A

APPENDIX A

Stakeholder Participation Materials

Presentation Outline

- Onterra, LLC
- Why Create a Management Plan?
- Elements of a Lake Management Planning Project
  - Data & Information
  - Planning Process

Onterra, LLC

- Founded in 2005
- Staff
  - Four full-time ecologists
  - One part-time paleoecologist
  - Three full-time field technicians
  - Five summer interns
- Services
  - Science and planning
- Philosophy
  - Promote realistic planning
  - Assist, not direct

Why create a lake management plan?

- Preserve/restore ecological function to ensure cultural services
- To create a better understanding of lake's positive and negative attributes.
- To discover ways to minimize the negative attributes and maximize the positive attributes.
- Snapshot of lake's current status or health.
- Foster realistic expectations and dispel any misconceptions.

A goal without a plan is just a wish!

Elements of an Effective Lake Management Planning Project

Data and Information Gathering

Environmental & Sociological

Planning Process

Brings it all together

Data and Information Gathering

- **Study Components**
  - Water Quality Analysis
  - Watershed Assessment
  - Paleocore Collection & Analysis
  - Aquatic Plant Surveys
  - Bio-Acoustic Survey
  - Fisheries Data Integration
  - Shoreland & CWH Assessment
  - Stakeholder Survey

Water Quality Analysis

- General water chemistry (current & historical)
- Nutrient analysis
  - Lake trophic state (Eutrophication)
  - Limiting plant nutrient
- Supporting data for watershed modeling
- Silver is a WDNR Long-Term Trends Lake
  - Onterra will sample in winter for D.O. profile

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Watershed Assessment

- Geographic area within which all water drains to a common point

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Watershed Delineation

- Delineation of Watershed
- Understanding of location in Wisconsin's watersheds
- Watershed Modeling
  - Land cover
  - Phosphorus loading
  - Scenario development

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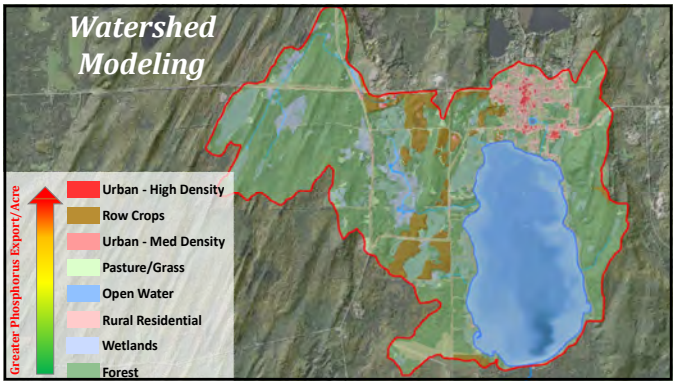
Watershed Modeling



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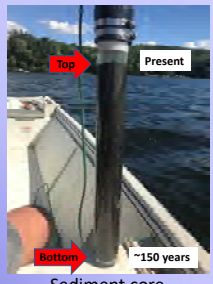
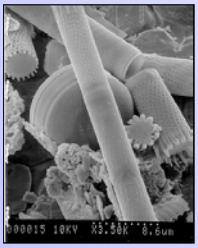
Paleocore Collection & Analysis



Sediment core



Diatoms

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Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Early-Season AIS Survey (CLP, PYI, EWM)
  - Point-intercept survey
  - Emergent & floating-leaf community mapping
  - Late-Season AIS Survey (EWM and PL)
    - Completed in 2021 and 2022

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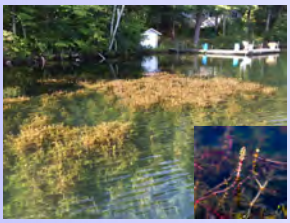
Non-native Aquatic Plants

Curly-leaf Pondweed

Verified 1992

Eurasian Watermilfoil



Verified 1993

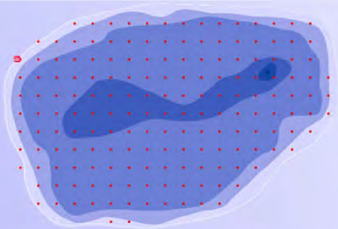
Non-native Aquatic Plants

Pale Yellow Iris

Purple Loosestrife

Point-Intercept Survey

Silver Lake
40-meter Resolution
173 Total Points
Cason & Associates: 2012
Golden Sands Survey: 2020



Emergent & Floating-leaf Plant Community Mapping Survey

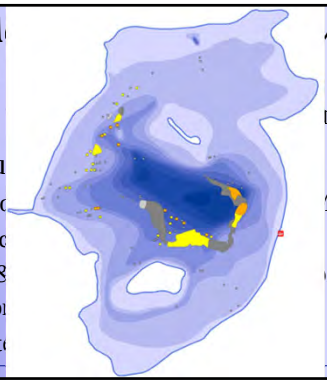
- Important for habitat, water quality, and shoreland stabilization
- Negatively impacted by shoreland development
- Ecological indicator communities
- Sub-meter GPS delineation
- Separation by community type
- Identification of dominant species

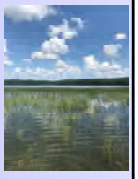
Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Early-Season AIS Survey (CLP, PYI, EWM)
  - Point-intercept survey
  - Emergent & floating-leaf community mapping
  - Late-Season AIS Survey (EWM and PL)
    - Completed in 2021 and 2022

A…ys

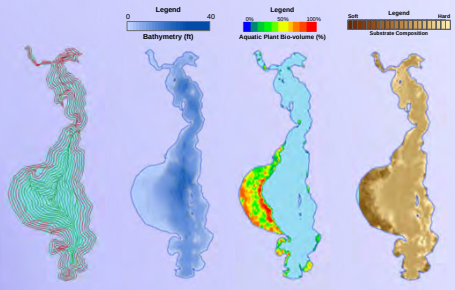
- Concerned …native plants
- Multiple su…
  - Early-Seas…M)
  - Point-inter…
  - Emergent &…ing
  - Late-Season…
    - Complete…





Acoustic Survey

- Systematically record multi-channel sonar data from entire lake
- Create models based upon processed data.



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Fisheries Data Integration

- No fish sampling completed
- Assemble data from WDNR, USGS, & USFWS
- Fish survey results summaries (if available)
- Use information in planning as applicable

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Shoreland Assessment

- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- EPA National Lakes Assessment results indicate shoreland development has greatest negative impact to health of our nation's lakes.
- Assessment uses WDNR protocol considers vegetative cover, maintained lawn, shoreline protection, impervious surfaces, and other shoreland development indicators.
- Coarse woody habitat is also assessed.

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Stakeholder Survey

- Survey includes primarily riparian property owners
- Standard survey used as base
  - Planning committee potentially develops additional questions and options
  - Must not lead respondent to specific answer through a "loaded" question
- Survey must be approved by WDNR

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Planning Process

Planning Committee Meetings

Study Results (including a stakeholder survey)
Conclusions & Initial Recommendations
Management Goals
Management Actions
Timeframe
Facilitator(s)

Implementation Plan

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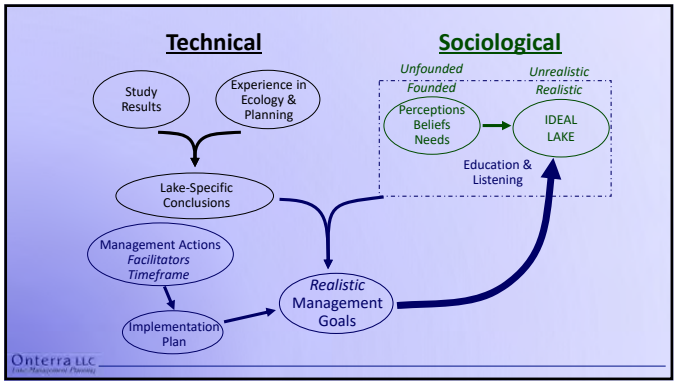
The Planning Process



Planning Committee

- Role
  - Provide perspective as Silver Lake stakeholder representatives
  - Gain understanding of Silver Lake ecosystem and communicate with others
- Responsibilities
  - Stakeholder survey development (this summer)
  - Review draft result sections
  - Two planning meetings (2022)
  - Review/approve entire draft report
- Remember to record time spent on project activities (form provided)

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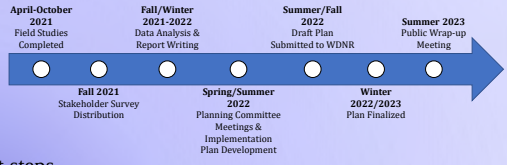
Project Timeline



- Next steps
  - Josephine will be in touch soon regarding the stakeholder survey
  - Committee works with her to finalize survey – fall distribution
  - Field work completed through early 2021

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Silver Lake
Project Update
October 2021

Submitted by: Tim Hoyman, Onterra, LLC

With the help of a Surface Water Planning Grant totaling over $15,000 through the Wisconsin Department of Natural Resources, a project is underway to create an updated lake management plan for Silver Lake (Photo 1). The management plan will contain historical and current data from the lake as well as an implementation plan that will guide the Scandinavia Silver Lake District (SSLD) in the future management of the lake. Onterra, LLC, a lake management planning firm out of De Pere, assisted the district in applying for the grant and will facilitate the planning process.

Photo 1. Silver Lake, Waupaca County, Wisconsin. Photo credit: Onterra

Studies are being completed that are aimed at assessing the health of Silver Lake and focused upon evaluating the lake's aquatic plant community, water quality, and watershed. In addition, perceptions of lake stakeholders will be gathered through the stakeholder survey contained in this mailing. A wealth of data has already been collected over the summer and fall, and the analyses of the information is currently underway.

Three aquatic plant surveys were completed over the 2021 growing season by Onterra staff. Data gathered by Golden Sands Resource Conservation & Development Council in 2020 will also be utilized in the project. The first survey of 2021 was completed in late-May to locate and map the invasive plant species, curly-leaf pondweed. During the survey only four locations containing the plant were mapped. Onterra visited the lake twice in August to complete the emergent (e.g., cattails and bulrushes) and floating-leaf (e.g., water lilies) community mapping survey and the late-season aquatic invasive species (AIS) survey. The latter survey is aimed at mapping Eurasian watermilfoil (EWM). Both points and polygons were used to map EWM by density within the lake. During 2021, EWM occupied the majority of the lake with many areas matting on the surface. EWM will obviously be a primary topic of discussion during the plan development phase of the project.

In mid-summer 2020, a point-intercept survey was completed by Golden Sands to quantitatively assess the Silver Lake native and non-native aquatic plant communities. This survey includes the collection of plants using a rake at 173 points evenly spaced across the lake. Each species retrieved with the rake is identified and assigned an abundancy rating. The same survey methodology and point locations were used in 2005 and 2012, so comparisons with those data will be made as a part of the results analysis. In 2020, two native species, coontail and common waterweed dominated the lake's plant community. Coontail was highly dominate and located at over 90% of the points. Common waterweed was found at 57%. EWM was close behind at about 55%. These three species were found in the same order of dominance during the 2005 and 2012 surveys, as well.

On September 14, 2021, Onterra ecologists collected a sediment core from the bottom of Silver Lake (Photo 2). The purpose of this core collection is to analyze fossilized diatom communities present in the top and bottom layers of the sample which indicate if and how Silver Lake's environment, like nutrient levels and aquatic plant abundance, may have changed over time. Diatoms are a type of algae that have a silica shell. Silica, like glass, does not decompose quickly, so the shells of the diatoms remain in the sediments for centuries. Occasionally, in shallow, productive lakes like Silver, the diatoms in the lower layers of sediment are destroyed by natural chemicals; however, preliminary inspection of the sediment samples from Silver Lake indicates that the diatoms, and other indicators used in the analysis, remain intact. This analysis, called paleoecology, allows for comparisons that can be made between present day and pre-settlement times. This is a useful tool for identifying changes that are human-related, and is unique in allowing for a glimpse at conditions during a time before data was collected and recorded. Knowing the condition of the lake before human impacts affected its health helps to set correct expectations for how the lake may be improved. The results of this core analysis from Silver Lake will be included within the full comprehensive report.

Photo 2. Sediment core collected on Silver Lake. Photo credit: Onterra.

The primary objective of this project is to create a realistic management plan that the SSLD will be able implement to protect and improve Silver Lake. During a planning project such as this, understanding the people that care for and use the lake is equally as important as understanding the lake itself. A planning committee has been assembled and is comprised mostly of district members. This planning committee will be instrumental in the development of the management plan because they will act as a focus group and represent the experience and views of the lake stakeholders.

The stakeholder survey contained in this mailing is a critical component within this project because it allows all district members to be heard. It allows for an understanding of how people use the lake, what condition they believe it is in, and how it has changed over the years. It also helps us to understand how the district would like to see the lake managed and what is import to them in terms of the lake's beneficial uses. More people responding to the survey brings about a better understand of how the lake should be managed to meet the expectations of the district. So, please return the survey and urge your neighbors and friends from the SSLD to do the same.

Over the course of the next several months, Onterra staff will continue to compile data regarding Silver Lake. We will analyze that data, draw conclusions, and develop a detailed report. In spring 2022, will meet with the planning committee and go over our findings and conclusions with them. We will also learn about the lake from the planning committee and the results of the stakeholder survey. During the second meeting, which will be held a few weeks after the first meeting, we will work with the committee to develop a list of challenges facing the lake and the lake district. We will use that list to develop management goals and then work to design actions the district can perform to meet the goal. If needed, the management plan will also include goals and actions designed to build the capacity of the lake district to implement the plan. The goals and actions will be assembled with appropriate timeframes and facilitators to form the Silver Lake implementation plan.

Presentation Outline

- Lake Management Planning Project Overview
- Meeting Objective
- Study Results
  - Water Quality
  - Paleoecology
  - Watershed
  - Aquatic Plants
  - AIS and AIS Control
- "Big Picture"
- Planning Meeting II

Onterra LLC Lake Management Planning

Management Planning Project Overview

Collect and compile information about Silver Lake
Includes both environmental & sociological
Historical & current information
Past management actions

Planning Meeting I/II
Report Sections

Create a realistic and implementable management plan
Challenges facing lake and SSLD
Create goals that will address challenges
Develop actions that will meet goals
Assign timeframes & facilitators

Planning Meeting II
Implementation Plan

Onterra LLC Lake Management Planning

Summary of Project Results

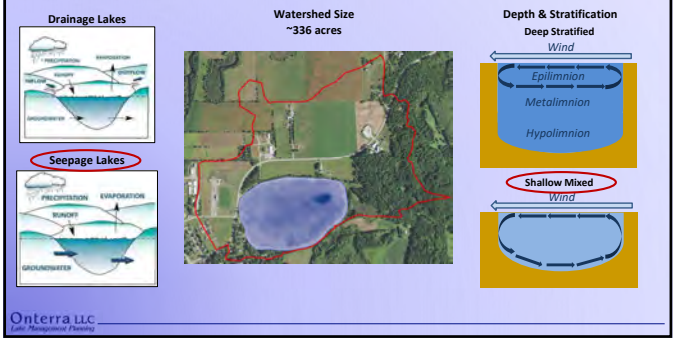
Water Quality
- Better water quality from 2005-present compared to 1988-1999.
- Lake has transitioned from turbid-state to clear-state.
- Reduced bullhead population, watershed BMPs, and increased HWM have cumulated to produce better water quality.

Watershed
- Watershed is relatively small and recent changes likely helped to better water quality
- While impossible to document quantitatively, largest positive impact from watershed is likely the creation of Jorgens Park Preserve.

Aquatic Plant Community
- Aquatic plant community is not of high quality, but is substantially responsible for maintaining the lake's current level of water quality.
- Eurasian watermilfoil x Northern watermilfoil hybrid was documented with DNA analysis in samples collected in 2021.

Onterra LLC Lake Management Planning

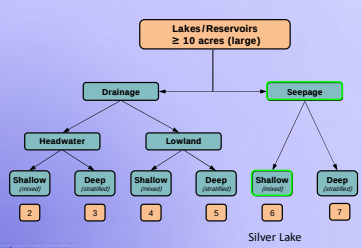
Wisconsin Lakes Natural Community Types



Onterra LLC Lake Management Planning

Natural Community Types

Categorization of lakes with similar features that influence water quality



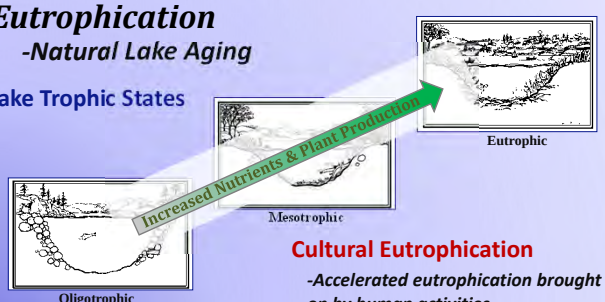
Ecoregions

An area containing similar geology, physiography, hydrology, climate, and soils. As well as common terrestrial and aquatic fauna.

Onterra LLC Lake Management Planning

Eutrophication
-Natural Lake Aging

Lake Trophic States



Cultural Eutrophication

-Accelerated eutrophication brought on by human activities.

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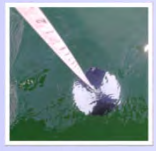
Lake Water Quality – Trophic Parameters

Phosphorus
Naturally occurring & essential for all life
Regulates phytoplankton biomass in **most** WI lakes
Most often 'limiting plant nutrient' (shortest supply) **N:P = 33:1**
Human activity often increases P delivery to lakes

Chlorophyll-*a*
Pigment used in photosynthesis
Used as surrogate for phytoplankton biomass

Secchi Disk Transparency
Measure of water clarity
Measured using a Secchi disk



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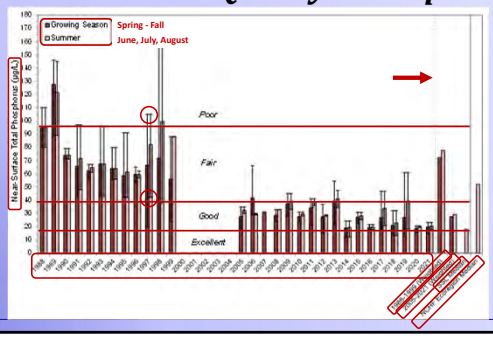
Silver Lake Water Quality - Phosphorus



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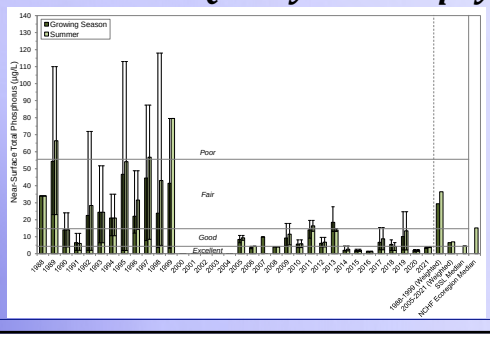
Silver Lake Water Quality – Chlorophyll-a



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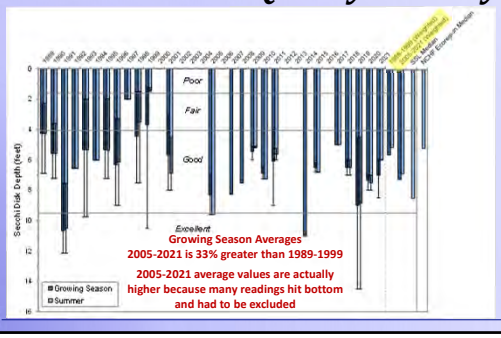
Silver Lake Water Quality – Clarity



Growing Season Averages
2005-2021 is 33% greater than 1989-1999

2005-2021 average values are actually higher because many readings hit bottom and had to be excluded

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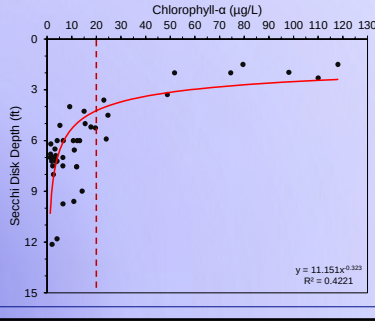
Silver Lake Water Quality – Clarity



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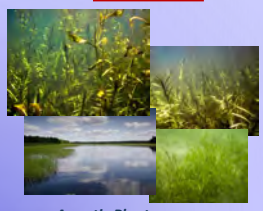
Shallow Lakes are Special

Clear State



Turbid State

Aquatic Plants are Incredibly Important

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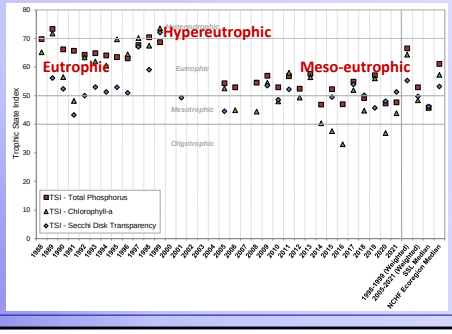
Silver Lake Water Quality – Trophic State



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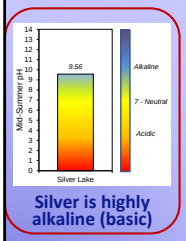
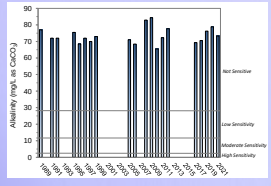
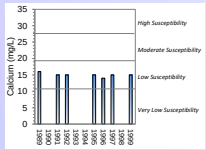
Additional Water Quality - Silver Lake



Silver is highly alkaline (basic)



Silver's high alkalinity means high buffering capacity against acid rain



Low calcium levels mean that zebra mussels would NOT establish well if introduced

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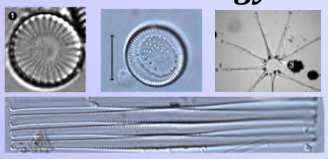
Silver Lake - Paleoecology



Top-Bottom Sediment Core Results

- Silver Lake historically had a good water quality and contained a healthy macrophyte population.
- There is strong evidence of ecological degradation when comparing bottom sample to top sample.

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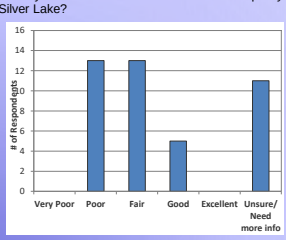
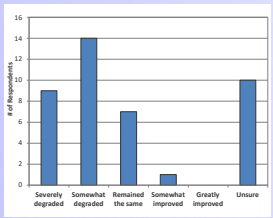
Water Quality – Stakeholder Survey Questions

Please Note: 192 Surveys Distributed, 44 Surveys Returned: 23% Response Rate

Stakeholder survey response Question #17. How would you describe the overall current water quality of Silver Lake?



Stakeholder survey response Question #18. How has the overall water quality changed in Silver Lake since you first visited the lake?



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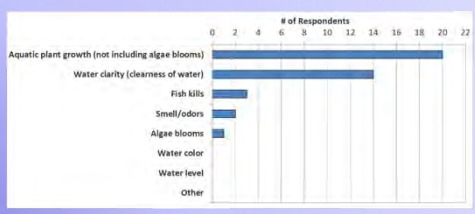
Water Quality – Stakeholder Survey Questions

Stakeholder survey response Question #19. Which of the following answers is the single most important aspect when considering water quality?



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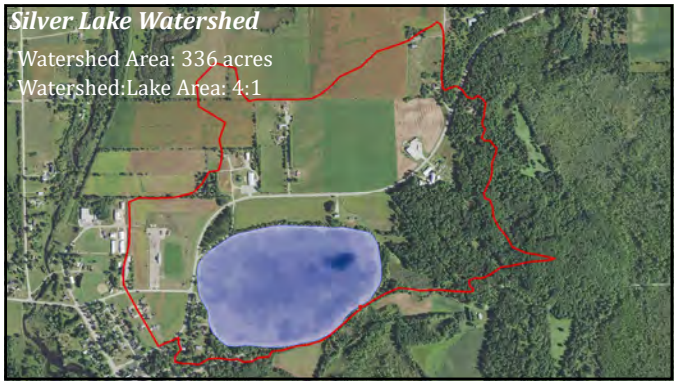

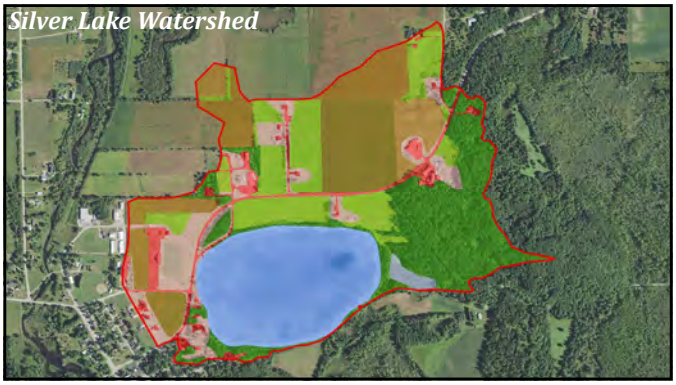

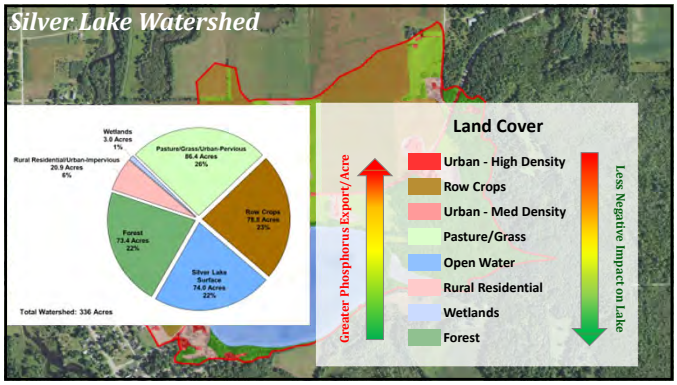

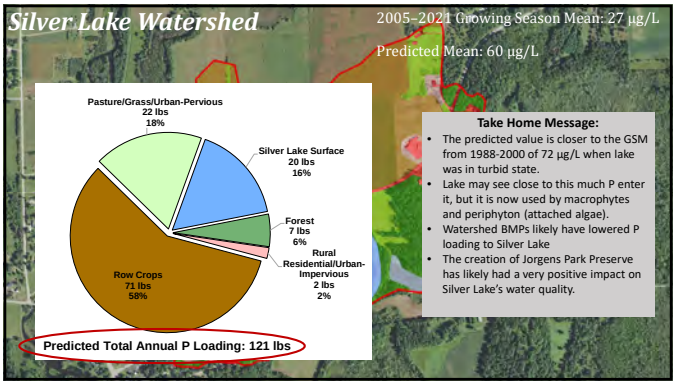

Aquatic Plant Surveys

- Assess both native and non-native populations
- Numerous surveys completed
  - Early-Season AIS Survey (2021 Onterra)
  - Whole-Lake Point-Intercept Survey (2005, 2012, 2020)
  - Emergent/Floating-Leaf Community Mapping Survey (2021 Onterra)
  - Late-Season AIS Survey (2021 Onterra)

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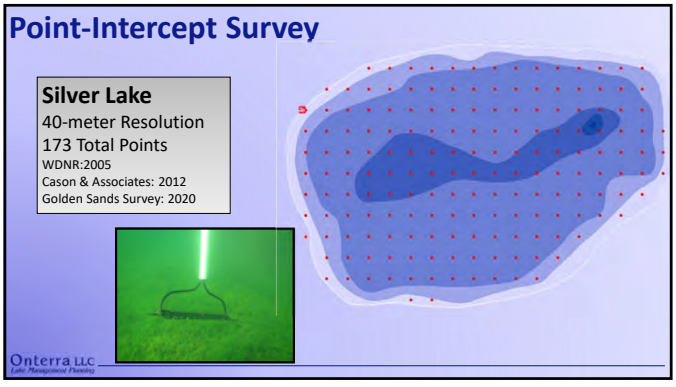
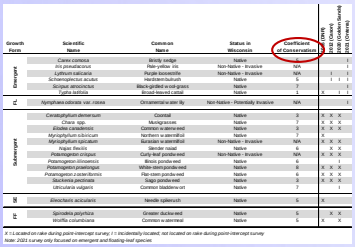


Aquatic Plant Species List

22 Native Species Total
14 Native Species on Rake
5 Non-Native Species
- Ornamental Tiger lily
- Purple loosestrife
- Pale-yellow iris
- Eurasian watermilfoil
- Curly-leaf pondweed



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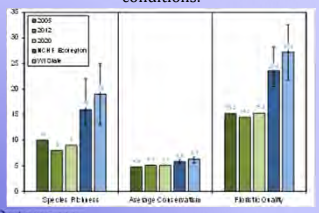
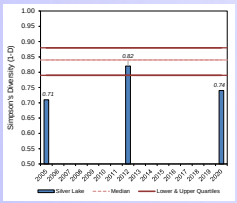
Vegetation Analysis Matrices

Floristic Quality Analysis
Evaluates the closeness of an area's flora to undisturbed conditions.



Species Diversity
Utilizes species richness and also takes into account evenness or the variation in abundance of the individual species within the community



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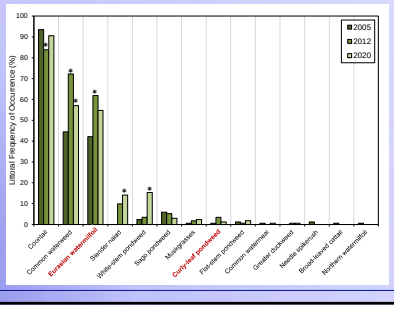
Vegetation Analysis Matrices

Littoral Frequency of Occurrence



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Emergent Non-Native Aquatic Plants

Pale-yellow Iris

Purple Loosestrife

Ornamental Tiger Lily

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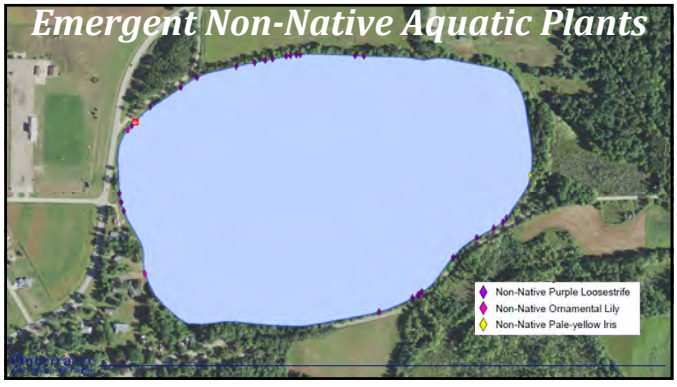
Emergent Non-Native Aquatic Plants



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Submerged Non-Native Aquatic Plants

Curly-leaf Pondweed

~~Hybrid Watermilfoil~~

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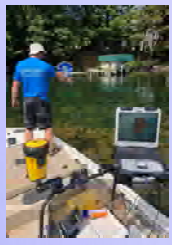
Professional AIS Mapping



Point-Based Mapping

- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

Polygon-Based Mapping

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting

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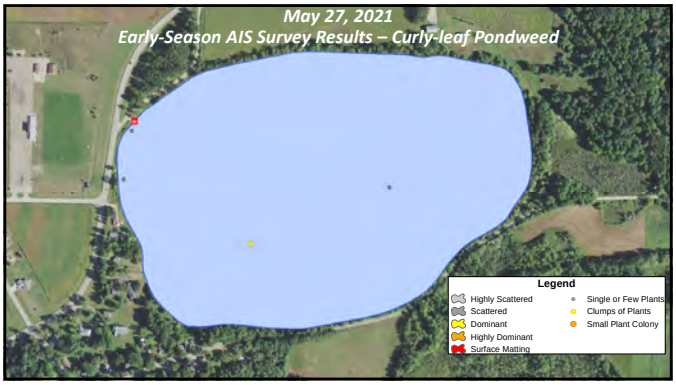

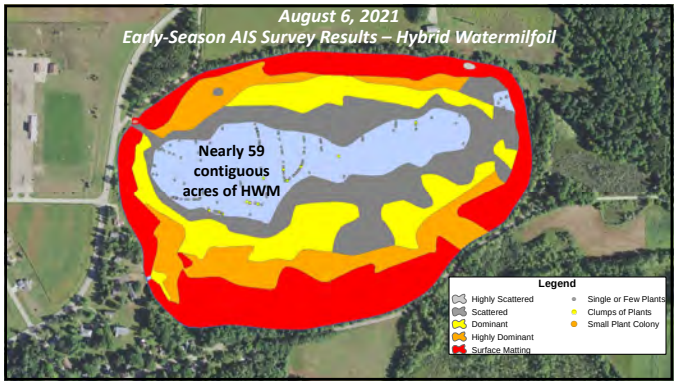

Aquatic Plant Management – Stakeholder Survey Question

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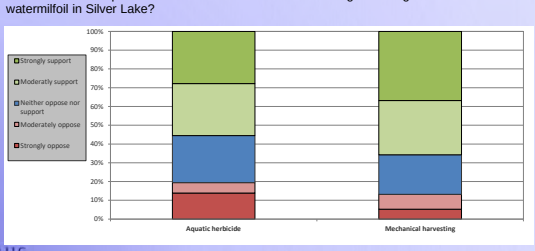

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HWM Management History

Verified in Silver Lake in 1993, likely there prior

WDNR Harvesting:
1994 and 1995 (funding ended)

Herbicide Spot Treatments:
2004 – Small areas near properties
2006 – 9.5 acres – 2,4-D, looked good in 2007, but returned 2008

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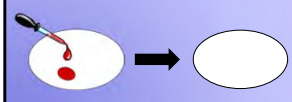
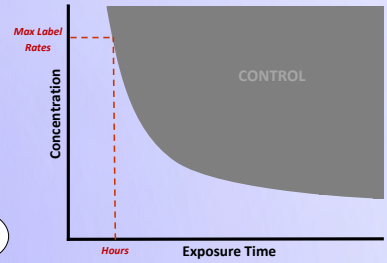
Ecological Definitions of Herbicide Treatment

Spot Treatment:

Herbicide applied at a scale where dissipation will not result in significant lake wide concentrations; impacts are anticipated to be localized to in/around application area.





High Concentration ► Short Exposure Time

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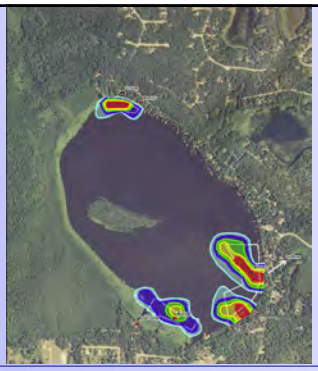
Horizontal Herbicide Mixing (Dissipation)

- ~25 acres of 305 acre lake (8%)
- Tracer Dye (Rhodamine WT) Survey

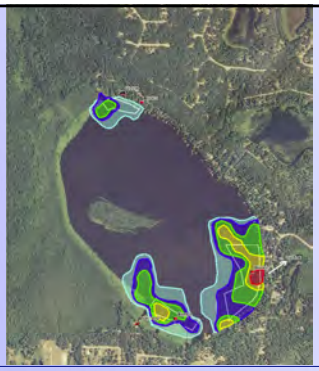
1 HAT

12/24 hours for mortality
- 75-100%
- 50-75%
- 25-50%
- 10-25%
- 5-10%



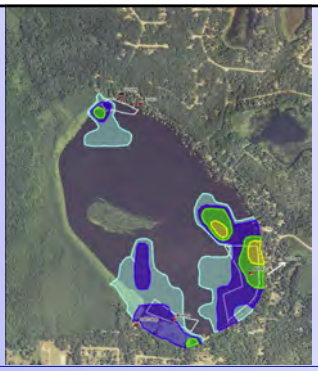
2.5 HAT

12/24 hours for mortality
- 75-100%
- 50-75%
- 25-50%
- 10-25%
- 5-10%



4 HAT

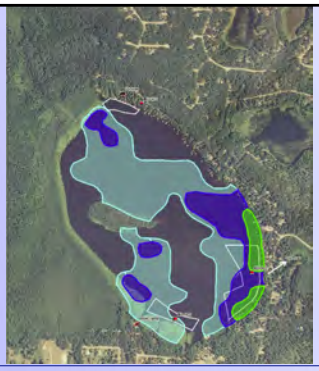
12/24 hours for mortality
- 75-100%
- 50-75%
- 25-50%
- 10-25%
- 5-10%



6 HAT

12/24 hours for mortality
- 75-100%
- 50-75%
- 25-50%
- 10-25%
- 5-10%

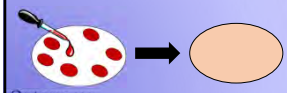
2,4-D CET needed for EWM control based upon published studies:
- **sustained 4.0 ppm for 12 hours**
- **sustained 2.0 ppm for 24 hours**
- **0.1-0.3 ppm for 6 weeks**

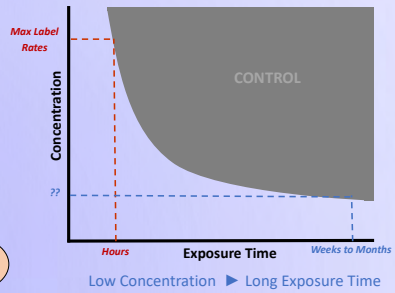


Ecological Definitions of Herbicide Treatment

Whole-Lake/Basin Treatment:

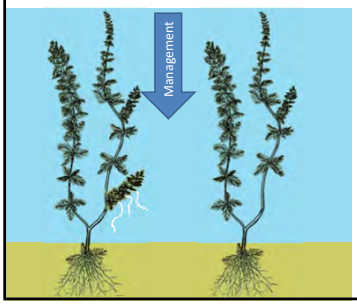
Herbicide applied at a scale where dissipation will result in significant lake wide concentrations; impacts are anticipated to be on a lake-wide scale.





Low Concentration ▶ Long Exposure Time

EWM Life-Cycle & Control Strategy Philosophy



- Herbicide needs to translocate to root crown (*hard to kill with herbicides*)
- Hand-harvesting that extracts roots is effective (*extremely time intensive*)
- Mechanical harvesting can minimize nuisance conditions (*spread to new areas not a concern for established populations)*
- Sometimes EWM does not cause nuisance conditions or ecological changes

AIS Management Perspectives

1. **No Coordinated Active Management (Let Nature Take its Course)**
   - Lake group does not lead efforts
   - Encourage nuisance abatement through manual removal by property owners
2. **Minimize navigation and recreation impediment (Nuisance Mgmt)**
   - May be accomplished through mechanical harvesting or herbicide treatment
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Onterra LLC

Florpyrauxifen-benzyl (ProcellaCOR™)

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ProcellaCOR™ 2019-2021 Field Trials

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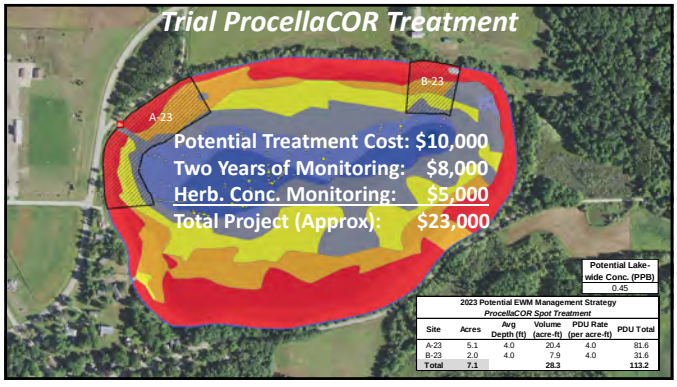
Trial ProcellaCOR Treatment



Potential Lake-wide Conc. (PPB)
0.45

2023 Potential EWM Management Strategy
ProcellaCOR Spot Treatment

Site	Acres	Avg Depth (ft)	Volume (acre-ft)	PDU Rate (per acre-ft)	PDU Total
A-23	5.1	4.0	20.4	4.0	81.6
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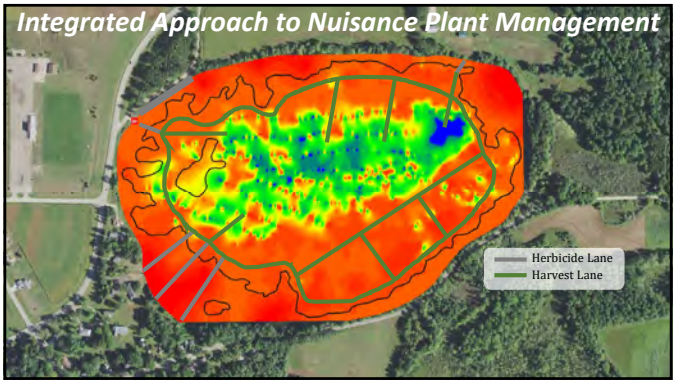
Integrated Approach to Nuisance Plant Management



Overarching Conclusions

Silver Lake's paleoecological study indicated that even prior to European settlement, the lake was healthy, but mesotrophic (moderately productive) and dominated by macrophytes (clear state).

The lake's ecology degraded with human impacts to the watershed, like agriculture, road construction, and urbanization.

Prior to the 2000s, the lake was dominated by planktonic algae (turbid state) and fluctuated between eutrophy and hypereutrophy.

Watershed BMPs, reduction in bullhead numbers, and expanding HWM *flipped* the lake back to a clear state; however, it is still highly productive and the macrophyte population is dominated by disturbance-tolerant species.

Lake-wide reductions in macrophytes would very likely cause Silver Lake to flip back to a turbid state.

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Planning Meeting II

Primary Objective: Create implementation plan framework

Steps to Achieve Objective:

1. Discuss challenges facing lake and lake group
2. Convert challenges to management goals
3. Create management actions to meet management goals
4. Determine timeframes and facilitators to carry out actions

Results Remaining to Discuss:

- Shoreland Condition
- Fisheries

Assignment for Planning Meeting II

1. Email list of challenges facing lake and lake group (just to Tim)
2. Review stakeholder survey results (Tim! - Handout)
3. Send potential report section edits and questions to Tim

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Meeting Outline

- Overarching Conclusions from Planning Meeting I
- Study Results
  - Shoreland Condition
  - Fishery
- Review Aquatic Plant Management Discussion
- Challenges Discussion
- Implementation Plan Framework

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Shoreland Assessment

- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- EPA National Lakes Assessment results indicate shoreland development has greatest negative impact to health of our nation's lakes.

Urbanized

Range

Natural

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Shoreland Impacts

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Natural Vegetation Layers

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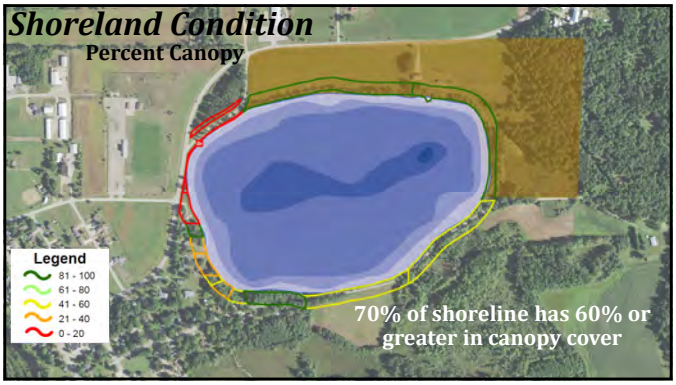
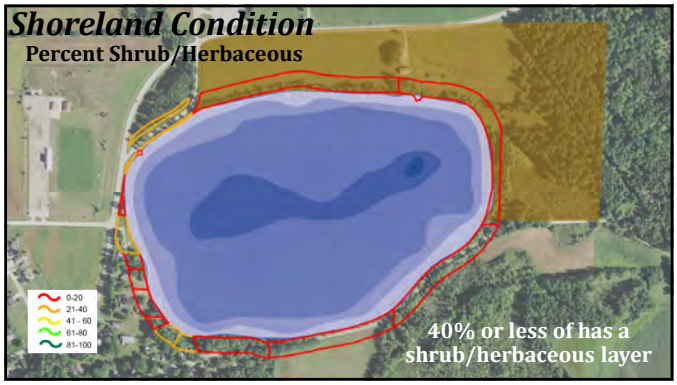
Shoreland Condition

Percent Canopy



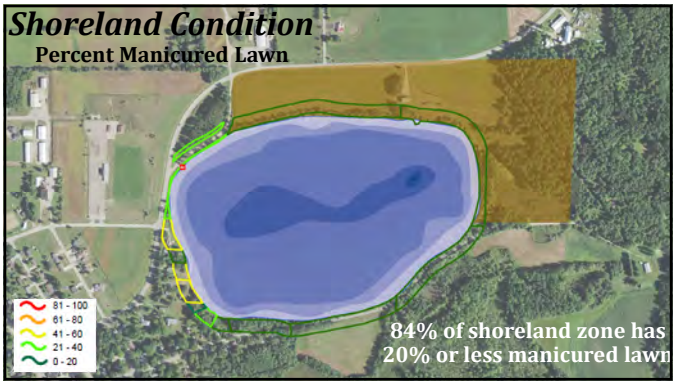
Shoreland Condition

Percent Shrub/Herbaceous



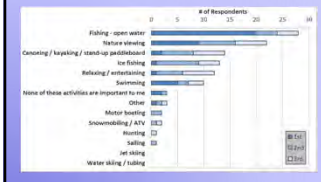
Shoreland Condition

Percent Manicured Lawn



Silver Lake Fishery

8. Please rank up to three activities that are important reasons for owning your property on or near Silver Lake or would be important to you as a future activity if lake rehabilitation efforts allow for activity. Please select the options below in order of importance with the 1st being most important.



28 people picked fishing in Top 3

9. Have you personally fished on Silver Lake in the past three years?

Answer Options	Response Percent	Response Count
Yes	26.2%	11
No	73.8%	31
answered question		42
skipped question		2

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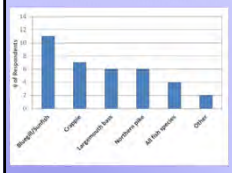
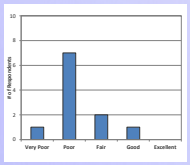
Silver Lake Fishery

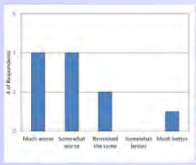
Stakeholder survey response Question #10. What species of fish do you like to catch on Silver Lake?



Stakeholder survey response Question #11. How would you describe the current quality of fishing on Silver Lake?



Stakeholder survey response Question #12. How has the quality of fishing changed on Silver Lake since you started fishing the lake?



- Lake is managed as largemouth bass and bluegill fishery.
- Last stocking was LMB in 2014 and Northern Pike in 2013.
- 2017 report discussed management of invasive plants to enhance predator fish feeding on smaller fish.
- Next survey is scheduled for 2025.

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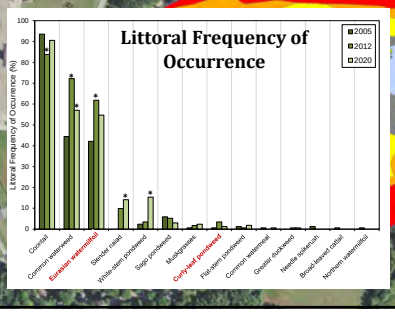
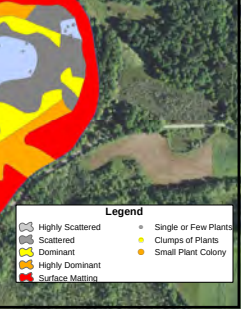
Aquatic Invasive Plant Management 101

August 6, 2021
Early-Season AIS Survey Results – Hybrid Watermilfoil





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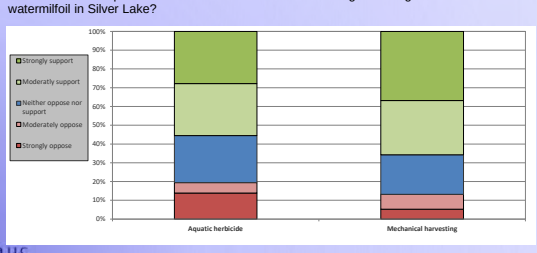

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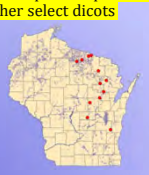
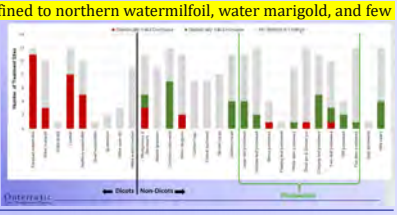
ProcellaCOR™ 2019-2021 Field Trials

- Onterra has monitored dozens of projects
- Nearly all show high level of initial control with little to no EWM/HWM extending through year-after-treatment
- Dissipation & mixing resulting in off-target impacts on many projects
- Slightly reduced efficacy and dissipation in high pH lakes, SE WI lakes
- Native plant impacts largely confined to northern watermilfoil, water marigold, and few other select dicots





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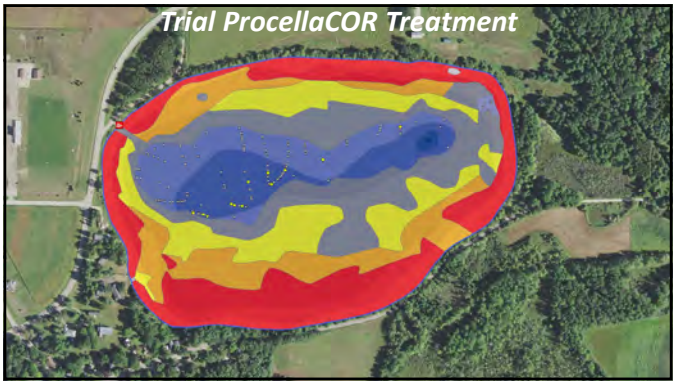
Trial ProcellaCOR Treatment



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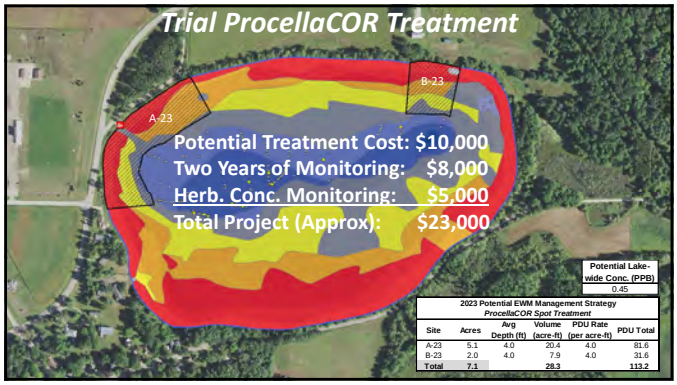

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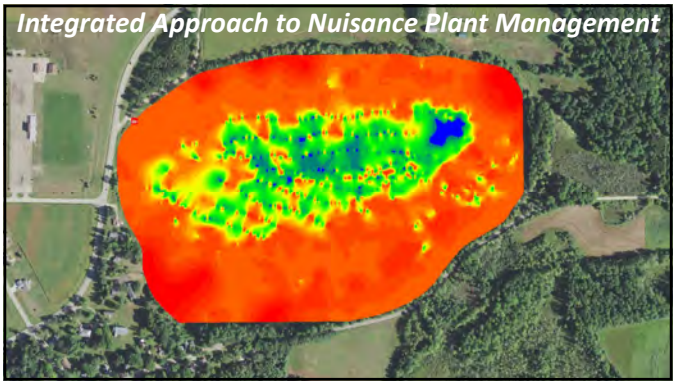
Integrated Approach to Nuisance Plant Management



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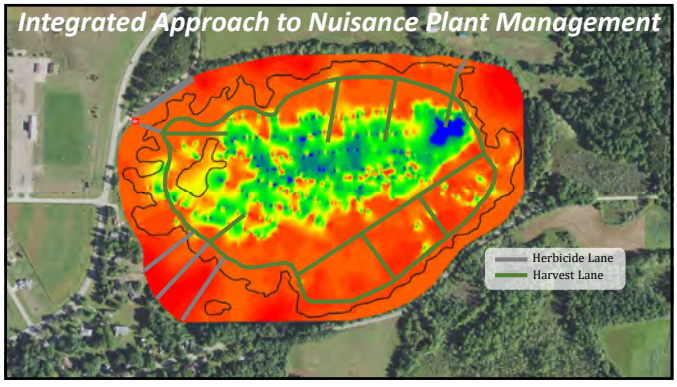

Thank You

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Lake Management Planning

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Meeting Objective

- Present highlights of study results from Silver Lake
  - Focusing on primarily on water quality and aquatic plants
- Answer questions (throughout)
- Outline management plan goals and actions

Presentation Outline

- Overview of Planning Process
- Summary of Project Conclusions
- Specific Results Discussion
- Proposed Management Plan (Mixed In)

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Management Plan Development Process

Primary Objective: Develop realistic and implementable management plan

Step 1: Learn about and understand lake

Step 2: Understand challenges facing lake and lake group

Step 3: Convert challenges to Management Goals

Step 4: Create Management Actions to meet Management Goals

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Summary of Project Results

Water Quality

- Better water quality from 2005-present compared to 1988-1999.
- Lake has transitioned from turbid-state to clear-state.
- Reduced bullhead population, watershed BMPs, and increased HWM have cumulated to produce better water quality.

Watershed

- Watershed is relatively small and recent changes likely helped to better water quality
- While impossible to document quantitatively, largest positive impact from watershed is likely the creation of Jorgens Park Preserve.

Aquatic Plant Community

- Aquatic plant community is not of high quality, but is substantially responsible for maintaining the lake's current level of water quality.
- Eurasian watermilfoil x Northern watermilfoil hybrid was documented with DNA analysis in samples collected in 2021.

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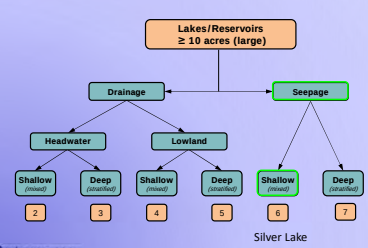
Natural Community Types

Categorization of lakes with similar features that influence water quality



Ecoregions

An area containing similar geology, physiography, hydrology, climate, and soils. As well as common terrestrial and aquatic fauna.

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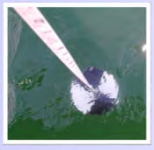
Lake Water Quality – Trophic Parameters

↑ **Phosphorus**
Naturally occurring & essential for all life
Regulates phytoplankton biomass in **most** WI lakes
Most often 'limiting plant nutrient' (shortest supply) **N:P = 33:1**
Human activity often increases P delivery to lakes

↑ **Chlorophyll-*a***
Pigment used in photosynthesis
Used as surrogate for phytoplankton biomass

↓ **Secchi Disk Transparency**
Measure of water clarity
Measured using a Secchi disk



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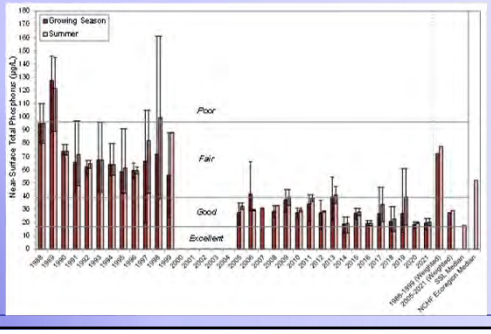
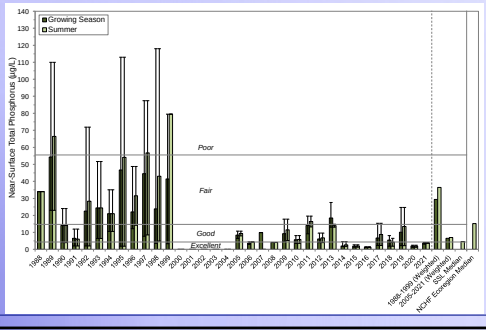
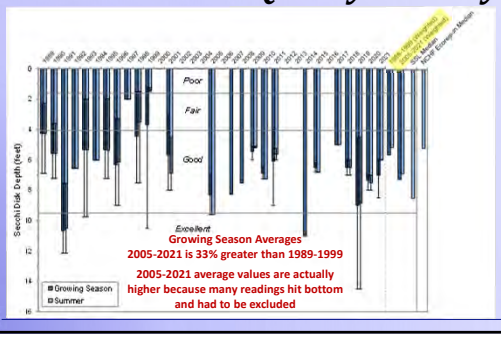
Silver Lake Water Quality - Phosphorus



Silver Lake Water Quality – Chlorophyll-a



Silver Lake Water Quality – Clarity

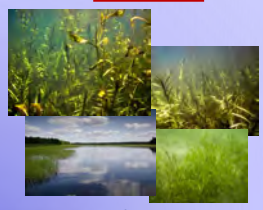


Growing Season Averages
2005-2021 is 33% greater than 1989-1999

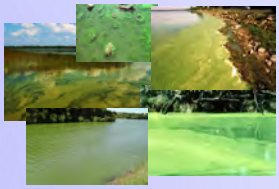
2005-2021 average values are actually higher because many readings hit bottom and had to be excluded

Shallow Lakes are Special

Clear State



Turbid State

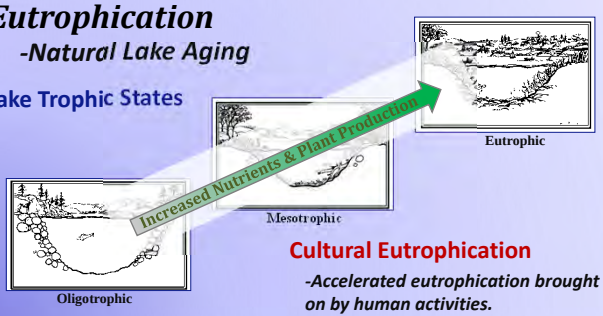


Aquatic Plants are Incredibly Important

Eutrophication

-Natural Lake Aging

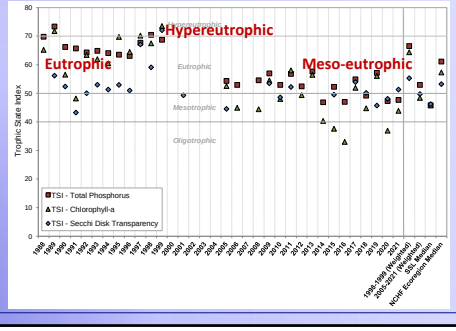
Lake Trophic States



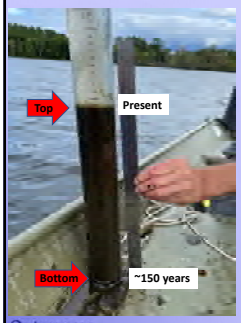
Cultural Eutrophication

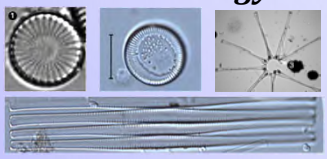
-Accelerated eutrophication brought on by human activities.

Silver Lake Water Quality – Trophic State



Silver Lake - Paleoecology





Top-Bottom Sediment Core Results

- Silver Lake historically had a good water quality and contained a healthy macrophyte population.
- There is strong evidence of ecological degradation when comparing bottom sample to top sample.

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Management Goal:

Maintain Silver Lake's Water Quality in its Current 'Clear State'

Management Actions

1. **Create informational communication regarding Silver Lake's historical and current water quality conditions.**
2. **Monitor Secchi disk transparency through WDNR Citizens Lake Monitoring Network.**

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Aquatic Plant Surveys

- Assess both native and non-native populations
- Numerous surveys completed
  - Early-Season AIS Survey (2021 Onterra)
  - Whole-Lake Point-Intercept Survey (2005, 2012, 2020)
  - Emergent/Floating-Leaf Community Mapping Survey (2021 Onterra)
  - Late-Season AIS Survey (2021 & 2022 Onterra)

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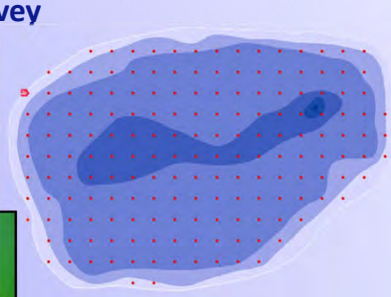
Point-Intercept Survey

Silver Lake
40-meter Resolution
173 Total Points
WDNR:2005
Cason & Associates: 2012
Golden Sands Survey: 2020



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Aquatic Plant Species List

22 Native Species Total
14 Native Species on Rake
5 Non-Native Species

- Ornamental Tiger lily
- Purple loosestrife
- Pale-yellow iris
- Hybrid watermilfoil
- Curly-leaf pondweed

Growth Form	Scientific Name	Common Name	Status in Wisconsin	Coefficient of Conservation	2005 (Cason)	2012 (Cason)	2012 (Golden Sands)	2020 (Golden Sands)
Emergent	*Carex comosa*	Bristly sedge	Native	5				
	Iris pseudacorus	Pale-yellow iris	Non-Native - Invasive	NA				
	Lythrum salicaria	Purple loosestrife	Non-Native - Invasive	NA				
	Schoenoplectus acutus	Hardstem bulrush	Native	5				
	Sparganium eurycarpum	Giant bur-reed	Native	7				
	Typha latifolia	Broad-leaved cattail	Native	1	X			
FL	*Nymphaea odorata* var. *rosea*	Ornamental water lily	Non-Native - Potentially Invasive	NA				
Submergent	*Ceratophyllum demersum*	Coontail	Native	3	X	X	X	
	Chara spp.	Muskgrasses	Native	7	X	X	X	
	Elodea canadensis	Common waterweed	Native	3	X	X	X	
	Myriophyllum sibiricum	Northern watermilfoil	Native	6	X			
	Myriophyllum spicatum	Eurasian watermilfoil	Non-Native - Invasive	NA	X	X	X	
	Najas flexilis	Slender naiad	Native	6	X			
	Potamogeton crispus	Curly-leaf pondweed	Non-Native - Invasive	NA	X	X	X	
	Potamogeton illinoensis	Illinois pondweed	Native	6	X			
	Potamogeton praelongus	White-stem pondweed	Native	8	X	X	X	
	Potamogeton zosteriformis	Flat-stem pondweed	Native	6	X	X	X	
	Stuckenia pectinata	Sago pondweed	Native	3	X	X	X	
	Utricularia vulgaris	Common bladderwort	Native	7				
M	*Eleocharis acicularis*	Needle spikerush	Native	5	X			
FF	*Spirodela polyrhiza*	Greater duckweed	Native	5		X	X	
	Wolffia columbiana	Common watermeal	Native	5		X	X	

X = Located on rake during point-intercept survey; I = Incidentally located, not located on rake during point-intercept survey
Note: 2021 survey only focused on emergent and floating-leaf species.

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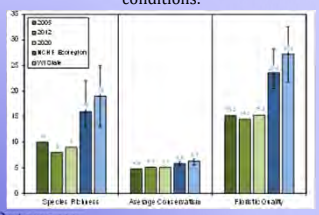
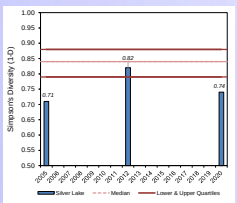
Vegetation Analysis Matrices

Floristic Quality Analysis
Evaluates the closeness of an area's flora to undisturbed conditions.



Species Diversity
Utilizes species richness and also takes into account evenness or the variation in abundance of the individual species within the community



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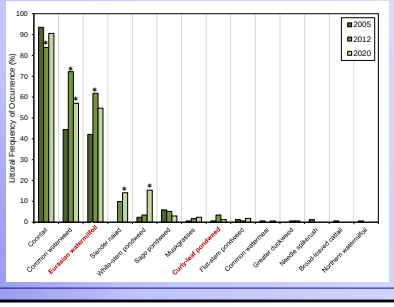
Vegetation Analysis Matrices

Littoral Frequency of Occurrence



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Submerged Non-Native Aquatic Plants

Curly-leaf Pondweed

~~**Hybrid Watermilfoil**~~

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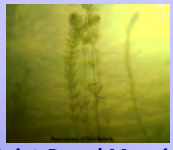
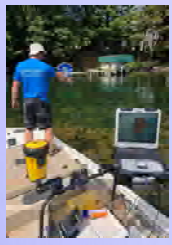
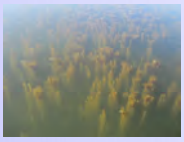
Professional AIS Mapping



Point-Based Mapping

- Single or Few Plants
- Clumps of Plants
- Small Plant Colony





Polygon-Based Mapping

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting

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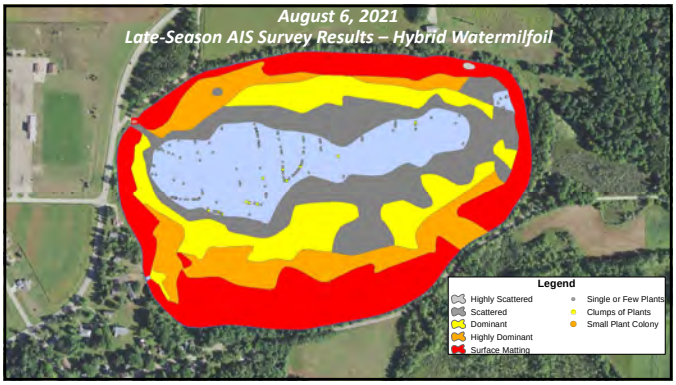

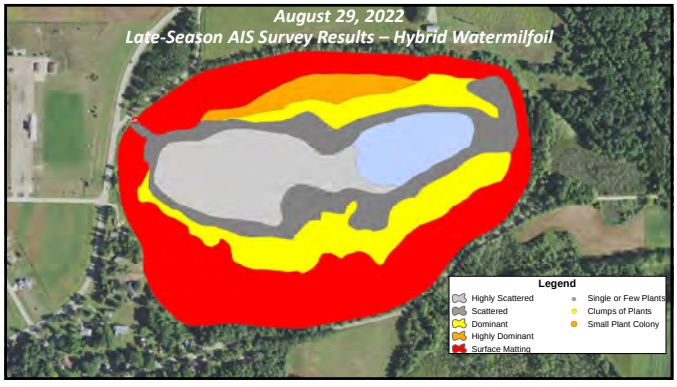

Management Goal:

Assure Recreational Opportunities on Silver Lake

Management Actions

1. **Use integrated pest management to control nuisance aquatic plants and provide access to open water.**
2. **Conduct periodic quantitative vegetation monitoring on Silver Lake.**

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HWM Management History

Verified in Silver Lake in 1993, likely there prior

WDNR Harvesting:
1994 and 1995 (funding ended)

Herbicide Spot Treatments:
2004 – Small areas near properties
2006 – 9.5 acres – 2,4-D, looked good in 2007, but returned 2008

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AIS Management Perspectives

1. **No Coordinated Active Management (Let Nature Take its Course)** This has been implemented since 2008.
   - Lake group does not lead management efforts
   - Encourage nuisance abatement through manual removal by property owners
2. **Minimize navigation and recreation impediment (Nuisance Mgmt)**
   - May be accomplished through mechanical harvesting or herbicide treatment
   - Prioritize areas based on human use & HWM density
3. **Reduce AIS Population on a lake-wide level (Population Management)** This is not applicable at this time.
   - Most applicable for new discoveries, whole-lake herbicide, water level drawdown
   - Not possible on some systems with current management "toolbox"
   - Will not eradicate AIS
   - Set triggers (thresholds) of implementation and tolerance

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Florpyrauxifen-benzyl (ProcellaCOR™)

- New class of synthetic auxin hormone mimics
  - Much different binding affinity than other auxins
  - Use at PPB rate vs PPM
- Shorter contact exposure time (CET) requirement
- Short environmental fate of active ingredient (photolysis)
- Formulated for spot treatments, but Onterra scaling to whole-lake use patterns
- Detailed information on field applications is limited (first in 2019 in WI)

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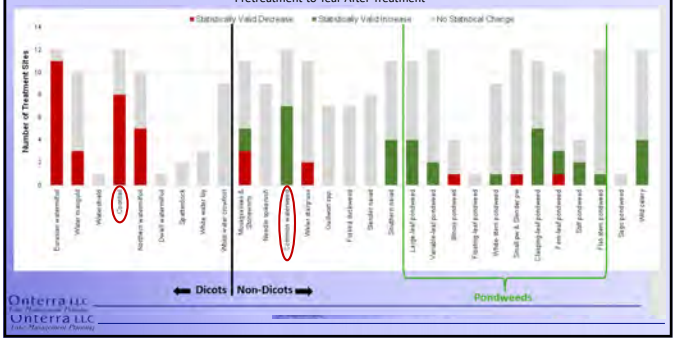
ProcellaCOR™ 2019-2021 Field Trials

Pretreatment to Year After Treatment



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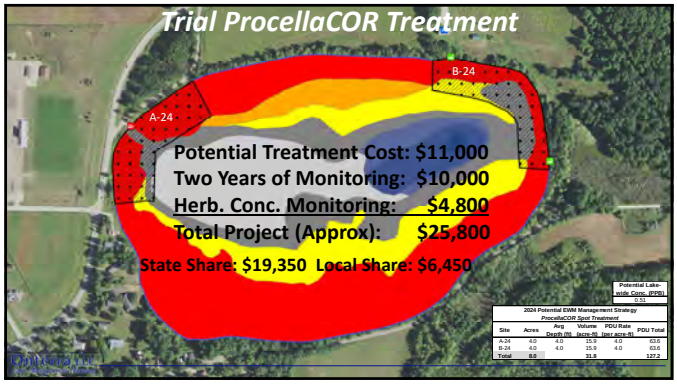
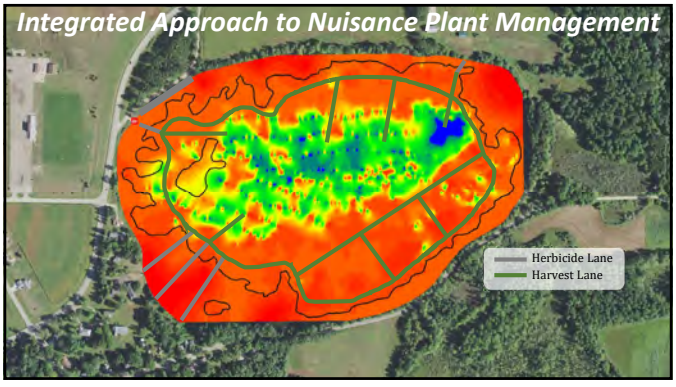
Trial ProcellaCOR Treatment



Integrated Approach to Nuisance Plant Management



Management Goal:

Increase Scandinavia Silver Lake District Capacity to Manage Silver Lake

Management Actions

1. **Create a district-specific communication strategy for district events and business.**
2. **Develop partnerships with other entities that have responsibilities in managing Silver Lake.**
3. **Assure consistent funding for lake management activities on Silver Lake.**

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Overarching Conclusions

Silver Lake's paleoecological study indicated that even prior to European settlement, the lake was healthy, but mesotrophic (moderately productive) and dominated by macrophytes (clear state).

The lake's ecology degraded with human impacts to the watershed, like agriculture, road construction, and urbanization.

Prior to the 2000s, the lake was dominated by planktonic algae (turbid state) and fluctuated between eutrophy and hypereutrophy.

Watershed BMPs, reduction in bullhead numbers, and expanding HWM *flipped* the lake back to a clear state; however, it is still highly productive and the macrophyte population is dominated by disturbance-tolerant species.

Lake-wide reductions in macrophytes would very likely cause Silver Lake to flip back to a turbid state.

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Thank You

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Lake Management Planning

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B

APPENDIX B

Stakeholder Survey Response Charts and Comments

Silver Lake - Anonymous Stakeholder Survey

Surveys Distributed: 192
Surveys Returned: 44
Response Rate: 23%

Silver Lake Property

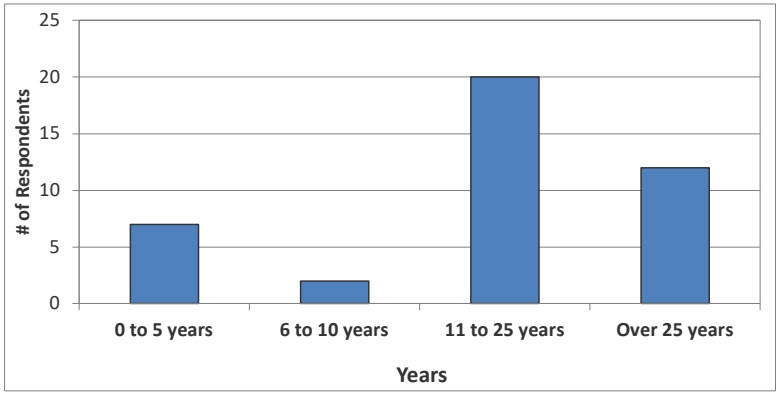
1. Is your property on the lake or off the lake?

Answer Options	Response Percent	Response Count
On the lake	11.9%	5
Off the lake	88.1%	37
answered question		**42**
skipped question		**2**

2. How many years have you owned or rented your property on or near Silver Lake?

Answer Options	Response Count
	41
answered question	**41**
skipped question	**3**

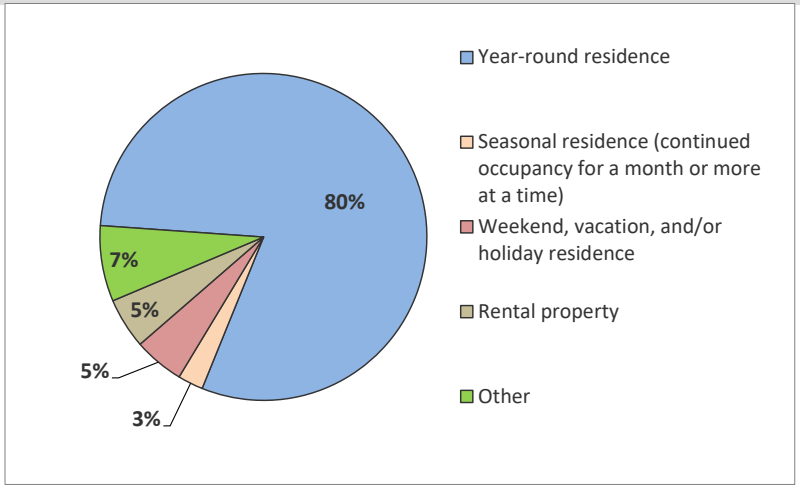
Category (# of years)	Responses	% Response
0 to 5 years	**7**	**17%**
6 to 10 years	**2**	**5%**
11 to 25 years	**20**	**49%**
Over 25 years	**12**	**29%**



3. How is your property on or near Silver Lake used?

Answer Options	Response Percent	Response Count
Year-round residence	80.0%	32
Seasonal residence (continued occupancy for a month or more at a time)	2.5%	1
Weekend, vacation, and/or holiday residence	5.0%	2
Rental property	5.0%	2
Other	7.5%	3
answered question		40
skipped question		4

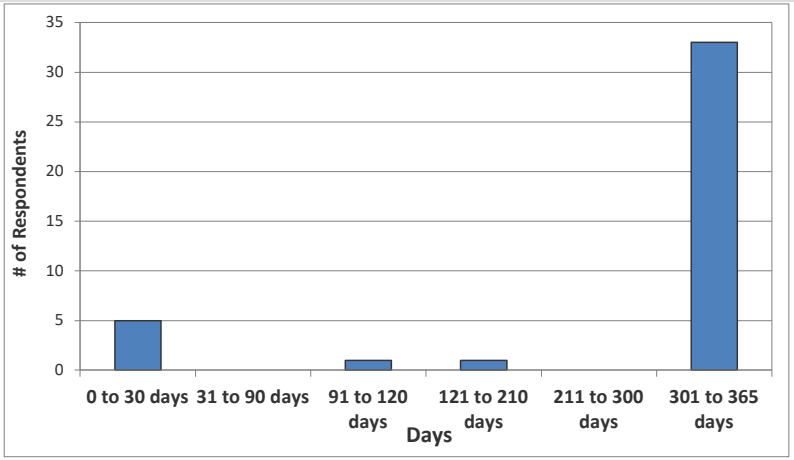
Number	"Other" Responses
1	commercial
2	Commercial rental
3	Lot



4. Considering the past three years, how many days each year is your property used by you or others?

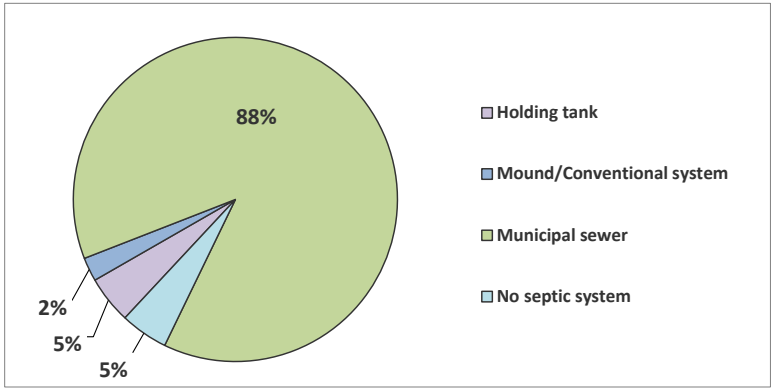
	Response Count
answered question	40
skipped question	4

Category (# of days)	Responses	% Response
0 to 30 days	5	13%
31 to 90 days	0	0%
91 to 120 days	1	3%
121 to 210 days	1	3%
211 to 300 days	0	0%
301 to 365 days	33	83%



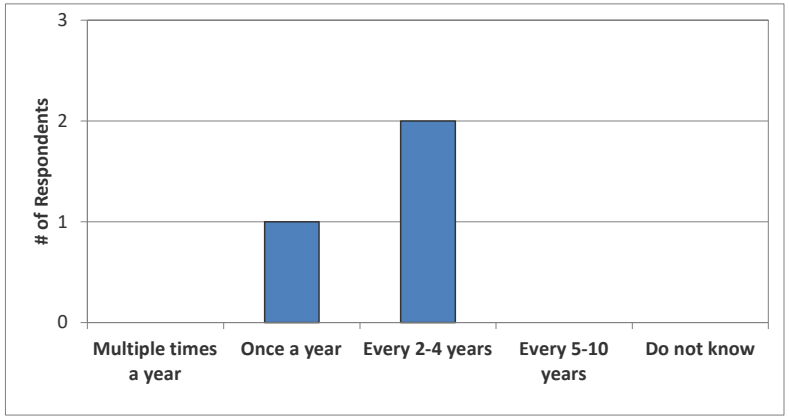
5. What type of septic system does your property utilize?

Answer Options	Response Percent	Response Count
Holding tank	4.8%	2
Mound/Conventional system	2.4%	1
Municipal sewer	88.1%	37
Advanced treatment system	0.0%	0
Do not know	0.0%	0
No septic system	4.8%	2
answered question		42
skipped question		2



6. How often is the septic system on your property pumped?

Answer Options	Response Percent	Response Count
Multiple times a year	0.0%	0
Once a year	33.3%	1
Every 2-4 years	66.7%	2
Every 5-10 years	0.0%	0
Do not know	0.0%	0
answered question		3
skipped question		41

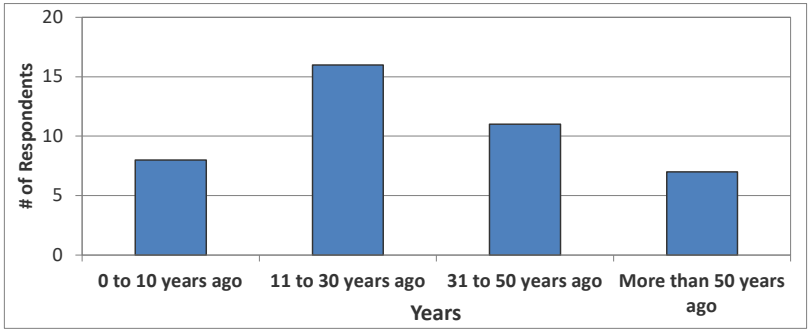


Recreational Activity on Silver Lake

7. How many years ago did you first visit Silver Lake?

Answer Options	Response Count
answered question	42
skipped question	2

Category (# of days)	Responses	% Response
0 to 10 years ago	8	19%
11 to 30 years ago	16	38%
31 to 50 years ago	11	26%
More than 50 years ago	7	17%

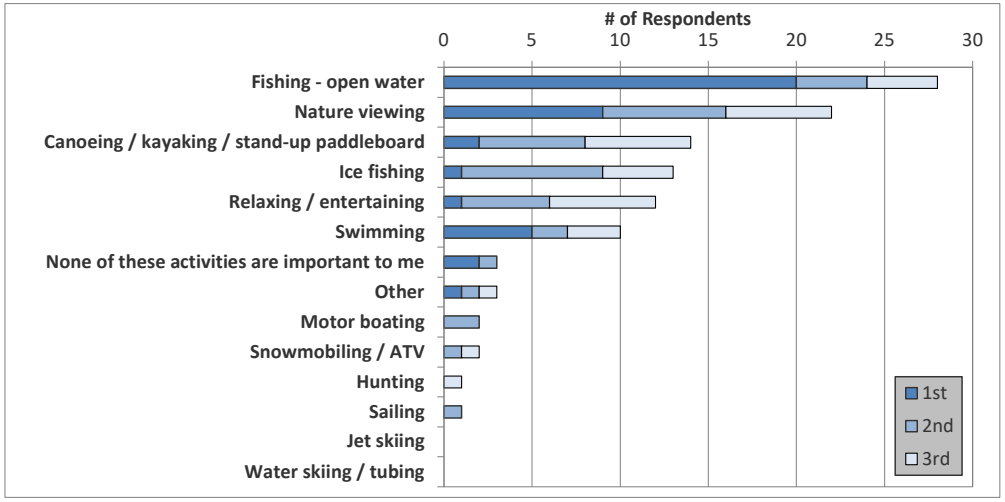


8. Please rank up to three activities that are important reasons for owning your property on or near Silver Lake or would be important to you as a future activity if lake rehabilitation efforts allow for activity. Please select the options below in order of importance with the 1st being most important.

Answer Options	1st	2nd	3rd	Response Count
Fishing - open water	20	4	4	28
Nature viewing	9	7	6	22
Canoeing / kayaking / stand-up paddleboard	2	6	6	14
Ice fishing	1	8	4	13
Relaxing / entertaining	1	5	6	12
Swimming	5	2	3	10
None of these activities are important to me	2	1	0	3
Other	1	1	1	3
Motor boating	0	2	0	2
Snowmobiling / ATV	0	1	1	2
Hunting	0	0	1	1
Sailing	0	1	0	1
Jet skiing	0	0	0	0
Water skiing / tubing	0	0	0	0
		answered question		41
		skipped question		3

Question continued…

Number	"Other" responses
1	Hiking
2	walking
3	Growing fruit trees/gardening.

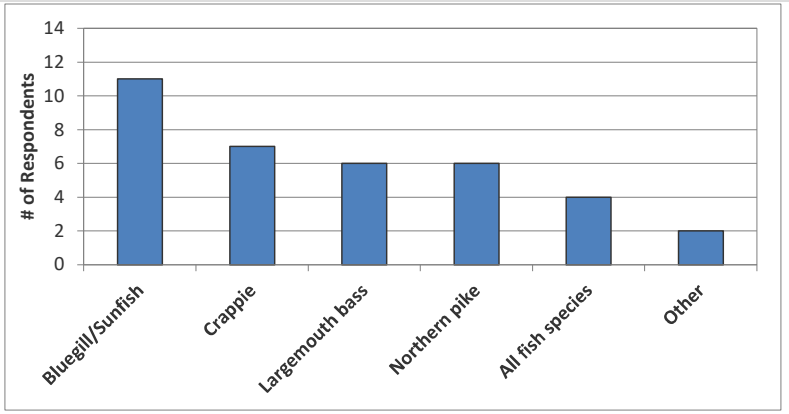


9. Have you personally fished on Silver Lake in the past three years?

Answer Options	Response Percent	Response Count
Yes	26.2%	11
No	73.8%	31
answered question		42
skipped question		2

10. What species of fish do you try to catch on Silver Lake?

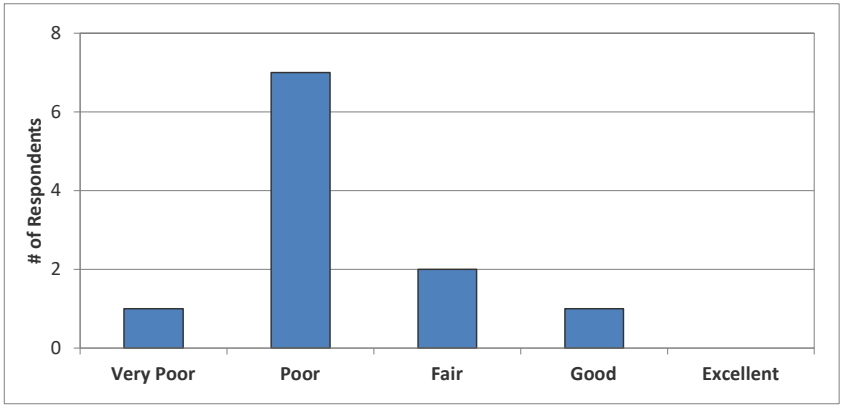
Answer Options	Response Percent	Response Count
Bluegill/Sunfish	100.0%	11
Crappie	63.6%	7
Largemouth bass	54.6%	6
Northern pike	54.6%	6
All fish species	36.4%	4
Other	18.2%	2
answered question		11
skipped question		33



Number	"Other" responses
1	Walleye
2	Perch

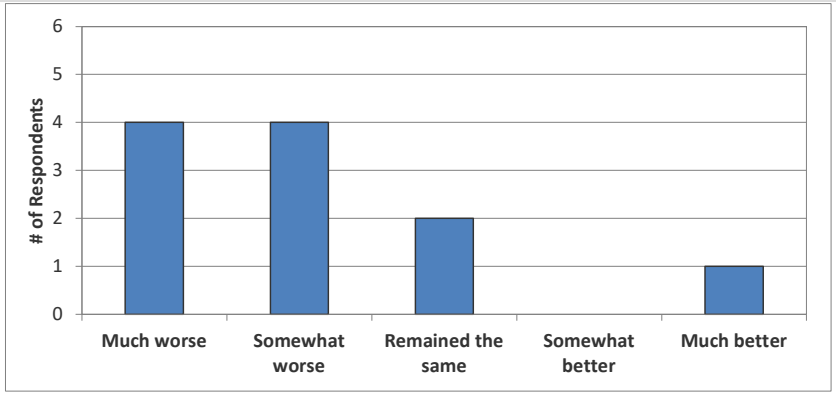
11. How would you describe the current quality of fishing on Silver Lake?

Answer Options	Very Poor	Poor	Fair	Good	Excellent	Response Count
	1	7	2	1	0	11
				answered question		11
				skipped question		33



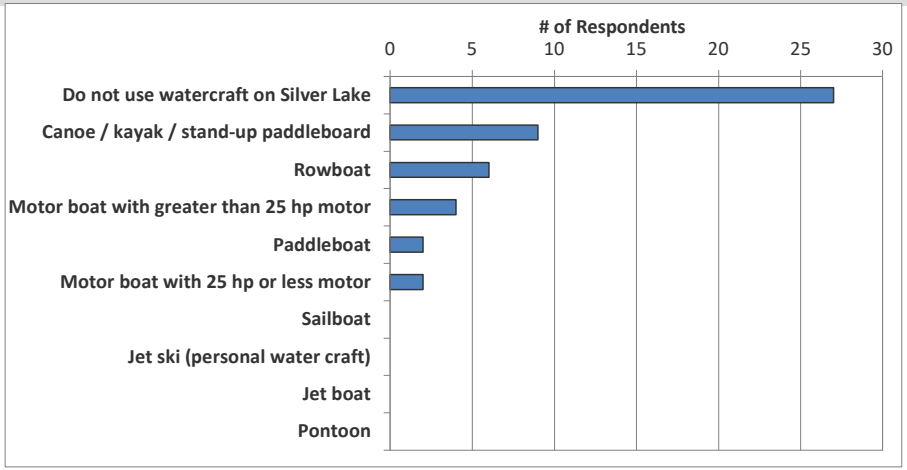
12. How has the quality of fishing changed on Silver Lake since you have started fishing the lake?

Answer Options	Much worse	Somewhat worse	Remained the same	Somewhat better	Much better	Response Count
	4	4	2	0	1	11
					answered question	**11**
					skipped question	**33**



13. What types of watercraft do you currently use on Silver Lake?

Answer Options	Response Percent	Response Count
Do not use watercraft on Silver Lake	64.3%	27
Canoe / kayak / stand-up paddleboard	21.4%	9
Rowboat	14.3%	6
Motor boat with greater than 25 hp motor	9.5%	4
Paddleboat	4.8%	2
Motor boat with 25 hp or less motor	4.8%	2
Sailboat	0.0%	0
Jet ski (personal water craft)	0.0%	0
Jet boat	0.0%	0
Pontoon	0.0%	0
answered question		**42**
skipped question		**2**



14. Do you use your watercraft on waters other than Silver Lake?

Answer Options	Response Percent	Response Count
Yes	43.2%	16
No	56.8%	21
answered question		37
skipped question		7

15. What is your typical cleaning routine after using your watercraft on waters other than Silver Lake?

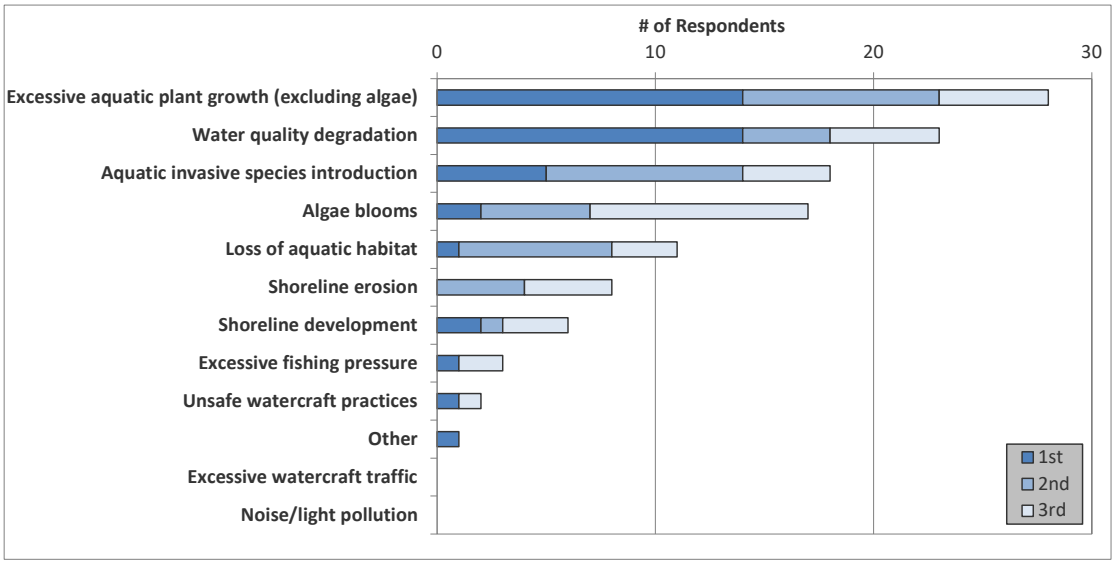
Answer Options	Response Percent	Response Count
Remove aquatic hitch-hikers (ex. - plant material, clams, mussels)	80.0%	12
Drain bilge	40.0%	6
Rinse boat	40.0%	6
Power wash boat	6.7%	1
Apply bleach	6.7%	1
Air dry boat for 5 or more days	66.7%	10
Do not clean boat	0.0%	0
Other		1
answered question		15
skipped question		29

Number	"Other" Responses
1	My craft stays on the lake year round.

16. From the list below, please rank your top three concerns regarding Silver Lake, with the 1st being your top concern.

Answer Options	1st	2nd	3rd	Response Count
Excessive aquatic plant growth (excluding algae)	14	9	5	28
Water quality degradation	14	4	5	23
Aquatic invasive species introduction	5	9	4	18
Algae blooms	2	5	10	17
Loss of aquatic habitat	1	7	3	11
Shoreline erosion	0	4	4	8
Shoreline development	2	1	3	6
Excessive fishing pressure	1	0	2	3
Unsafe watercraft practices	1	0	1	2
Other	1	0	0	1
Excessive watercraft traffic	0	0	0	0
Noise/light pollution	0	0	0	0
			answered question	**41**
			skipped question	**3**

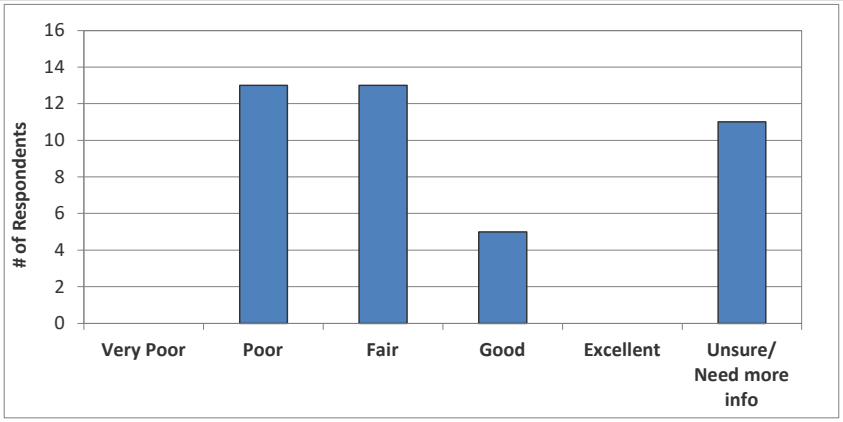
Number	"Other" responses
1	fish habitat



Silver Lake Current and Historic Condition, Health and Management

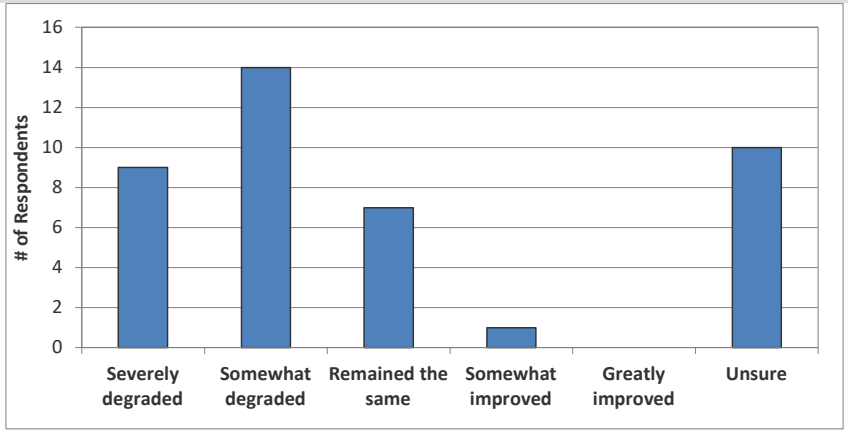
17. How would you describe the overall current water quality of Silver Lake?

Answer Options	Very Poor	Poor	Fair	Good	Excellent	Unsure/ Need more info	Response Count
	0	13	13	5	0	11	42
						answered question	**42**
						skipped question	**2**



18. How has the overall water quality changed in Silver Lake since you first visited the lake?

Answer Options	Severely degraded	Somewhat degraded	Remained the same	Somewhat improved	Greatly improved	Unsure	Response Count
	9	14	7	1	0	10	41
						answered question	**41**
						skipped question	**3**



19. Considering your answer(s) above, which of the following answers is the single most important aspect when considering water quality?

Answer Options	Response Percent	Response Count
Water clarity (clearness of water)	35.0%	14
Water color	0.0%	0
Aquatic plant growth (not including algae blooms)	50.0%	20
Algae blooms	2.5%	1
Smell/odors	5.0%	2
Water level	0.0%	0
Fish kills	7.5%	3
Other	0.0%	0
	answered question	**40**
	skipped question	**4**

20. Before reading the statement above, had you ever heard of aquatic invasive species?

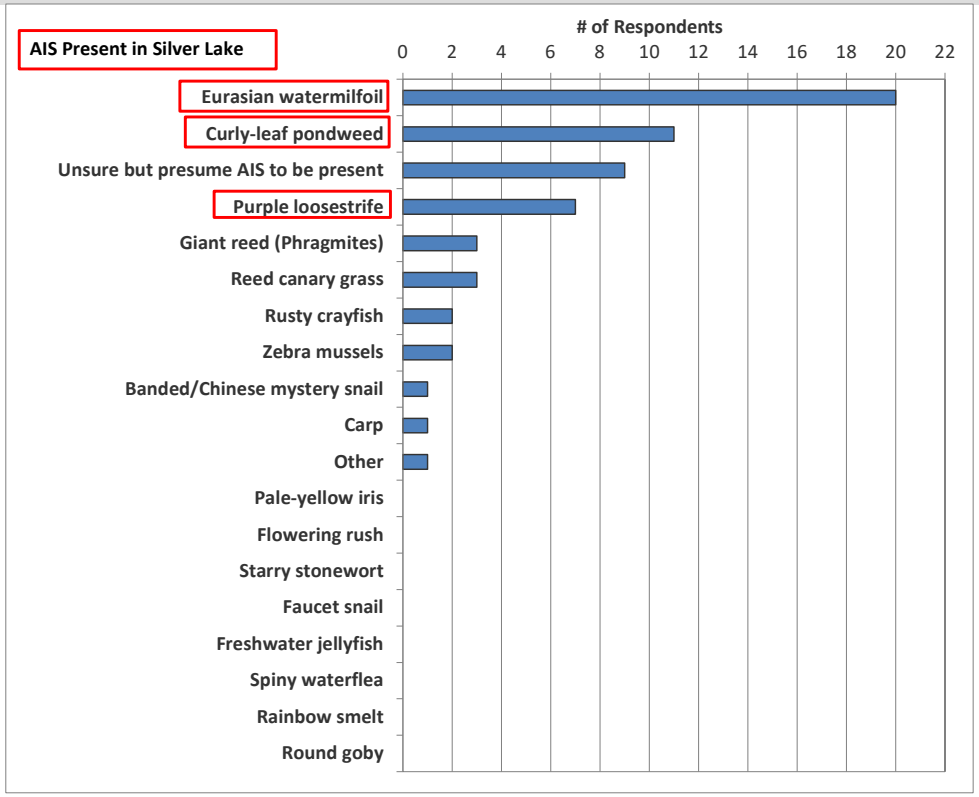
Answer Options	Response Percent	Response Count
Yes	85.0%	34
No	15.0%	6
answered question		40
skipped question		4

21. Do you believe aquatic invasive species are present within Silver Lake?

Answer Options	Response Percent	Response Count
Yes	86.7%	26
I think so but am not certain	0.0%	0
No	13.3%	4
answered question		30
skipped question		14

22. Which aquatic invasive species do you believe are in Silver Lake?

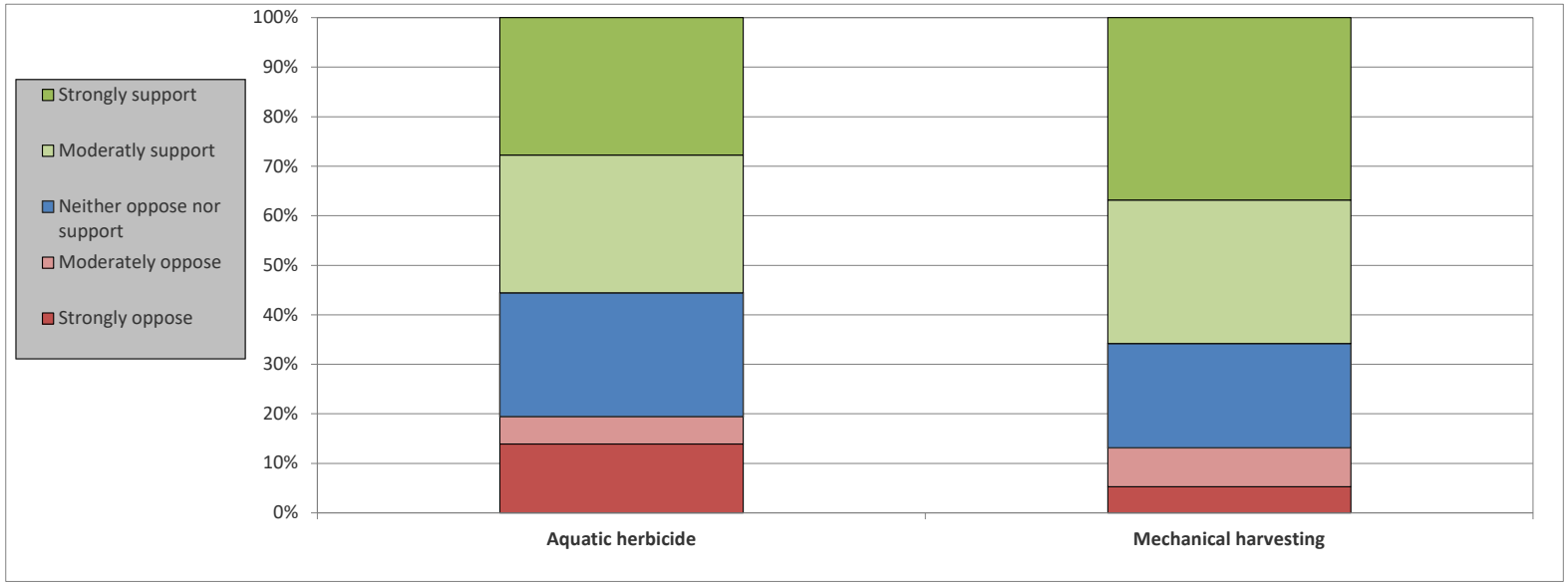
Answer Options	Response Percent	Response Count
Eurasian watermilfoil	71.4%	20
Curly-leaf pondweed	39.3%	11
Unsure but presume AIS to be present	32.1%	9
Purple loosestrife	25.0%	7
Giant reed (Phragmites)	10.7%	3
Reed canary grass	10.7%	3
Rusty crayfish	7.1%	2
Zebra mussels	7.1%	2
Banded/Chinese mystery snail	3.6%	1
Carp	3.6%	1
Other	3.6%	1
Pale-yellow iris	0.0%	0
Flowering rush	0.0%	0
Starry stonewort	0.0%	0
Faucet snail	0.0%	0
Freshwater jellyfish	0.0%	0
Spiny waterflea	0.0%	0
Rainbow smelt	0.0%	0
Round goby	0.0%	0
answered question		28
skipped question		16



Number	"Other" responses
1	Don't know don't use

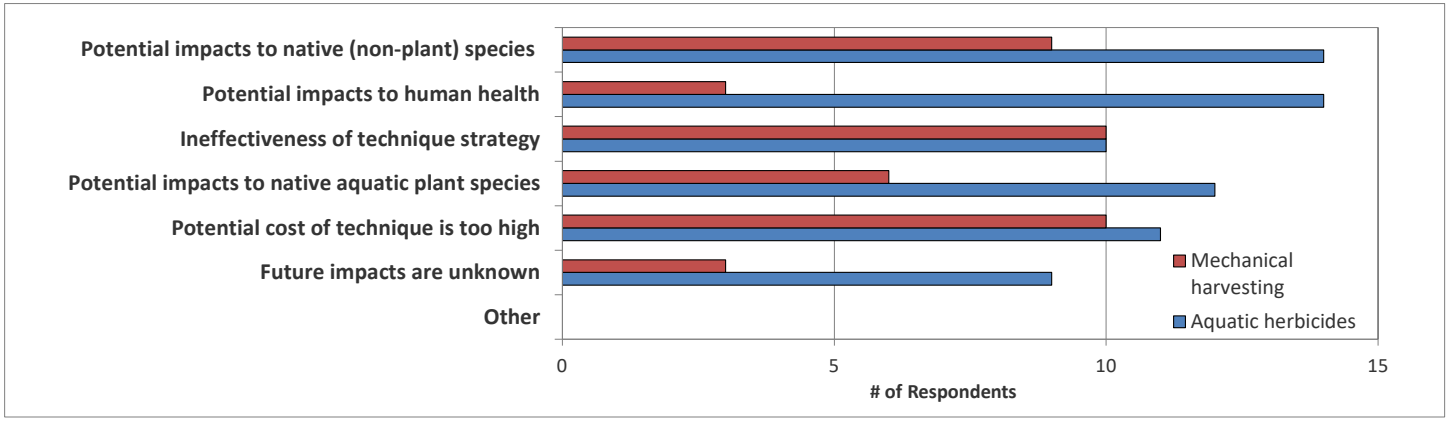
23. What is your level of support or opposition for the future use of aquatic herbicides and mechanical harvesting to manage Eurasian watermilfoil in Silver Lake?

Answer Options	Strongly oppose	Moderately oppose	Neither oppose nor support	Moderatly support	Strongly support	Response Count
Aquatic herbicide	5	2	9	10	10	36
Mechanical harvesting	2	3	8	11	14	38
					answered question	**38**
					skipped question	**6**



24. What concerns, if any, do you have for the future use of aquatic herbicides and/or mechanical harvesting to target Eurasian watermilfoil in Silver Lake?

Answer Options	Aquatic herbicides	Mechanical harvesting	Response Count
Other	0	0	0
Future impacts are unknown	9	3	9
Potential cost of technique is too high	11	10	12
Potential impacts to native aquatic plant species	12	6	12
Ineffectiveness of technique strategy	10	10	12
Potential impacts to human health	14	3	14
Potential impacts to native (non-plant) species such as fish, insects, etc.	14	9	15
		answered question	**23**
		skipped question	**21**



Number	"Other" responses
1	Don't know

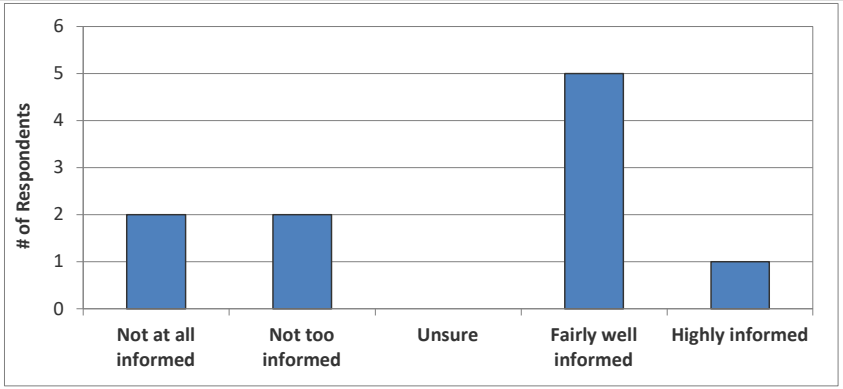
Scandinavia Silver Lake District

25. Before reading the above, had you ever heard of the Scandinavia Silver Lake District ?		
Answer Options	**Response Percent**	**Response Count**
Yes	64.3%	27
No	35.7%	15
answered question		**42**
skipped question		**2**

26. What is your membership status with the Scandinavia Silver Lake District?		
Answer Options	**Response Percent**	**Response Count**
Current member	34.6%	9
Former member	3.9%	1
Never been a member	61.5%	16
answered question		**26**
skipped question		**18**

27. How informed has (or had) the Scandinavia Silver Lake District kept you regarding issues with Silver Lake and its management?

Answer Options	Not at all informed	Not too informed	Unsure	Fairly well informed	Highly informed	Response Count
	2	2	0	5	1	10
					answered question	**10**
					skipped question	**34**

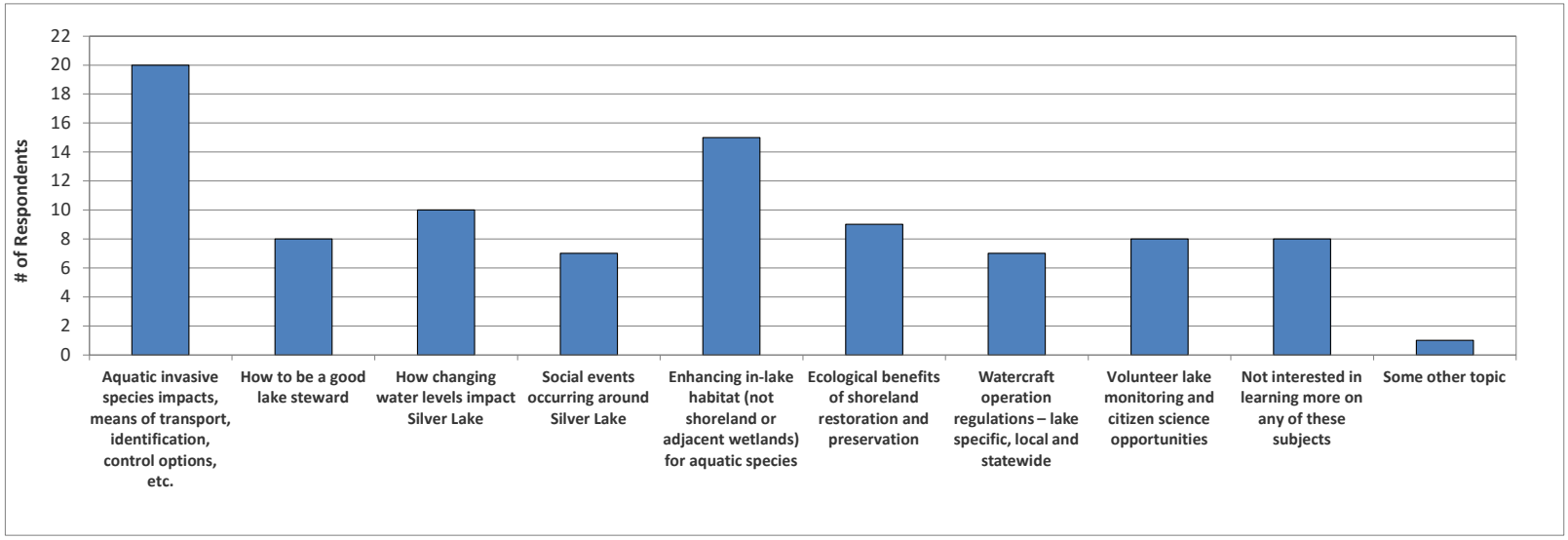


28. Stakeholder education is an important component of every lake management planning effort. Which of these subjects would you like to learn more about?

Answer Options	Response Percent	Response Count
Aquatic invasive species impacts, means of transport, identification, control options, etc.	58.8%	20
How to be a good lake steward	23.5%	8
How changing water levels impact Silver Lake	29.4%	10
Social events occurring around Silver Lake	20.6%	7
Enhancing in-lake habitat (not shoreland or adjacent wetlands) for aquatic species	44.1%	15
Ecological benefits of shoreland restoration and preservation	26.5%	9
Watercraft operation regulations – lake specific, local and statewide	20.6%	7
Volunteer lake monitoring and citizen science opportunities	23.5%	8
Not interested in learning more on any of these subjects	23.5%	8
Some other topic	2.9%	1
	answered question	**34**
	skipped question	**10**

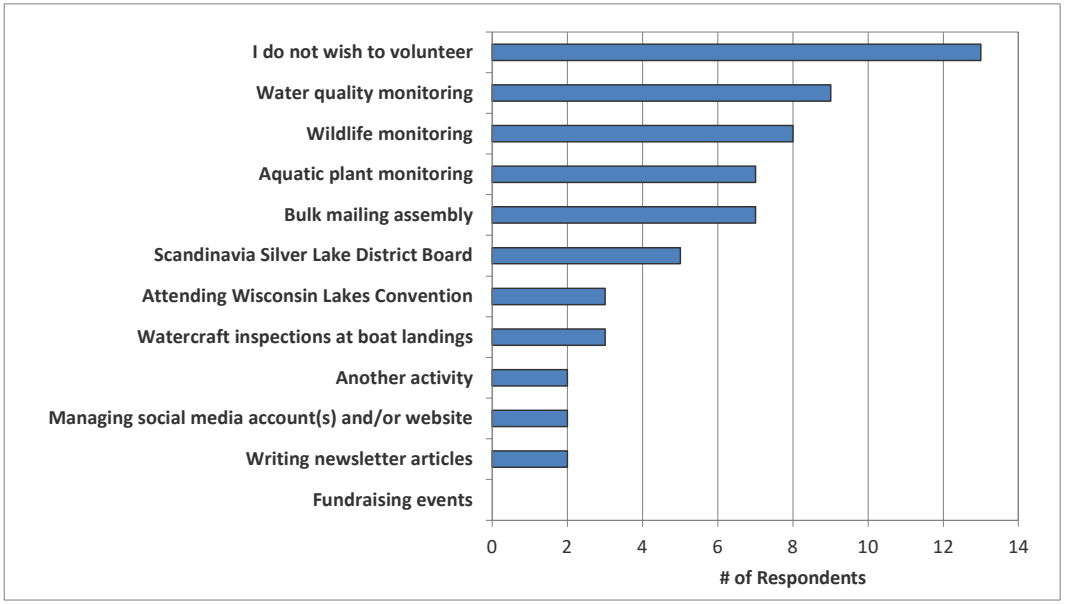
Number	Other (please specify)
1	Water qualities of the Scandinavia Mill Pond

Question continued…


# of Respondents
22
20
18
16
14
12
10
8
6
4
2
0
Aquatic invasive species impacts, means of transport, identification, control options, etc.
How to be a good lake steward
How changing water levels impact Silver Lake
Social events occurring around Silver Lake
Enhancing in-lake habitat (not shoreland or adjacent wetlands) for aquatic species
Ecological benefits of shoreland restoration and preservation
Watercraft operation regulations – lake specific, local and statewide
Volunteer lake monitoring and citizen science opportunities
Not interested in learning more on any of these subjects
Some other topic

29. The effective management of your lake will require the cooperative efforts of numerous volunteers. Please select the activities you would be willing to participate in if the Scandinavia Silver Lake District requires additional assistance.

Answer Options	Response Percent	Response Count
Fundraising events	0.0%	0
Writing newsletter articles	6.1%	2
Managing social media account(s) and/or webs	6.1%	2
Another activity	6.1%	2
Watercraft inspections at boat landings	9.1%	3
Attending Wisconsin Lakes Convention	9.1%	3
Scandinavia Silver Lake District Board	15.2%	5
Bulk mailing assembly	21.2%	7
Aquatic plant monitoring	21.2%	7
Wildlife monitoring	24.2%	8
Water quality monitoring	27.3%	9
I do not wish to volunteer	39.4%	13
answered question		**33**
skipped question		**11**



Number	"Another activity" Responses
1	Wherever needed
2	Construct informational kiosk at the boat landing.

30. Please feel free to provide written comments concerning Silver Lake, its current and/or historic condition and its management.

Answer Options	Response Count
	17
answered question	**17**
skipped question	**27**

Number	Response Text
1	I have lived here for 12 years and this is the first time I have been given ANY information for or about Silver Lake. Better communication would be a great bump in township pride. The Corn Roast has become a repetitive joke and could incorporate the lake to bring in funds and awareness of future projects for the lake and trail.
2	I'm 90 years young and have never used the lake. *Name removed.*
3	I am very glad to see so many people that are truly interested in helping and caring about what is going on and about trying to preserve and bringing back the beauty and the natural state, that Silver Lake used to be in.
4	Please make a beach.

5	Need to get rid of the crap aquatic plants.
6	The Lake District in Iola has spent hundreds of thousands of dollars on Lake Iola and the lake is worse now than in the late 70's. It is shallower than ever. The same process is happening to Silver Lake. No amount of weeding is going to stop the process of silt accumulating on the bottom and making the lake more shallow. Nature will turn Silver Lake into a marsh, which is nothing we can do to stop. Also Silver Lake is a town and village property. I do not want, nor believe the Village should be taxed on that property without town involvement. Finally, once you start this process it will not end. The cost will continually go up. In this time of increasing inflation, we should not take on added tax burdens.
7	Glad of this effort and moving forward on restoration of the lake.
8	I am 85 years old undergoing cancer treatment.
9	The on again off again management of Silver Lake has resulted in the present condition of the lake. The Silver Lake District "the Village Board" because of lack of interest is to blame for this. The ideal solution would be to separate the Village Board as the responsible party. Success is dependent on a group of individuals willing to uphold the bylaws of the district and be aware of problems and pursue management practices that will reconcile these concerns. When organized in 1977 the Village Board was the interested party and wanted a solution to Silver Lake's poor condition at the time. Their interest resulted in a favorable outcome. The purview of Silver Lake history makes it obvious that an active interest and a timely approach could have remedied the present situation at a considerable savings than what is presently anticipated.
10	I feel that other measures should be considered before pouring a lot of money into a lake that has become more of a runoff collection pond from area farm fields, state highway and personal lawns. If these areas are not addressed I feel the money, time and effort into trying to make the lake better is wasteful.
11	It would be great to have a beach area. I would also like it if the weeds were kept under control.
12	Silver Lake is an irreplaceable asset for all to enjoy and a osprey nesting site. Jorgen's Park for people of all ages with a shelter, numerous trails, dog walking accessible. A wonderful opportunity in nature to nurture mind body and soul.
13	Thank you for this opportunity.
14	I support taking steps to preserve Silver Lake. I have lived here many years, and am aware of lake quality deteriorating. How sad. I certainly don't want Silver Lake to follow in the footsteps of Gurholt Lake! You hardly know there is a lake there. God is not going to give us another lake! It is our responsibility to preserve Silver Lake.
15	While I personally have no interest in working on the lake, I do think it is important and it is reassuring to hear about this organization and the effort being put into it.
16	Dredge the lake, thin out weeds!
17	Thank you for all you do!

C

APPENDIX C

Water Quality Data

Silver Lake

	Secchi (feet)				Chlorophyll-*a* (µg/L)				Total Phosphorus (µg/L)			
	Growing Season		Summer		Growing Season		Summer		Growing Season		Summer	
Year	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean
1988					1	34.0	1	34.0	2	95.0	2.0	95.0
1989	3	4.3	3	4.3	3	54.3	2	66.5	4	127.8	3.0	121.7
1990	3	5.6	3	5.6	2	14.0	2	14.0	3	74.0	3.0	74.0
1991	4	10.7	3	10.5	4	6.5	3	6.0	5	65.6	4.0	71.5
1992	1	6.6	1	6.6	4	22.5	3	28.3	4	62.3	3.0	64.7
1993	3	5.3	3	5.3	3	24.4	3	24.4	3	67.3	3.0	67.3
1994	1	6.0	1	6.0	3	21.0	3	21.0	3	64.0	3.0	64.0
1995	4	5.3	3	5.4	5	46.7	4	54.1	4	58.8	3.0	61.3
1996	4	6.3	2	6.1	4	22.1	2	31.5	4	59.5	2.0	59.5
1997	1	2.0	1	2.0	4	44.5	3	56.8	4	66.5	3.0	82.0
1998	4	4.4	3	3.5	6	23.8	3	43.1	3	72.0	2.0	99.5
1999	4	3.7	3	1.4	2	41.4	1	79.5	2	56.0	1.0	88.0
2000	0		0		0		0		0		0.0	
2001	8	5.7	4	6.9	0		0		0		0.0	
2002	0		0		0		0		0		0.0	
2003	0		0		0		0		0		0.0	
2004	0		0		0		0		0		0.0	
2005	2	8.3	1	9.6	3	8.4	2	9.4	3	27.7	2.0	32.5
2006	0		0		2	3.6	1	4.3	3	41.7	2.0	29.5
2007	1	8.3	0		1	9.9	0		1	31.0	0.0	
2008	1	7.5	0		1	4.1	1	4.1	2	28.5	1.0	33.0
2009	3	5.4	2	5.2	3	9.2	2	11.5	4	37.3	2.0	39.0
2010	2	6.9	1	7.3	3	5.7	2	5.9	4	27.5	2.0	29.5
2011	4	6.1	2	5.6	3	14.0	2	16.4	4	34.3	2.0	38.5
2012	0		0		3	6.1	2	6.8	4	27.3	2.0	28.5
2013	0		0		3	18.5	2	13.9	4	39.5	2.0	40.9
2014	1	11.0	0		4	2.0	3	2.7	5	18.9	3.0	19.3
2015	2	6.5	1	6.8	3	1.9	2	2.0	4	27.2	2.0	28.1
2016	0		0		3	1.2	2	1.3	4	19.4	2.0	19.6
2017	1	5.0	1	5.0	3	6.7	2	8.8	4	26.8	2.0	33.8
2018	2	6.5	2	6.5	3	5.5	2	4.2	4	20.9	2.0	22.7
2019	6	9.0	3	8.8	3	10.1	2	13.5	4	27.1	2.0	39.4
2020	3	7.3	2	7.5	3	2.0	2	1.9	3	18.6	2.0	19.9
2021	3	7.0	1	6.0	3	3.6	2	3.9	4	19.7	2.0	20.4
All Years (Weighted)		6.0		5.6		18.5		23.1		48.3		56.3
SSL Median				8.5				4.7				18.0
NCHF Ecoregion Median				5.3				15.2				52.0

D

APPENDIX D

Point-Intercept Aquatic Macrophyte Survey Data

Silver Lake, Waupaca Cty.

	Scientific Name	Common Name	LFOO (%)				2005-2012		2012-2020	
			2005	2012	2020	Year_4	% Change	Direction	% Change	Direction
Dicots	*Ceratophyllum demersum*	Coontail	93.6	83.8	90.6	0.0	-10.4	▼	8.1	▲
	Myriophyllum spicatum	Eurasian watermilfoil	42.1	61.8	54.7	0.0	46.9	▲	-11.6	▼
	Myriophyllum sibiricum	Northern watermilfoil	0.6	0.0	0.0	0.0	-100.0	▼		-
Non-dicots	*Elodea canadensis*	Common waterweed	44.4	72.3	57.1	0.0	62.6	▲	-21.0	▼
	Najas flexilis	Slender naiad	0.0	9.8	14.1	0.0		▲	43.7	▲
	Potamogeton praelongus	White-stem pondweed	2.3	3.5	15.3	0.0	48.3	▲	341.0	▲
	Stuckenia pectinata	Sago pondweed	5.8	5.2	2.9	0.0	-11.0	▼	-43.5	▼
	Chara spp.	Muskgrasses	0.6	1.7	2.4	0.0	196.5	▲	35.7	▲
	Potamogeton crispus	Curly-leaf pondweed	0.6	3.5	1.2	0.0	493.1	▲	-66.1	▼
	Potamogeton zosteriformis	Flat-stem pondweed	1.2	0.6	1.8	0.0	-50.6	▼	205.3	▲
	Wolffia columbiana	Common watermeal	0.6	0.0	0.6	0.0	-100.0	▼		▲
	Spirodela polyrhiza	Greater duckweed	0.0	0.6	0.6	0.0		▲	1.8	▲
	Eleocharis acicularis	Needle spikerush	1.2	0.0	0.0	0.0	-100.0	▼		-
	Typha latifolia	Broad-leaved cattail	0.6	0.0	0.0	0.0	-100.0	▼		-

▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
▲ or ▼ = Change Not Statistically Valid (Chi-square; α = 0.05)

E

APPENDIX E

Fisheries Reports and Data Summaries

2017 Spring Electrofishing (SEII) Summary Report

Silver Lake (WBIC 198800)

Waupaca County

Introduction and Survey Objectives

In 2017, the Department of Natural Resources conducted a one night electrofishing survey of Silver Lake in order to provide insight and direction for the future fisheries management of this water body. Primary sampling objectives of this survey were to characterize species composition, relative abundance, and size structure. The following report is a brief summary of that survey, the general status of the fish populations and future management options for Silver Lake.

Acres: 71
Shoreline Miles: 1.3
Maximum Depth (feet): 17
Lake Type: Seepage
Public Access: One Public Boat Launch
Regulations: Statewide Default Regulations

Survey Information							
Site location	Survey Date	Water Temperature (°F)	Target Species	Total Miles Shocked	Number of Stations	Gear	Number of Netters
Silver Lake	5/23/2017	58	All	1.27	3	Boomshocker	2

WISCONSIN DNR CONTACT INFO.

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647 Lakeland Rd.
Shawano, WI 54166

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Elliot Hoffman phone and email: 715-526-4231; elliot.hoffman@wisconsin.gov

Survey Method

- Silver Lake was sampled according to spring electrofishing (SEII) protocols as outlined in the statewide lake assessment plan. The primary objective for this sampling period was to count and measure adult bass and panfish. Other gamefish may be sampled but are considered by-catch as part of this survey.
- The entire shoreline was sampled with a boomshocker. All fish captured were identified to species and all gamefish and panfish were measured for length. A subsample of fish were weighed and age structures collected for age and growth analysis.
- Fish metrics used to describe fish populations include proportional stock density, catch per unit effort, length frequency distribution, and mean age at length.

Fish Metric Descriptions
PSD, CPUE, LFD, and Growth

Proportional Stock Density (PSD) is an index used to describe size structure of fish populations. It is calculated by dividing the number of quality size fish by the number of stock size fish for a given species. PSD values between 40 - 60 generally describe a balanced fish population.

Catch per unit effort (CPUE) is an index used to measure fish population relative abundance, which simply refers to the number of fish captured per unit of distance or time. For electrofishing surveys, we typically quantify CPUE by the number and size of fish per mile of shoreline. CPUE indexes are compared to statewide data by percentiles. For example, if a CPUE is in the 90th percentile, it is higher than 90% of the other CPUEs in the state.

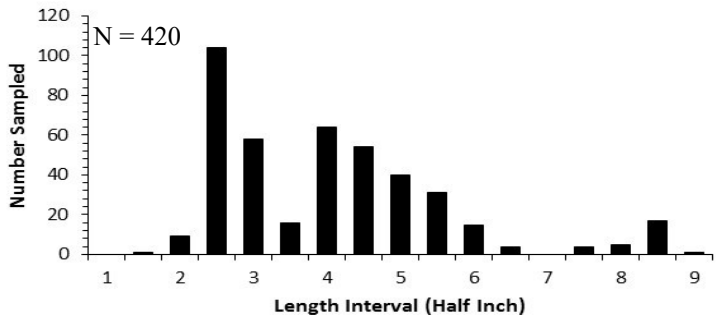
Length frequency distribution (LFD) is a graphical representation of the number of fish captured by half inch or one inch size intervals. Smaller fish (or younger age classes) may not always be represented in the length frequency due to different habitat usage or sampling gear limitations.

Mean Age at Length is an index used to assess fish growth. Growth structures (otoliths, spines, or scales) are collected from a specified length bin of interest (e.g., 6.5 - 7.5 inches for bluegill). Mean age is compared to statewide data by percentile with growth characterized by the following benchmarks: slow (<33rd percentile); moderate (33rd to 66th percentile); and fast (>66th percentile).

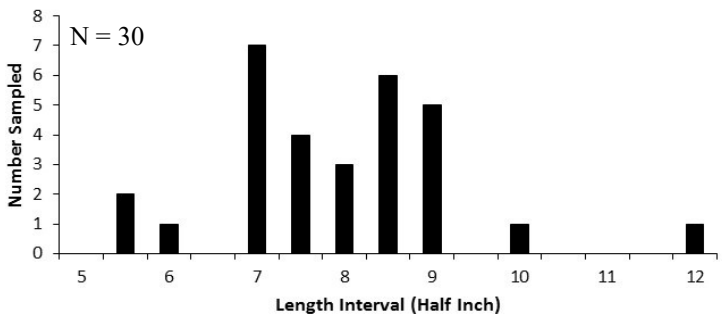
Size Structure Metrics									
Species	Total	Average Length (inches)	Length Range (inches)	Stock and Quality Size (inches)	Stock No	Quality No	PSD	Percentile Rank	Size Rating
BLUEGILL	420	4.3	2.0 - 9.0	3.0 and 6.0	307	46	15	28	Low
BLACK CRAPPIE	30	8.2	5.8 - 12.4	5.0 and 8.0	30	16	53	64	Moderate
LARGEMOUTH BASS	85	10.8	6.5 - 16.6	8.0 and 12.0	79	19	24	13	Low
PUMPKINSEED	54	5.3	2.8 - 7.5	3.0 and 6.0	50	15	30	57	Moderate

Abundance Metrics							
Species	CPUE Total (number per mile)	Percentile Rank	Overall Abundance Rating	Length Index	Length Index CPUE	Length Index Percentile Rank	Length Index Abundance Rating
BLUEGILL	420.0	95	High	≥ 7.0 inches	27.0	83	High
BLACK CRAPPIE	30.0	84	High	≥ 10.0 inches	2.0	80	High
LARGEMOUTH BASS	66.9	91	High	≥ 14.0 inches	9.4	85	High
PUMPKINSEED	54.0	94	High	≥ 7.0 inches	5.0	90	High

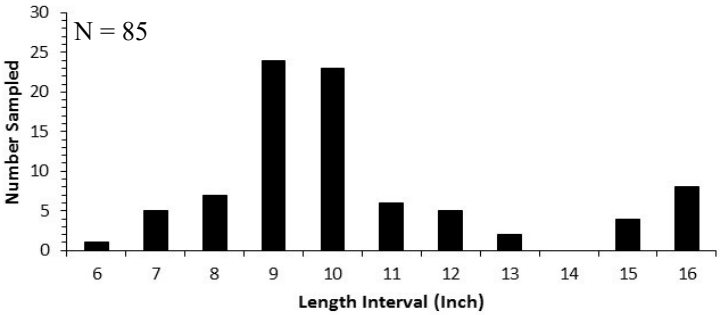
Bluegill Length Frequency



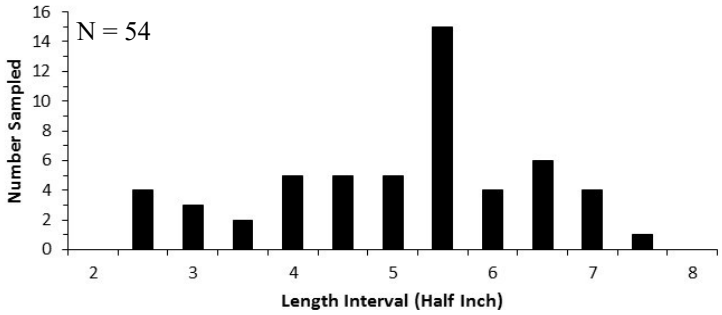
Black Crappie Length Frequency



Largemouth Bass Length Frequency



Pumpkinseed Length Frequency



Summary

- A total of 599 fish from six species were collected during our survey. The most frequently encountered and common species were bluegill (420), largemouth bass (85), and pumpkinseed (54).
- Other fish species sampled in lower abundance include black crappie (30), northern pike (9), and green sunfish (1).
- All fish species captured were native species.
- Largemouth bass were the dominant gamefish captured in our survey. Largemouth bass densities were high and the majority of the individuals captured were ≤ 12 inches. Silver Lake also provides a quality largemouth bass fishery as 9.4 largemouth bass > 14.0 inches were captured per mile of electrofishing, which ranks at the 85th percentile statewide.
- Only nine northern pike were captured. However, fyke netting would be a more appropriate sampling technique to assess the northern pike population.
- The panfish population is comprised of bluegill, black crappie, pumpkinseed, and green sunfish. Bluegill were found at high densities. The majority of the individuals were < 6 inches in length. Bluegill 5.5 – 6.5 inches long grew very quickly. Given the high density of small individuals combined with the fast growth rates, it is likely that Silver Lake went through a winterkill 4-5 years ago and the bluegill population is dominated by individuals born in the last three years. Despite a population dominated by small individuals, Silver Lake has a high density of harvestable size bluegills when compared to other lakes in WI.
- Silver Lake supports high quality black crappie and pumpkinseed populations, with high densities of harvestable sized fish.
- During the last survey in 2009, only black bullhead, bluegill, and bluntnose minnow were captured. It is likely that Silver Lake went through a significant winterkill shortly before 2009. The current fishery is a marked improvement since the last 2009 survey.

Growth Metrics						
Species	Total (N)	Length Bin (inches)	Mean Age (years)	Age Range (years)	Percentile Rank	Growth Rating
BLUEGILL	9	5.5 - 6.4	3	3	100th	Fast
BLACK CRAPPIE	6	7.5 - 8.4	7.2	3 - 8	4th	Slow

Management Options

This survey was primarily intended to assess largemouth bass and panfish populations. Other species are captured but different survey techniques are typically used to better assess their population metrics. Therefore, management recommendations are focused on bass and panfish.

Largemouth Bass

- The largemouth bass population was dominated by smaller individuals. Efforts should be made to control invasive submersed aquatic vegetation. If density of plants is too high, predators can not effectively forage and their growth rates slow. If future surveys show the bass population continues to maintain high densities dominated by smaller individuals, a special regulation aimed at harvest of smaller individuals should be considered.

Panfish

- The bluegill population was dominated by smaller individuals. Efforts should be made to control dense invasive submersed aquatic vegetation. Given the high densities of bluegill observed in 2017, it is not likely that the fast panfish growth rates observed will continue into the future because of increased competition for resources. If vegetation densities are lowered, predators will be able to reduce panfish densities and there will be more resources available for each individual.

Other Management Objectives

- Work with WDNR staff and local lake management organizations to manage invasive aquatic plants as necessary. High densities of invasive plants often inhibit the ability of predators to effectively forage resulting in slow growing predator populations. Additionally prey fish (e.g., bluegill) populations can become overabundant and slow growing when predators cannot effectively forage on them.

F

APPENDIX F

WDNR Plan Approval Letter

From: Johnson, Ted M - DNR <TedM.Johnson@wisconsin.gov>
Sent: Wednesday, September 14, 2022 2:12 PM
To: Tim Hoyman
Cc: Kristy Stacy; Carl Lantz; Mikulyuk, Alison F - DNR; MacFarland, Laura L - DNR
Subject: RE: Official First Draft of Silver Lake, Waupaca County, Comprehensive Lake Management Plan - Soliciting Agency Comments

Hi Tim,

The department has had a chance to review the draft lake management plan. The plan is well written and does a good job of laying out options for future management. It is agreed that HEWM management, on a whole lake scale, would be inadvisable and could negatively impact water quality. Limited select herbicide use in conjunction with harvesting could go a long way towards improving recreation on the lake.

Please consider this email as department approval of this lake management plan. The status of the variance request is another matter that is being evaluated by program leads (Ali Mikulyuk and Laura MacFarland).

Thank you and the lake stakeholders for the hard work necessary to complete this plan.

Sincerely,

Ted

We are committed to service excellence.
Visit our survey at http://dnr.wi.gov/customersurvey to evaluate how I did.

Ted M. Johnson
Phone (Cell): (920) 362-0181
e-mail: tedm.johnson@wi.gov

From: Tim Hoyman <THoyman@onterra-eco.com>
Sent: Thursday, July 14, 2022 11:54 AM
To: Johnson, Ted M - DNR <TedM.Johnson@wisconsin.gov>
Cc: Kristy Stacy <kristybstacy@gmail.com>; Carl Lantz <carlelantz@gmail.com>
Subject: Official First Draft of Silver Lake, Waupaca County, Comprehensive Lake Management Plan - Soliciting Agency Comments

Hi Ted,

Attached, please find the Official First Draft of the Silver Lake Comprehensive Management Plan, along with available appendices. This planning project is being sponsored by the Scandinavia Silver Lake District and will be posted on the

Village of Scandinavia website soon for a 21-day public comment period. Further, a district information meeting is being planned for Tuesday, August 16th. Please share these documents with others as you see necessary.

The implementation plan begins on page 85 and includes three management goals and eight actions. Please note that the first action under Management Goal 3: Assure Recreational Opportunities on Silver Lake, would implement a trial ProcellaCOR treatment with associated quantitative monitoring of target and non-target species, as well has herbicide concentration monitoring. The district would like you to declare that action eligible for funding through a Small-Scale AIS Control Grant. The grant application would be developed for the November 2022 application cycle and the trial treatment would be implemented in spring 2023.

Thank you very much,

Tim

Tim Hoyman
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