Normandale Alum Treatment, May 2019

Normandale Lake: A holistic approach to improving water quality and managing invasive species in a shallow lake

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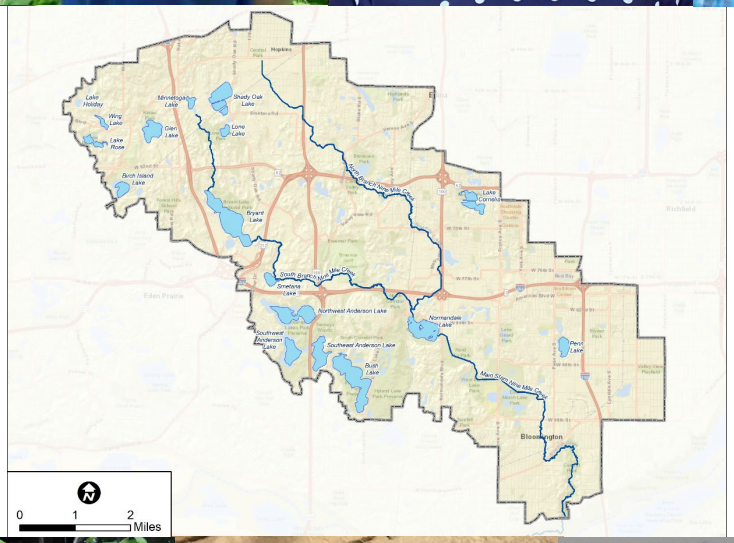
Janna Kieffer, PE, Barr Engineering Co.

Nine Mile Creek Watershed District Staff






9 MILE CREEK WATERSHED DISTRICT





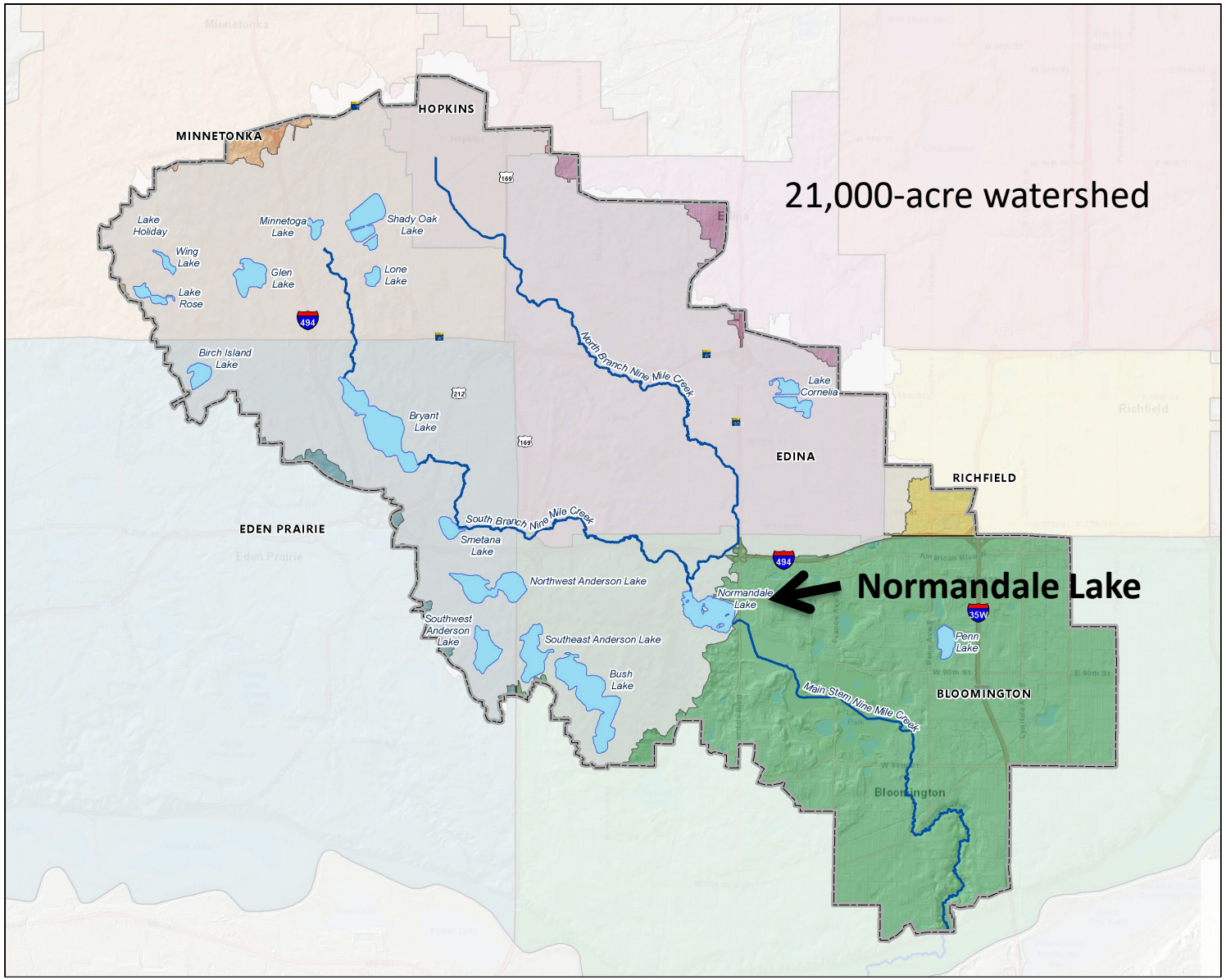


Nine Mile Creek Watershed District Board of Managers

Holistic Lake Management Approach

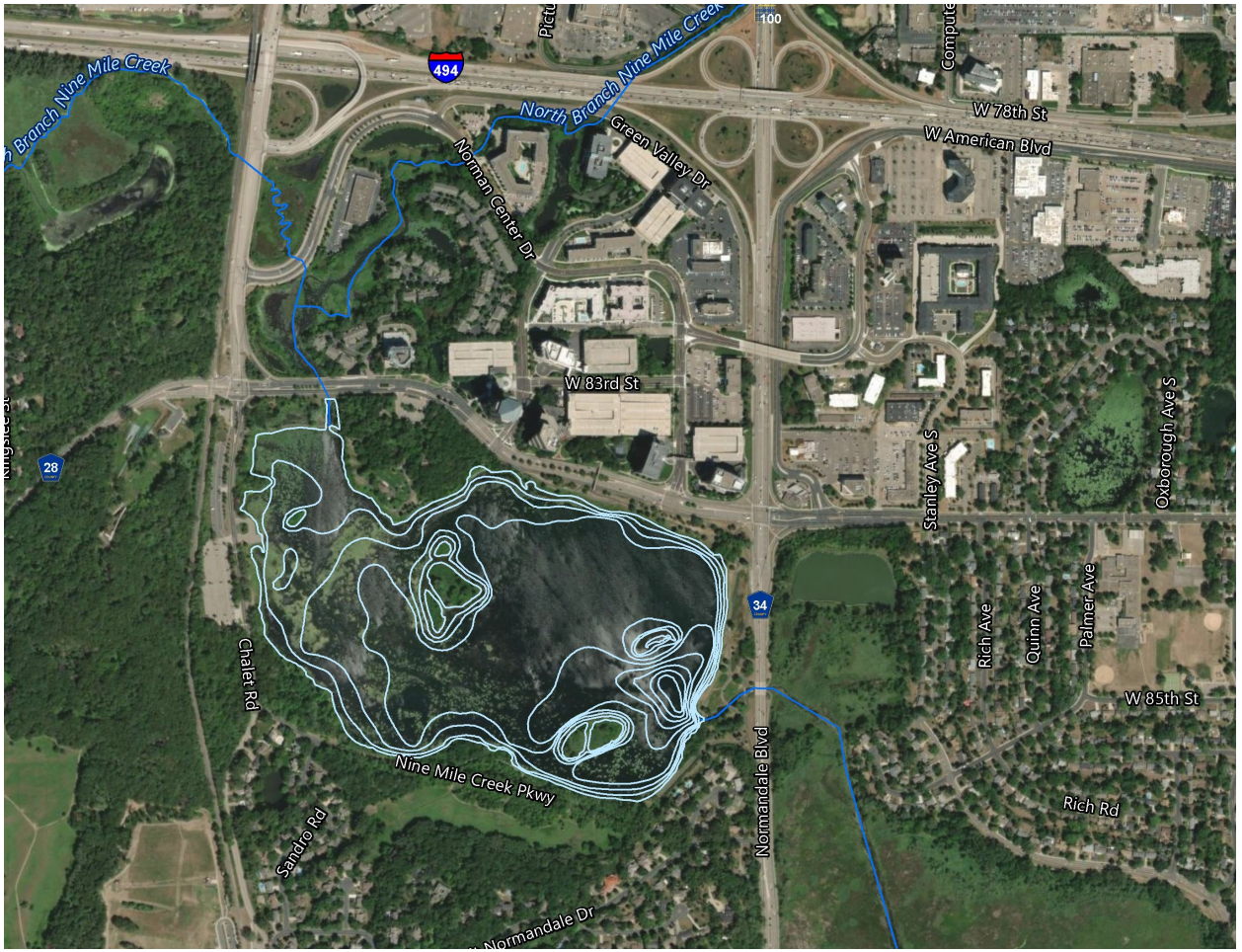
Manage to:

- meet MPCA water quality standards
- achieve a balanced ecosystem

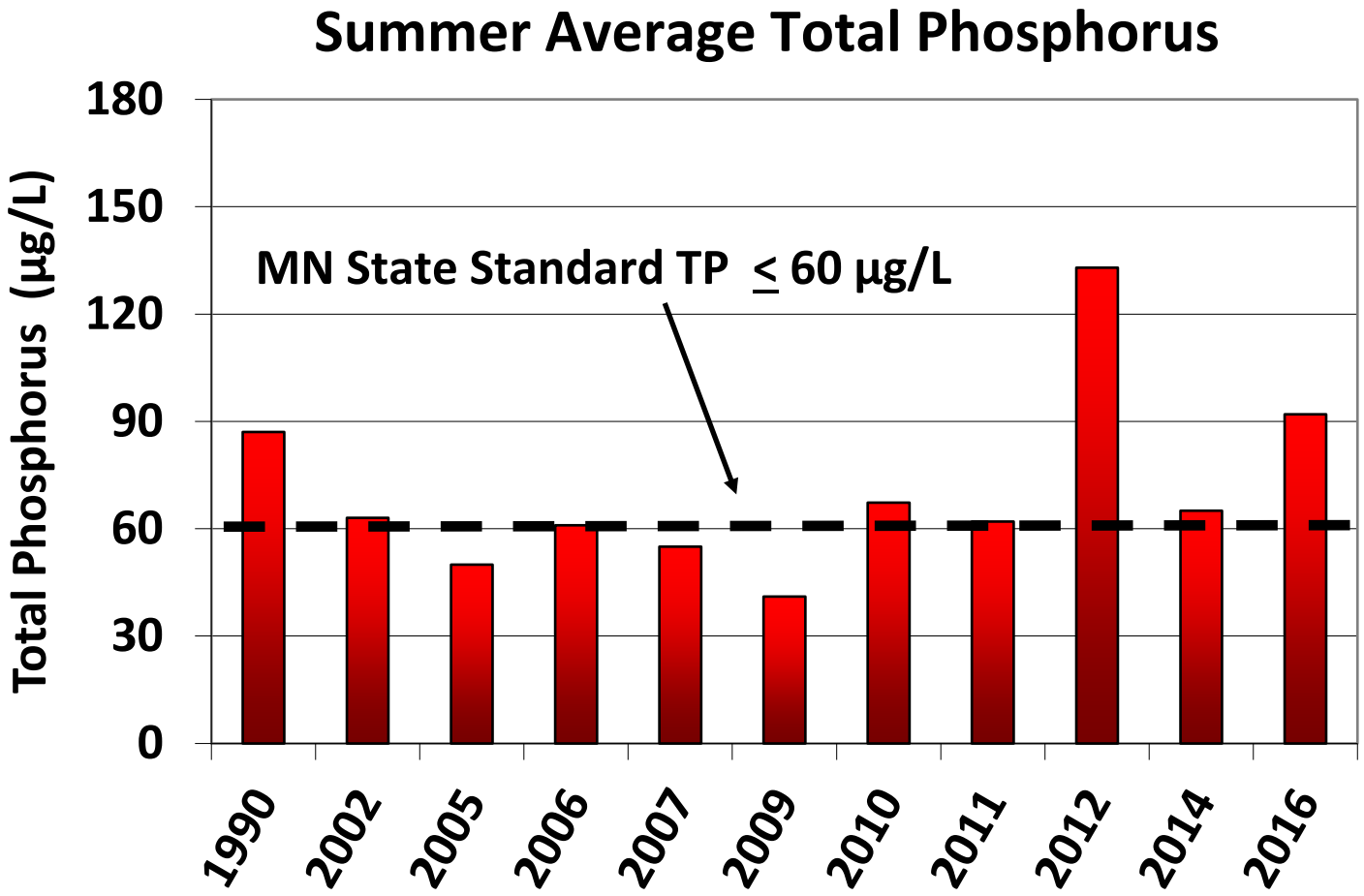

21,000-acre watershed
Normandale Lake
MINNETONKA
HOPKINS
EDEN PRAIRIE
EDINA
RICHFIELD
BLOOMINGTON
Lake Holiday
Minnetoga Lake
Shady Oak Lake
Wing Lake
Glen Lake
Lone Lake
Lake Rose
Birch Island Lake
Bryant Lake
North Branch Nine Mile Creek
Lake Cornelia
South Branch Nine Mile Creek
Smetana Lake
Northwest Anderson Lake
Normandale Lake
Southwest Anderson Lake
Southeast Anderson Lake
Bush Lake
Penn Lake
Main Stem Nine Mile Creek
494
169
212
35W

Normandale Lake Characteristics

- ~100 acres
- Shallow lake
  - 10 feet max depth
  - 4 feet average depth
- Lake constructed by NMCWD in late-1970s for flood control

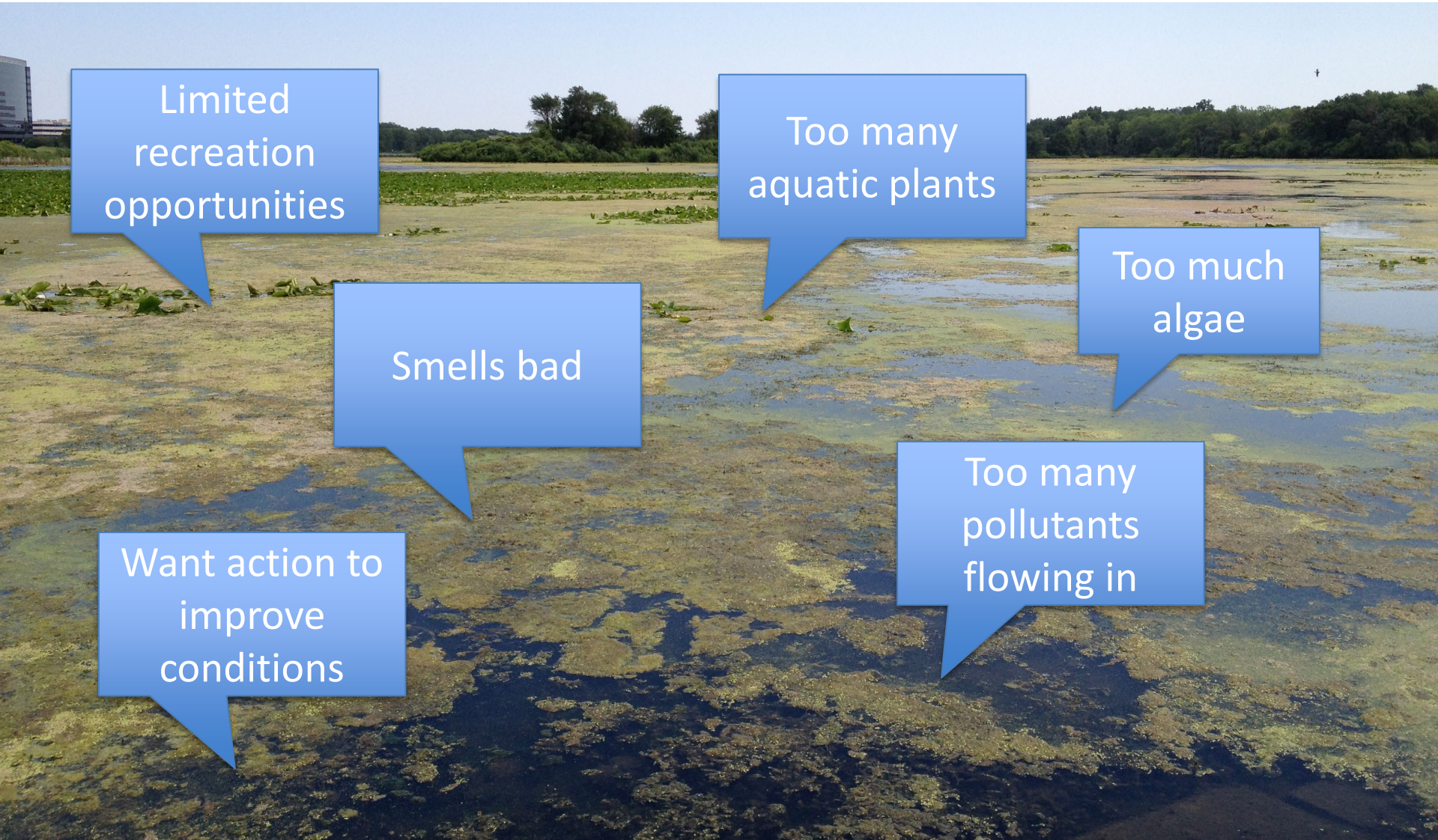


Normandale Lake Water Quality



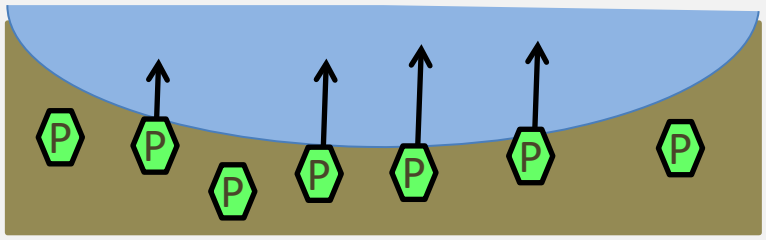
Normandale Lake Water Quality

Public Perception



2017 Water Quality Study

- Internal phosphorus loading can be a significant source of phosphorus to Normandale Lake



Management Strategy: **Alum Treatment**

- Reduce/prevent release of phosphorus from lake bottom sediments

2017 Water Quality Study

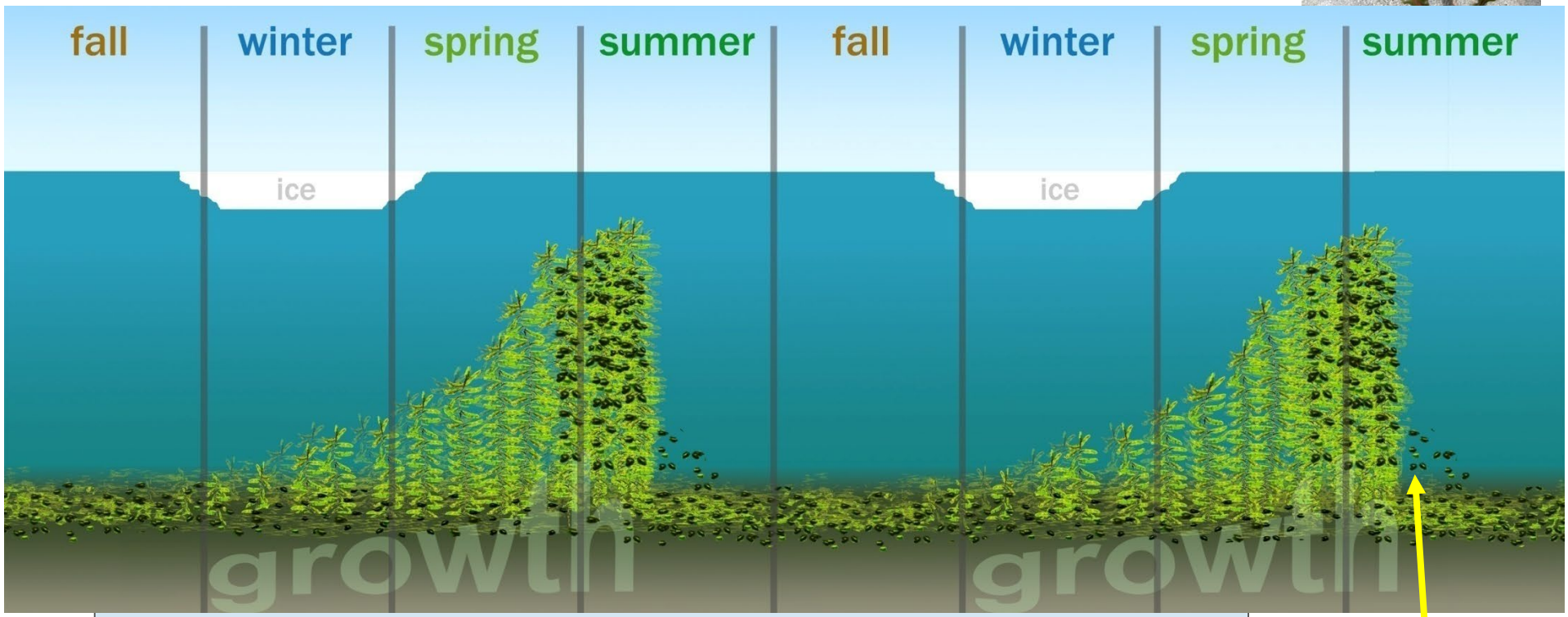
- Aquatic plants have a significant role in the ecology and water quality of Normandale Lake
- Health of native plant population threatened by curly-leaf pondweed

Management Strategy: **Lake Drawdown**

- Reduce curly-leaf pondweed
- Potentially improve diversity of native plant population

Curly-leaf Pondweed

Non-native, invasive plant; unusual growth cycle



Winter: Plants continue growing under ice

Late-spring/early-summer: Plants die back and form turions

Summer: Turions remain dormant

Fall: Turions germinate

Winter: New plants sprout from turions

Curly-leaf turion

Normandale Lake
Water Quality Improvement Project

Project goals:

- Improve lake water quality
- Improve ecological health of the lake

Normandale Lake
Water Quality Improvement Project

Management Practice	Timing
Lake Drawdown	Fall 2018
Alum Treatment	Spring 2019
Herbicide Treatments (2 – 5 successive years)	Spring 2020, 2021, 2022
Fisheries Management	2019-2022

Project Implementation

Drawdown: August 2018-March 2019

- Drained the lake to manage curly-leaf pondweed by freezing turions

Project Implementation

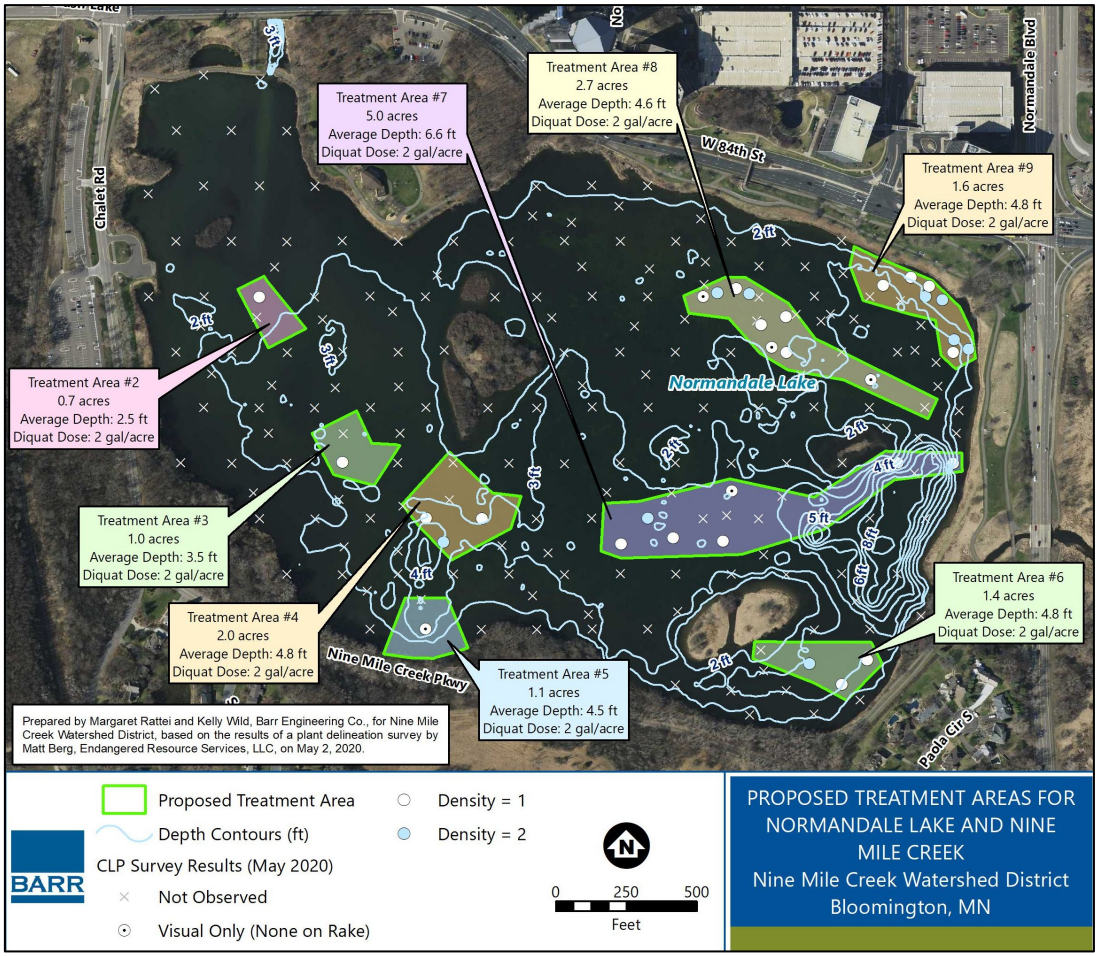
Alum Treatment: May 2019

- Treated lake with a buffered solution of alum to reduce release of phosphorus from lake bottom sediment

Project Implementation

Herbicide Treatment: Spring 2020, 2021, 2022

- Partial lake herbicide treatment to manage remaining curly-leaf pondweed following drawdown



Project Implementation

Fisheries Management:

Pre-Drawdown Fish Survey (2018)

- Carp population exceeds ecologically damaging threshold (100 kg/ha)
- No young of the year carp
- Bluegill population may be limiting carp recruitment

Project Implementation

Fisheries Management:

Post-Drawdown Fish Surveys (2019, 2020)

- Bluegill numbers remained similar pre- and post-drawdown
- Carp recruitment occurred post-drawdown in 2019 but not 2020
- Carp population exceeds ecologically damaging threshold (100 kg/ha)

DNR Fish Stocking

2019: Black Crappie (30), Bluegill Sunfish (20)

2022: Black Crappie (4), Bluegill Sunfish (46), Largemouth Bass (16)

Project Implementation

Fisheries Management:

Post-Drawdown Carp Management

Box Netting

- Over 5,000 carp removed (2020)
- 1,500 carp removed (2021)
- ~1,200 carp removed (2022)

Tracking

- Radio tagged fish in 2019
- PIT tagged fish in 2021 & 2022

Measuring Project Outcomes

Water quality improvement

- Total phosphorus
- Chlorophyll *a* (algae indicator)
- Water clarity

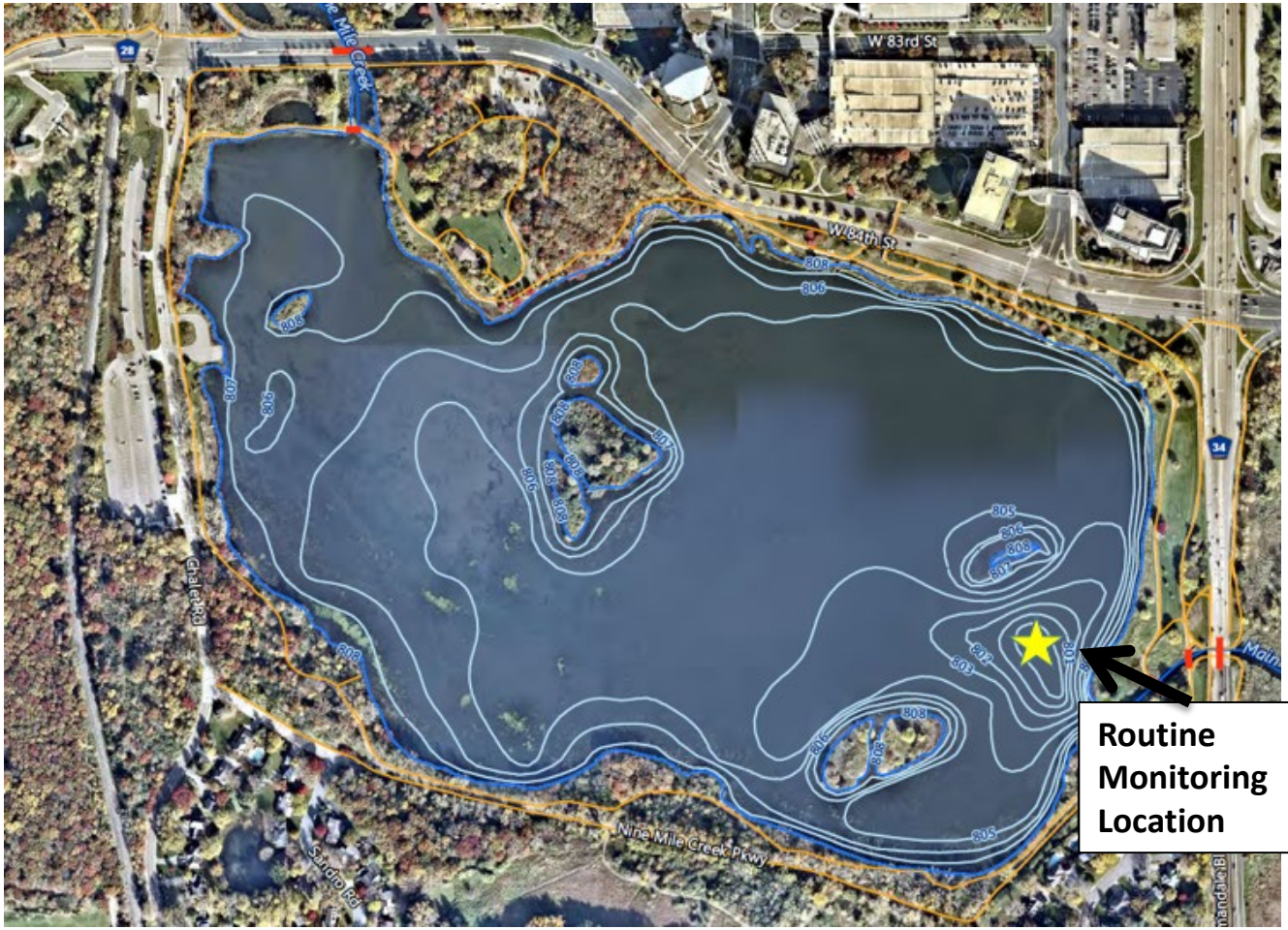
Curly-leaf pondweed (CLP) reduction

- CLP plant frequency and biomass monitoring
- CLP turion monitoring

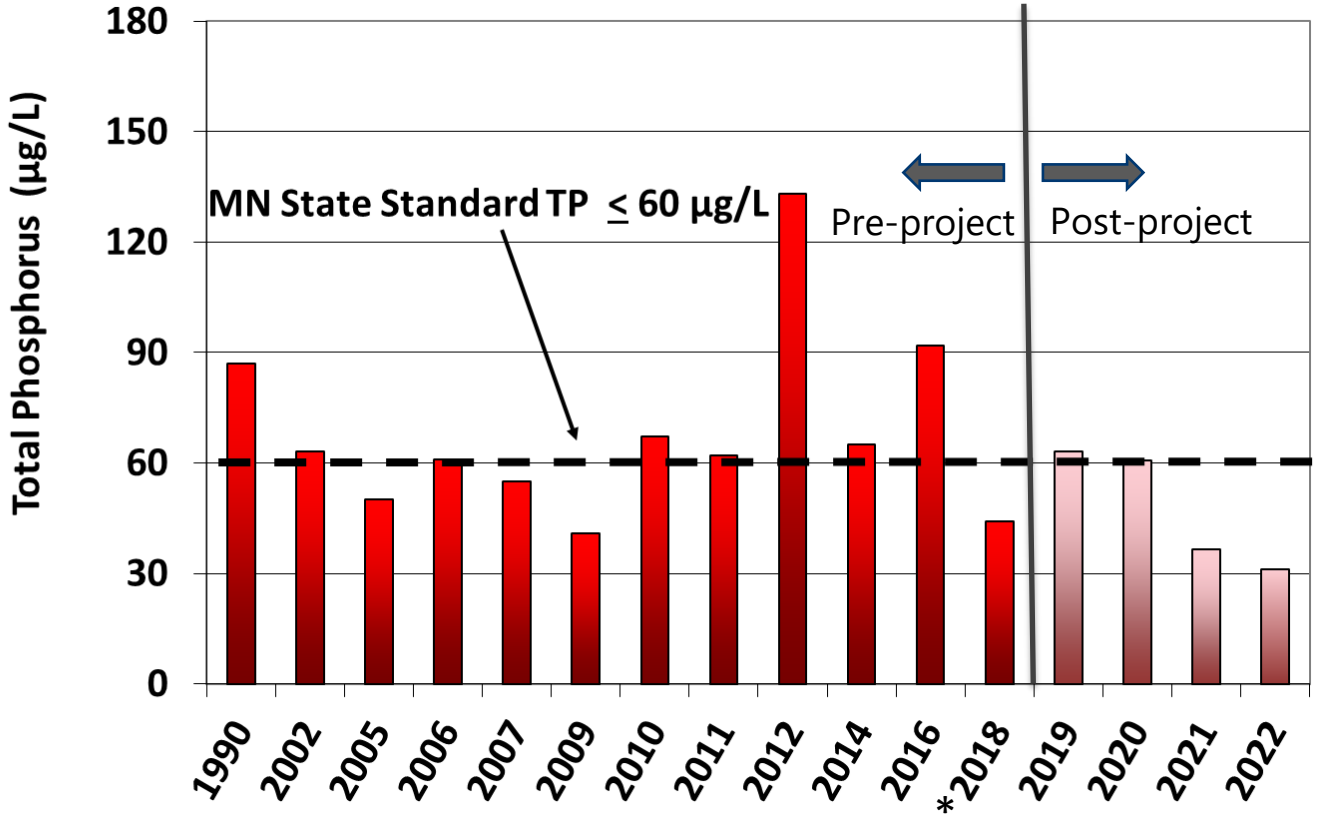
Health of aquatic plant community

- Aquatic plant species richness using Floristic Quality Index (FQI)
- Aquatic plant biomass monitoring

Water Quality Monitoring

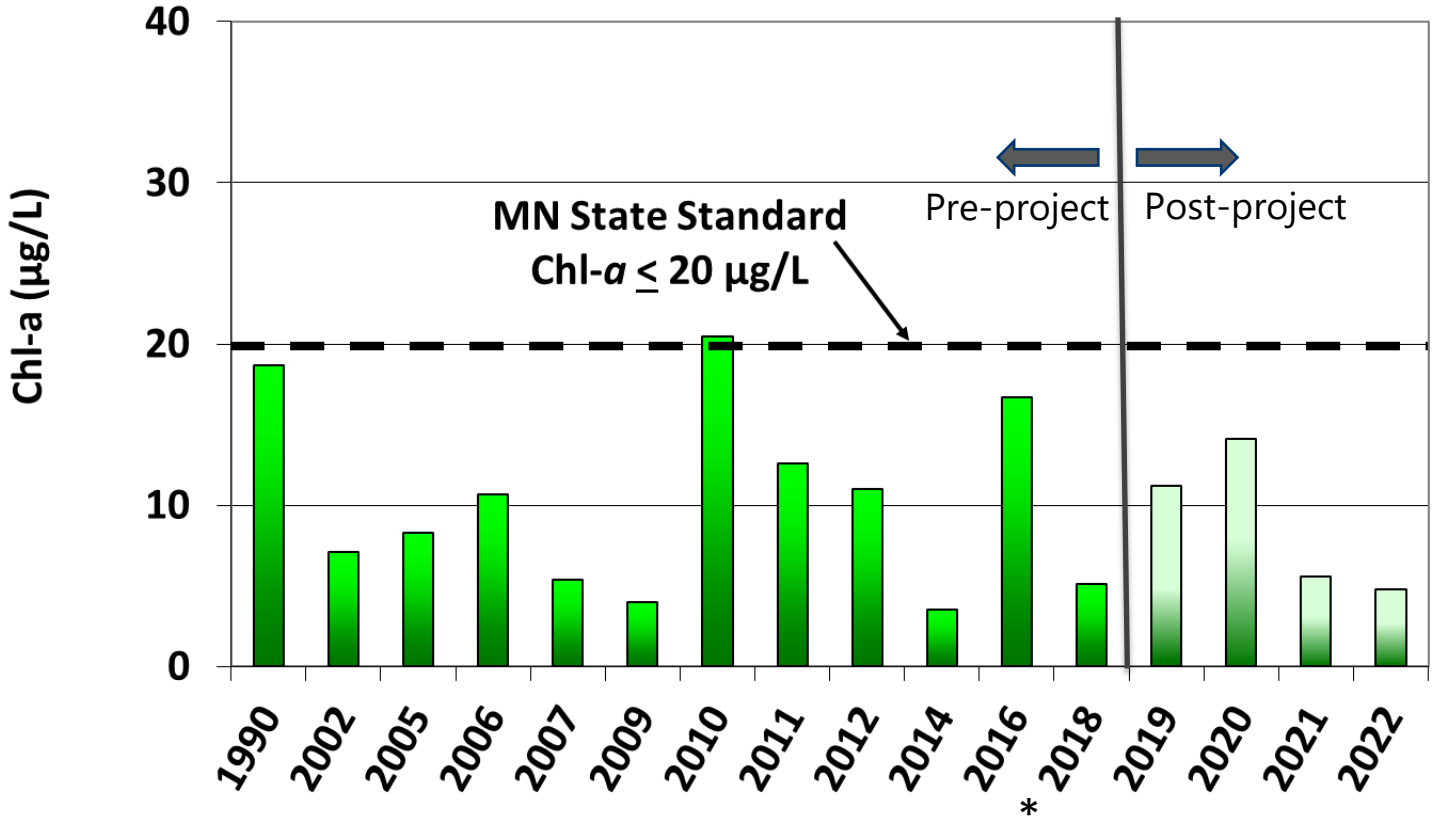


Measuring Project Outcomes – Phosphorus



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

Measuring Project Outcomes – Chlorophyll *a*



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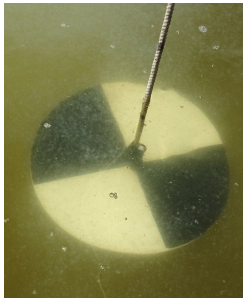
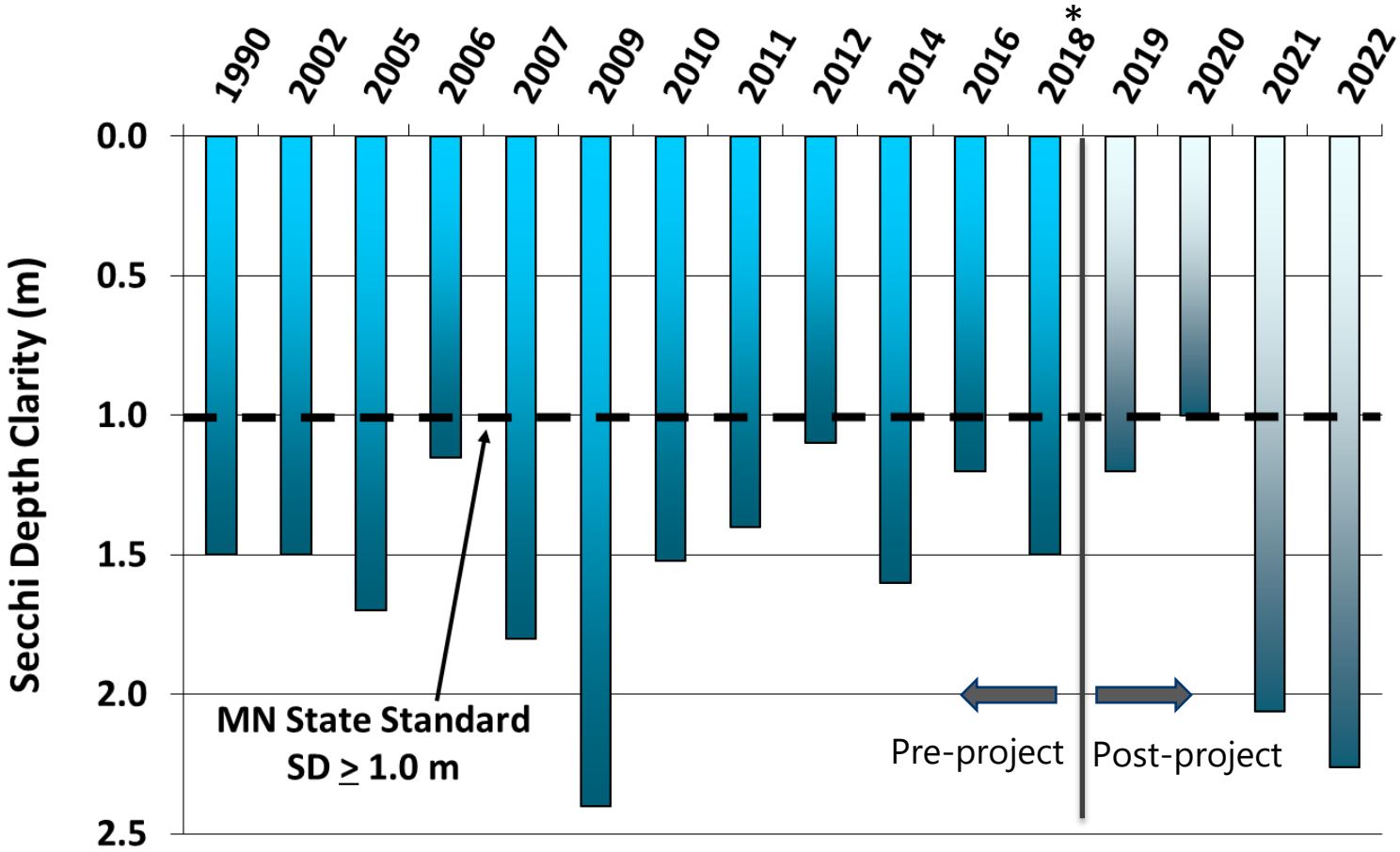
Measuring Project Outcomes – Water Clarity





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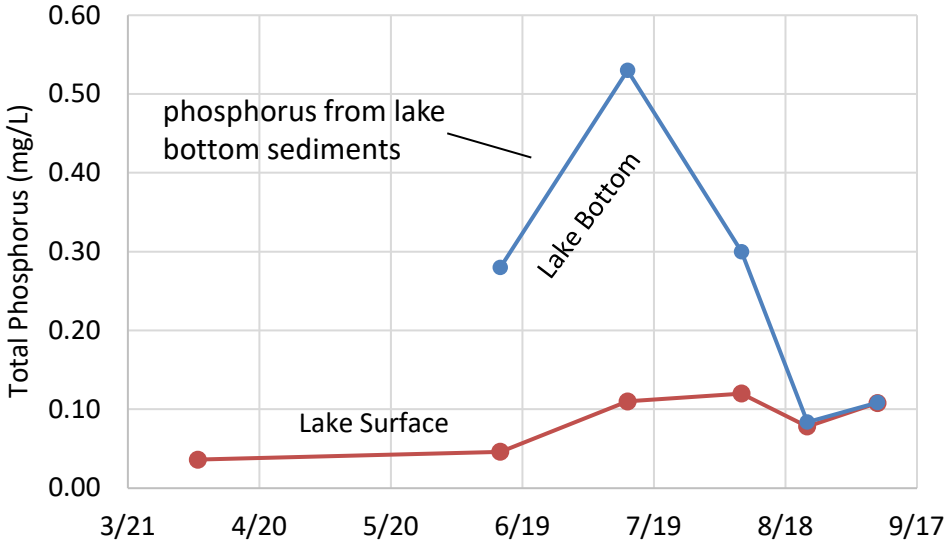
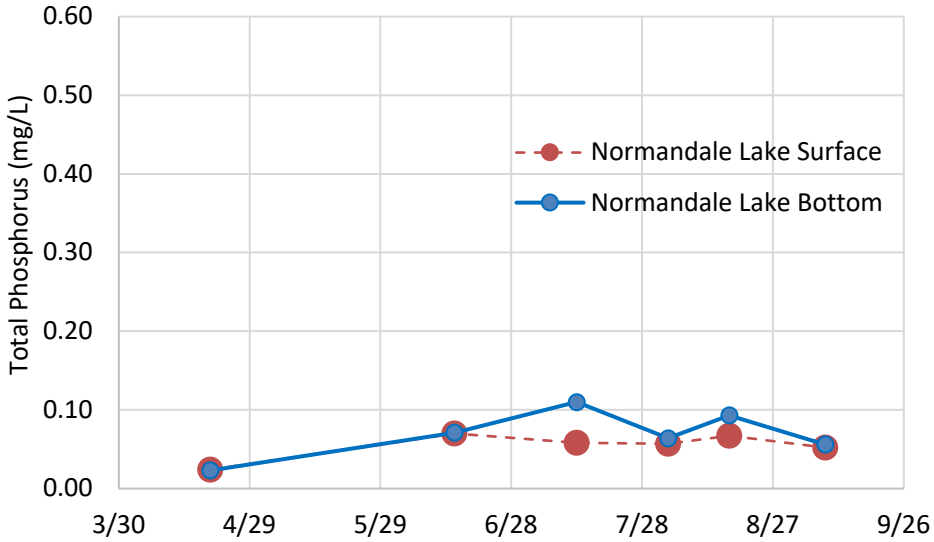
Measuring Project Outcomes – Internal Phosphorus Loading

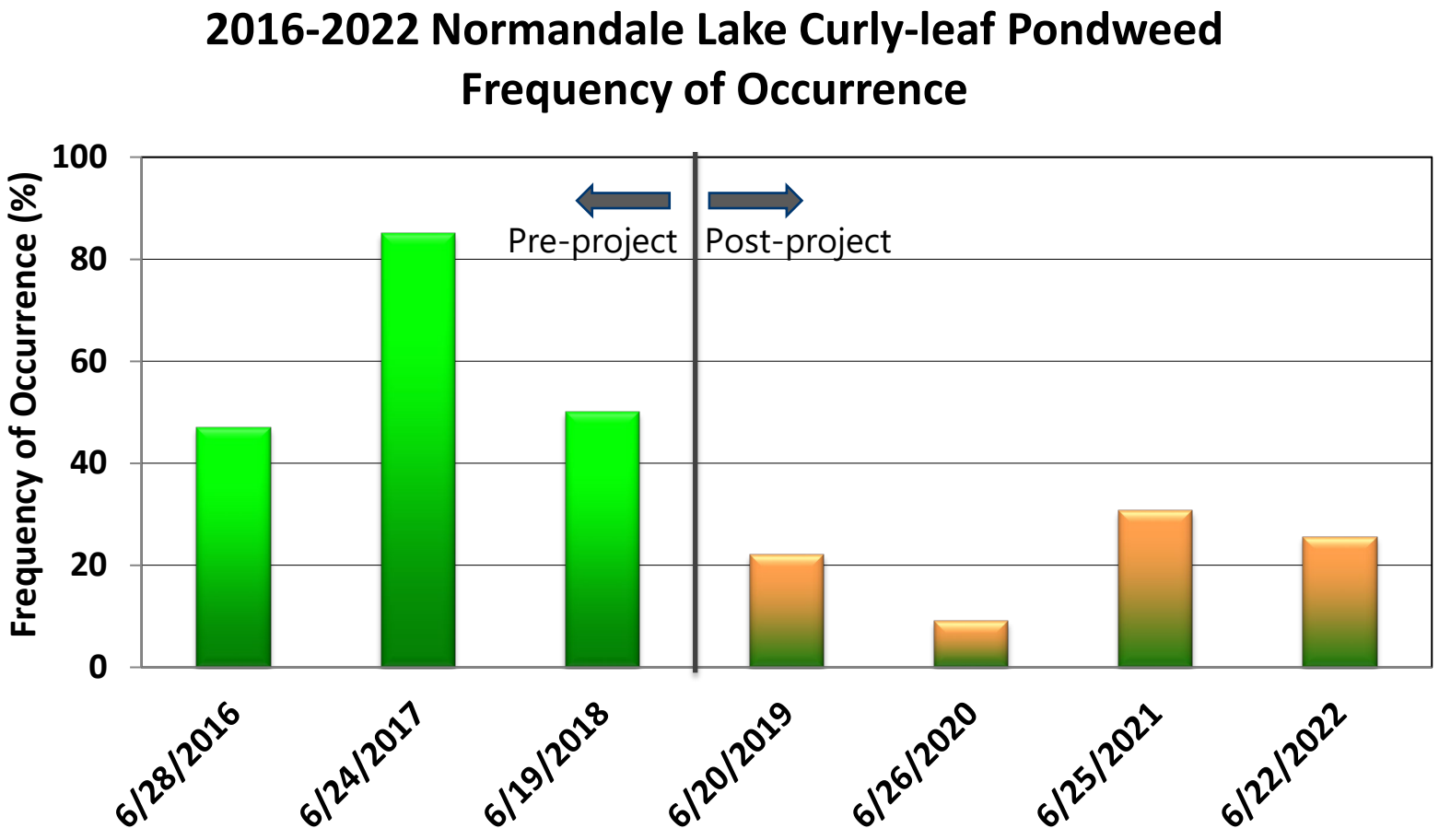
Total Phosphorus 2016:
Normandale Lake Surface vs the Lake Bottom

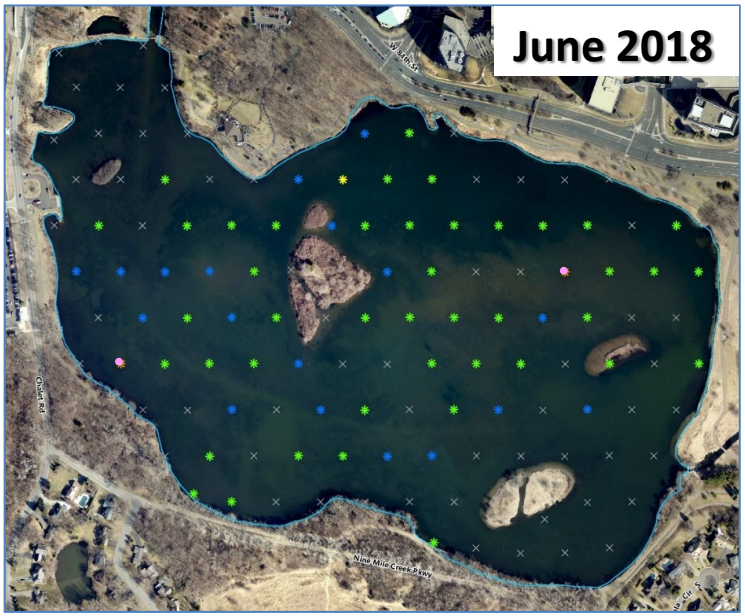


Total Phosphorus 2020:
Normandale Lake Surface vs the Lake Bottom



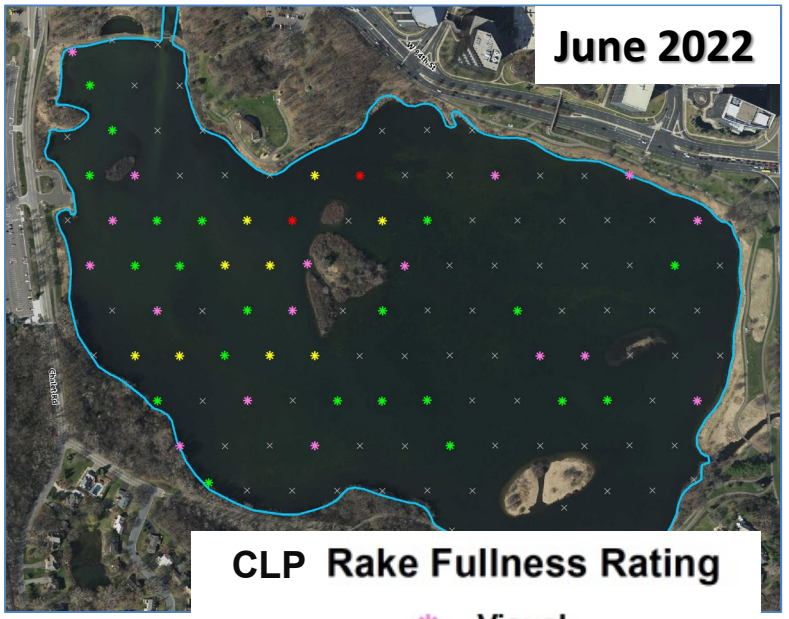
Measuring Project Outcomes – Curly-leaf Pondweed Reduction





CLP Rake Fullness Rating

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



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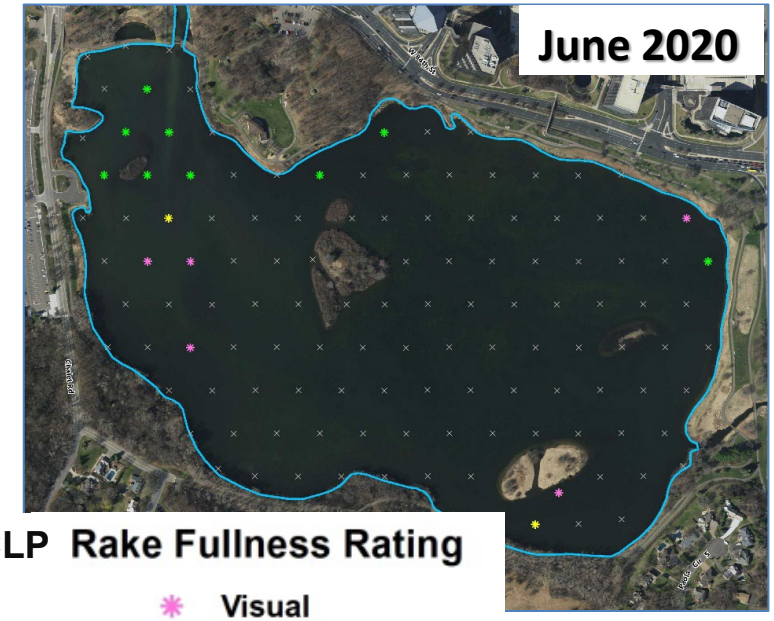

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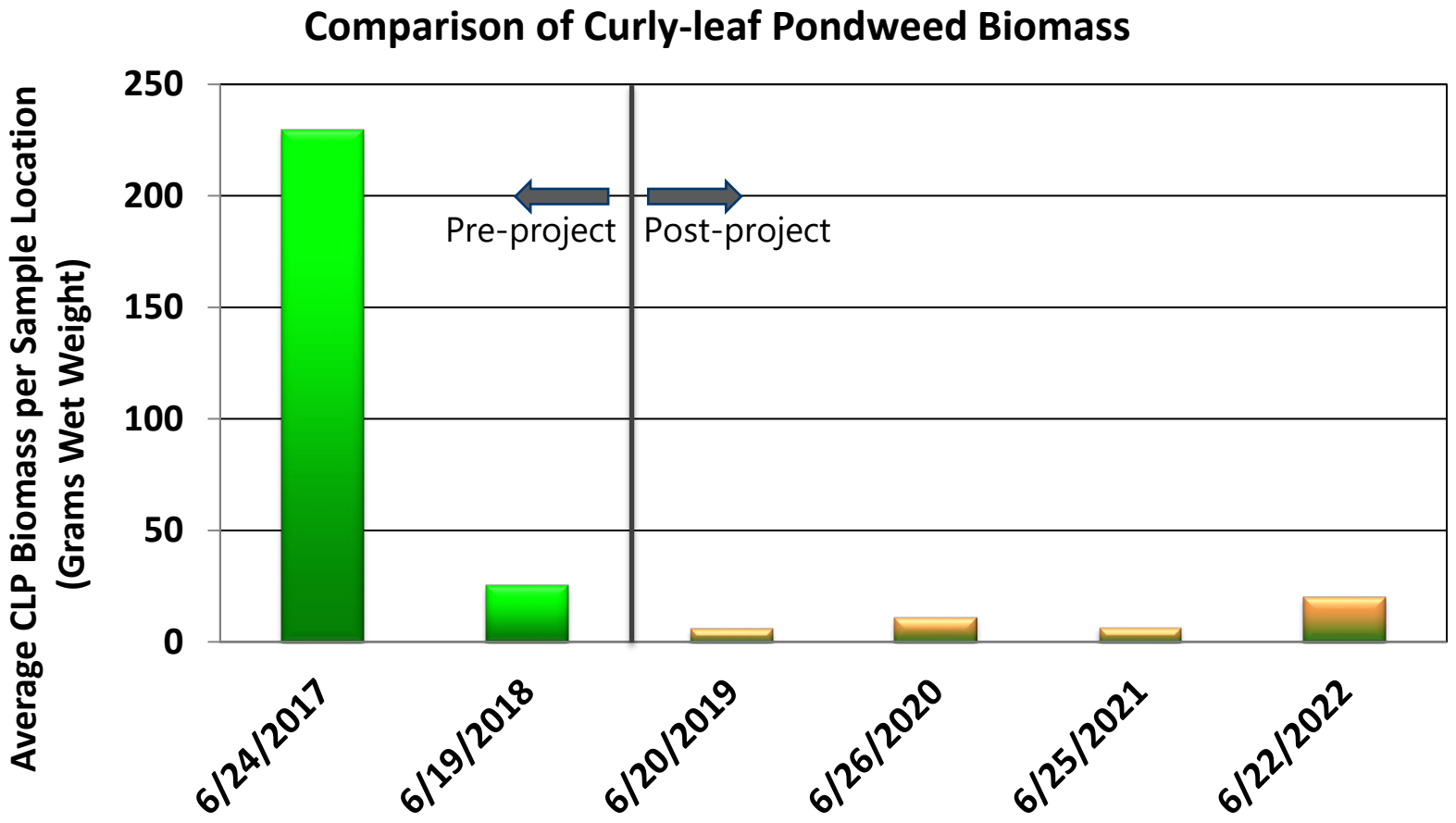
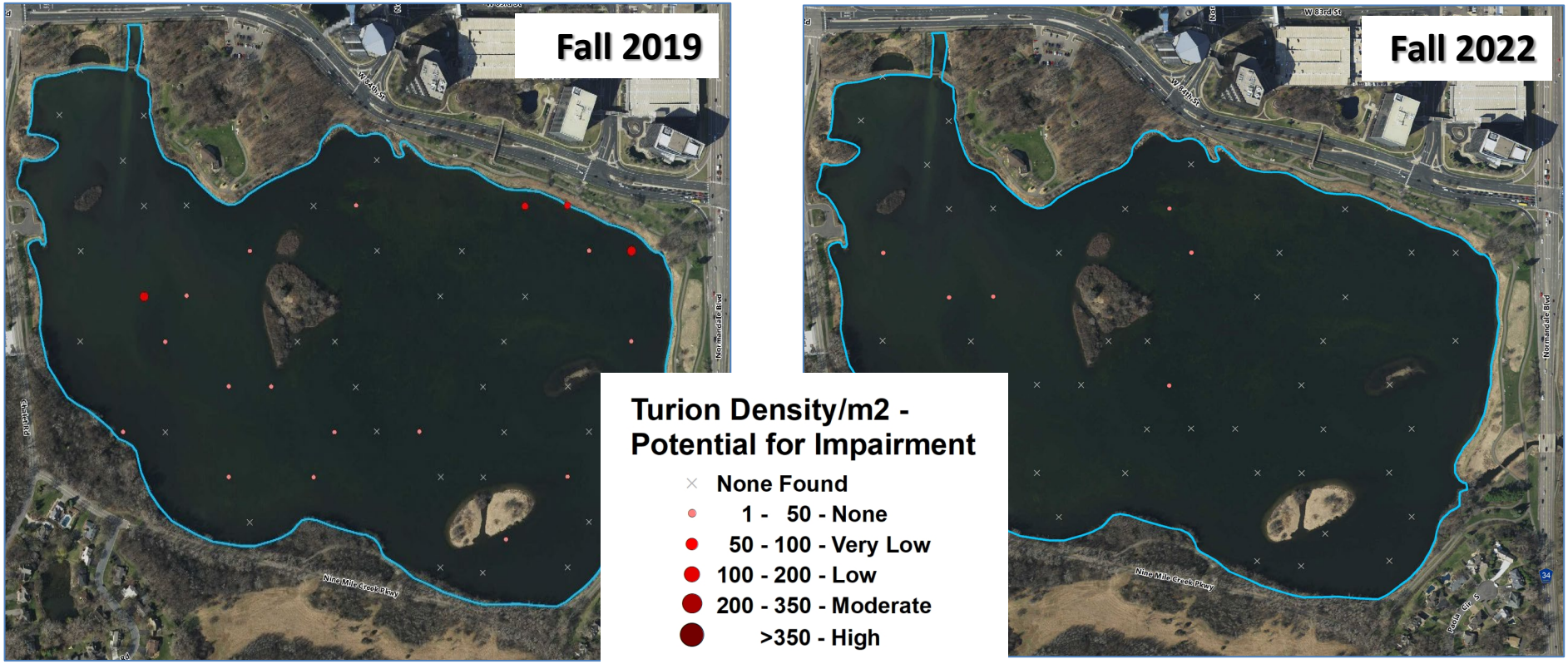
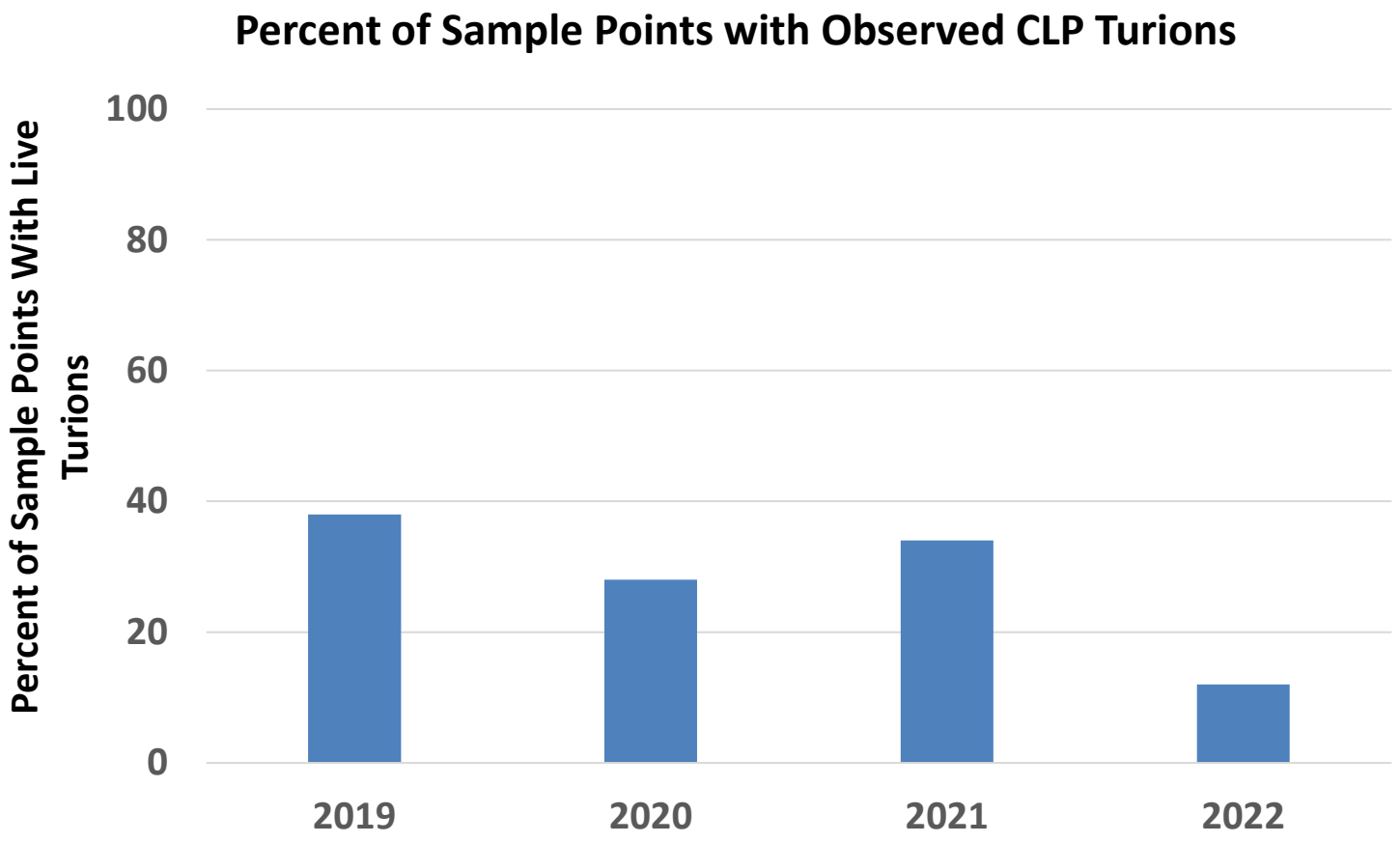
Measuring Project Outcomes – Curly-leaf Pondweed Reduction



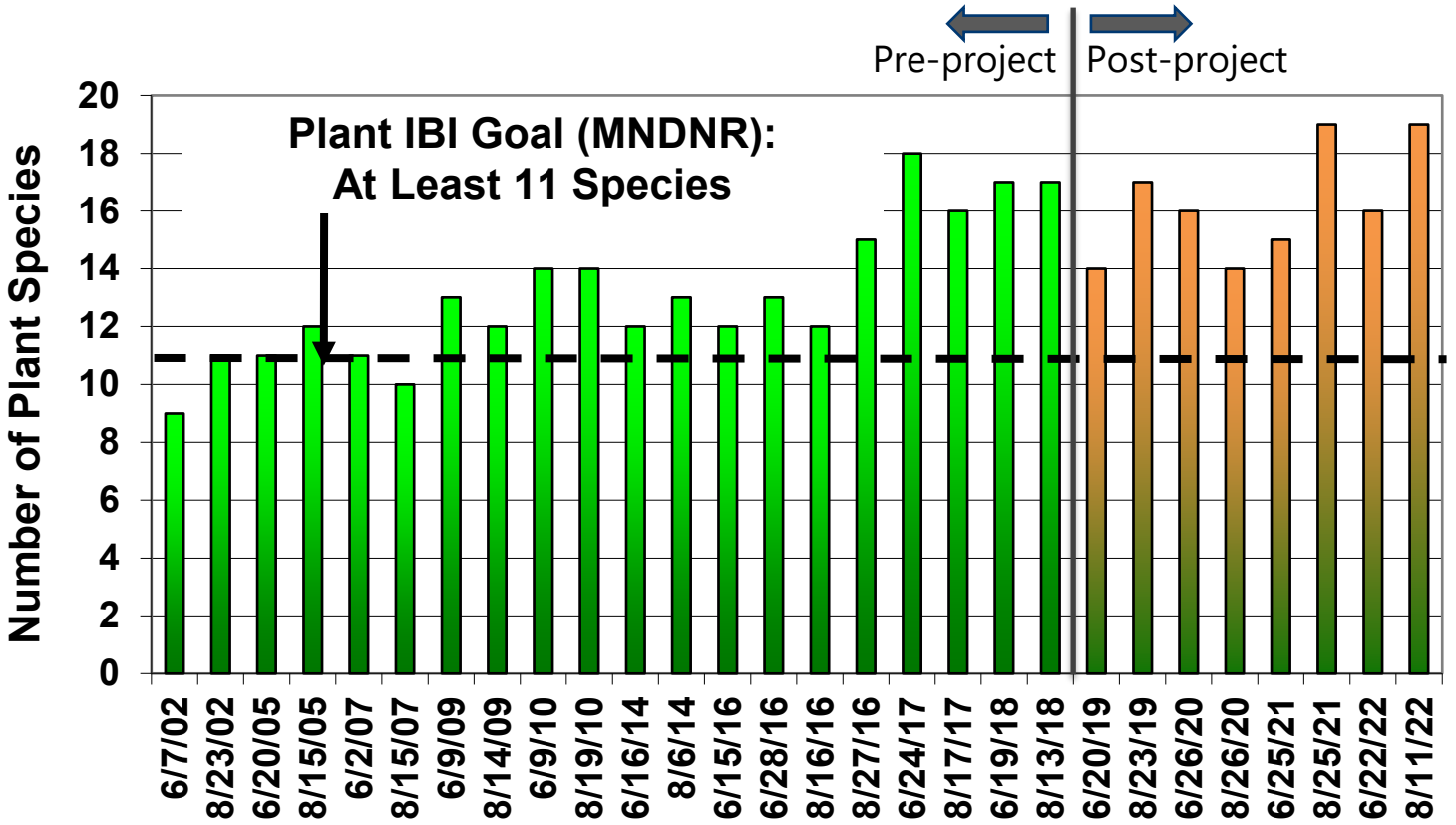
Measuring Project Outcomes – Curly-leaf Pondweed Turions



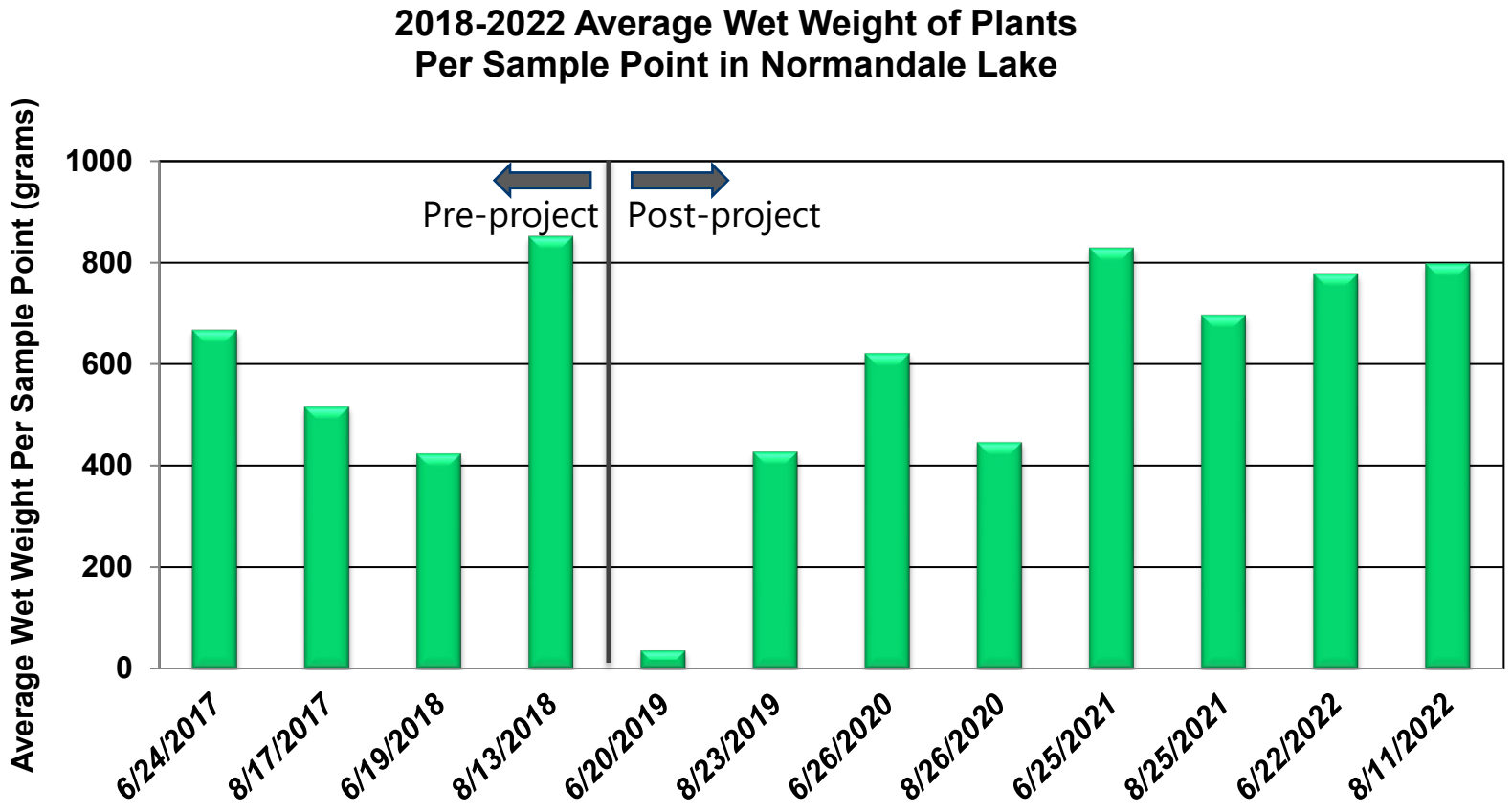
Measuring Project Outcomes – Curly-leaf Pondweed Turions



Measuring Project Outcomes – Health of Aquatic Plant Community



Measuring Project Outcomes – Health of Aquatic Plant Community



Fisheries Management Outcomes

Integrated Pest Management (IPM) Plan:

Long-term fisheries monitoring and action plan

Normandale Lake
Water Quality Improvement Project

Project goals:

- Improve lake water quality
- Improve ecological health of the lake

Next steps:

- Continue spring herbicide treatments next two years
- Thorough review of data to inform additional management, if needed
- Continue working in the upstream watershed


QUESTIONS?