A

APPENDIX A

Public Participation Materials

Town of Winchester

Town of Winchester
Lake Management Planning Project
Town-Wide Kick-off Meeting
June 20, 2015

Tim Hoyman, CLM
Onterra LLC
Lake Management Planning

Presentation Outline

- Onterra, LLC
- Why Create a Management Plan?
- Elements of this Lake Management Planning Project
  - Data & Information
  - AIS Education & Volunteer Involvement
  - Planning Process
- Project Phasing
- Project Deliverables

Onterra, LLC
Lake Management Planning

Onterra, LLC

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

Onterra, LLC
Lake Management Planning

Why create a lake management plan?

A goal without a plan is just a wish!

Onterra, LLC
Lake Management Planning

Elements of an Effective Lake Management Planning Project

Data and Information Gathering

Environmental & Sociological

Planning Process

Brings it all together

Onterra, LLC
Lake Management Planning

Data & Information Gathering

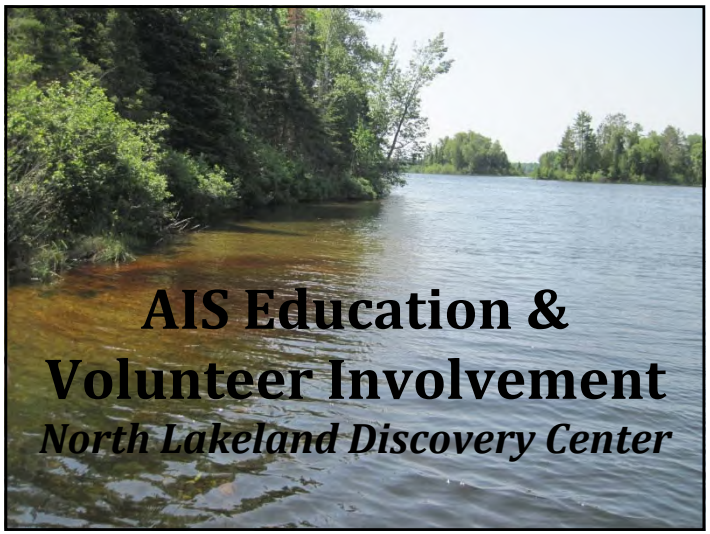
- Study Components
  - Water Quality Analysis
    - Citizen and professional sample collection
    - Nutrient analysis, productivity, and watershed model calibration
  - Watershed Assessment
    - Modeling based upon land cover
    - Lakes are modeled in sequence, so order is important
  - Aquatic Plant Surveys
    - Multiple surveys on each lake throughout growing season
    - Assessment of native and non-native plants

Onterra, LLC
Lake Management Planning

Data & Information Gathering

- Study Components (continued)
  - Shoreland and Coarse Woody Habitat Assessment
    - Not conducted on a property-by-property basis
    - Aimed at setting up priorities for restoration and protection of important habitat
  - Fisheries Data Integration
    - Compilation of existing data (WDNR, GLIFWC)
  - Stakeholder Survey
    - Individual survey for each lake/chain in project
    - Primary method for full stakeholder input

Onterra, LLC
Lake Management Planning



Planning Process

Planning Committee Meetings

Study Results (including a stakeholder survey)

Conclusions & Initial Recommendations

Management Goals

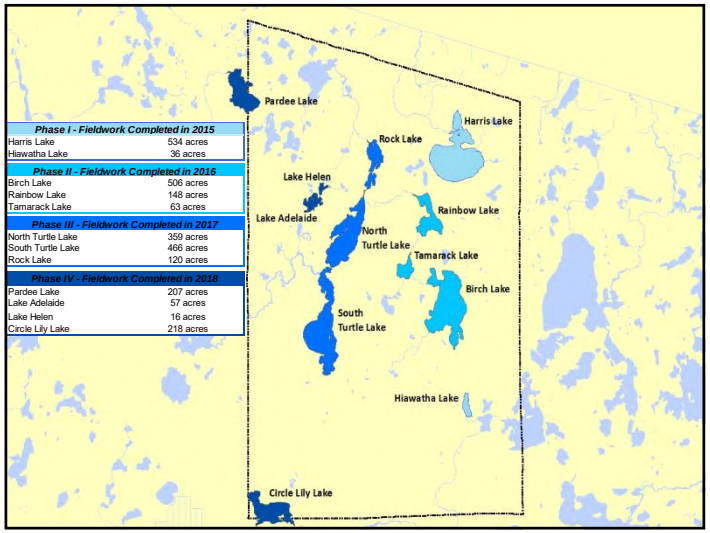
Management Actions

- Timeframe
- Facilitator(s)

↓

Implementation Plan

Onterra, LLC
Lake Management Planning



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Town of Winchester Lake Management Plan Documents

- Multiple document types
  - Town of Winchester Lake Management Plan
  - Lake-Specific Results and Conclusions
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- Town-wide Compilation
  - All documents
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  - Town-wide management plan
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Onterra, LLC
Lake Management Planning

Thank You

Many of the graphics used in this presentation were supplied by:

Wisconsin Lakes Partnership

UW Extension

Wisconsin Dept of Natural Resources

Onterra, LLC
Lake Management Planning

Town of Winchester

Town of Winchester
Lake Management Planning Project
Hiawatha Lake Kick-off Meeting
June 27, 2015

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Onterra, LLC Lake Management Planning

Why create a lake management plan?

- 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.
- To foster realistic expectations and dispel myths.
- To create a snapshot of the lake for future reference and planning.

A goal without a plan is just a wish!

Onterra, LLC Lake Management Planning

Elements of an Effective Lake Management Planning Project

Data and Information Gathering

Environmental & Sociological

Planning Process

Brings it all together

Onterra, LLC
Lake Management Planning

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- Study Components
  - Water Quality Analysis
  - Watershed Assessment
  - Aquatic Plant Surveys
  - Fisheries Data Integration
  - Shoreline Assessment
  - Stakeholder Survey

Onterra, LLC
Lake Management Planning

Water Quality Analysis

- General water chemistry (current & historic)
  - Citizens Lake Monitoring Network & Professional
- Nutrient analysis
  - Lake trophic state (Eutrophication)
  - Limiting plant nutrient
- Supporting data for watershed modeling

Onterra, LLC
Lake Management Planning

Watershed Assessment

- Delineation of drainage basins
- Modeling
  - Land cover
  - Phosphorus loading
  - Lakes are modeled in series
  - Scenario development

Onterra, LLC
Lake Management Planning

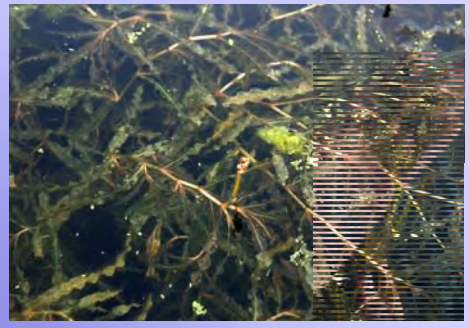
Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Early Season AIS survey
  - Point-intercept survey
  - Aquatic plant community mapping

Onterra, LLC
Lake Management Planning

Non-native Aquatic Plants

Curly-leaf Pondweed



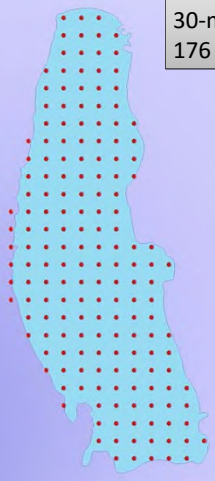
Onterra, LLC
Lake Management Planning

Non-native Aquatic Plants

Eurasian Water Milfoil

Onterra, LLC
Lake Management Planning

Hiawatha Lake
30-meter resolution
176 total points



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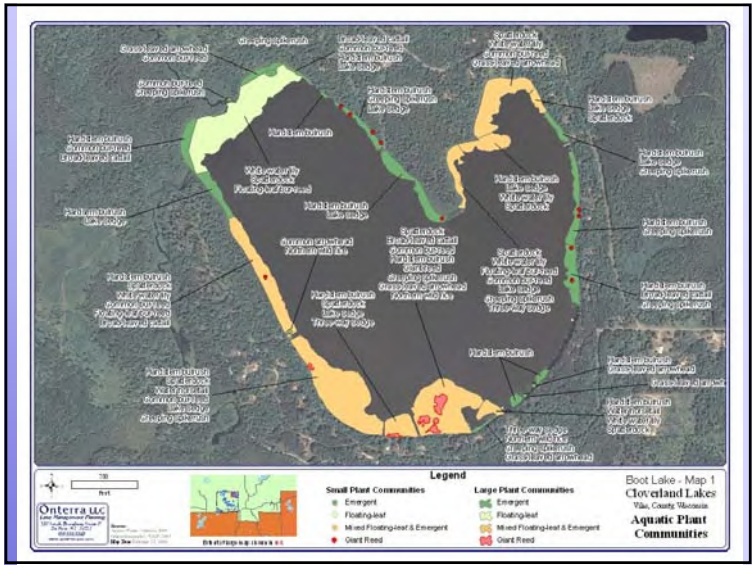


Shoreland Assessment

- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- It does not look at lake shoreline on a property-by-property basis.
- Assessment ranks shoreland area from shoreline back 35 feet

Urbanized

Range

Natural

Onterra, LLC
Lake Management Planning

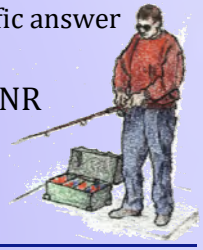
Fisheries Data Integration

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

Onterra, LLC
Lake Management Planning

Stakeholder Survey

- Standard survey used as base
  - Planning committee develops additional questions and options
  - Must not lead respondent to specific answer through a “loaded” question
- Survey must be approved by WDNR



Onterra, LLC
Lake Management Planning

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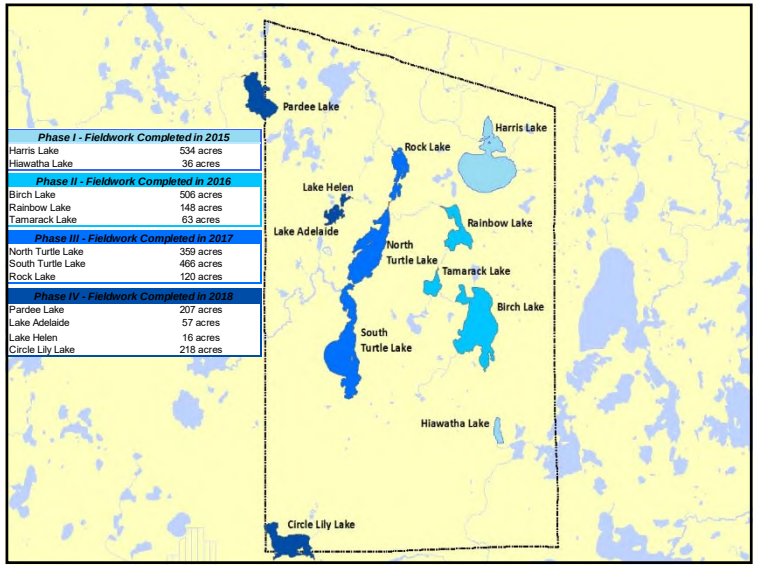
Onterra, LLC
Lake Management Planning



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Onterra, LLC
Lake Management Planning

Town of Winchester

Town of Winchester
Lake Management Planning Project

Harris Lake Kick-off Meeting
July 25, 2015

Eddie Heath
Onterra LLC
Lake Management Planning

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Onterra, LLC
Lake Management Planning

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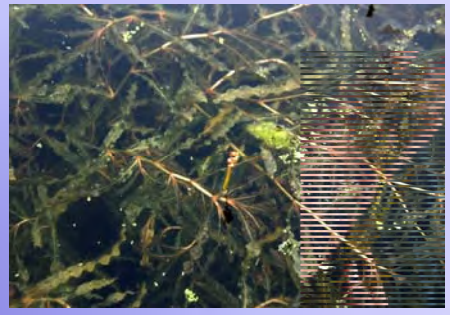

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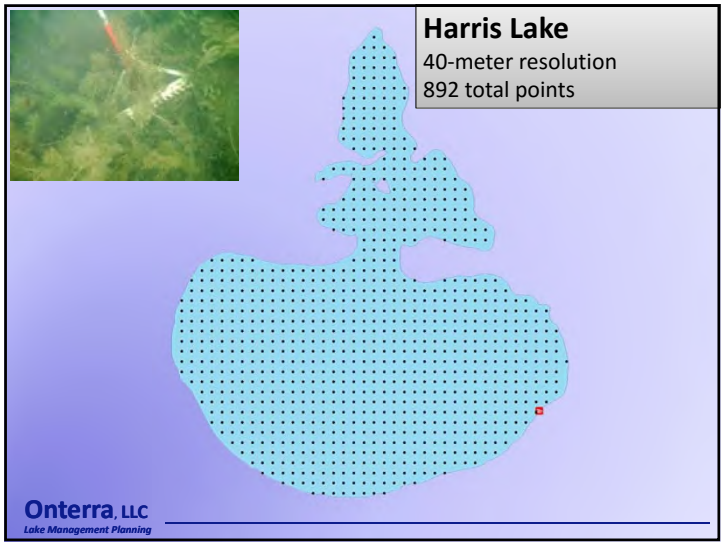

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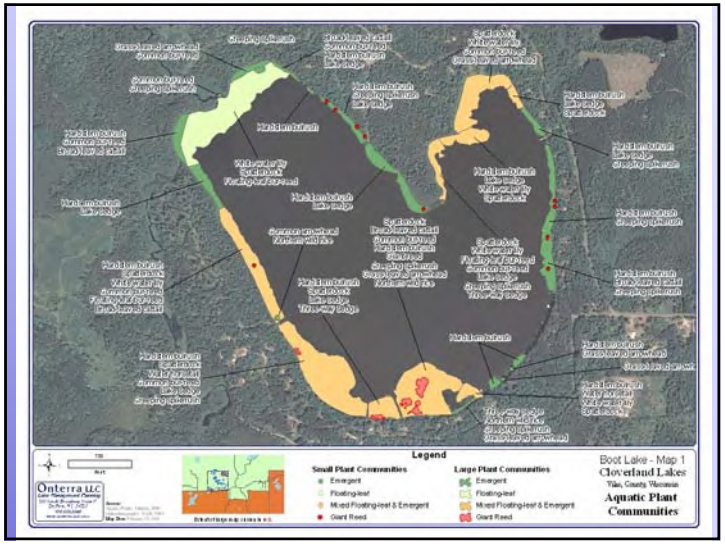

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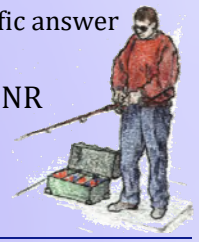

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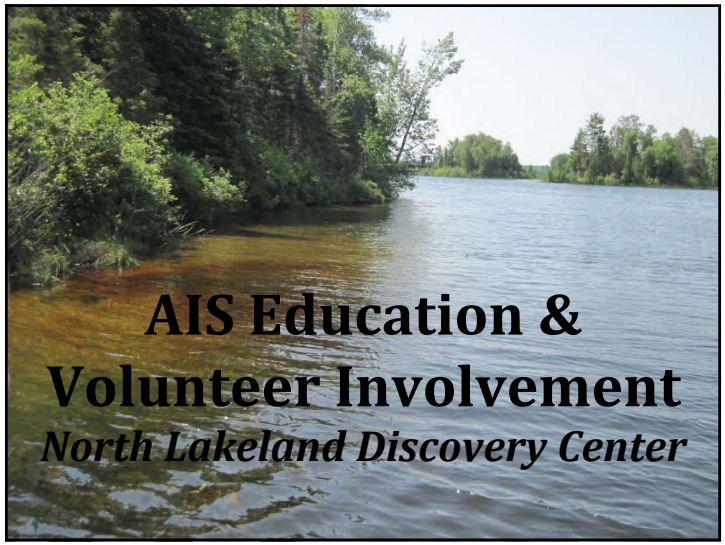

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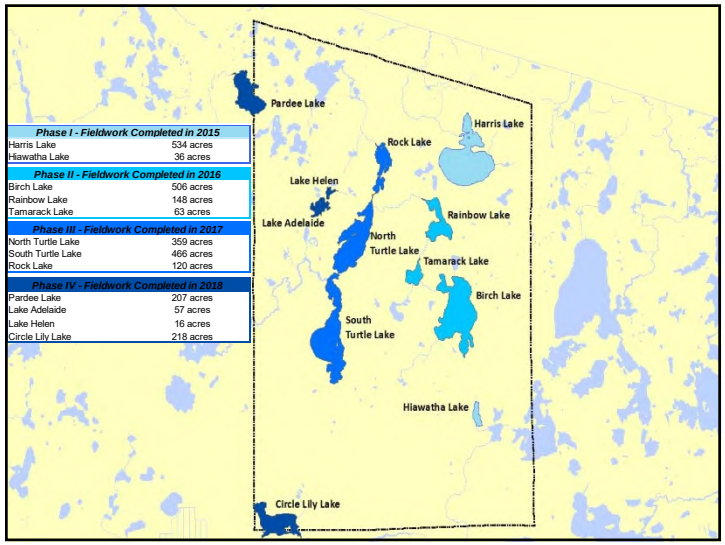
Lake Management Planning



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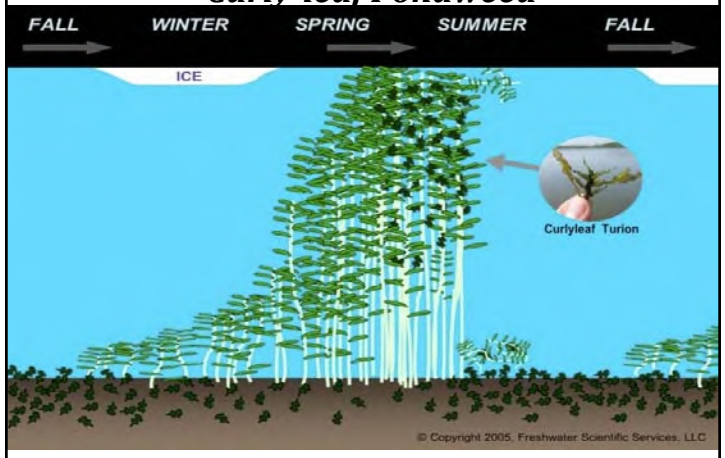

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Lake Management Planning

AIS Mapping

Point-Based Mapping

- Single plants to colonies or areas less than 40-feet in diameter
- Abundance descriptions:
  - Single or Few Plants
  - Clumps of Plants
  - Small Plant Colony

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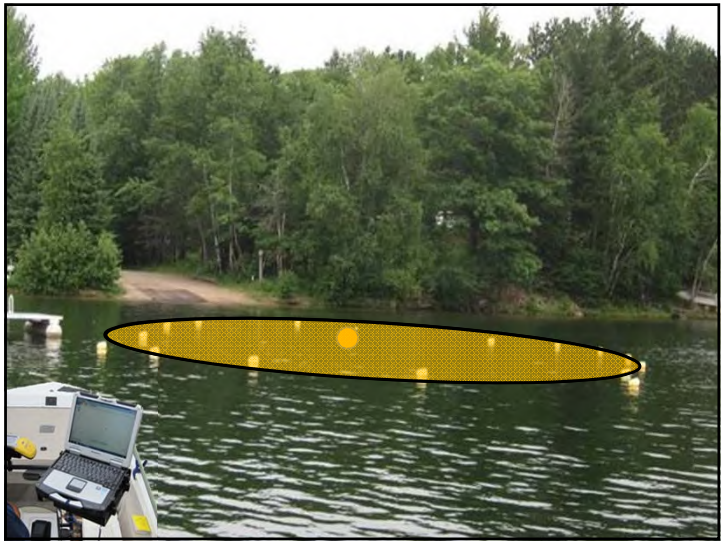
Lake Management Planning

More EWM than can be mapped using Point-based Methods

Onterra, LLC
Lake Management Planning



AIS Mapping

Polygon-Based Mapping

- Colonies or areas over 40-feet diameter
- Boundary at target plant extent or morphological feature (depth contour, shoreline)
- Density ratings:

May not represent true colonies or "beds"

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

Increase in Ecological Impact

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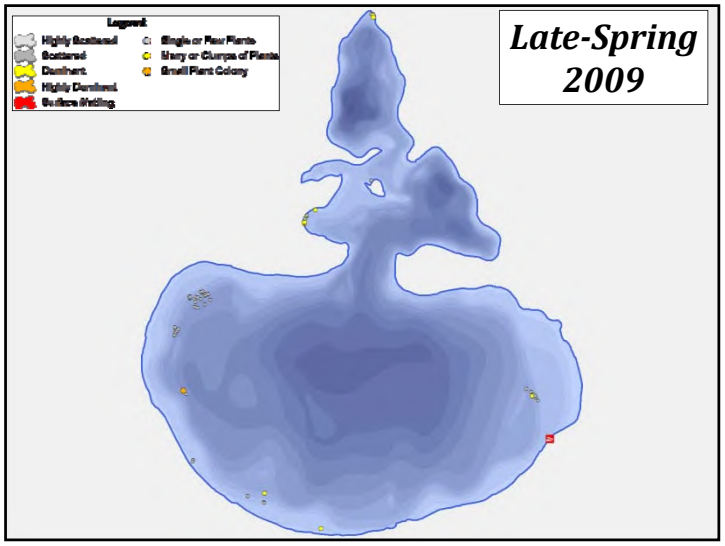
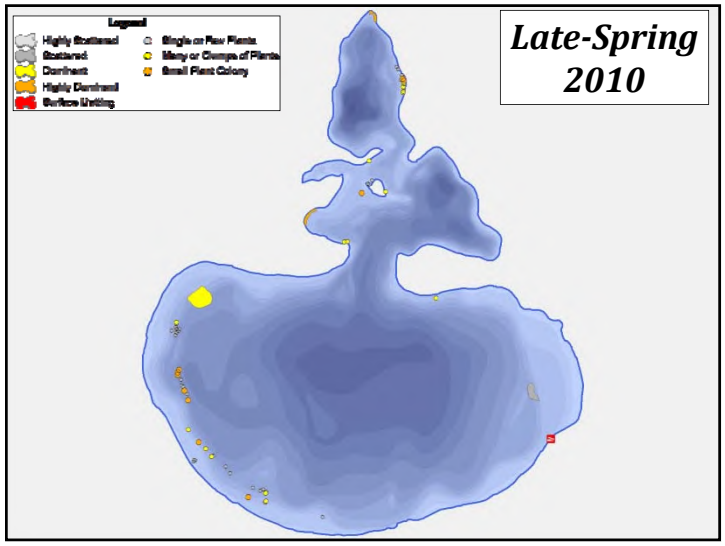
Lake Management Planning



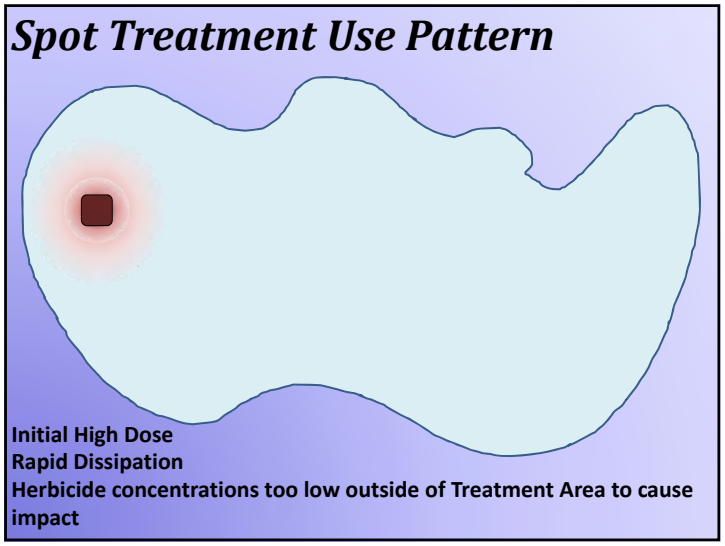


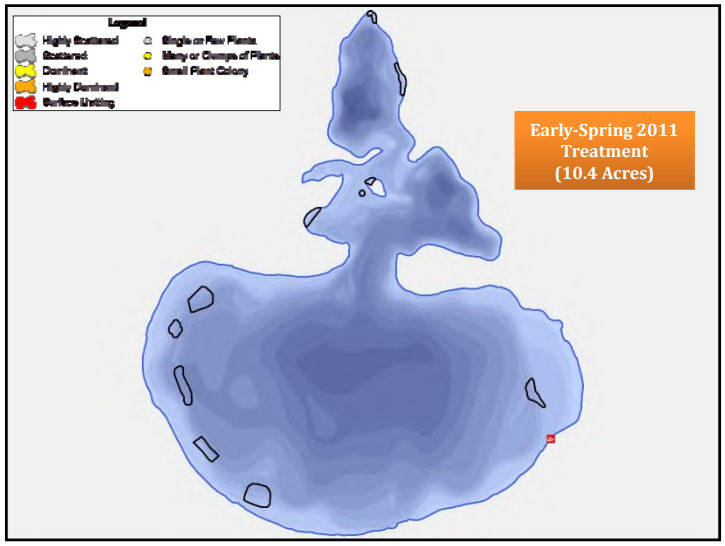
Early-season Herbicide Control Strategy

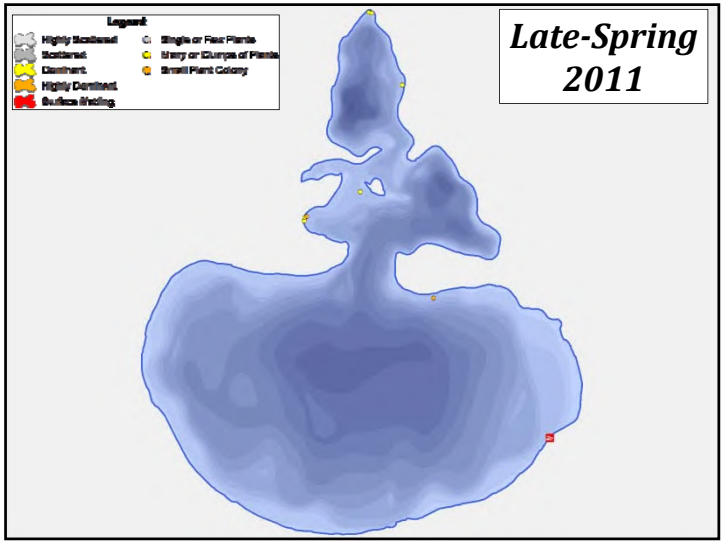
- Exotic species are small, actively growing, and most vulnerable
- Many native species are dormant
- Cool water temperatures result in slower microbial degradation
- Minimize biomass decomposition

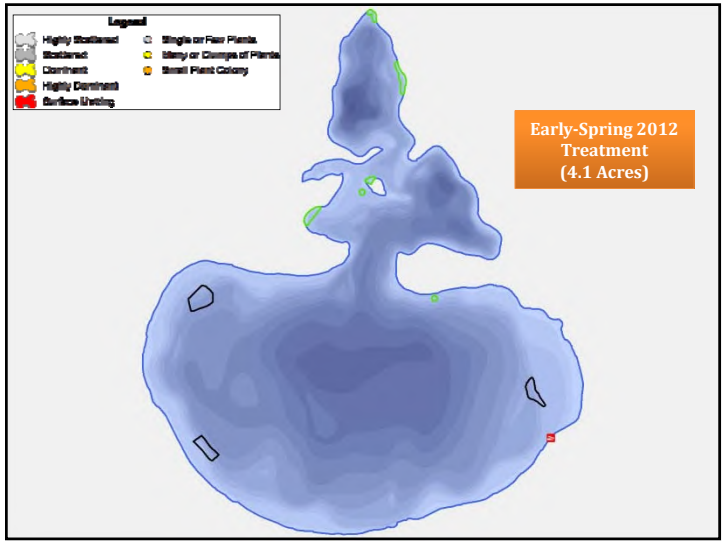
Herbicide Use Patterns

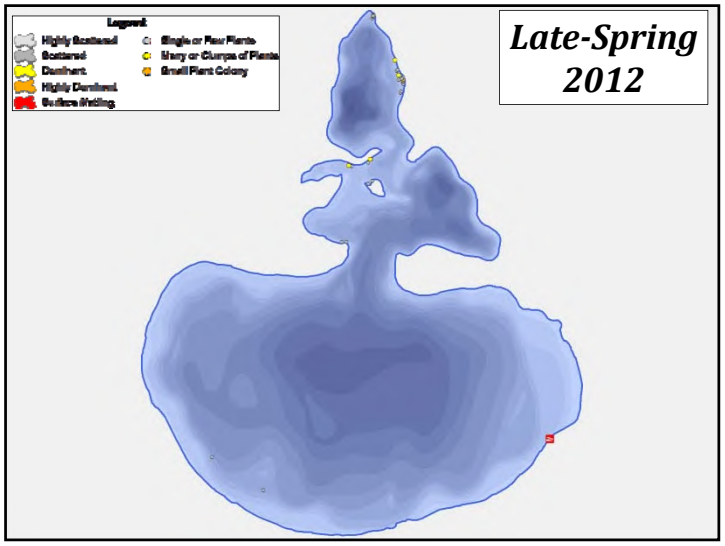
- **Dissipation: horizontal and vertical movement of herbicide within the water column**
  - Water flow
  - Wind
  - Treatment area relative to lake
  - Water depth
- **Degradation: physical breakdown of herbicide into inert components**
  - Microbial
  - Photolytic

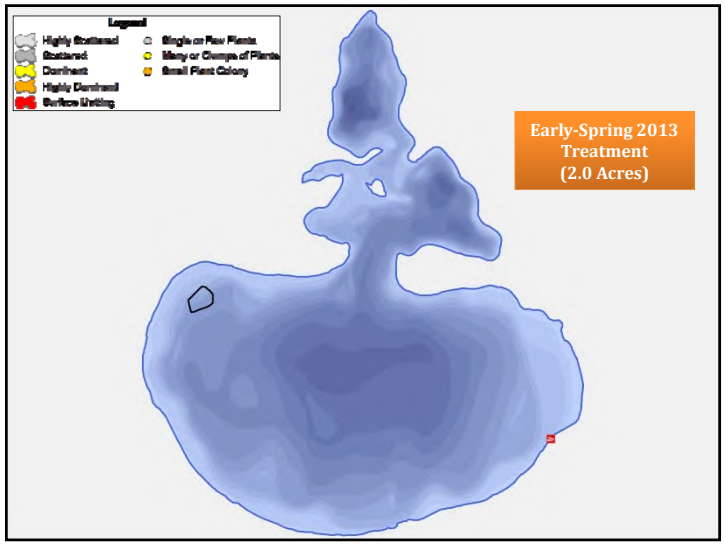

Spot Treatment Use Pattern
Initial High Dose
Rapid Dissipation
Herbicide concentrations too low outside of Treatment Area to cause impact

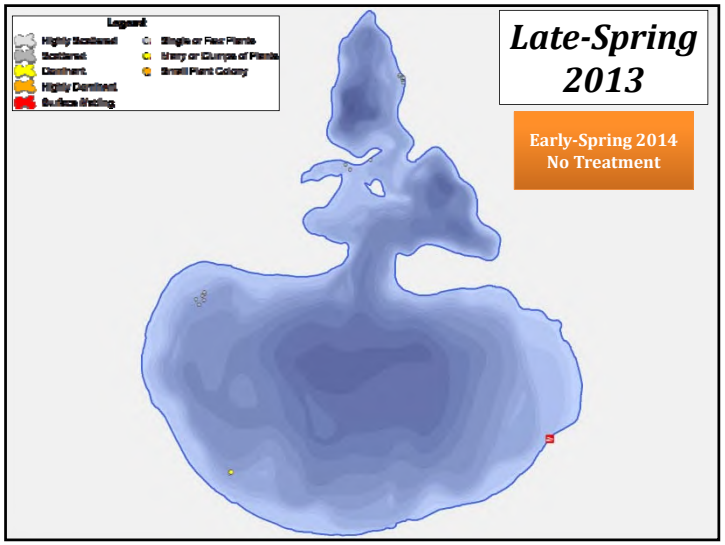

Early-Spring 2011 Treatment (10.4 Acres)

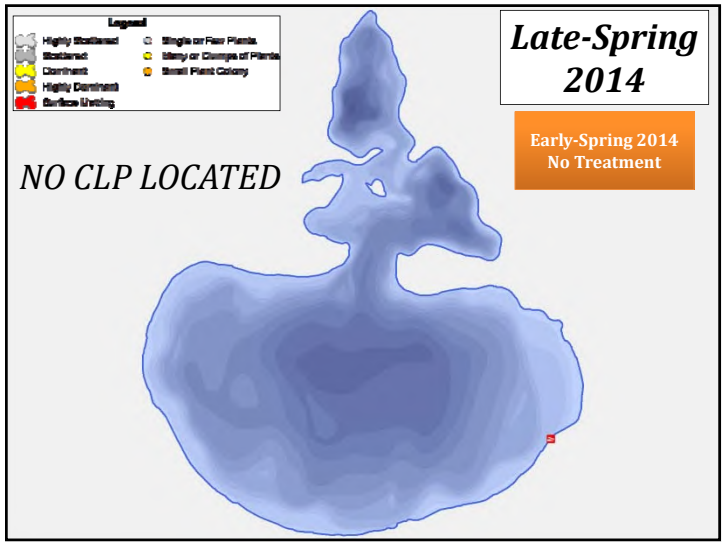

Late-Spring 2011

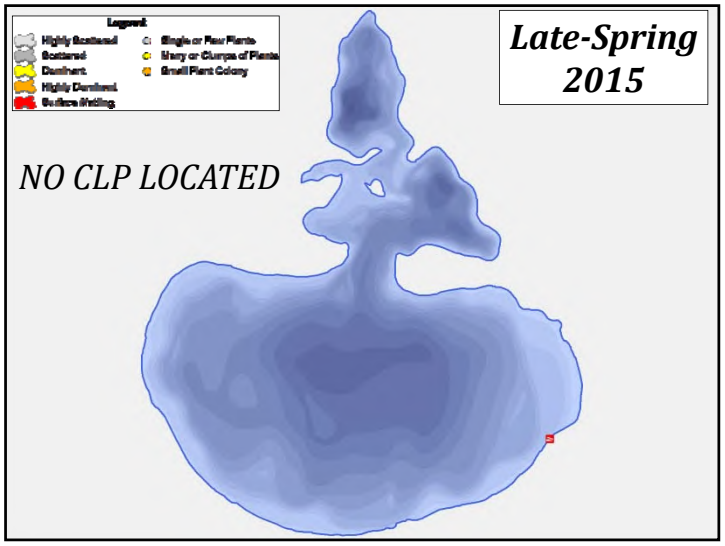

Early-Spring 2012 Treatment (4.1 Acres)


Late-Spring
2012


Early-Spring 2013
Treatment
(2.0 Acres)


Late-Spring
2013
Early-Spring 2014
No Treatment


Late-Spring
2014
Early-Spring 2014
No Treatment
NO CLP LOCATED



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UWEX Extension

WISCONSIN DEPT. OF NATURAL RESOURCES

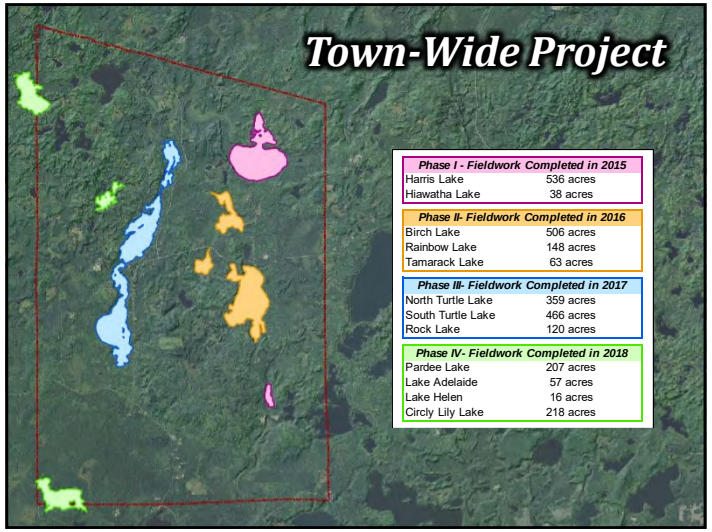
Onterra LLC
Lake Management Planning

Presentation Outline

- Lake Management Planning Project Overview
- Study Results
  - Water Quality
  - Watershed
  - Shoreland Condition
  - Aquatic Plants
  - Fishery

  Stakeholder Survey
- "Big Picture"
- Implementation Plan Development

Onterra LLC
Lake Management Planning



Management Planning Project Overview

- Collect & analyze data – completed
  - Technical & sociological
- Construct long-term & useable plan

Onterra LLC
Lake Management Planning

Summary of Project Results

Water Quality
- Overall, excellent for deep, headwater drainage lake

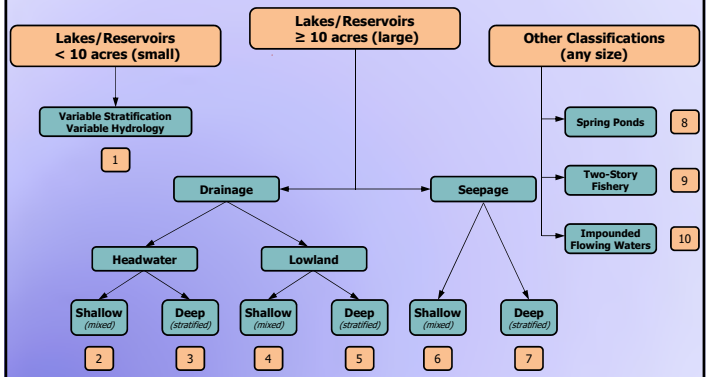
Watershed & Immediate Shoreline
- Watershed in excellent shape – primarily forests & wetlands
- Majority of shoreland little to no development

Aquatic Plant Community
- High species richness & diversity
- Rare species present (northeastern bladderwort)
- Curly-leaf pondweed currently at undetectable level

Fisheries
- Data pertaining to walleye & muskellunge

Onterra LLC
Lake Management Planning

Wisconsin Lakes Natural Community Types



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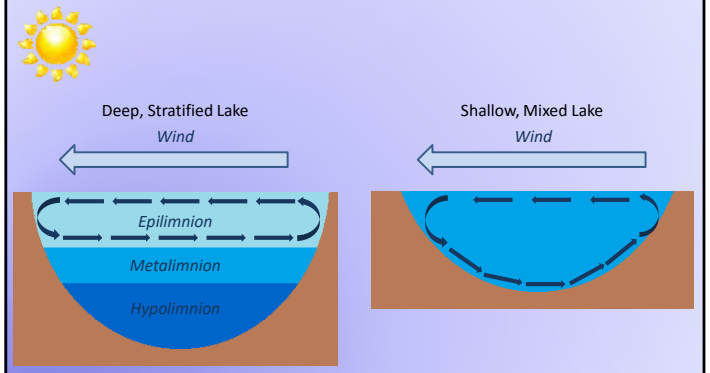
Wisconsin Lakes Classification



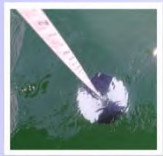
Onterra LLC
Lake Management Planning

Introduction to Lake Water Quality

Phosphorus
Naturally occurring & essential for all life
Regulates phytoplankton biomass in most WI lakes
Most often 'limiting plant nutrient' (shortest supply)
Human development 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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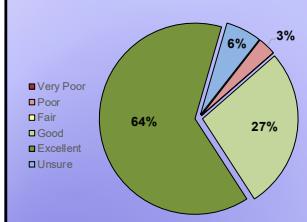
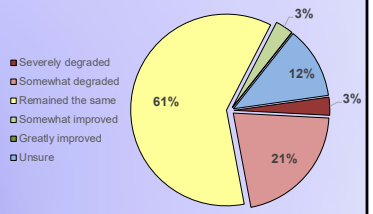
Harris Stakeholder Perceptions of Water Quality

How would you describe the current water quality of Harris Lake?



How has water quality changed in Harris Lake since you first visited the lake?



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Water Quality

Wisconsin Ecoregions

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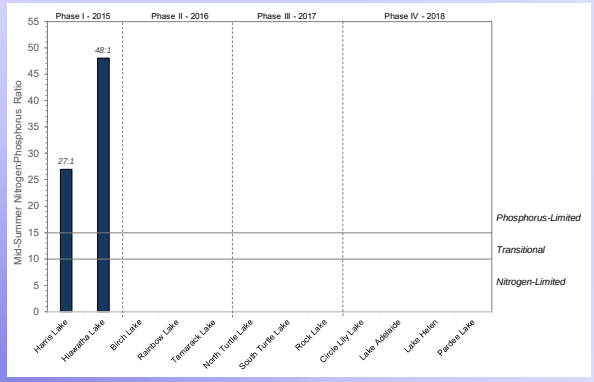
Town of Winchester – Phase I Lakes
Mid-Summer Nitrogen:Phosphorus Ratio



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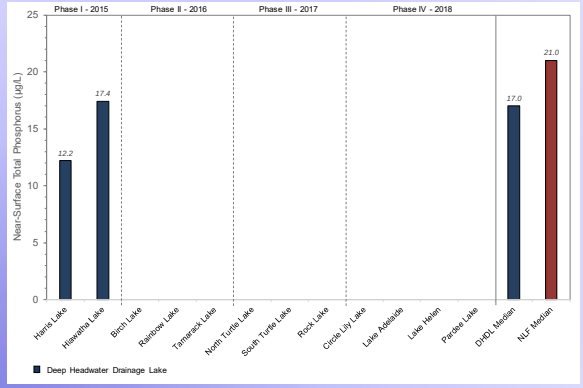
Town of Winchester – Phase I Lakes
Near-Surface Total Phosphorus



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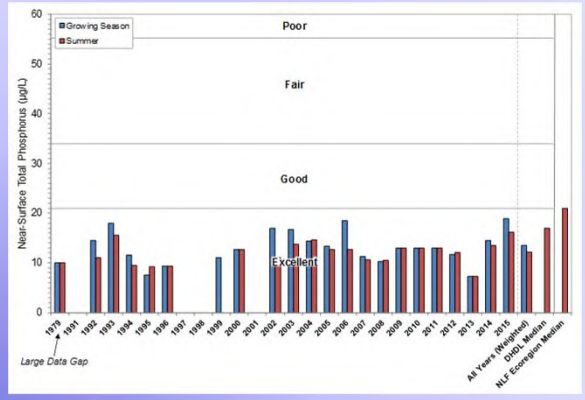
Harris Lake Long-Term Trends
Near-Surface Total Phosphorus



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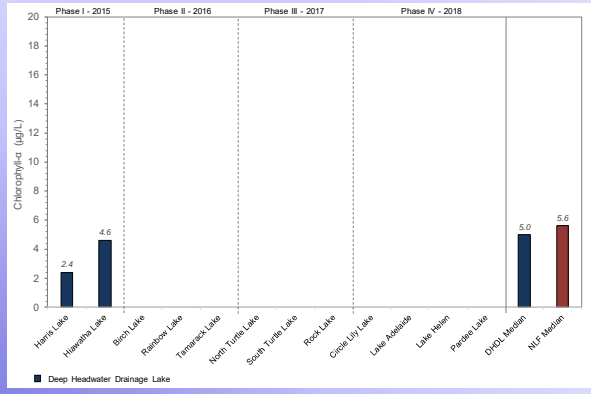
Town of Winchester – Phase I Lakes
Chlorophyll-*a*



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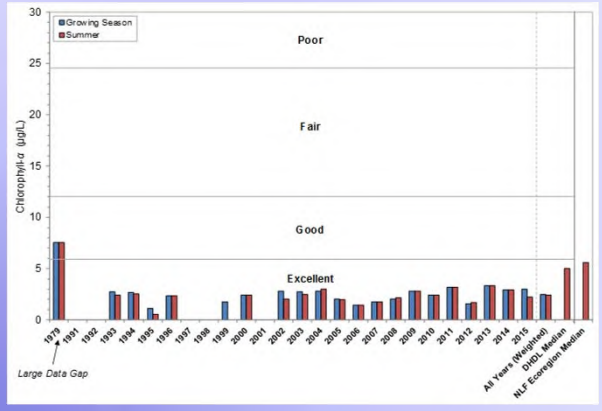
Harris Lake Long-Term Trends
Chlorophyll-*a*



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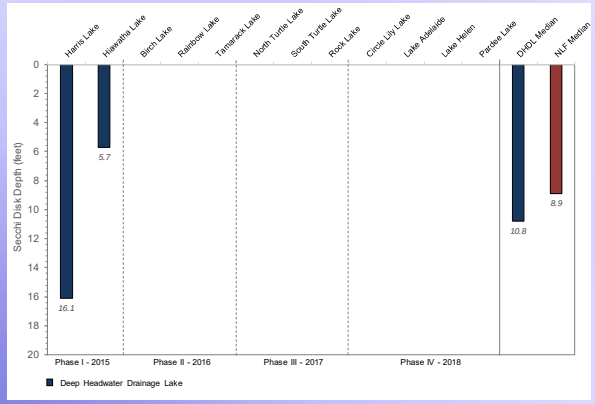
Town of Winchester – Phase I Lakes
Secchi Disk Transparency



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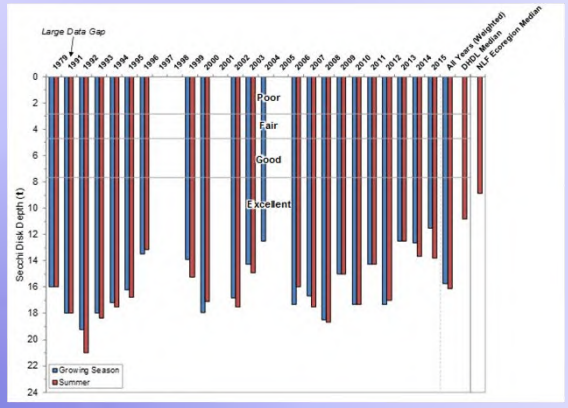
Harris Lake Long-Term Trends
Secchi Disk Transparency



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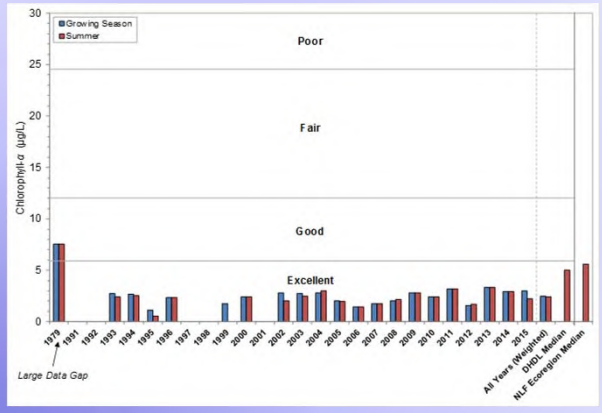
Harris Lake Long-Term Trends
Chlorophyll-*a*



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Harris Lake Long-Term Trends
Secchi Disk Transparency

Why has Secchi disk transparency declined since 2013?

- Likely a result of increased amounts of dissolved organic acids
- Give water *tea-like* or *stained appearance*
- Primarily originate from wetlands
- 2015 *True Color* indicates water *lightly tea-colored (30 SU)*
- 15 SU measured in 2003

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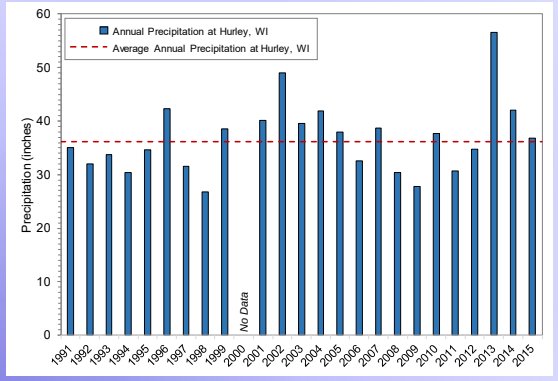
Annual Precipitation Data – Hurley, WI



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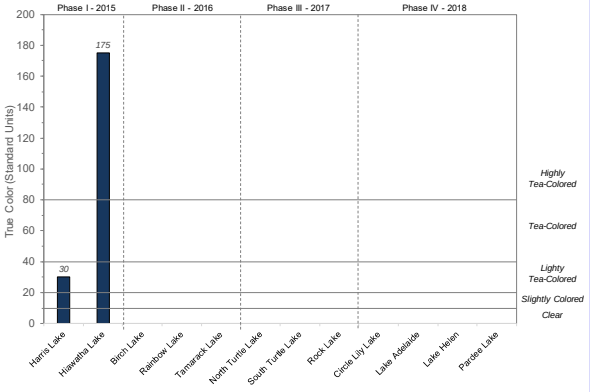
Town of Winchester – Phase I Lakes
True Color



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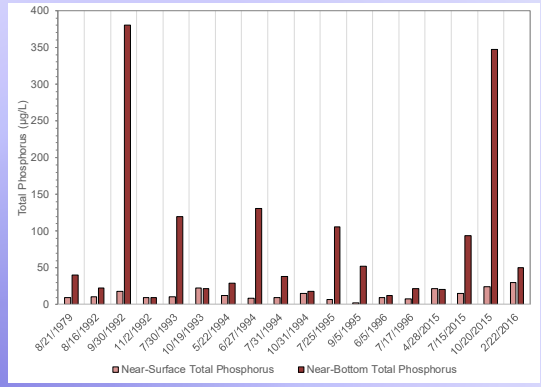
Harris Lake Near-Bottom Total Phosphorus



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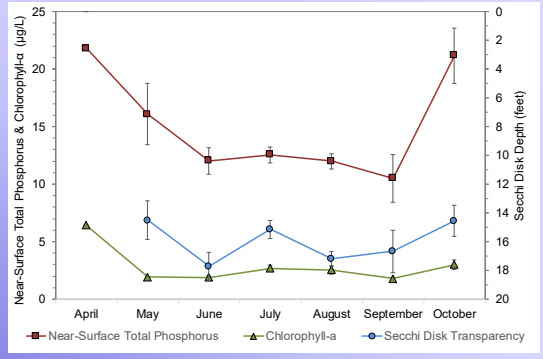
Harris Lake Water Quality Seasonal Dynamics



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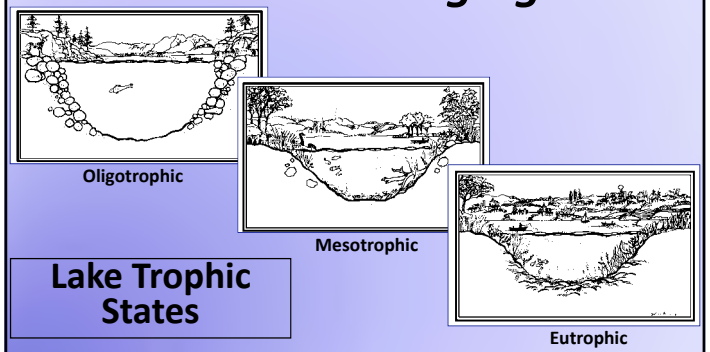
Eutrophication -Lake Aging



Lake Trophic States

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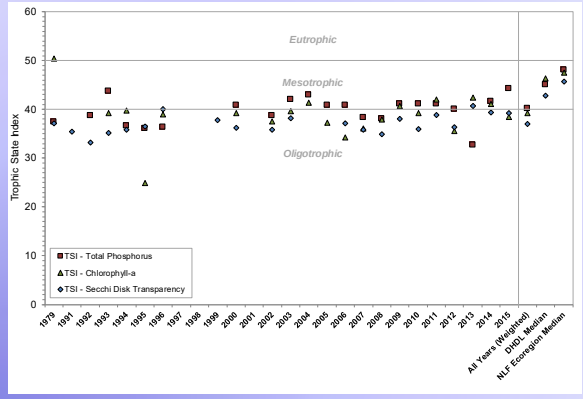
Harris Lake Trophic State Index



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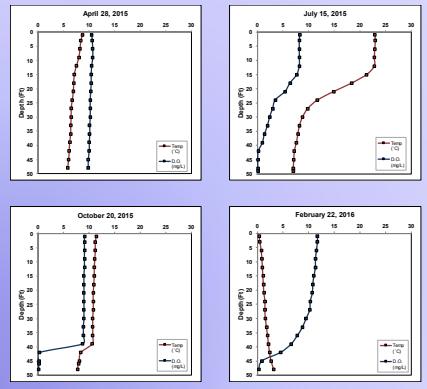
Temperature & Dissolved Oxygen



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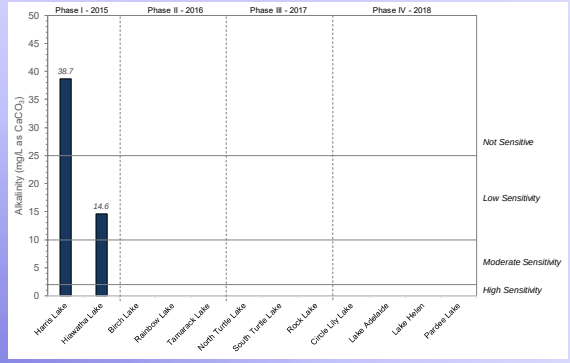
Additional Water Quality Parameters Alkalinity



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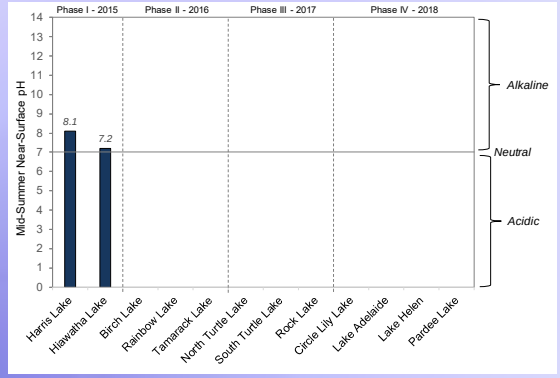
Additional Water Quality Parameters pH



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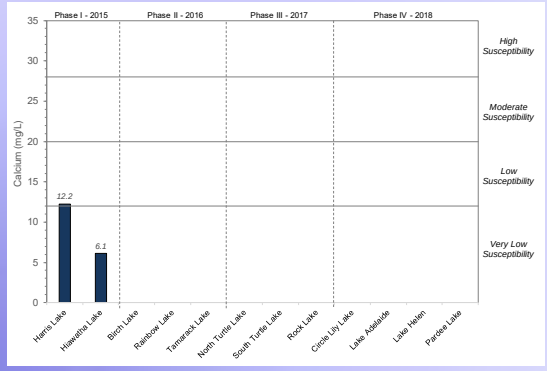
Additional Water Quality Parameters Calcium



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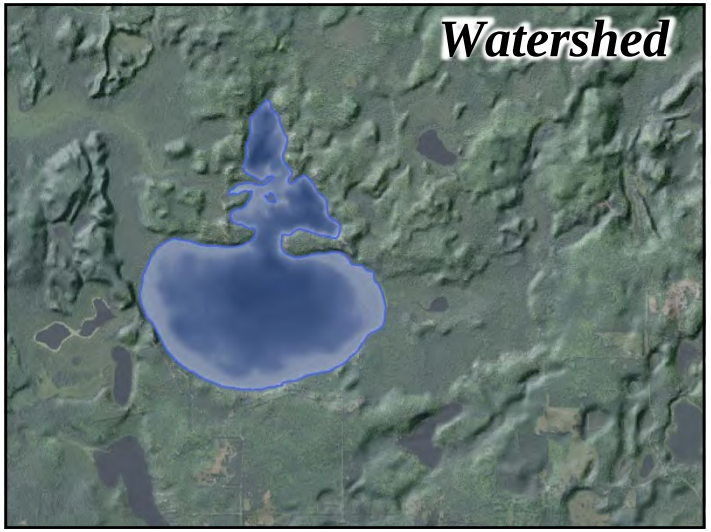
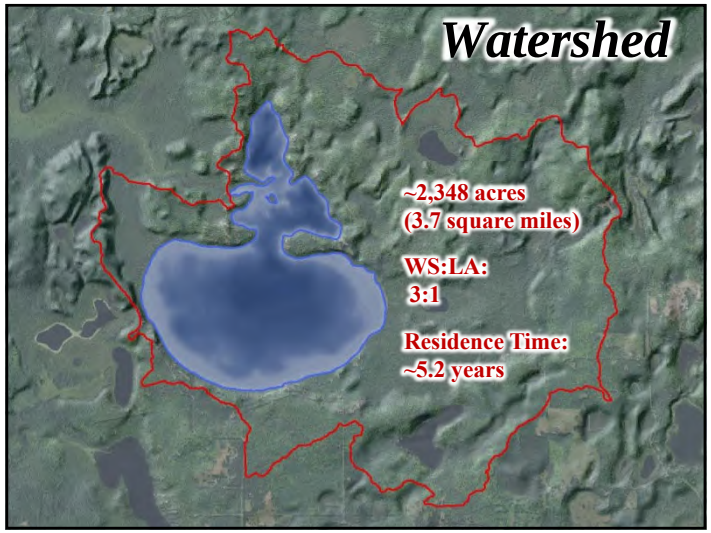
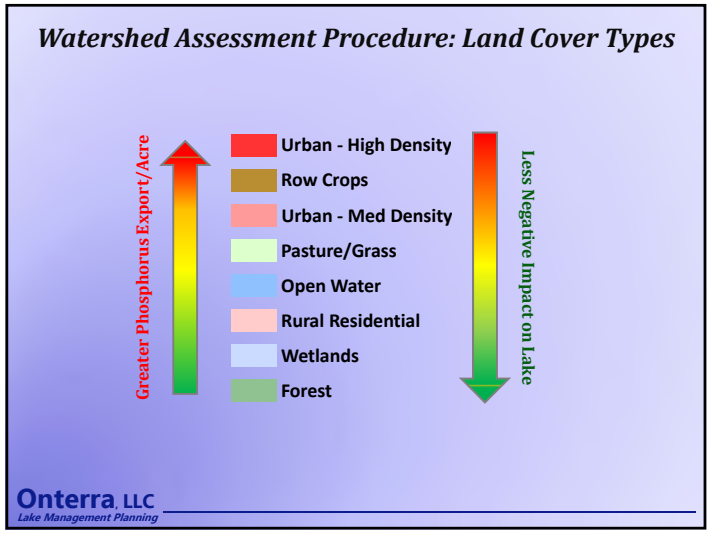



Watershed
~2,348 acres
(3.7 square miles)
WS:LA:
3:1
Residence Time:
~5.2 years


Watershed Assessment Procedure: Land Cover Types
Greater Phosphorus Export/Acre
Urban - High Density
Row Crops
Urban - Med Density
Pasture/Grass
Open Water
Rural Residential
Wetlands
Forest
Less Negative Impact on Lake
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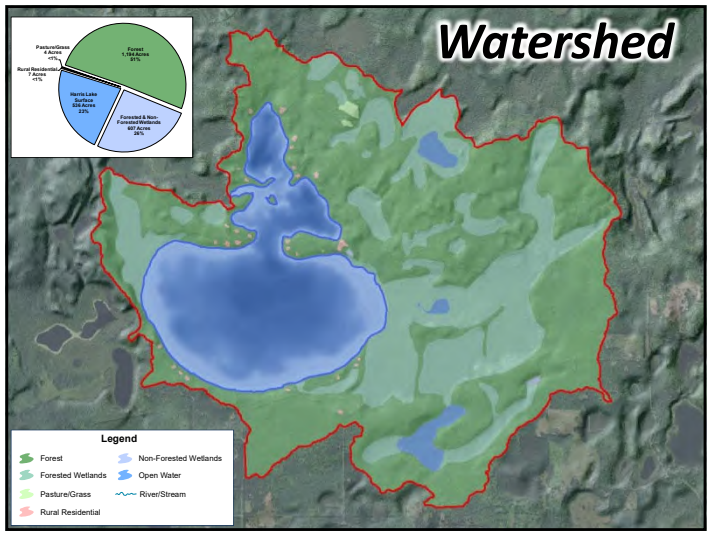
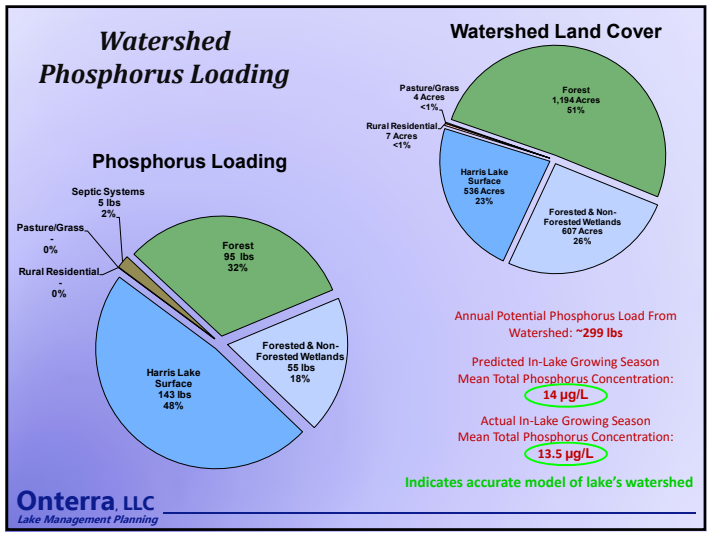

Watershed
Legend
Forest
Non-Forested Wetlands
Forested Wetlands
Open Water
Pasture/Grass
River/Stream
Rural Residential


Watershed
Phosphorus Loading
Watershed Land Cover
Pasture/Grass
4 Acres
<1%
Forest
1,194 Acres
51%
Rural Residential
7 Acres
<1%
Harris Lake
Surface
536 Acres
23%
Forested & Non-
Forested Wetlands
607 Acres
26%
Phosphorus Loading
Septic Systems
5 lbs
2%
Pasture/Grass
-
0%
Rural Residential
-
0%
Forest
95 lbs
32%
Forested & Non-
Forested Wetlands
55 lbs
18%
Harris Lake
Surface
143 lbs
48%
Annual Potential Phosphorus Load From
Watershed: ~299 lbs
Predicted In-Lake Growing Season
Mean Total Phosphorus Concentration:
14 µg/L
Actual In-Lake Growing Season
Mean Total Phosphorus Concentration:
13.5 µg/L
Indicates accurate model of lake's watershed
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Harris Lake Watershed Scenarios

- **Scenario 1:** 25% of forests (299 acres) converted to pasture/grass
  - P concentrations increase from 13.5 to 16.0 µg/L
  - Chl-*a* increase from 2.5 to 4.8 µg/L
  - Secchi decline from 15.8 to 10.4 feet
- **Scenario 2:** 25% of forests (299 acres) converted to row crop agriculture
  - P concentrations increase from 13.5 to 21.0 µg/L
  - Chl-*a* increase from 2.5 to 7.2 µg/L
  - Secchi decline from 15.8 to 8.0 feet

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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.
- It does not look at lake shoreline on a property-by-property basis.
- Assessment ranks shoreland area from shoreline back 35 feet

Urbanized Range **Natural**

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Shoreline Assessment Category Descriptions

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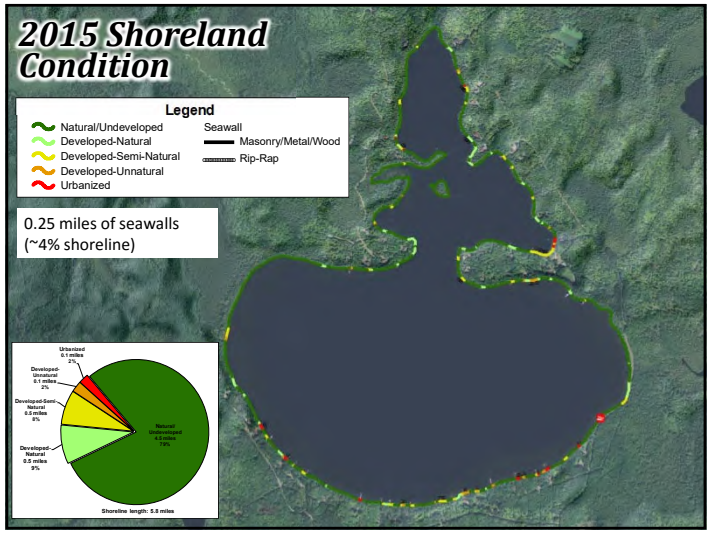
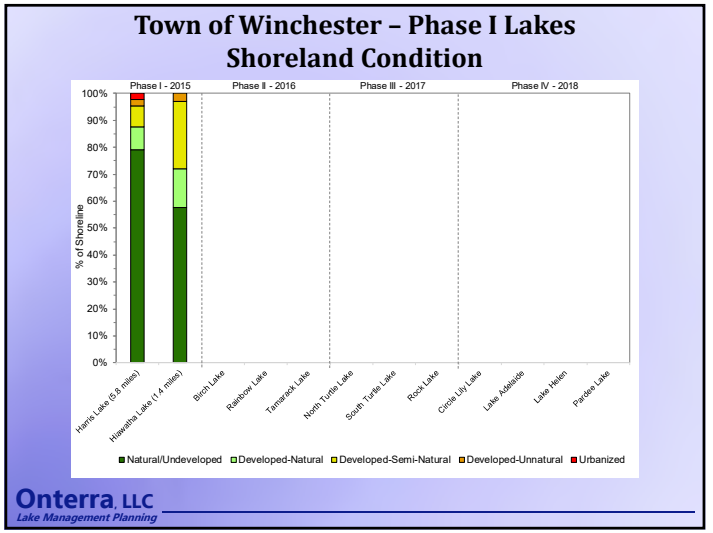

2015 Shoreland Condition
Legend
Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized
Seawall
Masonry/Metal/Wood
Rip-Rap
0.25 miles of seawalls (~4% shoreline)


Town of Winchester – Phase I Lakes Shoreland Condition
Phase I - 2015
Phase II - 2016
Phase III - 2017
Phase IV - 2018
% of Shoreline
Harris Lake (5.8 miles)
Hiawatha Lake (1.4 miles)
Birch Lake
Rainbow Lake
Tamarack Lake
North Turtle Lake
South Turtle Lake
Rock Lake
Circle Lily Lake
Lake Adelaide
Lake Helen
Pardee Lake
Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized
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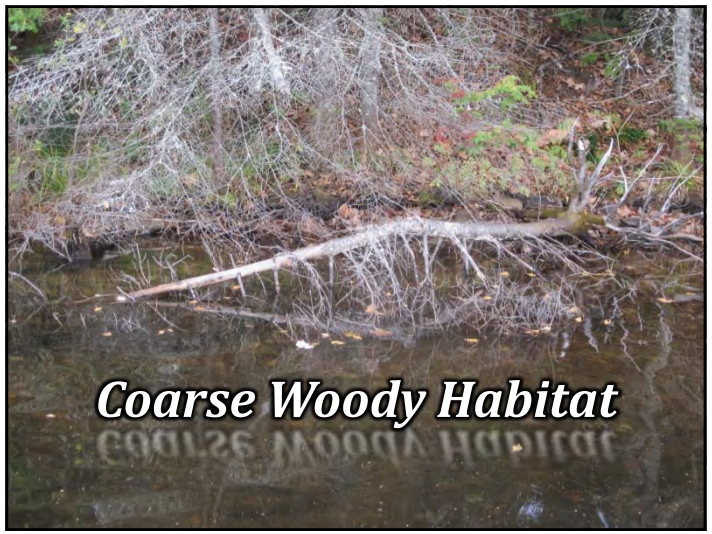
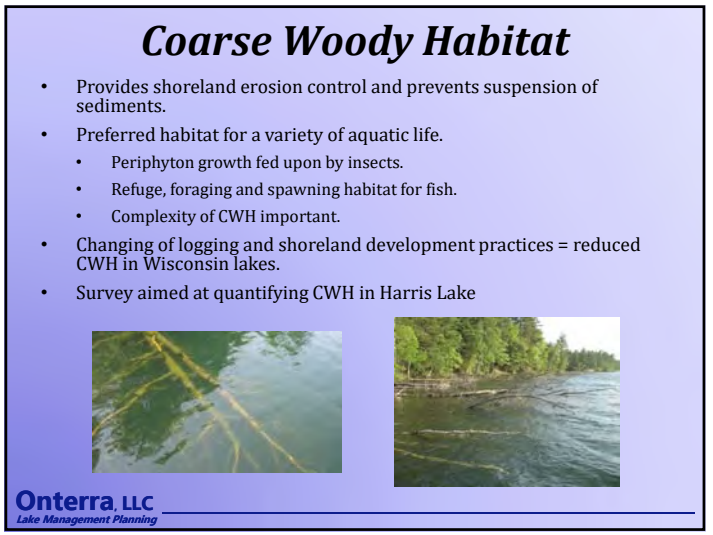

Coarse Woody Habitat


Coarse Woody Habitat
Provides shoreland erosion control and prevents suspension of sediments.
Preferred habitat for a variety of aquatic life.
Periphyton growth fed upon by insects.
Refuge, foraging and spawning habitat for fish.
Complexity of CWH important.
Changing of logging and shoreland development practices = reduced CWH in Wisconsin lakes.
Survey aimed at quantifying CWH in Harris Lake
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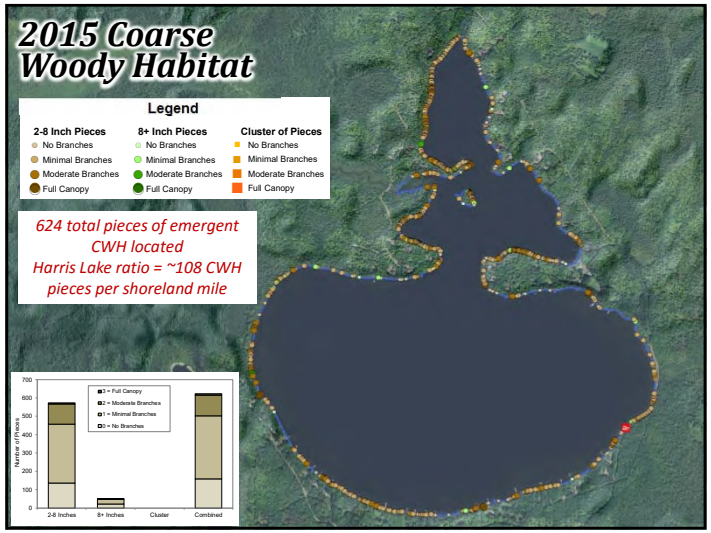

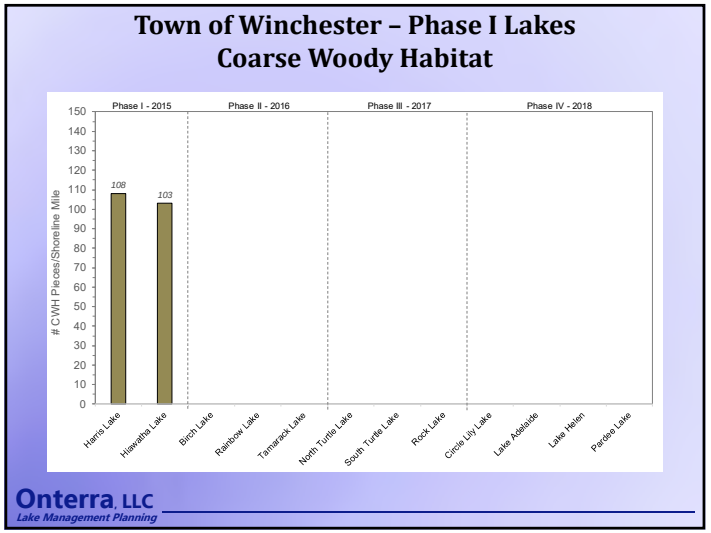

Aquatic Plant Surveys

- Assess both non-native & native species
- Four surveys completed in 2015
  - Early-Season AIS Survey
  - Whole-Lake Point-Intercept Survey
  - Acoustic Survey
    - Water depth (bathymetry)
    - Substrate hardness
    - Aquatic plant bio-volume
  - Emergent/Floating-Leaf Community Mapping Survey

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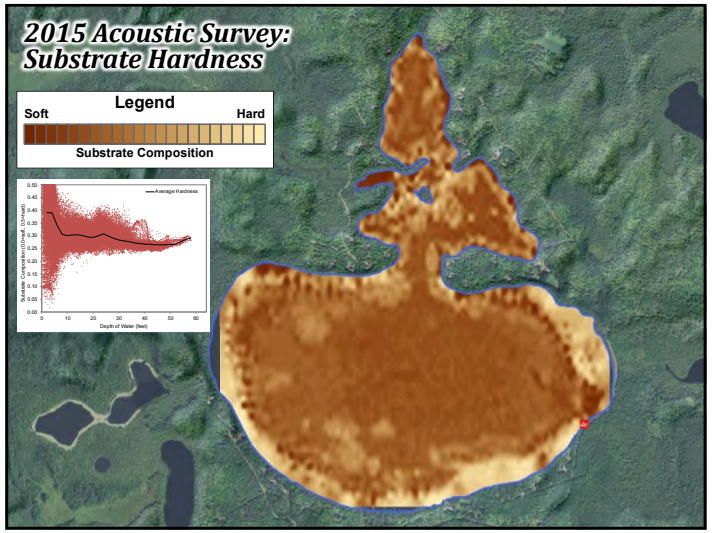
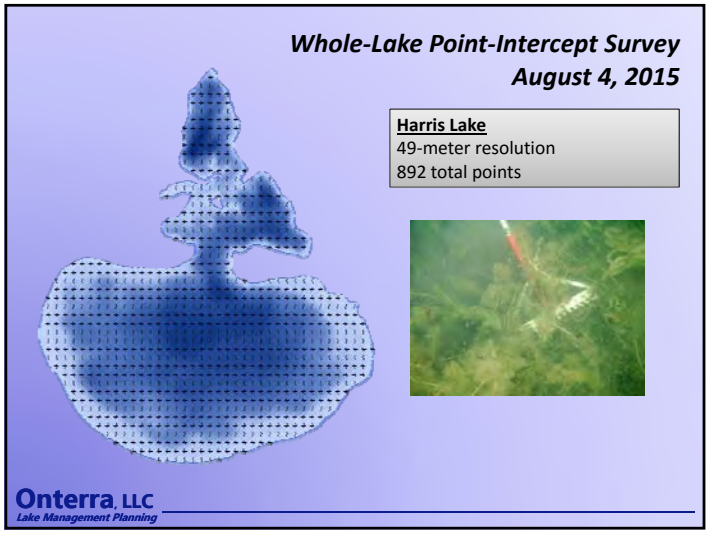

2015 Acoustic Survey:
Substrate Hardness
Legend
Soft
Hard
Substrate Composition


Whole-Lake Point-Intercept Survey
August 4, 2015
Harris Lake
49-meter resolution
892 total points
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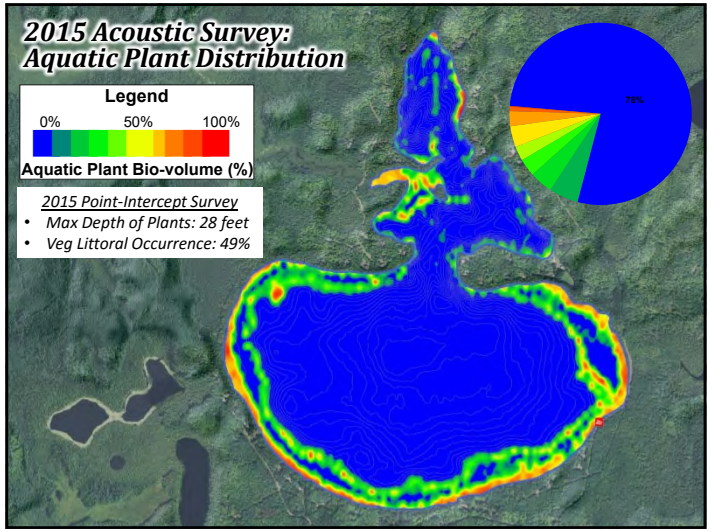
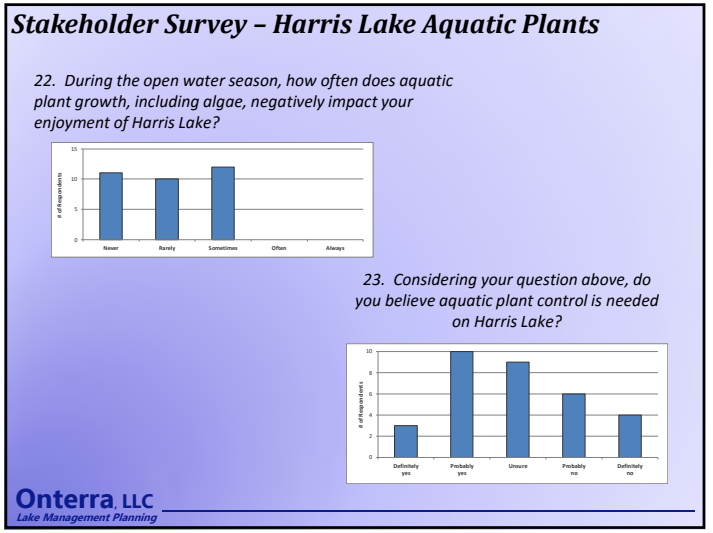

2015 Acoustic Survey:
Aquatic Plant Distribution
Legend
0%
50%
100%
Aquatic Plant Bio-volume (%)
2015 Point-Intercept Survey
Max Depth of Plants: 28 feet
Veg Littoral Occurrence: 49%
78%


Stakeholder Survey – Harris Lake Aquatic Plants
22. During the open water season, how often does aquatic plant growth, including algae, negatively impact your enjoyment of Harris Lake?
Never
Rarely
Sometimes
Often
Always
23. Considering your question above, do you believe aquatic plant control is needed on Harris Lake?
Definitely yes
Probably yes
Unsure
Probably no
Definitely no
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Aquatic Plant Species List

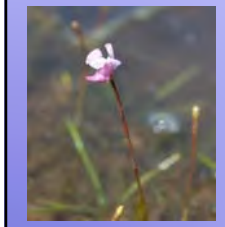
55 Native Species

1 Non-Native Species

Curly-leaf pondweed

1 Special Concern Species

Northeastern bladderwort



Growth Form	Scientific Name	Common Name	Coefficient of Conservatism (C)	2009 (WDNR)	2015 (Onterra)
Emergent	*Calla palustris*	Water arum	9		I
	Carex lasiocarpa	Narrow-leaved woolly sedge	9		I
	Carex pseudocyperus	Cyperus-like sedge	6		I
	Carex utriculata	Common yellow lake sedge	7		I
	Cladium mariscoides	Smooth sawgrass	10		I
	Dulichium arundinaceum	Three-way sedge	9	X	X
	Eleocharis palustris	Creeping spikerush	6	X	X
	Equisetum fluviatile	Water horsetail	7	X	X
	Juncus effusus	Soft rush	4		I
	Pontederia cordata	Pickerelweed	9		X
	Sagittaria latifolia	Common arrowhead	3		I
	Sagittaria rigida	Stiff arrowhead	8		I
	Schoenoplectus acutus	Hardstem bulrush	5	X	X
	Schoenoplectus pungens	Three-square rush	5	X	X
	Schoenoplectus tabernaemontani	Softstem bulrush	4		X
	Scirpus cyperinus	Wool grass	4		I
	Typha spp.	Cattail spp.	1		I
FL-EE	*Sparganium emersum*	Short-stemmed bur-reed	8		I
FL	*Brasenia schreberi*	Watershield	7		X
	Nuphar variegata	Spatterdock	6	X	X
	Nymphaea odorata	White water lily	6	X	X
	Pericaria amphibia	Water smartweed	5	X	X
	Sparganium angustifolium	Narrow-leaf bur-reed	9		I
	Sparganium fluctuans	Floating-leaf bur-reed	10		I
Submergent	*Bidens beckii*	Water marigold	8	X	X
	Chara spp.	Musk-grasses	7	X	X
	Elodea canadensis	Common waterweed	3	X	X
	Ericaulon aquaticum	Pipewort	9	X	X
	Heteranthera dubia	Water stargrass	6	X	X
	Isoetes spp.	Quillwort spp.	8	X	X
	Lobelia dortmanna	American shorerweed	10	X	X
	Myriophyllum alterniflorum	Water lobelia	10	X	X
	Myriophyllum sibiricum	Alternate-flowered water milfoil	10		X
	Najas flexilis	Northern water milfoil	7	X	X
	Nitella spp.	Slender naiad	6	X	X
	Potamogeton amplifolius	Stoneworts	8	X	
	Potamogeton crispus *	Large-leaf pondweed	7	X	X
	Potamogeton epihydrus	Curly-leaf pondweed	Exotic	X	I
	Potamogeton foliosus	Ribbon-leaf pondweed	8		X
	Potamogeton friesii	Leafy pondweed	6	X	
	Potamogeton gleminesis	Fries' pondweed	8		X
	Potamogeton illinoensis	Variable-leaf pondweed	7	X	X
	Potamogeton praelongus	Illinois pondweed	8	X	X
	Potamogeton pusillus	White-stem pondweed	6	X	X
	Potamogeton richardsonii	Small pondweed	7	X	X
	Potamogeton robbinsii	Clasping-leaf pondweed	5	X	X
	Potamogeton strictifolius	Fern-leaf pondweed	8	X	X
	Potamogeton zosteriformis	Stiff pondweed	6		X
	Ranunculus flammula	Flat-stem pondweed	6	X	X
	Sium suave	Creeping waterparsnip	9	X	X
	Utricularia cornuta	Sago pondweed	3	X	X
	Utricularia intermedia	Flat-leaf bladderwort	9	X	X
	*Utricularia resupinata**	Northeastern bladderwort	9	X	X
	Utricularia vulgaris	Common bladderwort	7		I
	Vallisneria americana	Wild celery	6	X	X
SUE	*Eleocharis acicularis*	Needle spikerush	5	X	X
	Juncus pelocarpus	Brown-fruited rush	8	X	X
	Sagittaria cristata	Crested arrowhead	9	X	I

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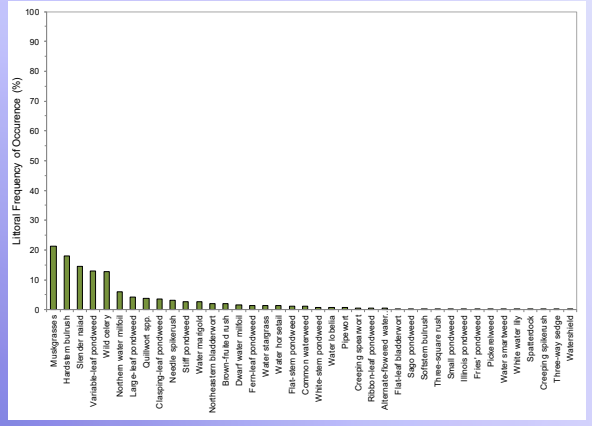
2015 Littoral Frequency of Occurrence



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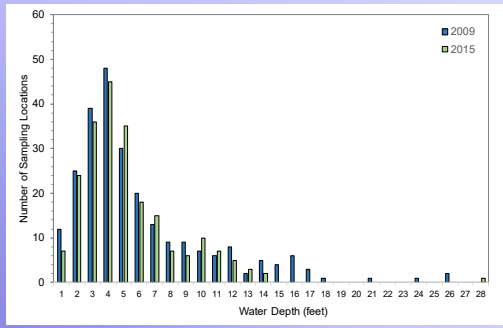
2009 & 2015 Comparison
Littoral Frequency of Occurrence

- 2009 Veg Occurrence: 54%
- 2015 Veg Occurrence: 49%
- Not statistically different



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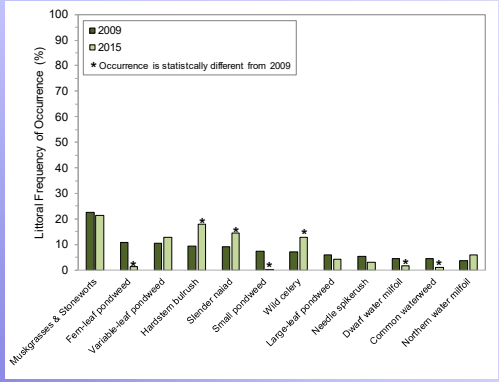
2009 & 2015 Comparison
Littoral Frequency of Occurrence



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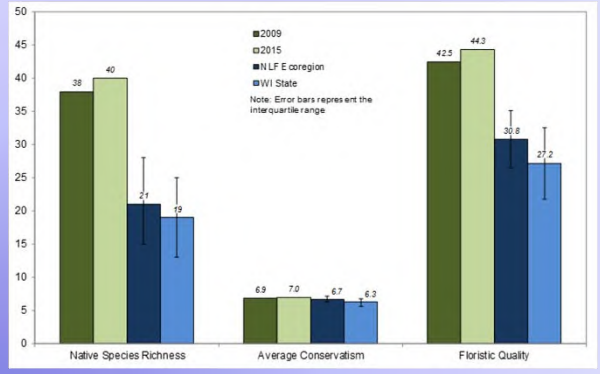
2009 & 2015 Comparison
Floristic Quality Analysis



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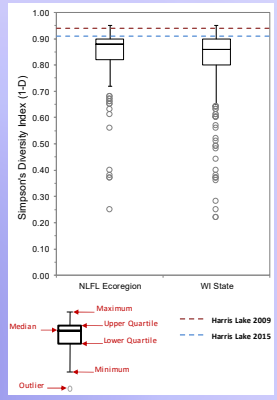
2009 & 2015 Comparison
Simpson's Diversity Index



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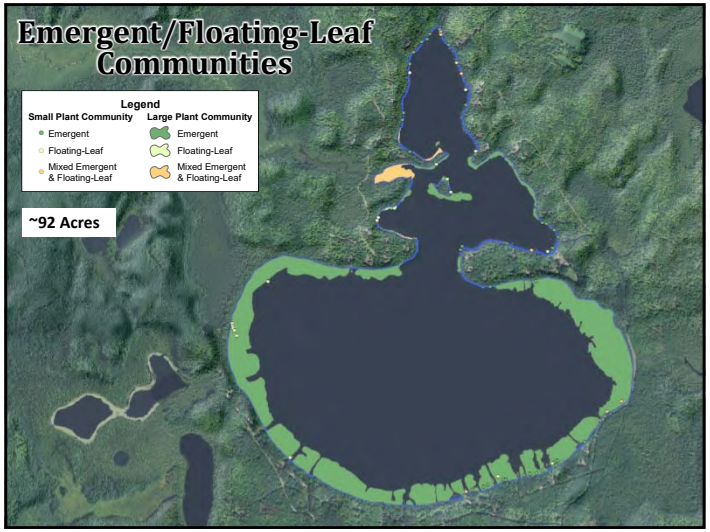
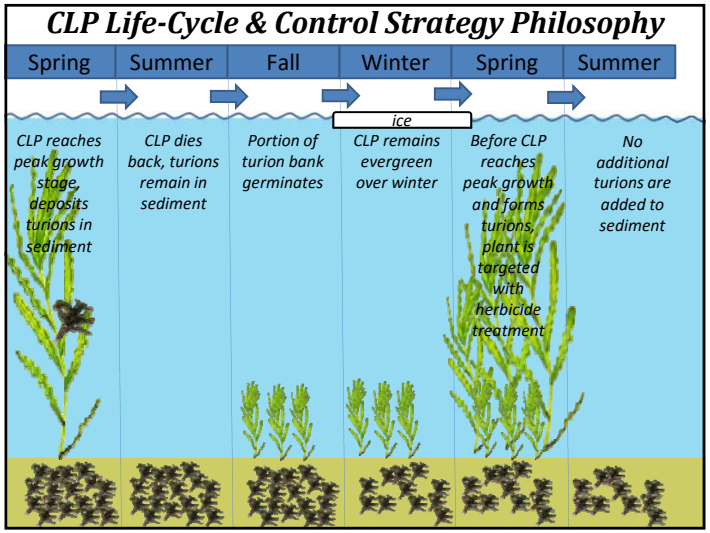
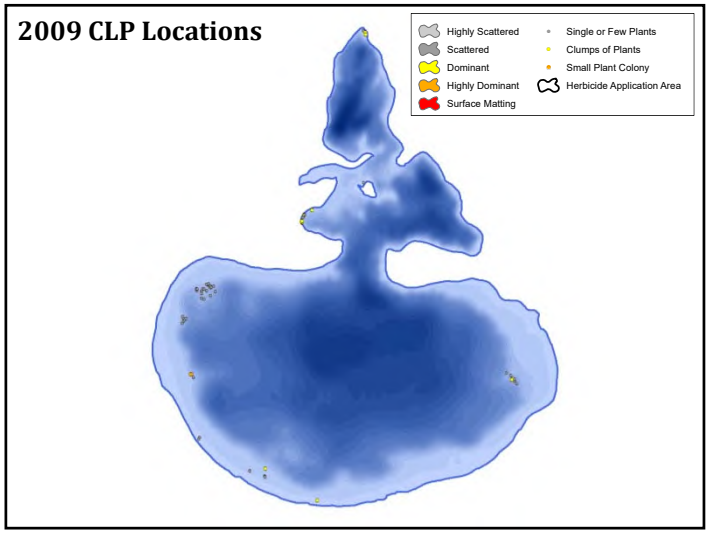
Emergent/Floating-Leaf Communities

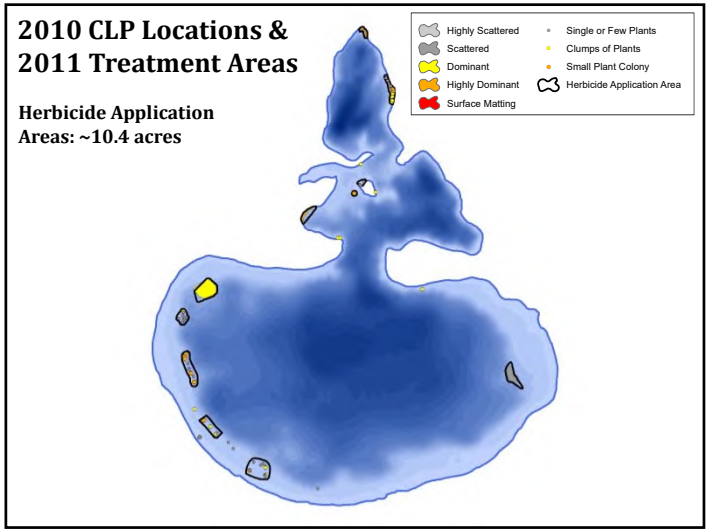


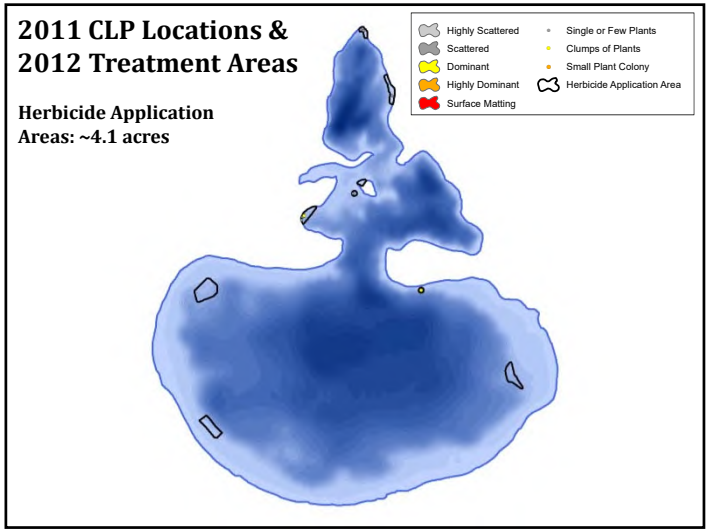
Non-Native Aquatic Plants
Curly-Leaf Pondweed

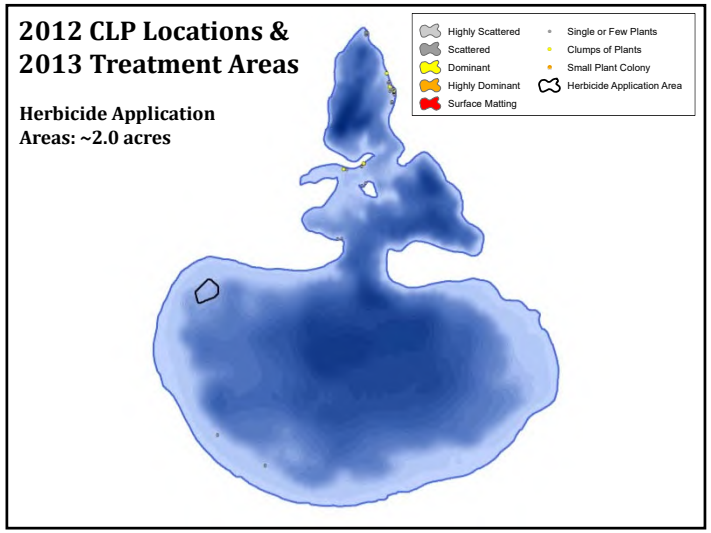
- 2008: CLP discovered in Harris Lake
- 2009 PI Survey: CLP littoral occurrence of 1.5%
- HLA awarded WDNR AIS-EDR Grant
- Onterra completed first mapping survey of CLP in 2009
- Herbicide applications occurred in 2010, 2011, 2012, and 2013
- HLA volunteer hand-removal also utilized
- No treatment in 2014
- No CLP located in 2014 or 2015

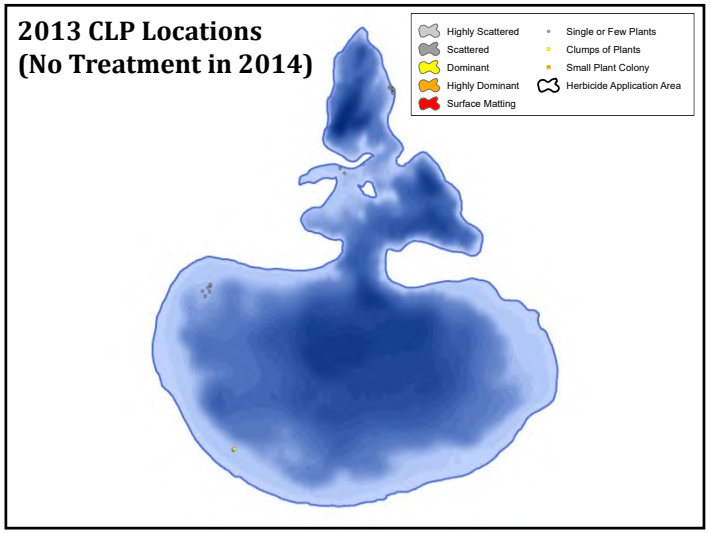

CLP Life-Cycle & Control Strategy Philosophy
Spring
Summer
Fall
Winter
Spring
Summer
ice
CLP reaches peak growth stage, deposits turions in sediment
CLP dies back, turions remain in sediment
Portion of turion bank germinates
CLP remains evergreen over winter
Before CLP reaches peak growth and forms turions, plant is targeted with herbicide treatment
No additional turions are added to sediment

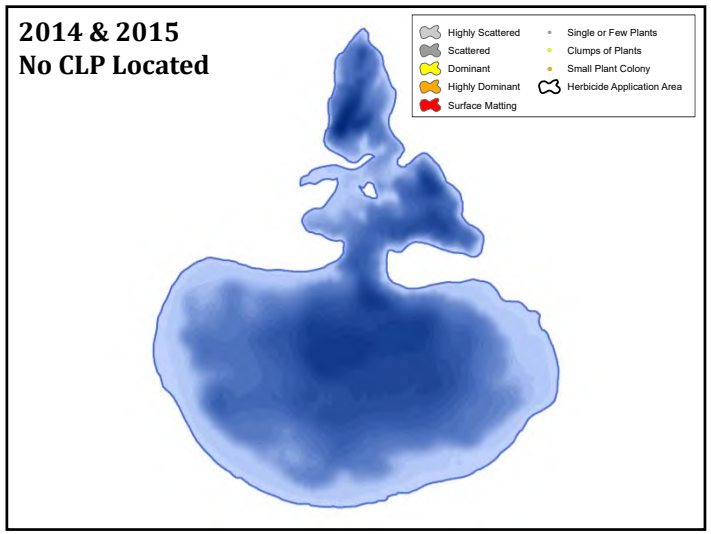

2009 CLP Locations
Highly Scattered
Scattered
Dominant
Highly Dominant
Surface Matting
Single or Few Plants
Clumps of Plants
Small Plant Colony
Herbicide Application Area


2010 CLP Locations &
2011 Treatment Areas
Herbicide Application
Areas: ~10.4 acres
Highly Scattered
Scattered
Dominant
Highly Dominant
Surface Matting
Single or Few Plants
Clumps of Plants
Small Plant Colony
Herbicide Application Area


2011 CLP Locations &
2012 Treatment Areas
Herbicide Application
Areas: ~4.1 acres
Highly Scattered
Scattered
Dominant
Highly Dominant
Surface Matting
Single or Few Plants
Clumps of Plants
Small Plant Colony
Herbicide Application Area


2012 CLP Locations &
2013 Treatment Areas
Herbicide Application
Areas: ~2.0 acres
Highly Scattered
Scattered
Dominant
Highly Dominant
Surface Matting
Single or Few Plants
Clumps of Plants
Small Plant Colony
Herbicide Application Area

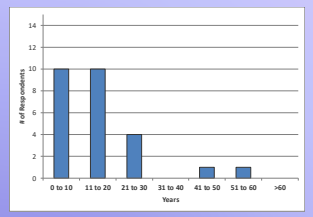

2013 CLP Locations
(No Treatment in 2014)
Highly Scattered
Scattered
Dominant
Highly Dominant
Surface Matting
Single or Few Plants
Clumps of Plants
Small Plant Colony
Herbicide Application Area


2014 & 2015
No CLP Located
Highly Scattered
Scattered
Dominant
Highly Dominant
Surface Matting
Single or Few Plants
Clumps of Plants
Small Plant Colony
Herbicide Application Area

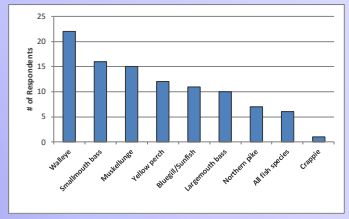

Fisheries

Stakeholder Survey – Harris Lake Fishery

9. For how many years have you fished Harris Lake?



10. What species of fish do you like to catch on Harris Lake?



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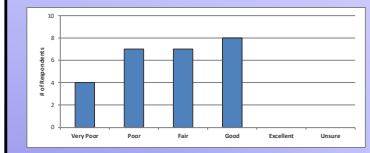
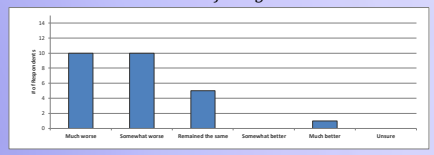
Stakeholder Survey – Harris Lake Fishery

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



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



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Harris Lake Fisheries

- Designated as *Area of Special Natural Resource Interest (ASNRI)*
  Priority Navigable Waterway
  - Naturally reproducing walleye & muskellunge populations

Native American Spear Harvest

- Highly regulated process
  - Permits & harvest reporting required
- Annual review of population estimates (WDNR & GLIFWC)
- *Total Allowable Catch* Established
  - ~35% of walleye; 27% of musky
- *Safe Harvest Level* Established
- Tribal *declaration* or *quota* established

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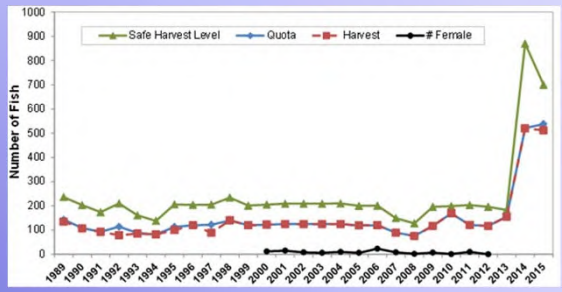
Harris Lake Fisheries

Harris Lake Walleye Spear Harvest

- Harvest 2 walleyes >20 inches per nightly permit
  - 1 between 20 and 24 inches
  - 1 any size over 20 inches



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Harris Lake Fisheries

Harris Lake Walleye Hook and Line Harvest

- Daily limit of 3
  - No minimum length limit, but only 1 over 14 inches is allowed
- 1992 Creel Survey
  - 460 hook and line harvest (79 tribal spearing)
- 1997 Creel Survey
  - 562 hook and line harvest (89 tribal spearing)

Goal is 2-4 adult fish/acre

- 2013 GLIFWC Survey: 11.9 adult fish/acre

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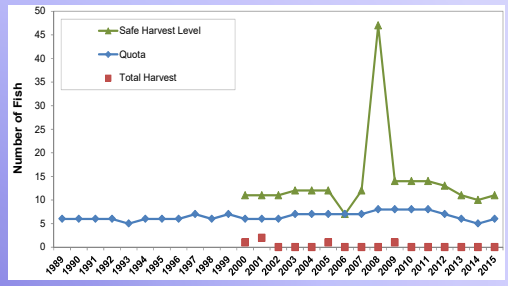
Harris Lake Fisheries

Harris Lake Muskellunge Spear Harvest

- 5 muskies harvested since 1989



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Conclusions

Water Quality

- Overall, excellent for deep, headwater drainage lake
- No detectable trends in phosphorus concentrations
- Recent decline in water clarity likely result of increased precipitation (dissolved organic acids)

Watershed & Immediate Shoreland

- Watershed mainly comprised of natural land cover
- Model-predicted phosphorus aligns with measured phosphorus
- Minimal development along shoreland
- High occurrence of course woody habitat

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Conclusions

Aquatic Plant Community

- Exceptional species richness & diversity
- Indicative of high-quality environment
- CLP currently at an undetectable level
- ESAIS survey to occur in June 2016

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Many of the graphics used in this presentation were supplied by:

Wisconsin Lakes Partnership

UW Extension

Wisconsin Dept. of Natural Resources

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Presentation Outline

- Lake Management Planning Project Overview
- Study Results
  - Water Quality
  - Watershed
  - Shoreland Condition
  - Aquatic Plants
  - Fishery

  Stakeholder Survey
- "Big Picture"
- Implementation Plan Development

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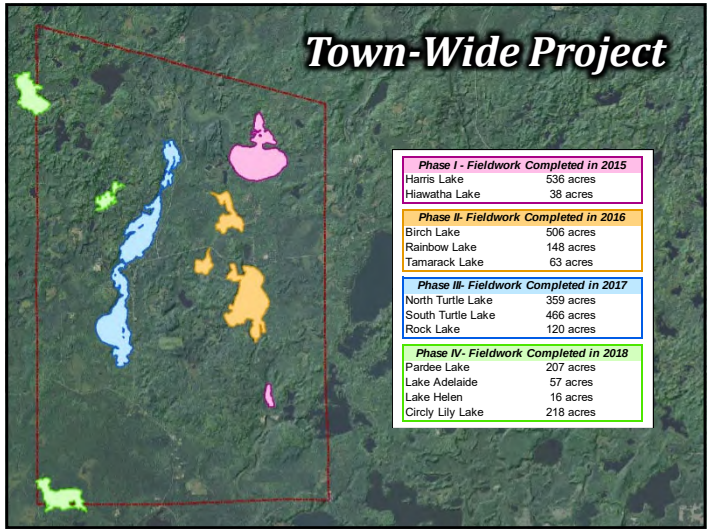

Management Planning Project Overview

- Collect & analyze data – completed
  - Technical & sociological
- Construct long-term & useable plan

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Summary of Project Results

Water Quality
- Overall, excellent for deep, headwater drainage lake

Watershed & Immediate Shoreline
- Watershed in excellent shape – primarily forests & wetlands
- Majority of shoreland little to no development

Aquatic Plant Community
- High-quality species present
- Number of native species relatively low, but expected given water quality
- No non-native species located

Fisheries
- Not much information available

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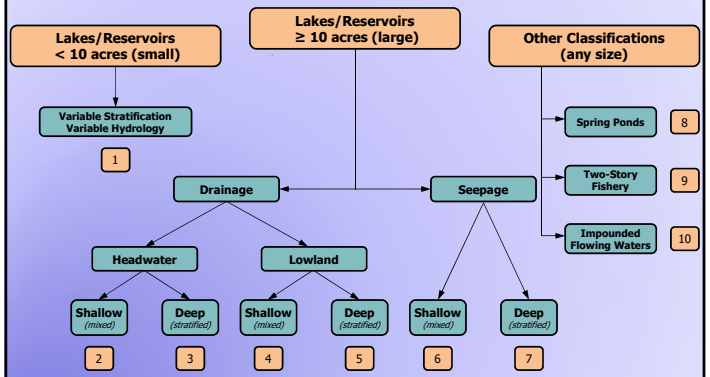
Wisconsin Lakes Natural Community Types



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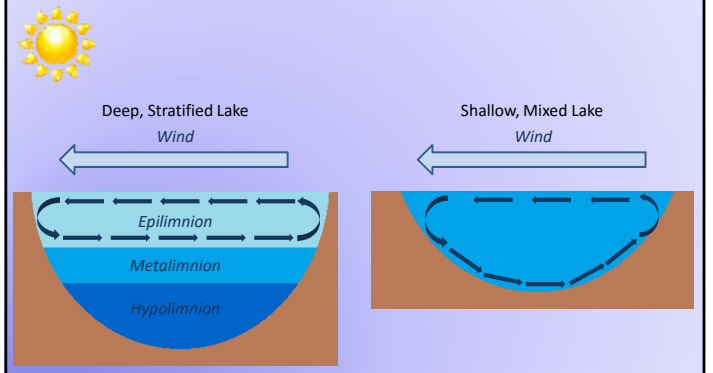
Wisconsin Lakes Classification



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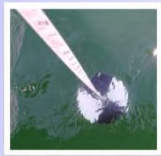
Introduction to Lake Water Quality

Phosphorus
Naturally occurring & essential for all life
Regulates phytoplankton biomass in most WI lakes
Most often 'limiting plant nutrient' (shortest supply)
Human development 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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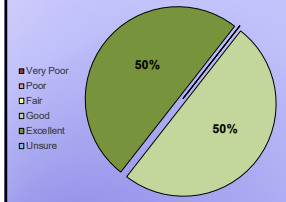
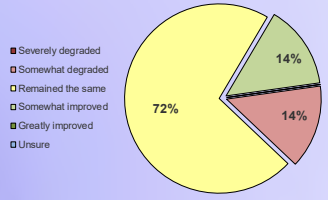
Hiawatha Stakeholder Perceptions of Water Quality

How would you describe the current water quality of Hiawatha Lake?



How has water quality changed in Hiawatha Lake since you first visited the lake?



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Water Quality

Wisconsin Ecoregions

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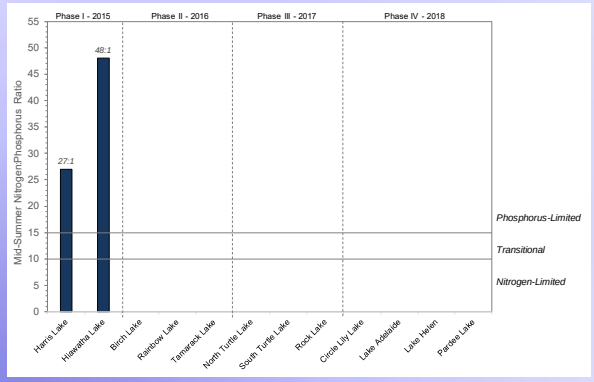
Town of Winchester – Phase I Lakes
Mid-Summer Nitrogen:Phosphorus Ratio



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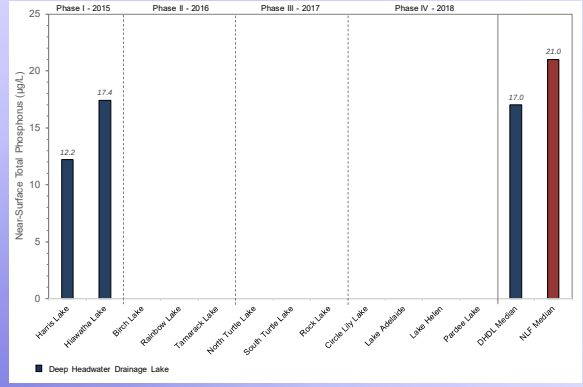
Town of Winchester – Phase I Lakes
Near-Surface Total Phosphorus



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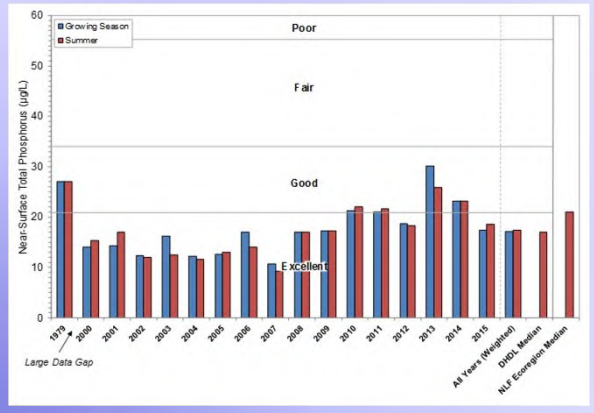
Hiawatha Lake Long-Term Trends
Near-Surface Total Phosphorus



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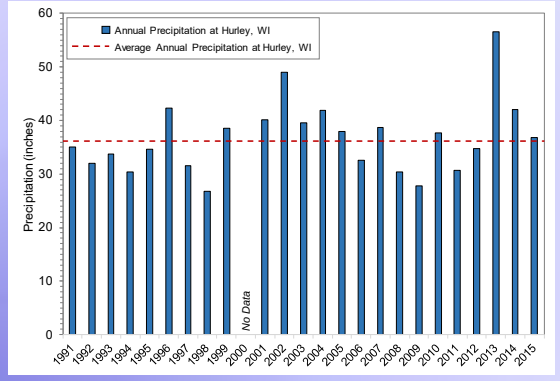
Annual Precipitation Data – Hurley, WI



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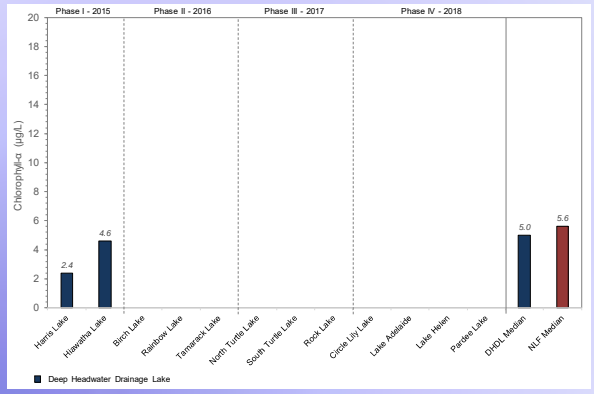
Town of Winchester – Phase I Lakes
Chlorophyll-*a*



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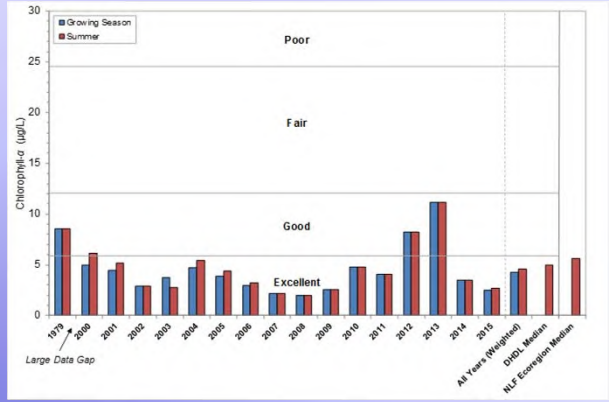
Hiawatha Lake Long-Term Trends
Chlorophyll-*a*



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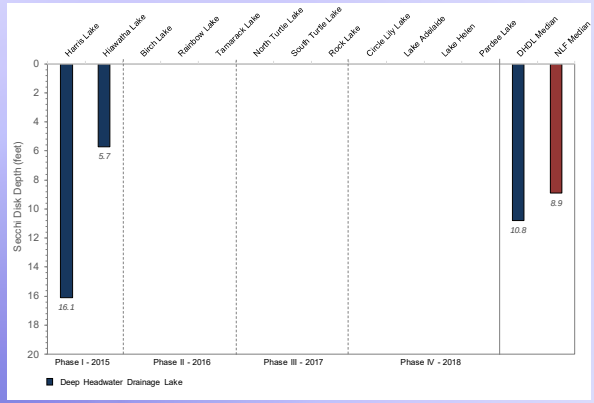
Town of Winchester – Phase I Lakes
Secchi Disk Transparency



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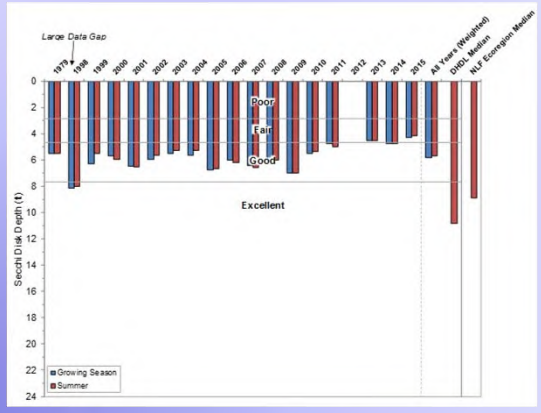
Hiawatha Lake Long-Term Trends
Secchi Disk Transparency



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Hiawatha Lake Water Clarity

Secchi disk transparency lower than predicted based on chl-*a* concentrations

- Water clarity largely determined by dissolved organic acids
- Give water *tea-like* or *stained appearance*
- Primarily originate from wetlands
- 2015 *True Color* indicates water *heavily tea-colored (175 SU)*

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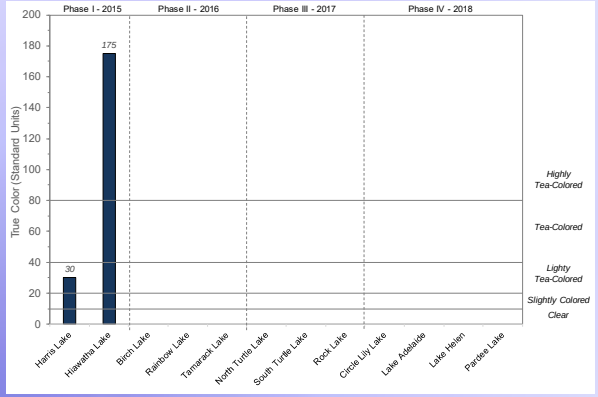
Town of Winchester – Phase I Lakes True Color



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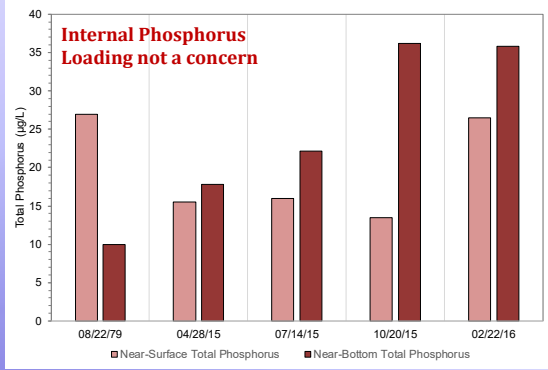
Hiawatha Lake Near-Bottom Total Phosphorus



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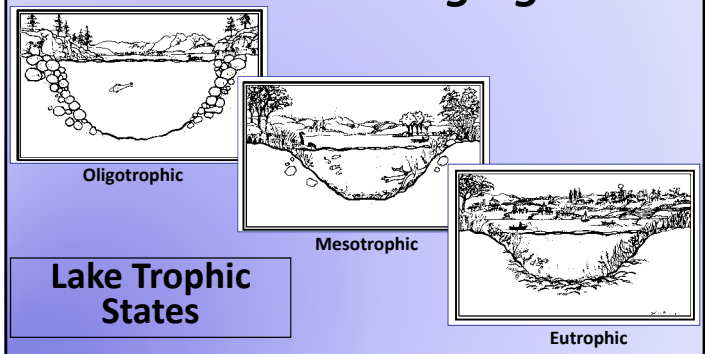
Eutrophication -Lake Aging



Lake Trophic States

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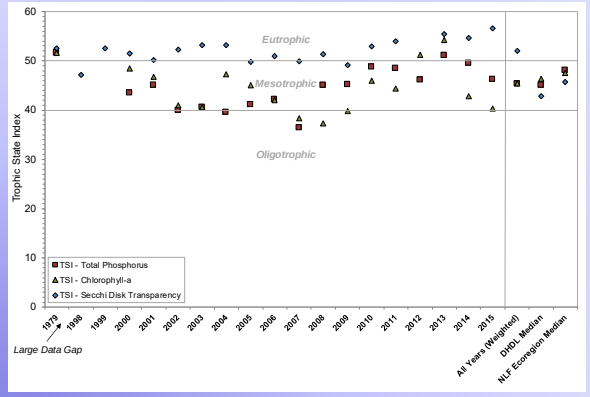
Hiawatha Lake Trophic State Index



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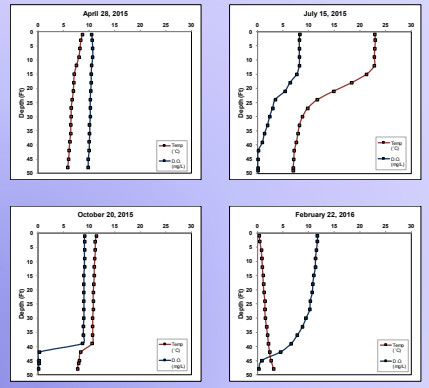
Temperature & Dissolved Oxygen



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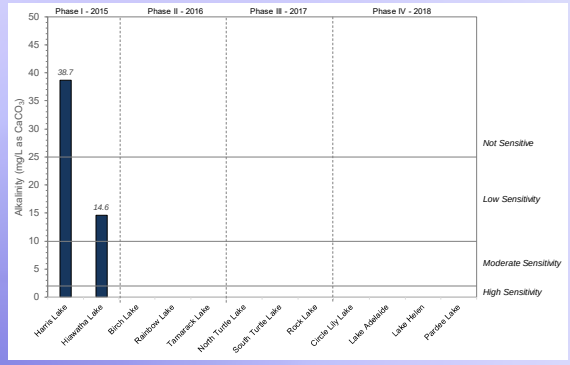
Additional Water Quality Parameters Alkalinity



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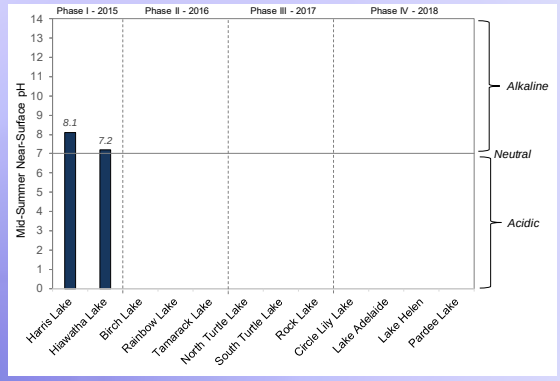
Additional Water Quality Parameters pH



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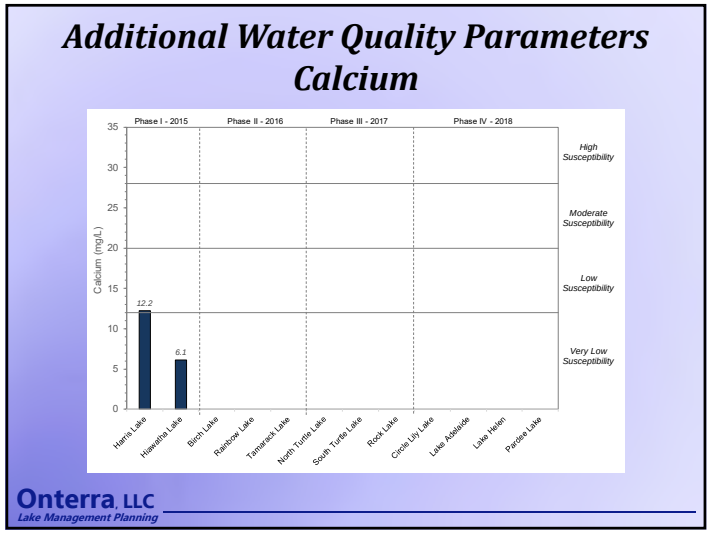
Additional Water Quality Parameters
Calcium
Phase I - 2015
Phase II - 2016
Phase III - 2017
Phase IV - 2018
Calcium (mg/L)
35
30
25
20
15
10
5
0
12.2
6.1
High Susceptibility
Moderate Susceptibility
Low Susceptibility
Very Low Susceptibility
Harris Lake
Hiawatha Lake
Birch Lake
Rainbow Lake
Tamarack Lake
North Turtle Lake
South Turtle Lake
Rock Lake
Circle Lily Lake
Lake Adelaide
Lake Helen
Pardee Lake
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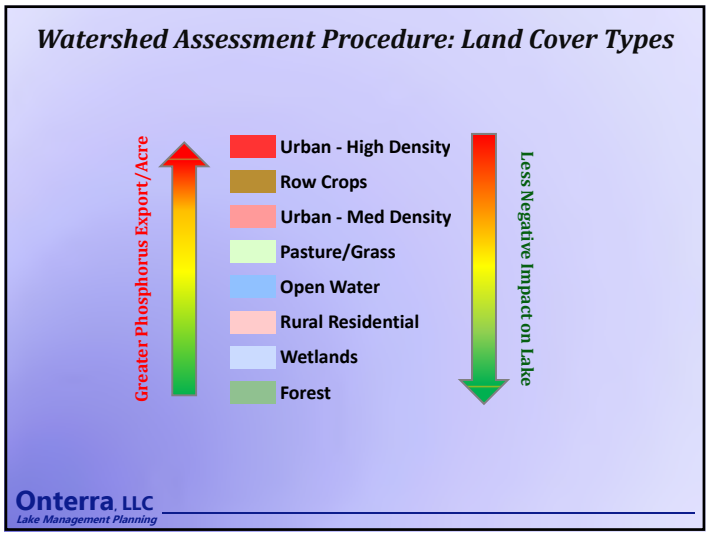
Watershed


Watershed
~819 acres
(1.3 square miles)
WS:LA: 21:1
Residence Time:
~1.3 years


Watershed Assessment Procedure: Land Cover Types
Greater Phosphorus Export/Acre
Urban - High Density
Row Crops
Urban - Med Density
Pasture/Grass
Open Water
Rural Residential
Wetlands
Forest
Less Negative Impact on Lake
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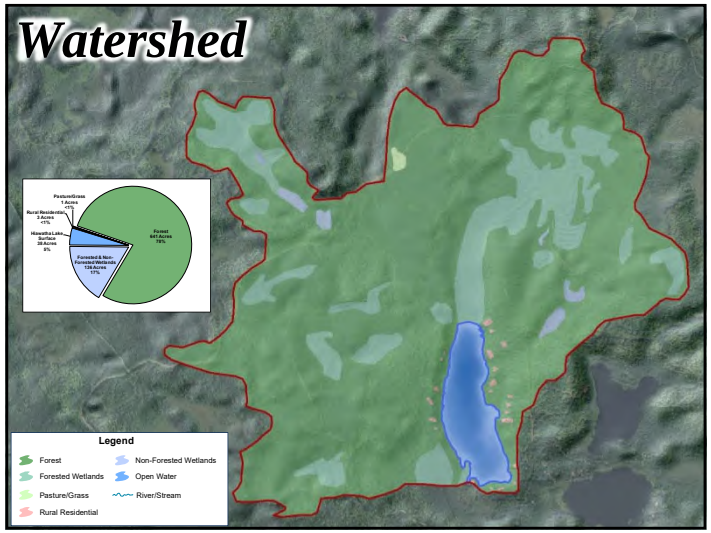

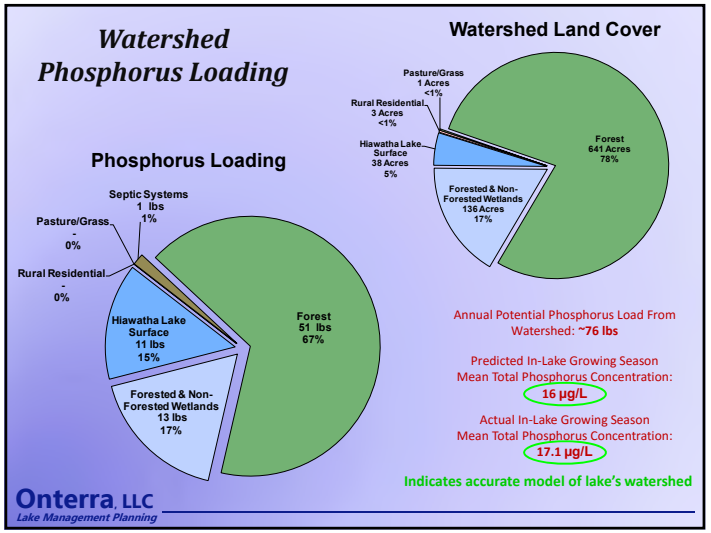

Hiawatha Lake Watershed Scenarios

- **Scenario 1:** 25% of forests (160 acres) converted to pasture/grass
  - P concentrations increase from 17.1 to 21.0 µg/L
  - Chl-*a* increase from 4.6 to 6.0 µg/L
  - Secchi decline from 5.7 to 4.7 feet
- **Scenario 2:** 25% of forests (160 acres) converted to row crop agriculture
  - P concentrations increase from 17.1 to 34.0 µg/L
  - Chl-*a* increase from 4.6 to 12.0 µg/L
  - Secchi decline from 5.7 to 3.0 feet

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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.
- It does not look at lake shoreline on a property-by-property basis.
- Assessment ranks shoreland area from shoreline back 35 feet

Urbanized → Range → **Natural**

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Shoreline Assessment Category Descriptions

More Natural Habitat

Urbanized | Developed-Unnatural | Developed-Semi-Natural | Developed-Natural | Natural/Undeveloped

Greater Need for Restoration

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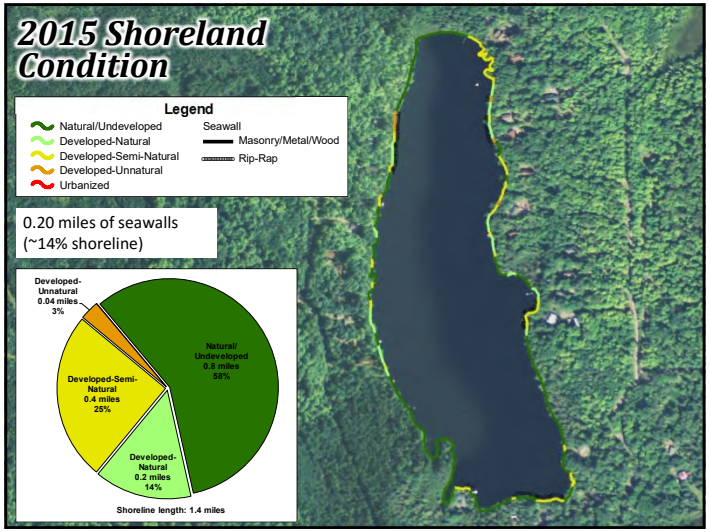
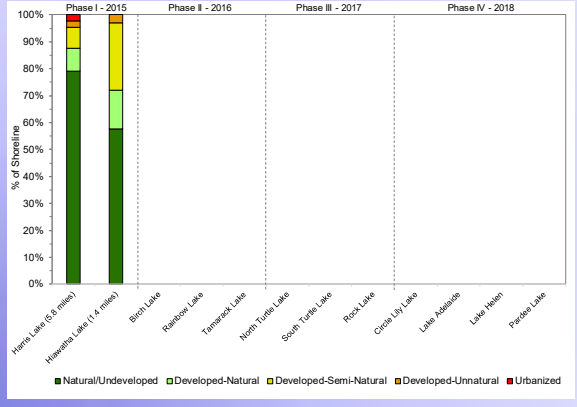
2015 Shoreland Condition



Town of Winchester – Phase I Lakes Shoreland Condition



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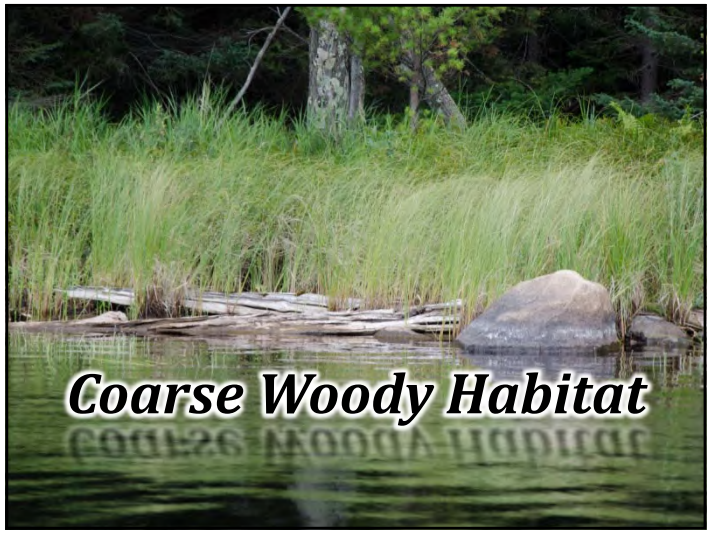

Coarse Woody Habitat

- Provides shoreland erosion control and prevents suspension of sediments.
- Preferred habitat for a variety of aquatic life.
  - Periphyton growth fed upon by insects.
  - Refuge, foraging and spawning habitat for fish.
  - Complexity of CWH important.
- Changing of logging and shoreland development practices = reduced CWH in Wisconsin lakes.
- Survey aimed at quantifying CWH in Hiawatha Lake

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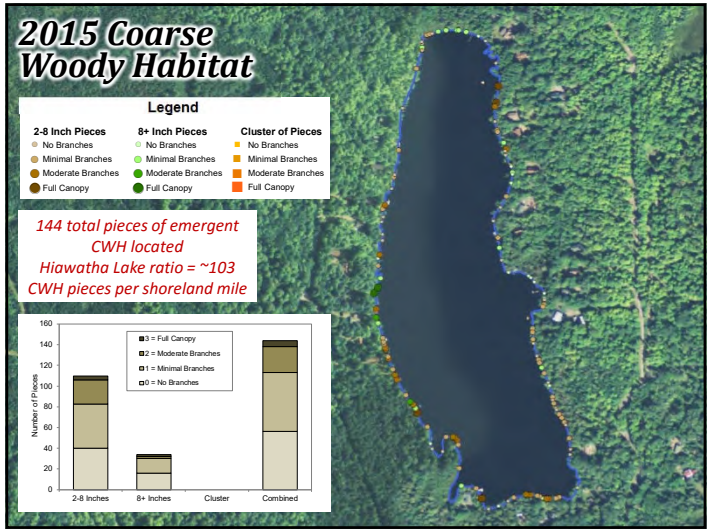
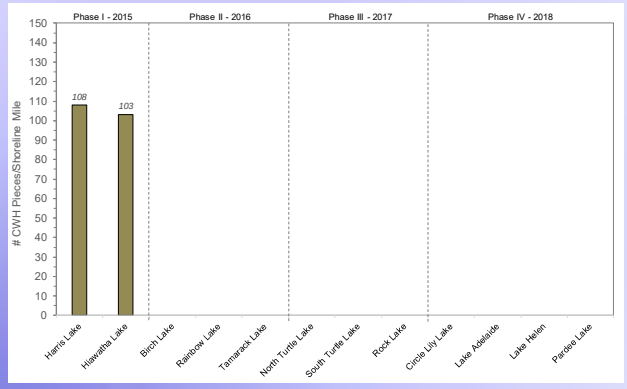


Town of Winchester – Phase I Lakes
Coarse Woody Habitat



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Aquatic Plant Surveys

- Assess both non-native & native species
- Four surveys completed in 2015
  - Early-Season AIS Survey
  - Whole-Lake Point-Intercept Survey
  - Acoustic Survey
    - Water depth (bathymetry)
    - Substrate hardness
    - Aquatic plant bio-volume
  - Emergent/Floating-Leaf Community Mapping Survey

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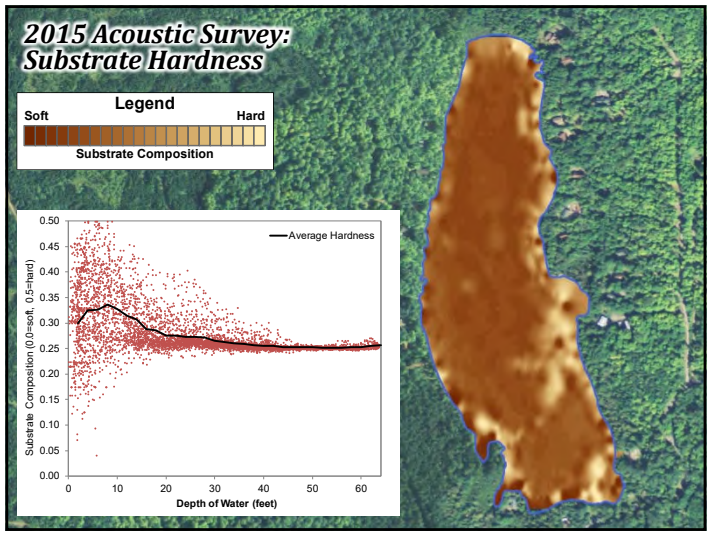
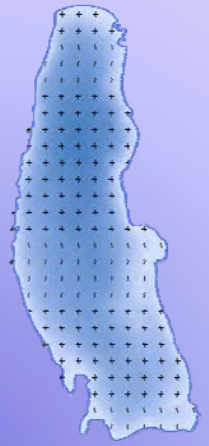


Whole-Lake Point-Intercept Survey
August 18, 2015



Hiawatha Lake
30-meter resolution
176 total points

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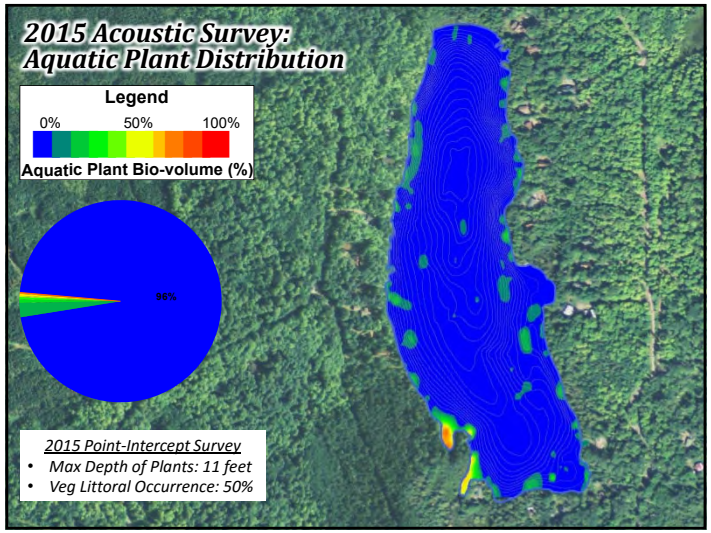
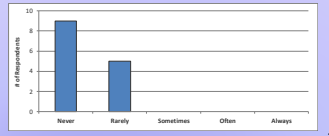
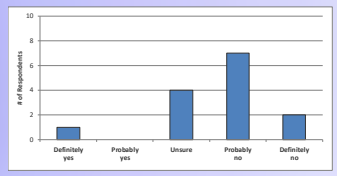


Stakeholder Survey – Hiawatha Lake Aquatic Plants

22. During the open water season, how often does aquatic plant growth, including algae, negatively impact your enjoyment of Hiawatha Lake?



23. Considering your question above, do you believe aquatic plant control is needed on Hiawatha Lake?



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Aquatic Plant Species List

26 Native Species

No Non-Native Species

Growth Form	Scientific Name	Common Name	Coefficient of Conservatism (C)	2015 (Onterra)
Emergent	*Carex aquatilis*	Long-bracted fuasiock sedge	7	I
	Carex lasiocarpa	Narrow-leaved woolly sedge	9	I
	Carex utriculata	Common yellow lake sedge	7	I
	Dulichium arundinaceum	Three-way sedge	9	I
	Eleocharis palustris	Creeping spikerush	6	X
	Equisetum fluviatile	Water horsetail	7	X
	Glyceria canadensis	Rattlesnake grass	7	I
	Juncus effusus	Soft rush	4	I
	Schoenoplectus tabernaemontani	Softstem bulrush	4	I
	Scirpus cyperinus	Wool grass	4	I
	Typha spp.	Cattail spp.	1	I
FL/E	*Sparganium emersum*	Short-stemmed bur-reed	8	I
FL	*Nuphar variegata*	Spatterdock	6	X
	Sparganium fluctuans	Floating-leaf bur-reed	10	I
Submergent	*Callitriche palustris*	Common water starwort	8	I
	Chara spp.	Muskgrasses	7	X
	Eriocaulon aquaticum	Pipewort	9	X
	Fontinalis sphagnifolia	Rolled water moss	N/A	X
	Isoetes spp.	Quillwort spp.	8	X
	Najas flexilis	Slender naiad	6	X
	Nitella spp.	Stoneworts	7	X
	Potamogeton berchtoldii	Slender pondweed	7	X
	Potamogeton epihydrus	Ribbon-leaf pondweed	8	X
	Potamogeton gramineus	Variable-leaf pondweed	7	X
	Potamogeton natans	Floating-leaf pondweed	5	I
	Potamogeton spirillus	Spiral-fruited pondweed	8	X

FL/E = Floating Leaf and Emergent; FL = Floating Leaf
X = Located on rake during point-intercept survey; I = Incidental Species

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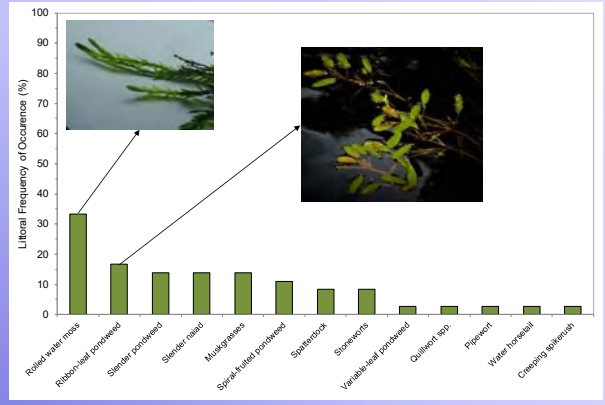
2015 Littoral Frequency of Occurrence



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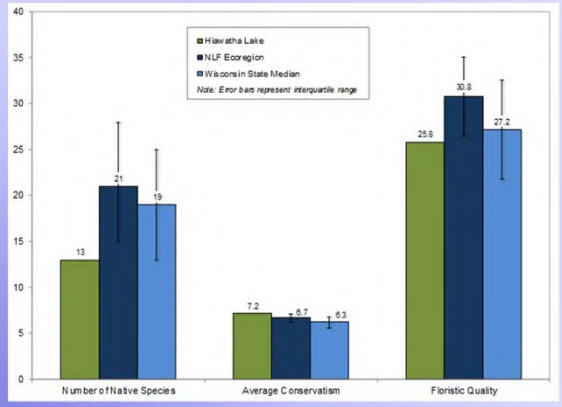
Floristic Quality Analysis



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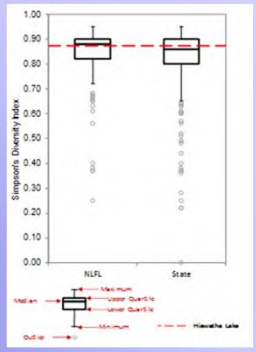
2009 & 2015 Comparison
Simpson's Diversity Index



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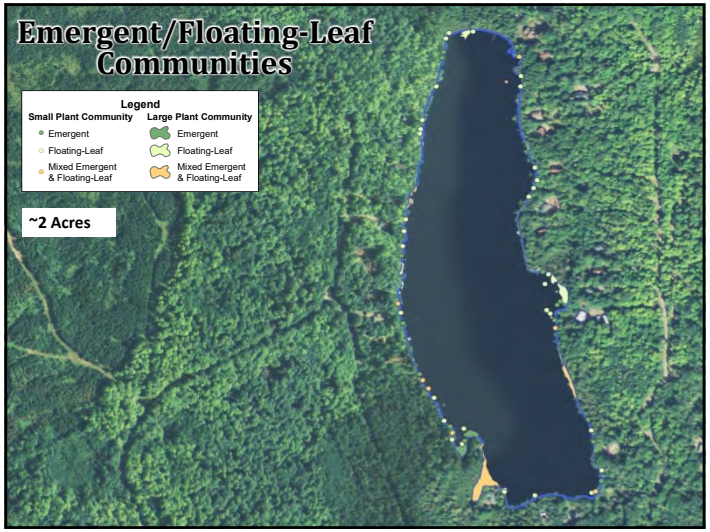
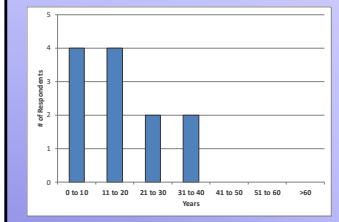
Emergent/Floating-Leaf Communities

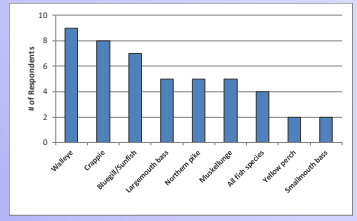


Stakeholder Survey – Hiawatha Lake Fishery

9. For how many years have you fished Hiawatha Lake?



10. What species of fish do you like to catch on Hiawatha Lake?



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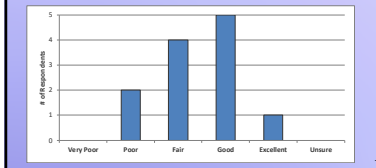
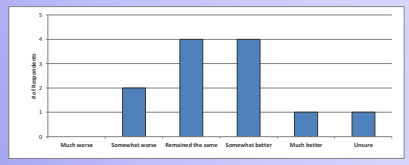
Stakeholder Survey – Hiawatha Lake Fishery

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



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



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Hiawatha Lake Fisheries

Native American Spear Harvest

- No spearing has occurred on Hiawatha Lake

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Conclusions

Water Quality

- Overall, excellent for deep, headwater drainage lake
- Recent higher phosphorus & chl-*a* concentrations likely due to increases in precipitation
- Water clarity low, but primarily driven by dissolved organic acids

Watershed & Immediate Shoreland

- Watershed mainly comprised of natural land cover
- Model-predicted phosphorus aligns with measured phosphorus
- Minimal development along shoreland
- High occurrence of course woody habitat

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Conclusions

Aquatic Plant Community

- Species richness low, but expected given lake's lower pH/alkalinity & low water clarity
- Quality of species present very high and indicative of high-quality environment
- No non-native plants located

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Many of the graphics used in this presentation were supplied by:

Wisconsin Lakes Partnership

UW Extension

Wisconsin Dept. of Natural Resources

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Presentation Outline

- Project Goals
- Overall Study Conclusions
- Key Study Results – Detailed
- Management Goals and Actions
- Questions

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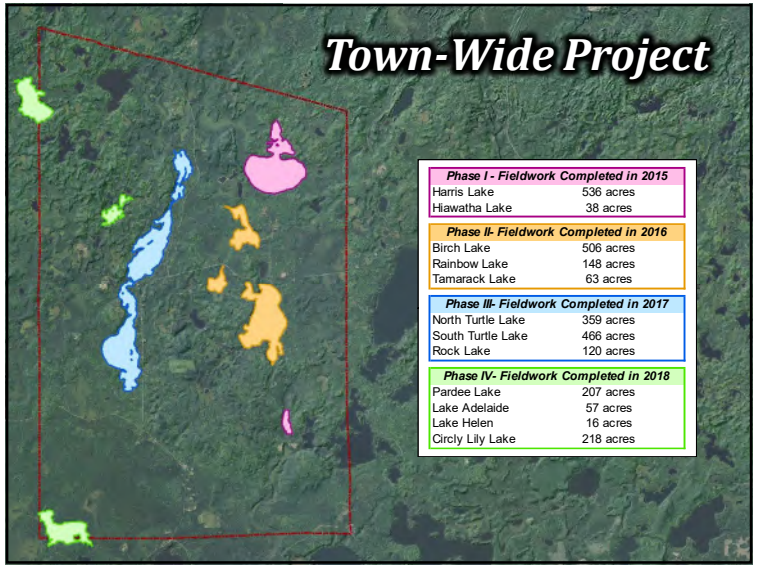

Study and Plan Goals

- Collect & Analyze Data
  - 2015/2016
- Construct Long-Term & Useable Plan
  - Planning Meetings 2016
  - Final Plan approved by WDNR in winter 2017

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Data and information gathering

- Study Components
  - Water Quality Analysis
  - Watershed Assessment
  - Shoreland Assessment
  - Aquatic Plant Surveys
  - Stakeholder Survey
  - Fisheries Data Integration

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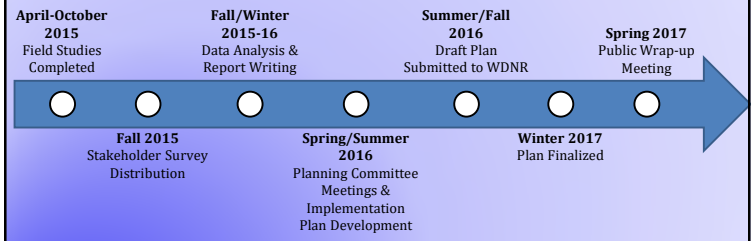
Phase I Timeline



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Overall Project Conclusions

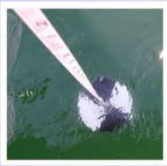
- **Water Quality (nutrients and algae)**
  - Overall, water quality is excellent for deep headwater drainage lakes
  - Low concentrations of phosphorus & low phytoplankton abundance
- **Watersheds (drainage basin)**
  - Excellent shape; majority comprised of forests & wetlands
  - Modeling indicated no unaccounted sources of phosphorus
- **Immediate shoreland zone**
  - Largely natural/minimal development
- **Aquatic Plant Community**
  - Native plant communities are of high quality
  - Curly-leaf pondweed occurrence in Harris Lake is low

Introduction to Lake Water Quality

Phosphorus
Naturally occurring & essential for all life
Regulates phytoplankton biomass in most WI lakes
Most often 'limiting plant nutrient' (shortest supply)
Human development 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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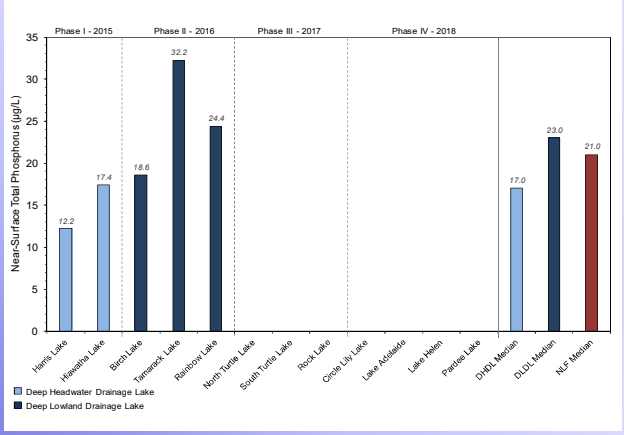
Summer Total Phosphorus



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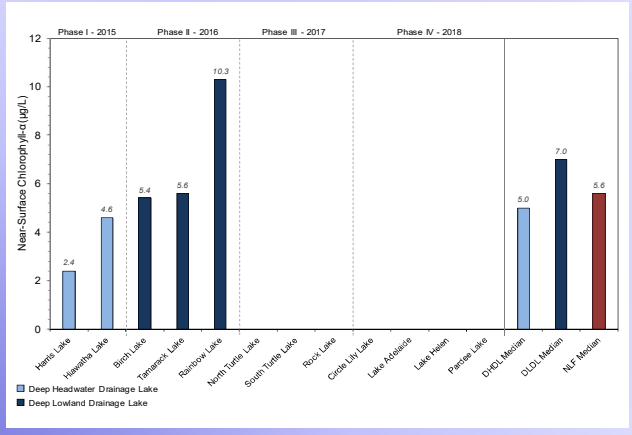
Summer Chlorophyll



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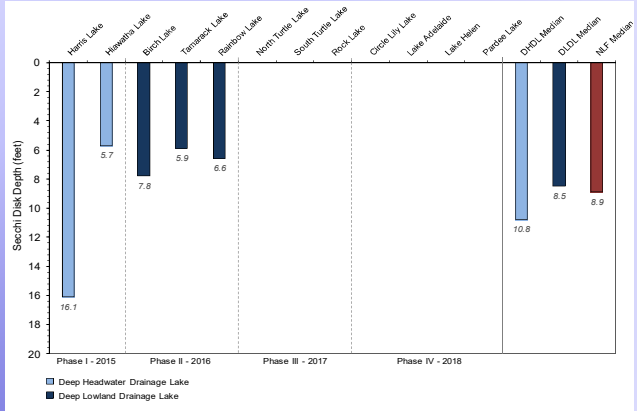
Summer Water Clarity (Secchi Disk Depth)



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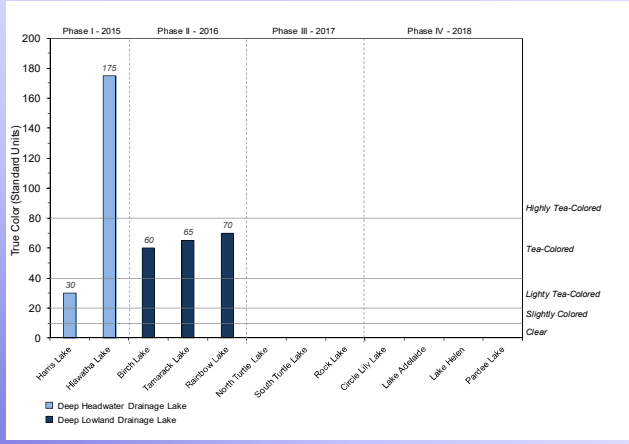
True Color



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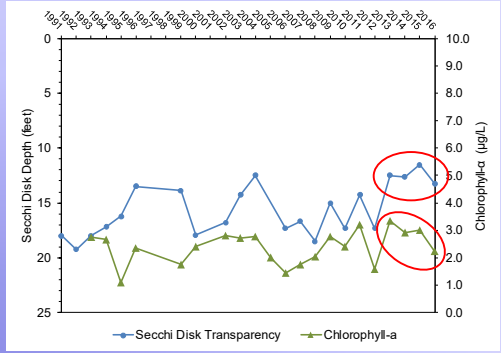
Harris Lake Water Clarity



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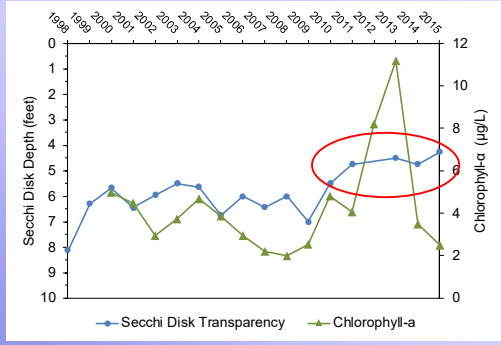
Hiawatha Lake Water Clarity



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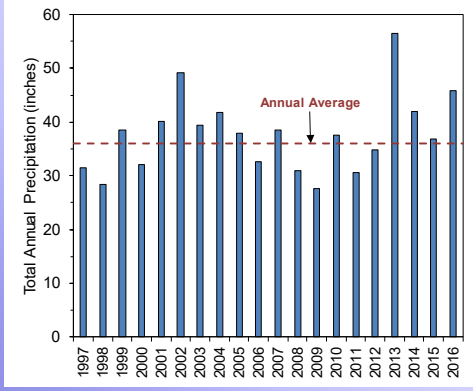
Annual Precipitation Data – Hurley, WI



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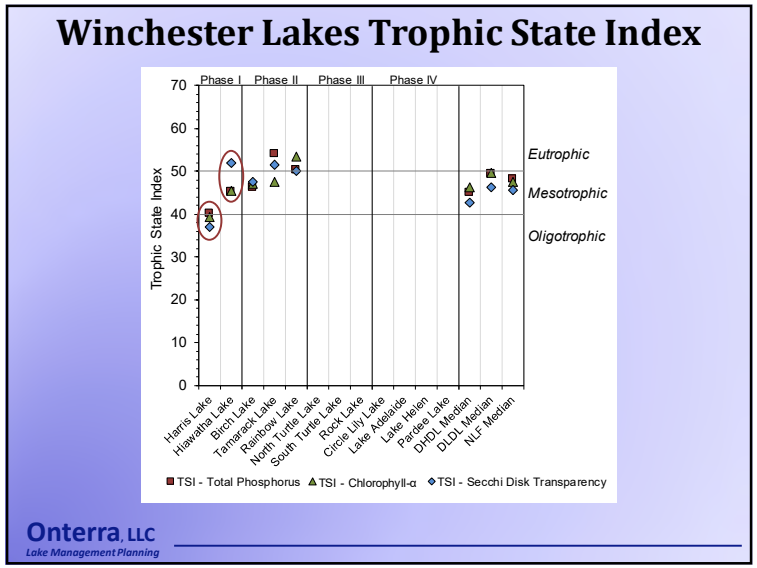
Winchester Lakes Trophic State Index
Phase I
Phase II
Phase III
Phase IV
Trophic State Index
70
60
50
40
30
20
10
0
Eutrophic
Mesotrophic
Oligotrophic
Harris Lake
Hiawatha Lake
Birch Lake
Tamarack Lake
Rainbow Lake
North Turtle Lake
South Turtle Lake
Rock Lake
Circle Lily Lake
Lake Adelaide
Lake Helen
Pardee Lake
DHDL Median
DLDL Median
NLF Median
TSI - Total Phosphorus
TSI - Chlorophyll-α
TSI - Secchi Disk Transparency
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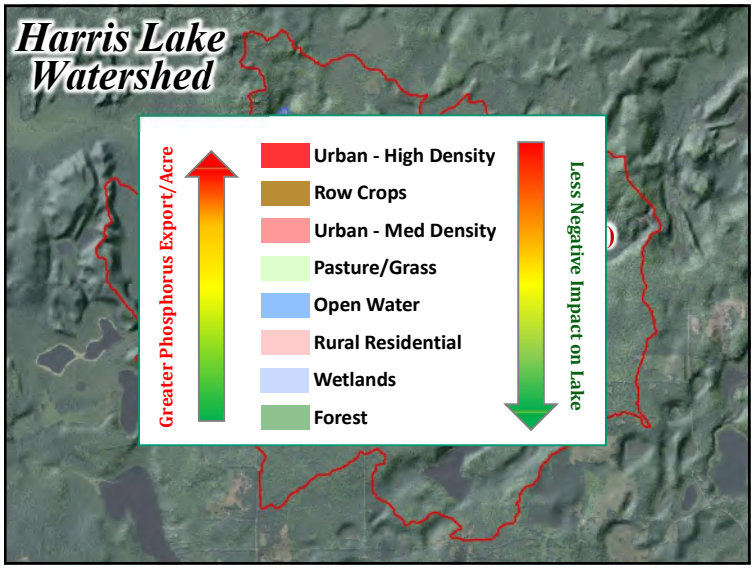
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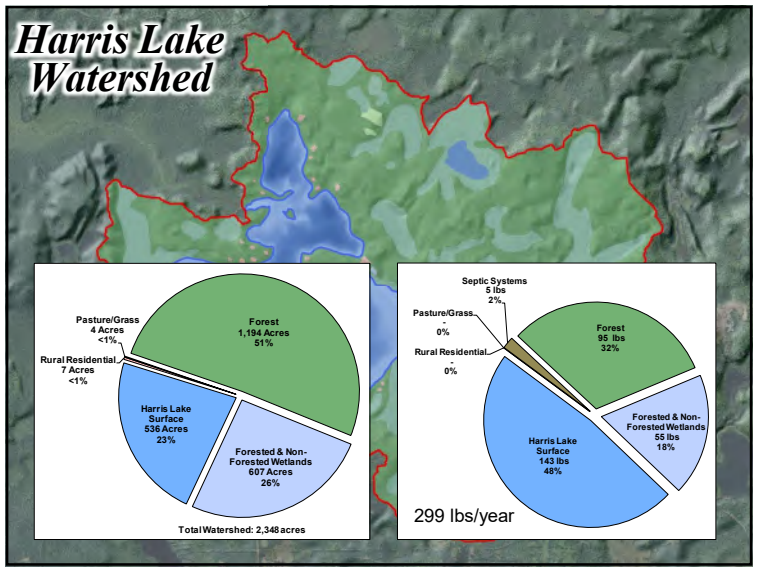
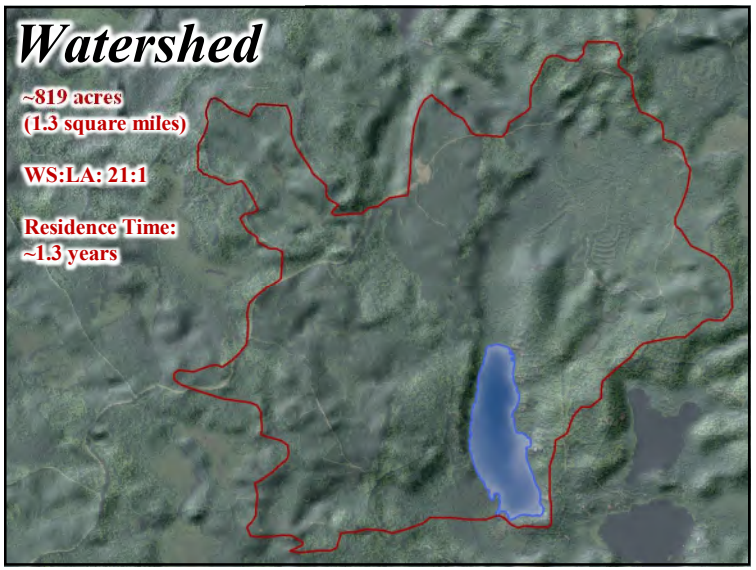
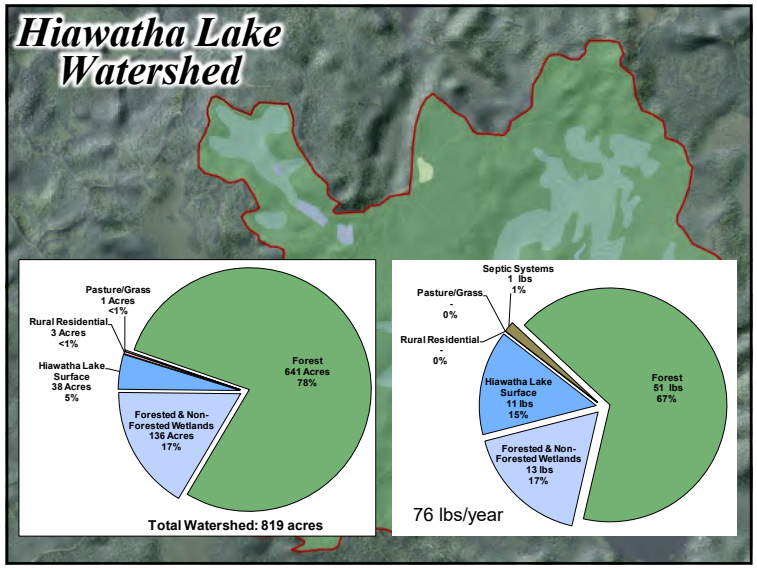
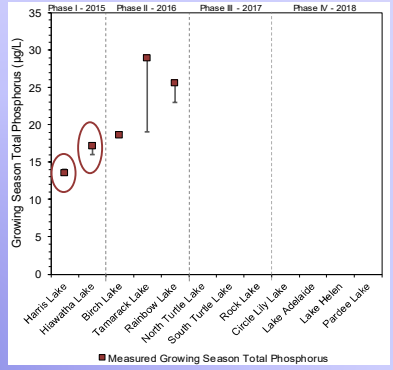

Harris Lake Watershed
Pasture/Grass
4 Acres
<1%
Forest
1,194 Acres
51%
Rural Residential
7 Acres
<1%
Harris Lake Surface
536 Acres
23%
Forested & Non-Forested Wetlands
607 Acres
26%
Total Watershed: 2,348 acres
Septic Systems
5 lbs
2%
Pasture/Grass
-
0%
Rural Residential
-
0%
Forest
95 lbs
32%
Forested & Non-Forested Wetlands
55 lbs
18%
Harris Lake Surface
143 lbs
48%
299 lbs/year


Watershed
~819 acres
(1.3 square miles)
WS:LA: 21:1
Residence Time:
~1.3 years



Predicted vs Measured Total Phosphorus



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Shoreland Assessment

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- EPA National Lakes Assessment results indicate shoreland development has greatest negative impact to health of our nation's lakes.
- It does not look at lake shoreline on a property-by-property basis.
- Assessment ranks shoreland area from shoreline back 35 feet

Urbanized — **Natural**

Range

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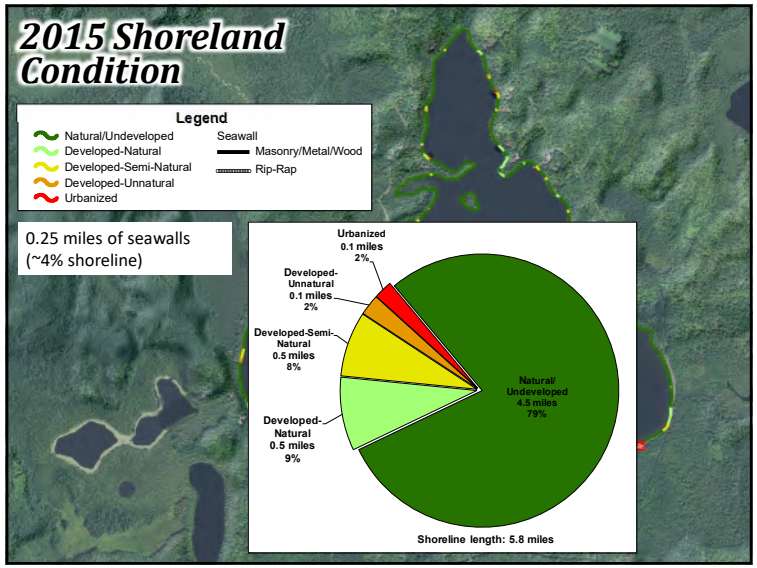
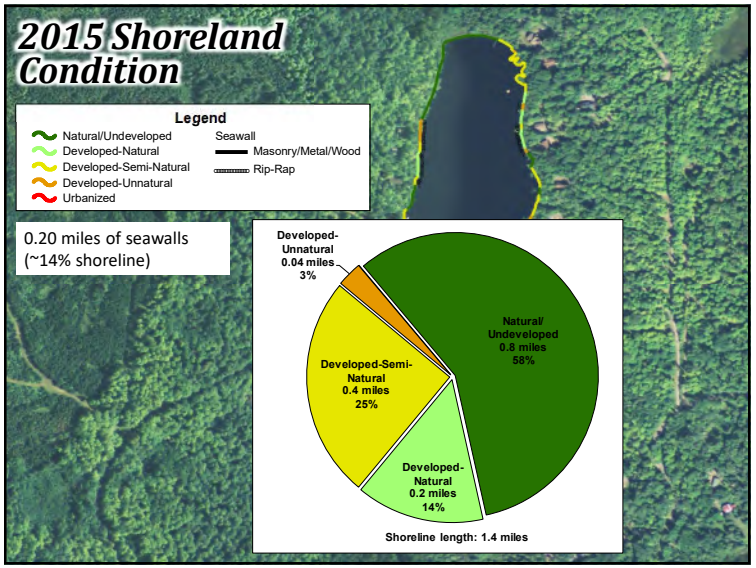
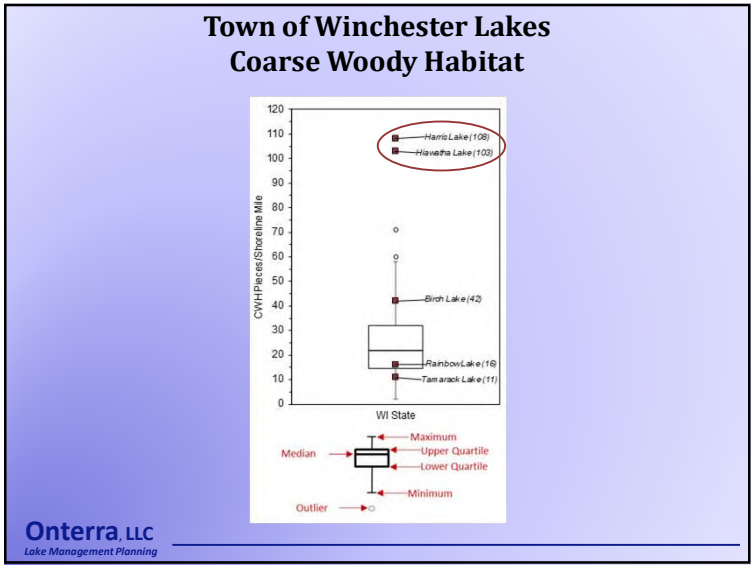

2015 Shoreland Condition
Legend
Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized
Seawall
Masonry/Metal/Wood
Rip-Rap
0.25 miles of seawalls (~4% shoreline)
Urbanized 0.1 miles 2%
Developed-Unnatural 0.1 miles 2%
Developed-Semi-Natural 0.5 miles 8%
Developed-Natural 0.5 miles 9%
Natural/Undeveloped 4.5 miles 79%
Shoreline length: 5.8 miles


2015 Shoreland Condition
Legend
Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized
Seawall
Masonry/Metal/Wood
Rip-Rap
0.20 miles of seawalls (~14% shoreline)
Developed-Unnatural 0.04 miles 3%
Developed-Semi-Natural 0.4 miles 25%
Natural/Undeveloped 0.8 miles 58%
Developed-Natural 0.2 miles 14%
Shoreline length: 1.4 miles


Coarse Woody Habitat


Town of Winchester Lakes
Coarse Woody Habitat
CWH Pieces/Shoreline Mile
Harris Lake (108)
Hiawatha Lake (103)
Birch Lake (42)
Rainbow Lake (16)
Tamarack Lake (11)
WI State
Maximum
Upper Quartile
Median
Lower Quartile
Minimum
Outlier
Onterra, LLC
Lake Management Planning

Management Goal:
Maintain Current Water Quality Conditions

Management Actions

1. **Continue monitoring of Harris/Hiawatha lakes' water quality through WDNR Citizens Lake Monitoring Network (CLMN)**
   Important for tracking long-term changes.
2. **Preserve natural and restore highly developed shoreland areas on Harris/Hiawatha Lake**
3. **Hiawatha Lake: Preserve natural land cover within the watershed beyond the immediate shoreland zone**
   HLA to reach out to land owners within the watershed

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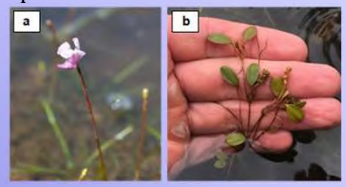
Plant Data Overview – Phase I & II

- 83 native plant species located to date
  - 2 listed as special concern: Northeastern bladderwort & Vasey's pondweed



- 1 non-native plant species
  - Curly-leaf pondweed (Harris Lake)

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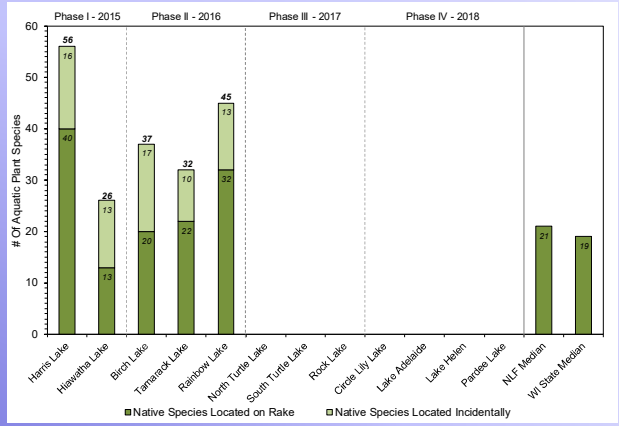
Lake Management Planning

Native Species Richness



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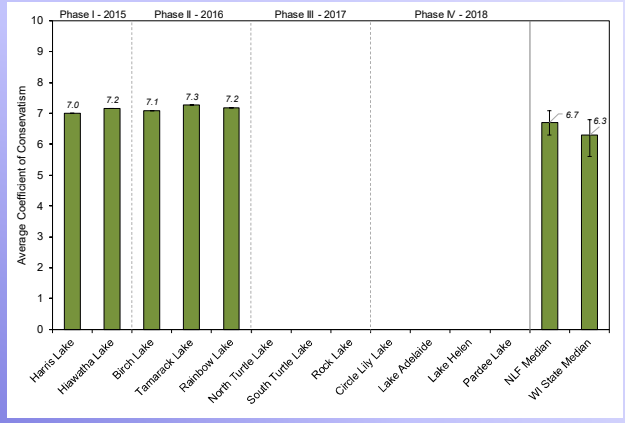
Lake Management Planning

Average Conservatism



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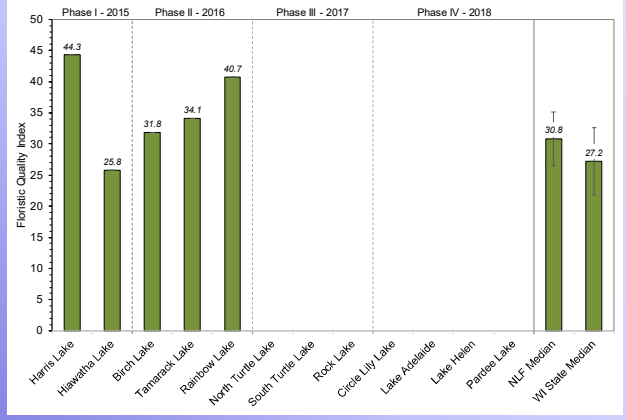
Floristic Quality



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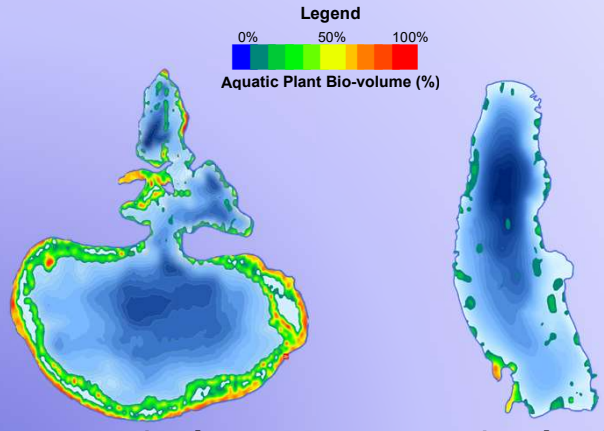
Aquatic Plant Distribution



Harris Lake

Hiawatha Lake

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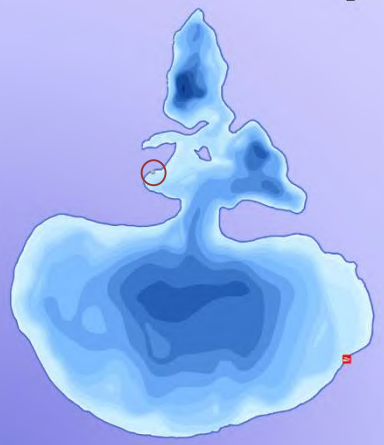
Lake Management Planning

Non-Native Aquatic Plants



Curly-leaf pondweed
(*Potamogeton crispus*)

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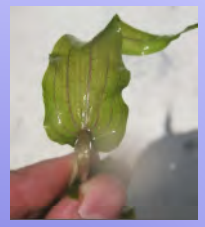
Non-Native vs Native Look-a-Likes

Clasping-leaf pondweed



Curly-leaf pondweed

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Management Goal:
Control Existing AIS and Prevent New Introductions to Harris Lake

Management Actions

1. **Continue CLP monitoring and hand-removal strategy to manage CLP population in Harris Lake**
   - *Annual professional monitoring continues through 2018*
   - *HLA volunteers continue monitoring*
   - *CLP control/monitoring strategy developed for 2019 and beyond*
2. **Initiate AIS rapid response plan upon discovery of new infestation**
3. **Continue Clean Boats Clean Waters watercraft inspections**

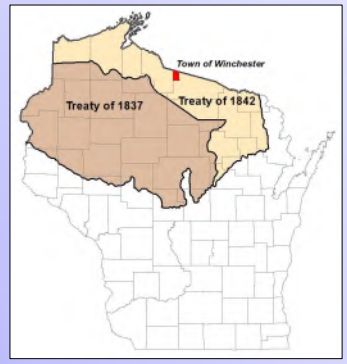
Management Goal:
Prevent AIS introductions to Hiawatha Lake

Management Actions

1. **Continue HLA volunteer AIS monitoring**
2. **Initiate AIS rapid response plan upon discovery of new infestation**

Native American Spear Harvest

- Town is within Treaty of 1842
- Tribal and State authorities establish *total allowable catch* based on population estimates (typically 35% for walleye & 27% for muskellunge)
- The total allowable catch number may be reduced based on confidence in population estimates: *safe harvest level*
- Tribal community claims percentage of safe harvest level, or *declaration*
- Bag limits for hook and line anglers set to accommodate declaration
- Can only harvest two walleye over 20 inches per night – one between 20 and 24" and one any size over 20"



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Management Goal:
Enhance the fishery of Harris/Hiawatha Lake

Management Actions

1. **Continue work with WDNR fisheries managers to enhance the fishery of Harris/Hiawatha Lake**

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Management Goal:
Assure and Enhance the Communication and outreach of the Harris/Hiawatha Lakes Associations with lake stakeholders

Management Actions

1. **Promote stakeholder involvement, inform stakeholders on various lake issues, as well as the quality of life on Harris/Hiawatha lake.**

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Management Goal:
Reduce Shoreland Erosion on Harris Lake Brought About by Beaver Activity

Management Actions

1. **Investigate management strategies for beaver and beaver dam removal in Harris Creek to reduce shoreland erosion caused by high water.**

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Lake Management Planning

Thank You

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Wisconsin Lakes Partnership

UW Extension

Wisconsin Dept. of Natural Resources

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Lake Management Planning

Town of Winchester

Town of Winchester
Lake Management Planning Project
Phase II: Birch, Tamarack, & Rainbow Lakes
Kick-off Meeting
July 25, 2016

Brenton Butterfield
Onterra LLC
Lake Management Planning

Presentation Outline

- Onterra, LLC
- Why Create a Management Plan?
- Elements of this Lake Management Planning Project
  - Data & Information
  - AIS Education & Volunteer Involvement
  - Planning Process
- Project Phasing
- Project Deliverables

Onterra LLC Lake Management Planning

Onterra, LLC

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

Onterra LLC Lake Management Planning

Why create a lake management plan?

- 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.
- To foster realistic expectations and dispel myths.
- To create a snapshot of the lake for future reference and planning.

Onterra LLC Lake Management Planning

Elements of an Effective Lake Management Planning Project

Data and Information Gathering

Environmental & Sociological

Planning Process

Brings it all together

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Data and information gathering

- Study Components
  - Water Quality Analysis
  - Watershed Assessment
  - Aquatic Plant Surveys
  - Fisheries Data Integration
  - Shoreline Assessment
  - Stakeholder Survey

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Water Quality Analysis

- General water chemistry (current & historic)
  - Citizens Lake Monitoring Network & Professional
- Nutrient analysis
  - Lake trophic state (Eutrophication)
  - Limiting plant nutrient
- Supporting data for watershed modeling

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Watershed Assessment

- Delineation of drainage basins
- Modeling
  - Land cover
  - Phosphorus loading
  - Lakes are modeled in series
  - Scenario development

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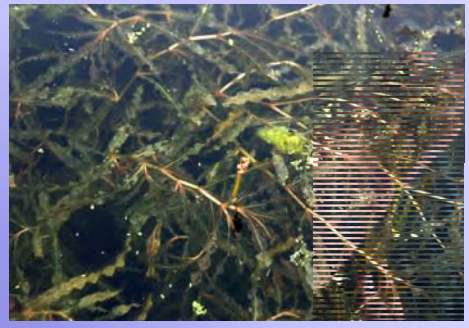
Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Early Season AIS Survey

Onterra LLC Lake Management Planning

Non-native Aquatic Plants

Curly-leaf Pondweed



Onterra LLC Lake Management Planning

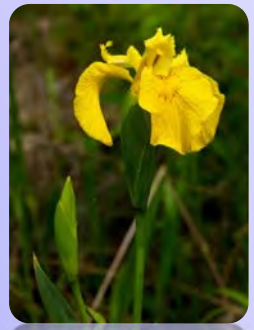
Non-native Aquatic Plants

Eurasian Water Milfoil

Onterra LLC Lake Management Planning

Non-native Aquatic Plants

Purple Loosestrife & Pale-yellow Iris

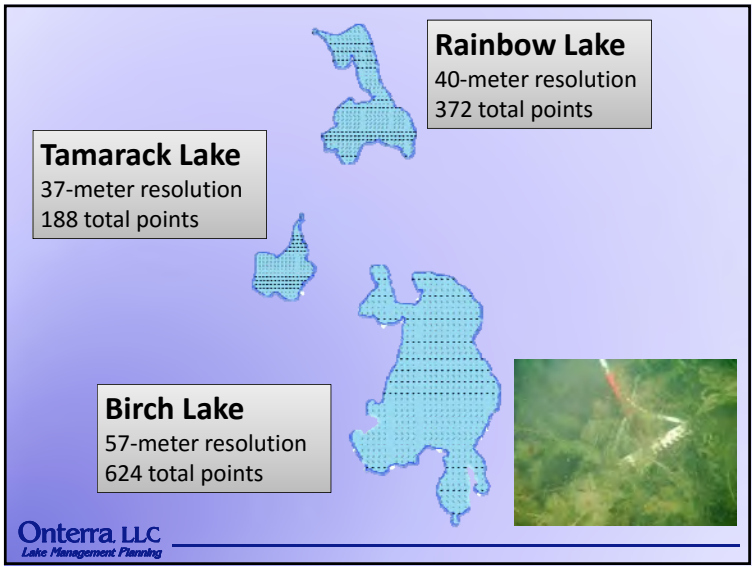


Onterra LLC Lake Management Planning

Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Early Season AIS survey
  - Point-intercept survey

Onterra LLC
Lake Management Planning



Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Early Season AIS survey
  - Point-intercept survey
  - Aquatic plant community mapping

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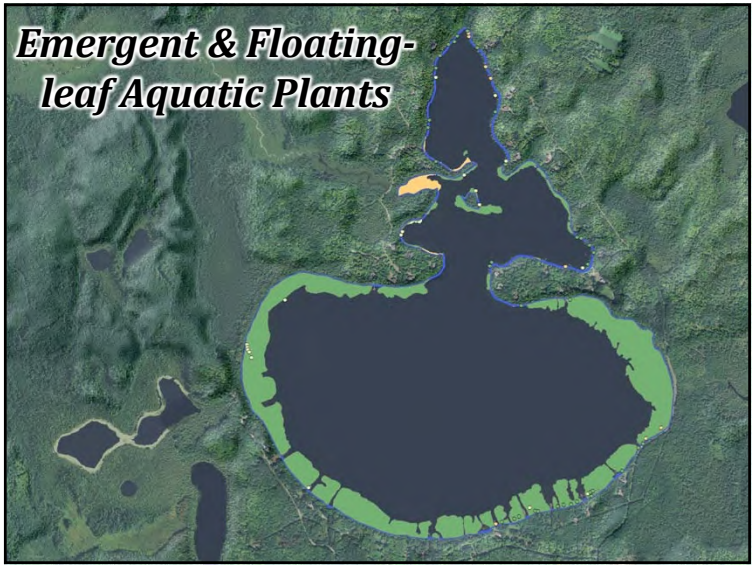
Lake Management Planning



Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Early Season AIS survey
  - Point-intercept survey
  - Aquatic plant community mapping

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Shoreland Assessment

- Shoreland area is important for buffering runoff and provides valuable habitat for aquatic and terrestrial wildlife.
- It does not look at lake shoreline on a property-by-property basis.
- Assessment ranks shoreland area from shoreline back 35 feet

Urbanized — Range — **Natural**

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Fisheries Data Integration

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

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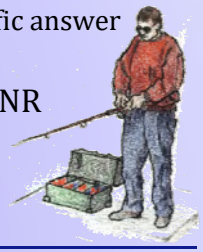
Stakeholder Survey

- Standard survey used as base
  - Planning committee 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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Lake Management Planning

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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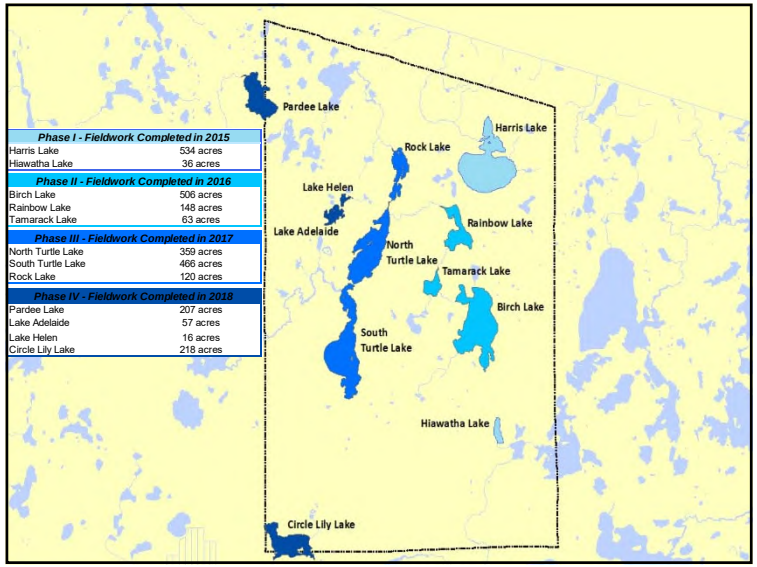
Lake Management Planning



Phase I - Fieldwork Completed in 2015	
Harris Lake	534 acres
Hiawatha Lake	36 acres
Phase II - Fieldwork Completed in 2016	
Birch Lake	506 acres
Rainbow Lake	148 acres
Tamarack Lake	63 acres
Phase III - Fieldwork Completed in 2017	
North Turtle Lake	359 acres
South Turtle Lake	466 acres
Rock Lake	120 acres
Phase IV - Fieldwork Completed in 2018	
Pardee Lake	207 acres
Lake Adelaide	57 acres
Lake Helen	16 acres
Circle Lily Lake	218 acres

Town of Winchester
Lake Management Plan Documents

- Multiple document types
  - Town of Winchester Lake Management Plan
  - Lake-Specific Results and Conclusions
  - Lake-Specific Implementation Plan
  - Appendices (raw data, etc.)
- Town-wide Compilation
  - All documents
- Individual Lake Document
  - Town-wide management plan
  - Lake-specific documents

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Lake Management Planning

Thank You

Many of the graphics used in this presentation were supplied by:

Wisconsin Lakes Partnership

UW Extension

Wisconsin Dept. of Natural Resources

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Lake Management Planning

Presentation Outline

- Lake Management Planning Project Overview
- Study Results
  - Water Quality
  - Watershed
  - Shoreland Condition
  - Aquatic Plants
  - Fishery

  Stakeholder Survey
- "Big Picture"
- Implementation Plan Development

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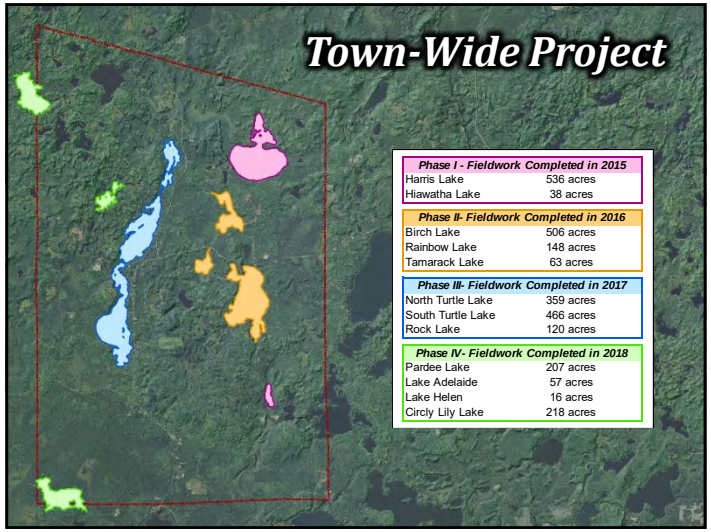
Lake Management Planning



Management Planning Project Overview

- Collect & analyze data – completed
  - Technical & sociological
- Construct long-term & useable plan

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Summary of Project Results

Water Quality
- Good to excellent for deep lowland drainage lakes

Watershed & Immediate Shoreline
- Watersheds in excellent shape – primarily forests & wetlands
- Majority of shoreland areas contain little to no development

Aquatic Plant Community
- High-quality native species present
- No non-native species located

Fisheries
- Not too much information available

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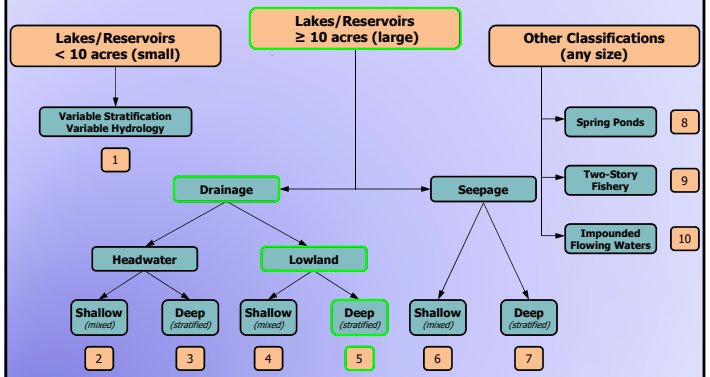
Wisconsin Lakes Natural Community Types



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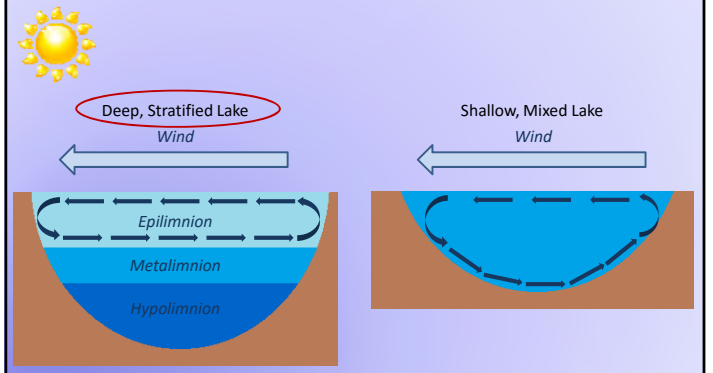
Wisconsin Lakes Classification



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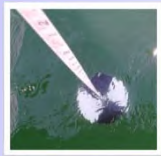
Introduction to Lake Water Quality

Phosphorus
Naturally occurring & essential for all life
Regulates phytoplankton biomass in most WI lakes
Most often 'limiting plant nutrient' (shortest supply)
Human development 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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Water Quality

Wisconsin Ecoregions

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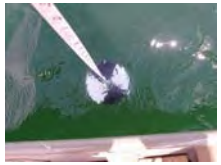
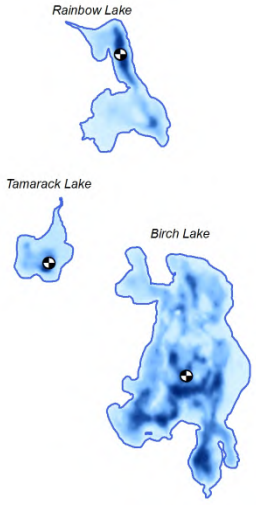
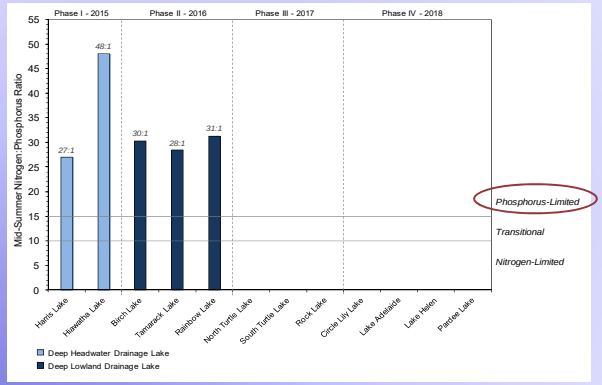
Water Quality Sampling Locations





Town of Winchester – Phase I & II Lakes Mid-Summer Nitrogen:Phosphorus Ratio



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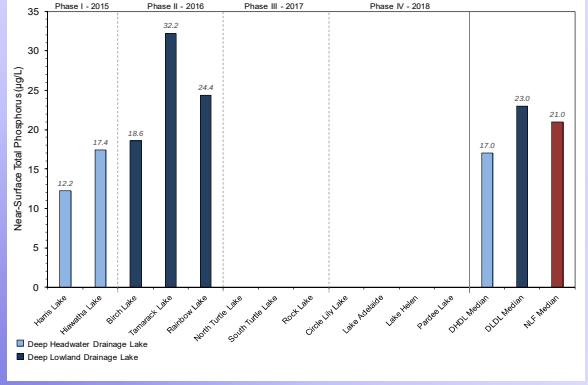
Town of Winchester – Phase II Lakes
Near-Surface Summer Total Phosphorus



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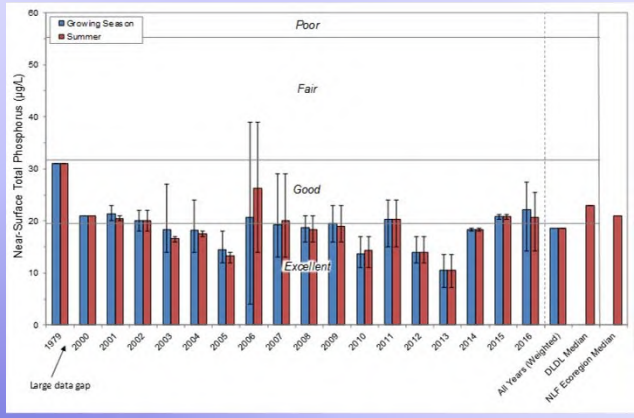
Birch Lake Total Phosphorus



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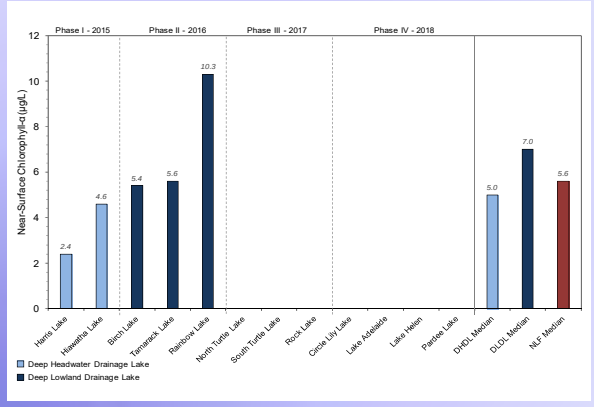
Town of Winchester – Phase I Lakes
Chlorophyll-*a*



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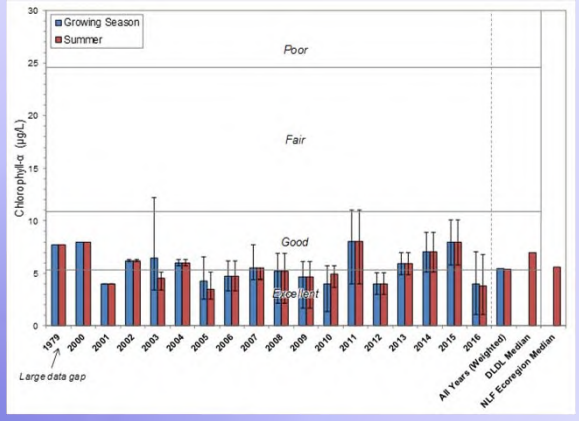
Birch Lake Chlorophyll-α



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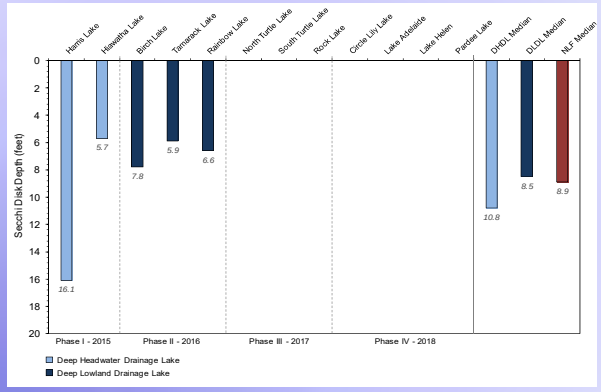
Town of Winchester – Phase I Lakes
Secchi Disk Transparency



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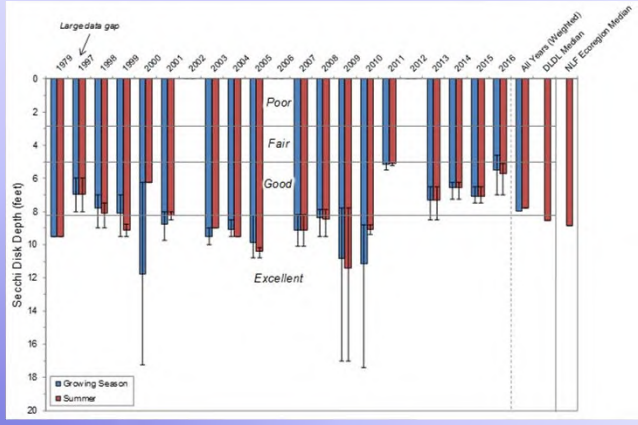
Birch Lake Secchi Disk Depth



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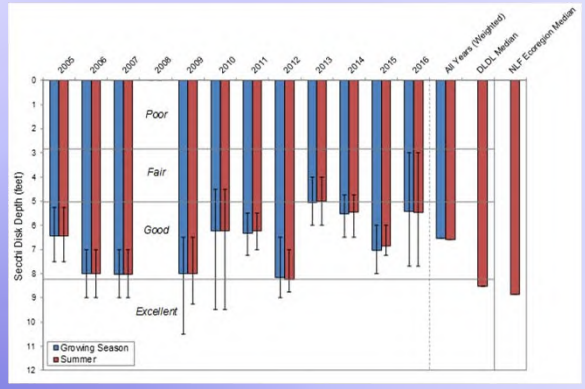
Rainbow Lake Secchi Disk Depth



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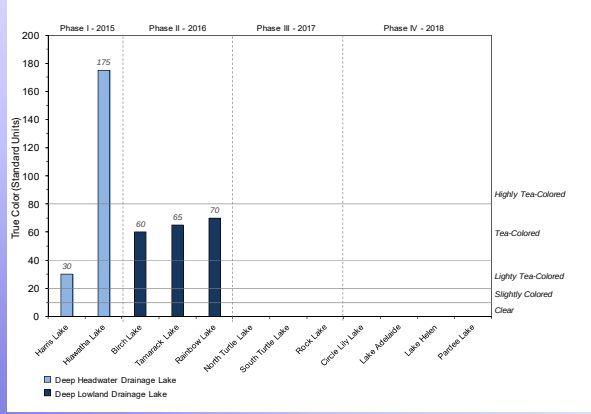
Town of Winchester – Phase I Lakes
True Color



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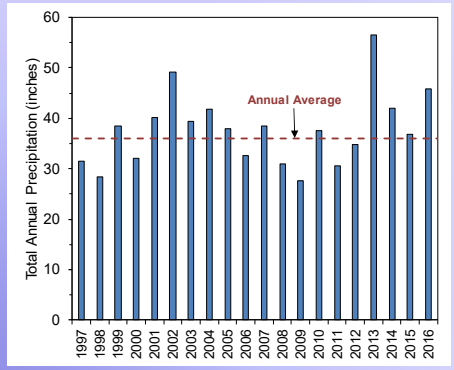
Annual Precipitation Data – Hurley, WI



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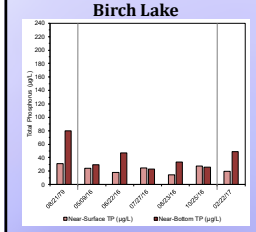
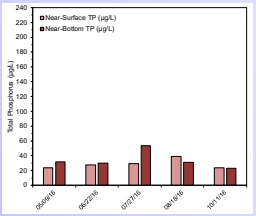
Internal Phosphorus Loading

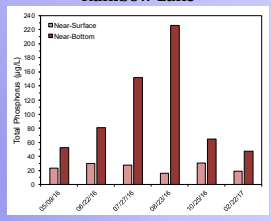
Birch Lake



Tamarack Lake



Rainbow Lake



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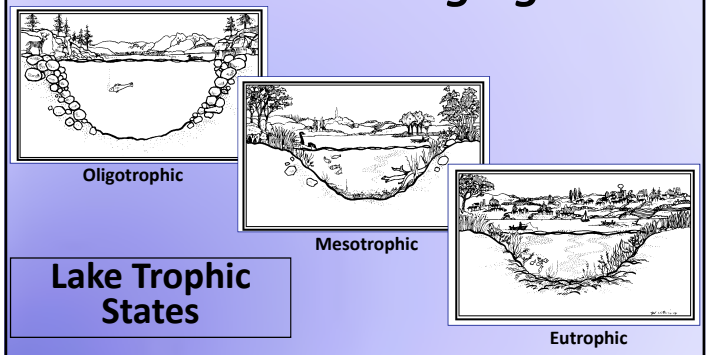
Eutrophication -Lake Aging



Lake Trophic States

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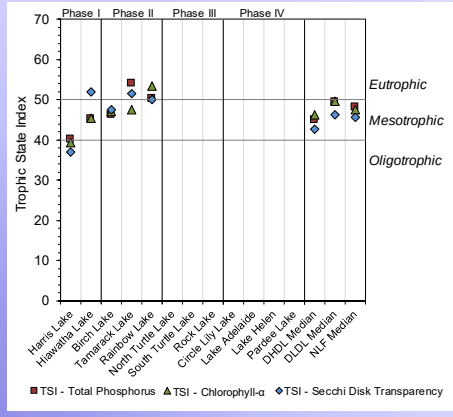
Lake Management Planning

Winchester Lakes Trophic State Index



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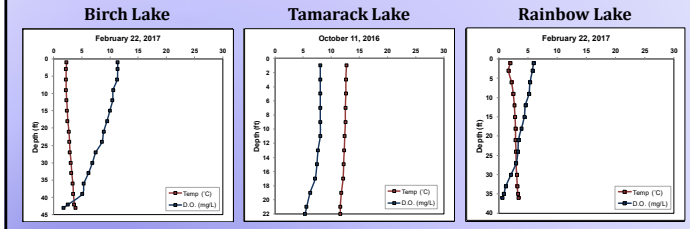
Temperature & Dissolved Oxygen



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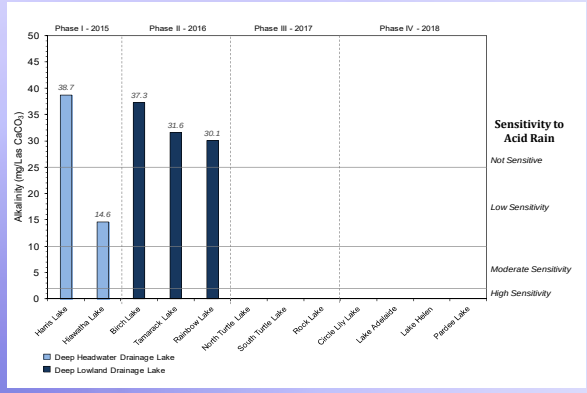
Additional Water Quality Parameters
Alkalinity



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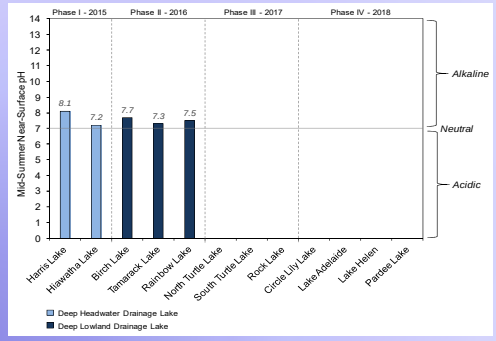
Additional Water Quality Parameters
pH



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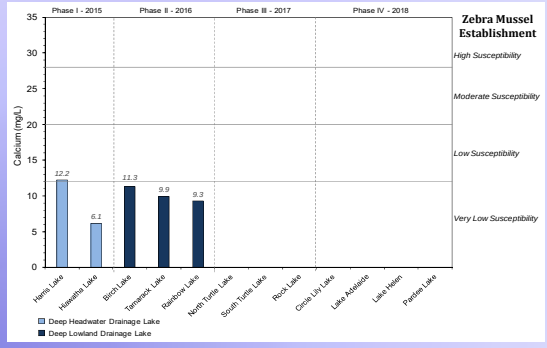
Additional Water Quality Parameters
Calcium



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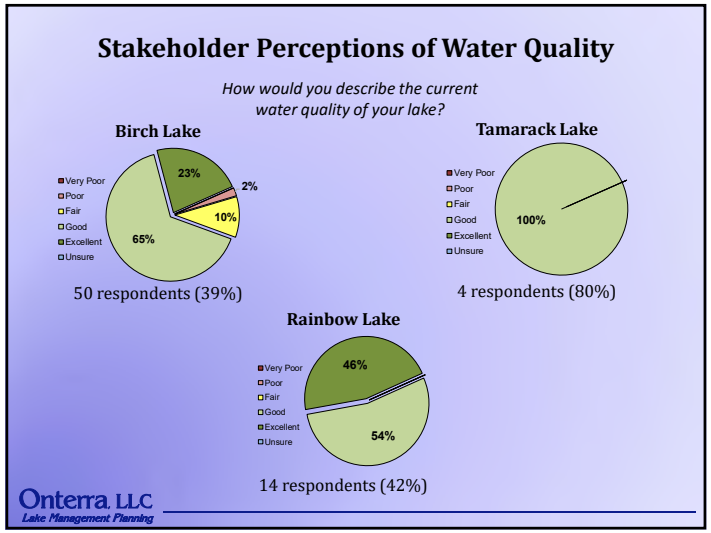
Stakeholder Perceptions of Water Quality
How would you describe the current water quality of your lake?
Birch Lake
Very Poor
Poor
Fair
Good
Excellent
Unsure
23%
2%
10%
65%
50 respondents (39%)
Tamarack Lake
100%
4 respondents (80%)
Rainbow Lake
46%
54%
14 respondents (42%)
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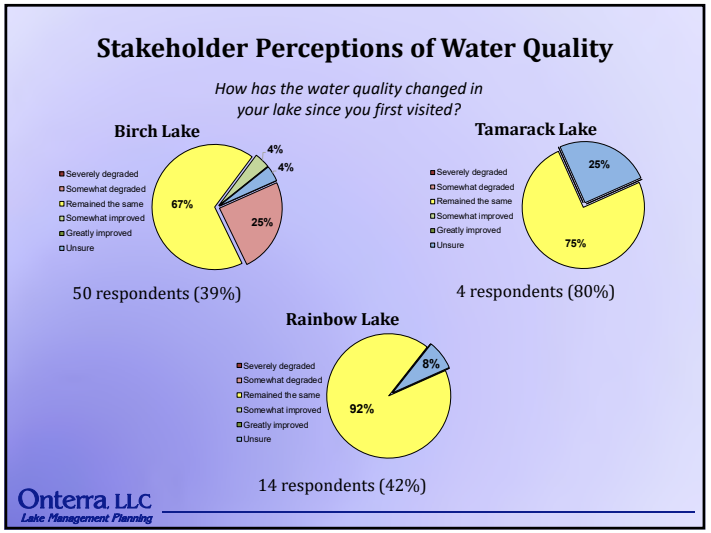
Stakeholder Perceptions of Water Quality
How has the water quality changed in your lake since you first visited?
Birch Lake
Severely degraded
Somewhat degraded
Remained the same
Somewhat improved
Greatly improved
Unsure
4%
4%
67%
25%
50 respondents (39%)
Tamarack Lake
25%
75%
4 respondents (80%)
Rainbow Lake
8%
92%
14 respondents (42%)
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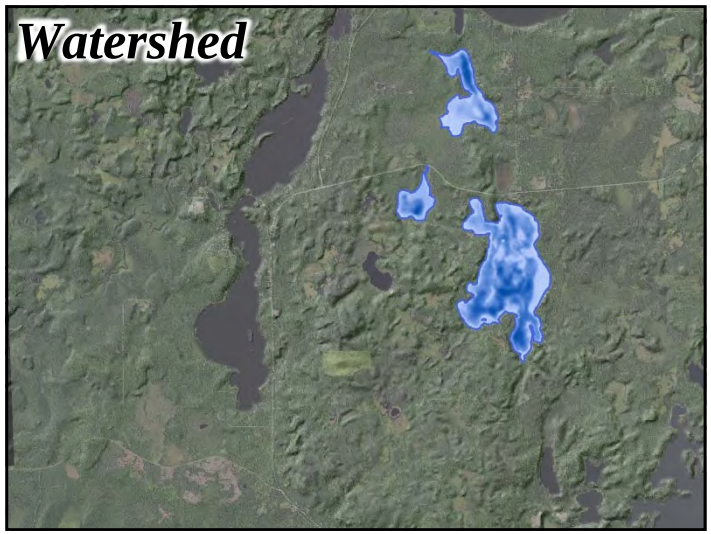
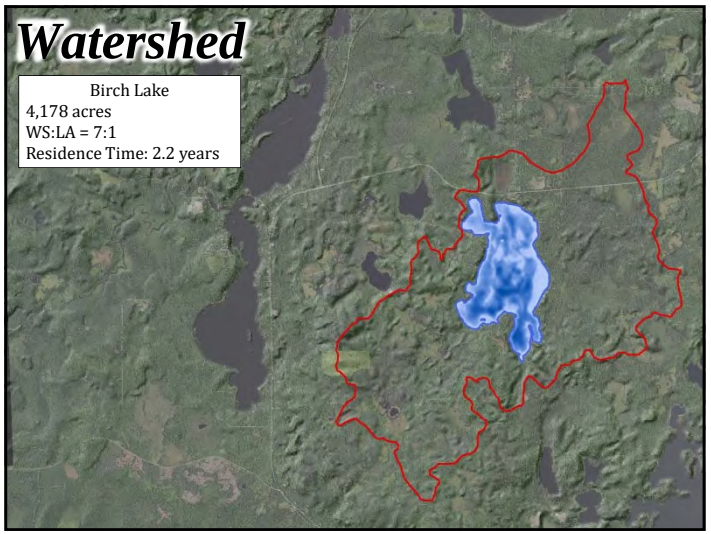
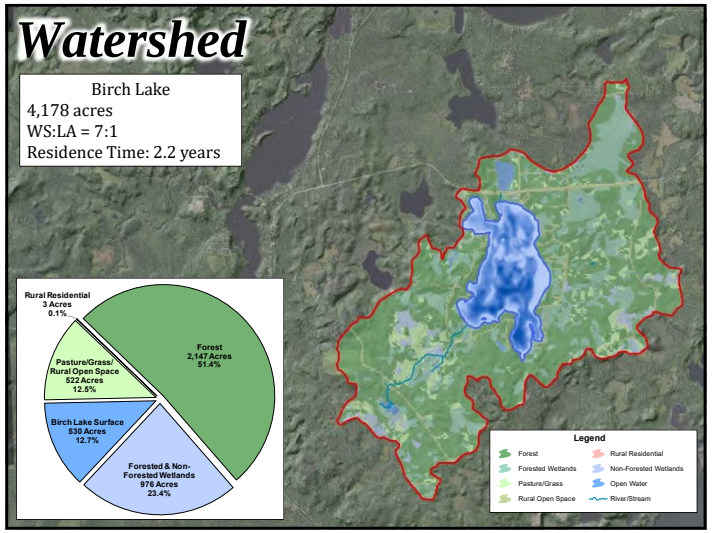
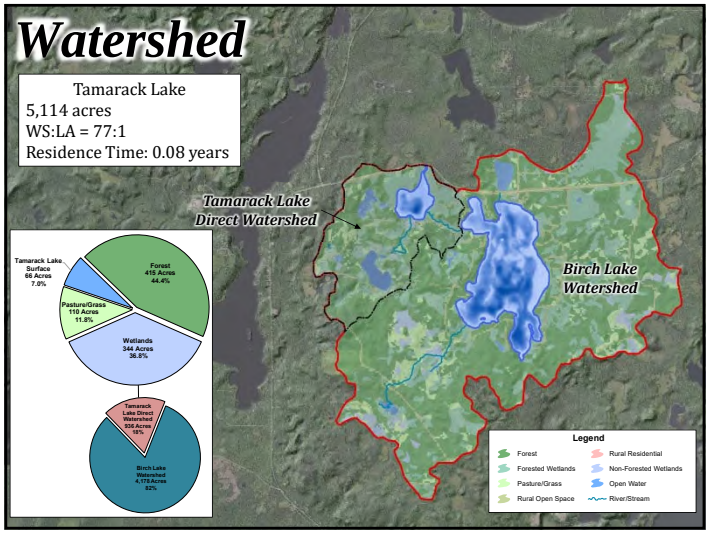
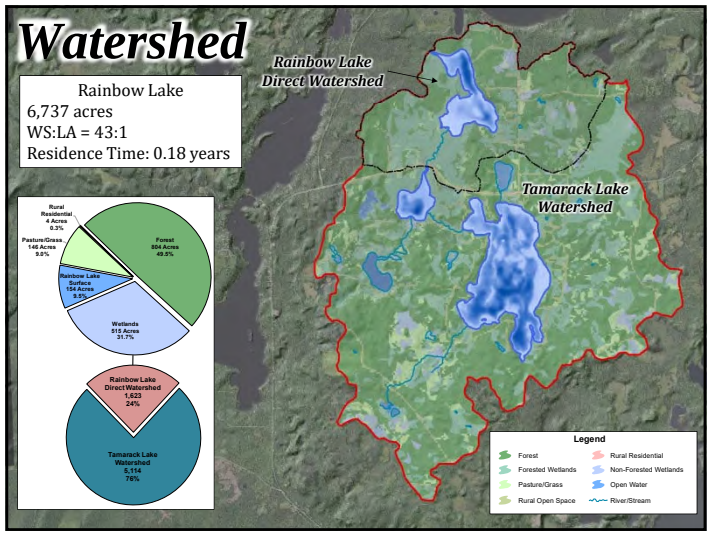
Lake Management Planning

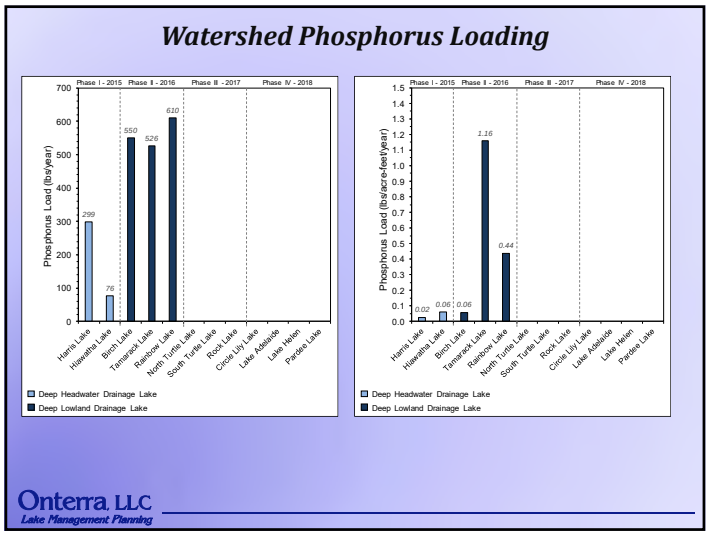

Watershed

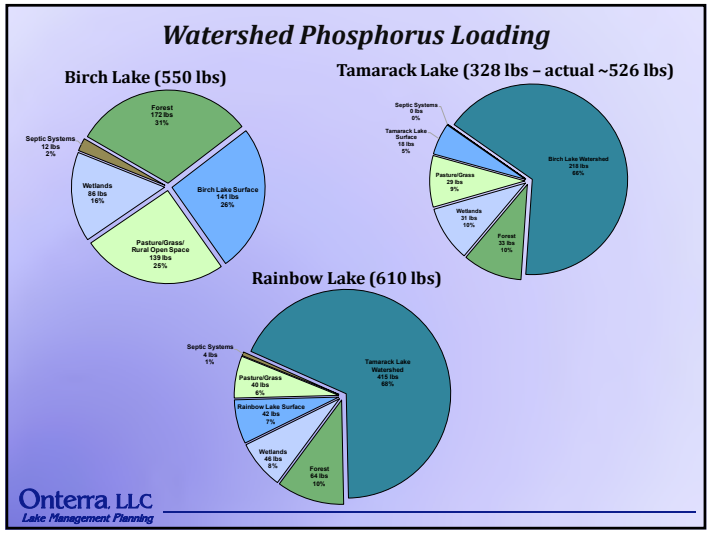

Watershed
Birch Lake
4,178 acres
WS:LA = 7:1
Residence Time: 2.2 years


Watershed
Birch Lake
4,178 acres
WS:LA = 7:1
Residence Time: 2.2 years
Rural Residential 3 Acres 0.1%
Forest 2,147 Acres 51.4%
Pasture/Grass/ Rural Open Space 522 Acres 12.5%
Birch Lake Surface 530 Acres 12.7%
Forested & Non-Forested Wetlands 976 Acres 23.4%
Legend
Forest
Forested Wetlands
Pasture/Grass
Rural Open Space
Rural Residential
Non-Forested Wetlands
Open Water
River/Stream


Watershed
Tamarack Lake
5,114 acres
WS:LA = 77:1
Residence Time: 0.08 years
Tamarack Lake Direct Watershed
Birch Lake Watershed
Tamarack Lake Surface 66 Acres 7.0%
Forest 415 Acres 44.4%
Pasture/Grass 110 Acres 11.8%
Wetlands 344 Acres 36.8%
Tamarack Lake Direct Watershed 836 Acres 16%
Birch Lake Watershed 4,178 Acres 82%
Legend
Forest
Forested Wetlands
Pasture/Grass
Rural Open Space
Rural Residential
Non-Forested Wetlands
Open Water
River/Stream


Watershed
Rainbow Lake
6,737 acres
WS:LA = 43:1
Residence Time: 0.18 years
Rainbow Lake Direct Watershed
Tamarack Lake Watershed
Rural Residential 4 Acres 0.3%
Forest 804 Acres 49.8%
Pasture/Grass 146 Acres 9.6%
Rainbow Lake Surface 154 Acres 9.5%
Wetlands 515 Acres 31.7%
Rainbow Lake Direct Watershed 1,623 24%
Tamarack Lake Watershed 5,114 76%
Legend
Forest
Forested Wetlands
Pasture/Grass
Rural Open Space
Rural Residential
Non-Forested Wetlands
Open Water
River/Stream


Watershed Phosphorus Loading
Phase I - 2015
Phase II - 2016
Phase III - 2017
Phase IV - 2018
Phosphorus Load (lbs/year)
299
76
550
526
610
Phosphorus Load (lbs/acre-feet/year)
0.02
0.05
0.06
1.16
0.44
Harris Lake
Hiawatha Lake
Birch Lake
Tamarack Lake
Rainbow Lake
North Turtle Lake
South Turtle Lake
Rock Lake
Circle Lily Lake
Lake Adelaide
Lake Helen
Paradise Lake
Deep Headwater Drainage Lake
Deep Lowland Drainage Lake
Onterra, LLC
Lake Management Planning


Watershed Phosphorus Loading
Birch Lake (550 lbs)
Forest 172 lbs 31%
Septic Systems 12 lbs 2%
Wetlands 86 lbs 16%
Birch Lake Surface 141 lbs 26%
Pasture/Grass/ Rural Open Space 139 lbs 25%
Tamarack Lake (328 lbs – actual ~526 lbs)
Septic Systems 0 lbs 0%
Tamarack Lake Surface 18 lbs 5%
Pasture/Grass 29 lbs 9%
Wetlands 31 lbs 10%
Forest 33 lbs 10%
Birch Lake Watershed 218 lbs 66%
Rainbow Lake (610 lbs)
Septic Systems 4 lbs 1%
Pasture/Grass 40 lbs 6%
Rainbow Lake Surface 42 lbs 7%
Wetlands 46 lbs 8%
Forest 64 lbs 10%
Tamarack Lake Watershed 415 lbs 68%
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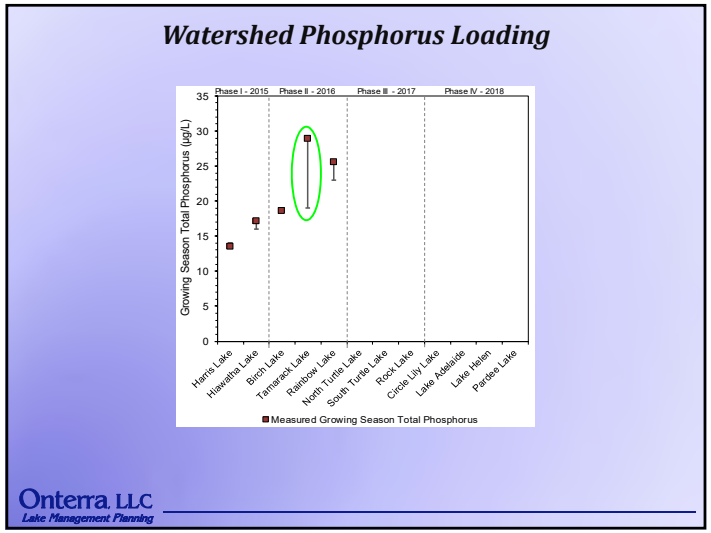
Lake Management Planning


Watershed Phosphorus Loading
Phase I - 2015
Phase II - 2016
Phase III - 2017
Phase IV - 2018
Growing Season Total Phosphorus (µg/L)
0
5
10
15
20
25
30
35
Harris Lake
Hiawatha Lake
Birch Lake
Tamarack Lake
Rainbow Lake
North Turtle Lake
South Turtle Lake
Rock Lake
Circle Lily Lake
Lake Adelaide
Lake Helen
Pardee Lake
Measured Growing Season Total Phosphorus
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Shoreland Condition


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.
It does not look at lake shoreline on a property-by-property basis.
Assessment ranks shoreland area from shoreline back 35 feet
Urbanized
Natural
Range
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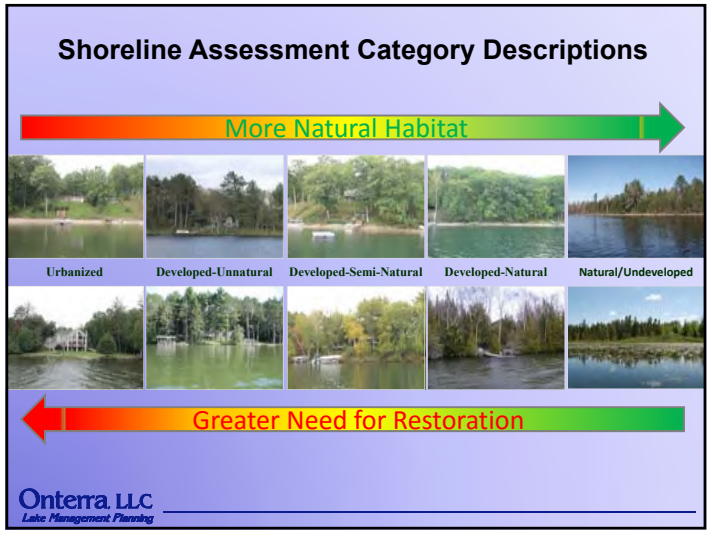
Shoreline Assessment Category Descriptions
More Natural Habitat
Urbanized
Developed-Unnatural
Developed-Semi-Natural
Developed-Natural
Natural/Undeveloped
Greater Need for Restoration
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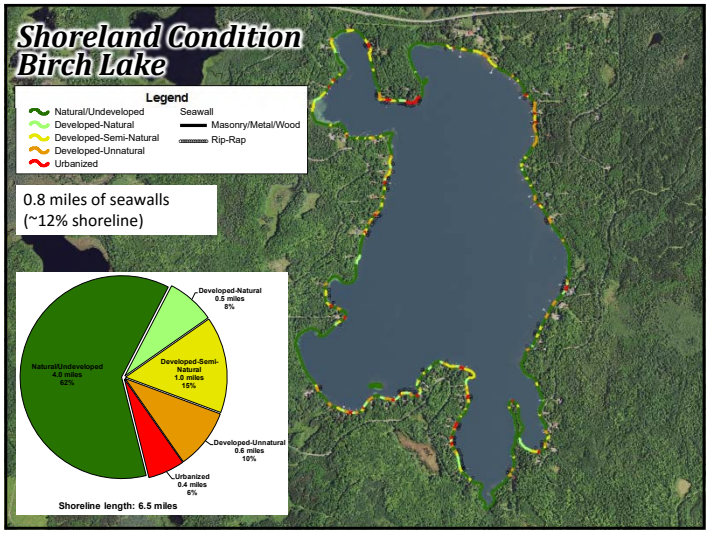
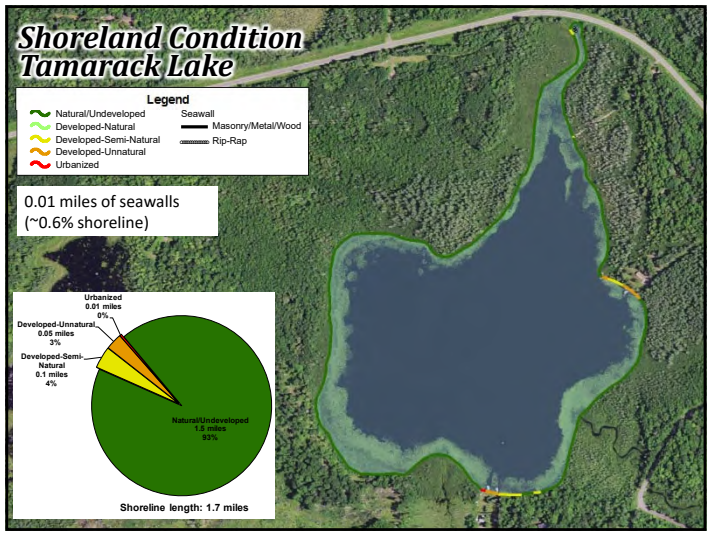
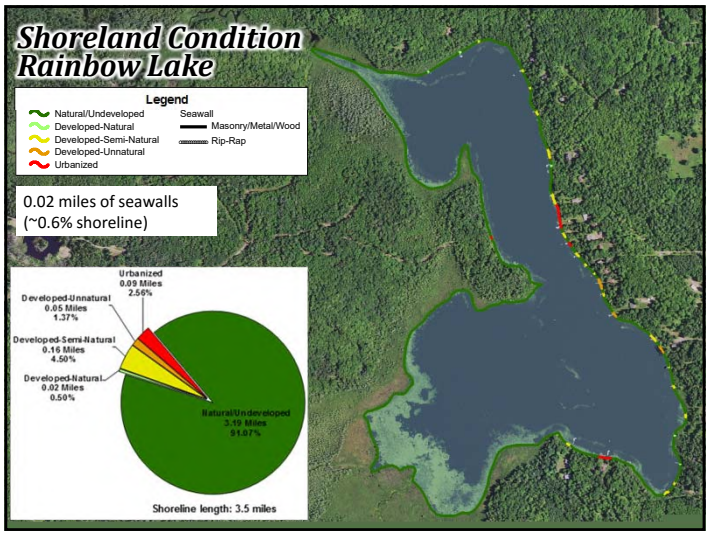
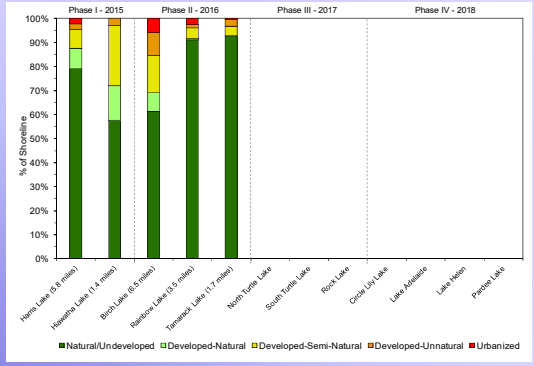

Shoreland Condition
Birch Lake
Legend
Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized
Seawall
Masonry/Metal/Wood
Rip-Rap
0.8 miles of seawalls
(~12% shoreline)
Developed-Natural
0.5 miles
8%
Developed-Semi-Natural
1.0 miles
15%
Developed-Unnatural
0.6 miles
10%
Urbanized
0.4 miles
6%
Natural/Undeveloped
4.0 miles
62%
Shoreline length: 6.5 miles


Shoreland Condition
Tamarack Lake
Legend
Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized
Seawall
Masonry/Metal/Wood
Rip-Rap
0.01 miles of seawalls
(~0.6% shoreline)
Urbanized
0.01 miles
0%
Developed-Unnatural
0.05 miles
3%
Developed-Semi-Natural
0.1 miles
4%
Natural/Undeveloped
1.5 miles
93%
Shoreline length: 1.7 miles


Shoreland Condition
Rainbow Lake
Legend
Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized
Seawall
Masonry/Metal/Wood
Rip-Rap
0.02 miles of seawalls
(~0.6% shoreline)
Urbanized
0.09 Miles
2.56%
Developed-Unnatural
0.05 Miles
1.37%
Developed-Semi-Natural
0.16 Miles
4.50%
Developed-Natural
0.02 Miles
0.50%
Natural/Undeveloped
3.19 Miles
91.07%
Shoreline length: 3.5 miles

Town of Winchester Lakes
Shoreland Condition



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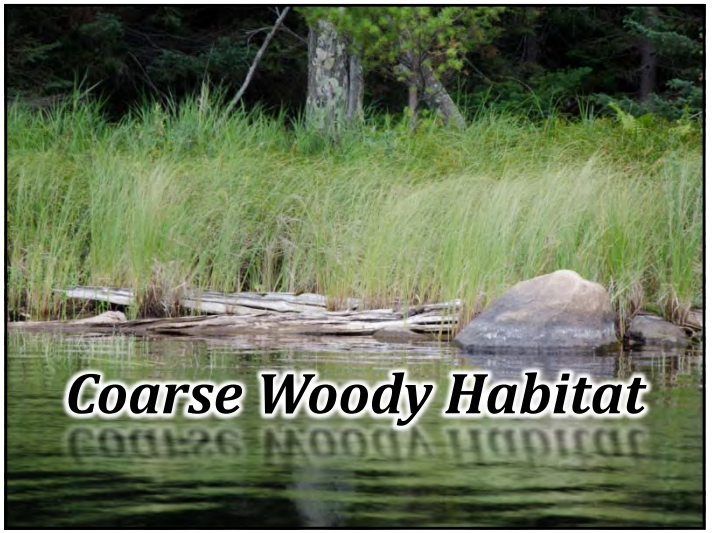
Lake Management Planning



Coarse Woody Habitat

- Provides shoreland erosion control and prevents suspension of sediments.
- Preferred habitat for a variety of aquatic life.
  - Periphyton growth fed upon by insects.
  - Refuge, foraging and spawning habitat for fish.
  - Complexity of CWH important.
- Changing of logging and shoreland development practices = reduced CWH in Wisconsin lakes.
- Survey aimed at quantifying CWH in Town of Winchester Lakes

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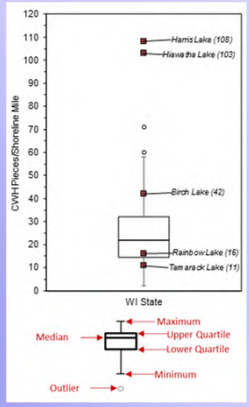
Town of Winchester Lakes
Coarse Woody Habitat



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Aquatic Plant Surveys

- Assess both non-native & native species
- Four surveys completed in 2016
  - Early-Season AIS Survey
  - Whole-Lake Point-Intercept Survey
  - Acoustic Survey
    - Water depth (bathymetry)
    - Substrate hardness
    - Aquatic plant bio-volume
  - Emergent/Floating-Leaf Community Mapping Survey

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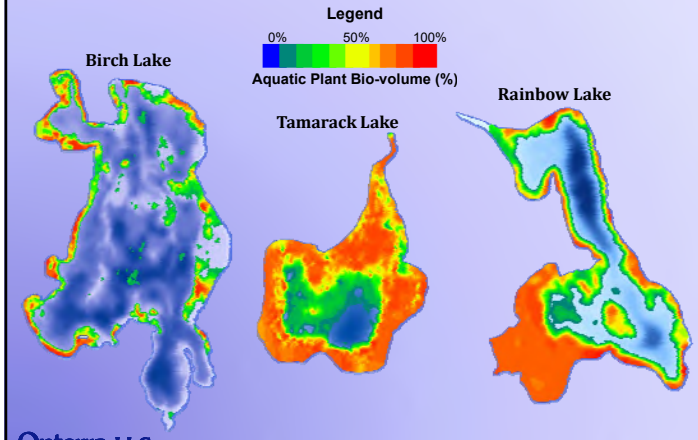
Aquatic Plant Bio-Volume



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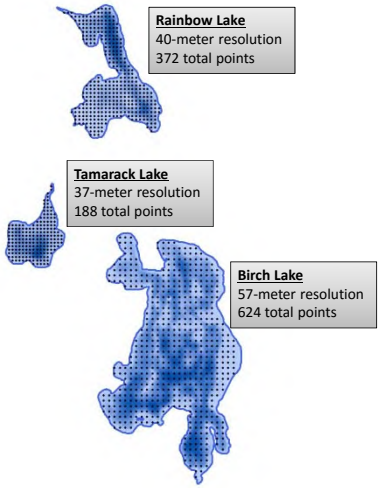
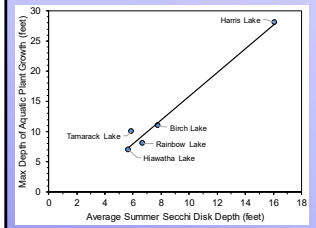
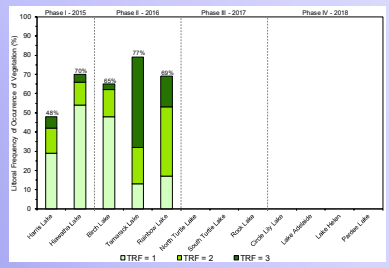
Whole-Lake Point-Intercept Survey



Frequency of Aquatic Plants





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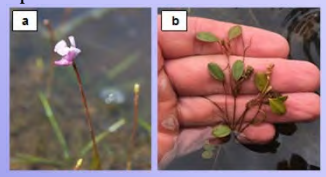
Plant Data Overview – Phase I & II

- 83 native plant species located to date
  - 2 listed as special concern: Northeastern bladderwort & Vasey's pondweed



- 1 non-native plant species
  - Curly-leaf pondweed (Harris Lake)

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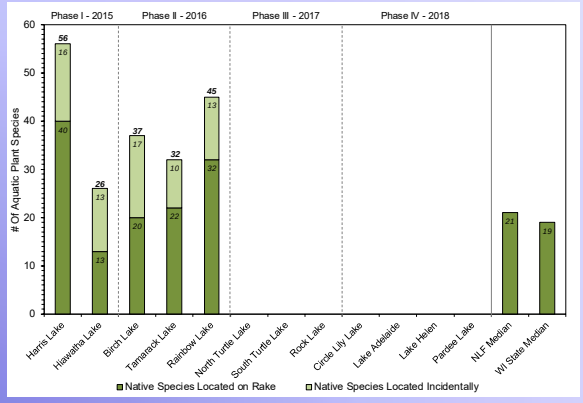
Native Species Richness



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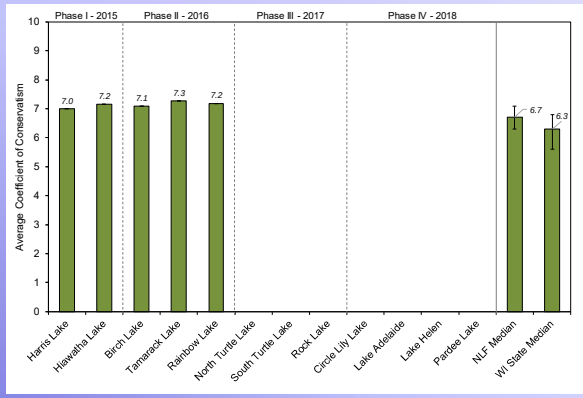
Average Conservatism



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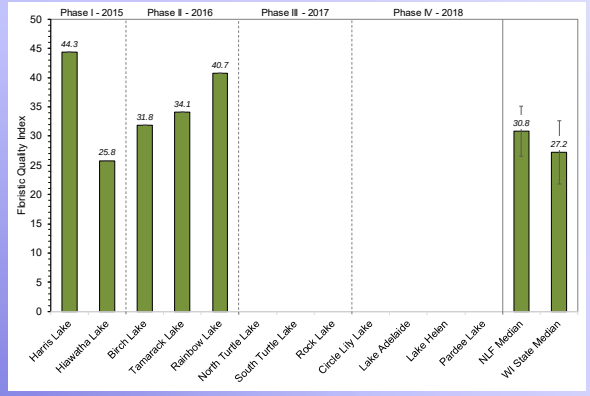
Floristic Quality



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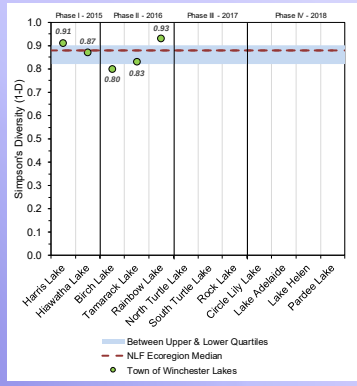
Simpson's Diversity Index



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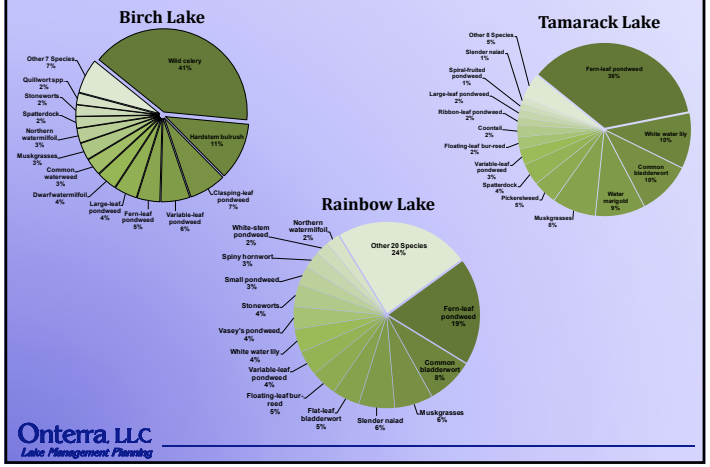
Relative Occurrence



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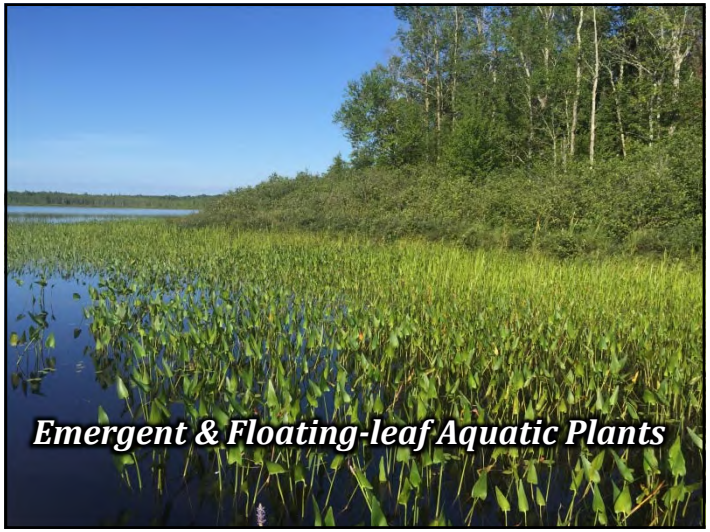

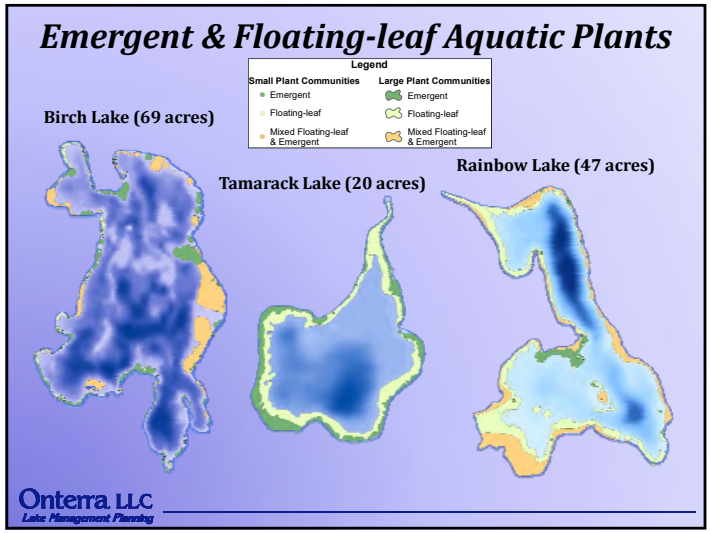
Emergent & Floating-leaf Aquatic Plants
Legend
Small Plant Communities
Emergent
Floating-leaf
Mixed Floating-leaf & Emergent
Large Plant Communities
Emergent
Floating-leaf
Mixed Floating-leaf & Emergent
Birch Lake (69 acres)
Tamarack Lake (20 acres)
Rainbow Lake (47 acres)
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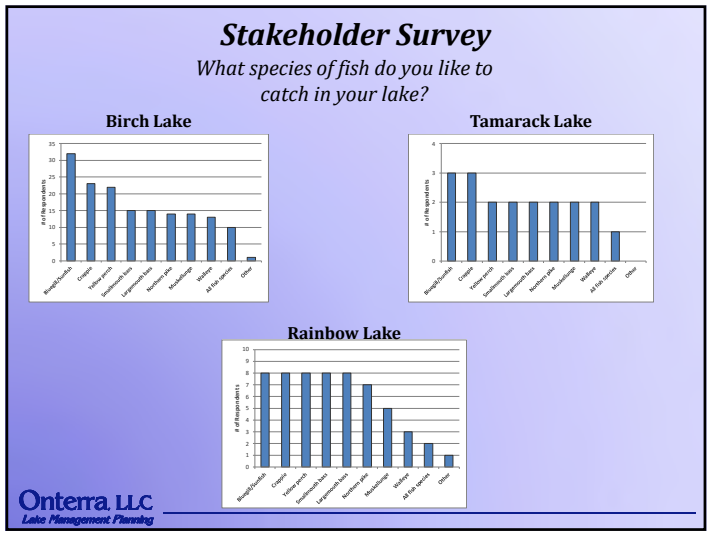
Lake Management Planning


Fisheries


Stakeholder Survey
What species of fish do you like to catch in your lake?
Birch Lake
Tamarack Lake
Rainbow Lake
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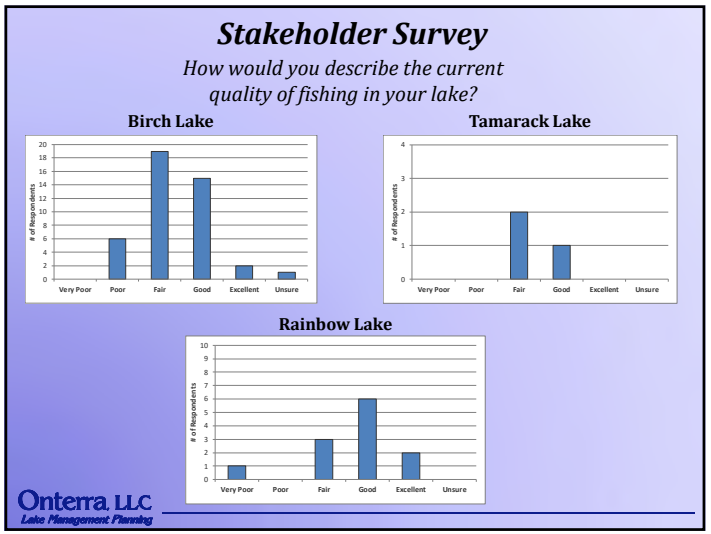
Lake Management Planning


Stakeholder Survey
How would you describe the current quality of fishing in your lake?
Birch Lake
Tamarack Lake
Rainbow Lake
Very Poor
Poor
Fair
Good
Excellent
Unsure
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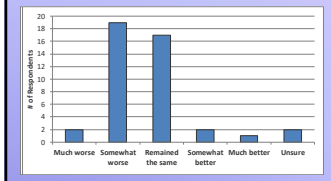
Lake Management Planning

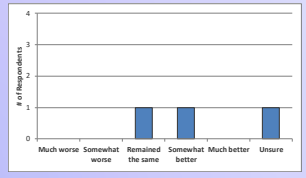
Stakeholder Survey

How has the quality of fishing changed since you first started fishing the lake?

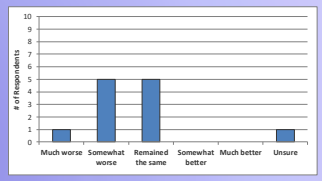
Birch Lake



Tamarack Lake



Rainbow Lake



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Native American Spear Harvest

- Town is within Treaty of 1842
- Tribal and State authorities establish *total allowable catch* based on population estimates (typically 35% for walleye & 27% for muskellunge)
- The total allowable catch number may be reduced based on confidence in population estimates: *safe harvest level*
- Tribal community claims percentage of safe harvest level, or *declaration*
- Bag limits for hook and line anglers set to accommodate declaration
- Can only harvest two walleye over 20 inches per night – one between 20 and 24" and one any size over 20"

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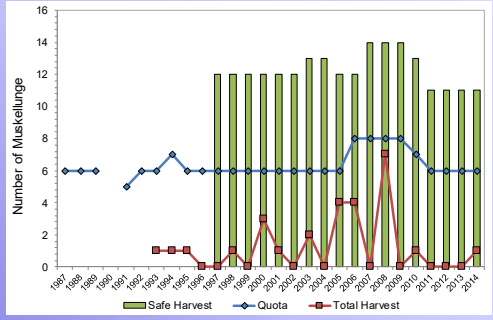
Lake Management Planning

Birch Lake Spear Harvest



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Conclusions

Water Quality

- Overall very good for deep lowland drainage lakes
- Recent increase in precipitation likely cause of recent decline in clarity
- Water clarity largely influenced by dissolved tannins

Watershed & Immediate Shoreland

- Watershed mainly comprised of natural land cover
- Model-predicted phosphorus aligns with measured phosphorus in Birch Lake
- Slightly higher phosphorus in Tamarack and Rainbow due to underestimates from model
- Minimal development within shoreland areas
- High occurrence of CWH in Birch Lake; lower occurrence in Tamarack and Rainbow lakes

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Conclusions

Aquatic Plant Community

- High native species richness
- Quality of species present very high and indicative of high-quality environment
- No non-native plants located

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Many of the graphics used in this presentation were supplied by:

Wisconsin Lakes Partnership

UW Extension

Wisconsin Dept. of Natural Resources

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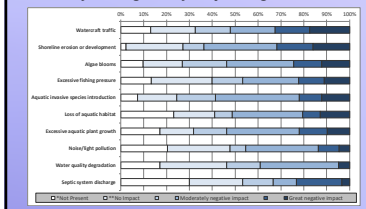
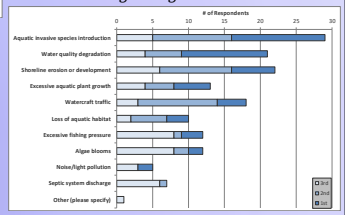
Birch Lake

To what level do you believe the following factors may be negatively impacting the lake?



Please rank your top three concerns regarding the lake.



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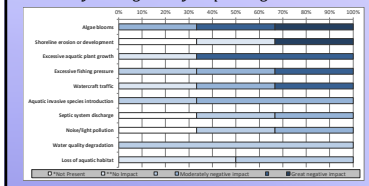
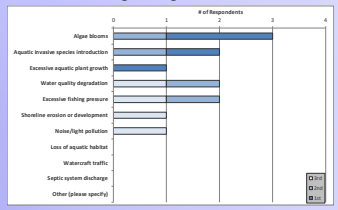
Tamarack Lake

To what level do you believe the following factors may be negatively impacting the lake?



Please rank your top three concerns regarding the lake.



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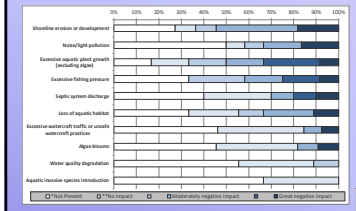
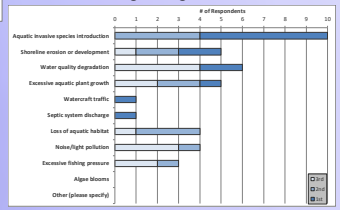
Rainbow Lake

To what level do you believe the following factors may be negatively impacting the lake?



Please rank your top three concerns regarding the lake.



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Bryozoans

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