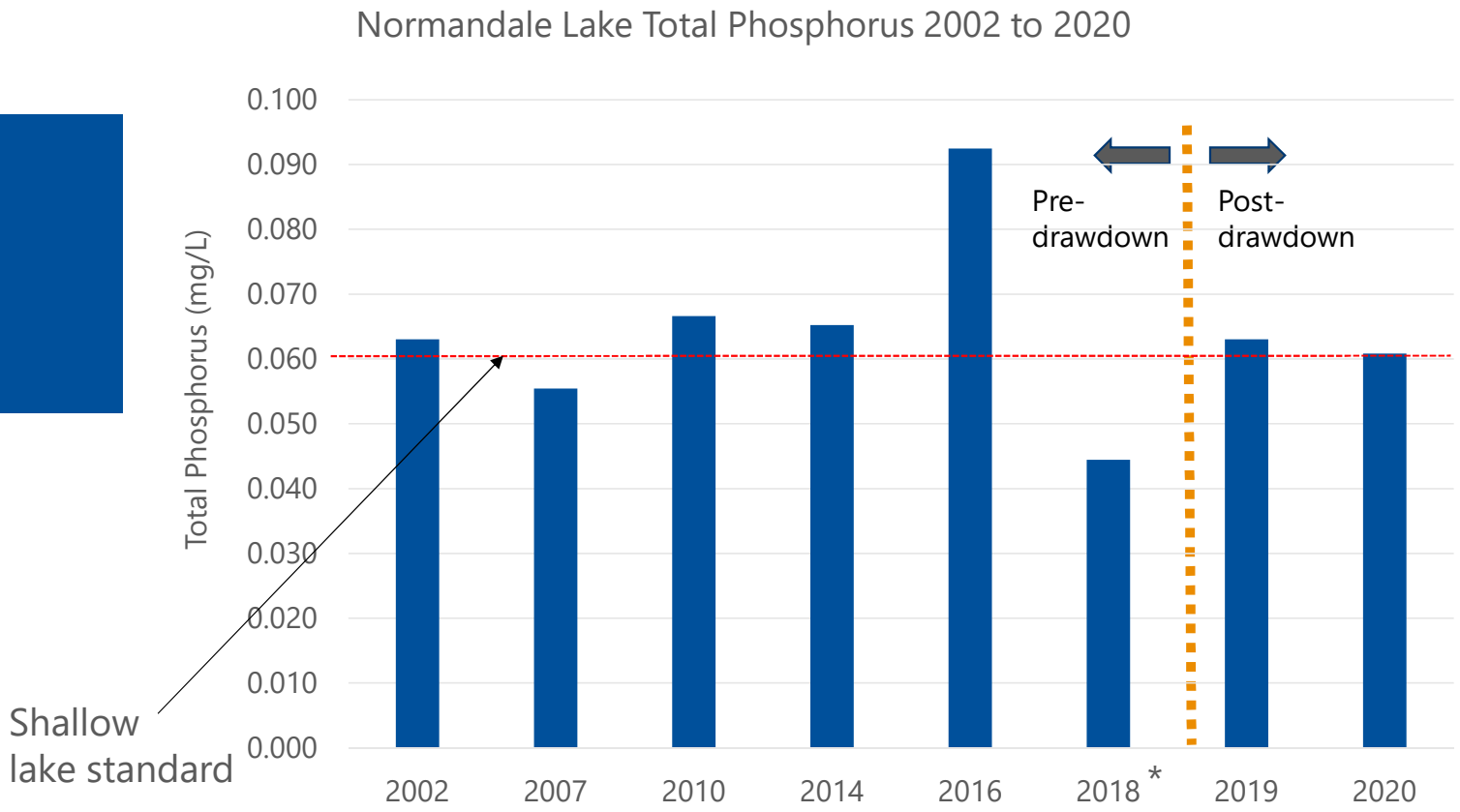
Curly-leaf pondweed (CLP) reduction

- Aquatic plant frequency and biomass monitoring
- CLP turion monitoring

Health of aquatic plant community

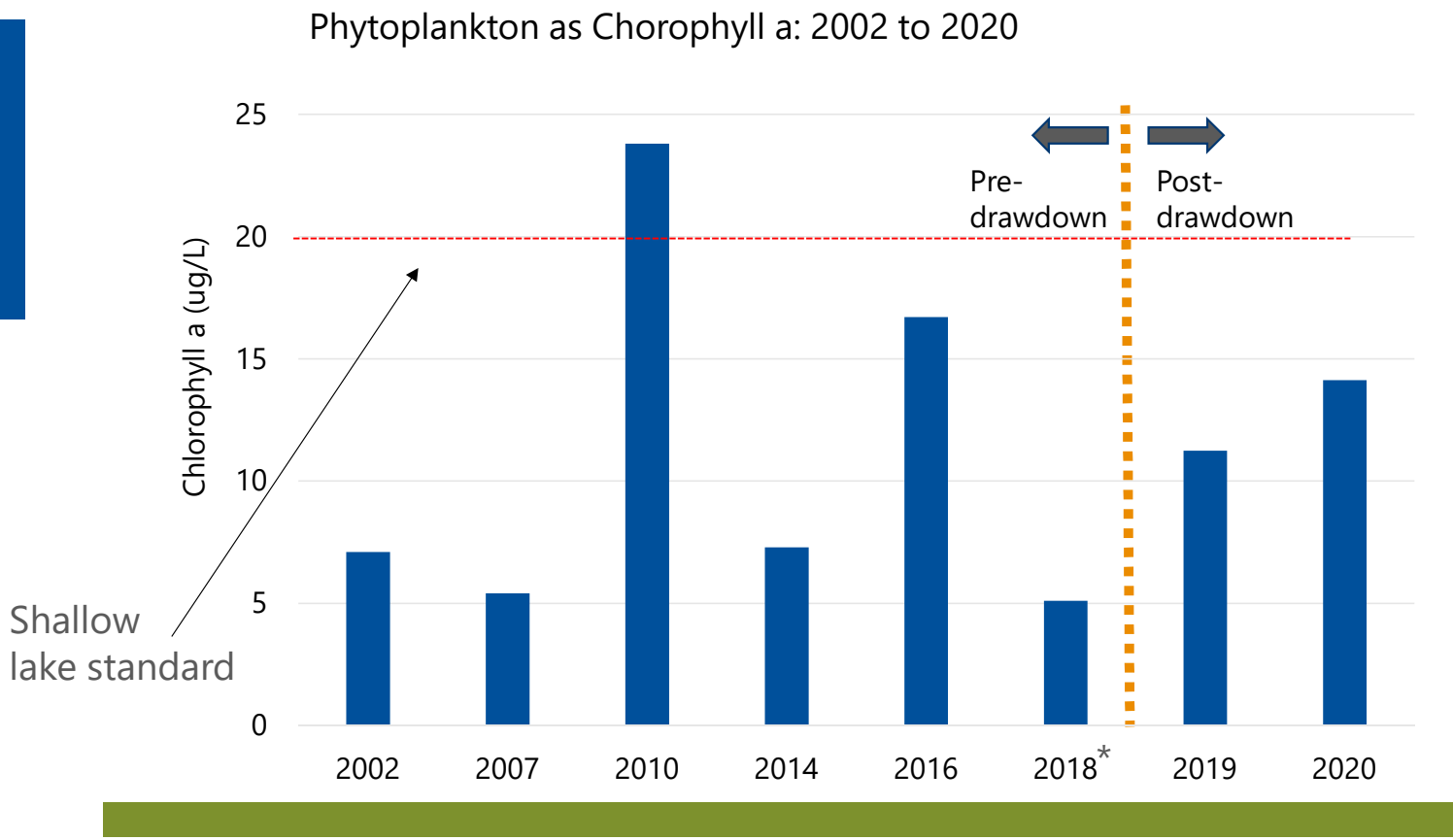
- Aquatic plant species richness
- Quality of the plant community per Floristic Quality Index (FQI)

Normandale Lake: Water Quality



- 2018 summer average includes a September sampling event that reflects the lake drawdown already underway

Normandale Lake: Water Quality



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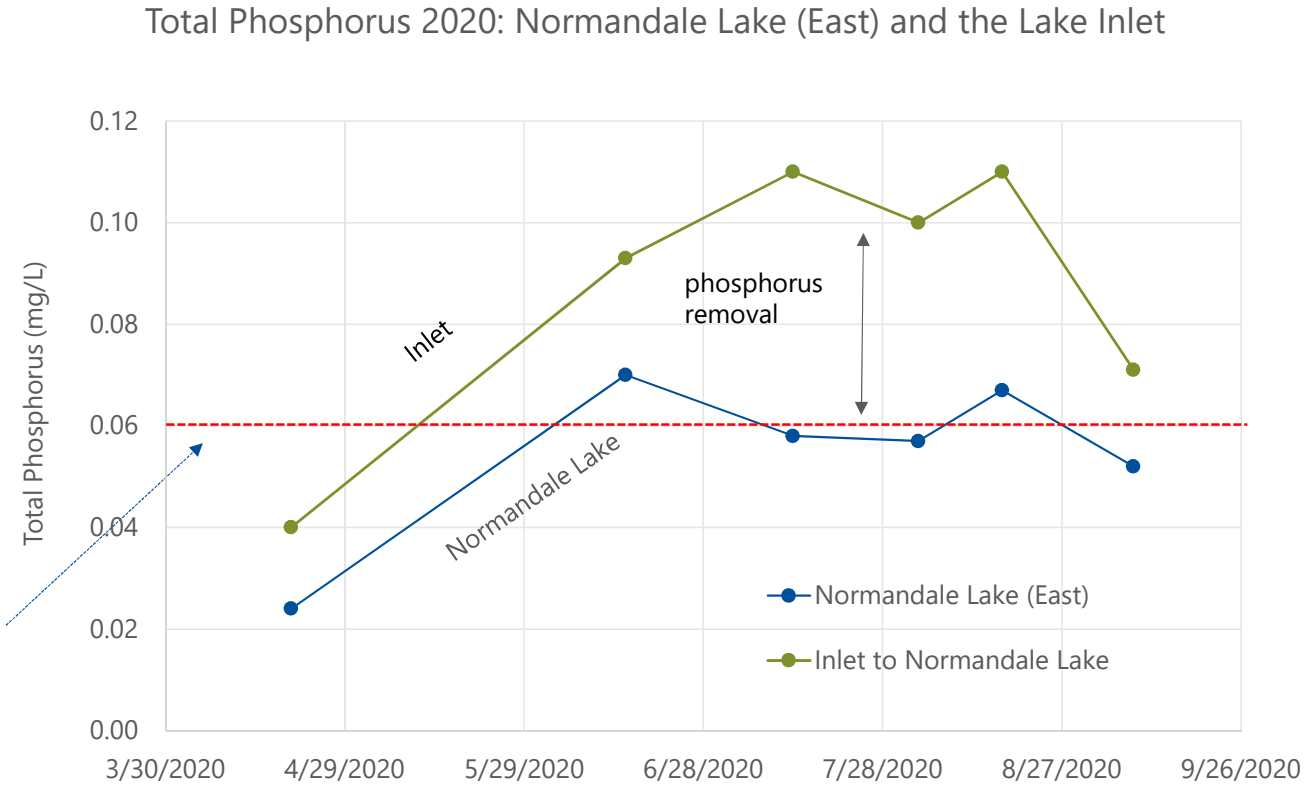
Normandale Lake: Water Quality

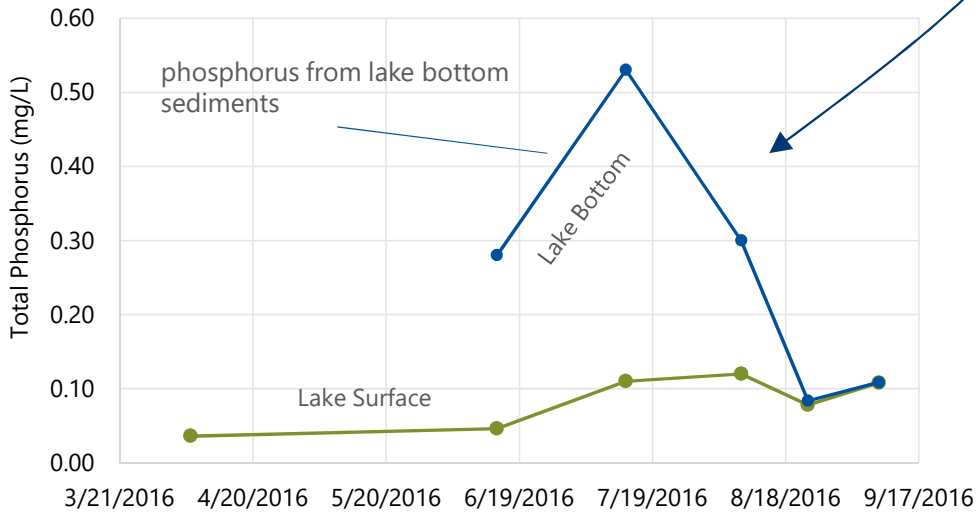


Shallow lake standard

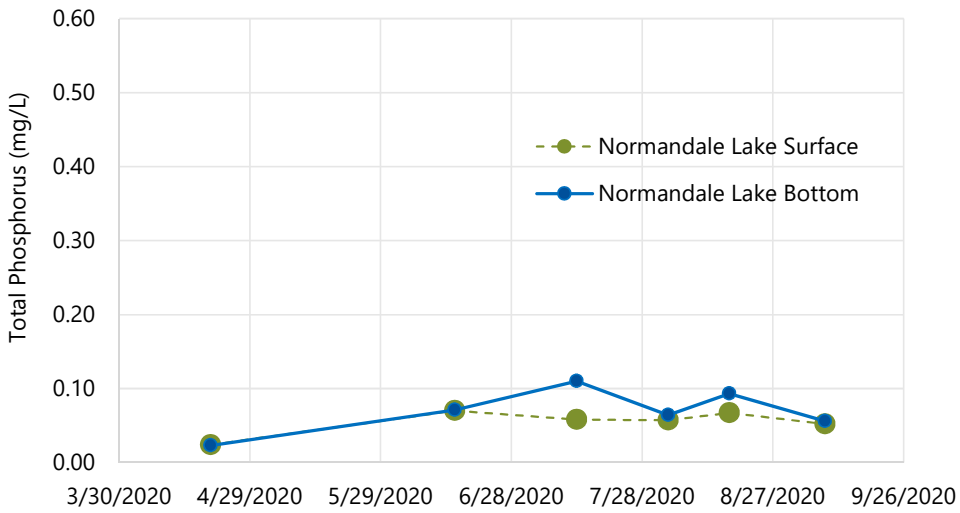
Normandale Lake: Water Quality

Why alum treatment?

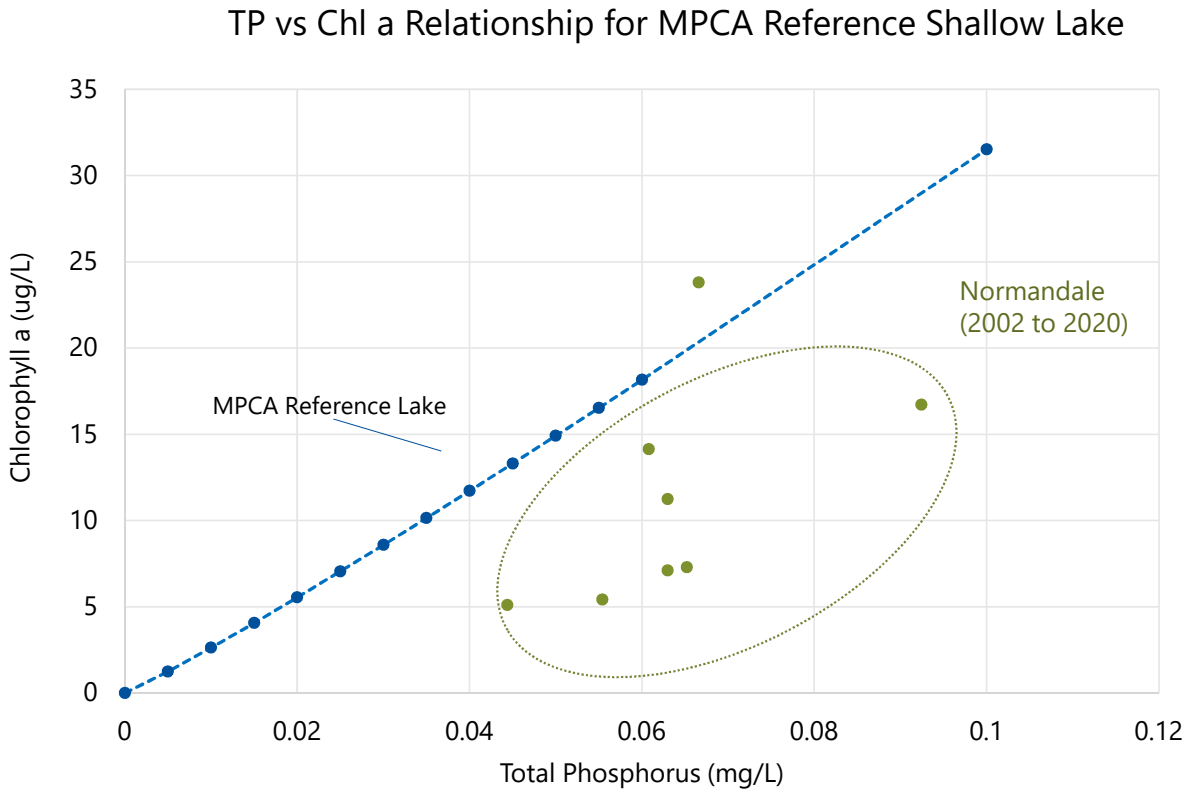
Total Phosphorus 2016: Normandale Lake Surface vs the Lake Bottom



Total Phosphorus 2020: Normandale Lake Surface vs the Lake Bottom

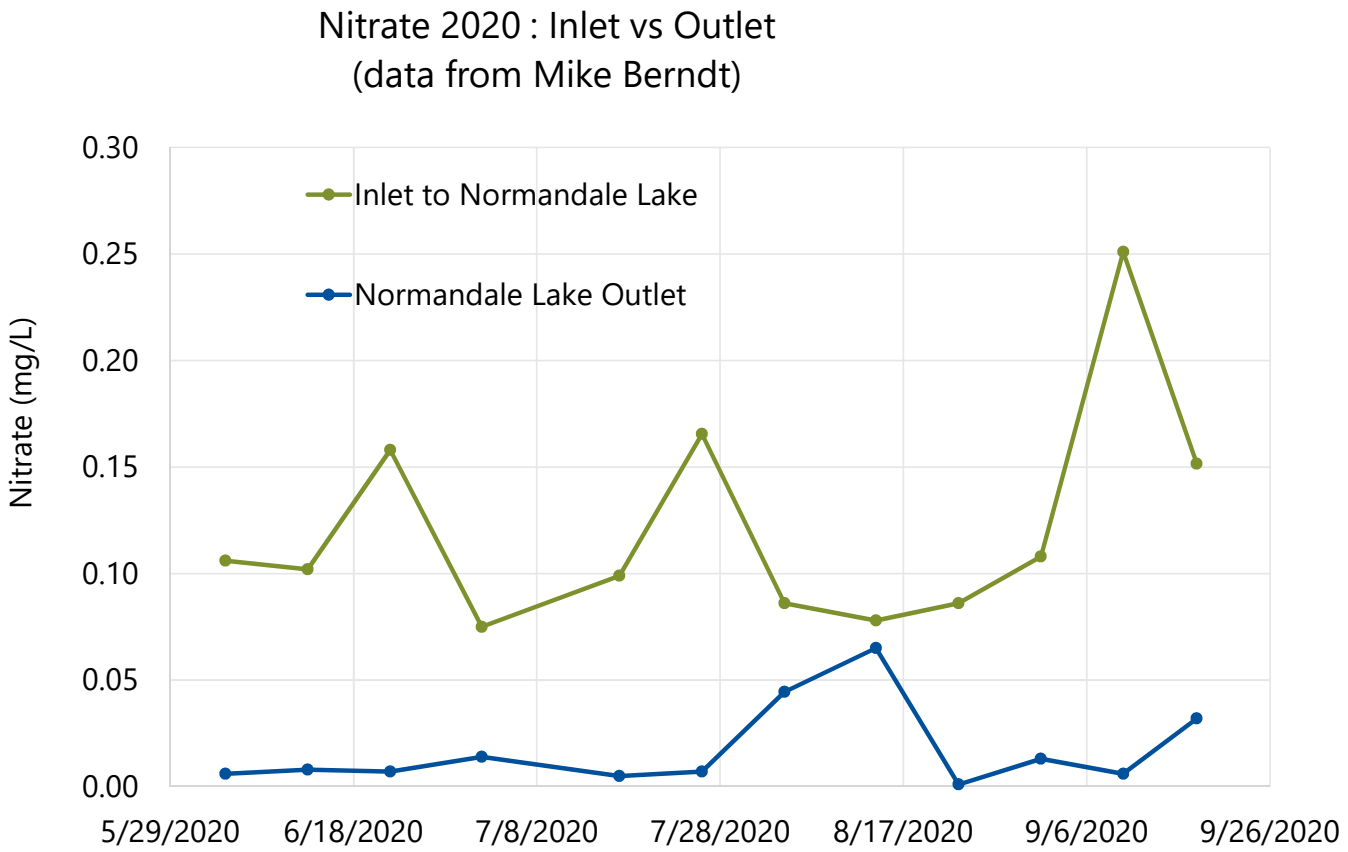


Normandale Lake: Water Quality



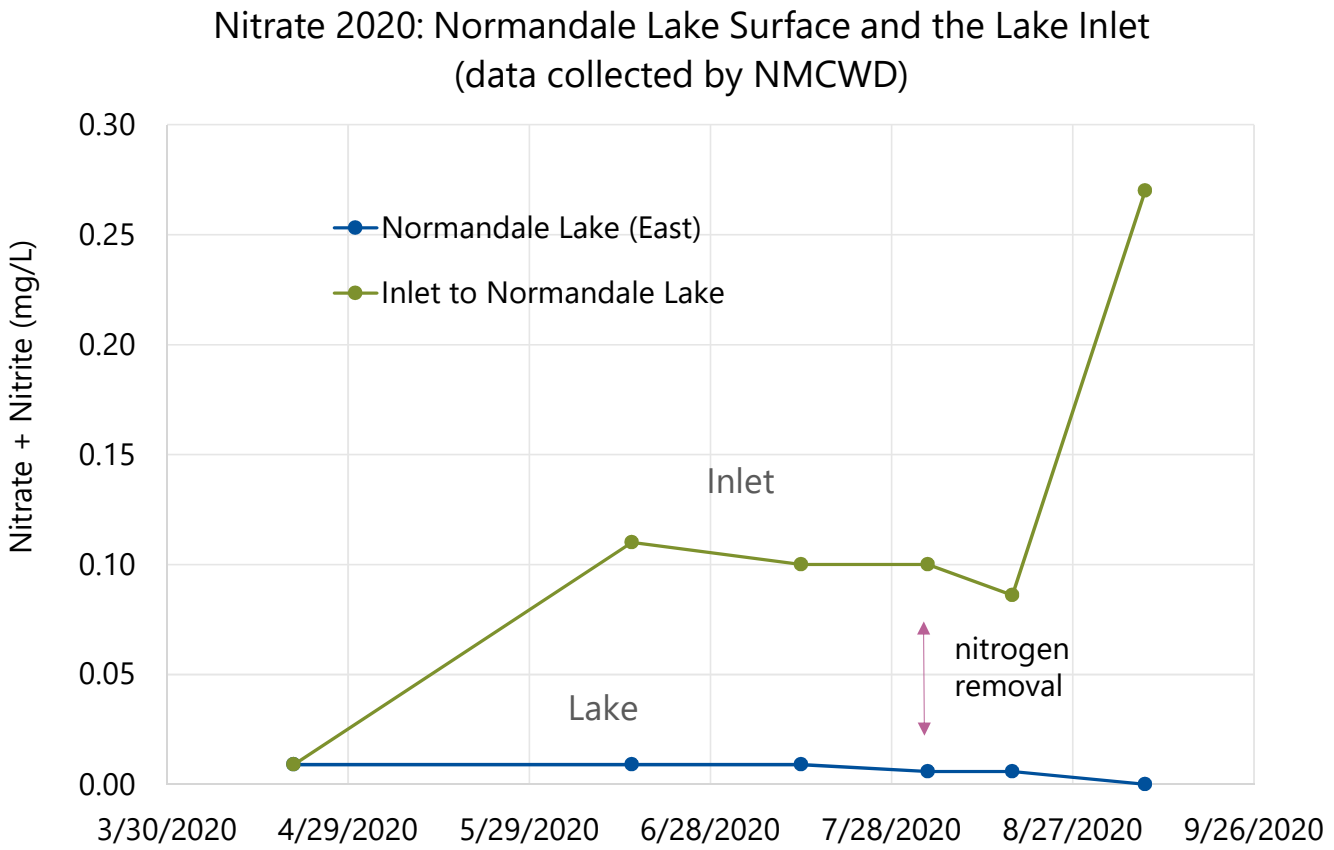
Normandale Lake: Water Quality

New Data



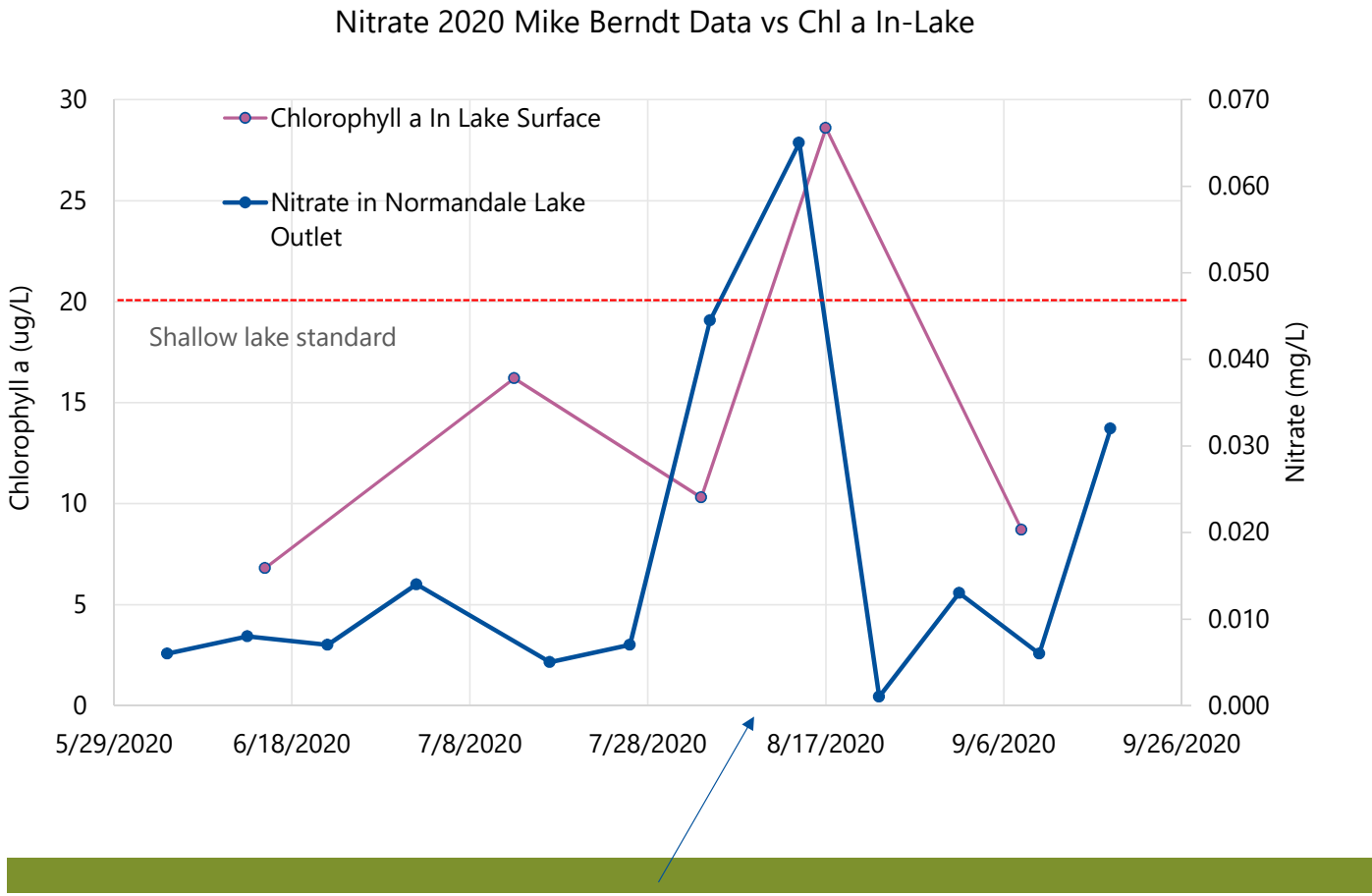
Normandale Lake: Water Quality

Lake is removing a lot of nitrogen as nitrate + nitrite



Normandale Lake: Water Quality

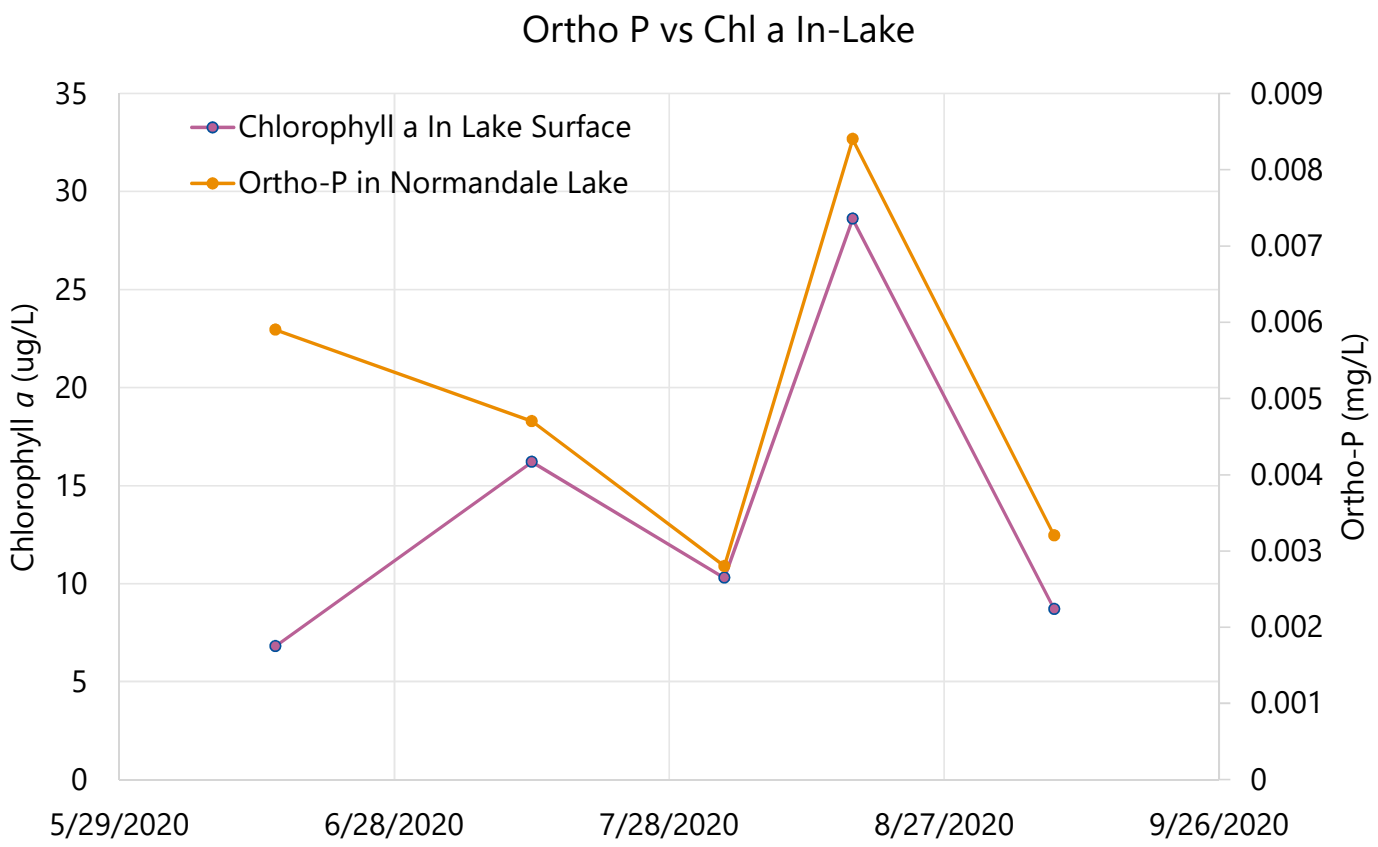
Limited nitrogen is moderating potential phytoplankton blooms



2.8 inch rain event on 8/14

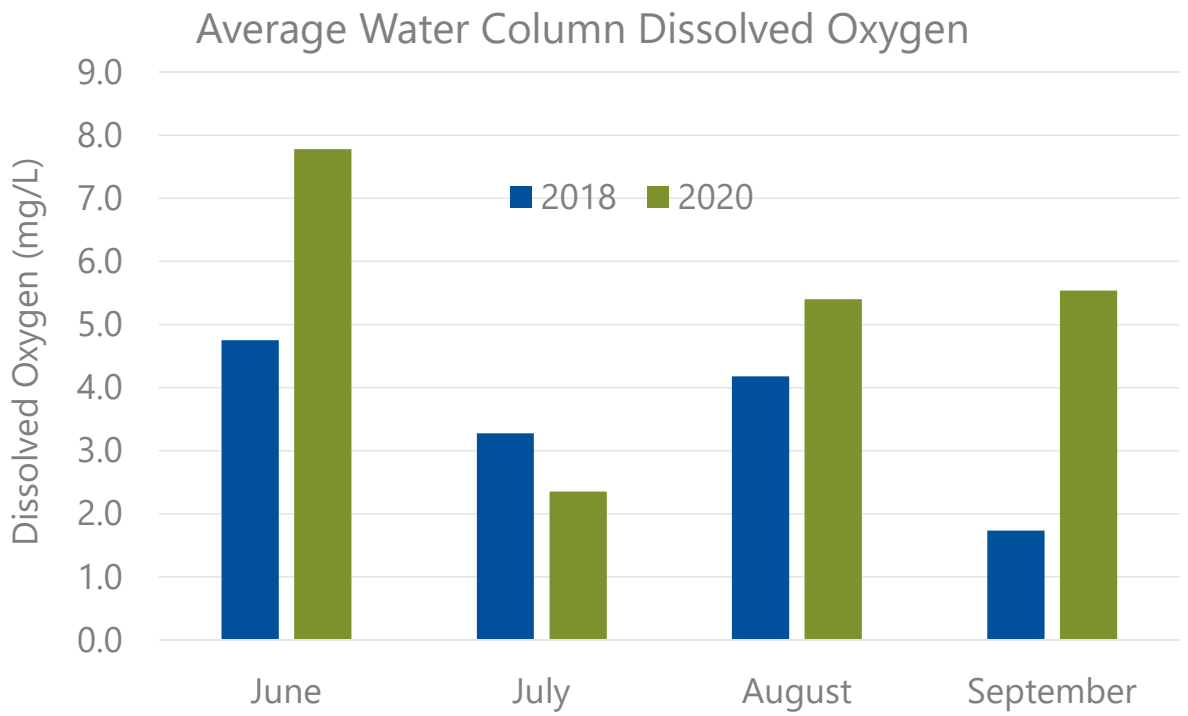
Normandale Lake: Water Quality

Both nitrogen and phosphorus needed to create bigger phytoplankton blooms



Normandale Lake: Water Quality

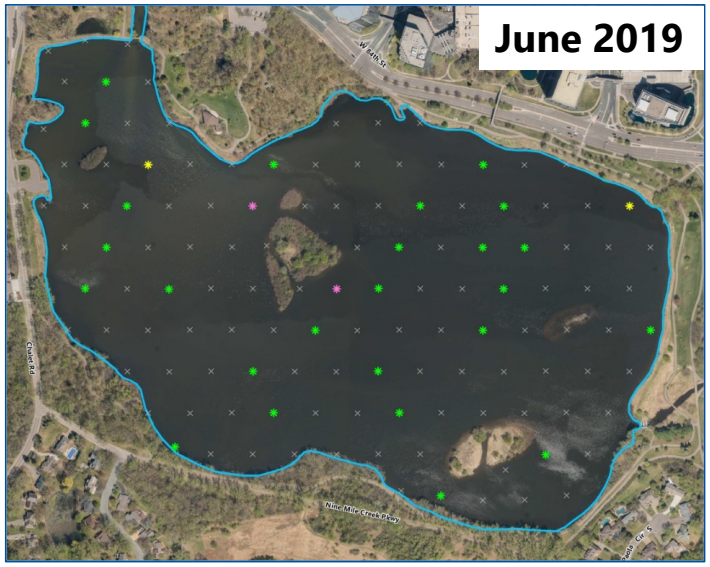
Dissolved Oxygen



Normandale Lake: Curly-leaf Pondweed

Rake Fullness Rating

- Visual
- 1
- 2
- 3
- None Found



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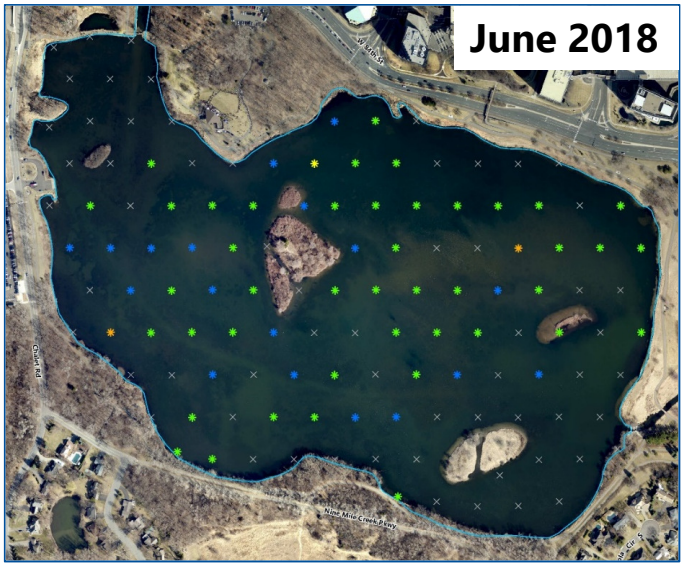
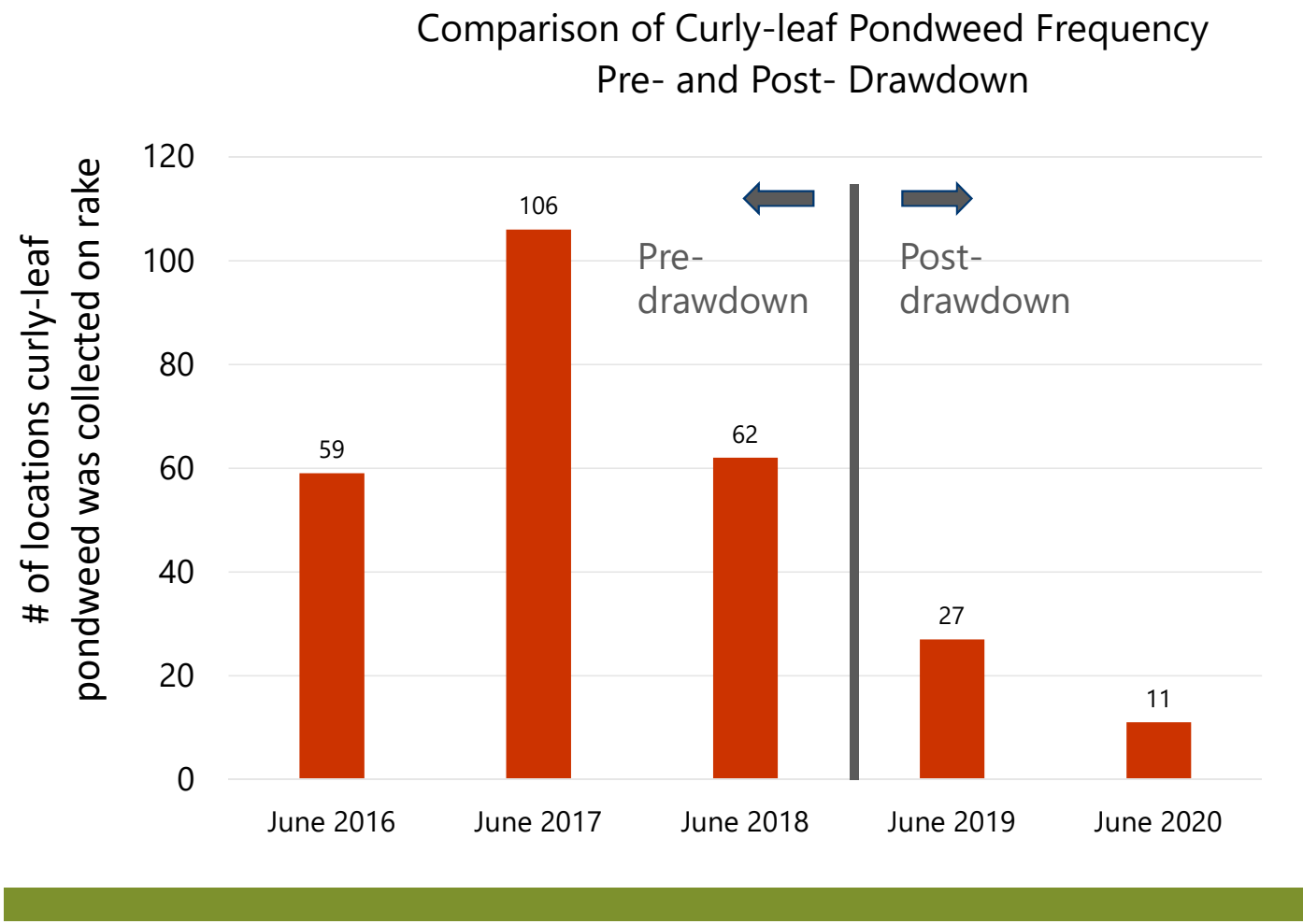


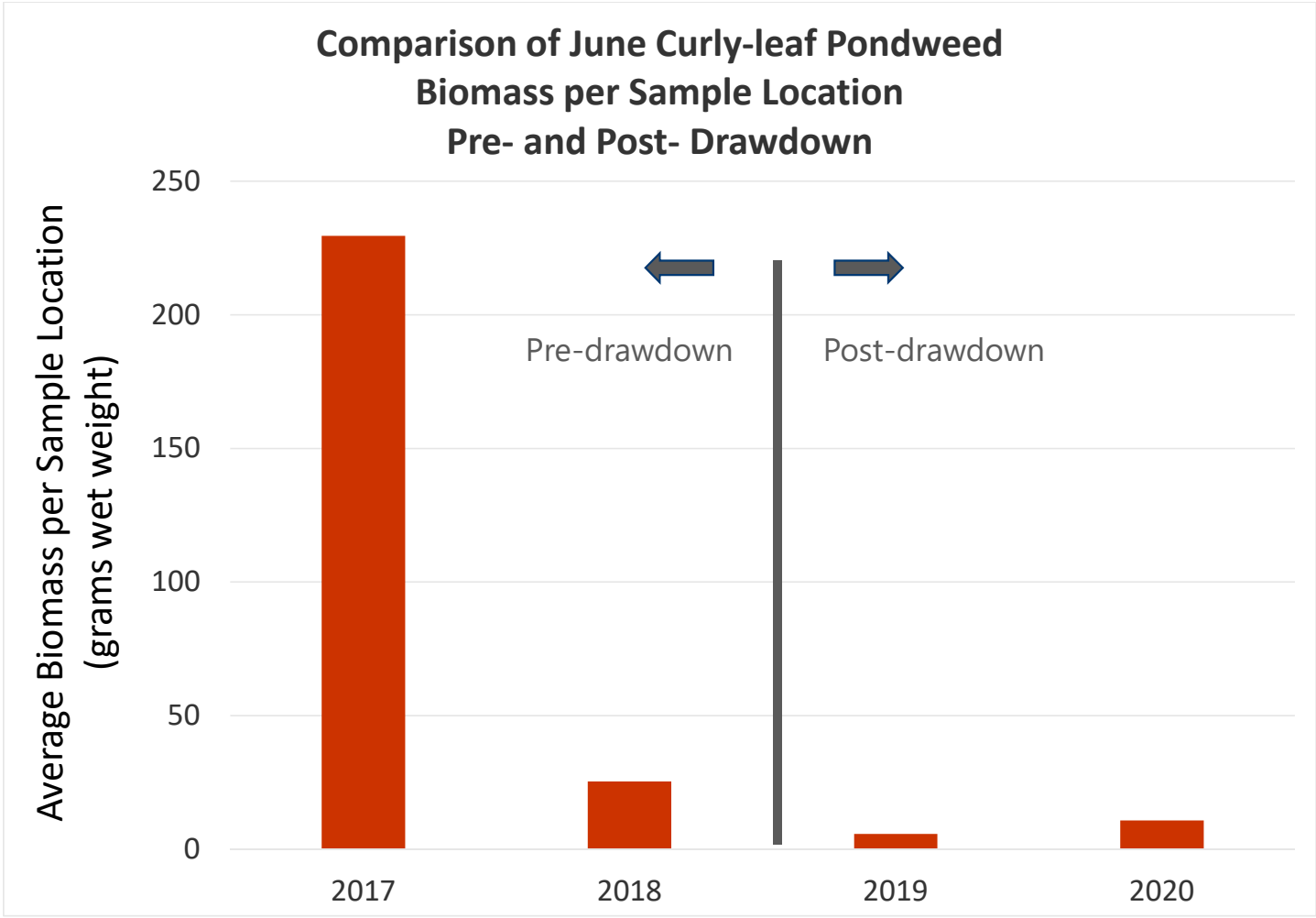
Rake Fullness Rating

- Visual
- 1
- 2
- 3
- 4
- None Found

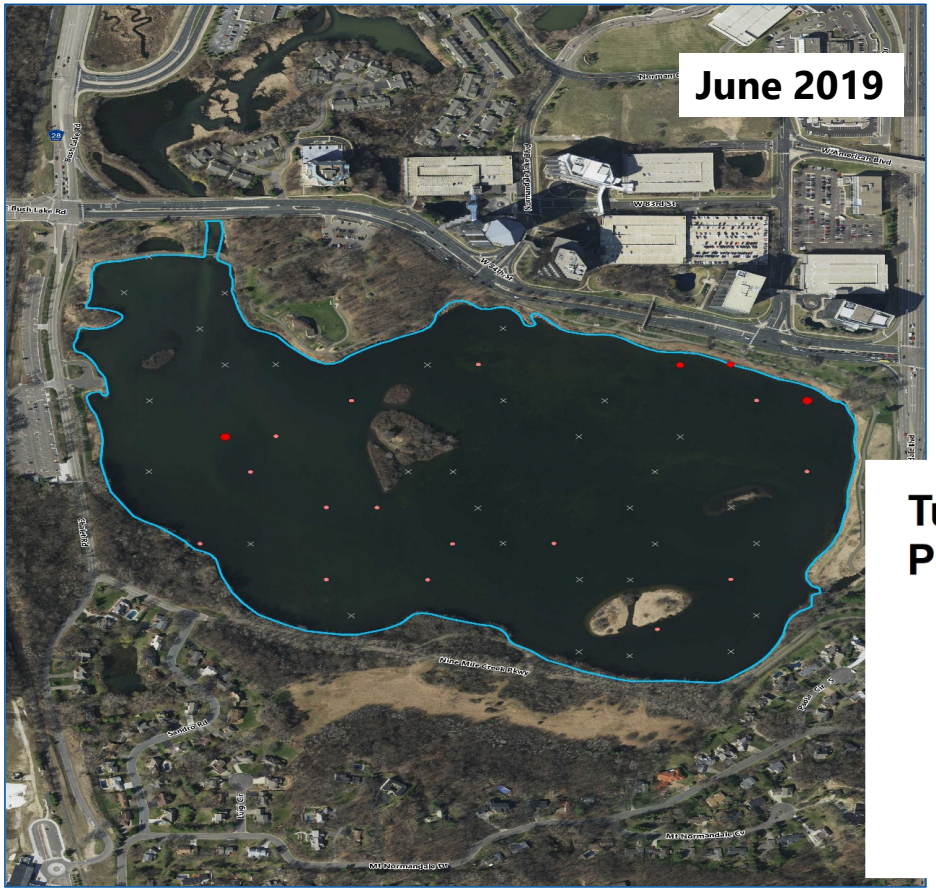
Normandale Lake: Curly-leaf Pondweed

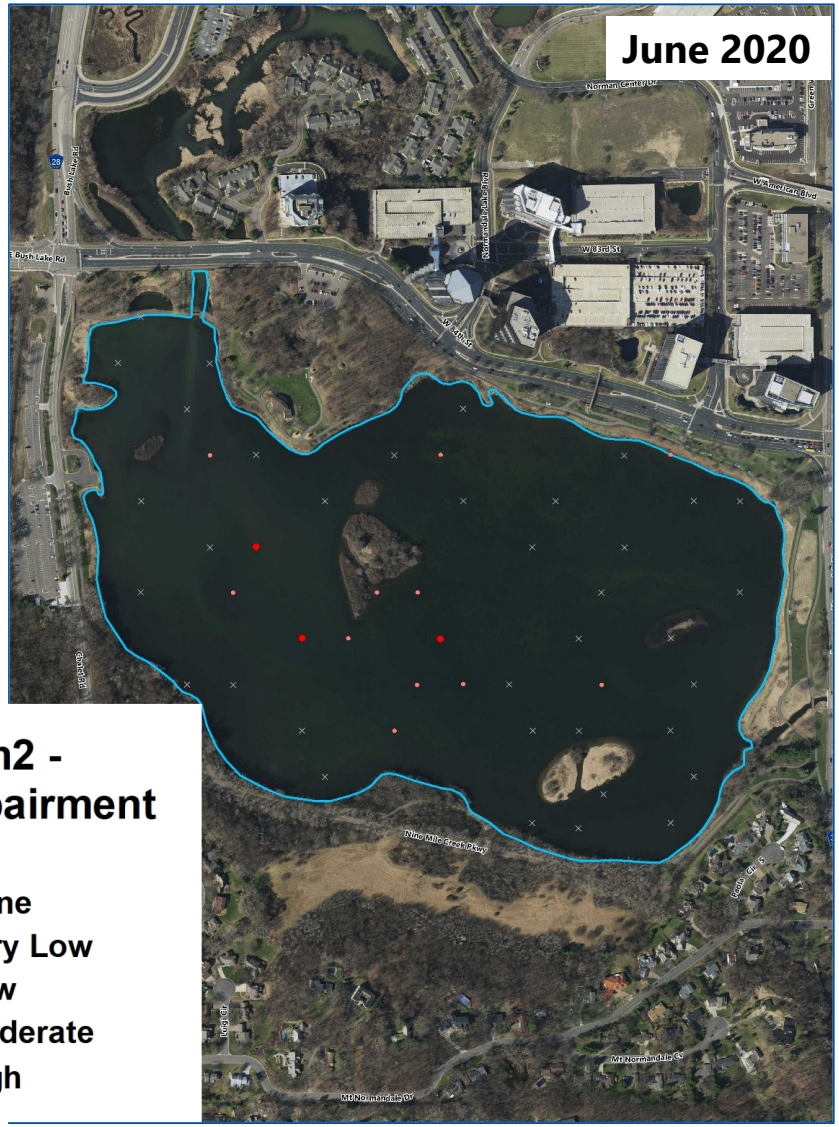


Normandale Lake: Curly-leaf Pondweed



Normandale Lake: Curly-leaf Pondweed Turions





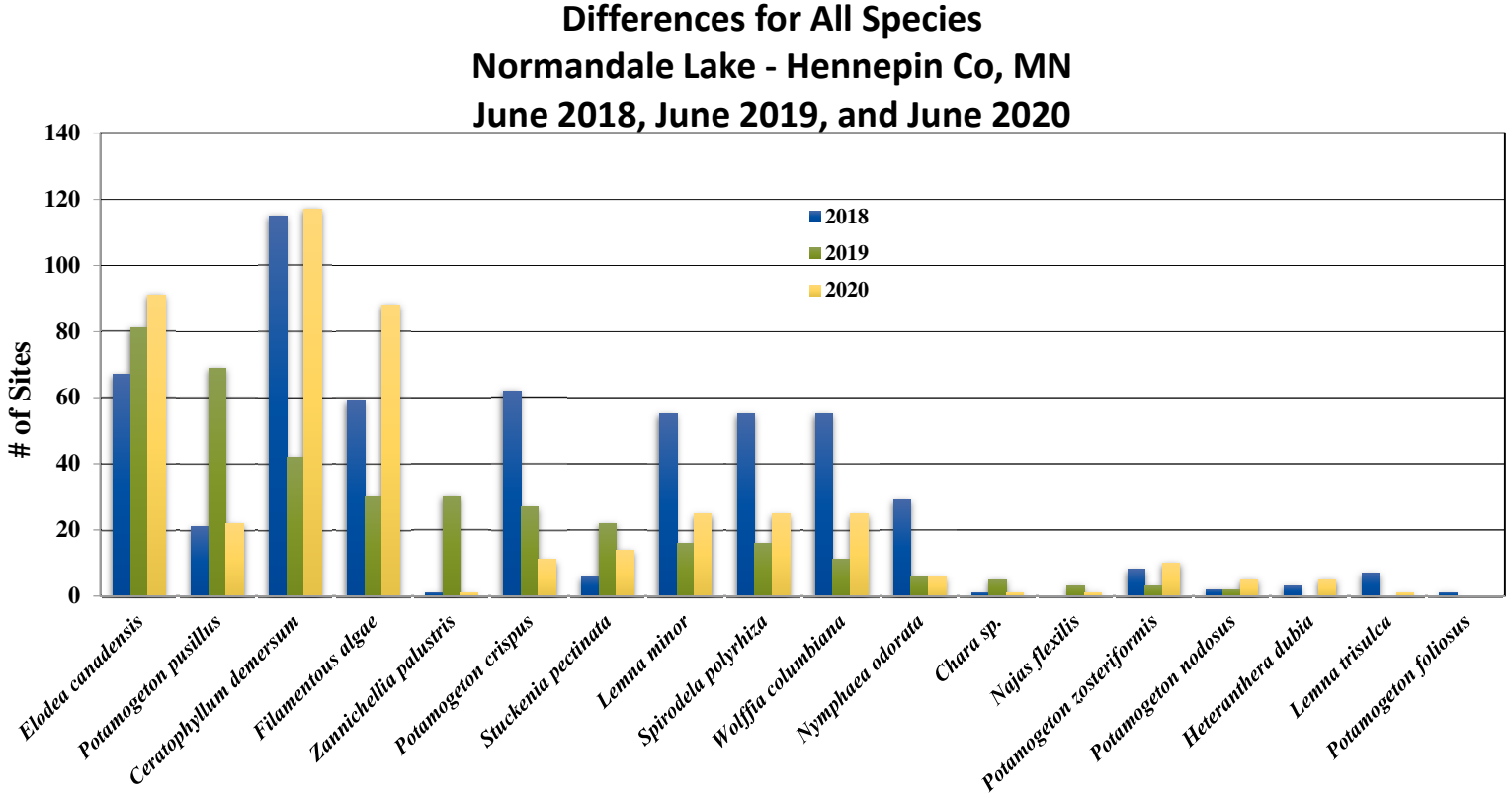
Turion Density/m2 - Potential for Impairment

- None Found
- 1 - 50 - None
- 50 - 100 - Very Low
- 100 - 200 - Low
- 200 - 350 - Moderate
- >350 - High

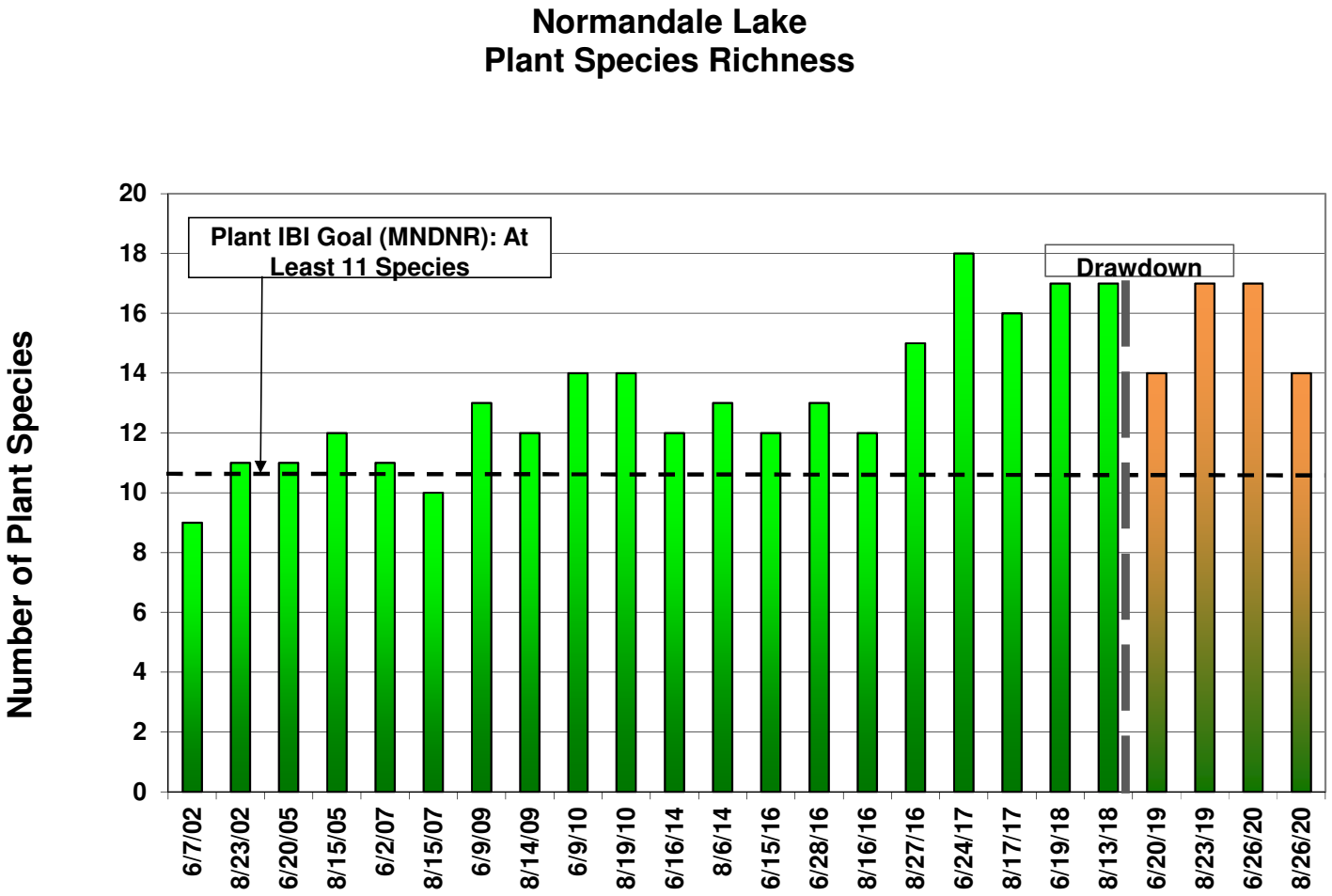
Normandale Lake: Curly-leaf Pondweed Turions

- 2019 Turion Survey Results:
  - Turions at 19 of 50 sample points (38%)
  - Total of 36 live turions
  - All turions were small, indicating they were produced by plants that germinated when the lake refilled in spring 2019
- 2020 Turion Survey Results
  - Turions at 14 of 50 sample points (28%)
  - Total of 21 live turions
  - Turions were small except for one. This may mean they were produced by plants that germinated from seeds after the 2020 treatment
  - Nearly a significant decline in turions in 2020 ($p = 0.08$)

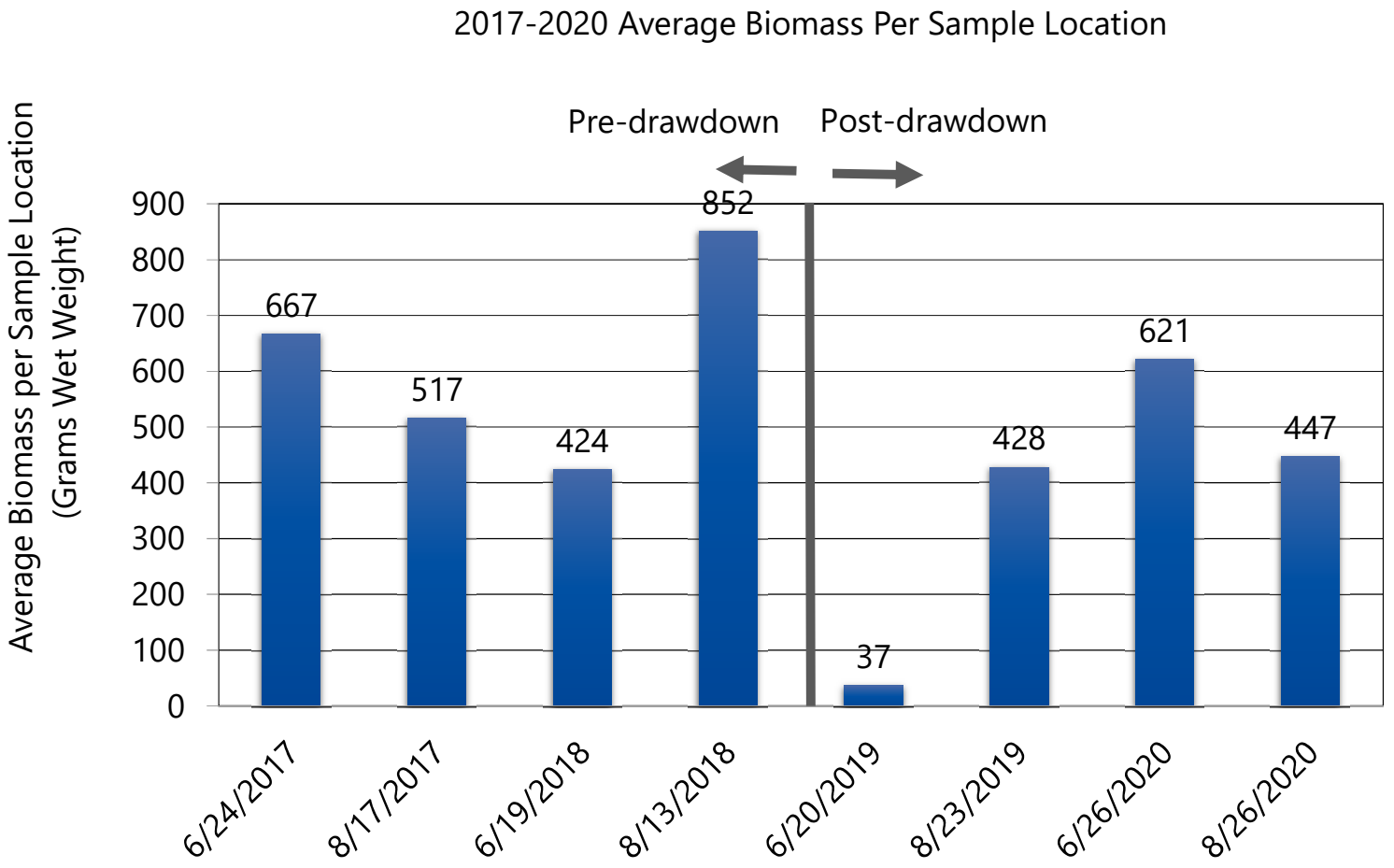
Normandale Lake: Aquatic Plant Community



Normandale Lake: MNDNR Plant IBI – Species Richness



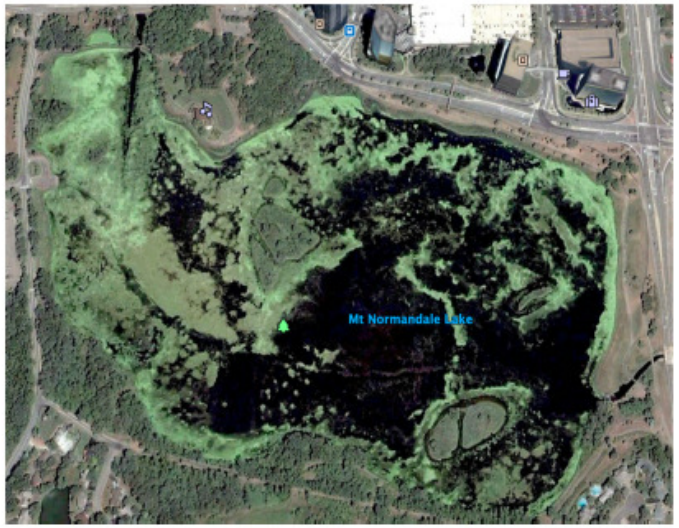
Normandale Lake: Aquatic Plant Community



Other Measures of Project Success

- Water quality improvement
- Curly-leaf pondweed reduction
- Health of aquatic plant community
- Visual/Aesthetics?
- Odor?
- Other?

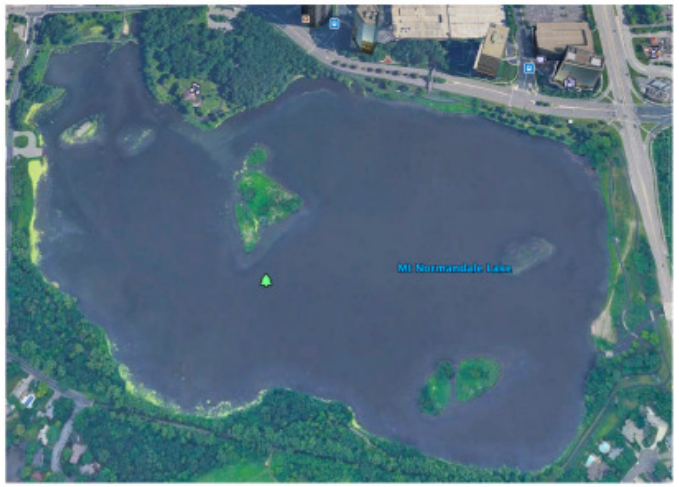
6/17/2005



6/6/2006

6/2/2008

5/18/2010

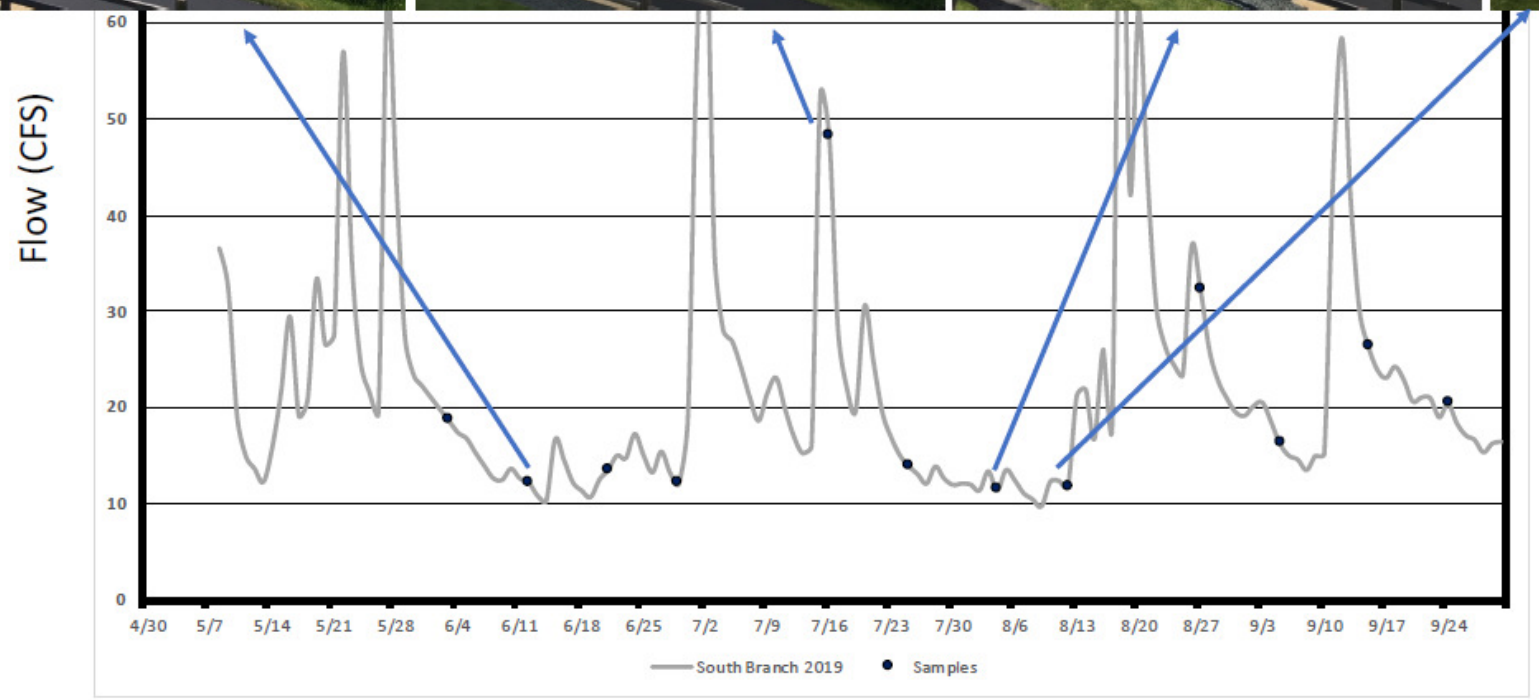


6/5/2019

6/2/20

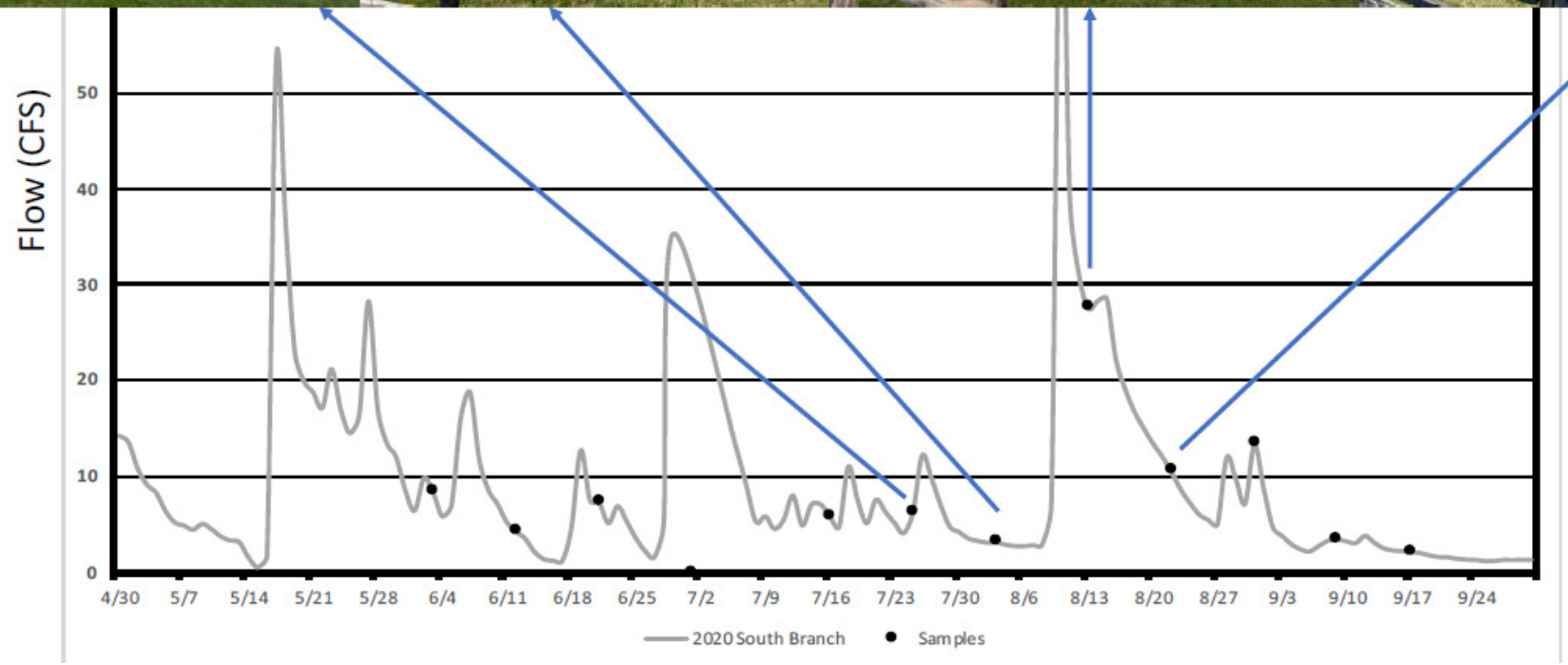
Photos courtesy of Mike Berndt.

2019



Photos and graph courtesy of Mike Berndt.

2020



Photos and graph
courtesy of Mike Berndt

Filamentous Algae

Normandale Lake: Looking forward to 2021 and beyond

2018
- Start drawdown
- Fisheries assessment

2019
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- Monitor / Assess

2020
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2024
- Curly-leaf pondweed spot treatment (?)
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Looking forward to 2021 and beyond: Carp Management

- Conclusions of 2020 carp management efforts (Carp Solutions)
  - Carp population likely **exceeds ecologically damaging threshold** (100 kg/ha)
  - Ageing analysis concluded population dominated by age-1 year class
  - Box netting was relatively successful- **over 5,000 carp removed** from the lake with just two relatively small nets.
  - Trapnet surveys suggest that **native fish community is currently strong enough to control carp recruitment**.
- Recommendations of 2020 carp management efforts (Carp Solutions)
  - Mark-recapture survey to better quantify carp population
  - More carp removal using baited nets
  - Further assessment of carp movement upstream for spawning /barrier needs
- Are carp affecting water quality?

Normandale Lake: Looking forward to 2021 and beyond

2021: Monitoring and Management

- Curly-leaf pondweed
  - Continue survey and spot treatment
- Identify potential monitoring needs to assist in management decisions in 2024
  - *Dissolved oxygen transects across lakes*
    - Determine if aeration or harvesting needed to improve summer oxygen conditions
- Identify potential additional monitoring needs to address public concerns?
  - *Camera*: document plant community/filamentous changes
  - *Filamentous algae biomass*: document changes over time

2022 – 2024:

- Monitor → Assess → Adjust
- Upon completion of CLP herbicide treatments, evaluate need for other management strategies as identified in board-accepted 2018 Engineers Report (in collaboration w/City of Bloomington, Army Corp of Engineers, DNR)