A

APPENDIX A

Public Participation Materials

Frog and Bass Lakes Association

Frog and Bass Lakes Management Planning Project Kick-off Meeting
July 24, 2010

Eddie Heath
Onterra LLC
Lake Management Planning

Presentation Outline

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

Onterra, LLC

- Founded in 2005
- Staff
  - Five full-time ecologists
  - One part-time ecologist
  - One intern
- Services
  - Science and planning
- Philosophy
  - Promote realistic planning
  - Assist, not direct

Why create a lake management plan?

A goal without a plan is just a wish!

Elements of an Effective Lake Management Planning Project

Data and Information Gathering

Environmental & Sociological

Planning Process

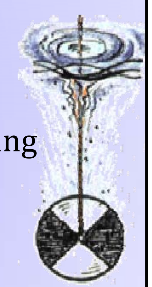
Brings it all together

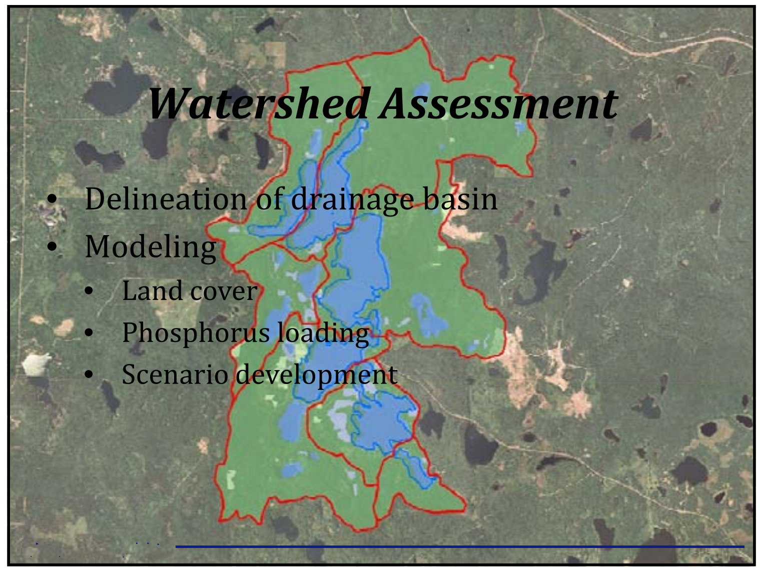
Data and information gathering

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

Water Quality Analysis

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





Watershed Assessment

- Delineation of drainage basin
- Modeling
  - Land cover
  - Phosphorus loading
  - Scenario development

Aquatic Plant Surveys

- Concerned with both native and non-native plants

Non-native Aquatic Plants

Curly-leaf Pondweed

Non-native Aquatic Plants

Eurasian Water Milfoil

Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Curly-leaf pondweed survey
  - Point-intercept survey

Bass Lake

28-me

106 to

30-meter resolution

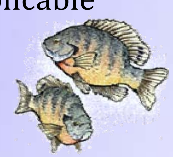
125 total points

Aquatic Plant Surveys

- Concerned with both native and non-native plants
- Multiple surveys used in assessment
  - Curly-leaf pondweed survey
  - Point-intercept survey
  - Plant community mapping
  - Volunteer survey findings

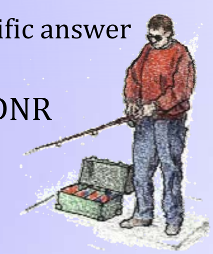
Fisheries Data Integration

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



Stakeholder Survey

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



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

Planning Process

Planning Committee Meetings

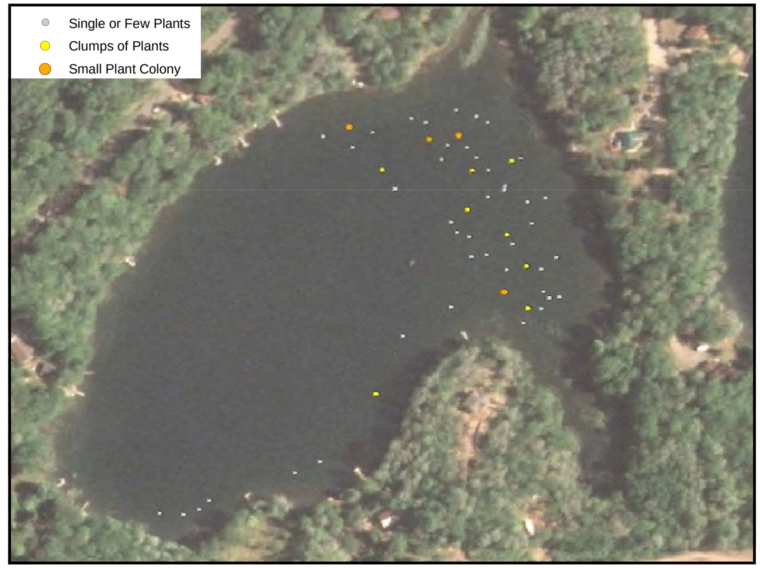
Study Results (including a stakeholder survey)
Conclusions & Initial Recommendations
Management Goals
Management Actions
Timeframe
Facilitator(s)

Implementation Plan

Frog and Bass Lake Aquatic Invasive Species

Bass Lake suspected milfoil Species

- County point-intercept survey locates suspected plants
- Onterra surveys lake in September 2009

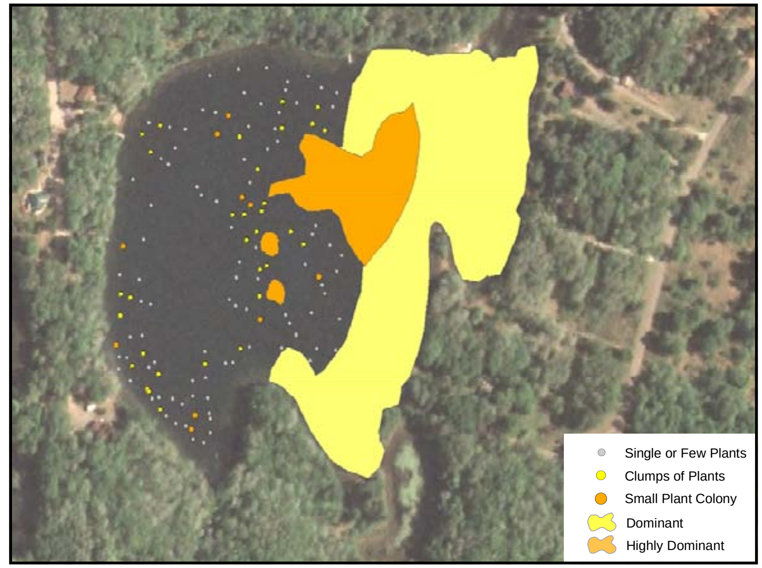


Bass Lake suspected milfoil Species

- County point-intercept survey locates suspected plants
- Onterra surveys lake in September 2009
- Specimens are sent to UW Herbarium – unconfirmed ID
- Specimens sent for DNA – confirmed NWM

Frog Lake EWM

- Located in 2001, later confirmed as hybrid species (*EWM x NWM*)
- Extremely successful treatment in 2005
- EWM rebounds and documented by County point-intercept survey
- Onterra surveys lake in September 2009

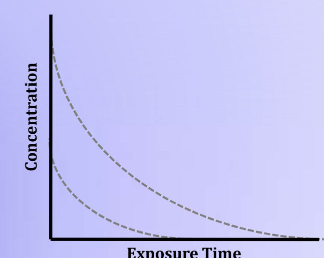


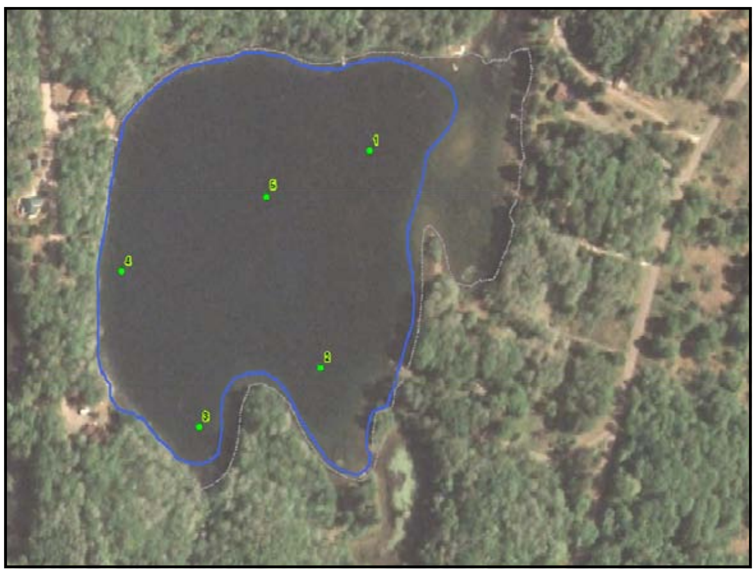
Frog Lake EWM

- Located in 2001, later confirmed as hybrid species (*EWM x NWM*)
- Extremely successful treatment in 2005
- EWM rebounds and documented by County point-intercept survey
- Onterra surveys lake in September 2009
- Treatment strategy is developed using liquid 2,4-D

Liquid 2,4-D

- Whole-lake scale
- Joint WDNR and US Army Cops of Engineer research project





EWM Treatment Monitoring

- Two types of monitoring are used to determine treatment effectiveness
  - Qualitative monitoring
    - EWM Mapping
  - Quantitative monitoring
    - Point-intercept Survey
- Residual 2,4-D monitoring

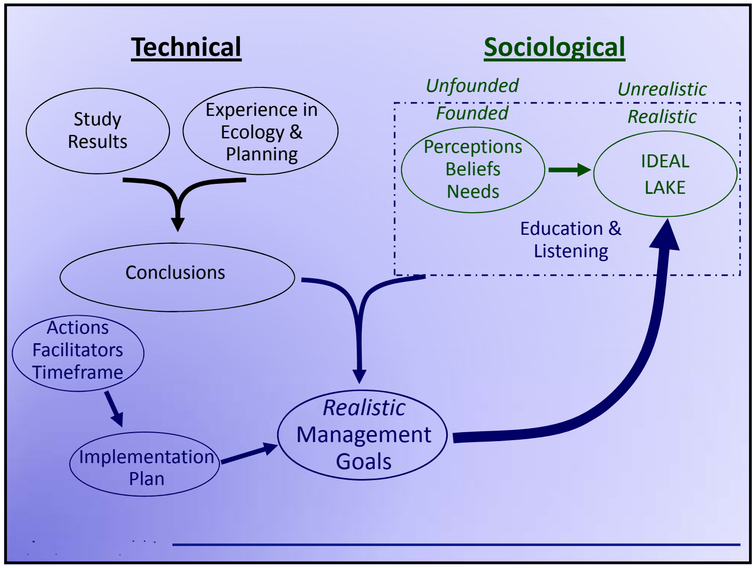
Thank You

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

Wisconsin Lakes Partnership

Extension

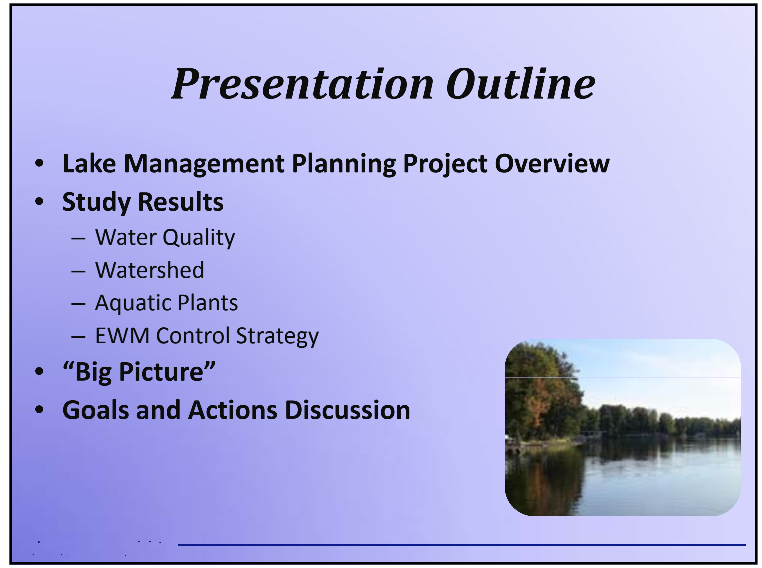
Wisconsin Dept. of Natural Resources



Stakeholder Survey

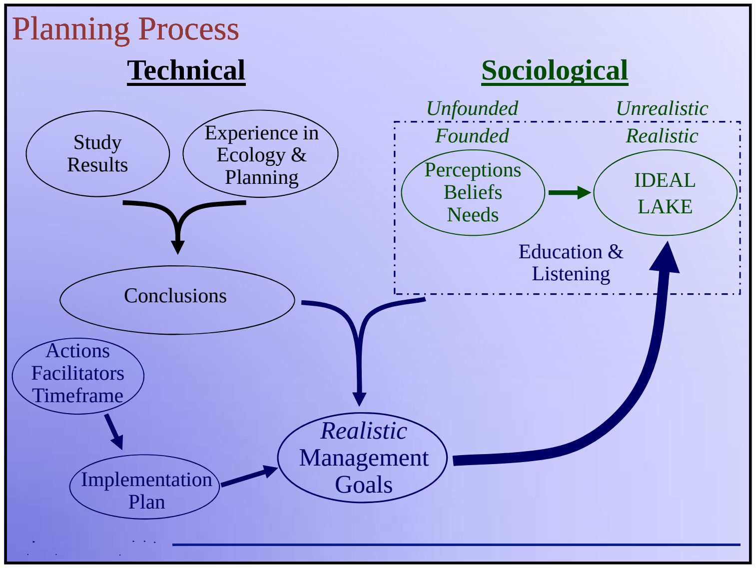
1. Onterra distributes standard survey to planning committee
2. Planning committee develops additional questions and options to be included within the survey
3. Onterra updates survey and submits to WDNR for approval
4. WDNR-approved survey is provided to planning committee
5. Planning committee prints survey, stuffs surveys in envelopes, and mails out surveys to distribution list they develop
6. Onterra provides customized Excel spreadsheet to the planning committee
7. Completed surveys are returned to planning committee and they tally results in provided electronic format
8. Excel spreadsheet of entered data is emailed to Onterra for analysis


Frog & Bass Lake Association
Frog & Bass Lake
Management Planning Project
Planning Meeting I
June 30, 2011
Eddie Heath
Onterra LLC
Lake Management Planning

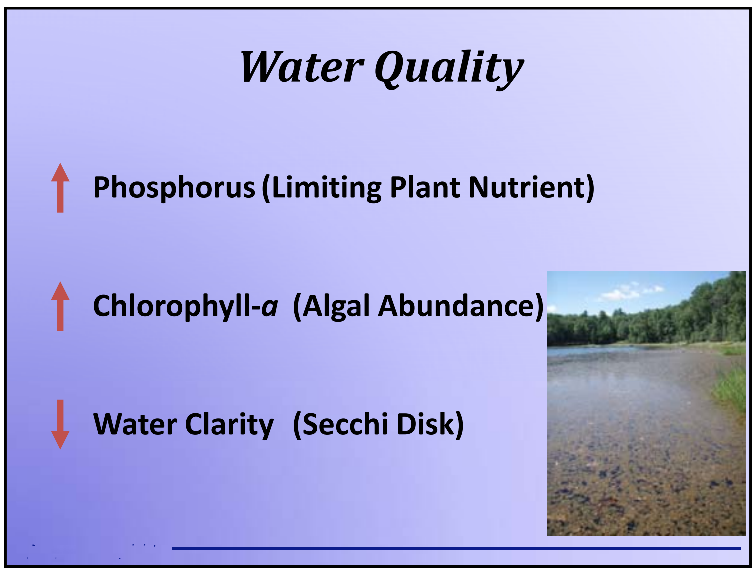

Presentation Outline
• Lake Management Planning Project Overview
• Study Results
– Water Quality
– Watershed
– Aquatic Plants
– EWM Control Strategy
• "Big Picture"
• Goals and Actions Discussion

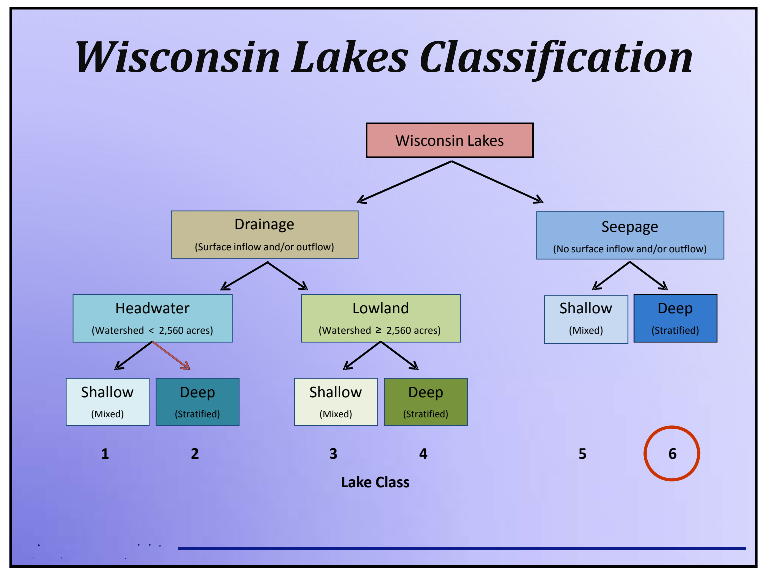

Study and Plan Goals
•Collect & Analyze Data
•Construct Long-Term & Useable Plan


The Planning Process
…it's not as easy as you may think.


Planning Process
Technical
Sociological
Unfounded
Unrealistic
Founded
Realistic
Study Results
Experience in Ecology & Planning
Perceptions Beliefs Needs
IDEAL LAKE
Education & Listening
Conclusions
Actions Facilitators Timeframe
Realistic Management Goals
Implementation Plan

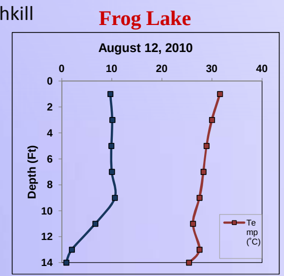

Water Quality


Water Quality
Phosphorus (Limiting Plant Nutrient)
Chlorophyll-a (Algal Abundance)
Water Clarity (Secchi Disk)

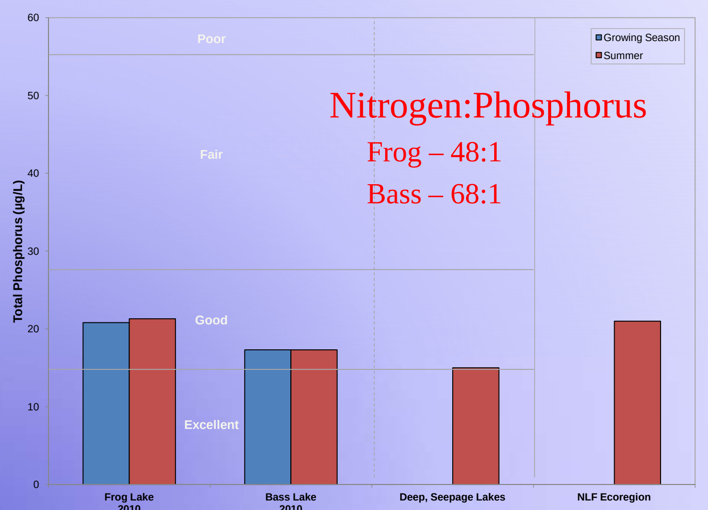

Wisconsin Lakes Classification
Wisconsin Lakes
Drainage
(Surface inflow and/or outflow)
Seepage
(No surface inflow and/or outflow)
Headwater
(Watershed < 2,560 acres)
Lowland
(Watershed ≥ 2,560 acres)
Shallow
(Mixed)
Deep
(Stratified)
Shallow
(Mixed)
Deep
(Stratified)
Shallow
(Mixed)
Deep
(Stratified)
1
2
3
4
5
6
Lake Class

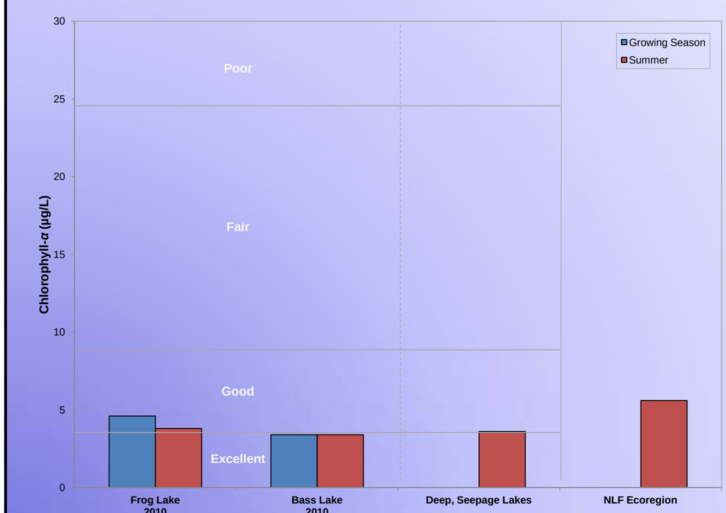
Dissolved Oxygen and Temperature Profiles

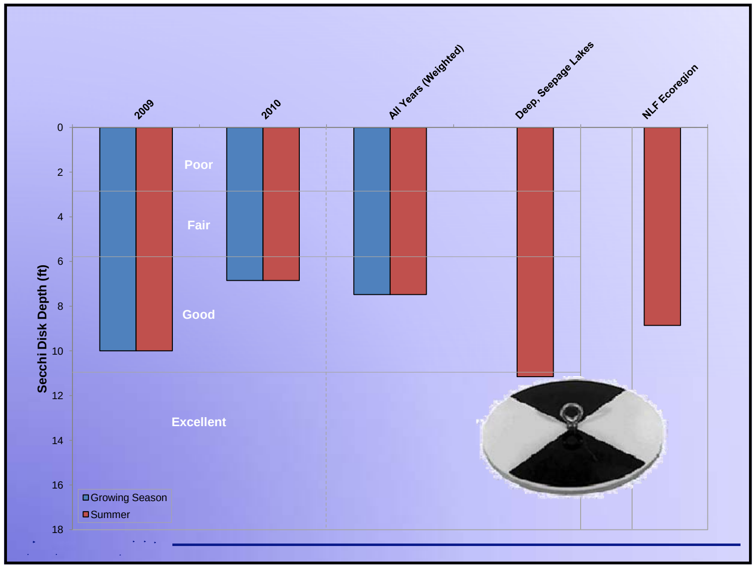
- **Dissolved Oxygen and Temperature Profiles**
  - Lake is very well mixed throughout summer
  - Very limited anoxia occurs near lake bottom during summer
    - May suggest little concern for winter fishkill

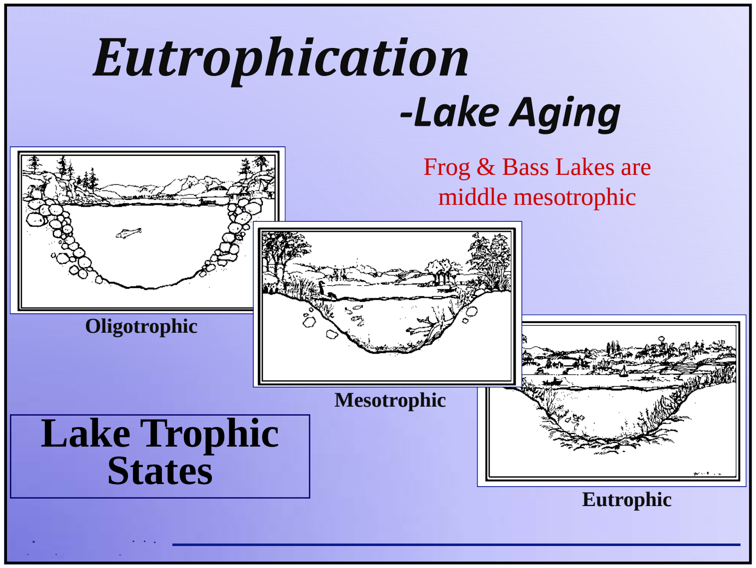


Lillie Mason Regions



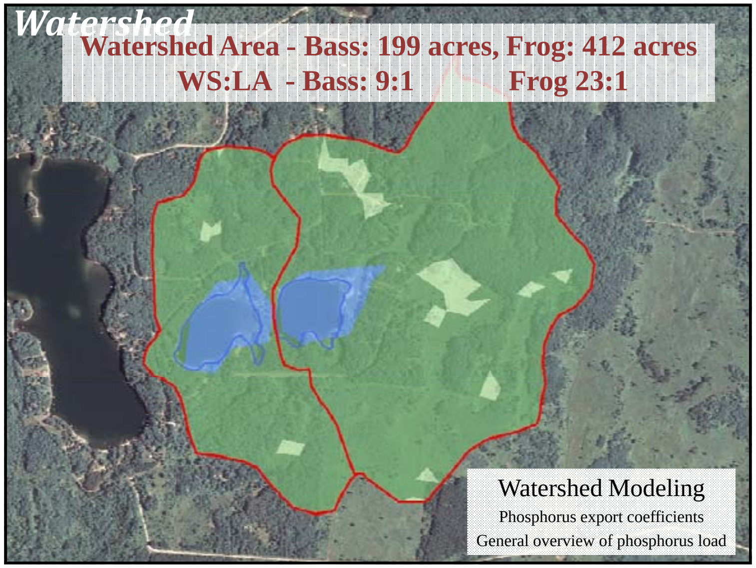


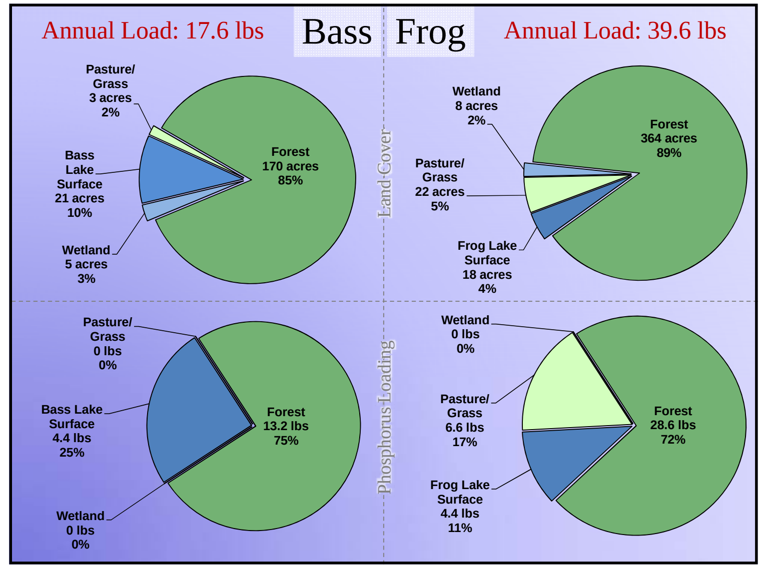

2009
2010
All Years (Weighted)
Deep, Seepage Lakes
NLF Ecoregion
Secchi Disk Depth (ft)
0
2
4
6
8
10
12
14
16
18
Poor
Fair
Good
Excellent
Growing Season
Summer


Eutrophication
-Lake Aging
Frog & Bass Lakes are middle mesotrophic
Oligotrophic
Mesotrophic
Eutrophic
Lake Trophic States

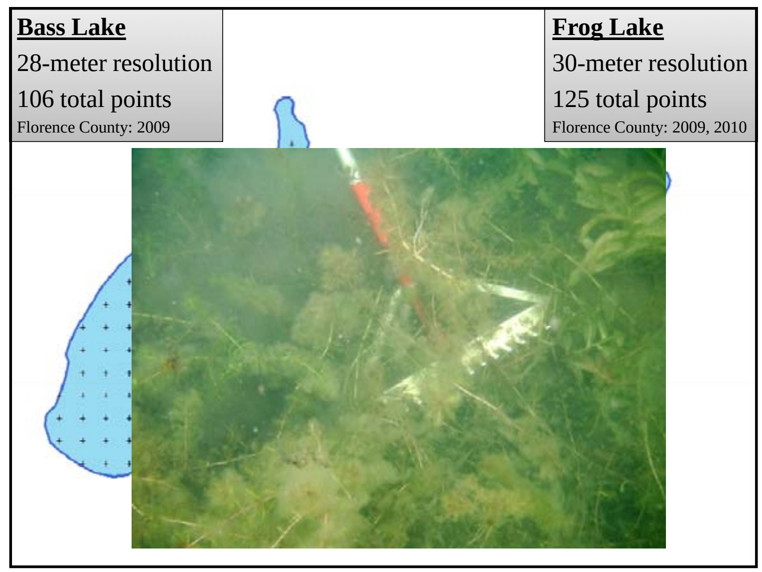

Watershed


Watershed

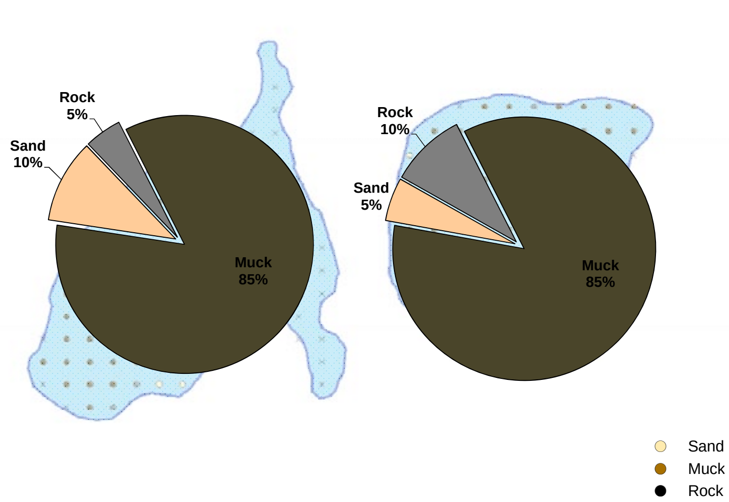

Watershed
Watershed Area - Bass: 199 acres, Frog: 412 acres
WS:LA - Bass: 9:1 Frog 23:1
Watershed Modeling
Phosphorus export coefficients
General overview of phosphorus load


Annual Load: 17.6 lbs
Bass
Frog
Annual Load: 39.6 lbs
Land Cover
Phosphorus Loading
Pasture/ Grass 3 acres 2%
Bass Lake Surface 21 acres 10%
Wetland 5 acres 3%
Forest 170 acres 85%
Wetland 8 acres 2%
Pasture/ Grass 22 acres 5%
Frog Lake Surface 18 acres 4%
Forest 364 acres 89%
Pasture/ Grass 0 lbs 0%
Bass Lake Surface 4.4 lbs 25%
Wetland 0 lbs 0%
Forest 13.2 lbs 75%
Wetland 0 lbs 0%
Pasture/ Grass 6.6 lbs 17%
Frog Lake Surface 4.4 lbs 11%
Forest 28.6 lbs 72%


Aquatic Plants


Bass Lake
28-meter resolution
106 total points
Florence County: 2009
Frog Lake
30-meter resolution
125 total points
Florence County: 2009, 2010

Sediment



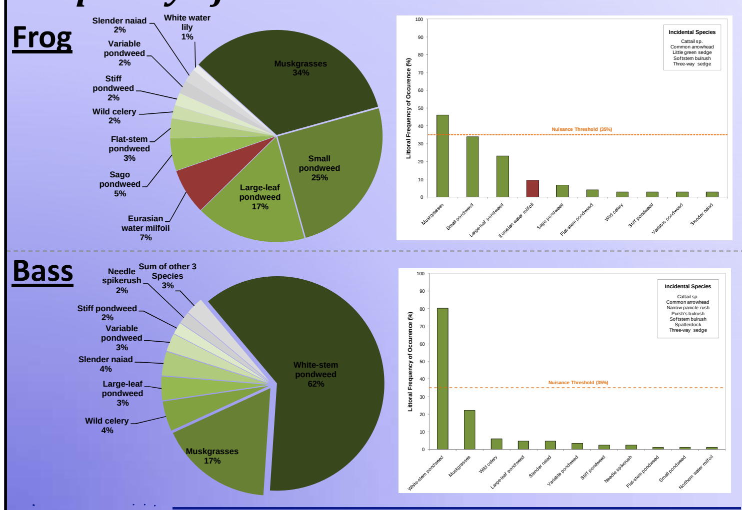
Species List

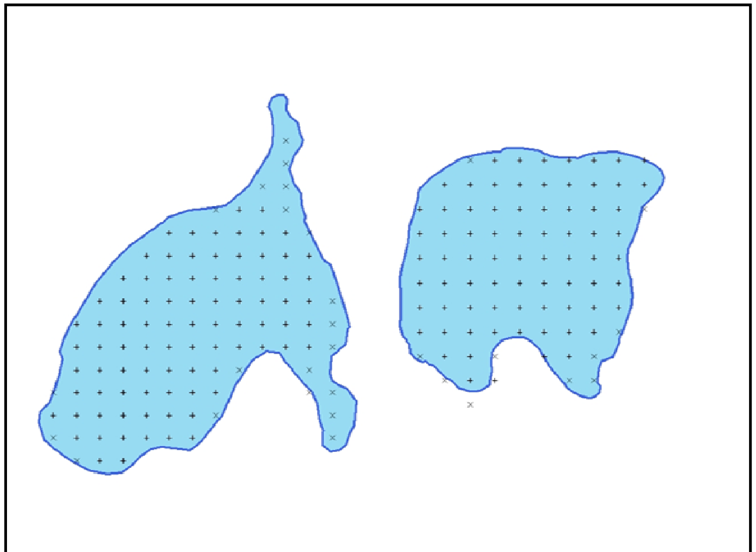
- **21 Native Species**
- **1 Non-native Species**
  - EWM hybrid on Frog

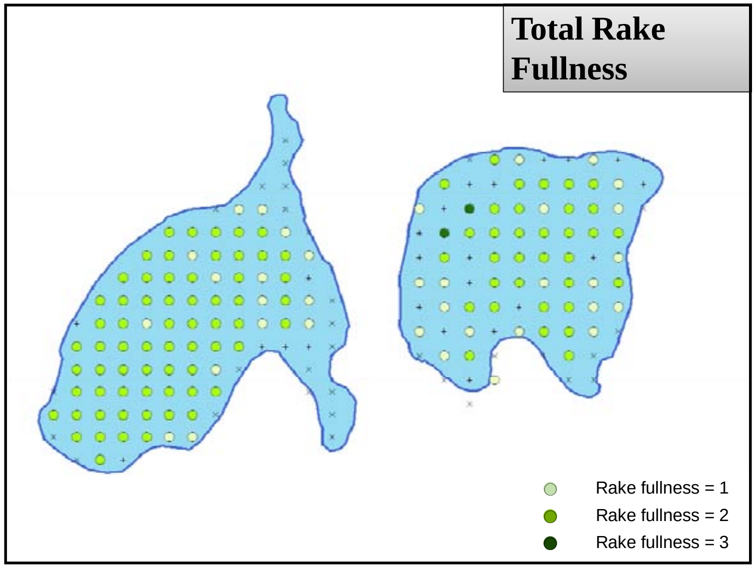
Life Form	Scientific Name	Common Name	Coefficient of Conservatism (C)	Frog Lake	Bass Lake
Emergent	*Carex viridula*	Little green sedge	6	X	
	Dulichium arundinaceum	Three-way sedge	9	X	X
	Juncus brevicaudatus	Narrow-panicle rush	6		X
	Sagittaria latifolia	Common arrowhead	3	X	X
	Schoenoplectus purshianus	Pursh's bulrush	9		X
	Schoenoplectus tabernaemontani	Softstem bulrush	4	X	X
	Typha sp.	Cattail sp.	1	X	X
FL	*Nuphar variegata*	Spatterdock	6		X
	Nymphaea odorata	White water lily	6	X	
Submergent	*Chara sp.*	Muskgrasses	7	X	X
	Myriophyllum sibiricum	Northern water milfoil	7		X
	Myriophyllum spicatum	Eurasian water milfoil	Exotic	X	
	Najas flexilis	Slender naiad	6	X	X
	Potamogeton amplifolius	Large-leaf pondweed	7	X	X
	Potamogeton gramineus	Variable pondweed	7	X	X
	Potamogeton praelongus	White-stem pondweed	8		X
	Potamogeton pusillus	Small pondweed	7	X	X
	Potamogeton strictifolius	Stiff pondweed	8	X	X
	Potamogeton zosteriformis	Flat-stem pondweed	6	X	X
	Stuckenia pectinata	Sago pondweed	3	X	
	Vallisneria americana	Wild celery	6	X	X
SE	*Eleocharis acicularis*	Needle spike-rush	5		X

SE = Submergent and Emergent
FL = Floating-leaf
X = Present

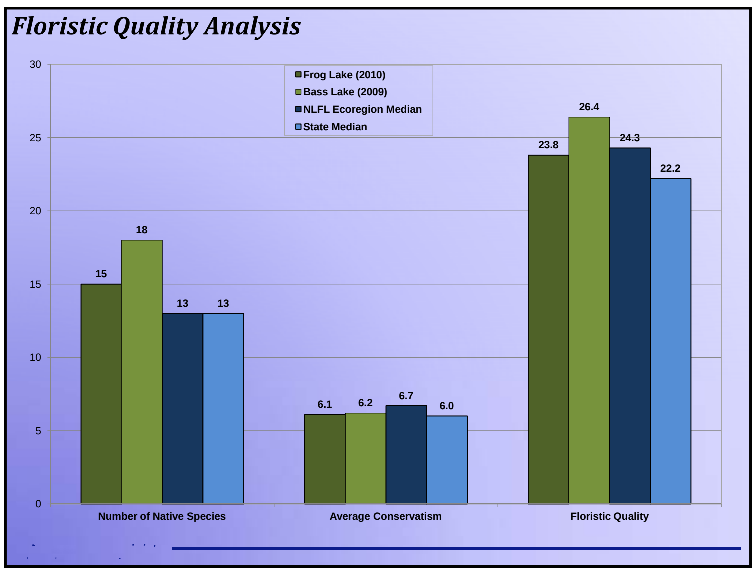
Frequency of Occurrence

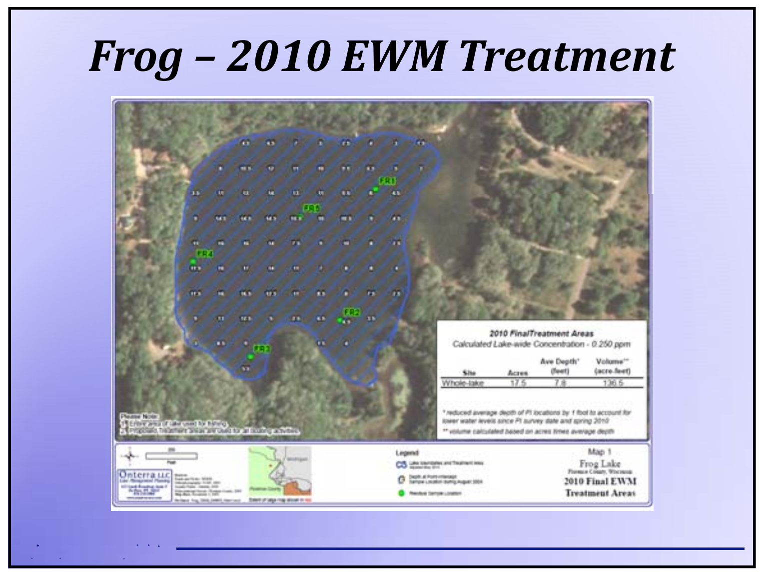


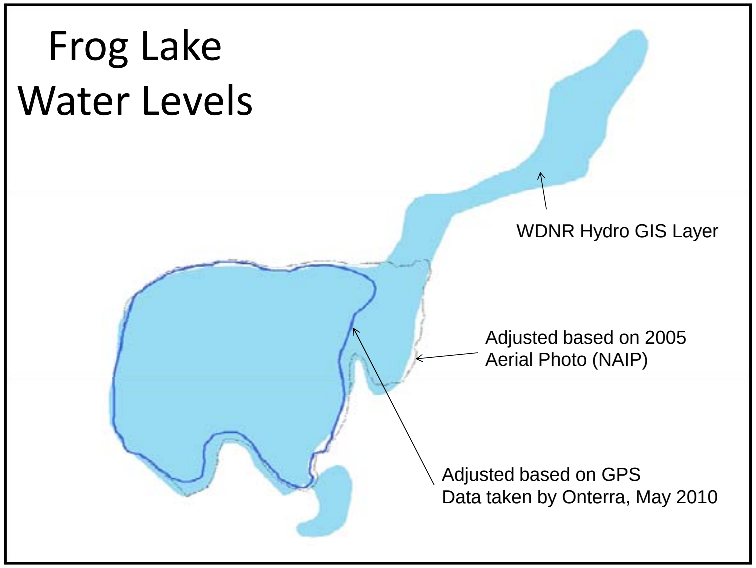


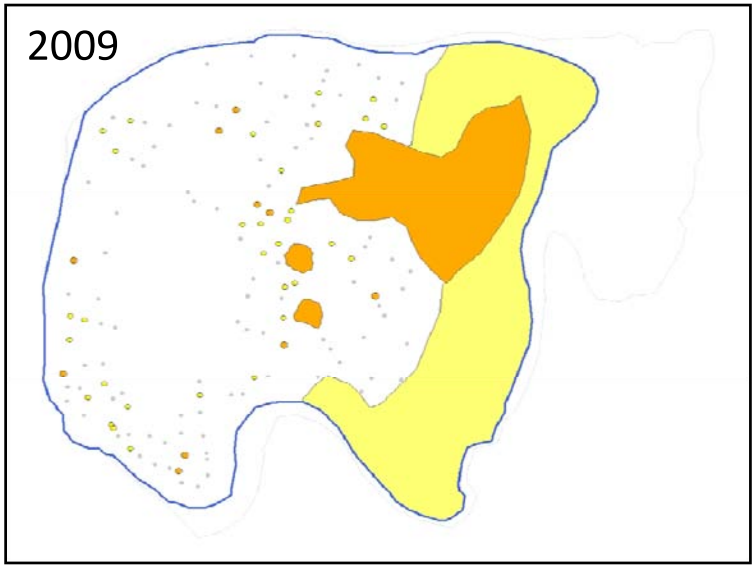

Total Rake Fullness
Rake fullness = 1
Rake fullness = 2
Rake fullness = 3

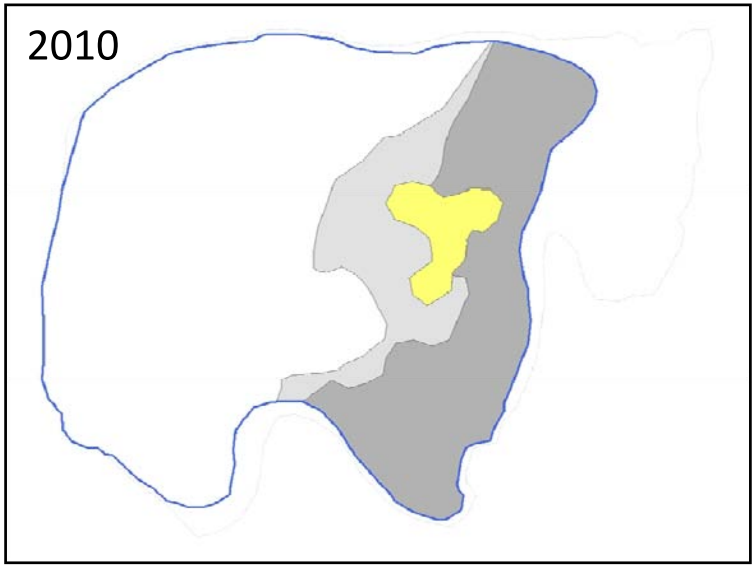

Aquatic Plants
Wisconsin Ecoregions
Northern Lakes and Forests
Frog and Bass Lakes
North Central Hardwood Forests
Driftless Area
Southeastern Wisconsin Till Plains

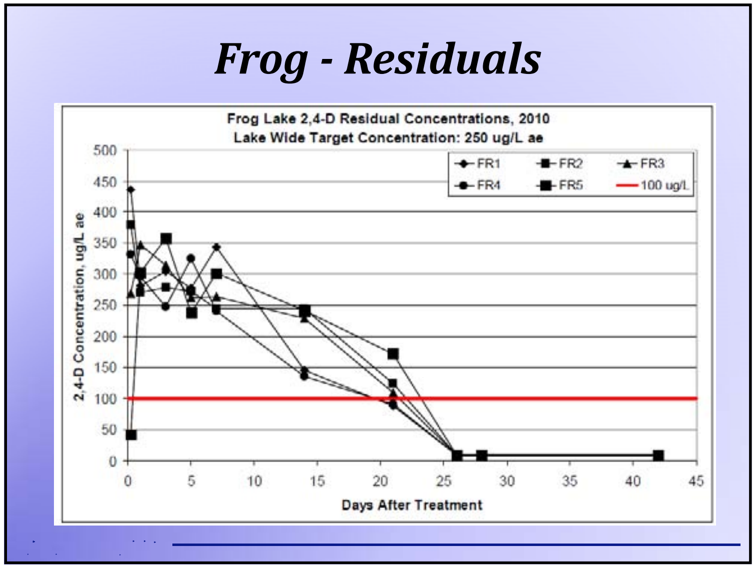

Floristic Quality Analysis
Frog Lake (2010)
Bass Lake (2009)
NLFL Ecoregion Median
State Median
0
5
10
15
20
25
30
15
18
13
13
6.1
6.2
6.7
6.0
23.8
26.4
24.3
22.2
Number of Native Species
Average Conservatism
Floristic Quality

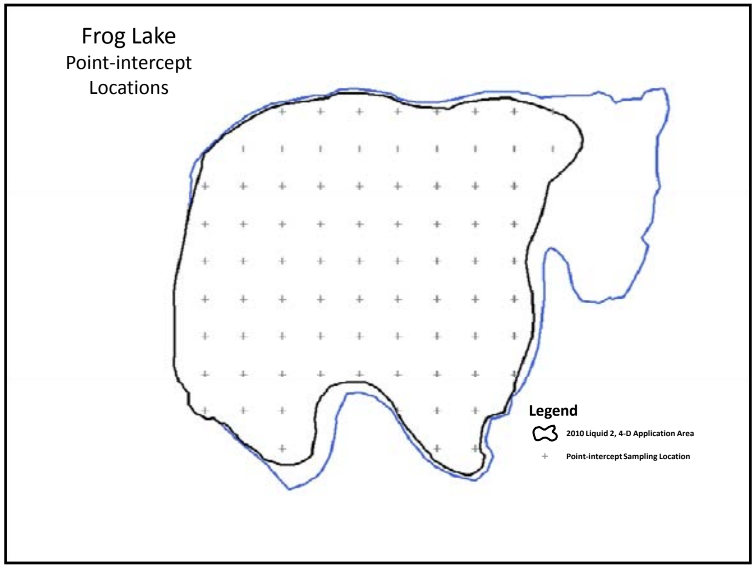

Frog – 2010 EWM Treatment

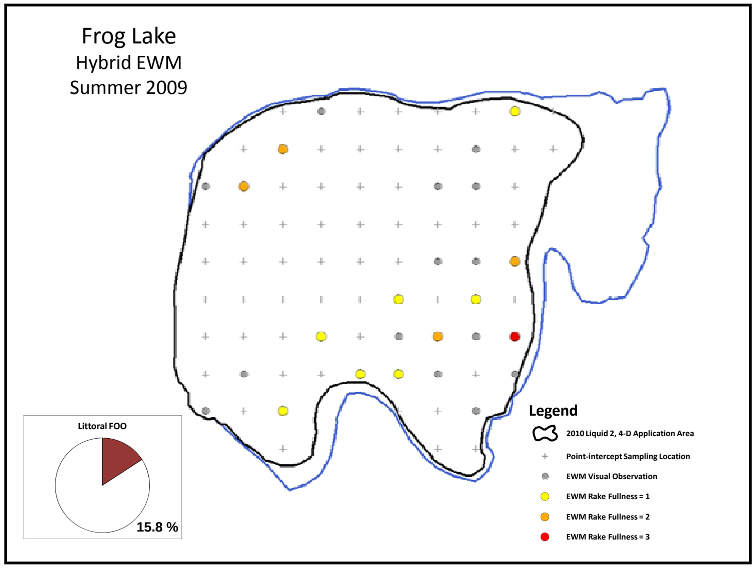

Frog Lake
Water Levels
WDNR Hydro GIS Layer
Adjusted based on 2005
Aerial Photo (NAIP)
Adjusted based on GPS
Data taken by Onterra, May 2010

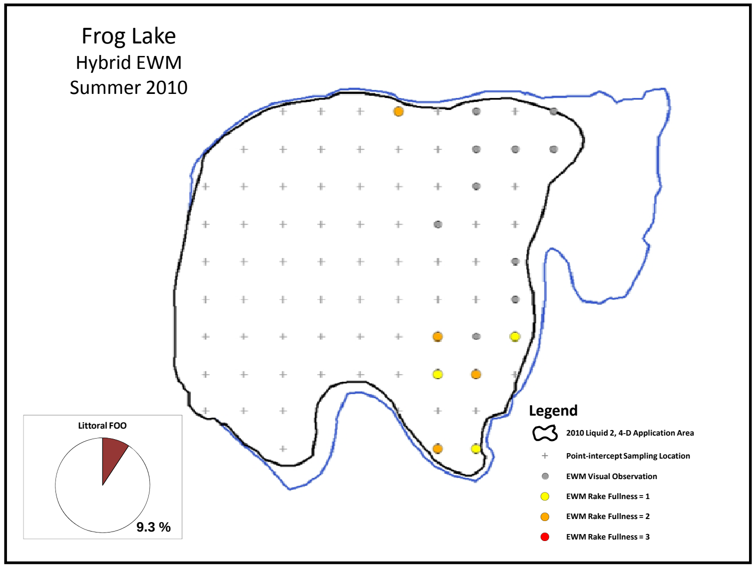

2009

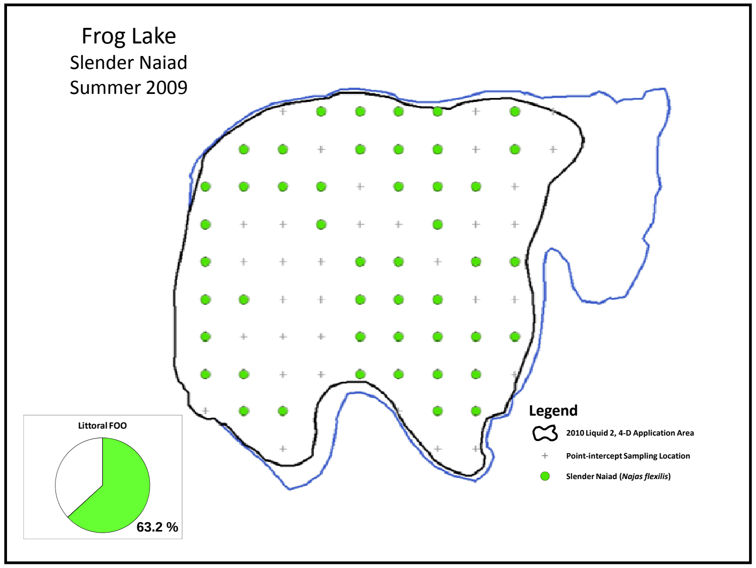

2010

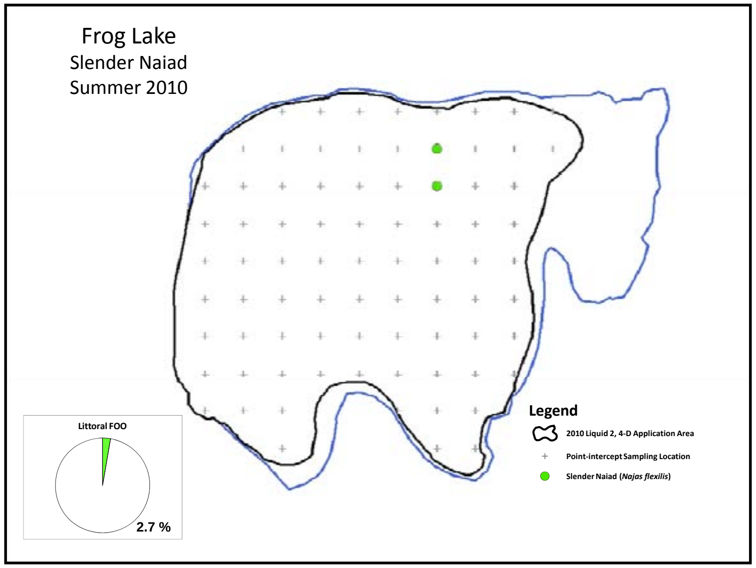

Frog - Residuals
Frog Lake 2,4-D Residual Concentrations, 2010
Lake Wide Target Concentration: 250 ug/L ae
FR1
FR2
FR3
FR4
FR5
100 ug/L
2,4-D Concentration, ug/L ae
Days After Treatment

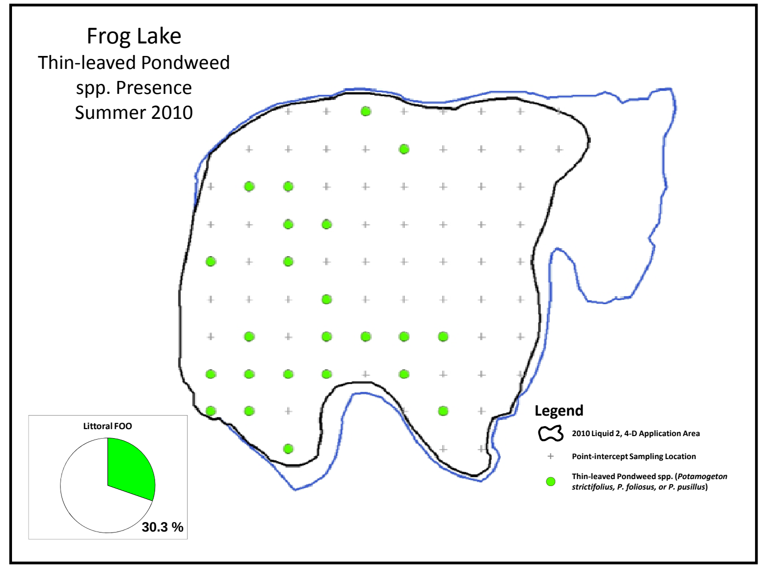

Frog Lake
Point-intercept
Locations
Legend
2010 Liquid 2, 4-D Application Area
Point-intercept Sampling Location

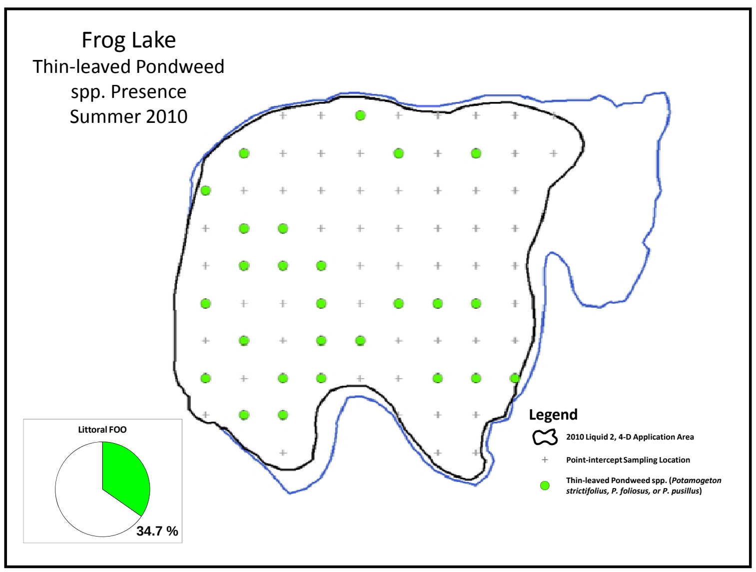

Frog Lake
Hybrid EWM
Summer 2009
Littoral FOO
15.8 %
Legend
2010 Liquid 2, 4-D Application Area
Point-intercept Sampling Location
EWM Visual Observation
EWM Rake Fullness = 1
EWM Rake Fullness = 2
EWM Rake Fullness = 3

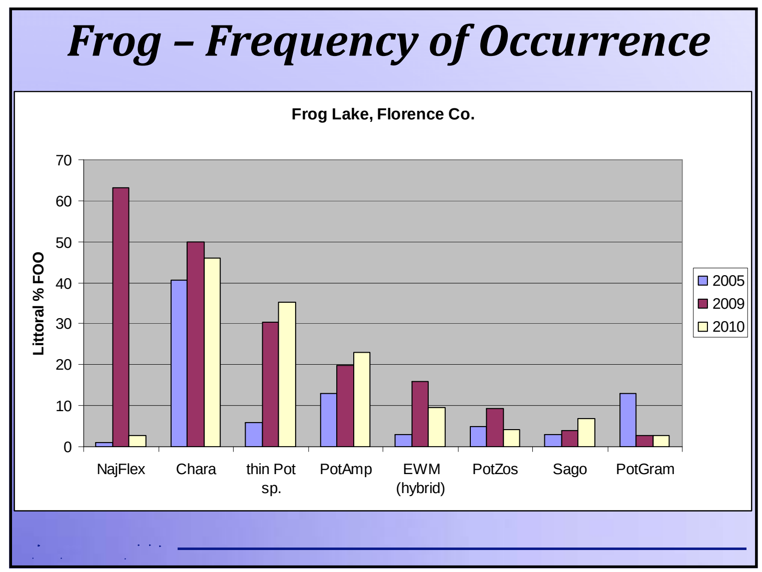

Frog Lake
Hybrid EWM
Summer 2010
Littoral FOO
9.3 %
Legend
2010 Liquid 2, 4-D Application Area
Point-intercept Sampling Location
EWM Visual Observation
EWM Rake Fullness = 1
EWM Rake Fullness = 2
EWM Rake Fullness = 3


Frog Lake
Slender Naiad
Summer 2009
Littoral FOO
63.2 %
Legend
2010 Liquid 2, 4-D Application Area
Point-intercept Sampling Location
Slender Naiad (Najas flexilis)


Frog Lake
Slender Naiad
Summer 2010
Littoral FOO
2.7 %
Legend
2010 Liquid 2, 4-D Application Area
Point-intercept Sampling Location
Slender Naiad (*Najas flexilis*)


Frog Lake
Thin-leaved Pondweed
spp. Presence
Summer 2010
Littoral FOO
30.3 %
Legend
2010 Liquid 2, 4-D Application Area
Point-intercept Sampling Location
Thin-leaved Pondweed spp. (*Potamogeton strictifolius, P. foliosus, or P. pusillus*)


Frog Lake
Thin-leaved Pondweed
spp. Presence
Summer 2010
Littoral FOO
34.7 %
Legend
2010 Liquid 2, 4-D Application Area
Point-intercept Sampling Location
Thin-leaved Pondweed spp. (*Potamogeton strictifolius, P. foliosus, or P. pusillus*)

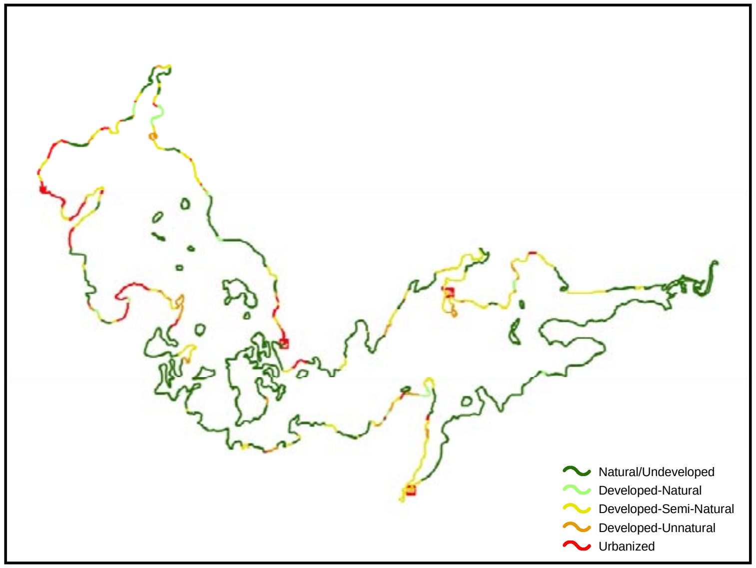

Frog – Frequency of Occurrence
Frog Lake, Florence Co.
Littoral % FOO
70
60
50
40
30
20
10
0
NajFlex
Chara
thin Pot sp.
PotAmp
EWM (hybrid)
PotZos
Sago
PotGram
2005
2009
2010

Overview of Data

- **Not Much Data Exists**
- **Outside Ceded Territory**
- **Tried to make it a Walleye Lake**
  - Walleye & forage fish stocked in '50s & '60's
  - Toxaphene use
  - Private walleye stocking in early '90s
- **Large mouth bass & northern pike are dominant predators**

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



Conclusions

- Water quality is as expected for small, seepage lakes.
- Overall watershed is in great condition.
  - Land cover exports minimal phosphorus.
  - Largest, *controllable* contributor is likely shoreland properties.
- Aquatic plant community
  - Based upon standard analysis, native community is of moderately high quality
  - Eurasian water milfoil control was moderately successful in 2010, but did not meet expectations.

Thank You

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

Wisconsin Lakes Partnership

UW Extension

WISCONSIN DEPT. OF NATURAL RESOURCES

B

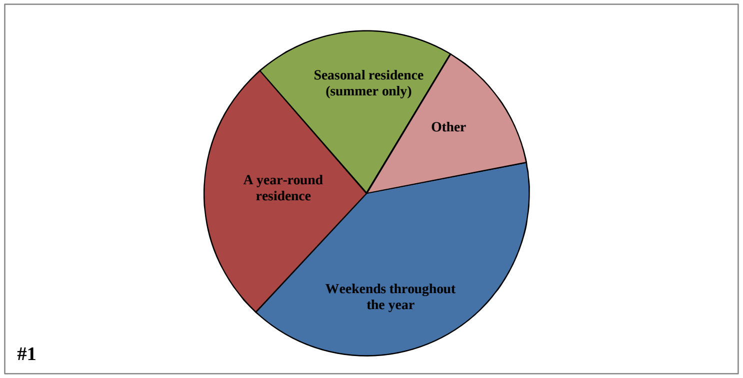
APPENDIX B

Stakeholder Survey Response Charts and Comments

Returned Surveys	16
Sent Surveys	24
Response Rate (%)	66.7

#1 What type of property do you own on Frog Lake?

	Total	*%*
Weekends throughout the year	6	*40.0*
A year-round residence	4	*26.7*
Seasonal residence (summer only)	3	*20.0*
Resort	0	*0.0*
Rental property	0	*0.0*
Undeveloped	0	*0.0*
I do not live on the lake	0	*0.0*
Other	2	*13.3*
	15	*100.0*

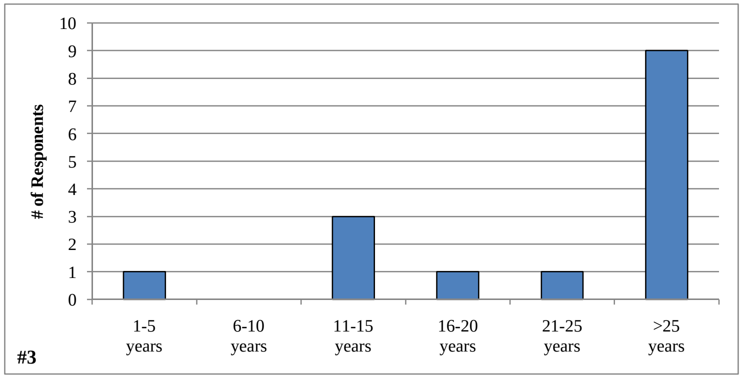


#2 If you are not a year-round resident, how many days each year is your property used by you or others?

Answered Question	15
Average	146.7
Standard deviation	141.2

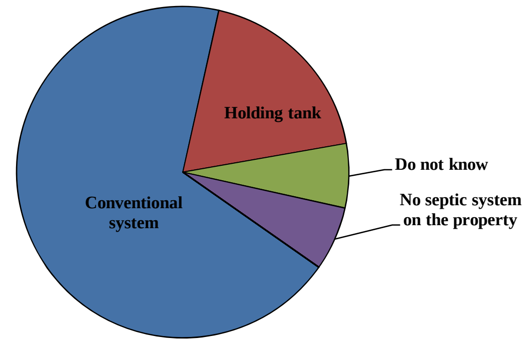
#3 How long have you owned your property on Frog Lake?

	Total	*%*
1-5 years	1	*6.7*
6-10 years	0	*0.0*
11-15 years	3	*20.0*
16-20 years	1	*6.7*
21-25 years	1	*6.7*
>25 years	9	*60.0*
	15	*100.0*



#4 What type of septic system does your property utilize?

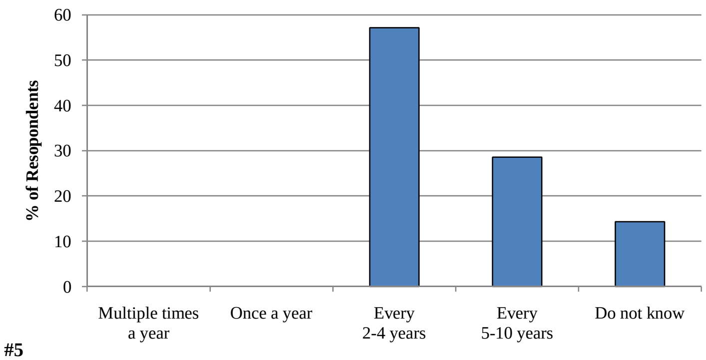
	Total	%
Conventional system	11	*68.8*
Holding tank	3	*18.8*
Do not know	1	*6.3*
No septic system on the property	1	*6.3*
Mound	0	*0.0*
Advanced treatment system	0	*0.0*
Municipal sewer	0	*0.0*
	16	*100.0*



#4

#5 How often is the septic tank on your property pumped?

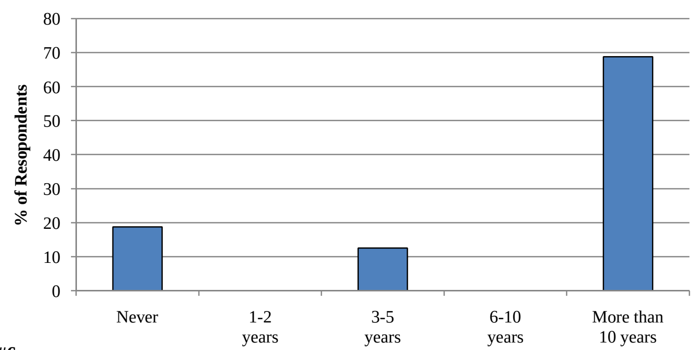
	Total	%
Multiple times a year	0	*0.0*
Once a year	0	*0.0*
Every 2-4 years	8	*57.1*
Every 5-10 years	4	*28.6*
Do not know	2	*14.3*
	14	*100.0*



#5

#6 For how many years have you fished Frog Lake?

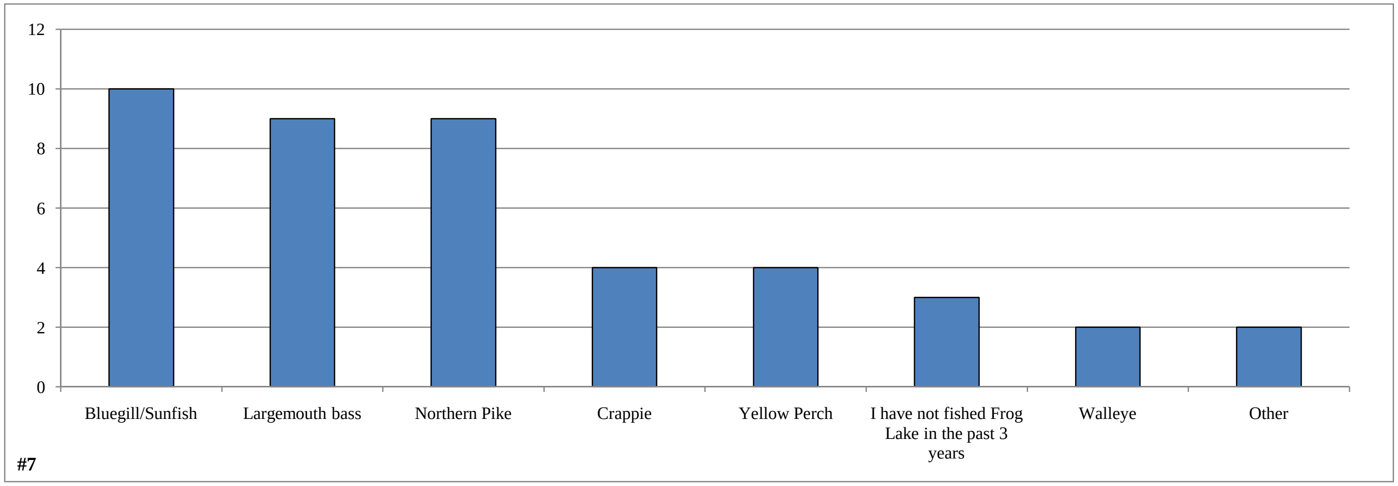
	Total	%
Never	3	*18.8*
1-2 years	0	*0.0*
3-5 years	2	*12.5*
6-10 years	0	*0.0*
More than 10 years	11	*68.8*
	16	*100.0*



#6

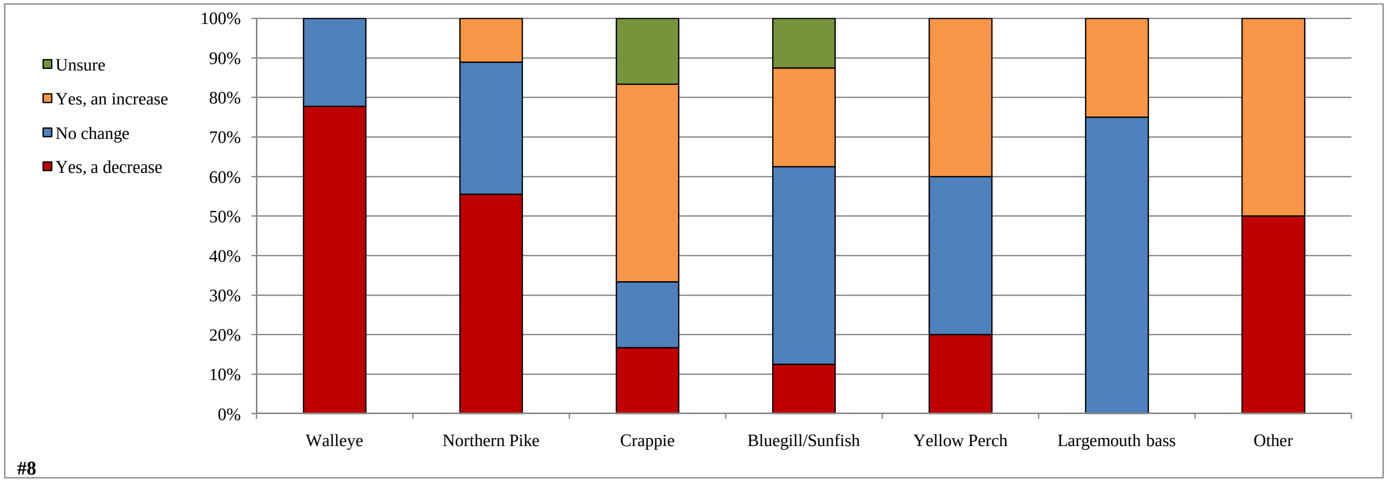
#7 What species have you been catching in the past 3 years?

	Total
Bluegill/Sunfish	10
Largemouth bass	9
Northern Pike	9
Crappie	4
Yellow Perch	4
I have not fished Frog Lake in the past 3 years	3
Walleye	2
Other	2



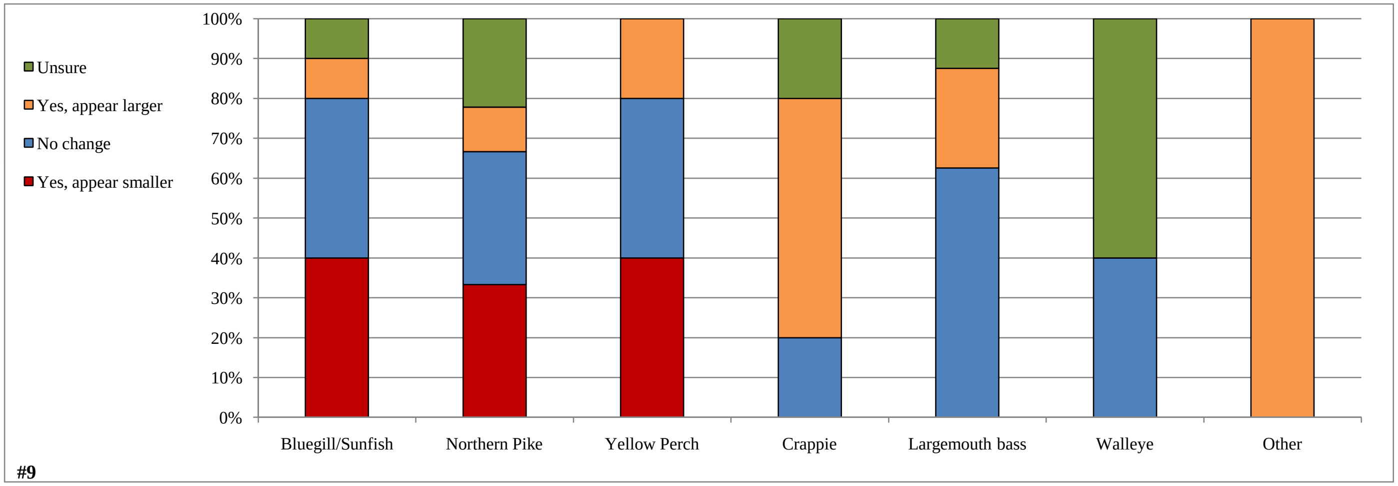
#8 Do you feel there has been a change in the abundance of fish species listed below since you starte fishing on Frog Lake?

	Yes, an increase	Yes, a decrease	No change	Unsure
Walleye	0	7	2	0
Northern Pike	1	5	3	0
Crappie	3	1	1	1
Bluegill/Sunfish	2	1	4	1
Yellow Perch	2	1	2	0
Largemouth bass	2	0	6	0
Other	1	1	0	0



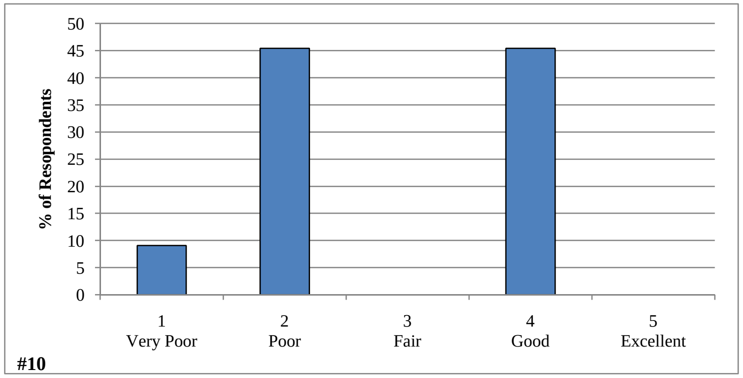
#9 Have you seen a change in the size of the fish species listed below since you started fishing on Frog Lake?

	Yes, appear smaller	Yes, appear larger	No change	Unsure
Bluegill/Sunfish	4	1	4	1
Northern Pike	3	1	3	2
Yellow Perch	2	1	2	0
Crappie	0	3	1	1
Largemouth bass	0	2	5	1
Walleye	0	0	2	3
Other	0	1	0	0



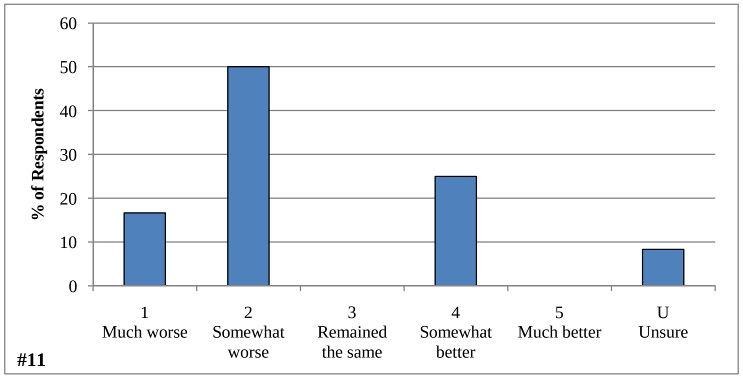
#10 How would you describe the current quality of fishing on Frog Lake?

	Total	%
1 - Very Poor	1	*9.1*
2 - Poor	5	*45.5*
3 - Fair	0	*0.0*
4 - Good	5	*45.5*
5 - Excellent	0	*0.0*
	11	*100.0*



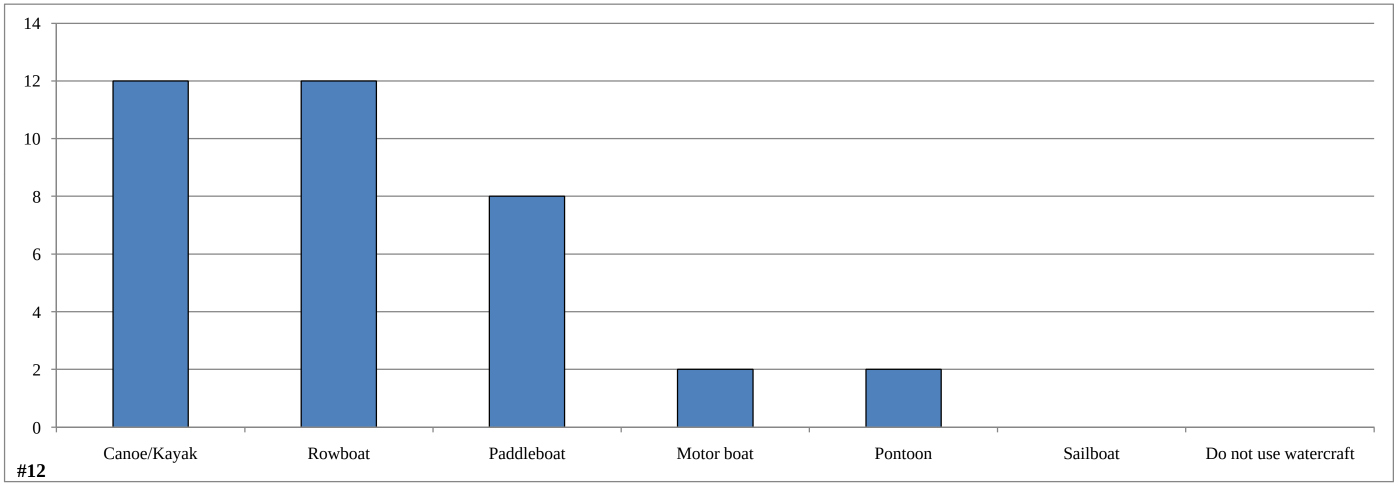
#11 How has the quality of fishing changed on Frog Lake since you started fishing the lake?

	Total	%
1 - Much worse	2	*16.7*
2 - Somewhat worse	6	*50.0*
3 - Remained the Same	0	*0.0*
4 - Somewhat better	3	*25.0*
5 - Much better	0	*0.0*
U - Unsure	1	*8.3*
	12	*100.0*



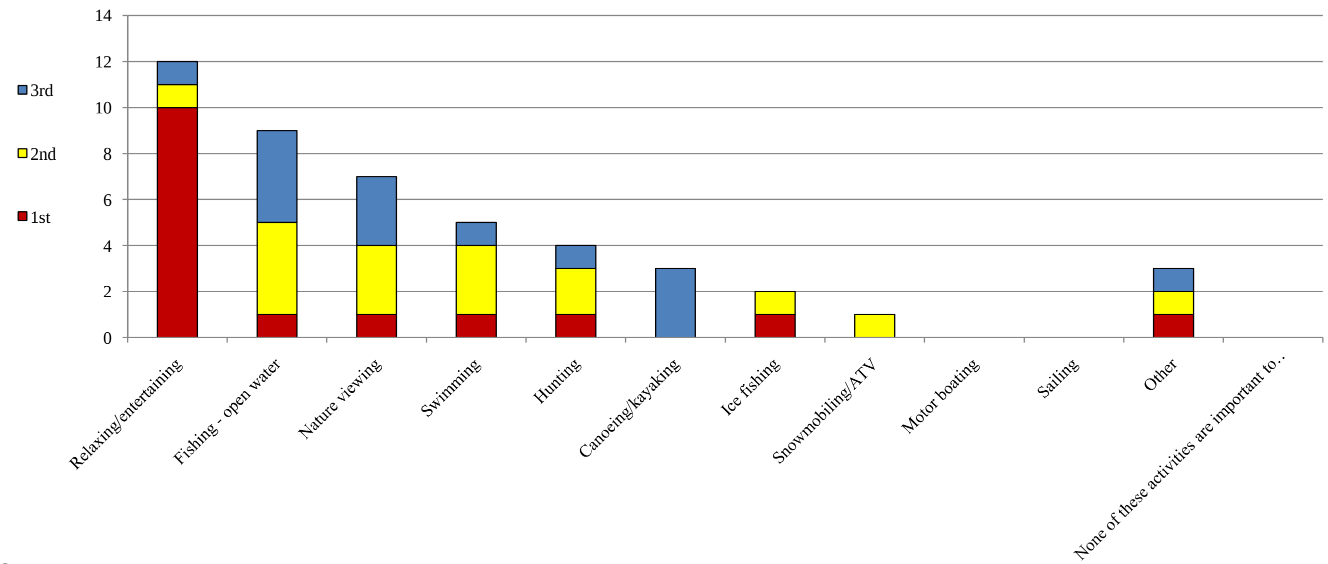
#12 What types of watercraft have you used on the lake?

	Total
Canoe/Kayak	12
Rowboat	12
Paddleboat	8
Motor boat	2
Pontoon	2
Sailboat	0
Do not use watercraft	0
	36



#13 Please rank up to three activities that are important reasons for owning your property on or near the lake.

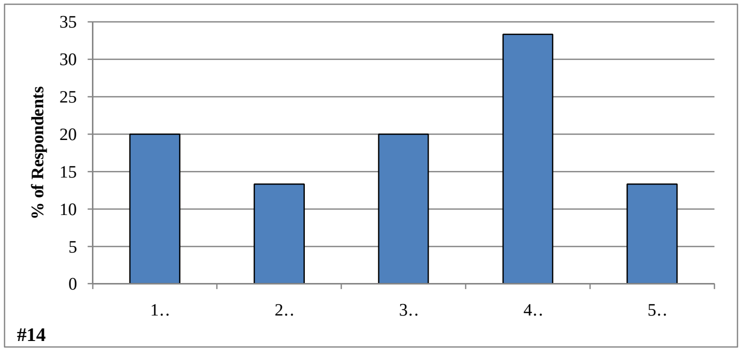
	1st	2nd	3rd	*% ranked*
Relaxing/entertaining	10	1	1	*26.1*
Fishing - open water	1	4	4	*19.6*
Nature viewing	1	3	3	*15.2*
Swimming	1	3	1	*10.9*
Hunting	1	2	1	*8.7*
Canoeing/kayaking	0	0	3	*6.5*
Ice fishing	1	1	0	*4.3*
Snowmobiling/ATV	0	1	0	*2.2*
Motor boating	0	0	0	*0.0*
Sailing	0	0	0	*0.0*
Other	1	1	1	*6.5*
None of these activities are important to me	0	0	0	*0.0*
	16	16	14	*100.0*



#13

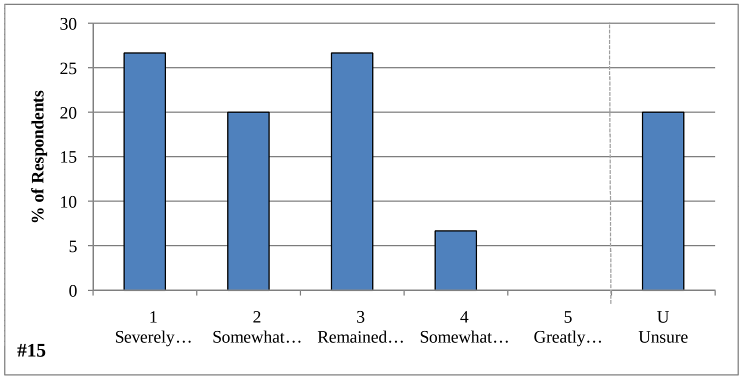
#14 How would you describe the current water quality of Frog Lake?

	Total	%
1 - Poor	3	*20.0*
2 - Fair	2	*13.3*
3 - Unsure	3	*20.0*
4 - Good	5	*33.3*
5 - Excellent	2	*13.3*
	15	*100.0*



#15 How has the water quality changed in Frog Lake since you obtained your property?

	Total	%
1 - Severely degraded	4	*26.7*
2 - Somewhat degraded	3	*20.0*
3 - Remained the same	4	*26.7*
4 - Somewhat improved	1	*6.7*
5 - Greatly improved	0	*0.0*
U - Unsure	3	*20.0*
	15	*100.0*



#16 Have you ever heard of aquatic invasive species?

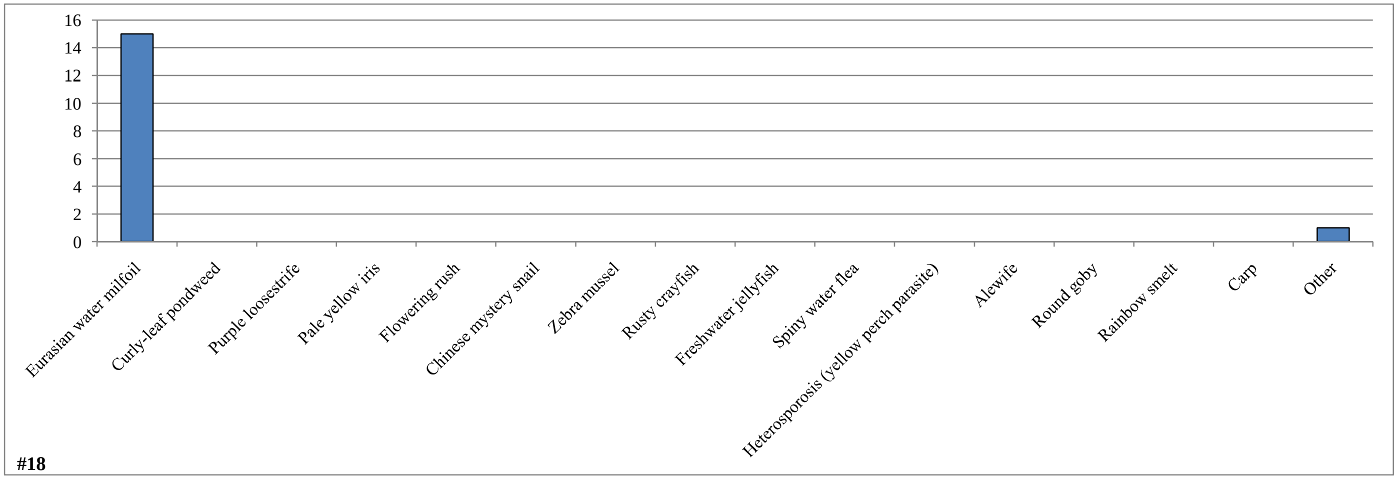
	Total	%
Yes	15	*100.0*
No	0	*0.0*
	15	*100.0*

#17 Are you aware of aquatic invasive species in Frog Lake?

	Total	%
Yes	15	*100.0*
No	0	*0.0*
	15	*100.0*

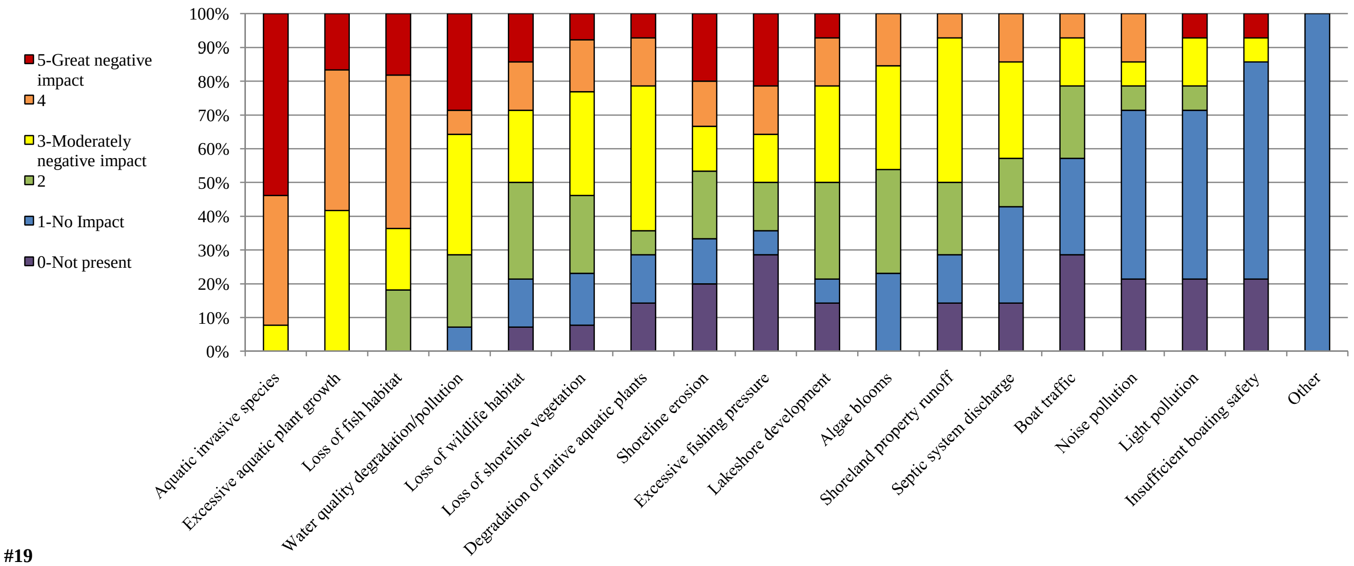
#18 Which aquatic invasive species are you aware of in the lake?

	Total
Eurasian water milfoil	15
Curly-leaf pondweed	0
Purple loosestrife	0
Pale yellow iris	0
Flowering rush	0
Chinese mystery snail	0
Zebra mussel	0
Rusty crayfish	0
Freshwater jellyfish	0
Spiny water flea	0
Heterosporosis (yellow perch parasite)	0
Alewife	0
Round goby	0
Rainbow smelt	0
Carp	0
Other	1



#19 To what level do you believe each of the following factors may be negatively impacting Frog Lake?

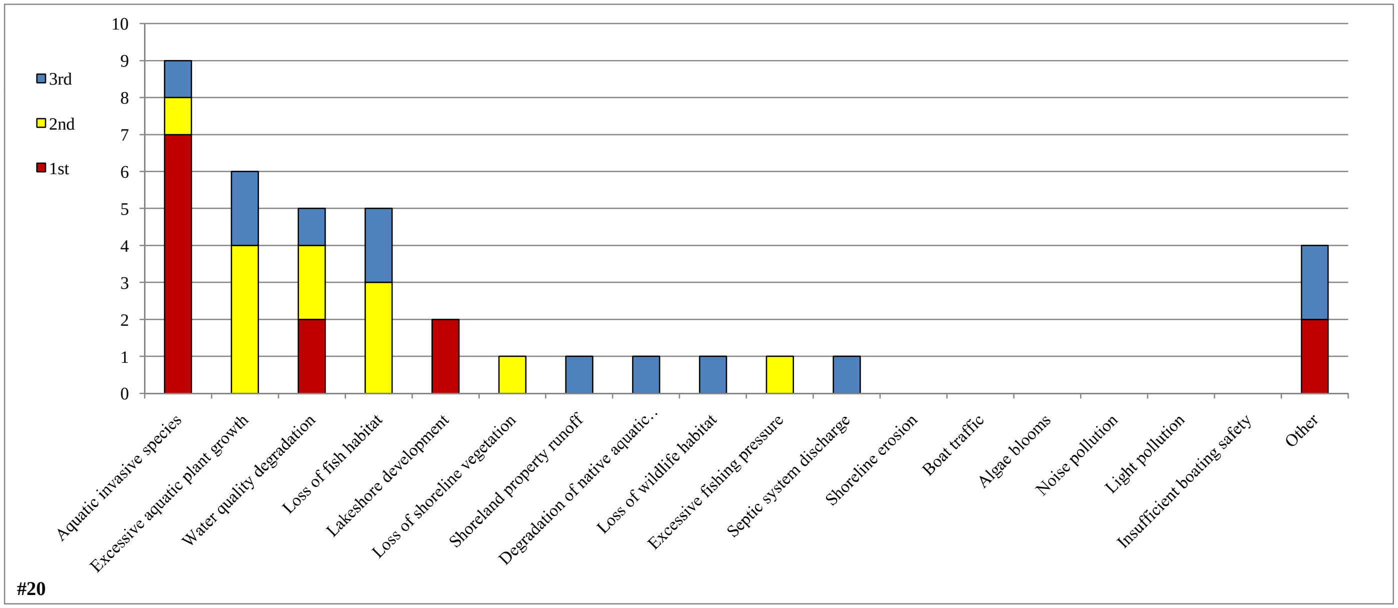
	0-Not present	1-No Impact	2	3-Moderately negative impact	4	5-Great negative impact	*Total*	*Average*
Aquatic invasive species	0	0	0	1	5	7	*13*	*4.5*
Excessive aquatic plant growth	0	0	0	5	5	2	*12*	*3.8*
Loss of fish habitat	0	0	2	2	5	2	*11*	*3.6*
Water quality degradation/pollution	0	1	3	5	1	4	*14*	*3.3*
Loss of wildlife habitat	1	2	4	3	2	2	*13*	*2.6*
Loss of shoreline vegetation	1	2	3	4	2	1	*12*	*2.5*
Degradation of native aquatic plants	2	2	1	6	2	1	*12*	*2.5*
Shoreline erosion	3	2	3	2	2	3	*12*	*2.5*
Excessive fishing pressure	4	1	2	2	2	3	*10*	*2.4*
Lakeshore development	2	1	4	4	2	1	*12*	*2.4*
Algae blooms	0	3	4	4	2	0	*13*	*2.4*
Shoreland property runoff	2	2	3	6	1	0	*12*	*2.1*
Septic system discharge	2	4	2	4	2	0	*12*	*2.0*
Boat traffic	4	4	3	2	1	0	*10*	*1.4*
Noise pollution	3	7	1	1	2	0	*11*	*1.4*
Light pollution	3	7	1	2	0	1	*11*	*1.4*
Insufficient boating safety	3	9	0	1	0	1	*11*	*1.2*
Other	0	1	0	0	0	0	*1*	*1.0*



#19

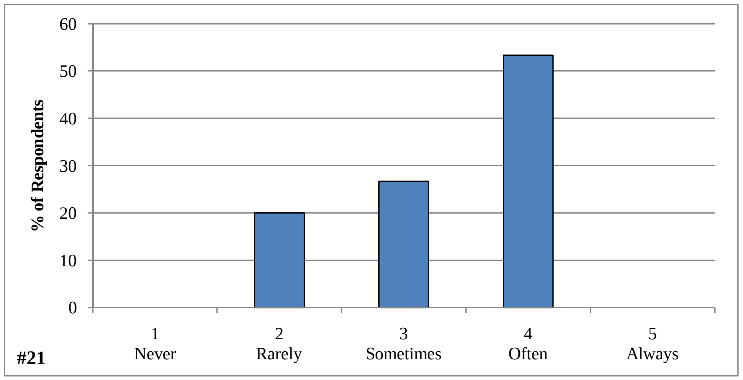
#20 From the list below, please rank your top three concerns regarding Frog Lake.

	1st	2nd	3rd	*% Ranked*
Aquatic invasive species	7	1	1	*24.3*
Excessive aquatic plant growth	0	4	2	*16.2*
Water quality degradation	2	2	1	*13.5*
Loss of fish habitat	0	3	2	*13.5*
Lakeshore development	2	0	0	*5.4*
Loss of shoreline vegetation	0	1	0	*2.7*
Shoreland property runoff	0	0	1	*2.7*
Degradation of native aquatic plants	0	0	1	*2.7*
Loss of wildlife habitat	0	0	1	*2.7*
Excessive fishing pressure	0	1	0	*2.7*
Septic system discharge	0	0	1	*2.7*
Shoreline erosion	0	0	0	*0.0*
Boat traffic	0	0	0	*0.0*
Algae blooms	0	0	0	*0.0*
Noise pollution	0	0	0	*0.0*
Light pollution	0	0	0	*0.0*
Insufficient boating safety	0	0	0	*0.0*
Other	2	0	2	*10.8*
	13	12	12	*100.0*



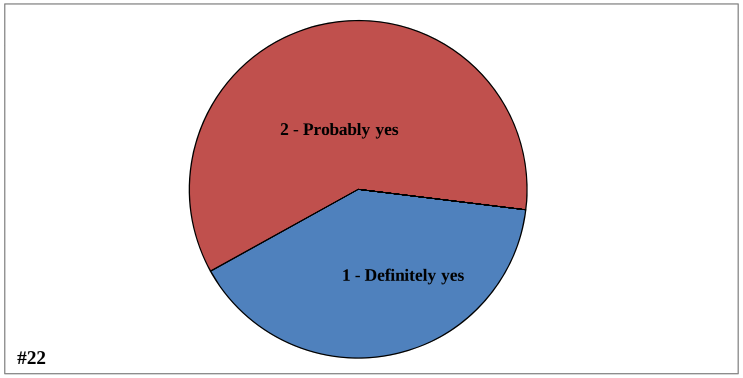
#21 During open water season how often does aquatic plant growth, including algae, negatively impact your enjoyment of Frog Lake?

	Total	%
1 - Never	0	*0.0*
2 - Rarely	3	*20.0*
3 - Sometimes	4	*26.7*
4 - Often	8	*53.3*
5 - Always	0	*0.0*
	15	*100.0*



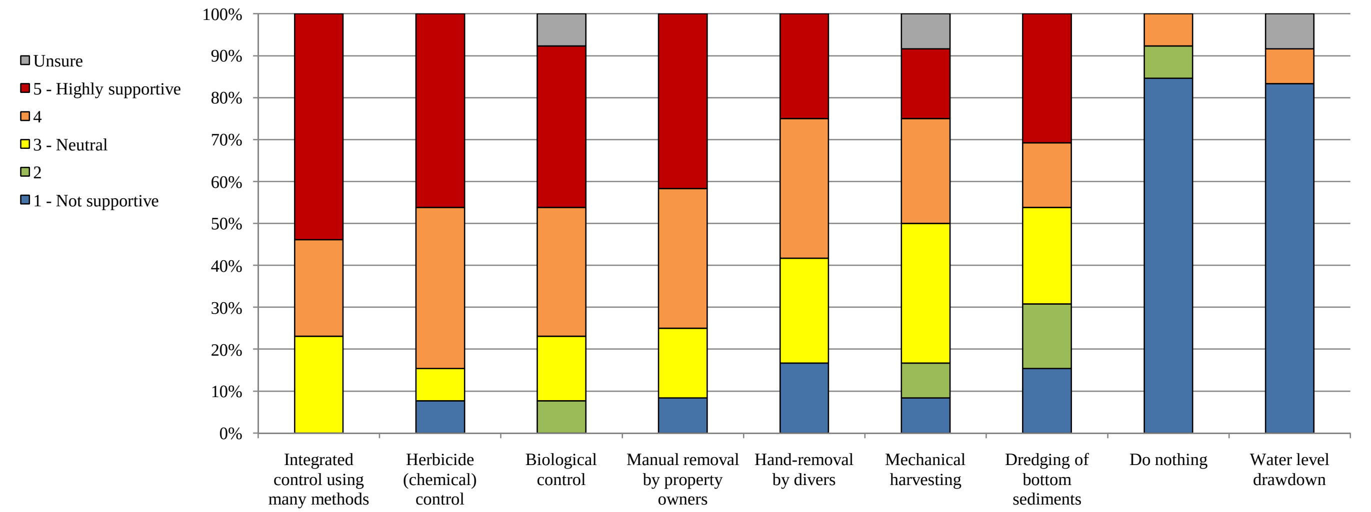
#22 Considering your answer to the question above, do you believe aquatic plant control is needed on Frog Lake?

	Total	%
1 - Definitely yes	6	*40.0*
2 - Probably yes	9	*60.0*
3 - Unsure	0	*0.0*
4 - Probably no	0	*0.0*
5 - Definitely no	0	*0.0*
	15	*100.0*



#23 What is your level of support for the responsible use of the following techniques on Frog Lake?

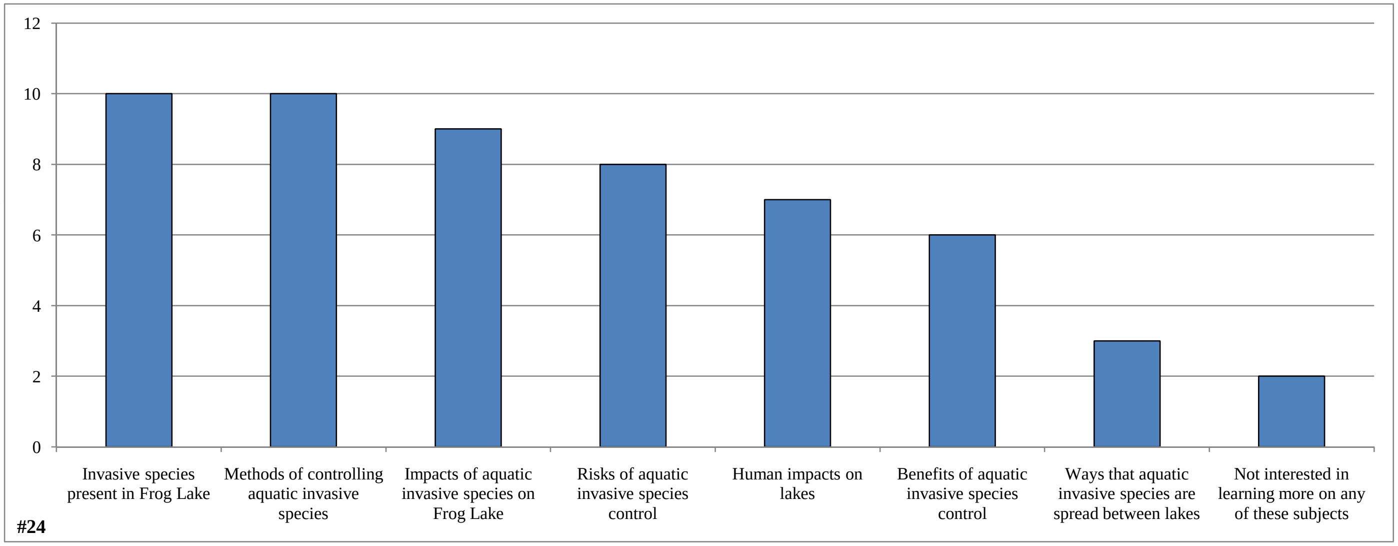
	1 - Not supportive	2	3 - Neutral	4	5 - Highly supportive	Unsure	*Total*	*Average*
Integrated control using many methods	0	0	3	3	7	0	*13*	*4.3*
Herbicide (chemical) control	1	0	1	5	6	0	*13*	*4.2*
Biological control	0	1	2	4	5	1	*12*	*4.1*
Manual removal by property owners	1	0	2	4	5	0	*12*	*4.0*
Hand-removal by divers	2	0	3	4	3	0	*12*	*3.5*
Mechanical harvesting	1	1	4	3	2	1	*11*	*3.4*
Dredging of bottom sediments	2	2	3	2	4	0	*13*	*3.3*
Do nothing	11	1	0	1	0	0	*13*	*1.3*
Water level drawdown	10	0	0	1	0	1	*11*	*1.3*



#23

#24 Which of these subjects would you like to learn more about?

	Total
Invasive species present in Frog Lake	10
Methods of controlling aquatic invasive species	10
Impacts of aquatic invasive species on Frog Lake	9
Risks of aquatic invasive species control	8
Human impacts on lakes	7
Benefits of aquatic invasive species control	6
Ways that aquatic invasive species are spread between lakes	3
Not interested in learning more on any of these subjects	2



#25 Before receiving this mailing, have you ever heard of the Frog and Bass Lakes Association?

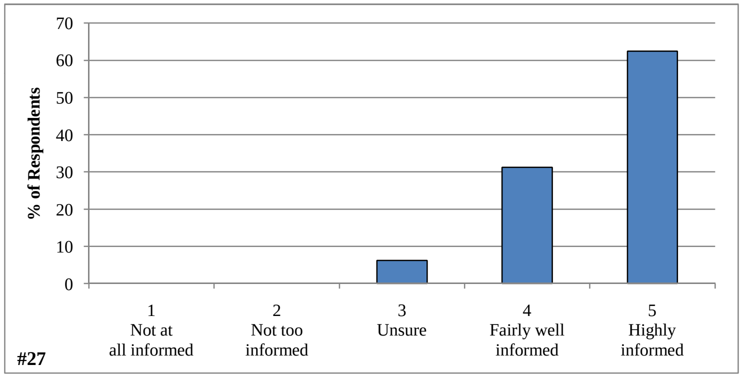
	Total	%
Yes	16	*100.0*
No	0	*0.0*
	16	*100.0*

#26 What is your membership status with the Frog and Bass Lakes Association?

	Total	%
Current member	15	*93.8*
Former member	0	*0.0*
Never been a member	1	*6.3*
	16	*100.0*

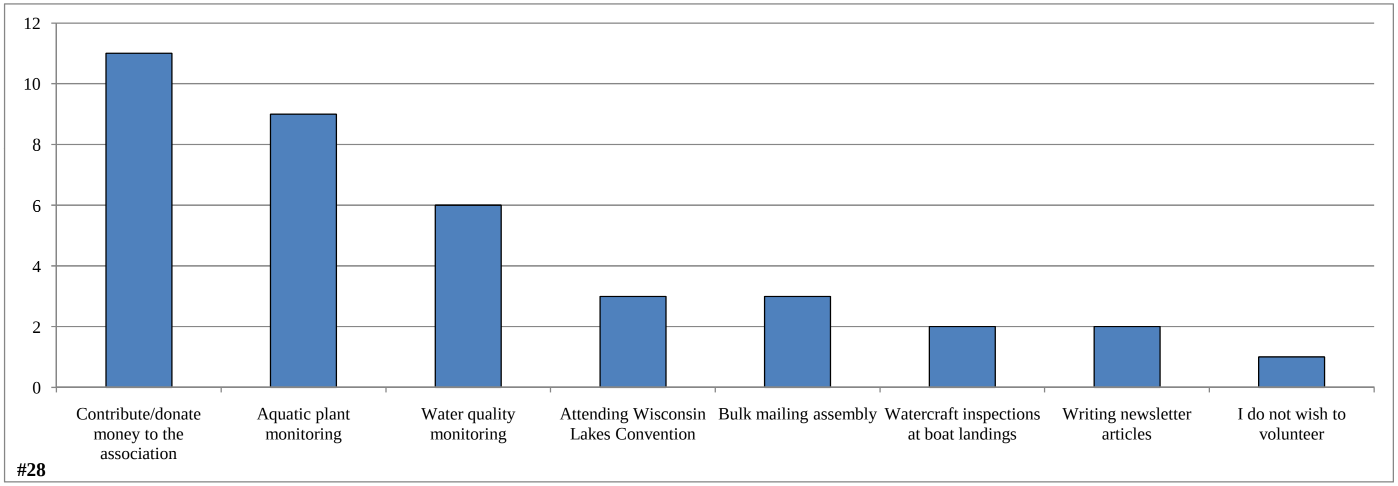
#27 How informed has the Frog and Bass Lakes Association kept you regarding issues with Frog Lake and its management?

	Total	%
1 - Not at all informed	0	*0.0*
2 - Not too informed	0	*0.0*
3 - Unsure	1	*6.3*
4 - Fairly well informed	5	*31.3*
5 - Highly informed	10	*62.5*
	16	*100.0*



#28 Please circle the activities you would be willing to participate in if the Frog and Bass Lakes Association requires additional assistance

	Total
Contribute/donate money to the association	11
Aquatic plant monitoring	9
Water quality monitoring	6
Attending Wisconsin Lakes Convention	3
Bulk mailing assembly	3
Watercraft inspections at boat landings	2
Writing newsletter articles	2
I do not wish to volunteer	1
	37



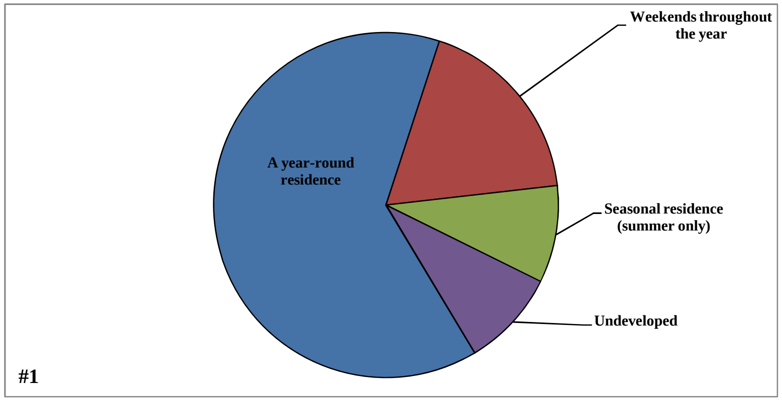
Survey Number	1g Comment	7h Comment	8g Comment	9g Comment	13k Comment	18p Comment	19r Comment	20r Comment	Question 29 or other Comments
1									
2									I see the survey has a list for walleye on it but I have not seen a walleye in the lake for over 20 year. I wish we could get the lake back to state that could once again support walleye.
3					aesthetics				
4									Frog Lake is a part of my family and has been for 40 years. I consider the quality of the lake to be one of the most important priorities in my life. Throughout the years the water level has risen and fallen, but invasive species seems to be the biggest threat. I do not feel that any expenditure to reduce the negative impact is unnecessary. I consider it an investment in the future quality of the lives of the people who experience the beauty of Frog Lake.
5	About 2 wks/mo May thru Nov & 2X Dec-Apr							water level	
6									
7			smallmouth bass						Our Association works hard and gets things done. Our water is very low and is an issue. We know water cycles and are hoping that our water levels come back. We need our boat landing respected and visitor to use it accordingly. Our fishing pressure is way to high for a small lake.
8									
9								Loss of water or lake water	I think a big thank you is in order for the work the association has done. Thank you all. Wish I was there more so I could help more and also pray for more water in the lake.
10								Water Levels	
11									
12	own land – no building				Friends & family are nearby				We are not at Frog Lake very often, but would be will to come for a work day or invest in our property in any way that would preserve the lake.
13									
14								Loss of water in lake	

Survey Number	1g Comment	7h Comment	8g Comment	9g Comment	13k Comment	18p Comment	19r Comment	20r Comment	Question 29 or other Comments
15		smallmouth bass	smallmouth bass	smallmouth bass		possibly white suckers?			As a kid and an adult I've seen the lake change quite a bit over the years. The changes have been subtle yearly, but when you add them over the years you realize how drastictly different things are. In the 70's, the lake was almost devoid of weeds. Only lilypads in the 3 bays and few in front of the Reinders (sp). Also were some bullrushes by the mouth of the boat landing bay and by Reinders bays. I believe that when the lake was poisoned in “57 “ or “58” it must have been a complete kill of plants and animals, as there were basically no weeds or bottom growth until the late 70's. Even at the edges of the water the plants stopped at the waters edge. Also, even though there were supposedly some in the lake, the only panfish caught for years were rock bass (full of grubs). See attached DNR fish surveys). It was some time in the eighties that we caught a few perch and started catching bluegills.

Returned Surveys	11
Sent Surveys	21
Response Rate (%)	52.4

#1 What type of property do you own on Bass Lake?

	Total	%
A year-round residence	7	*63.6*
Weekends throughout the year	2	*18.2*
Seasonal residence (summer only)	1	*9.1*
Undeveloped	1	*9.1*
Resort	0	*0.0*
Rental property	0	*0.0*
Other	0	*0.0*
I do not live on the lake	0	*0.0*
	11	*100.0*

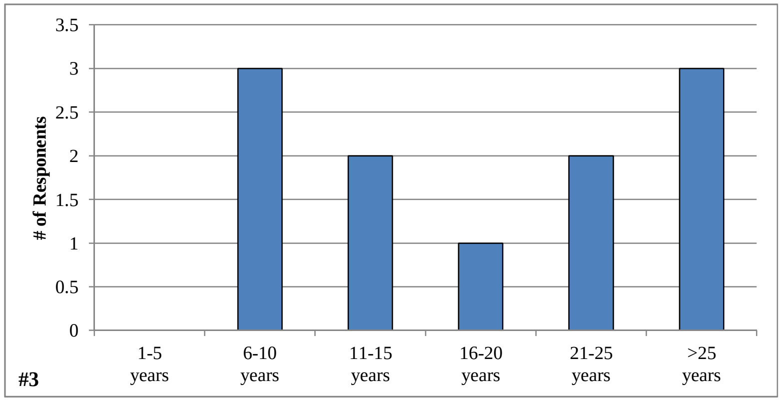


#2 If you are not a year-round resident, how many days each year is your property used by you or others?

Answered Question	11
Average	244.5
Standard deviation	168.5

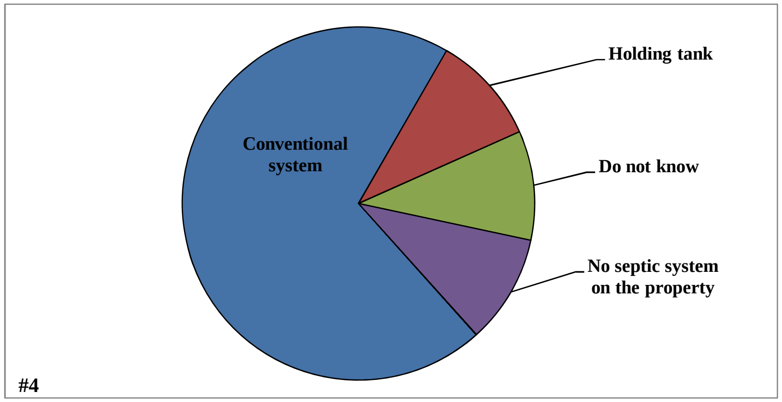
#3 How long have you owned your property on Bass Lake?

	Total	%
1-5 years	0	*0.0*
6-10 years	3	*27.3*
11-15 years	2	*18.2*
16-20 years	1	*9.1*
21-25 years	2	*18.2*
>25 years	3	*27.3*
	11	*100.0*



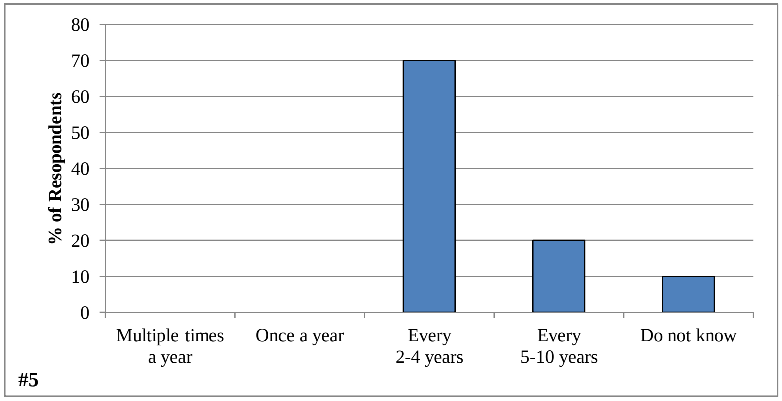
#4 What type of septic system does your property utilize?

	Total	%
Conventional system	7	*70.0*
Holding tank	1	*10.0*
Do not know	1	*10.0*
No septic system on the property	1	*10.0*
Mound	0	*0.0*
Advanced treatment system	0	*0.0*
Municipal sewer	0	*0.0*
	10	*100.0*



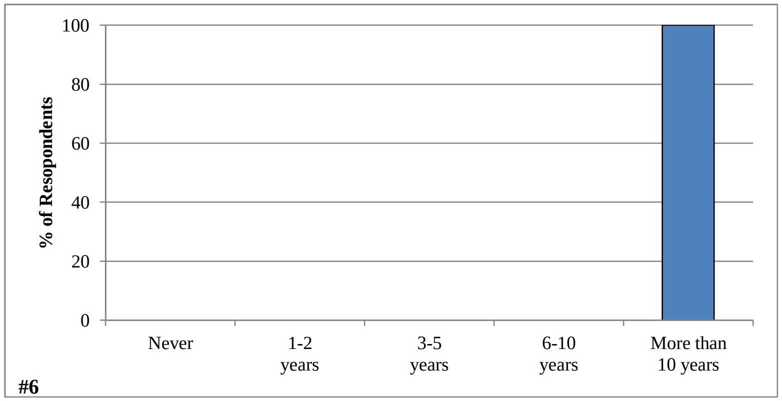
#5 How often is the septic tank on your property pumped?

	Total	%
Multiple times a year	0	*0.0*
Once a year	0	*0.0*
Every 2-4 years	7	*70.0*
Every 5-10 years	2	*20.0*
Do not know	1	*10.0*
	10	*100.0*



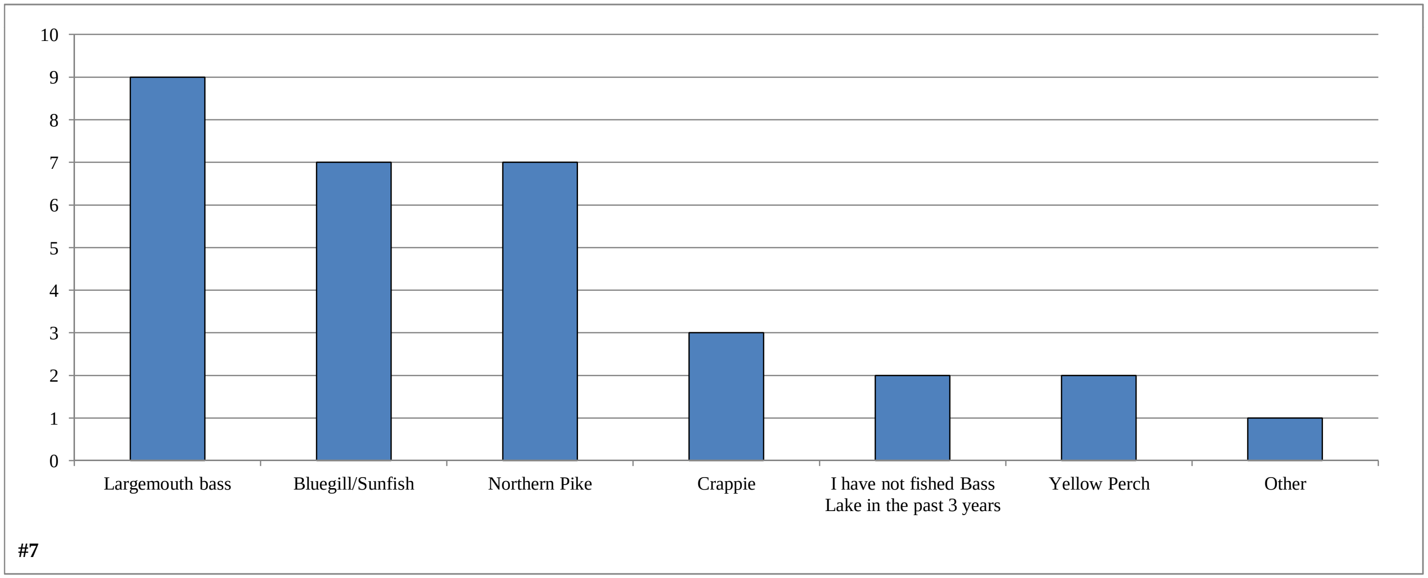
#6 For how many years have you fished Bass Lake?

	Total	%
Never	0	*0.0*
1-2 years	0	*0.0*
3-5 years	0	*0.0*
6-10 years	0	*0.0*
More than 10 years	11	*100.0*
	11	*100.0*



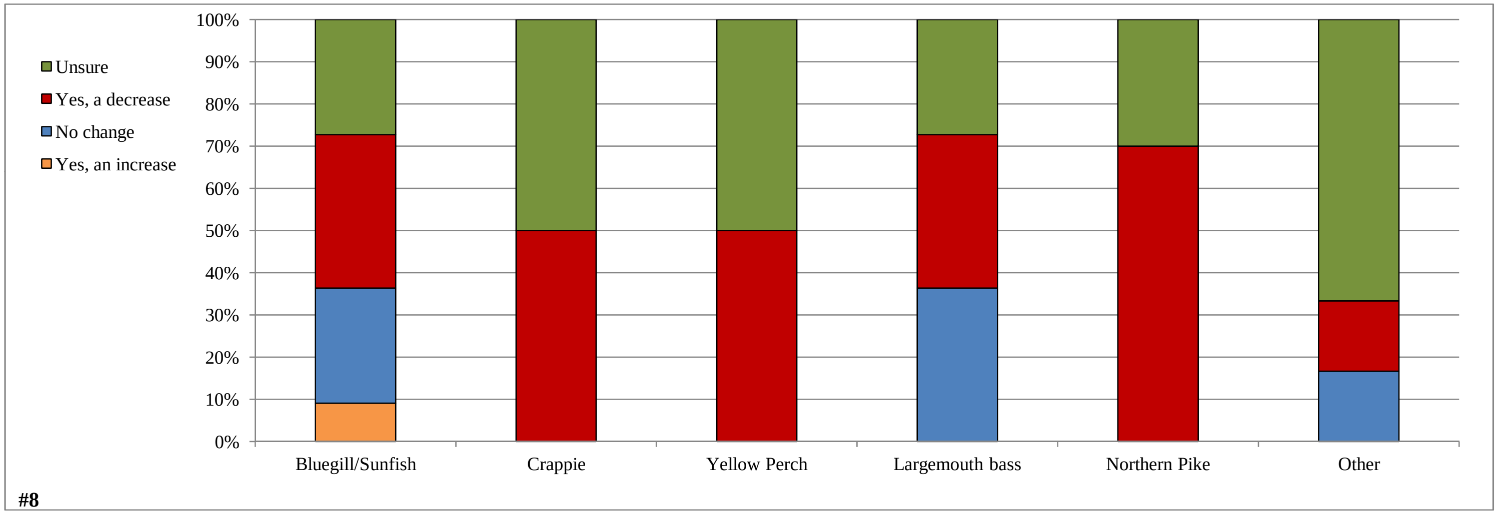
#7 What species have you been catching in the past 3 years?

	Total
Largemouth bass	9
Bluegill/Sunfish	7
Northern Pike	7
Crappie	3
I have not fished Bass Lake in the past 3 years	2
Yellow Perch	2
Other	1



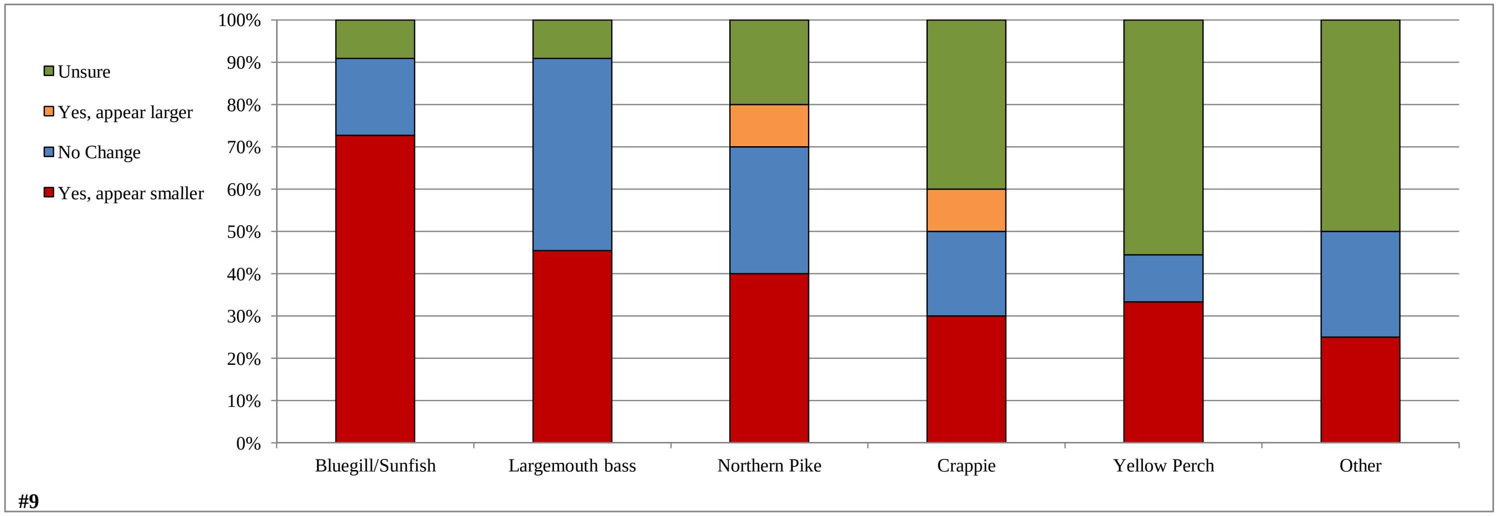
#8 Do you feel there has been a change in the abundance of fish species listed below since you starte fishing on Bass Lake?

	Yes, an increase	Yes, a decrease	No change	Unsure
Bluegill/Sunfish	1	4	3	3
Crappie	0	5	0	5
Yellow Perch	0	5	0	5
Largemouth bass	0	4	4	3
Northern Pike	0	7	0	3
Other	0	1	1	4



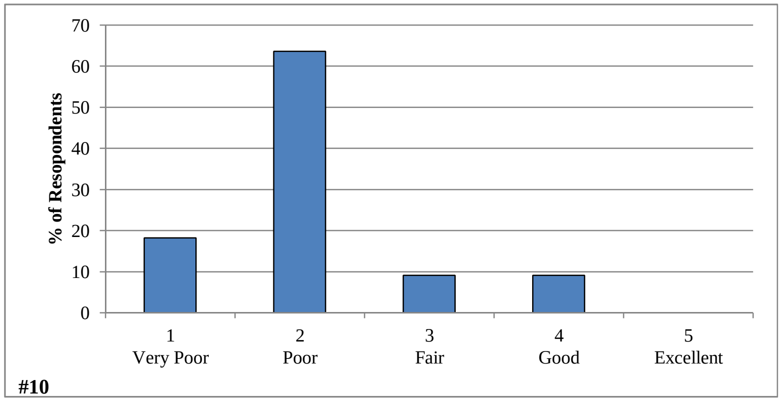
#9 Have you seen a change in the size of the fish species listed below since you started fishing on Bass Lake?

	Yes, appear smaller	Yes, appear larger	No Change	Unsure
Bluegill/Sunfish	8	0	2	1
Largemouth bass	5	0	5	1
Northern Pike	4	1	3	2
Crappie	3	1	2	4
Yellow Perch	3	0	1	5
Other	1	0	1	2



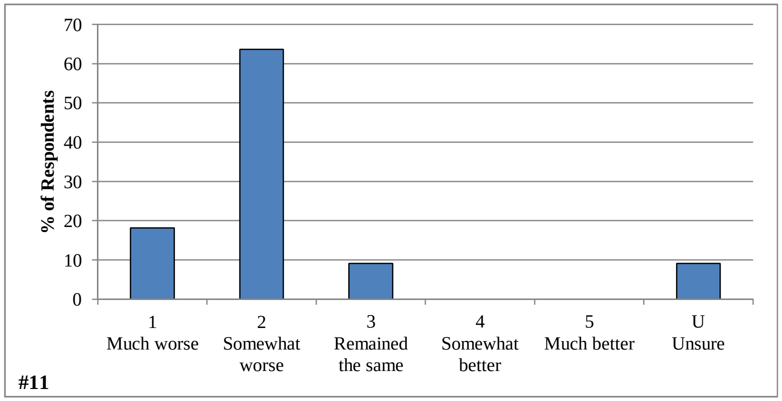
#10 How would you describe the current quality of fishing on Bass Lake?

	Total	%
1 - Very Poor	2	*18.2*
2 - Poor	7	*63.6*
3 - Fair	1	*9.1*
4 - Good	1	*9.1*
5 - Excellent	0	*0.0*
	11	*100.0*



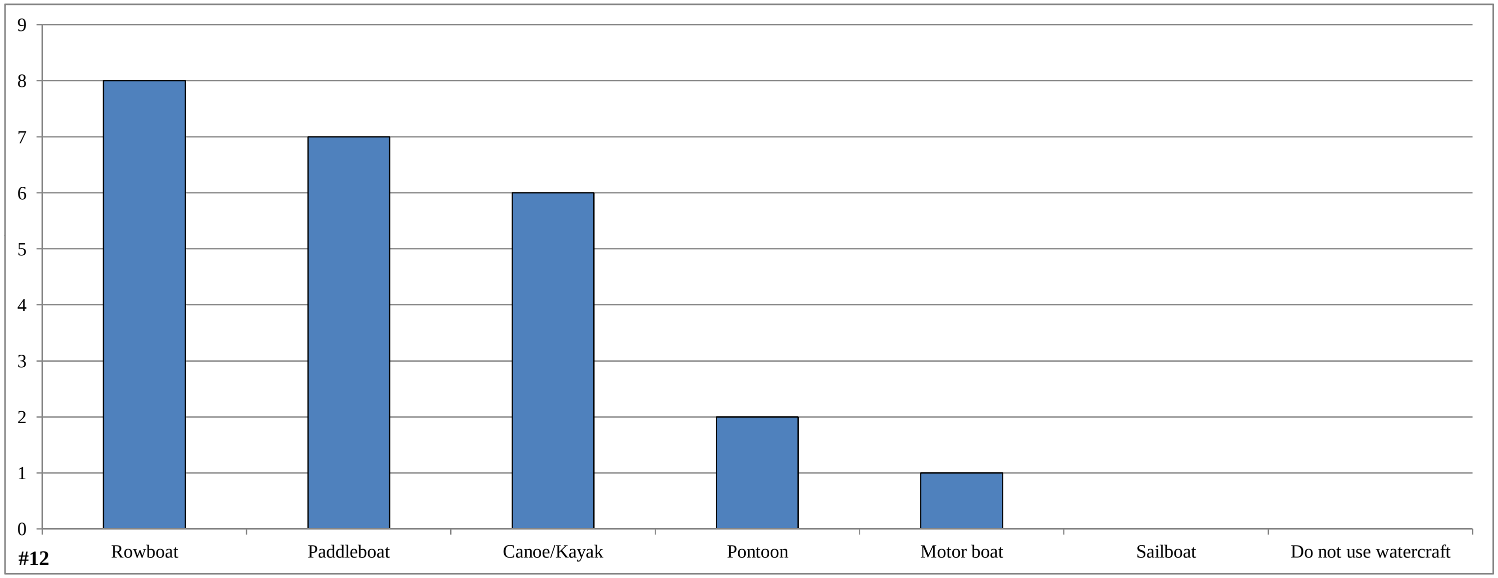
#11 How has the quality of fishing changed on Bass Lake since you started fishing the lake?

	Total	%
1 - Much worse	2	*18.2*
2 - Somewhat worse	7	*63.6*
3 - Remained the Same	1	*9.1*
4 - Somewhat better	0	*0.0*
5 - Much better	0	*0.0*
U - Unsure	1	*9.1*
	11	*100.0*



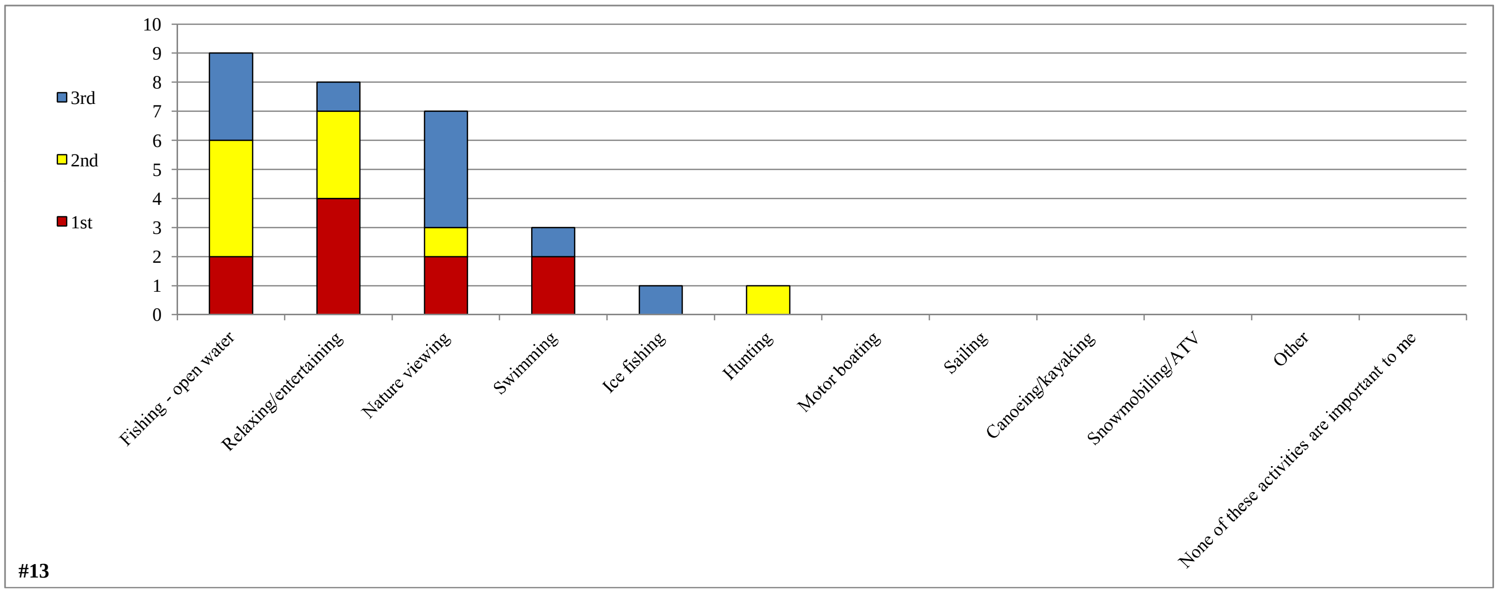
#12 What types of watercraft have you used on the lake?

	Total
Rowboat	8
Paddleboat	7
Canoe/Kayak	6
Pontoon	2
Motor boat	1
Sailboat	0
Do not use watercraft	0
	24



#13 Please rank up to three activities that are important reasons for owning your property on or near the lake.

	1st	2nd	3rd	*% ranked*
Fishing - open water	2	4	3	*31.0*
Relaxing/entertaining	4	3	1	*27.6*
Nature viewing	2	1	4	*24.1*
Swimming	2	0	1	*10.3*
Ice fishing	0	0	1	*3.4*
Hunting	0	1	0	*3.4*
Motor boating	0	0	0	*0.0*
Sailing	0	0	0	*0.0*
Canoeing/kayaking	0	0	0	*0.0*
Snowmobiling/ATV	0	0	0	*0.0*
Other	0	0	0	*0.0*
None of these activities are important to me	0	0	0	*0.0*
	10	9	10	*100.0*

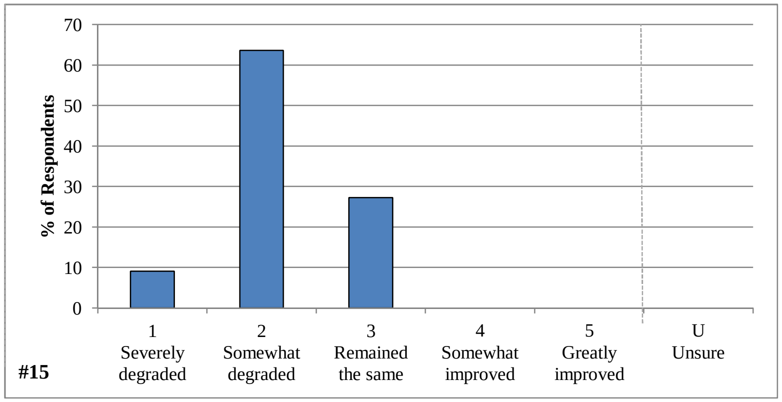


#14 How would you describe the current water quality of Bass Lake?

	Total	%
1 - Poor	3	*27.3*
2 - Fair	3	*27.3*
3 - Unsure	2	*18.2*
4 - Good	3	*27.3*
5 - Excellent	0	*0.0*
	11	*100.0*

#15 How has the water quality changed in Bass Lake since you obtained your property?

	Total	%
1 - Severely degraded	1	*9.1*
2 - Somewhat degraded	7	*63.6*
3 - Remained the same	3	*27.3*
4 - Somewhat improved	0	*0.0*
5 - Greatly improved	0	*0.0*
U - Unsure	0	*0.0*
	11	*100.0*



#16 Have you ever heard of aquatic invasive species?

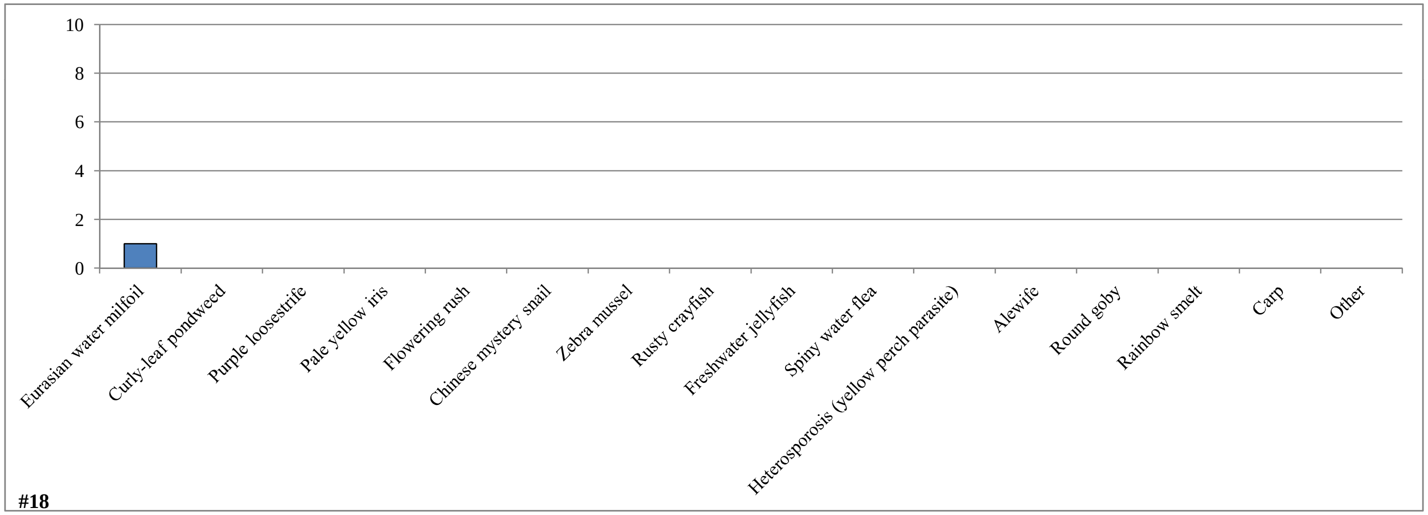
	Total	%
Yes	10	*100.0*
No	0	*0.0*
	10	*100.0*

#17 Are you aware of aquatic invasive species in Bass Lake?

	Total	%
Yes	1	*10.0*
No	9	*90.0*
	10	*100.0*

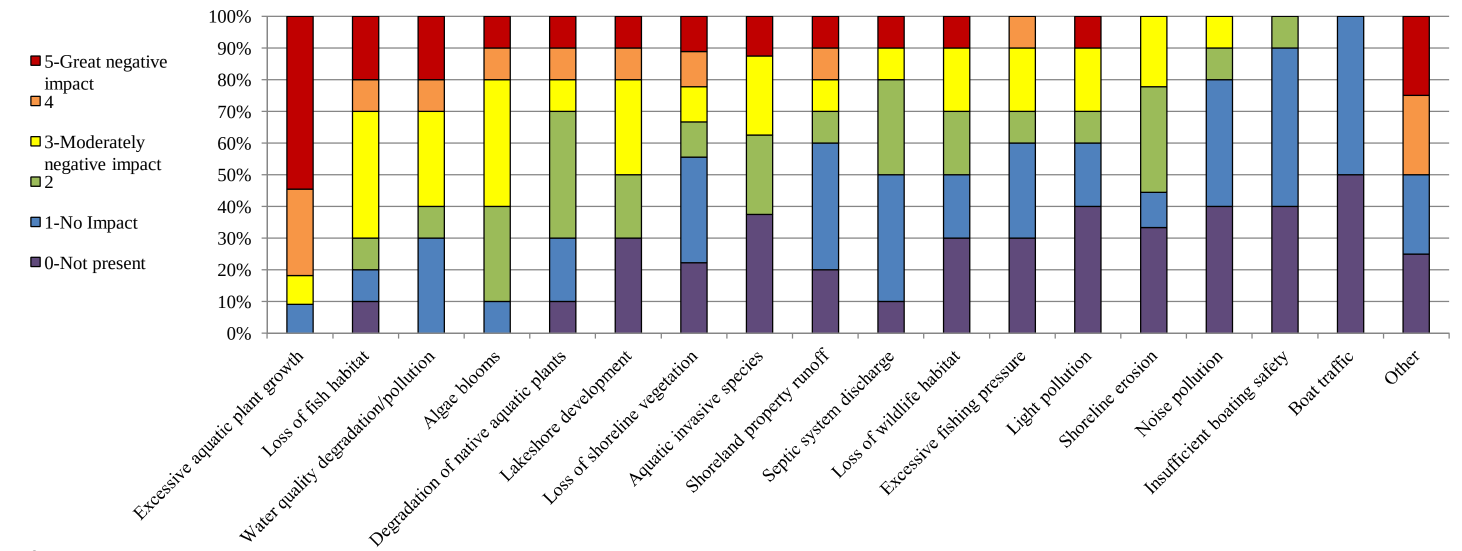
#18 Which aquatic invasive species are you aware of in the lake?

	Total
Eurasian water milfoil	1
Curly-leaf pondweed	0
Purple loosestrife	0
Pale yellow iris	0
Flowering rush	0
Chinese mystery snail	0
Zebra mussel	0
Rusty crayfish	0
Freshwater jellyfish	0
Spiny water flea	0
Heterosporosis (yellow perch parasite)	0
Alewife	0
Round goby	0
Rainbow smelt	0
Carp	0
Other	0



#19 To what level do you believe each of the following factors may be negatively impacting Bass Lake?

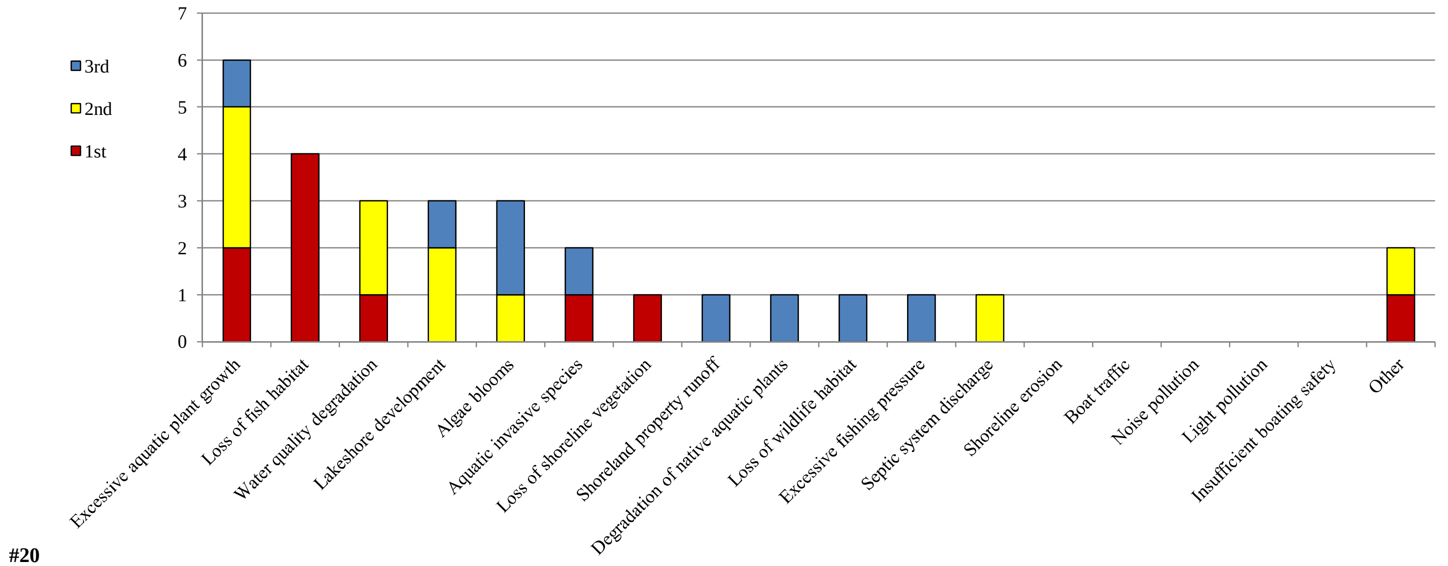
	0-Not present	1-No Impact	2	3-Moderately negative impact	4	5-Great negative impact	*Total*	*Average*
Excessive aquatic plant growth	0	1	0	1	3	6	*11*	*4.2*
Loss of fish habitat	1	1	1	4	1	2	*9*	*2.9*
Water quality degradation/pollution	0	3	1	3	1	2	*10*	*2.8*
Algae blooms	0	1	3	4	1	1	*10*	*2.8*
Degradation of native aquatic plants	1	2	4	1	1	1	*9*	*2.2*
Lakeshore development	3	0	2	3	1	1	*7*	*2.2*
Loss of shoreline vegetation	2	3	1	1	1	1	*7*	*1.9*
Aquatic invasive species	3	0	2	2	0	1	*5*	*1.9*
Shoreland property runoff	2	4	1	1	1	1	*8*	*1.8*
Septic system discharge	1	4	3	1	0	1	*9*	*1.8*
Loss of wildlife habitat	3	2	2	2	0	1	*7*	*1.7*
Excessive fishing pressure	3	3	1	2	1	0	*7*	*1.5*
Light pollution	4	2	1	2	0	1	*6*	*1.5*
Shoreline erosion	3	1	3	2	0	0	*6*	*1.4*
Noise pollution	4	4	1	1	0	0	*6*	*0.9*
Insufficient boating safety	4	5	1	0	0	0	*6*	*0.7*
Boat traffic	5	5	0	0	0	0	*5*	*0.5*
Other	1	1	0	0	1	1	*3*	*2.5*



#19

#20 From the list below, please rank your top three concerns regarding Bass Lake.

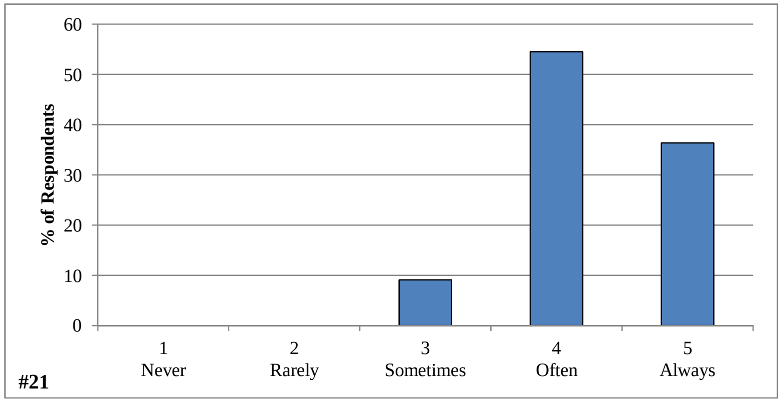
	1st	2nd	3rd	*% Ranked*
Excessive aquatic plant growth	2	3	1	*20.7*
Loss of fish habitat	4	0	0	*13.8*
Water quality degradation	1	2	0	*10.3*
Lakeshore development	0	2	1	*10.3*
Algae blooms	0	1	2	*10.3*
Aquatic invasive species	1	0	1	*6.9*
Loss of shoreline vegetation	1	0	0	*3.4*
Shoreland property runoff	0	0	1	*3.4*
Degradation of native aquatic plants	0	0	1	*3.4*
Loss of wildlife habitat	0	0	1	*3.4*
Excessive fishing pressure	0	0	1	*3.4*
Septic system discharge	0	1	0	*3.4*
Shoreline erosion	0	0	0	*0.0*
Boat traffic	0	0	0	*0.0*
Noise pollution	0	0	0	*0.0*
Light pollution	0	0	0	*0.0*
Insufficient boating safety	0	0	0	*0.0*
Other	1	1	0	*6.9*
	10	10	9	*100.0*



#20

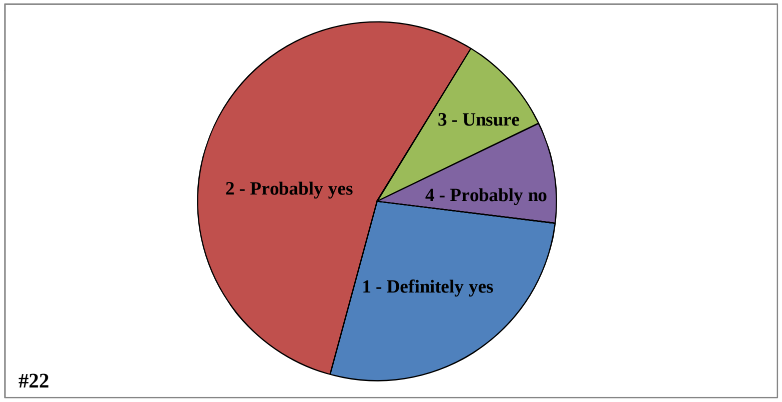
#21 During open water season how often does aquatic plant growth, including algae, negatively impact your enjoyment of Bass Lake?

	Total	%
1 - Never	0	*0.0*
2 - Rarely	0	*0.0*
3 - Sometimes	1	*9.1*
4 - Often	6	*54.5*
5 - Always	4	*36.4*
	11	*100.0*



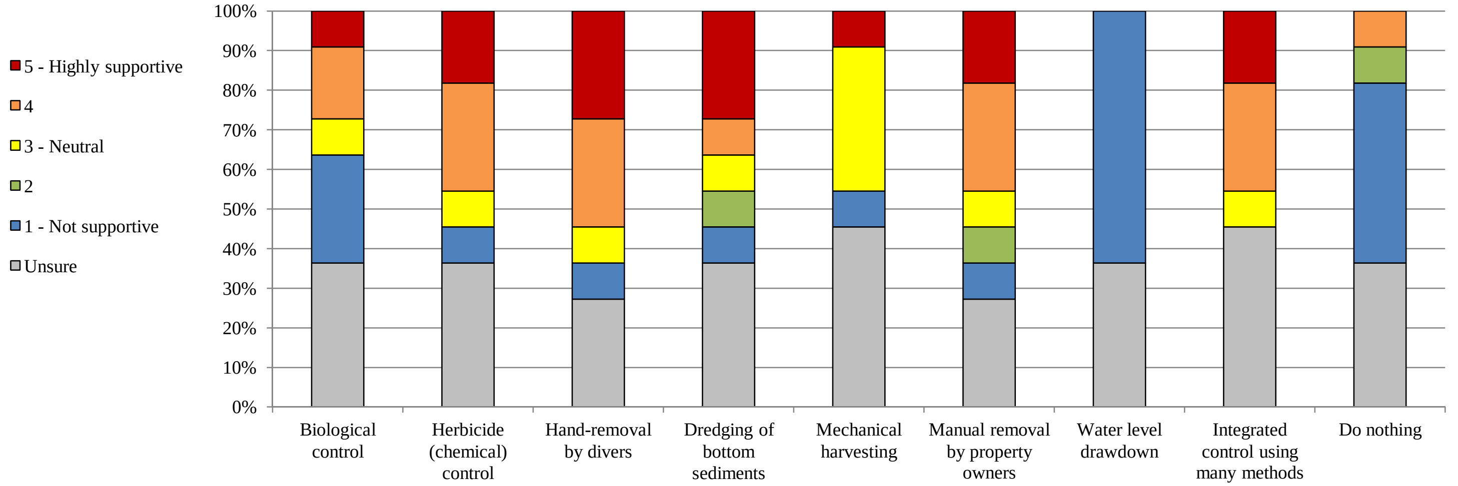
#22 Considering your answer to the question above, do you believe aquatic plant control is needed on Bass Lake?

	Total	%
1 - Definitely yes	3	*27.3*
2 - Probably yes	6	*54.5*
3 - Unsure	1	*9.1*
4 - Probably no	1	*9.1*
5 - Definitely no	0	*0.0*
	11	*100.0*



#23 What is your level of support for the responsible use of the following techniques on Bass Lake?

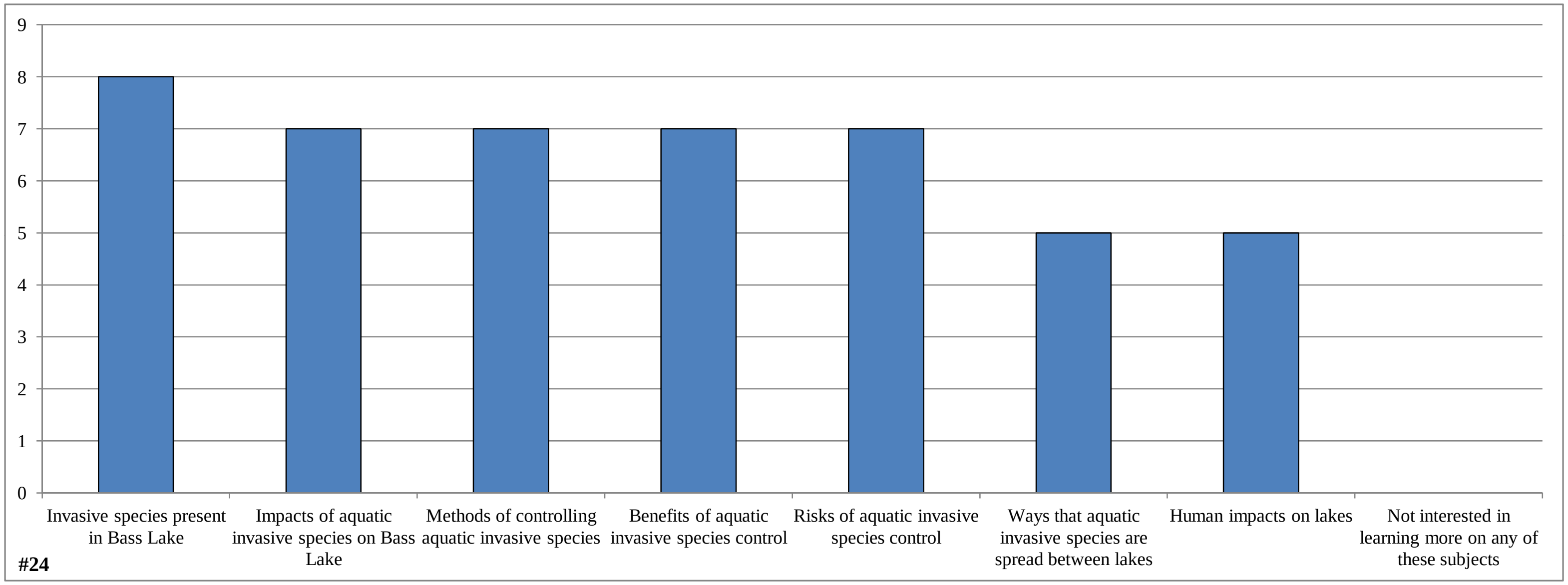
	1 - Not supportive	2	3 - Neutral	4	5 - Highly supportive	Unsure	Total	Average
Biological control	3	0	1	2	1	4	*7*	*4.2*
Herbicide (chemical) control	1	0	1	3	2	4	*7*	*3.5*
Hand-removal by divers	1	0	1	3	3	3	*8*	*3.0*
Dredging of bottom sediments	1	1	1	1	3	4	*7*	*2.7*
Mechanical harvesting	1	0	4	0	1	5	*6*	*1.6*
Manual removal by property owners	1	1	1	3	2	3	*8*	*1.0*
Water level drawdown	7	0	0	0	0	4	*7*	*0.6*
Integrated control using many methods	0	0	1	3	2	5	*6*	*0.5*
Do nothing	5	1	0	1	0	4	*7*	*0.5*



#19

#24 Which of these subjects would you like to learn more about?

	Total
Invasive species present in Bass Lake	8
Impacts of aquatic invasive species on Bass Lake	7
Methods of controlling aquatic invasive species	7
Benefits of aquatic invasive species control	7
Risks of aquatic invasive species control	7
Ways that aquatic invasive species are spread between lakes	5
Human impacts on lakes	5
Not interested in learning more on any of these subjects	0



#25 Before receiving this mailing, have you ever heard of the Frog and Bass Lakes Association?

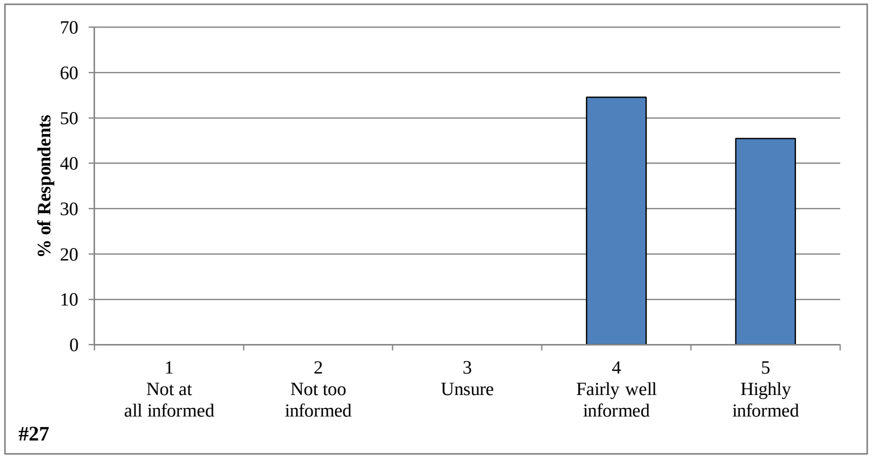
	Total	%
Yes	11	*100.0*
No	0	*0.0*
	11	*100.0*

#26 What is your membership status with the Frog and Bass Lakes Association?

	Total	%
Current member	9	*81.8*
Former member	2	*18.2*
Never been a member	0	*0.0*
	11	*100.0*

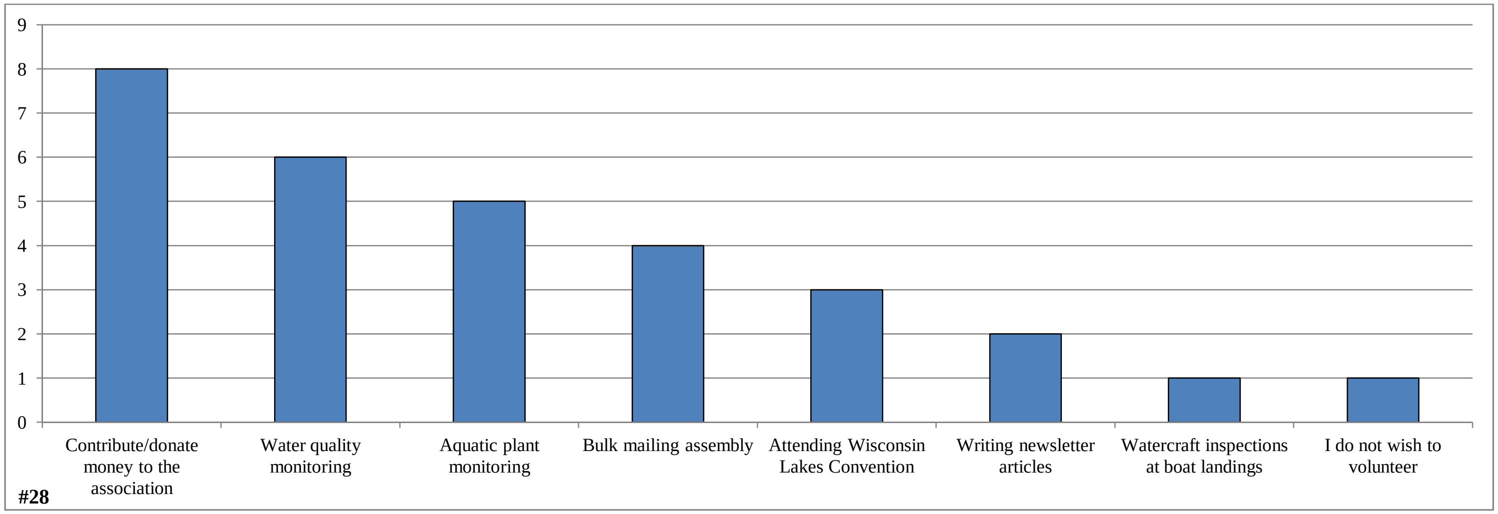
#27 How informed has the Frog and Bass Lakes Association kept you regarding issues with Bass Lake and its management?

	Total	%
1 - Not at all informed	0	*0.0*
2 - Not too informed	0	*0.0*
3 - Unsure	0	*0.0*
4 - Fairly well informed	6	*54.5*
5 - Highly informed	5	*45.5*
	11	*100.0*



#28 Please circle the activities you would be willing to participate in if the Frog and Bass Lakes Association requires additional assistance.

	Total
Contribute/donate money to the association	8
Water quality monitoring	6
Aquatic plant monitoring	5
Bulk mailing assembly	4
Attending Wisconsin Lakes Convention	3
Writing newsletter articles	2
Watercraft inspections at boat landings	1
I do not wish to volunteer	1
	30



Survey Number	1g Comment	7h Comment	8g Comment	9g Comment	13k Comment	18p Comment	19r Comment	20r Comment	Question 29 or other Comments
1									
2									
3							Too many people to support lake & modern conveniences i.e. dishwasher, washing machines…		Information out to all on water level, conservation of water as critical, lakes as wildlands not as urban lawn lands.
4								low water level	
6									
7									Our problem is lack of water which can only be solved with rain & snow. Lake is down 3-4 feet or more which makes the weeds a menace. There is no water under any docks. Some water is 10 - 20 feet from docks. My family uses the cabin a little. This last year is the first year my wife and I haven't been able to use our cottag-alzheimers is our problem.
8									In the mid sixties through the seventies the lagoon's were full of life - turtles on logs, bullfrogs, ducks, etc. The sunken logs and varying water depths were a great fish incubator for fish fry. Large Northerns could be found in the shallow waters during July/August. Bass & perch were just outside the lagoons in the moderately deeper waters with healthy crappie populations sprinkled throughout the lake. Every once in a while a nice walleye would be caught. Swimming was a daily event-weeds were at a miniimum and seldom did you have to swim through them. Snorkeling opportunities were many. Silt and Muck (natural aging of any body of water) have covered most structure in the lake. Low water levels have led to abundant weed growth in the fertile muck that now gets plenty of sunshine to the bottom of the lake. We can't do much about the water level - but we could impact structure and improve lagoon habitat now in preparation of higher water levels in the future - if much sucking-excavating & habitat restoration is allowed by the DNR. I's be interested in helping in these areas if enough people would be interested. This lake has been very good to me the last 45 years - I's like to help it be good for the next generation if possible - it takes a lot of people, effort, and dollars to make significant restorations though. I hope others are interested as well. Thanks to all who helped.
									Also, from survey 8 - #23:Natural cycle is at a low point - I would support & help pay for & help manually tp restore lagoon areas (if allowed) to be ready for higher water levels in the future. Great opportunities for improvement now with the low water levels. Digging out sections-hauling in large rocks, gravel spawning beds, logs & cribs would be great additions.
9							low water level	low water level	
10									
11									

C

APPENDIX C

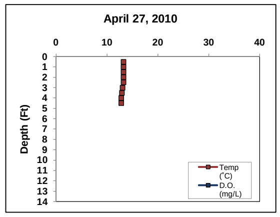
Water Quality Data

Frog Lake

Date: 4/27/2010
Time: 10:20
Weather: 100% sun, light breeze, 50°F
Entry: TWH Verf:

Max Depth: 5.0
FLS Depth (ft):
FLB Depth (ft):
Secchi Depth (ft):

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
0.5	13.2			
1	13.2			
1.5	13.2			
2	13.2			
2.5	13.2			
3	13.0			
3.5	12.9			
4	12.8			
4.5	12.8			



Parameter	FLS	FLB
Total P (µg/L)		
Dissolved P (µg/L)		
Chl-*a* (µg/L)		
TKN (µg/L)		
NO_3 + NO_2-N (µg/L)		
NH_3-N (µg/L)		
Total N (µg/L)		
Lab Cond. (µS/cm)		
Lab pH		
Alkalinity (mg/L $CaCO_3$)		
Total Susp. Solids (mg/L)		
Calcium (mg/L)		

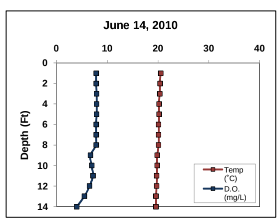
Data collected by DAC and EJH (Onterra)

Frog Lake

Date: 6/14/2010
Time:
Weather:
Entry: TWH

Max Depth: 14.9
FLS Depth (ft): 6.0
FLB Depth (ft): 0.0
Secchi Depth (ft): 11.7

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	20.5	7.8		
2	20.4	7.8		
3	20.3	7.9		
4	20.2	7.9		
5	20.2	7.9		
6	20.1	7.8		
7	20.1	7.8		
8	20.1	7.8		
9	19.8	6.7		
10	19.8	6.9		
11	19.7	7.2		
12	19.7	6.5		
13	19.6	5.5		
14	19.6	4.0		



Parameter	FLS	FLB
Total P (µg/L)	19.00	NA
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	1.11	NA
TKN (µg/L)	950.00	NA
NO_3 + NO_2-N (µg/L)	ND	NA
NH_3-N (µg/L)	65.00	NA
Total N (µg/L)	950.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

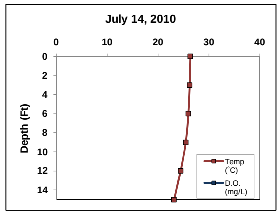
Data collected by BTB and EJH (Onterra)
Note: New WQ point on Frog, approx. 15ft.

Frog Lake

Date: 7/14/2010
Time: 12:45
Weather:
Entry: TWH

Max Depth: 15.0
FLS Depth (ft):
FLB Depth (ft):
Secchi Depth (ft): 10.6

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
0	26.3			
3	26.2			
6	25.9			
9	25.4			
12	24.4			
15	23.1			



Parameter	FLS	FLB
Total P (µg/L)	14.00	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	1.37	NA
TKN (µg/L)	NA	NA
NO_3 + NO_2-N (µg/L)	NA	NA
NH_3-N (µg/L)	NA	NA
Total N (µg/L)	NA	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

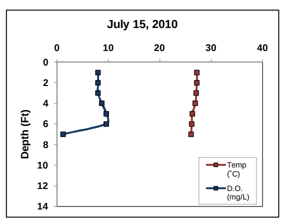
Data collected by Nick Baumgart

Frog Lake

Date: 7/15/2010
Time: 15:15
Weather: 100% sun, 78°F
Entry: TWH

Max Depth: 7.5
FLS Depth (ft): 6.0
FLB Depth (ft): NA
Secchi Depth (ft): 7.5

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	27.2	8		
2	27.2	8		
3	27.1	8		
4	26.9	8.7		
5	26.3	9.6		
6	26.2	9.6		
7	26.1	1.2		



Parameter	FLS	FLB
Total P (µg/L)	35.00	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	8.44	NA
TKN (µg/L)	1180.00	NA
NO_3 + NO_2-N (µg/L)	24.00	NA
NH_3-N (µg/L)	59.00	NA
Total N (µg/L)	1180.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	26.40	NA

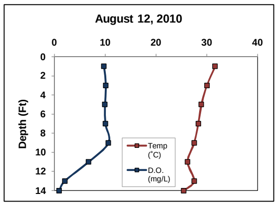
Data collected by TWH and KSH (Onterra)

Frog Lake

Date: 8/12/2010
Time: 16:20
Weather: 90°F
Entry: TWH

Max Depth: 15.1
FLS Depth (ft): 6.0
FLB Depth (ft): NA
Secchi Depth (ft): 8.2

Depth (ft)	Temp (˚C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	31.6	9.7		
3	30	10.1		
5	28.9	9.9		
7	28.3	10		
9	27.5	10.6		
11	26.2	6.7		
13	27.5	2		
14	25.4	0.9		



Parameter	FLS	FLB
Total P (µg/L)	17.00	NA
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	4.43	NA
TKN (µg/L)	960.00	NA
NO_3 + NO_2-N (µg/L)	ND	NA
NH_3-N (µg/L)	15.00	NA
Total N (µg/L)	960.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

Data collected by DAC and EJH (Onterra)

Water Quality Data

2010	Surface		Bottom	
Parameter	**Count**	**Mean**	**Count**	**Mean**
Secchi Depth (feet)	4	9.5	NA	NA
Total P (µg/L)	4.00	17.0	0.00	NA
Dissolved P (µg/L)	0.00	0.0	0.00	NA
Chl a (µg/L)	4.00	3.1	0.00	NA
TKN (µg/L	3.00	772.5	0.00	NA
NO3+NO2-N (µg/L)	3.00	12.0	0.00	NA
NH3-N (µg/L)	3.00	34.8	0.00	NA
Total N (µg/L)	3.00	772.5	0.00	NA
Lab Cond. (µS/cm)	0.00	0.0	0.00	NA
Lab pH	0.00	0.0	0.00	NA
Alkal (mg/l CaCO3)	0.00	0.0	0.00	NA
Total Susp Sol (mg/l)	0.00	0.0	0.00	NA
Calcium (µg/L)	1.00	13.2	0.00	NA

Morphological / Geographical Data

Parameter	Value
Acreage	
Volume (acre-feet)	
Perimeter (miles)	
Shoreland Developmetnt Factor	
Maximum Depth (feet)	
County	
WBIC	
Lillie Mason Region (1983)	NLF Ecoregion
Nichols Ecoregion (1999)	NLFL

Watershed Data

Trophic State Index (WTSI)

Year	TP	Chl-a	Secchi
2007			40.7
2008			39.6
2009			38.1
2010	48.2	43.8	42.4
All Years (Weighted)	48.2	43.8	41.1
Deep, Seepage Lakes	43.2	43.2	42.4
NLF Ecoregion	48.1	47.5	45.7

	Secchi (feet)		
	Growing Season		Summer
Year	**Count**	**Mean**	**Count**
2007	1	12.5	1
2008	1	13.5	1
2009	1	15.0	1
2010	5	10.2	4
All Years (Weighted)		11.5	
Deep, Seepage Lakes			
NLF Ecoregion			

Summer 2010 N: 772.5
Summer 2010 P: 17.0

Summer 2011 N:P 45 :1

	Chlorophyll-*a* (µg/L)				Total Phosphorus (µg/L)			
	Growing Season		Summer		Growing Season		Summer	
Mean	**Count**	**Mean**	**Count**	**Mean**	**Count**	**Mean**	**Count**	**Mean**
12.5								
13.5								
15.0								
11.1	5	4.6	4	3.8	5	20.8	4.0	21.3
12.2		4.6		3.8		20.8		21.3
11.2				3.6				15.0
8.9				5.6				21.0

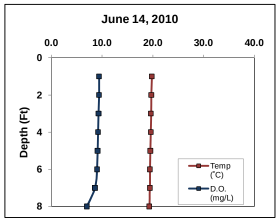
WiLMS Class	Acreage	kg/yr	lbs/yr
Forest			0.0
Open Water			0.0
Pasture/Grass			0.0
Row Crops			0.0
Urban - Rural Residential			0.0
Wetland			0.0
Watershed to Lake Area			

Bass Lake

Date: 6/14/2010
Time: 9:30
Weather: 100% clouds, calm, 60°F
Entry: TWH Verf:

Max Depth: 9.9
BLS Depth (ft): 6.0
BLB Depth (ft): NA
Secchi Depth (ft): 8.2

Depth (ft)	Temp (°C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	19.8	9.4		
2	19.7	9.4		
3	19.6	9.3		
4	19.6	9.2		
5	19.5	9.1		
6	19.4	9.0		
7	19.4	8.6		
8	19.3	7.0		



Parameter	BLS	BLB
Total P (µg/L)	19.00	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	5.65	NA
TKN (µg/L)	1140.00	NA
$NO_3 + NO_2$-N (µg/L)	ND	NA
NH_3-N (µg/L)	36.00	NA
Total N (µg/L)	1140.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

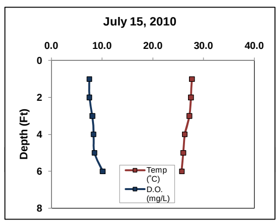
Data collected by EJH and BTB (Onterra)

Bass Lake

Date: 7/15/2010
Time: 14:35
Weather: 100% sun, 78°F
Entry: TWH

Max Depth: 7.1
BLS Depth (ft): 6.0
BLB Depth (ft): NA
Secchi Depth (ft): 6.3

Depth (ft)	Temp (°C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	27.7	7.5		
2	27.5	7.5		
3	27.2	8.1		
4	26.3	8.3		
5	26.0	8.5		
6	25.7	10.1		



Parameter	BLS	BLB
Total P (µg/L)	16.00	NA
Dissolved P (µg/L)	NA	NA
Chl-a (µg/L)	3.42	NA
TKN (µg/L)	1170.00	NA
$NO_3 + NO_2$-N (µg/L)	ND	NA
NH_3-N (µg/L)	44.00	NA
Total N (µg/L)	1170.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	9.00	NA

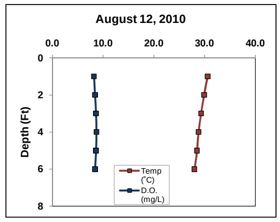
Data collected by TWH and KSH (Onterra)

Bass Lake

Date: 8/12/2010
Time: 12:35
Weather: 80% sun, no wind, 90°F
Entry: TWH

Max Depth: 6.4
BLS Depth (ft): 6.0
BLB Depth (ft): NA
Secchi Depth (ft): 6.4

Depth (ft)	Temp (°C)	D.O. (mg/L)	pH	Sp. Cond. (µS/cm)
1	30.6	8.2		
2	29.9	8.4		
3	29.3	8.6		
4	28.8	8.7		
5	28.5	8.6		
6	28.0	8.4		



Parameter	BLS	BLB
Total P (µg/L)	17.00	NA
Dissolved P (µg/L)	NA	NA
Chl-*a* (µg/L)	1.24	NA
TKN (µg/L)	1220.00	NA
NO_3 + NO_2-N (µg/L)	ND	NA
NH_3-N (µg/L)	23.00	NA
Total N (µg/L)	1220.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	NA	NA
Alkalinity (mg/L $CaCO_3$)	NA	NA
Total Susp. Solids (mg/L)	NA	NA
Calcium (mg/L)	NA	NA

Data collected by DAC and EJH (Onterra)

Water Quality Data

2010 Parameter	Surface Count	Surface Mean	Bottom Count	Bottom Mean
Secchi Depth (feet)	3	7.0	NA	NA
Total P (µg/L)	3.00	17.3	0.00	NA
Dissolved P (µg/L)	0.00	NA	0.00	NA
Chl a (µg/L)	3.00	3.4	0.00	NA
TKN (µg/L	3.00	1176.7	0.00	NA
NO3+NO2-N (µg/L)	3.00	ND	0.00	NA
NH3-N (µg/L)	3.00	34.3	0.00	NA
Total N (µg/L)	3.00	1176.7	0.00	NA
Lab Cond. (µS/cm)	0.00	NA	0.00	NA
Lab pH	0.00	NA	0.00	NA
Alkal (mg/l CaCO3)	0.00	NA	0.00	NA
Total Susp Sol (mg/l	0.00	NA	0.00	NA
Calcium (µg/L)	1.00	9.0	0.00	NA

Morphological / Geographical Data

Parameter	Value
Acreage	
Volume (acre-feet)	
Perimeter (miles	
Shoreland Developmetnt Facto	
Maximum Depth (feet	
County	
WBIC	
Lillie Mason Region (1983)	NLF Ecoregion
Nichols Ecoregion (1999)	NLFL

Watershed Data

WiLMS Class	Acreage	kg/yr	lbs/yr
Forest			0.0
Open Water			0.0
Pasture/Grass			0.0
Row Crops			0.0
Urban - Rural Residentia			0.0
Wetland			0.0
Watershed to Lake Area			

Trophic State Index (WTSI)

Year	TP	Chl-a	Secchi
2009			43.9
2010	45.3	42.7	49.4
All Years (Weighted)	45.3	42.7	48.1
Deep, Seepage Lakes	43.2	43.2	42.4
NLF Ecoregion	48.1	47.5	45.7

Year	Secchi (feet) Growing Season Count	Secchi Growing Season Mean	Secchi Summer Count	Secchi Summer Mean	Chlorophyll-*a* (µg/L) Growing Season Count	Chl Growing Season Mean	Chl Summer Count	Chl Summer Mean	Total Phosphorus (µg/L) Growing Season Count	TP Growing Season Mean	TP Summer Count	TP Summer Mean
2009	1	10.0	1	10.0								
2010	4	6.9	4	6.9	3	3.4	3	3.4	3	17.3	3.0	17.3
All Years (Weighted)		7.5		7.5		3.4		3.4		17.3		17.3
Deep, Seepage Lakes				11.2				3.6				15.0
NLF Ecoregion				8.9				5.6				21.0

D

APPENDIX D

Watershed Analysis WiLMS Results

Date: 6/16/2011   Scenario: Frog Lake Watershed

Lake Id: 585700
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 394.0 acre
Total Unit Runoff: 13.70 in.
Annual Runoff Volume: 449.8 acre-ft
Lake Surface Area <As>: 17.5 acre
Lake Volume <V>: 137 acre-ft
Lake Mean Depth <z>: 7.8 ft
Precipitation - Evaporation: 5.6 in.
Hydraulic Loading: 458.0 acre-ft/year
Areal Water Load <qs>: 26.2 ft/year
Lake Flushing Rate <p>: 3.34 1/year
Water Residence Time: 0.30 year
Observed spring overturn total phosphorus (SPO): 19.0 mg/m^3
Observed growing season mean phosphorus (GSM): 20.8 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	0.0	0.50	1.00	3.00	0.0	0	0	0
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	22	0.10	0.30	0.50	14.5	1	3	4
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	0.0	0.05	0.10	0.25	0.0	0	0	0
Wetlands	8	0.10	0.10	0.10	1.8	0	0	0
Forest	364	0.05	0.09	0.18	72.1	7	13	27
Lake Surface	17.5	0.10	0.30	1.00	11.6	1	2	7

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	0.0				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.00	0.00	0.00	0.0

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	20.5	40.5	84.6	100.0
Total Loading (kg)	9.3	18.4	38.4	100.0
Areal Loading (lb/ac-year)	1.17	2.32	4.83	
Areal Loading (mg/m^2-year)	131.15	259.49	541.85	
Total PS Loading (lb)	0.0	0.0	0.0	0.0
Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	18.9	35.8	69.0	100.0
Total NPS Loading (kg)	8.6	16.3	31.3	100.0

Phosphorus Prediction and Uncertainty Analysis Module

Date: 6/16/2011   Scenario: 2
Observed spring overturn total phosphorus (SPO): 19.0 mg/m^3
Observed growing season mean phosphorus (GSM): 20.8 mg/m^3
Back calculation for SPO total phosphorus: 0.0 mg/m^3
Back calculation GSM phosphorus: 0.0 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 0 kg

Lake Phosphorus Model	Low Total P (mg/m^3)	Most Likely Total P (mg/m^3)	High Total P (mg/m^3)	Predicted -Observed (mg/m^3)	% Dif.
Walker, 1987 Reservoir	11	23	47	2	10
Canfield-Bachmann, 1981 Natural Lake	13	23	43	2	10
Canfield-Bachmann, 1981 Artificial Lake	12	21	37	0	0
Rechow, 1979 General	6	12	26	-9	-43
Rechow, 1977 Anoxic	14	28	58	7	34
Rechow, 1977 water load<50m/year	10	20	43	-1	-5
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	11	22	46	3	16
Vollenweider, 1982 Combined OECD	11	19	34	-1	-5
Dillon-Rigler-Kirchner	5	11	22	-8	-42
Vollenweider, 1982 Shallow Lake/Res.	8	15	28	-5	-25
Larsen-Mercier, 1976	11	21	44	2	11
Nurnberg, 1984 Oxic	7	14	29	-7	-34

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	13	40	FIT	0	GSM
Canfield-Bachmann, 1981 Natural Lake	7	66	FIT	1	GSM
Canfield-Bachmann, 1981 Artificial Lake	7	60	FIT	1	GSM
Rechow, 1979 General	7	22	FIT	0	GSM
Rechow, 1977 Anoxic	17	48	FIT	0	GSM
Rechow, 1977 water load<50m/year	11	36	FIT	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	11	42	FIT	0	SPO
Vollenweider, 1982 Combined OECD	9	35	FIT	0	ANN
Dillon-Rigler-Kirchner	6	19	FIT	0	SPO
Vollenweider, 1982 Shallow Lake/Res.	7	28	FIT	0	ANN
Larsen-Mercier, 1976	13	36	P Pin	0	SPO
Nurnberg, 1984 Oxic	7	26	FIT	0	ANN

Water and Nutrient Outflow Module

Date: 6/16/2011   Scenario: 2
Average Annual Surface Total Phosphorus: 20.8mg/m^3
Annual Discharge: 4.58E+002 AF => 5.65E+005 m^3
Annual Outflow Loading: 24.7 LB =>   11.2 kg

Date: 6/16/2011 Scenario: Bass Lake Watershed

Lake Id: 584200
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 179.0 acre
Total Unit Runoff: 13.7 in.
Annual Runoff Volume: 204.4 acre-ft
Lake Surface Area <As>: 20.5 acre
Lake Volume <V>: 143.5 acre-ft
Lake Mean Depth <z>: 7.0 ft
Precipitation - Evaporation: 5.6 in.
Hydraulic Loading: 213.9 acre-ft/year
Areal Water Load <qs>: 10.4 ft/year
Lake Flushing Rate <p>: 1.49 1/year
Water Residence Time: 0.67 year
Observed spring overturn total phosphorus (SPO): 19.0 mg/m^3
Observed growing season mean phosphorus (GSM): 17.3 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	0.0	0.50	1.00	3.00	0.0	0	0	0
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	3	0.10	0.30	0.50	3.9	0	0	1
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	0.0	0.05	0.10	0.25	0.0	0	0	0
Wetlands	6	0.10	0.10	0.10	2.6	0	0	0
Forest	170	0.05	0.09	0.18	66.7	3	6	12
Lake Surface	20.5	0.10	0.30	1.00	26.8	1	2	8

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.3	0.5	0.8	
# capita-years	0.0				
% Phosphorus Retained by Soil		98	90	80	
Septic Tank Loading (kg/year)		0.00	0.00	0.00	0.0

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	10.2	20.5	47.5	100.0
Total Loading (kg)	4.6	9.3	21.5	100.0
Areal Loading (lb/ac-year)	0.50	1.00	2.32	0.0
Areal Loading (mg/m^2-year)	55.86	111.96	259.52	0.0
Total PS Loading (lb)	0.0	0.0	0.0	0.0
Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	8.4	15.0	29.2	100.0
Total NPS Loading (kg)	3.8	6.8	13.2	100.0

Phosphorus Prediction and Uncertainty Analysis Module

Date: 6/16/2011 Scenario: 1
Observed spring overturn total phosphorus (SPO): 19.0 mg/m^3
Observed growing season mean phosphorus (GSM): 17.3 mg/m^3
Back calculation for SPO total phosphorus: 0.0 mg/m^3
Back calculation GSM phosphorus: 0.0 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 0 kg

Lake Phosphorus Model	Low Total P (mg/m^3)	Most Likely Total P (mg/m^3)	High Total P (mg/m^3)	Predicted -Observed (mg/m^3)	% Dif.
Walker, 1987 Reservoir	12	23	54	6	35
Canfield-Bachmann, 1981 Natural Lake	12	21	41	4	23
Canfield-Bachmann, 1981 Artificial Lake	12	20	36	3	17
Rechow, 1979 General	4	7	17	-10	-58
Rechow, 1977 Anoxic	14	28	66	11	64
Rechow, 1977 water load<50m/year	8	17	39	0	0
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	10	21	48	2	11
Vollenweider, 1982 Combined OECD	10	18	35	0	0
Dillon-Rigler-Kirchner	5	9	22	-10	-53
Vollenweider, 1982 Shallow Lake/Res.	8	14	29	-4	-22
Larsen-Mercier, 1976	10	19	45	0	0
Nurnberg, 1984 Oxic	5	10	24	-7	-40

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	14	44	FIT	0	GSM
Canfield-Bachmann, 1981 Natural Lake	7	60	FIT	1	GSM
Canfield-Bachmann, 1981 Artificial Lake	6	58	FIT	1	GSM
Rechow, 1979 General	4	14	FIT	0	GSM
Rechow, 1977 Anoxic	17	53	FIT	0	GSM
Rechow, 1977 water load<50m/year	10	32	FIT	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	10	42	FIT	0	SPO
Vollenweider, 1982 Combined OECD	9	34	FIT	0	ANN
Dillon-Rigler-Kirchner	6	17	FIT	0	SPO
Vollenweider, 1982 Shallow Lake/Res.	7	27	FIT	0	ANN
Larsen-Mercier, 1976	12	36	P Pin	0	SPO
Nurnberg, 1984 Oxic	5	20	FIT	0	ANN

Water and Nutrient Outflow Module

Date: 6/16/2011   Scenario: Bass Lake Watershed
Average Annual Surface Total Phosphorus: 17.3mg/m^3
Annual Discharge: 2.14E+002 AF => 2.64E+005 m^3
Annual Outflow Loading: 9.7 LB =>   4.4 kg

E

APPENDIX E

Aquatic Plant Survey Data

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Myriophyllum spicatum	Chara sp.	Najas flexilis	Nymphaea odorata	Potamogeton amplifolius	Potamogeton foliosus	Potamogeton gramineus	Potamogeton natans	Potamogeton pusillus	Potamogeton strictifolius	Potamogeton zosteriformis	Stuckenia pectinata
1	45.857947320	-88.13033115	4	M	P		V		2	V							V	V
2	45.857677440	-88.13034020	9	M	P				2									
3	45.857407570	-88.13034924	11	M	P			1	1			1						
4	45.857137700	-88.13035829	12	M	P				2								1	
5	45.856867820	-88.13036734	12	M	P				2									
6	45.856597950	-88.13037639	9	M	P				2			1						
7	45.856328080	-88.13038543	3	M	P		V			2					1			1
8	45.858210870	-88.12993586	8	M	P				2		V							
9	45.857940990	-88.12994491	11	M	P		2		1			2						
10	45.857671120	-88.12995396	15	M	P													
11	45.857401250	-88.12996301	16	M	P													
12	45.857131370	-88.12997206	16	M	P			1	1									
13	45.856861500	-88.12998111	16	M	P				V						2	2		
14	45.856591630	-88.12999016	13	M	P		V		2						2	2		
15	45.856321750	-88.12999920	9	M	P				1			2						
16	45.856051880	-88.13000825				Terrestrial												
17	45.858474420	-88.12954056	5	M	P		2	1	1	V								
18	45.858204540	-88.12954962	11	M	P				2							1		
19	45.857934670	-88.12955867	13	M	P										2	2		
20	45.857664800	-88.12956772	15	M	P			1							2	2		
21	45.857394920	-88.12957677	16	M	P			1										
22	45.857125050	-88.12958582	17	M	P			1										
23	45.856855180	-88.12959487	17	M	P										1	1		
24	45.856585300	-88.12960392	13	M	P		1		2									
25	45.856315430	-88.12961297	9	M	P			2							1	1		

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Myriophyllum spicatum	Chara sp.	Najas flexilis	Nymphaea odorata	Potamogeton amplifolius	Potamogeton foliosus	Potamogeton gramineus	Potamogeton natans	Potamogeton pusillus	Potamogeton strictifolius	Potamogeton zosteriformis	Stuckenia pectinata
26	45.856045560	-88.12962203	6	M	P		V	2	1									
27	45.855775690	-88.12963108				Terrestrial												
28	45.858468090	-88.12915432	7	M	P			1	1									
29	45.858198220	-88.12916337	12	M	P				1						1	1	2	
30	45.857928340	-88.12917243	14	M	P													
31	45.857658470	-88.12918148	15	M	P										2	1		
32	45.857388600	-88.12919053	14	M	P		1								2	2		
33	45.857118730	-88.12919959	14	M	P				V		V				3	1		
34	45.856848850	-88.12920864	13	M	P				1						1	2		
35	45.856578980	-88.12921769	5	R	P			2	2				1					
36	45.856309110	-88.12922674				Terrestrial												
37	45.856039230	-88.12923580				Terrestrial												
38	45.858461760	-88.12876807	7	M	P				1									
39	45.858191890	-88.12877713	11	M	P				2									
40	45.857922020	-88.12878618	13	M	P				1						2	1	1	
41	45.857652150	-88.12879524	11	M	P		1		1		2							
42	45.857382270	-88.12880430	8	M	P				1		2							
43	45.857112400	-88.12881335	11	M	P				2						2	2		
44	45.856842530	-88.12882241	11	M	P			2	2									
45	45.856572650	-88.12883146	3	R	P													
46	45.858455440	-88.12838183	5	M	P				1									2
47	45.858185560	-88.12839089	10	M	P		1	1	1								2	
48	45.857915690	-88.12839994	11	M	P		V	1	1						1	2	V	
49	45.857645820	-88.12840900	10	M	P		1		1						1	2		
50	45.857375940	-88.12841806	9	M	P			2			2							

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Myriophyllum spicatum	Chara sp.	Najas flexilis	Nymphaea odorata	Potamogeton amplifolius	Potamogeton foliosus	Potamogeton gramineus	Potamogeton natans	Potamogeton pusillus	Potamogeton strictifolius	Potamogeton zosteriformis	Stuckenia pectinata
51	45.857106070	-88.12842712	7	R	P			2	2									
52	45.856836200	-88.12843617	9	M	P			2	1		2							
53	45.856566330	-88.12844523	7	M	P		V	2	2		2							
54	45.856296450	-88.12845429	2	M	P			2	2									
55	45.858449110	-88.12799559	3	M	P		V			V								V
56	45.858179230	-88.12800464	10	M	P			1	1								2	
57	45.857909360	-88.12801370	10	M	P		2	1	1						2	1		
58	45.857639490	-88.12802276	11	M	P		V		2									2
59	45.857369620	-88.12803182	10	M	P			1	1		1				1			
60	45.857099740	-88.12804088	8	M	P			2			2							
61	45.856829870	-88.12804994	8	M	P			2			1							
62	45.856560000	-88.12805900	7	M	P		V	2			2							
63	45.856290120	-88.12806806	4	M	P		V	2	1		1							
64	45.856020250	-88.12807711				Terrestrial												
65	45.858442780	-88.12760934	4	M	P		V	2	1	V				V				
66	45.858172900	-88.12761840	7	M	P		1	2			1							
67	45.857903030	-88.12762746	8	M	P		V		1		V						2	
68	45.857633160	-88.12763652	9	M	P				2									
69	45.857363290	-88.12764558	8	M	P		V		2									
70	45.857093410	-88.12765465	8	M	P			2										
71	45.856823540	-88.12766371	8	M	P		1	2	2		1							
72	45.856553670	-88.12767277	4	R	P			1	1		1							V
73	45.856283790	-88.12768183				Terrestrial												
74	45.856013920	-88.12769089				Terrestrial												
75	45.858436440	-88.12722310	3	M	P		2	1	1					V			1	

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Myriophyllum spicatum	Chara sp.	Najas flexilis	Nymphaea odorata	Potamogeton amplifolius	Potamogeton foliosus	Potamogeton gramineus	Potamogeton natans	Potamogeton pusillus	Potamogeton strictifolius	Potamogeton zosteriformis	Stuckenia pectinata
76	45.858166570	-88.12723216	5	M	P			2			V						V	
77	45.857896700	-88.12724122	5	M	P		3		1		1							V
78	45.857626830	-88.12725029	5	S	P		V	2			1							
79	45.857356950	-88.12725935	3	R	P			2					2					
80	45.857087080	-88.12726841	4	M	P			2			V							
81	45.856817210	-88.12727747	3	S	P			2	2	V								V
82	45.856547340	-88.12728654				Terrestrial												
83	45.856007590	-88.12730466				Terrestrial												
84	45.855737720	-88.12731372				Terrestrial												
85	45.855467840	-88.12732278				Terrestrial												
86	45.858430110	-88.12683685	2	M	P		V	1		V				1				
87	45.858160240	-88.12684592	3	M	P		V	2			V						V	
88	45.857890370	-88.12685498				Terrestrial												
89	45.857620490	-88.12686405				Terrestrial												
90	45.858423780	-88.12645061				Terrestrial												
91	45.858153900	-88.12645968				Terrestrial												
92	45.857884030	-88.12646874				Terrestrial												
93	45.857614160	-88.12647781				Terrestrial												
94	45.857344290	-88.12648688				Terrestrial												
95	45.857074410	-88.12649594				Terrestrial												
96	45.858957190	-88.12604623				Terrestrial												
97	45.858687310	-88.12605530				Terrestrial												
98	45.858417440	-88.12606437				Terrestrial												
99	45.858147570	-88.12607343				Terrestrial												
100	45.857877700	-88.12608250				Terrestrial												

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101	45.857607820	-88.12609157				Terrestrial												
102	45.857337950	-88.12610064				Terrestrial												
103	45.859220720	-88.12565091				Terrestrial												
104	45.858950850	-88.12565998				Terrestrial												
105	45.858680980	-88.12566905				Terrestrial												
106	45.859214380	-88.12526466				Terrestrial												
107	45.859477910	-88.12486934				Terrestrial												
108	45.859471570	-88.12448309				Terrestrial												
109	45.859735100	-88.12408776				Terrestrial												
110	45.859465230	-88.12409684				Terrestrial												
111	45.860538380	-88.12367426				Terrestrial												
112	45.860268500	-88.12368334				Terrestrial												
113	45.859998630	-88.12369242				Terrestrial												
114	45.859728760	-88.12370150				Terrestrial												
115	45.859458890	-88.12371058				Terrestrial												
116	45.860801900	-88.12327892				Terrestrial												
117	45.860532030	-88.12328800				Terrestrial												
118	45.860262160	-88.12329709				Terrestrial												
119	45.859992290	-88.12330617				Terrestrial												
120	45.859722410	-88.12331525				Terrestrial												
121	45.860795560	-88.12289266				Terrestrial												
122	45.860525680	-88.12290175				Terrestrial												
123	45.860255810	-88.12291083				Terrestrial												
124	45.861059080	-88.12249732				Terrestrial												
125	45.860789210	-88.12250640				Terrestrial												

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1	45.85794732	-88.13033115	7	S	P					1	1								
2	45.85767744	-88.1303402	4	S	P													V	V
3	45.85740757	-88.13034924	9	M	P														
4	45.8571377	-88.13035829	10	M	P						1								
5	45.85686782	-88.13036734	9	M	P														
6	45.85659795	-88.13037639	7	M	P					1	1								
7	45.85632808	-88.13038543																	
8	45.85821087	-88.12993586	7	M	P					2							1		
9	45.85794099	-88.12994491	11	M	P														
10	45.85767112	-88.12995396	13	M	P						3								
11	45.85740125	-88.12996301	14	M	P						2								
12	45.85713137	-88.12997206	15	M	P														
13	45.8568615	-88.12998111	14	M	P						1								
14	45.85659163	-88.12999016	12	M	P														
15	45.85632175	-88.1299992	6	M	P					1	1								
16	45.85605188	-88.13000825																	
17	45.85847442	-88.12954056																	
18	45.85820454	-88.12954962	10	M	P														
19	45.85793467	-88.12955867	13	M	P						3			1					
20	45.8576648	-88.12956772	13	M	P						2						1		
21	45.85739492	-88.12957677	15	M	P														
22	45.85712505	-88.12958582	16	M	P														
23	45.85685518	-88.12959487	15	M	P						2								

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24	45.8565853	-88.12960392	12	M	P						1								
25	45.85631543	-88.12961297	8	M	P					2									
26	45.85604556	-88.12962203	4	M	P													V	V
27	45.85577569	-88.12963108																	
28	45.85846809	-88.12915432	4	M	P					1								2	
29	45.85819822	-88.12916337	10	M	P														
30	45.85792834	-88.12917243	13	M	P						2								
31	45.85765847	-88.12918148	13	M	P						1		1						
32	45.8573886	-88.12919053	13	M	P					1	2								
33	45.85711873	-88.12919959	14	M	P						2								
34	45.85684885	-88.12920864	13	M	P						2								
35	45.85657898	-88.12921769	6	R	P														
36	45.85630911	-88.12922674																	
37	45.85603923	-88.1292358	3	R	P													1	1
38	45.85846176	-88.12876807	7	M	P					1									
39	45.85819189	-88.12877713	10	M	P									2					
40	45.85792202	-88.12878618	11	M	P						2		1						
41	45.85765215	-88.12879524	10	M	P							2							
42	45.85738227	-88.1288043	9	M	P			2				2							
43	45.8571124	-88.12881335	11	M	P					1	1		1						
44	45.85684253	-88.12882241	10	M	P														
45	45.85657265	-88.12883146	6	R	P					1									
46	45.85845544	-88.12838183	2	R	P														V

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47	45.85818556	-88.12839089	8	M	P					1	2								
48	45.85791569	-88.12839994	10	M	P					1									
49	45.85764582	-88.128409	8	M	P					1		1	2						
50	45.85737594	-88.12841806	8	M	P							2							
51	45.85710607	-88.12842712	8	R	P					1									
52	45.8568362	-88.12843617	8	M	P					2		2			1				
53	45.85656633	-88.12844523	7	M	P					2		1			2				
54	45.85629645	-88.12845429	1	S	P			V											
55	45.85844911	-88.12799559	3	M	P							V							V
56	45.85817923	-88.12800464	7	M	P					1	1								
57	45.85790936	-88.1280137	7	M	P			2		1		1							
58	45.85763949	-88.12802276	8	M	P			1		1	1	1							
59	45.85736962	-88.12803182	7	M	P					1		2							
60	45.85709974	-88.12804088	7	M	P			2		2		2							
61	45.85682987	-88.12804994	7	M	P			V		2		2							
62	45.85656	-88.128059	6	M	P			V		1	1	2							
63	45.85629012	-88.12806806	4	M	P			V		2		2							
64	45.85602025	-88.12807711																	
65	45.85844278	-88.12760934	1	M	P					1								V	V
66	45.8581729	-88.1276184	5	M	P					1	1	V							
67	45.85790303	-88.12762746	7	M	P			V		1		2							
68	45.85763316	-88.12763652	6	M	P			2			1	V		1					
69	45.85736329	-88.12764558	7	M	P							V							

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70	45.85709341	-88.12765465	7	M	P			1		1		V							
71	45.85682354	-88.12766371	6	M	P							1							
72	45.85655367	-88.12767277	2	R	P			V		1									V
73	45.85628379	-88.12768183																	
74	45.85601392	-88.12769089																	
75	45.85843644	-88.1272231	3	M	P			V											V
76	45.85816657	-88.12723216	5	M	P			V		1		V						V	
77	45.8578967	-88.12724122	4	M	P			1		1		V							
78	45.85762683	-88.12725029	4	M	P					2	1	1				1			
79	45.85735695	-88.12725935	3	R	P			V		1						1			
80	45.85708708	-88.12726841	3	M	P			V		2		1							
81	45.85681721	-88.12727747	3	S	P			V					1						V
82	45.85654734	-88.12728654																	
83	45.85600759	-88.12730466																	
84	45.85573772	-88.12731372																	
85	45.85546784	-88.12732278																	
86	45.85843011	-88.12683685	1	M	P														V
87	45.85816024	-88.12684592	3	M	P			V											
88	45.85789037	-88.12685498																	
89	45.85762049	-88.12686405																	
90	45.85842378	-88.12645061																	
91	45.8581539	-88.12645968																	
92	45.85788403	-88.12646874																	

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Total Rake Fullness	Myriophyllum spicatum	Potamogeton crispus	Chara sp.	Potamogeton pusillus	Potamogeton amplifolius	Stuckenia pectinata	Potamogeton zosteriformis	Najas flexilis	Potamogeton gramineus	Potamogeton strictifolius	Vallisneria americana	Nymphaea odorata
93	45.85761416	-88.12647781																	
94	45.85734429	-88.12648688																	
95	45.85707441	-88.12649594																	
96	45.85895719	-88.12604623																	
97	45.85868731	-88.1260553																	
98	45.85841744	-88.12606437																	
99	45.85814757	-88.12607343																	
100	45.8578777	-88.1260825																	
101	45.85760782	-88.12609157																	
102	45.85733795	-88.12610064																	
103	45.85922072	-88.12565091																	
104	45.85895085	-88.12565998																	
105	45.85868098	-88.12566905																	
106	45.85921438	-88.12526466																	
107	45.85947791	-88.12486934																	
108	45.85947157	-88.12448309																	
109	45.8597351	-88.12408776																	
110	45.85946523	-88.12409684																	
111	45.86053838	-88.12367426																	
112	45.8602685	-88.12368334																	
113	45.85999863	-88.12369242																	
114	45.85972876	-88.1237015																	
115	45.85945889	-88.12371058																	

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Total Rake Fullness	Myriophyllum spicatum	Potamogeton crispus	Chara sp.	Potamogeton pusillus	Potamogeton amplifolius	Stuckenia pectinata	Potamogeton zosteriformis	Najas flexilis	Potamogeton gramineus	Potamogeton strictifolius	Vallisneria americana	Nymphaea odorata
116	45.8608019	-88.12327892																	
117	45.86053203	-88.123288																	
118	45.86026216	-88.12329709																	
119	45.85999229	-88.12330617																	
120	45.85972241	-88.12331525																	
121	45.86079556	-88.12289266																	
122	45.86052568	-88.12290175																	
123	45.86025581	-88.12291083																	
124	45.86105908	-88.12249732																	
125	45.86078921	-88.1225064																	

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Chara sp.	Eleocharis acicularis	Myriophyllum sibiricum	Potamogeton amplifolius	Potamogeton gramineus	Potamogeton illinoensis	Potamogeton natans	Potamogeton praelongus	Potamogeton pusillus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton strictifolius	Potamogeton vaseyi	Potamogeton zosteriformis	Vallisneria americana
1	45.85602021	-88.13609076				Terrestrial																
2	45.85576833	-88.13609918	3	M						1				2	V						1	1
3	45.85551645	-88.1361076				Terrestrial																
4	45.85676998	-88.13570502	1	S						V				V								V
5	45.85651809	-88.13571344	5	M										2								
6	45.85626621	-88.13572186	6	M										2								
7	45.85601433	-88.13573028	7	M										2								
8	45.85576245	-88.1357387	7	M						2												
9	45.85551057	-88.13574712	6	M										2								
10	45.85525868	-88.13575554				Terrestrial																
11	45.85701598	-88.13533612	4	M										2								2
12	45.85676409	-88.13534454	7	M										2								
13	45.85651221	-88.13535296	10	M										3								
14	45.85626033	-88.13536138	12	M										2								
15	45.85600845	-88.1353698	12	M										2								
16	45.85575656	-88.13537822	10	M										2								
17	45.85550468	-88.13538664	8	M										2								
18	45.8552528	-88.13539507	2	M			2							1								
19	45.85726197	-88.1349672	7	M										2								
20	45.85701009	-88.13497563	12	M										2								
21	45.85675821	-88.13498405	13	M										2								
22	45.85650633	-88.13499248	14	M										2								
23	45.85625444	-88.1350009	14	M										2								
24	45.85600256	-88.13500932	12	M										2								
25	45.85575068	-88.13501774	10	M										2								
26	45.8554988	-88.13502617	8	M										2								
27	45.85524691	-88.13503459	1	R																		V
28	45.85750797	-88.13459829	4	M										2								1

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Chara sp.	Eleocharis acicularis	Myriophyllum sibiricum	Potamogeton amplifolius	Potamogeton gramineus	Potamogeton illinoensis	Potamogeton natans	Potamogeton praelongus	Potamogeton pusillus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton strictifolius	Potamogeton vaseyi	Potamogeton zosteriformis	Vallisneria americana
29	45.85725609	-88.13460672	10	M										2								
30	45.8570042	-88.13461514	14	M										2								
31	45.85675232	-88.13462357	15	M										1								
32	45.85650044	-88.13463199	12	M										2								
33	45.85624856	-88.13464042	14	M										2								
34	45.85599668	-88.13464884	12	M										2								
35	45.85574479	-88.13465727	9	M										2								
36	45.85549291	-88.13466569	5	R										2								
37	45.85775396	-88.13422937	3	S			1			1				1								
38	45.85750208	-88.1342378	7	M										2								
39	45.8572502	-88.13424623	9	M										2								
40	45.85699832	-88.13425465	11	M										2								
41	45.85674643	-88.13426308	11	M										2								
42	45.85649455	-88.13427151	14	M										2								
43	45.85624267	-88.13427993	10	M										2								
44	45.85599079	-88.13428836	8	M										2								
45	45.85573891	-88.13429679	8	M			2							2								1
46	45.85548702	-88.13430521	2	S			V	1														1
47	45.85774807	-88.13386888	6	M			2							1								
48	45.85749619	-88.13387731	10	M										1								
49	45.85724431	-88.13388574	12	M										2								
50	45.85699243	-88.13389417	14	M										2								
51	45.85674055	-88.1339026	12	M										2								
52	45.85648866	-88.13391102	12	M										2								
53	45.85623678	-88.13391945	11	M										2								
54	45.8559849	-88.13392788	10	M										2								
55	45.85573302	-88.13393631	6	S							2			1								
56	45.85548114	-88.13394474	1	S				1														V

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Chara sp.	Eleocharis acicularis	Myriophyllum sibiricum	Potamogeton amplifolius	Potamogeton gramineus	Potamogeton illinoensis	Potamogeton natans	Potamogeton praelongus	Potamogeton pusillus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton strictifolius	Potamogeton vaseyi	Potamogeton zosteriformis	Vallisneria americana
57	45.85799407	-88.13349996				Terrestrial																
58	45.85774218	-88.13350839	6	M			2							2								
59	45.8574903	-88.13351682	8	M			1							2								
60	45.85723842	-88.13352525	10	M										1								
61	45.85698654	-88.13353368	9	M										2								
62	45.85673466	-88.13354211	10	M										2								
63	45.85648277	-88.13355054	10	M			1							2								
64	45.85623089	-88.13355897	6	M			1							1								
65	45.85597901	-88.1335674	5	M			1							2								V
66	45.85572713	-88.13357583				Terrestrial																
67	45.85798818	-88.13313947	1	S			1		V													
68	45.85773629	-88.1331479	4	M			2		1					2								
69	45.85748441	-88.13315633	7	M																		
70	45.85723253	-88.13316476	8	M										2								
71	45.85698065	-88.1331732	8	M										2								
72	45.85672877	-88.13318163	7	M			1							2								
73	45.85647688	-88.13319006	6	M			1							2								
74	45.856225	-88.13319849				Terrestrial																
75	45.85823417	-88.13277054				Terrestrial																
76	45.85798228	-88.13277898	2	M					V					1								
77	45.8577304	-88.13278741	4	M			2		V					2								
78	45.85747852	-88.13279584	4	M			2							2	1							
79	45.85722664	-88.13280428	6	M										1								
80	45.85697476	-88.13281271	5	S							1											
81	45.85672287	-88.13282114	4	R			1															
82	45.85647099	-88.13282958	2	R																		
83	45.85873204	-88.13239318				Terrestrial																
84	45.85848015	-88.13240161				Terrestrial																

Point Number	Latitude	Longitude	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Notes	Chara sp.	Eleocharis acicularis	Myriophyllum sibiricum	Potamogeton amplifolius	Potamogeton gramineus	Potamogeton illinoensis	Potamogeton natans	Potamogeton praelongus	Potamogeton pusillus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton strictifolius	Potamogeton vaseyi	Potamogeton zosteriformis	Vallisneria americana
85	45.85822827	-88.13241005				Terrestrial																
86	45.85797639	-88.13241848				Terrestrial																
87	45.85772451	-88.13242692	2	M			1							1								
88	45.85747263	-88.13243535	4	M		Too Deep	1			2				2								
89	45.85722074	-88.13244379	4	M										2								
90	45.85696886	-88.13245222	4	M										1								
91	45.85671698	-88.13246066	4	M															2			
92	45.8564651	-88.13246909	2	S																		
93	45.85771861	-88.13206643				Terrestrial																
94	45.85746673	-88.13207486	2	S			1															
95	45.85721485	-88.1320833	4	M										V								
96	45.85696297	-88.13209174	4	M							1											
97	45.85671109	-88.13210017	4	M															1			
98	45.8564592	-88.13210861	3	M																		
99	45.85620732	-88.13211705				Terrestrial																
100	45.85595544	-88.13212548				Terrestrial																
101	45.85695707	-88.13173125				Terrestrial																
102	45.85670519	-88.13173969				Terrestrial																
103	45.85645331	-88.13174813				Terrestrial																
104	45.85594955	-88.131765				Terrestrial																
105	45.85569766	-88.13177344				Terrestrial																
106	45.85544578	-88.13178188				Terrestrial																

F

APPENDIX F

USACE Draft Report: Frog Lake, Florence County, Herbicide Concentration Monitoring Results, 2010

Draft: Frog Lake, Florence County, Residual Monitoring Results, 2010
8 February 2011

John Skogerboe
US Army Engineer Research and Development Center (ERDC)

A liquid formulation of 2,4-D was applied as a whole lake treatment at a target concentration of 250 ug/L ae (Figure 1) on 13 May 2010. Five sites were locate in the lake for herbicide residual sampling. Sampling was conducted by lake volunteers at pre-determined sample intervals (Table 1). Water samples were collected at mid depth for all locations. Following completion of each sample interval, 2-3 drops of muriatic acid were added to the sample to fix the herbicide.

Concentrations of 2,4-D remained constant through 7 days after treatment (DAT) averaging 289 ug/L ae compared to the lake wide target concentration of 250 ug/L ae (Figure 2 and Figure 3). By 21 DAT, 2,4-D concentrations declined but still exceeded the irrigation restriction limit of 100 ug/L ae. By 26 DAT 2,4-D concentrations were less than the detection limit. Based on results from other lakes, 2,4-D concentrations and exposure times in Frog Lake appeared to be sufficient to provide effective control of the milfoil. Point intercept (PI) data provided by Onterra showed only a 41% decline which was not statistically significant (P = 0.232). The milfoil in Frog Lake has been documented as a hybrid *(M spicatum x M sibericum*), which may have resulted in plants with a greater tolerance of 2,4-D. According to anecdotal reports from residents, milfoil plants were knocked down, but then recovered. Additional anecdotal data have indicated that water pH in the Lake is high (>9.0) which may also have affected the control. Additional plants were collected from Frog Lake in September and sent to the ERDC laboratory for additional testing.

Table 1. Frog Lake Sample Intervals

Sample Interval	Samples per Interval	Total Samples
3-6 HAT	5	5
1 DAT	5	10
3 DAT	5	15
5 DAT	5	20
7 DAT	5	25
14 DAT	5	30
21 DAT	5	35
28 DAT	5	40
42 DAT	5	45
56 DAT	5	50

Figure 1. Frog Lake Herbicide Application Map and Herbicide Residual Sample Locations (Onterra LLC)

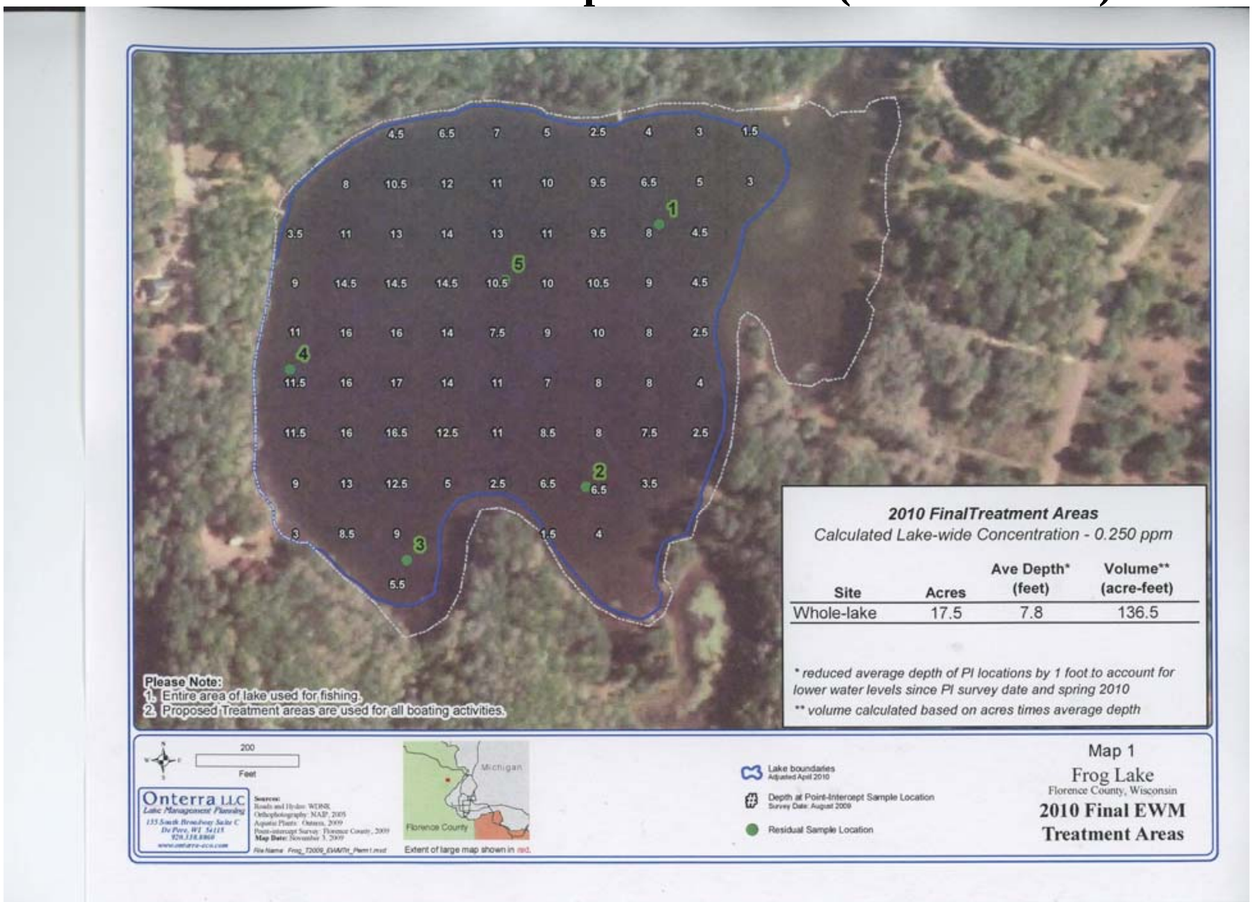


Figure 2

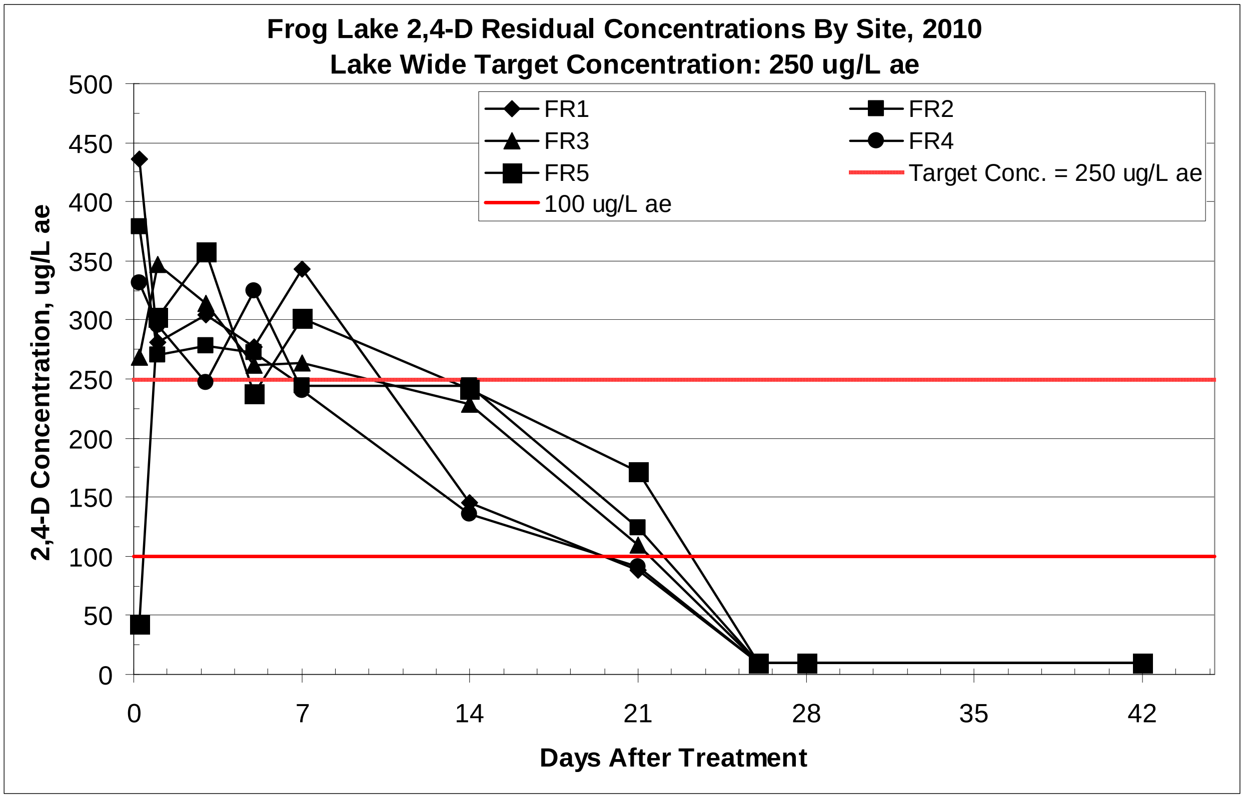
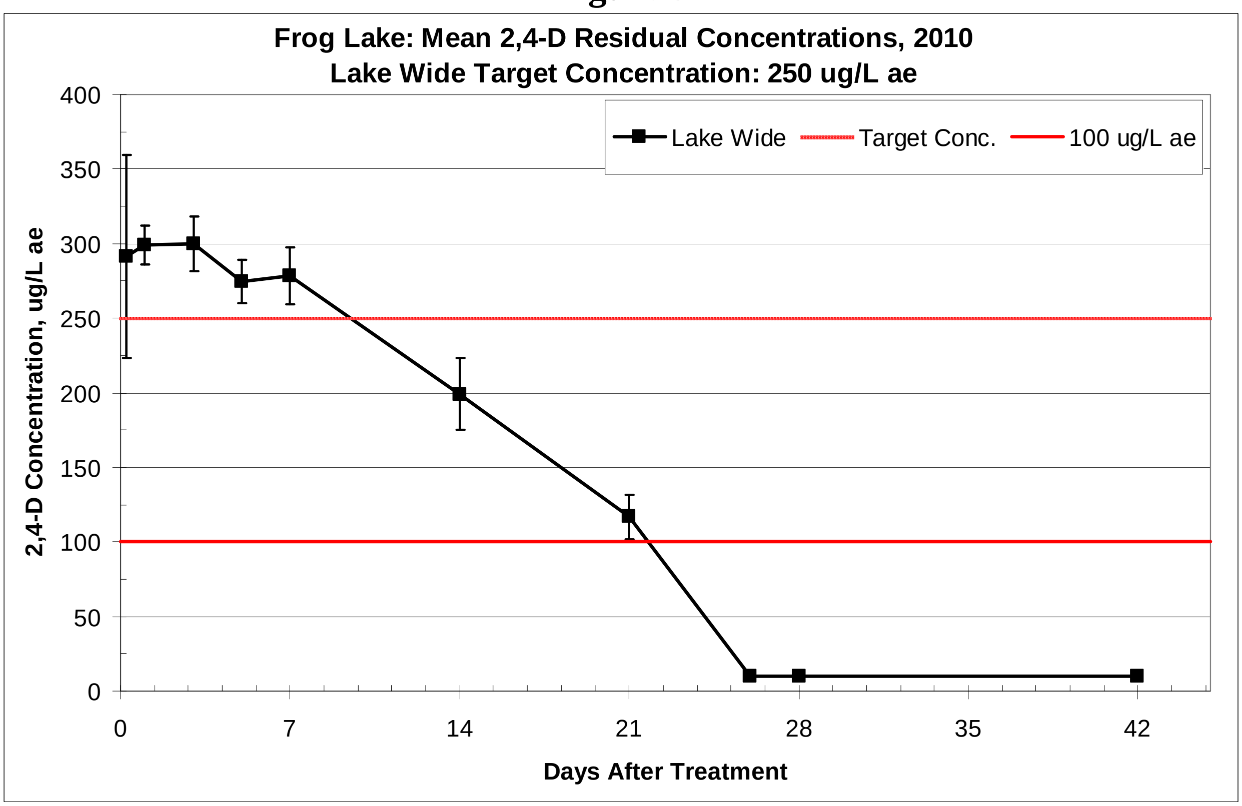


Figure 3



G

APPENDIX G

Frog Lake 2013 Proposed Strategy Report

INTRODUCTION

Frog Lake, Florence County, is a seepage lake with an adjusted surface area of approximately 17.5 acres (Map 1). In February of 2010, the Frog and Bass Lakes Association (FBLA) received a WDNR Lake Planning Grant to create a Lake Management Plan for both lakes, as well as monitor Eurasian water milfoil (EWM) herbicide treatments conducted in 2010 on Frog Lake. EWM was first discovered in September of 2002 in Frog Lake, and was later confirmed by the Wisconsin Department of Natural Resources (WDNR) as a hybrid species. Onterra ecologists collected additional samples from Frog Lake in 2011 and sent them to the Annis Water Resources Institute at Grand Valley State University in Michigan to undergo further genetic testing which may result in an understanding of which biotypes (strains) of hybrid EWM (HWM) occur in the lake.

A 15-acre granular 2,4-D treatment (Navigate® at 100 lbs per acre) was conducted on Frog Lake in 2005, which was considered by all accounts to be quite successful at reducing HWM populations within the lake. Knowing the amount of herbicide used, back-calculations indicate that this would have resulted in a whole-lake concentration of 0.435 ppm ae if evenly spread throughout the lake (water levels were approximately 3 feet higher than they are currently). This puts perspective on why the 2005 herbicide treatment was thought to be more successful than in 2010 – it was at a significantly higher dose.

Onterra was contracted in 2009 to complete a survey for EWM, and during this survey discovered a dense infestation of the plant throughout most of the lake, with the lake's shallow east side holding particularly dense stands of the exotic plant. Water clarity is quite good in Frog Lake, and EWM can be found growing out to 14 feet of water.

WHOLE LAKE VS SPOT TREATEMENT STRATEGIES

Herbicides that target submersed plant species are directly applied to the water, either as a liquid or an encapsulated granular formulation. Factors such as water depth, water flow, treatment area size, and plant density work to dilute herbicide concentration within aquatic systems. Understanding concentration-exposure times are important considerations for aquatic herbicides. Successful control of the target plant is achieved when it is exposed to a lethal concentration of the herbicide for a specific duration of time. Much information has been gathered in recent years, largely as a result of a joint research project between the WDNR and USACE. Based on their preliminary findings, lake managers have adopted two main treatment strategies; 1) whole-lake treatments, and 2) spot treatments.

Spot treatments are a type of control strategy where the herbicide is applied to a specific area (treatment site) such that when it dilutes from that area, its concentrations are insufficient to cause significant effects outside of that area. Spot treatments typically rely on a short exposure time (often hours) to cause mortality and therefore are applied at a much higher herbicide concentration than whole-lake treatments.

Whole-lake treatments are those where the herbicide is applied to specific sites, but when the herbicide reaches equilibrium within the entire volume of water (of the lake, lake basin, or within the epilimnion of the lake or lake basin); it is at a concentration that is sufficient to cause mortality to the target plant within that entire lake or basin. The application rate of whole-lake treatments is dictated by the volume of water in which the herbicide will reach equilibrium with. Because exposure time is so much greater, target herbicide levels for whole-lake treatments are significantly less than for spot treatments. In 2010, a whole-lake treatment strategy was utilized on Frog Lake.

2010 Whole Lake Treatment

As indicated above, a treatment strategy was devised for Frog Lake in 2010 using a low-dose, whole-lake treatment of liquid 2,4-D. FBLA volunteers collected water samples at different locations and time periods following the treatment. The water samples were tested for 2,4-D concentration by the US Army Corps of Engineers (USACE). The mean 0-7 days after treatment (DAT) lake-wide 2,4-D concentration was 0.289 ppm acid equivalent (ae), quite close to the target concentration (0.250 ppm ae).

At the beginning of the summer following the 2010 treatment, Frog Lake residents were quite pleased with the initial treatment results and could hardly find any HWM within the lake when looking from the surface. But as the summer progressed, the presumably injured HWM rebounded and during the late-summer post treatment survey, was erect in the water column. Based solely on the herbicide concentration monitoring data, it would appear that the 2010 treatment should have been more effective. With this uncertainty, no herbicide treatment was conducted in 2011 until more information about similar treatments was gathered. This also allowed the comprehensive lake management planning project to be completed and AIS control goals to be developed.

The data gathered from other lakes in 2010 suggests that treatments on lakes with populations of HWM were not as successful when compared to lakes with pure strains of EWM. In 2011, approximately 600 live strands of milfoil from Frog Lake and English Lake (Manitowoc County) were collected and sent to SePRO and the USACE for herbicide tolerance testing. Cultures of these plants were grown, and then experimental groups were challenged by exposing them to varying concentrations of either 2,4-D amine or triclopyr. While the results have not been finalized, the overall conclusion of the study is that the HWM strain(s) tested from Frog Lake (and English Lake) appears to be less responsive to auxin herbicides (2,4-D and triclopyr) than a pure EWM reference strain (SePRO, unpublished data).

English Lake shares some similarities with Frog Lake, most notably that they are both small lakes that contain hybrid Eurasian water milfoil (hybrid). Both lakes also conducted whole-lake 2,4-D treatments in 2010 with limited success and therefore decided to forgo treatment in 2011. While Frog Lake pursued the option of entering into the weevil research project in 2012, English Lake planned a whole-lake treatment in 2012 using a higher dose of 2,4-D (eplimentic target concentration of 0.350 ppm ae). It’s important to note that the English Lake treatment strategy is much more complex than Frog Lake due to issues of thermal stratification in the 85-foot deep lake. The 2012 whole-lake 2,4-D treatment on English Lake did not meet expectations and the English Lake Protection and Rehabilitation District is planning to conduct a whole-lake treatment strategy in 2013 using a combination of 2,4-D and endothall.

2012 Aquatic Plant Surveys on Frog Lake

As clearly illustrated on Figure 1, the HWM population was reduced following the spring 2010 herbicide treatment, but has rebounded, and in 2012, was found at much higher densities than in 2009. In 2012, almost the entire littoral zone of Frog Lake contained colonized HWM populations, with the majority being comprised of colonies exhibiting *dominant* or greater (*highly dominant* or *surface matting*) density ratings. The negative impacts to the ecosystem are believed to occur when HWM reaches or exceeds an aerial coverage of approximately 50% (*dominant*). Therefore, by minimizing the occurrence of these dense stands, the exotic's impact on the lake's ecology may also be minimized.

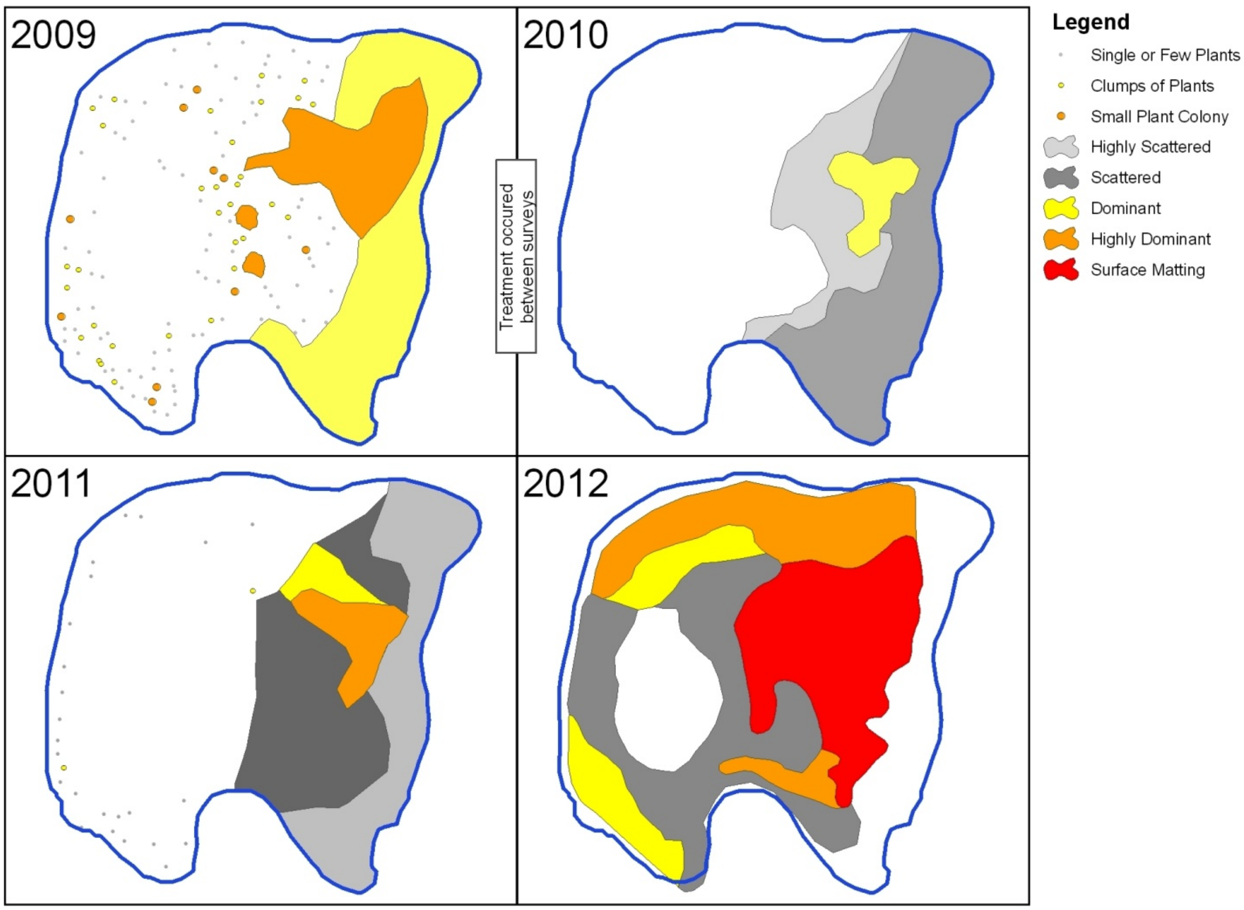


Figure 1. Qualitative HWM density-based mapping survey results from 2009-2012.

Comparing the 2009-2012 point-intercept data allows for an examination of species' responses to the whole-lake treatment on Frog Lake as well the drastic increase in HWM frequency throughout the lake. Since 2010 following the whole lake treatment, HWM frequency of occurrence has increased by over 400% and in 2012 was found at approximately 47% of all sampling locations (Figure 2). Slender naiad appeared to have been impacted by the 2010 herbicide treatment, but its population rebounded the following year (2011). Muskgrasses and thin-leaved pondweeds, as well slender naiad populations, where all reduced in 2012 and it is not known if their decline is the result of displacement by the HWM population or due to natural variation.

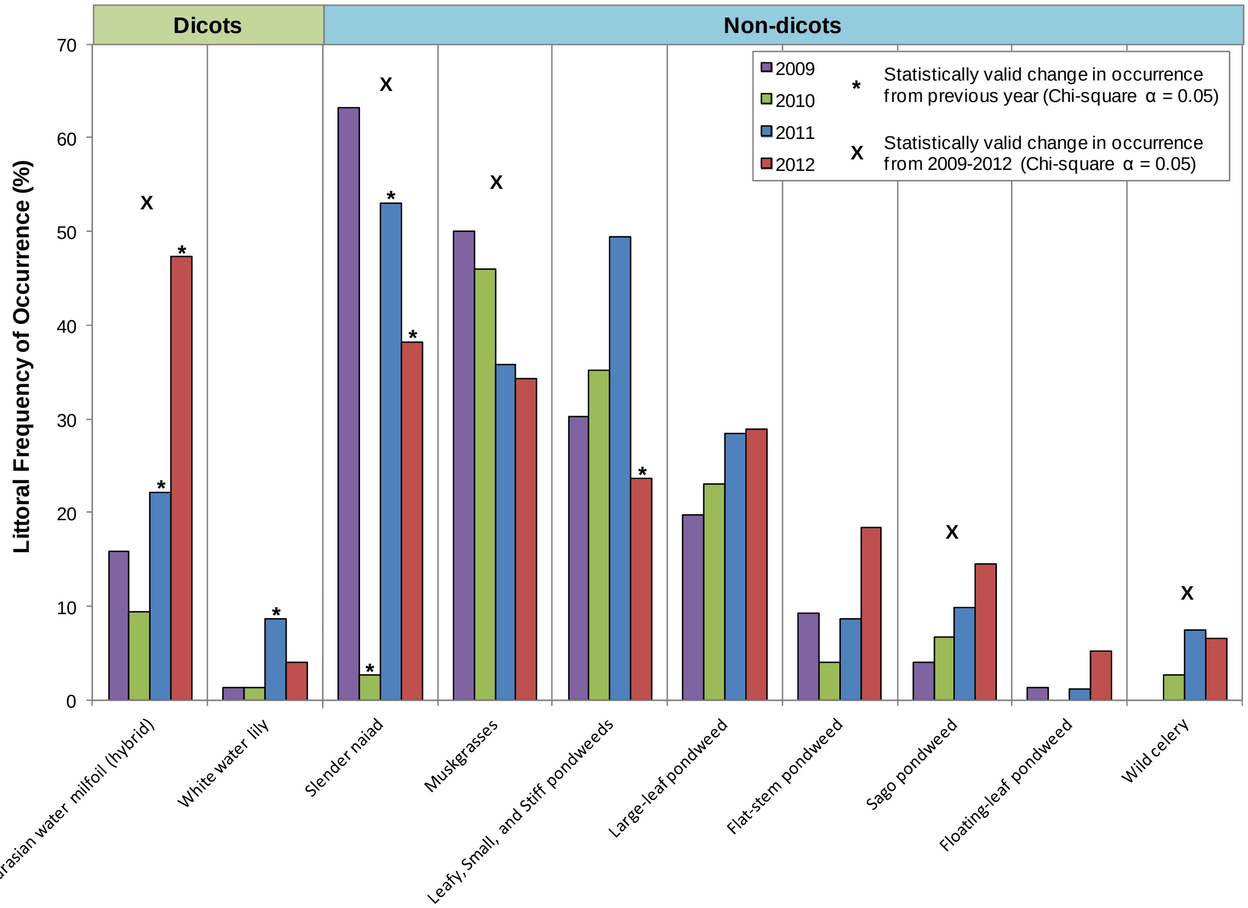


Figure 2. Littoral occurrence of native aquatic plants in Frog Lake from 2009-2012. Created using data from Florence County (2009-10) and WNDR (2011-12) point-intercept surveys.

PROPOSED 2013 CONTROL STRATEGY

HWM populations in Frog Lake are currently at levels that are likely causing negative impacts on the aquatic ecosystem, not to mention the recreational interference that are caused by the immense plant biomass in much of the lake. The navigational issues of Frog Lake are further confounded by the fact that most watercraft on this small lake utilizes electric motors or no motors at all. The concept of heterosis, or hybrid vigor, is important in regards to HWM management on Frog Lake. The root of this concept is that hybrid individuals typically have improved function compared to their pure-strain parents. HWM typically has thicker stems and is a prolific flowerer. These conditions likely contribute to this plant being particularly less susceptible to biological and chemical control strategies. The FBLA (and other managing entities) must realize that in order to effectively control the HWM population in Frog Lake, aggressive herbicide strategies will need to be implemented, which could have increased collateral affects on the native aquatic plant community compared with more-typical use rates employed for pure-strain EWM control projects.

As discussed within the Implementation Plan Section of the Frog Lake Comprehensive Management Plan (draft - November 2012), the FBLA has elected (formal vote of the general membership) to consider conducting a whole-lake herbicide treatment in 2013. Below is a list of the options that have been considered:

Auxin Herbicide Combination – 2,4-D & Triclopyr: Combination applications of 2,4-D and triclopyr are theorized to have additive, and potentially synergistic, effects compared to when the respective herbicide components are used independently. Granular herbicide products containing roughly 4:1 parts 2,4-D to triclopyr are commercially available, although only narrowly used in Wisconsin due to the relatively high cost of the product compared to 2,4-D. However, their use has increased in difficult treatment situations where 2,4-D and/or triclopyr use history has not proven effective. Combination whole-lake liquid 2,4-D/triclopyr treatment strategies have been discussed as potential options for HWM control. To date, data has only been made available from one auxin combination treatment. Preliminary results are mixed regarding a Waushara County lake that conducted a combination 2,4-D and triclopyr whole lake treatment in 2012 (0.30/0.10 ppm ae).

The preliminary results of the tolerance testing completed by SePRO indicate that the HWM strain(s) tested from Frog Lake were less responsive to both 2,4-D and triclopyr than a pure EWM reference strain. For that reason, Frog Lake may not be a good candidate for a field trial of using a combination of these herbicides.

Auxin and Endothall Combination – 2,4-D & Endothall: Similar to combining auxin herbicides together, an additive or a synergistic advantage is theorized when combining 2,4-D and endothall. The simultaneous exposure to endothall and 2,4-D have been shown to provide increased control of EWM in outdoor growth chamber studies (Madsen et. al 2010). However, this research investigated use patterns that involve 24-48 hours of exposure time, not days to weeks of exposure time as are anticipated for Frog Lake. As discussed above, this is the option being pursued by English Lake to combat the HWM population in this lake.

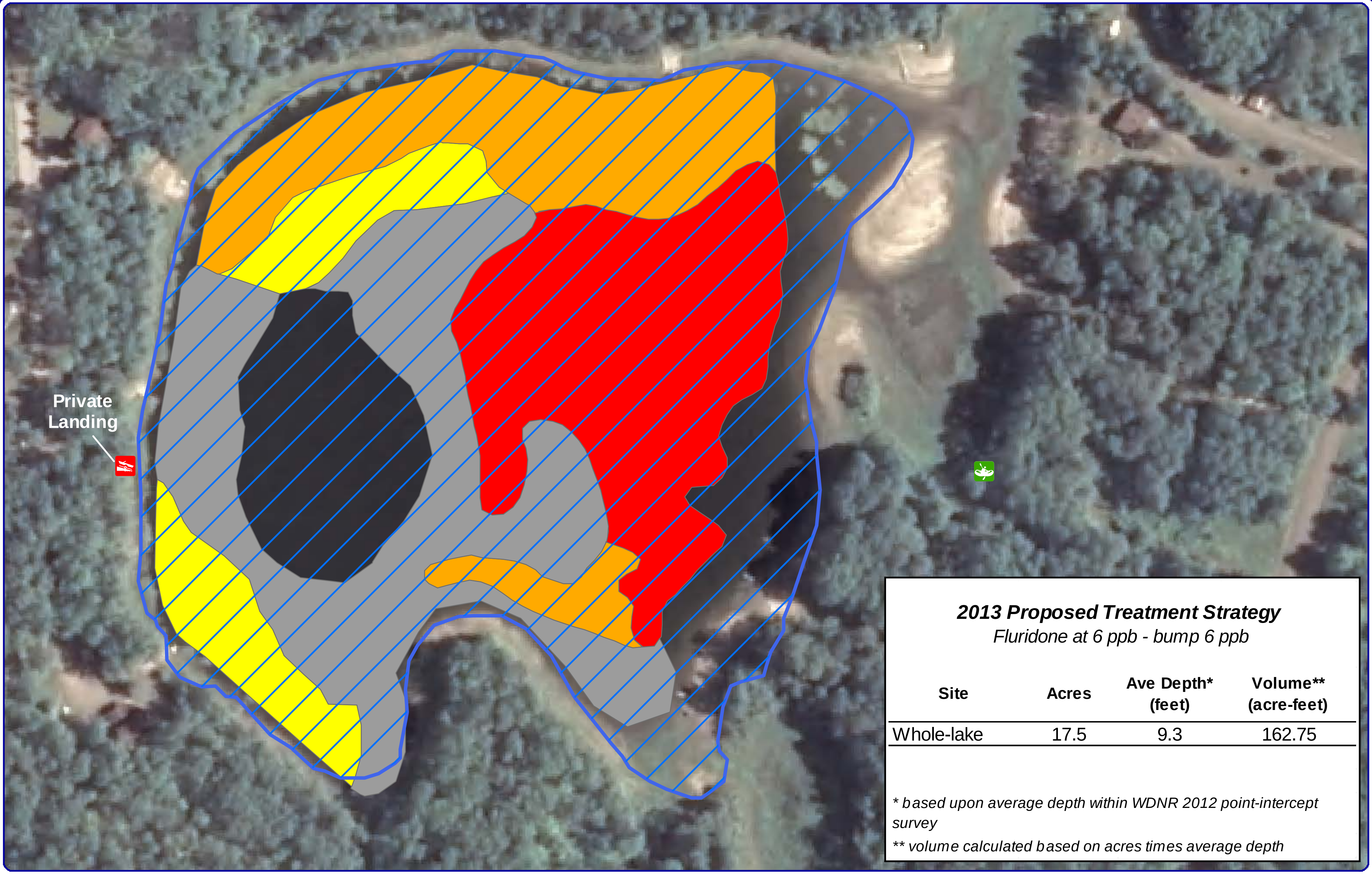
To date, only two combination 2,4-D/endothall field trials have occurred within Wisconsin that included the rigorous monitoring needed to evaluate treatment efficacy and selectivity (i.e. Half Moon Lake, Eau Claire County and Loon Lake, Shawano County) . Both of these treatments targeted what are thought to be pure-strain EWM populations. The Half Moon Lake treatment was highly effective at long-term control of EWM; however, the observed 2,4-D concentrations (approximately 0.350 ppm ae) may have been sufficient on their own for EWM control. Relatively substantial native plant occurrence declines were also observed in association with this treatment. Two years of EWM control were observed in Loon Lake in association with a combination 2,4-D (0.15 ppm ae) and endothall (0.20 ppm ae), however EWM populations during 2012 were at pretreatment levels despite active management occurring.

Slow Acting Enzyme Inhibitor Herbicide – Fluridone. Fluridone is a systemic herbicide that disrupts photosynthetic pathways (carotene inhibitor). Because the herbicide degrades via photolysis (some microbial degradation may also occur) and requires long exposure times (>30 days) to cause mortality to EWM, adding additional herbicide ("bump treatment") a few weeks following the initial application may be required based upon herbicide concentration monitoring results. Fluridone is commonly used in many parts of the United States, particularly for EWM and hydrilla control, but is often critiqued because of reduced selectivity towards native plants. Research indicates that common waterweed and coontail may be particularly impacted by fluridone treatments; however neither of these species are present in Frog Lake. As use rates of auxin herbicides have evolved into large-scale treatments, the lack of selectivity arguably mimics past data from fluridone treatments. More commonly used in Michigan, the standard fluridone use pattern involves applying the herbicide at 6 parts per billion (ppb) and following up with an additional "booster" or "bump" treatment at approximately 3 weeks following the treatment. The goal of the bump treatment would be to bring the level of fluridone in the lake back up to 6 ppb. This use pattern is commonly referred to as a "6-bump-6". Herbicide concentration samples would be collected and sent to the herbicide manufacture for rapid testing to determine the dose of the bump application. Please note that this would be separate from the herbicide concentration samples that would be collected by volunteers in association with the WDNR and USACE ongoing research project. The target concentration of fluridone would be discussed with the WDNR and USACE further if this method is pursued.

While preliminary research has identified a hybrid milfoil strain(s) from a lower peninsula of Michigan lake that expressed reduced susceptibility to fluridone, additional tolerance testing completed by SePRO indicate that the HWM strain(s) tested from Frog Lake showed a "classically susceptible response" to fluridone (Dr. Mark Heilman, personal comm.). For that reason, Frog Lake would be an ideal candidate for a whole-lake, low-dose fluridone treatment.

The goal of this report is to start a serious dialogue about how to move forward with a HWM control strategy on Frog Lake. At this time, it appears that moving forward with a whole-lake fluridone treatment on Frog Lake in 2013 may be the most appropriate option. While the use of fluridone has not occurred on natural lakes in Wisconsin in approximately a decade, it is widely used throughout the Midwest for EWM control. A justified concern that surrounds the herbicide treatment strategy involves the impact on the native aquatic plant community of the lake. While the native plant community of Frog Lake has remained relatively constant over time, it is not appropriate to sacrifice its long-term integrity in order to meet the AIS control strategy goals. Emerging data from the ongoing WDNR and USACE research project indicates that several of the species present in Frog Lake are particularly sensitive to 2,4-D when utilized in whole-lake treatment scenarios: muskgrasses, naiads, thin-leaved pondweeds, and possibly large leaf pondweed. While not without risk of injury, these species may be more tolerant to fluridone at the application rate discussed above.

As occurred in association with the 2010 whole-lake treatment, the aquatic plant community would be monitored using both quantitative and qualitative methodologies. Along with volunteer-based herbicide concentration monitoring, additional monitoring, such as water clarity, dissolved oxygen, and water temperature, will also be discussed prior to implementation of the control action.



2013 Proposed Treatment Strategy

Fluridone at 6 ppb - bump 6 ppb

Site	Acres	Ave Depth* (feet)	Volume** (acre-feet)
Whole-lake	17.5	9.3	162.75

** based upon average depth within WDNR 2012 point-intercept survey*

*** volume calculated based on acres times average depth*

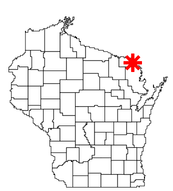
N W E S

200

Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Aquatic Plant Survey: Onterra, 2012
Orthophotography: NAIP, 2010
Map date: April 8, 2013



Project Location in Wisconsin

Legend

Hybrid EWM *(September 2012)*

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

Lake boundaries and Proposed Treatment Area *(Field-adjusted May 2010)*

Map 1

Frog Lake

Florence County, Wisconsin

2013 Proposed HWM Treatment Strategy v.1