

Lotus Lake Aquatic Vegetation Management Plan

RPBCWD Workshop
October 5, 2022

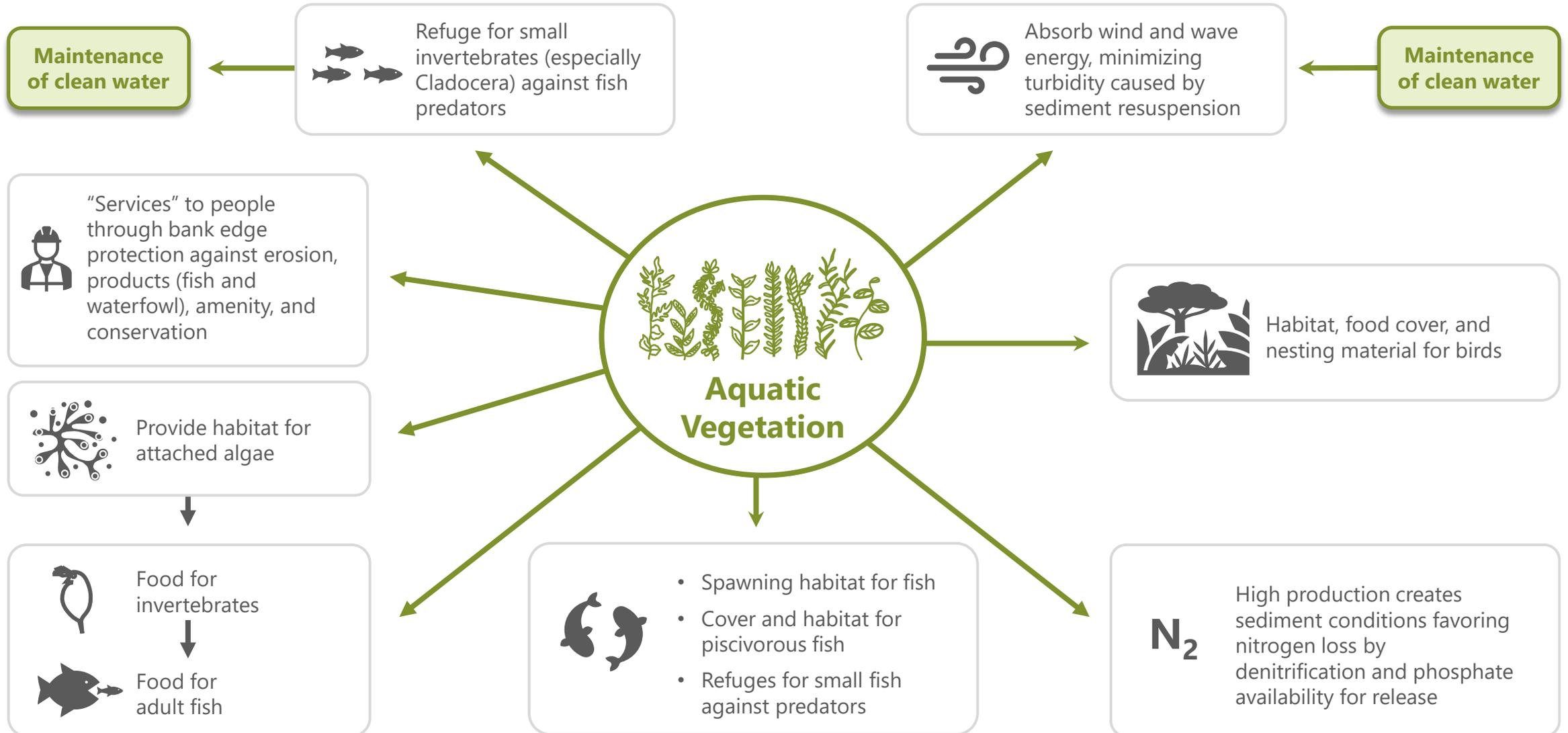


Objectives

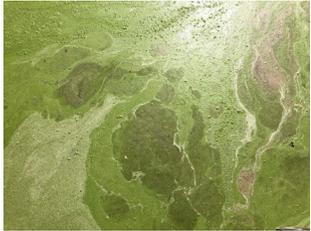
- Compile aquatic vegetation data and current management for Lotus Lake and identify any data gaps
- Describe current conditions and trends in the vegetation community
- Develop goals and ecosystem service assessments for the vegetation community
- Development and adaptive management framework for managing aquatic vegetation in Lotus Lake

Role of Aquatic Vegetation in Shallow Lakes

Why the plant dominated state?



Ecosystem Services



Water Quality - Supporting



Habitat - Provision



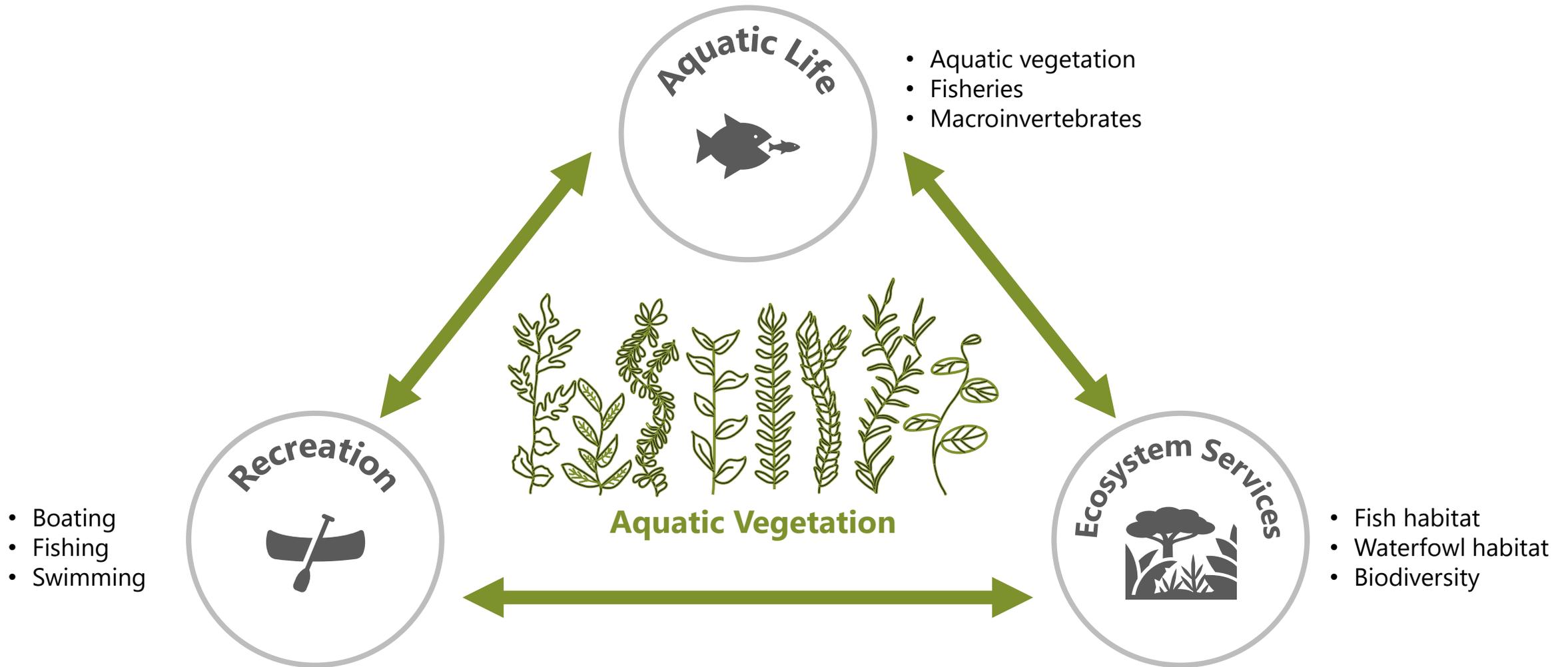
Recreation – Provision



Biodiversity - Provision

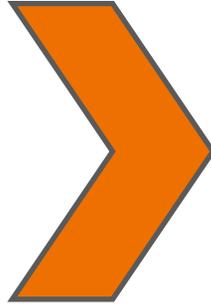
Balancing Aquatic Vegetation and Recreation in Shallow Lakes

Why the plant dominated state?

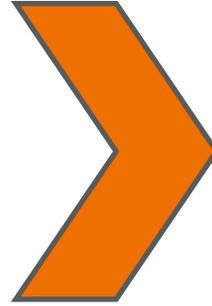


Aquatic Plant Community Continuum in Shallow Lakes

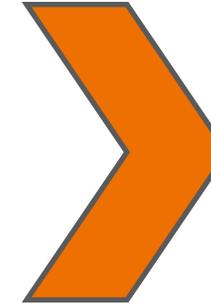
No
Vegetation



Native, monotypic
SAV community



Monotypic SAV
Dominated by
Invasive species



Diverse, native,
moderately abundant
plant community

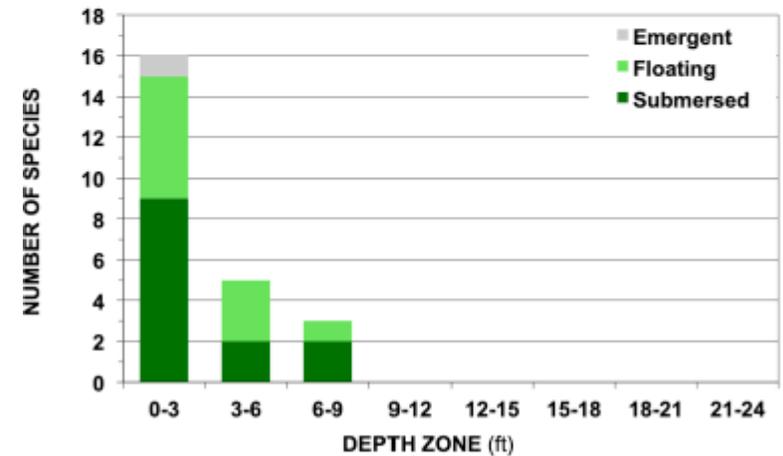
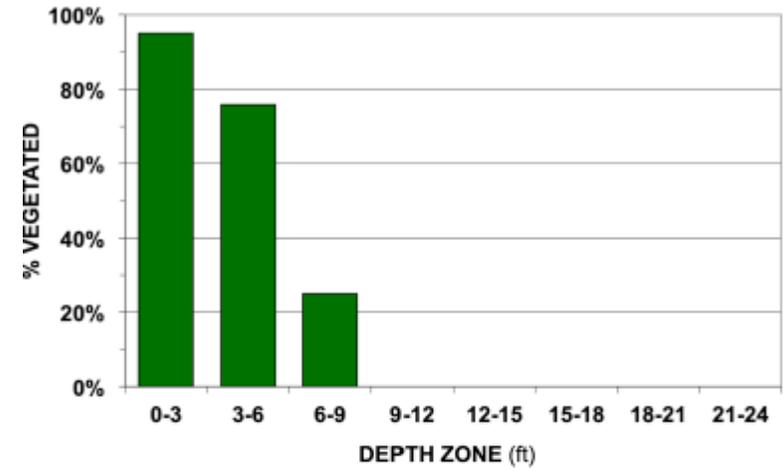
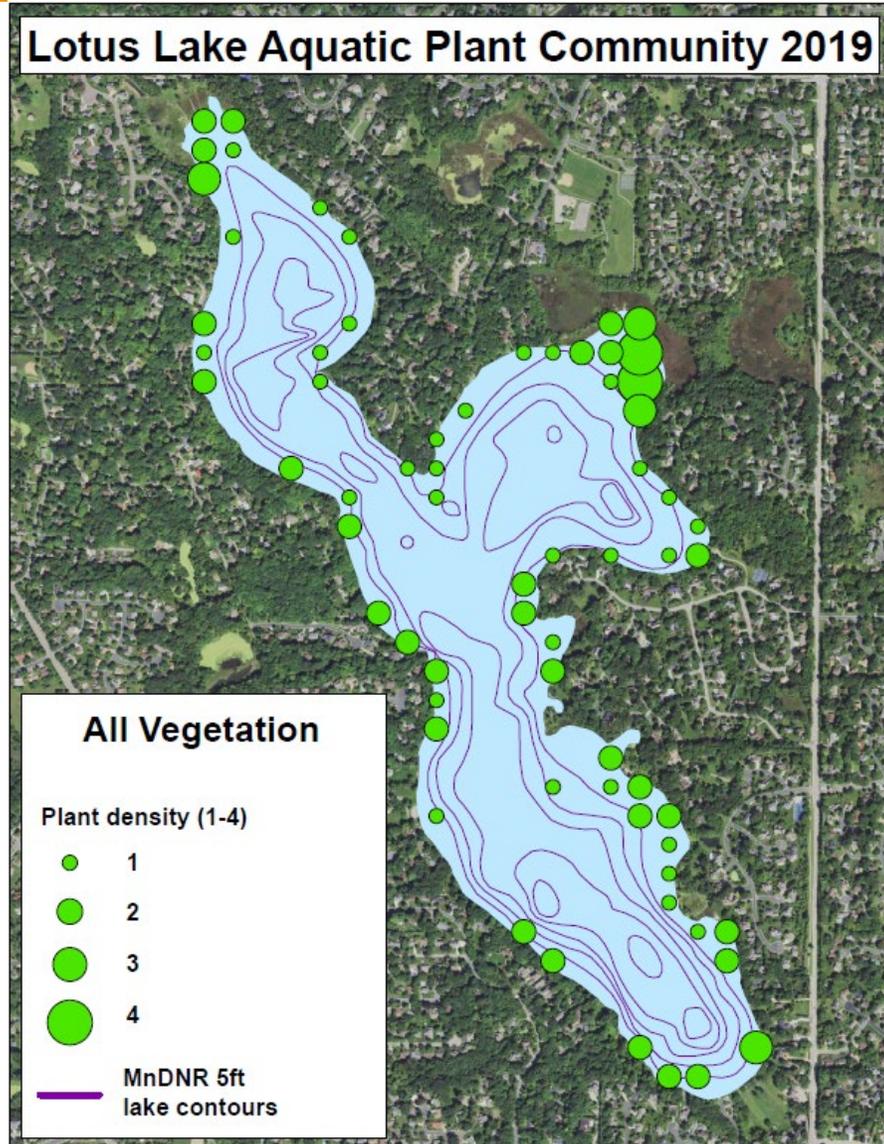


Photo by Chris Evans; University of Illinois



Photo by Rohan Wells

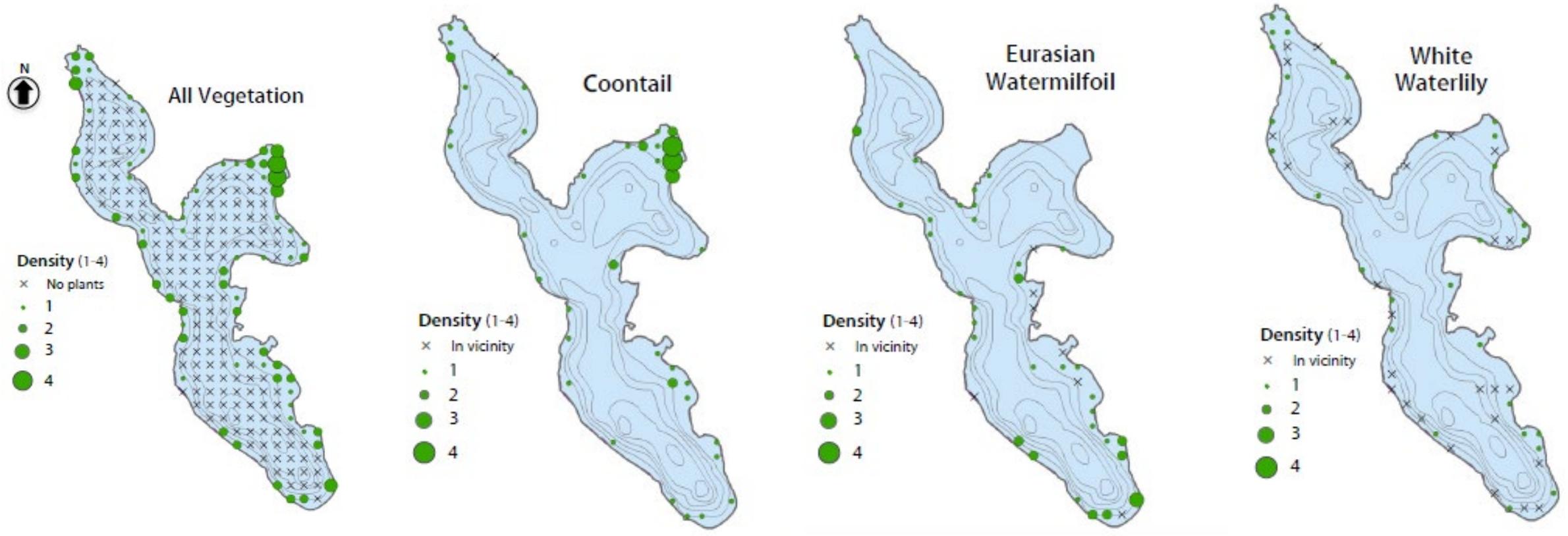
Lotus Lake Vegetation Community

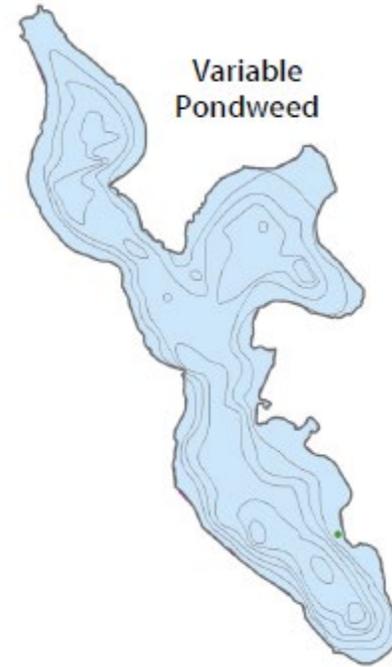
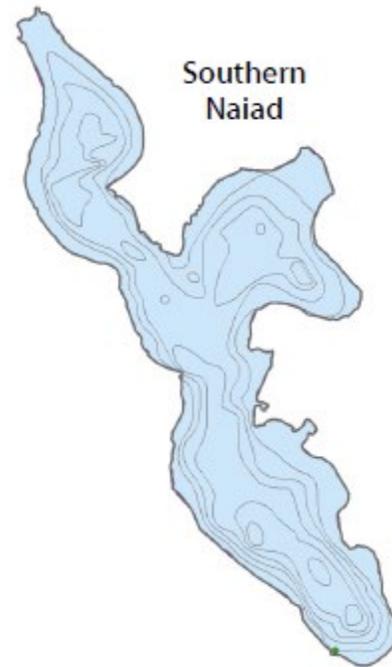
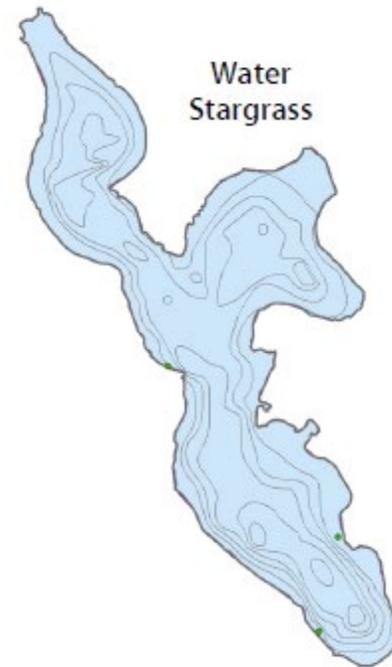
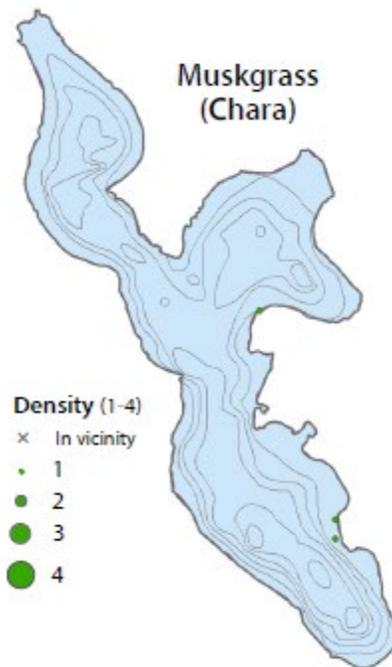
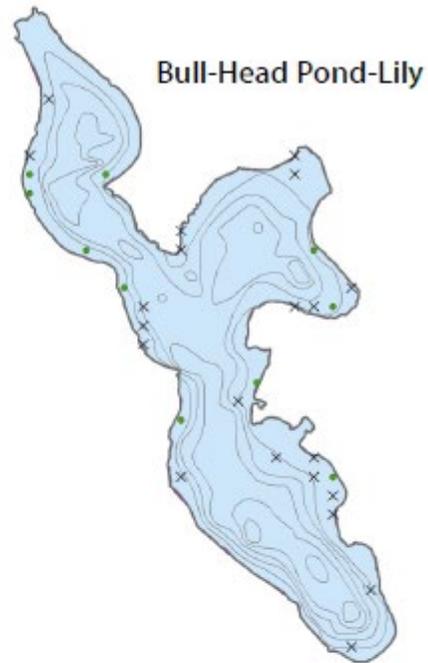
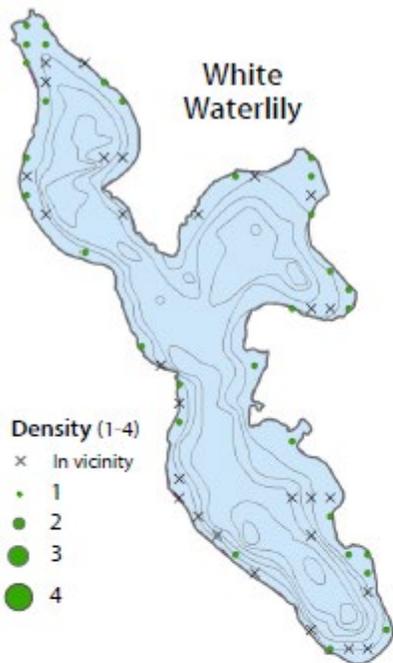


Plant Taxa	Common Name	% Occurrence			
		2013 ¹	2014 ¹	2017	2019
All Taxa (combined)				48	40
Submerged Taxa					
<i>Ceratophyllum demersum</i>	Coontail	33	35	43	23
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil			13	20
<i>Najas flexilis</i>	Slender naiad	3	4	4	1
<i>Chara sp.</i>	Muskgrass	3	7	3	2
<i>Heteranthera dubia</i>	Water Stargrass			3	2
<i>Stuckenia pectinata</i>	Sago Pondweed			2	0
<i>Eleocharis acicularis</i>	Needle spikerush			1	1
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Sparse	Sparse	Moderate 2	Moderate 2
<i>Potamogeton nodosus</i>	Long-leaf pondweed			1	0
<i>Potamogeton pusillus</i>	Small pondweed	3	6	1	1
<i>Potamogeton gramineus</i>	Variable pondweed			0	1
<i>Najas guadalupensis</i>	Southern naiad			0	1

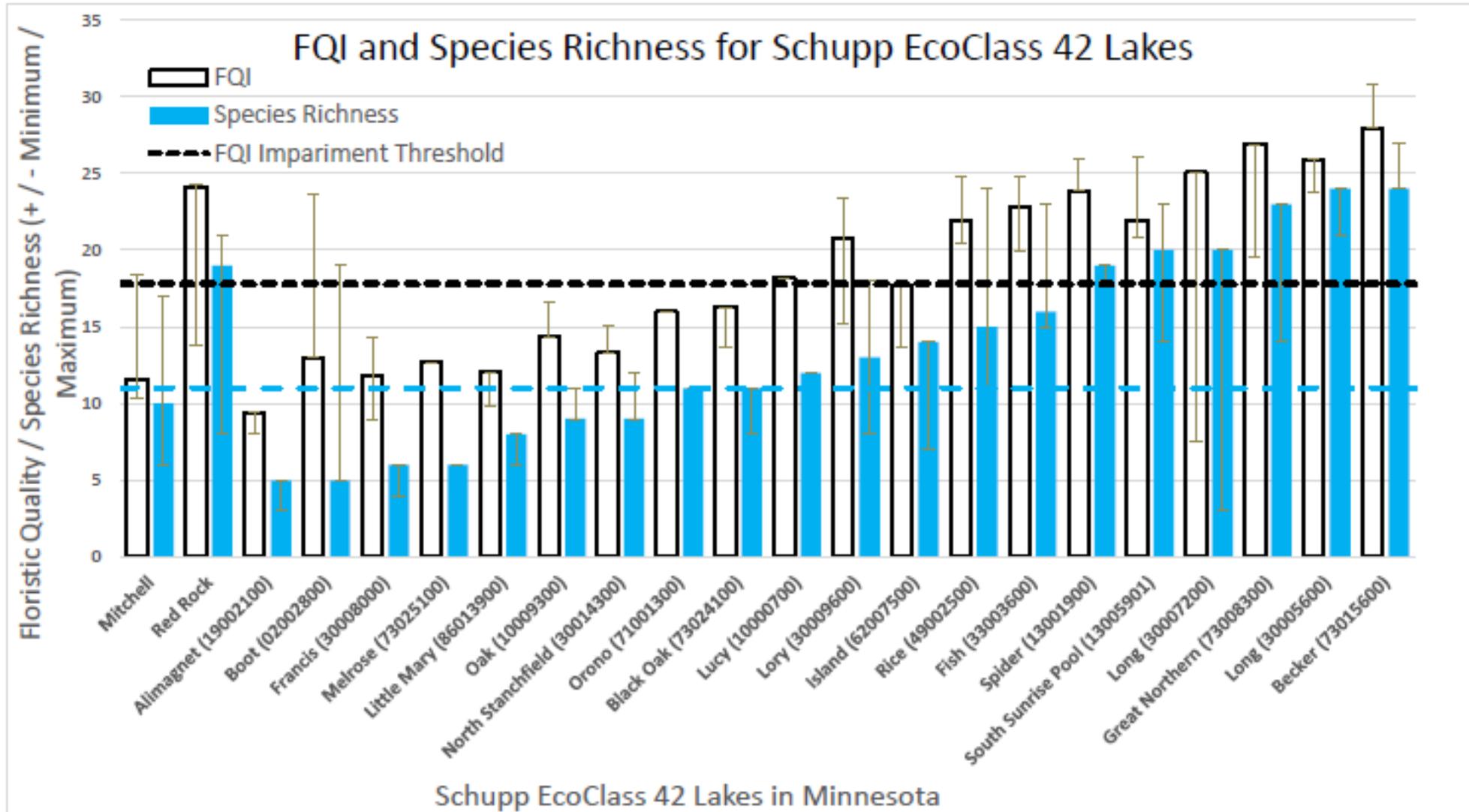
Plant Taxa	Common Name	% Occurrence			
		2013 ¹	2014 ¹	2017	2019
All Taxa (combined)				48	40
Floating/Emergent Taxa					
Nymphaea odorata (tuberosa)	White waterlily	17	20	19	19
Nuphar variegata	Yellow waterlily	7	13	9	6
Lemna minor	Small duckweed	3	3	5	5
Nelumbo lutea	American Lotus			4	4
Wolffia columbiana	Common watermeal			4	1
Typha sp.	Cattail			2	G
Schoenoplectus acutus	Hardstem bulrush			1	1
Spirodela polyrhiza	Large duckweed			0	1
Lythrum salicaria	Purple loosestrife			G	G
Phragmites australis	Common Reed			G	S

Lotus Lake Vegetation Community

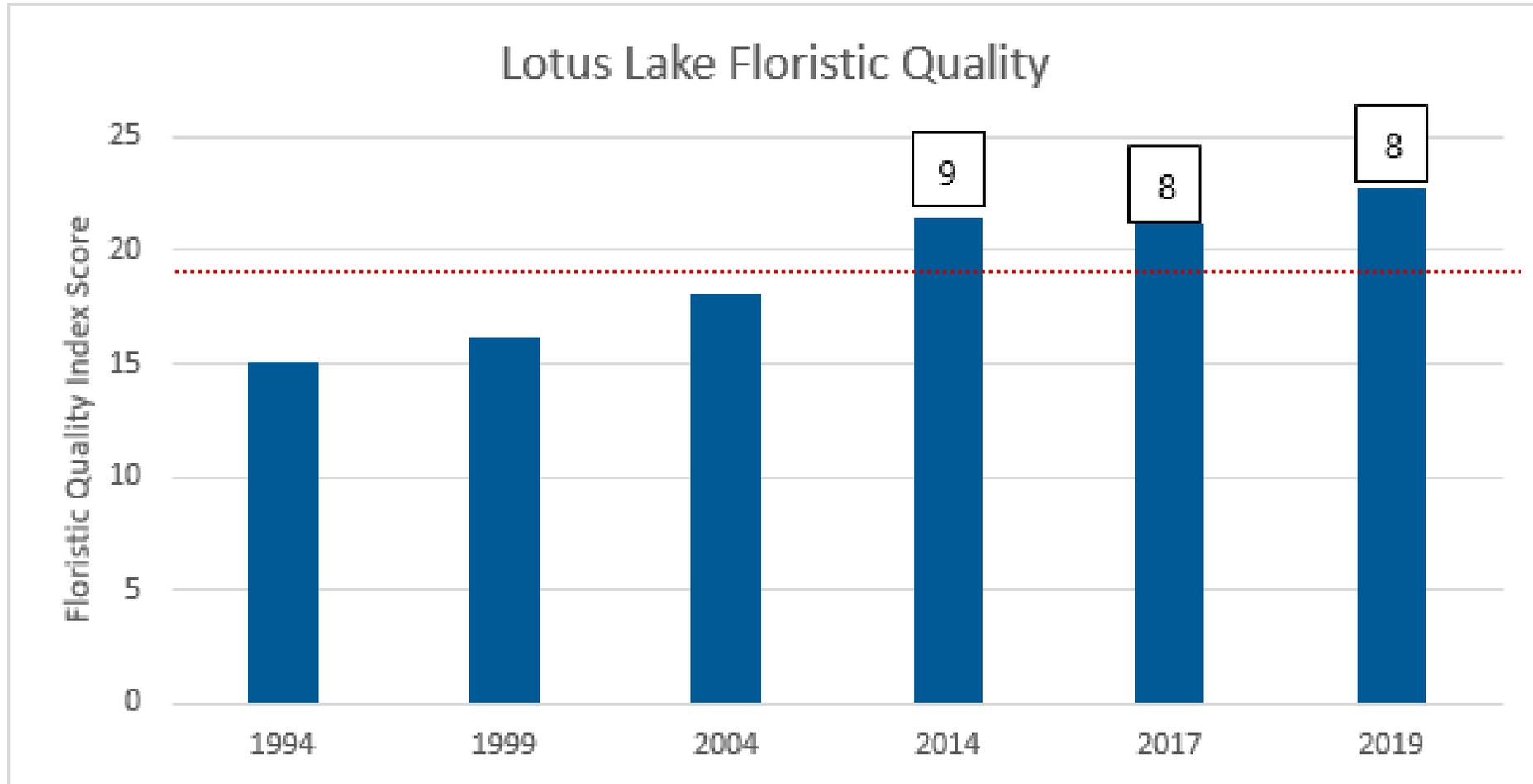




Reference Conditions for Lotus Lake



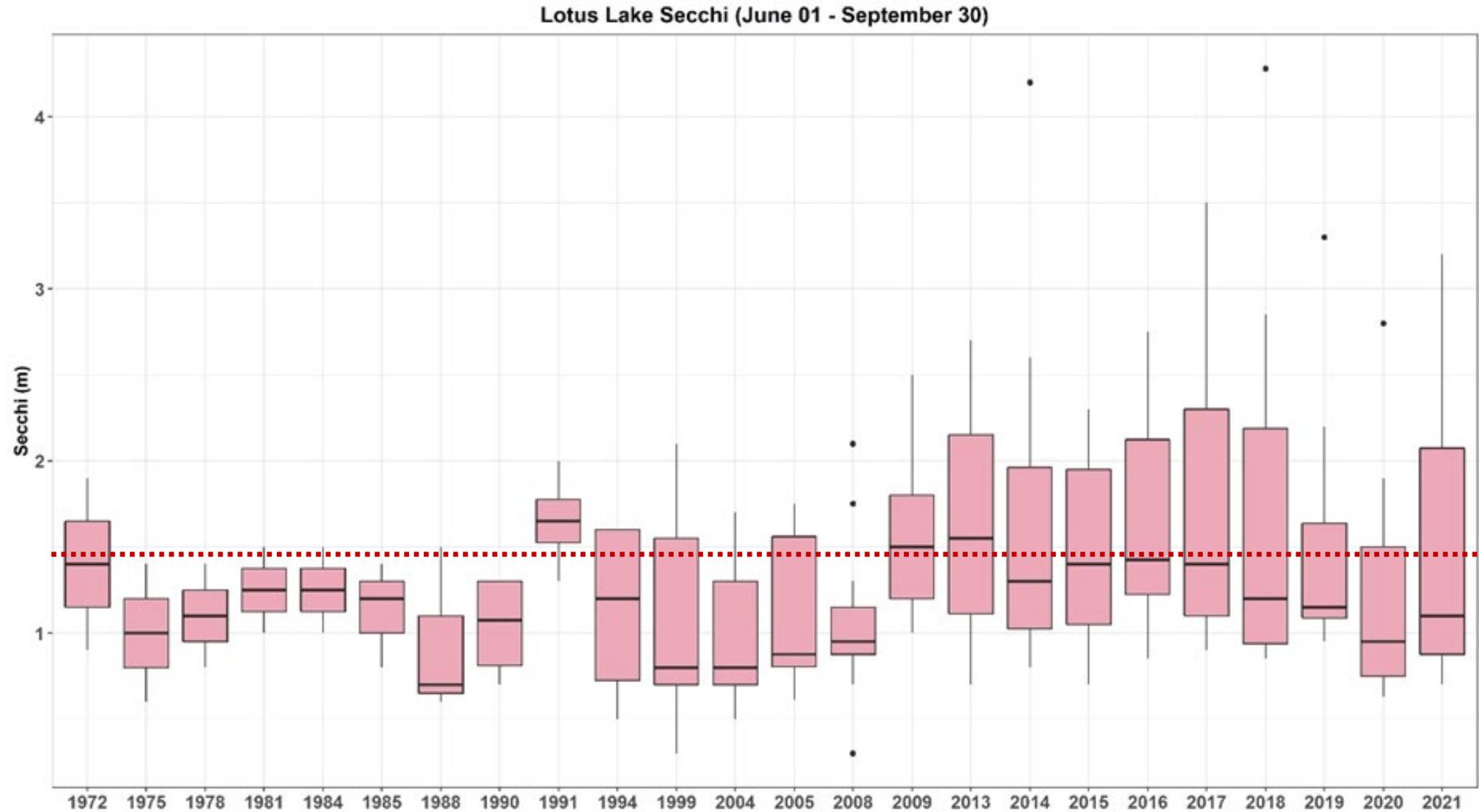
Floristic Quality Species Richness



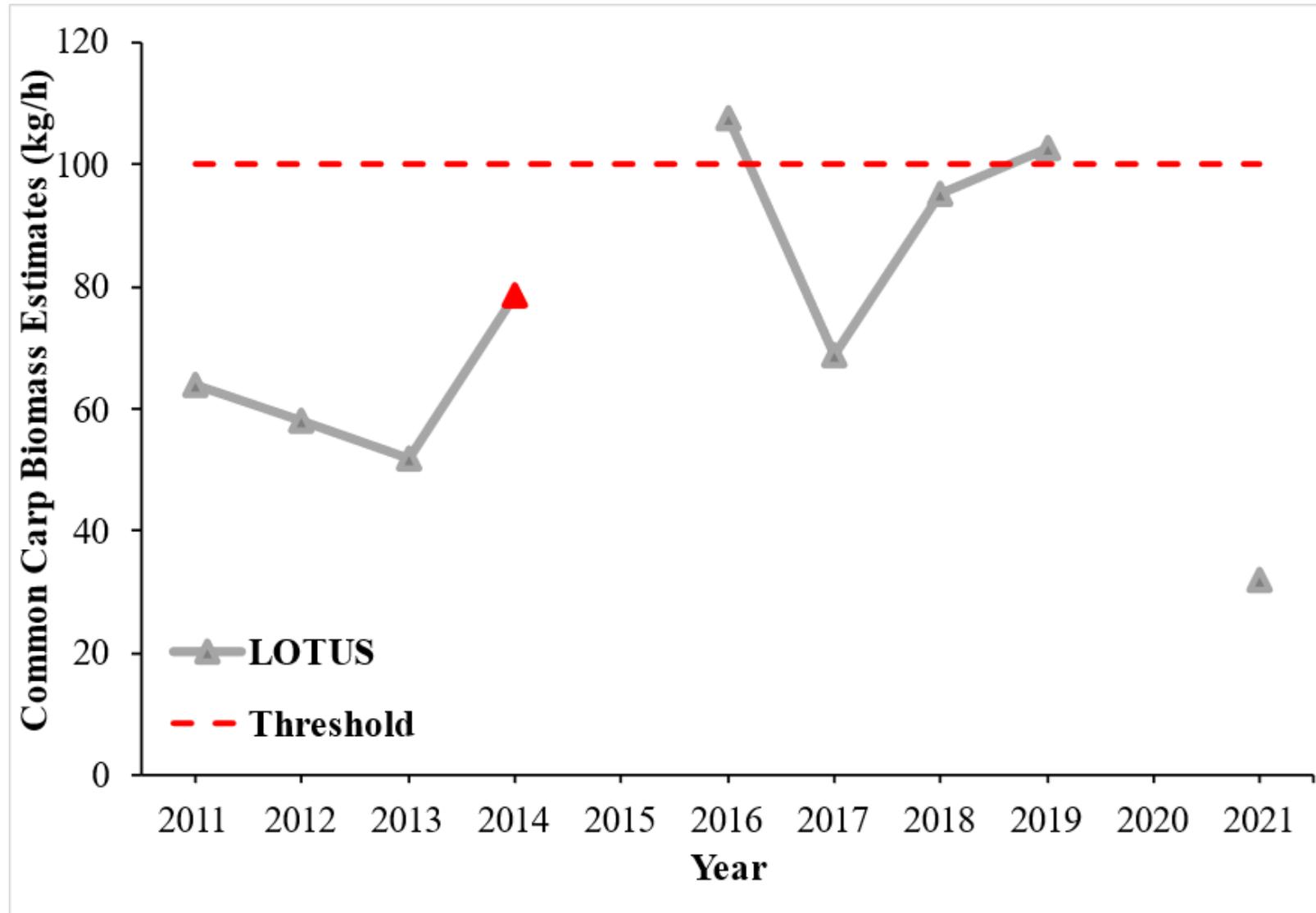
Aquatic Plant Community Stressors

Stressor	Impacts
Aquatic Invasive Species	AIS infestations tend to outcompete native macrophyte populations early in the year, leading to a decline in biodiversity and water quality through the growing season. Some example AIS include Curly-leaf pondweed, Eurasian watermilfoil, Brittle naiad, and starry stonewort.
Eutrophication and Watershed Disturbance	Watershed disturbance and eutrophication is one of the primary factors leading to the decline of aquatic plant communities (Radomski and Perleberg 2012).
Roughfish	Species such as black bullhead and common carp can be damaging to aquatic vegetation communities (Bajer et al. 2018).
Shoreline Development	Increased shoreline development and aquatic plant clearing can lead to more tolerant species and lower plant diversity.
Altered Hydrology	High, stable water levels and loss of natural winterkill can lead to stable turbid water conditions reducing aquatic plant and macroinvertebrate abundance.
Salinity	Increased salinity can cause a reduction in primary production and may select for tolerant species (Lind et al. 2018).

Water Quality - Clarity



Roughfish



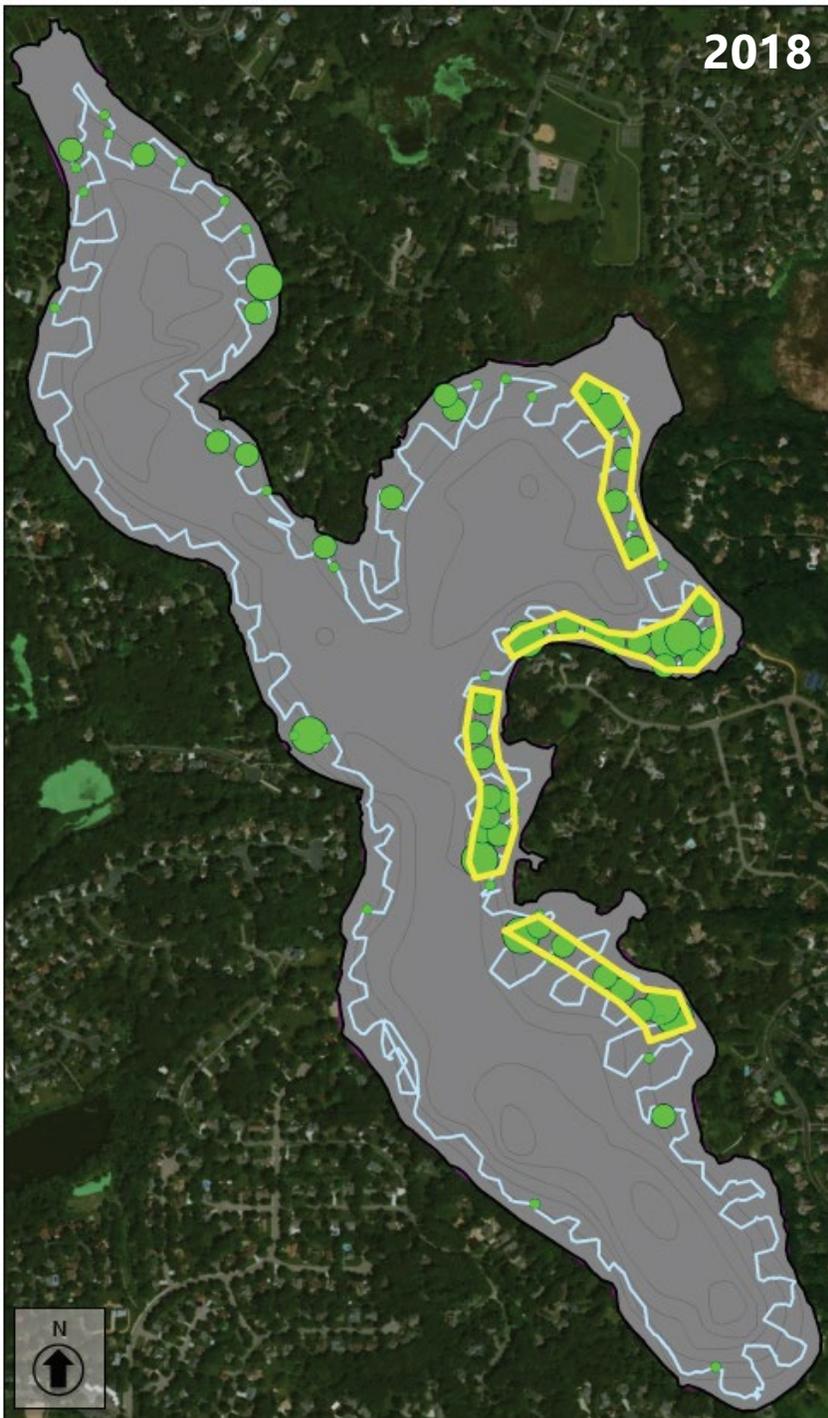
Shoreline Disturbance



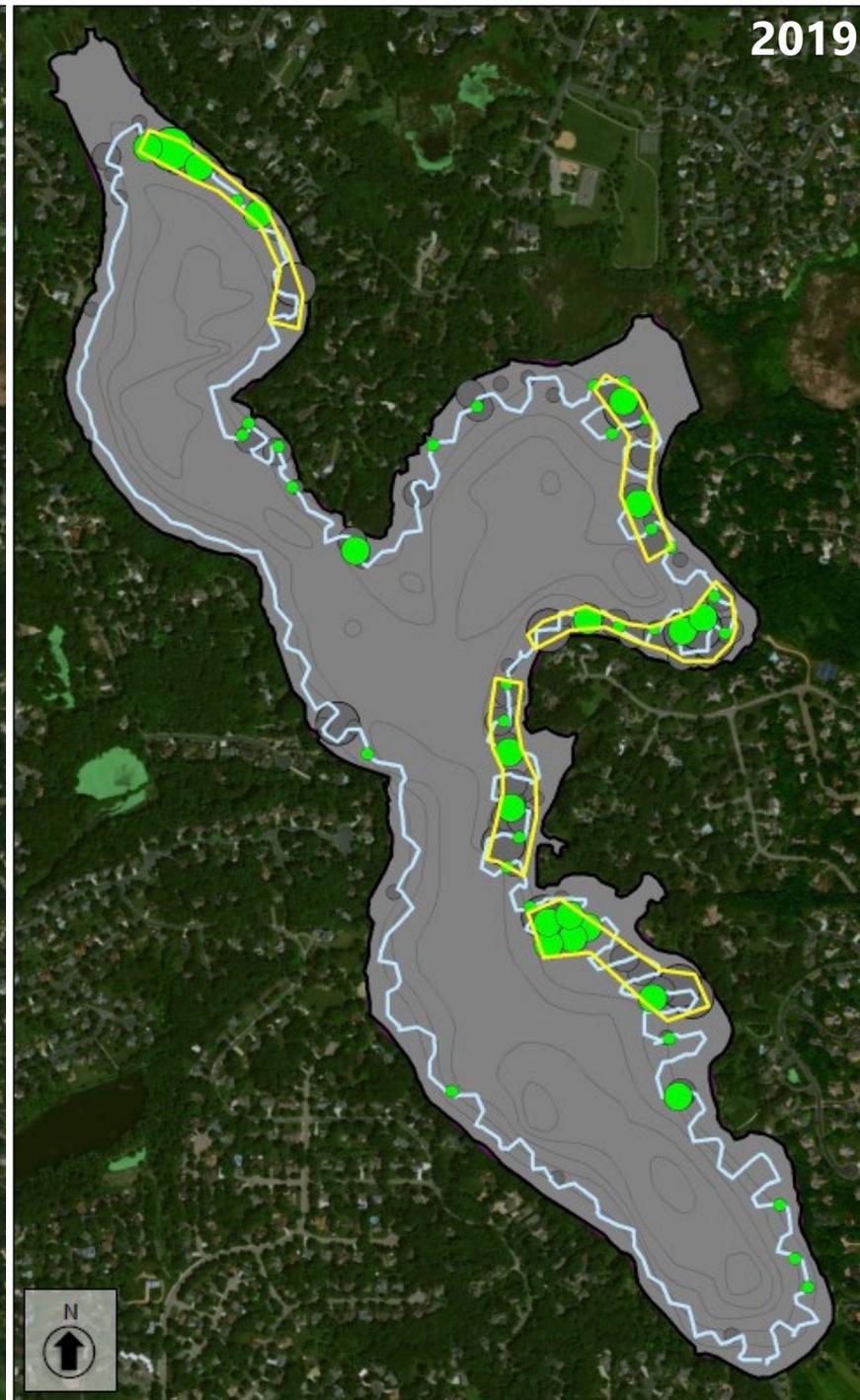
AIS Management in Lotus Lake

Year	Plant Targeted	Area Treated	Approach
2017	Brittle Naiad	2.42 acres	Diquat
2018	Curly-leaf Pondweed	15.3 acres	Diquat
2019	Curly-leaf Pondweed	20.6 acres	Diquat
2020	Curly-leaf Pondweed	12.8 acres	Diquat
2021	Curly-leaf Pondweed Eurasian Watermilfoil	22.8 acres	Diquat
2022	Curly-leaf Pondweed Eurasian Watermilfoil	20.8 acres	Diquat

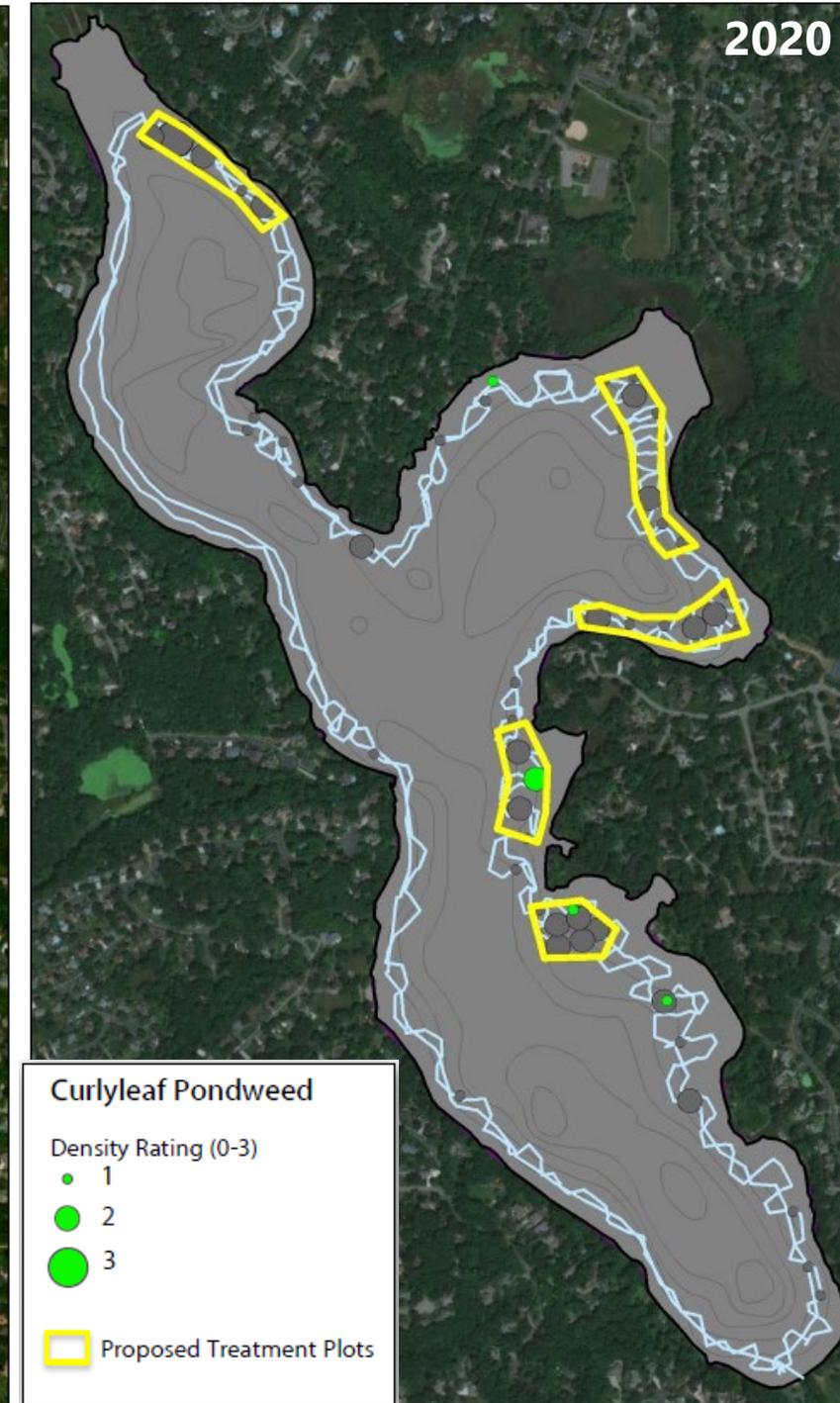
2018



2019



2020

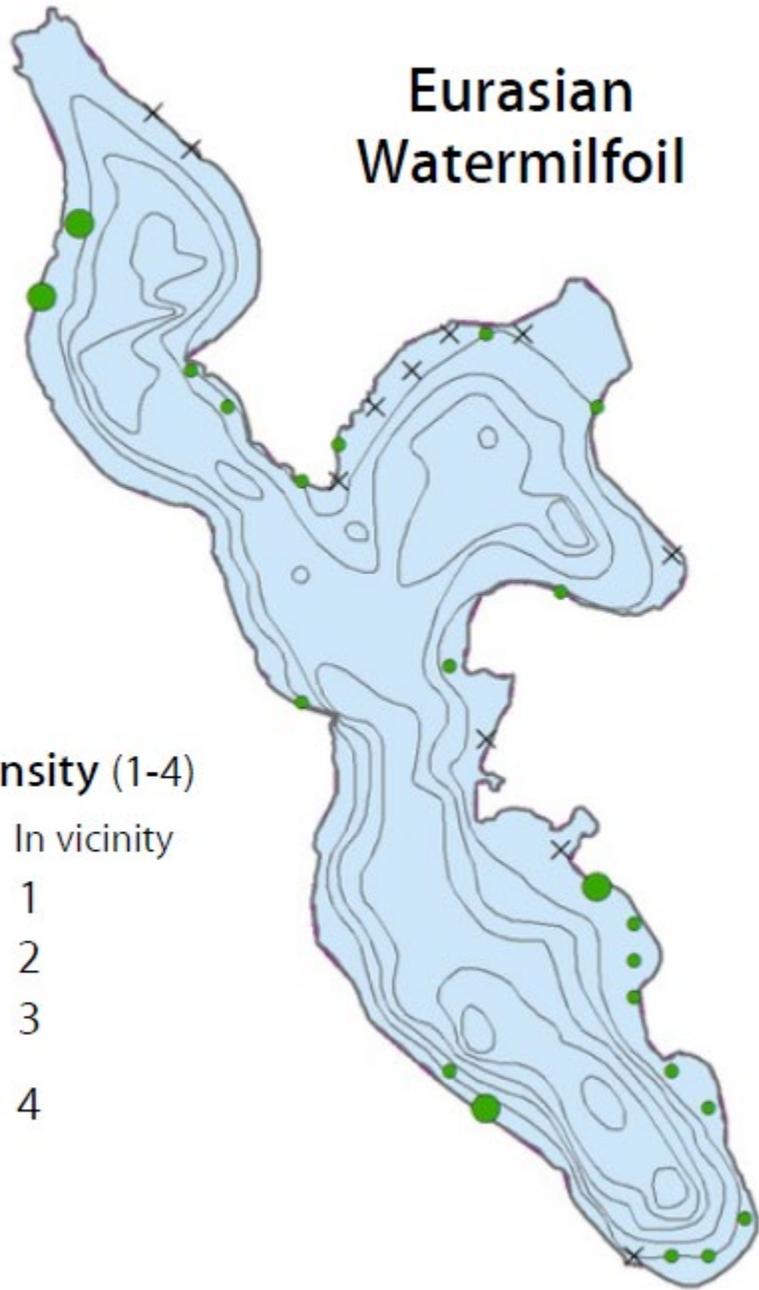


2017

Eurasian Watermilfoil

Density (1-4)

- x In vicinity
- 1
- 2
- 3
- 4

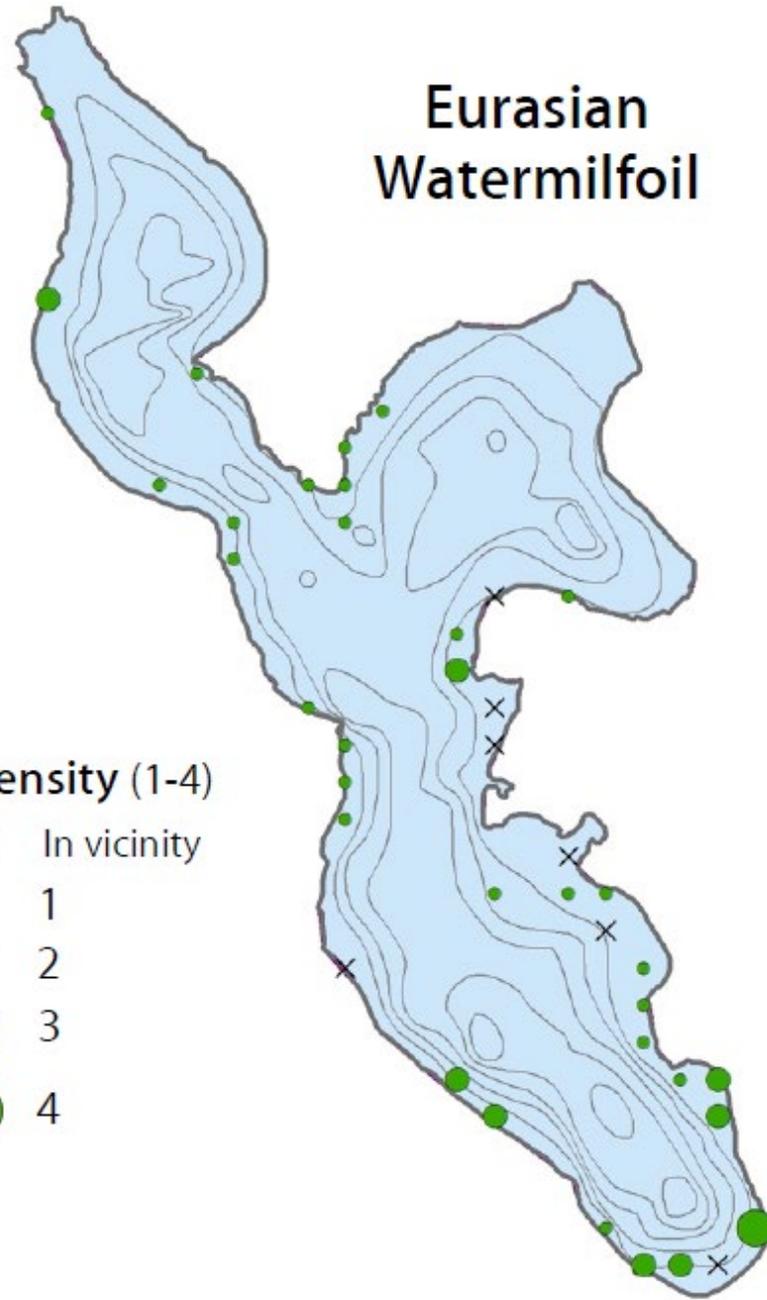


2019

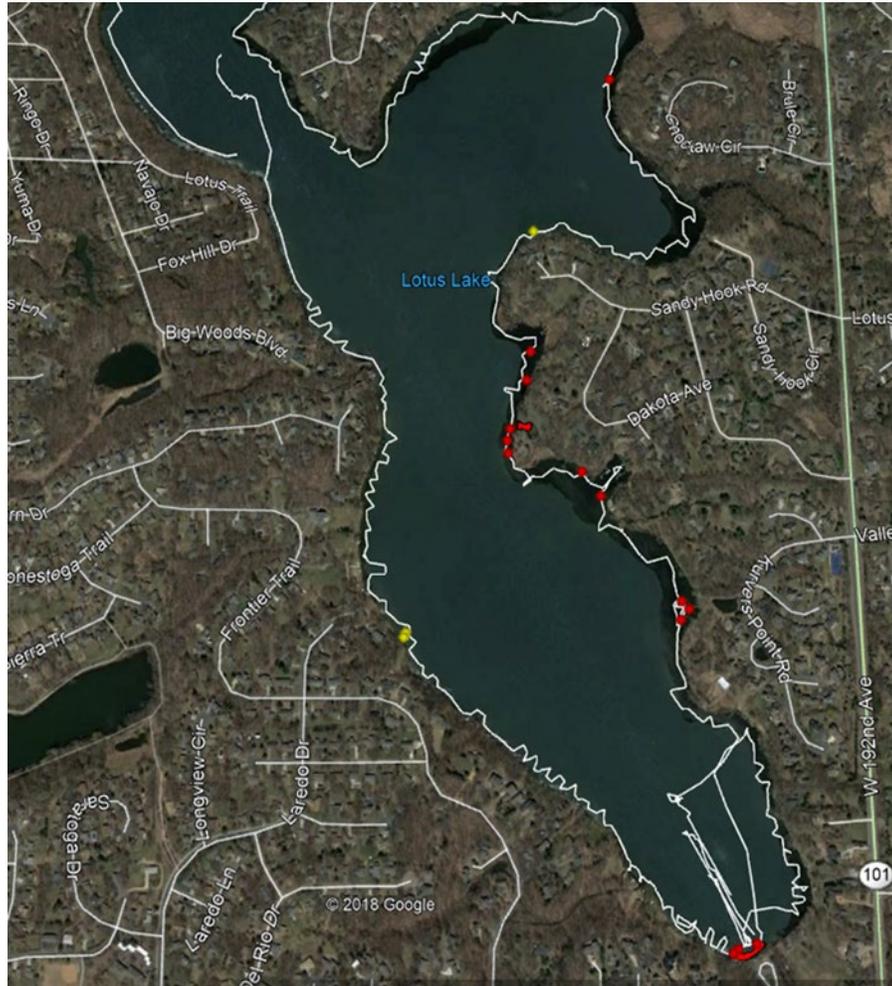
Eurasian Watermilfoil

Density (1-4)

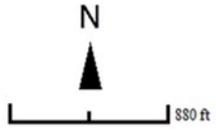
- x In vicinity
- 1
- 2
- 3
- 4



Brittle Naiad – 2017 versus 2020

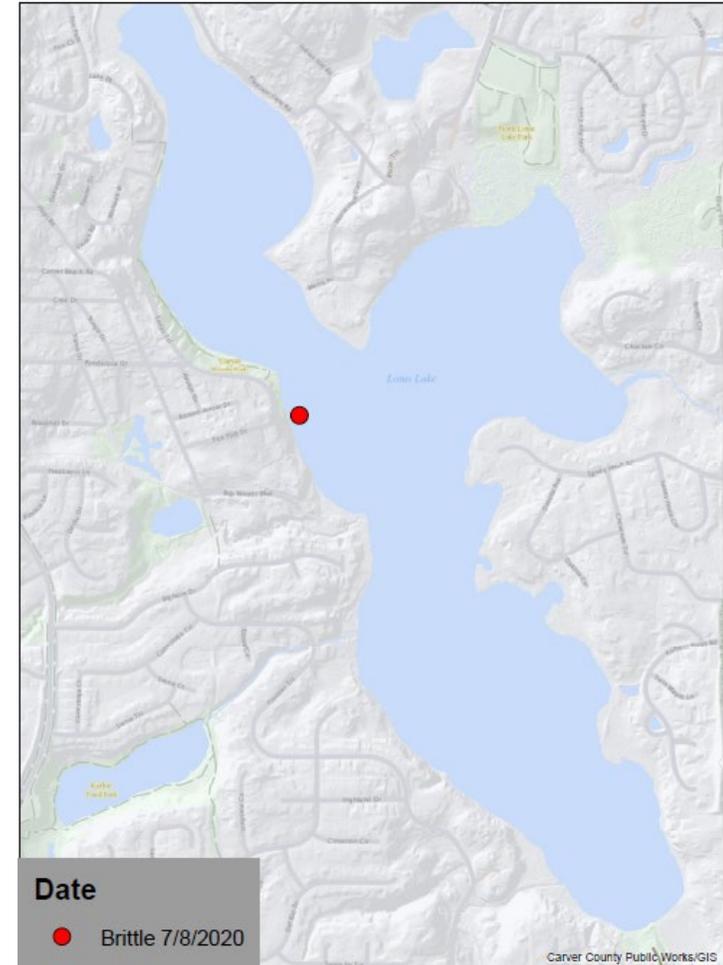


- Brittle Naiad (floating)
- Brittle Naiad (rooted)
- Boat Path



LOTUS LAKE Vegetation Survey Brittle Naiad

Riley Purgatory Bluff
Creek Watershed District



Date
● Brittle 7/8/2020

Summary

- Aquatic plant community is moderately healthy in Lotus Lake, but
 - Limited diversity (species richness) and lacks spatial distribution
 - Shoreline communities are highly fragmented
 - Depth of colonization is only 7 feet but should reach 15 to 20 feet
- Limiting factors may include:
 - Limited water clarity
 - Competition from AIS (EWM and CLP)
 - Physical impacts from harvesting or clearing and boating
 - roughfish

Aquatic Plant Community Stressors and Mitigation

Stressor	Mitigation and Management
Aquatic Invasive Species	Management through herbicide application and harvesting
Eutrophication and Watershed Disturbance	Watershed nutrient management (UAA) Internal load management (alum treatments) Sediment load management
Roughfish	Carp and Roughfish control
Shoreline Development	Naturalized shorelines Minimize aquatic plant harvesting/herbicide use in recreational areas
Altered Hydrology	Mimic natural water level fluctuations
Salinity	Road salt management in the watershed

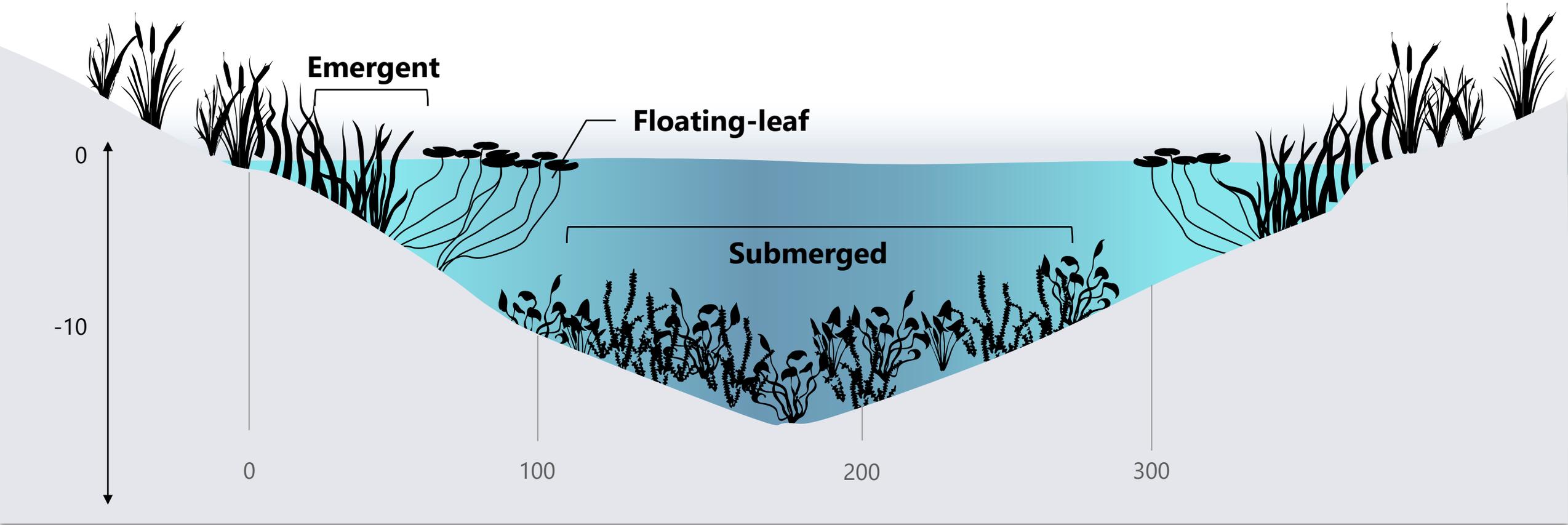
Recommendations and Next Steps

- Continue AIS control
 - May consider ProcellaCOR+diquat in heavy EWM areas
- Continue efforts to improve water quality
 - Internal load control efforts (alum treatments)
 - Watershed efforts (BMPs from UAA)
 - Reduce chloride use in watershed
- Continue roughfish control
 - May consider a fisheries management plan to support a balanced fishery
- Consider naturalization of the shoreline
 - Establish native nursery areas

Possible RPBCWD Aquatic Plant Management Activities

- Aquatic Invasive Species Management
- Water Quality Management
- Roughfish management
 - Gamefish management led by the Minnesota DNR
- Improve diversity of aquatic plants (biodiversity+habitat)
 - Proven techniques and case studies are limited
 - Nursery establishment
 - Shoreline naturalization
 - Requires lakeshore owners' cooperation and buy-in

Aquatic Vegetation Management – Gardening Your Lake



No
vegetation



Monotypic SAV
dominated by
invasive species



Native,
monotypic SAV
community

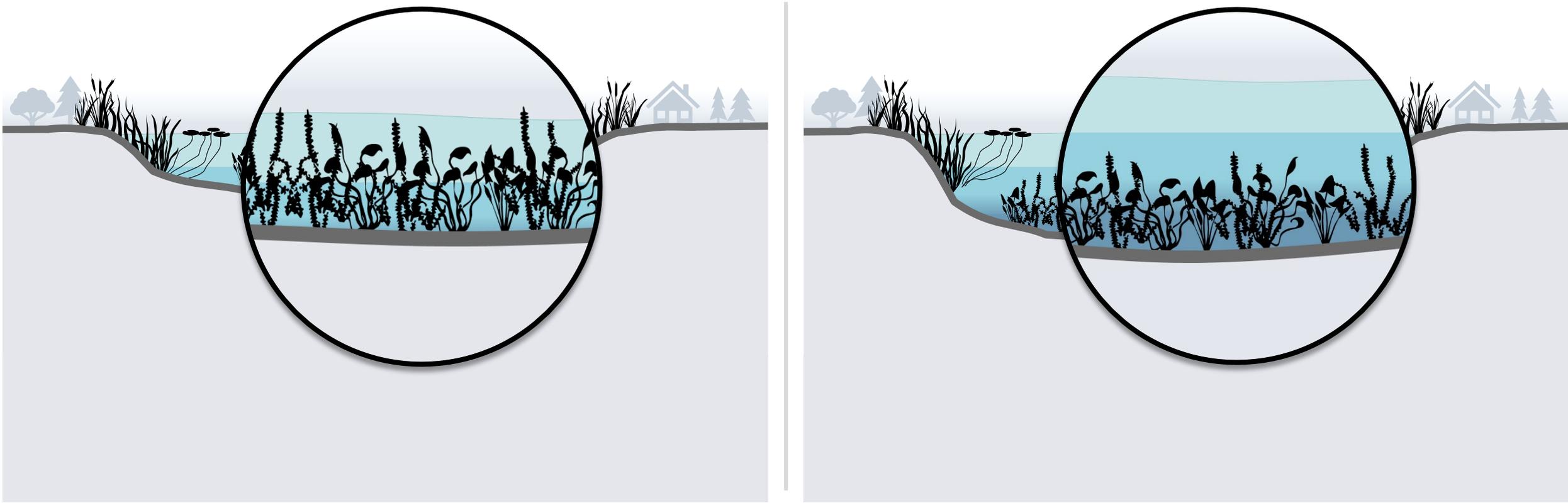


Diverse, native,
moderately abundant
plant community

Importance of Depth

not all shallow lakes are created equal

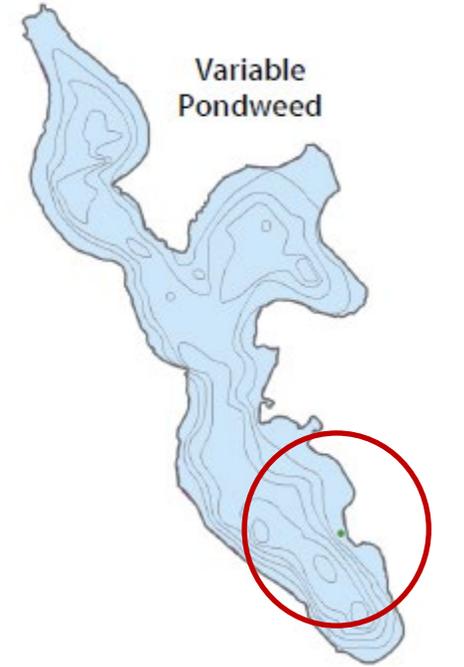
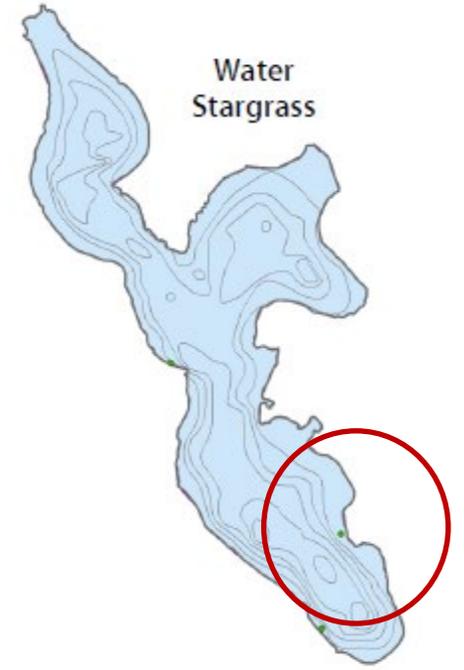
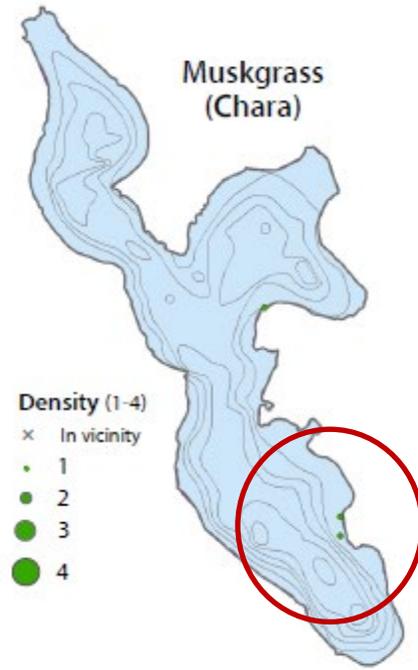
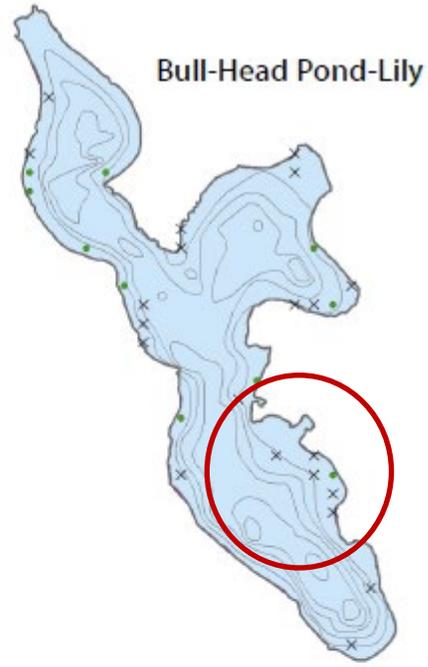
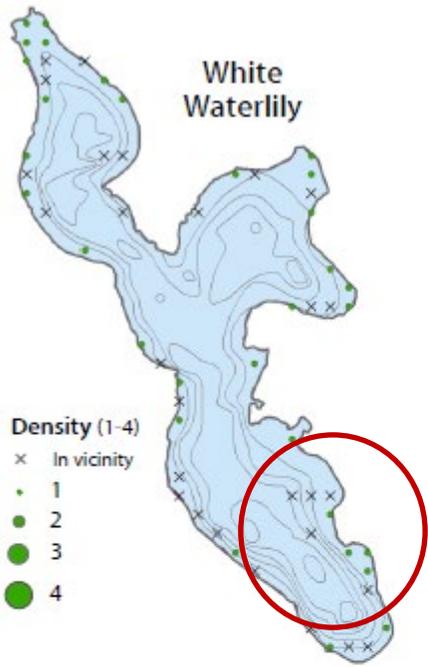
- Depth is a key factor establishing the “level of effort” required to maintain boating as a recreational use



Establishing Native Aquatic Plants - Transplanting

- Establishing in-lake submerged plant nursery
 - Identify donor lakes
 - Transplanting Methods – Submerged Plants
 - “Cooler Dump”
 - Burlap planting
 - Potted plants
- Emergent Planting
 - Direct planting in shallow areas
 - Nursery plants available



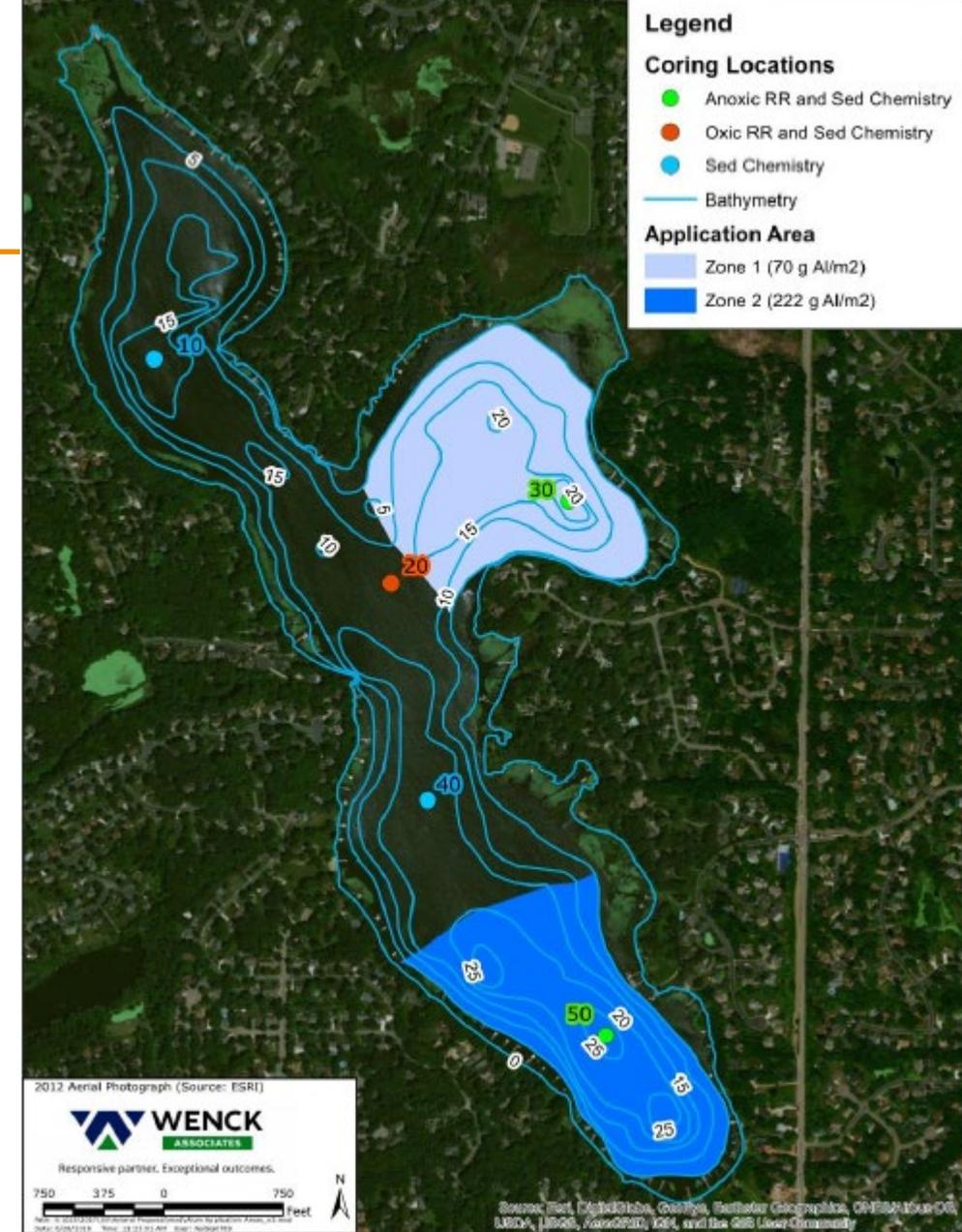


Questions?

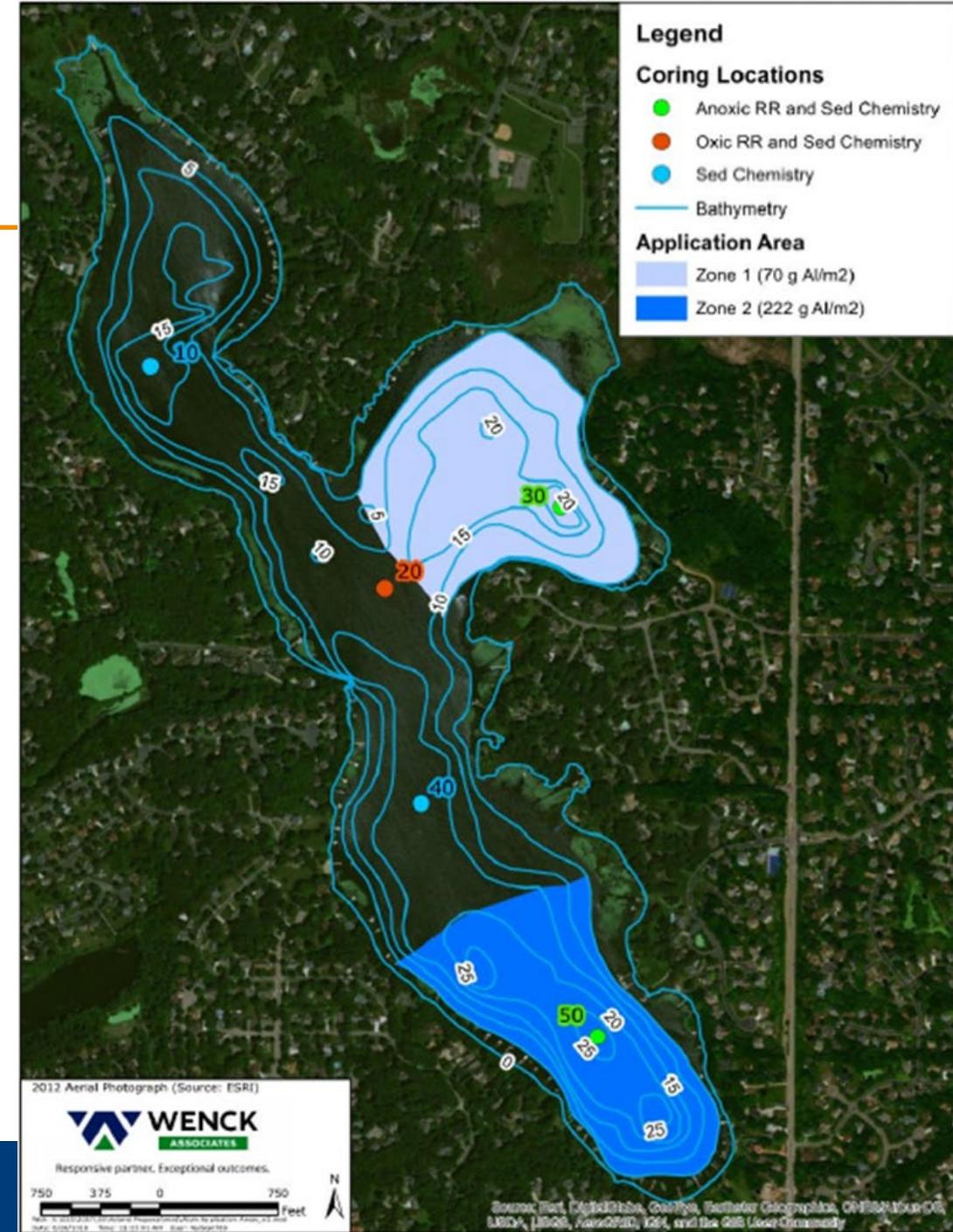
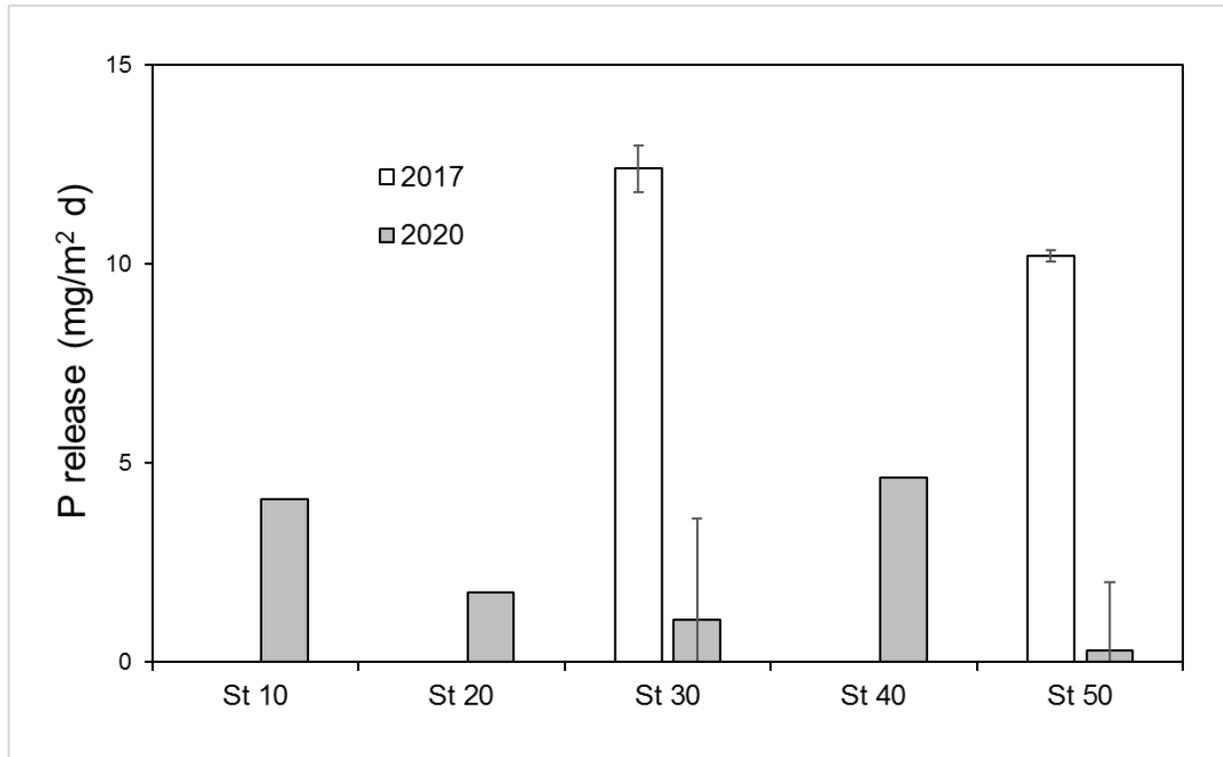


Lotus Lake Alum Treatment

- Application of alum should be applied in two areas at rates of 222 and 70 g-Al/m² as outlined in the alum dosing map

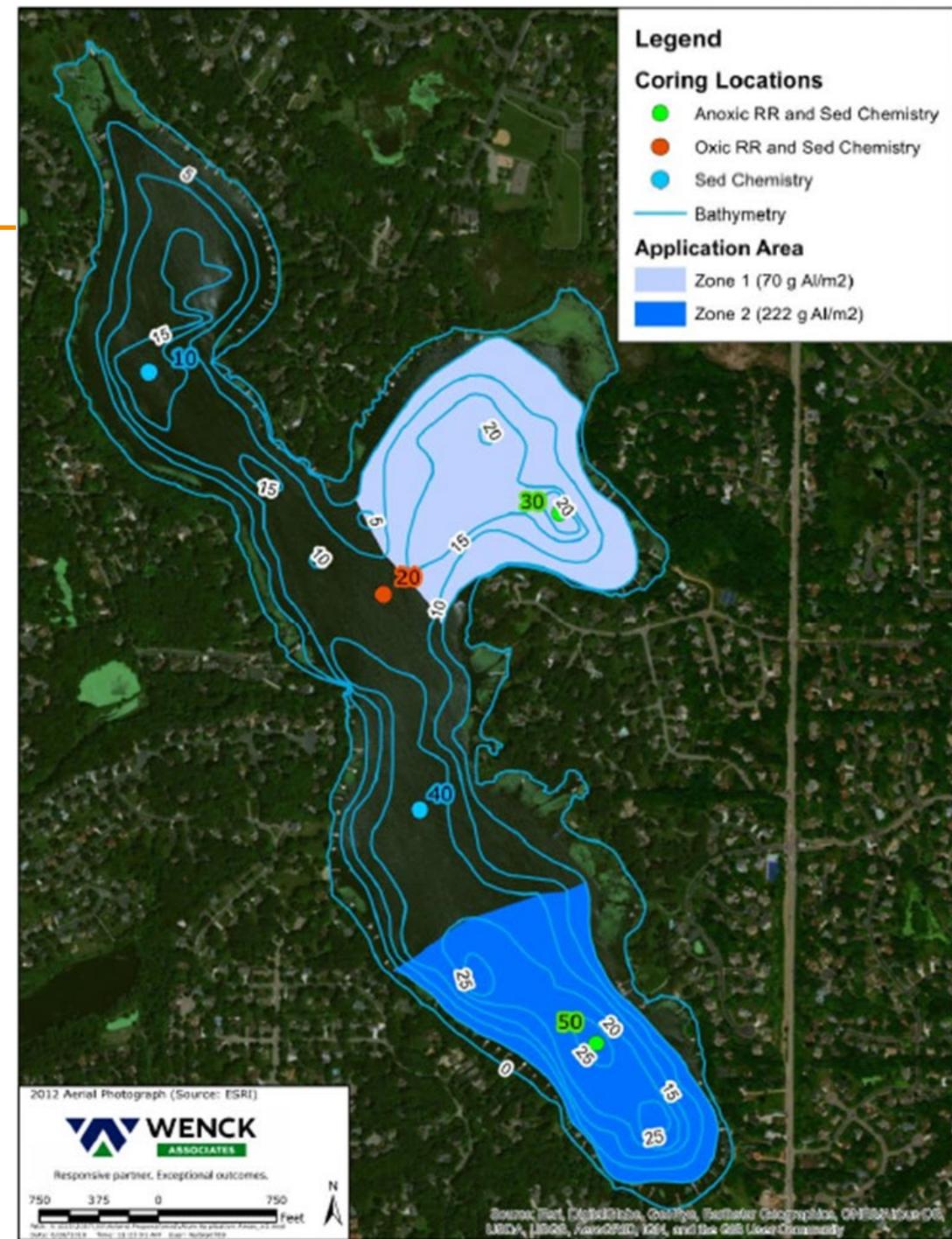


Contributing Sediments



Lotus Lake Options

- Adjust current alum treatment plan
 - Consider shallow area treatment
 - Split remaining treatments
 - 15-foot contour in Zone 1
 - 15-foot contour in Zone 2
 - 15-foot contour in new Zone 3
- Need updated cost estimate and adjust application plan



Physical Characteristics of Lakes

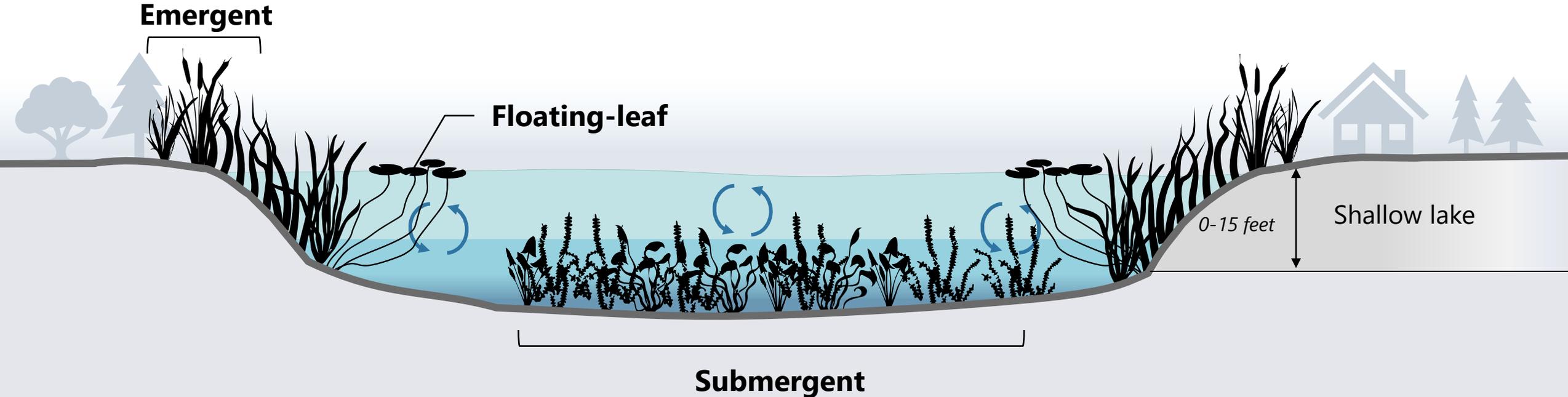


Diagram not to scale