A

APPENDIX A

Public Participation Materials

Muskellunge Lake
Comprehensive Management Plan
Project Kick-Off Meeting
June 7th, 2008 9:00 AM
Bradley Town Hall – 1518 W. Mohawk Dr. Tomahawk, WI

The Muskellunge Lake Protection & Rehabilitation District has received two grants totaling over $19,000 from the Wisconsin Department of Natural Resources to partially fund the completion of a comprehensive management plan for Muskellunge Lake. The design for the management plan has been finalized and approved by the WNR and includes two primary objectives: 1)the completion of an in-depth study including multiple plant surveys, water quality sampling, and watershed investigations; 2) the completion of a realistic management plan for the lake and its watershed. Most of the studies will be completed during this spring, summer and fall. The tasks associated with the analysis of the data will be completed during the fall and winter. The project will also incorporate opportunities for stakeholder education and input, which are both very important components of all lake management planning efforts. The first opportunity for your participation in the process will be at the Project Kick-off Meeting to be held on Saturday, June 7th at 9:00 am at the Bradley Town Hall.

Onterra, LLC, a lake management planning firm out of De Pere, has been hired to lead the project. During the meeting Eddie Heath, an Aquatic Ecologist with Onterra, will describe the project and its importance. His presentation will include a description of the project's components, a quick course on general lake ecology, and a breakdown of how the District's Planning Committee will be involved in the plan's completion. So, please plan on attending the meeting and do not hesitate to ask questions or make comments.

Presentation Outline

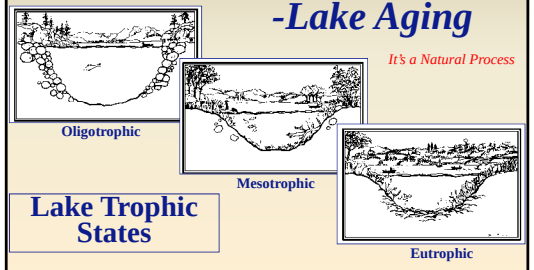
- Introduction to Lake Ecology
- Current Lake Project
  - Goals
  - Components
  - Process

Introduction to Lake Ecology

General Lake Ecology

Eutrophication -Lake Aging

It's a Natural Process



Lake Trophic States

General Lake Ecology

Cultural Eutrophication

Accelerated eutrophication caused by human activity.

General Lake Ecology

Limiting Nutrient

2 Cups Water 2 Cups Flour 2 Cups Sugar 2 Eggs	2 Cups Water 2 Cups Flour 2 Cups Sugar 2 Eggs
2 Cups Water 2 Cups Flour 2 Cups Sugar 2 Eggs	2 Cups Water 2 Cups Flour 2 Cups Sugar 2 Eggs

General Lake Ecology

Phosphorus

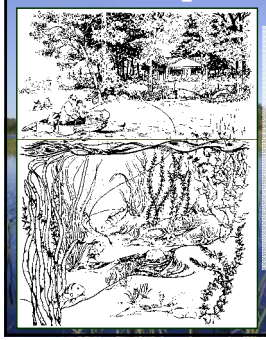
- *Limiting Nutrient*
- *Controls Plant Abundance (Productivity)*
  - *Algae*
  - *Macrophytes*

General Lake Ecology

Aquatic Plants (macrophytes)

- *Native Plants*
- *Exotic Plants (non-native)*

Native Aquatic Plants



- Base of the Food Web
- Cover (not only fish)
- Nursery
- Sediment Stabilization

General Lake Ecology

Non-native Aquatic Plants

Curly-leaf Pondweed

General Lake Ecology

Non-native Aquatic Plants

Eurasian Water Milfoil

General Lake Ecology

Consequences of Exotics

- Competition with Natives
  - Monotypic Community
- Decreased Recreational Value
- Decreased Property Value

Current Project

Study and Plan Goals

- Collect & Analyze Data
- Construct Long-Term & Useable Plan

A goal without a plan is just a wish.

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Project Components

- Public Participation
- Watershed Modeling
- Water Quality
- Aquatic Vegetation
  - Curly-leaf Survey
  - Comprehensive Survey
- Zebra Mussel Veliger Survey
- Ecologically Valuable Habitat Delineation
- Fisheries Data Integration
- Plan Development

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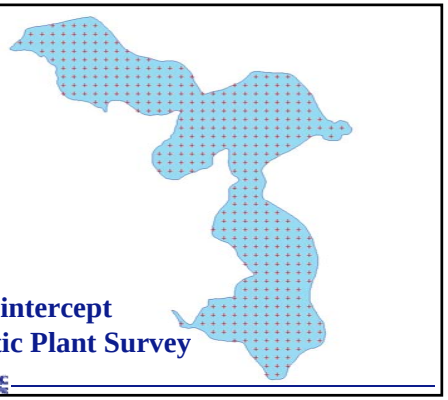

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Current Project

Your Participation is Important to the Success of this Project

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Current Project

Planning Process

Planning Committee Meetings

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

Implementation Plan

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Thank You

Eddie Heath eheath@onterra-eco.com

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Wisconsin Lakes Partnership

UW Extension

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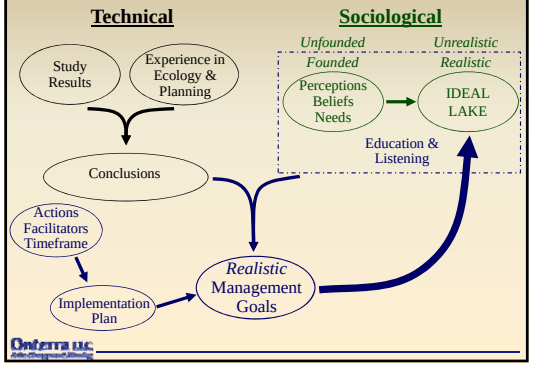
The Planning Process

…it's not as easy as you may think.

Planning Process



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Muskellunge Lake Management Planning Project

Update – February 2009

Submitted by:
Eddie Heath
Aquatic Ecologist
Onterra, LLC

The past few months have been very busy for us as we have been compiling and analyzing the data we collected on your lake during last year's field season. We enjoyed the numerous times we were on your lake last year. Our first trip to your lake was on February 12, 2008, where we drilled through the ice and collected water quality samples. We collected an additional five samples throughout the course of the summer and the analysis of these data will be complete once all of the results are received from the Wisconsin State Laboratory of Hygiene.

Numerous aquatic plant surveys were completed on the lake, identifying 49 native species included Vasey's pondweed, a species of special concern in Wisconsin. No exotic invasive species were located within the system from our surveys. Many nearby lakes contain Eurasian water milfoil, so there is a good chance that Muskellunge Lake has been exposed to fragments of this species carried in by transient boaters. Healthy plant communities, like those found in Muskellunge Lake, make establishment of aquatic invasive species difficult.

We have also accurately mapped the floating-leaf and emergent plant communities in the lake, creating a snap-shot in which future data can compare and determine whether these communities are expanding or receding.

Numerous opportunities for stakeholder participation have taken place since the start of the project. A kick-off meeting was held at the Bradley Town Hall on June 7, 2008 where Eddie Heath, an Aquatic Ecologist with Onterra, described the project and its importance. The presentation also included a description of the project's components, a quick course on general lake ecology, and a breakdown of how the district's Planning Committee will be involved in the plan's completion.

On August 29, 2008, a stakeholder survey was distributed to district members. Sixty-one stakeholders completed and returned the survey to district planning committee members that compiled the surveys. Subsequent analysis by Onterra has been conducted and will be used within the planning process.

The planning process will soon be underway, as Planning Committee members will meet with Onterra ecologists to develop realistic and implementable management goals. The management goals will be a collaborative effort to help stakeholders meet their realistic goals while doing what is best ecologically for the lake.

Once the plan is developed, a public meeting called a "Project Wrap-up Meeting" will be held to present the study results and the management plan to all interested folks.

Presentation Outline

- Current Lake Project Overview
- Planning Process
- Planning Project Study Results
  - Watershed
  - Water Quality
  - Aquatic Plants
- Preliminary Conclusions
- Discussion
  - Stakeholder Survey
- Management Goals

Current Project

Study and Plan Goals

- Collect & Analyze Data
- Construct Long-Term & Useable Plan

Current Project

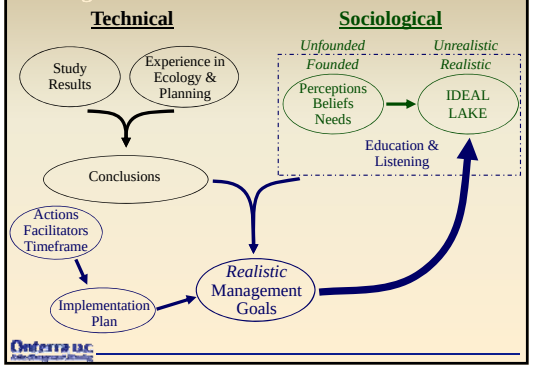
Study Components

- Stakeholder Participation
- Watershed Modeling
- Water Quality
- Aquatic Vegetation
  - Curly-leaf Survey
  - Comprehensive Survey
- Plan Development

The Planning Process

…it's not as easy as you may think.

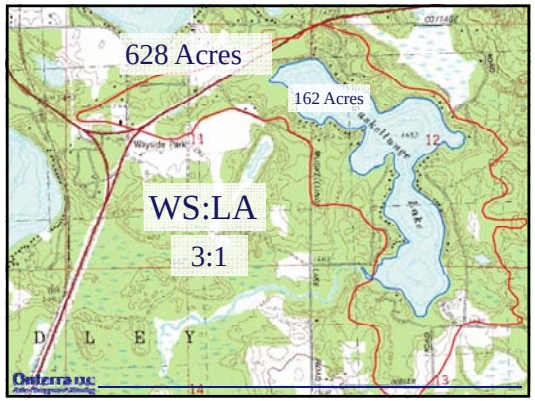
Planning Process

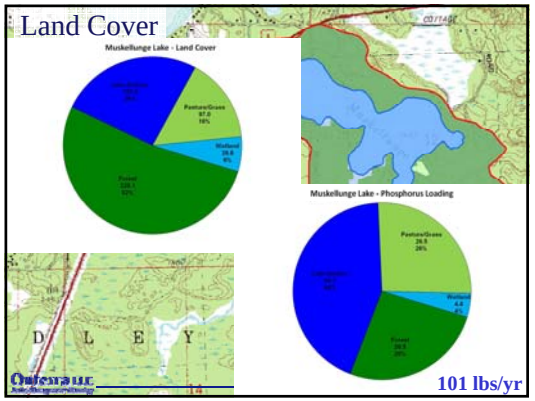



Muskellunge Lake
Watershed


Muskellunge Lake
12
11
MUSKELLUNGE LAKE


Muskellunge Lake
12
11
D L E Y

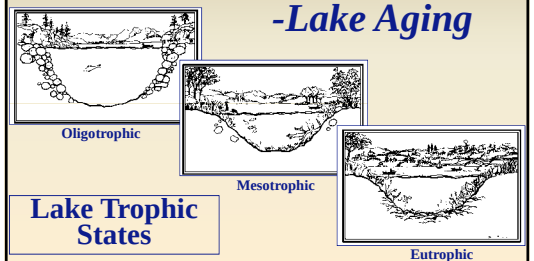

628 Acres
162 Acres
WS:LA
3:1
D L E Y


Land Cover
Muskellunge Lake - Land Cover
Muskellunge Lake - Phosphorus Loading
D L E Y
101 lbs/yr


Study Results
Water Quality
Northwest
Muskellunge Lake
Northeast
Southwest
Central
Southeast
Lillie & Mason
Regions

General Lake Ecology

Eutrophication -*Lake Aging*



Lake Trophic States

Ontera LLC

General Lake Ecology

Cultural Eutrophication

Accelerated eutrophication caused by human activity.

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Study Results

Water Quality

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

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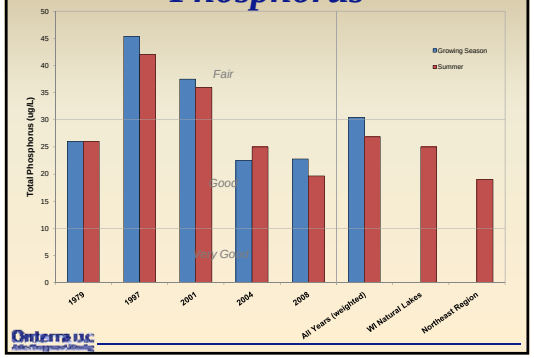
Phosphorus



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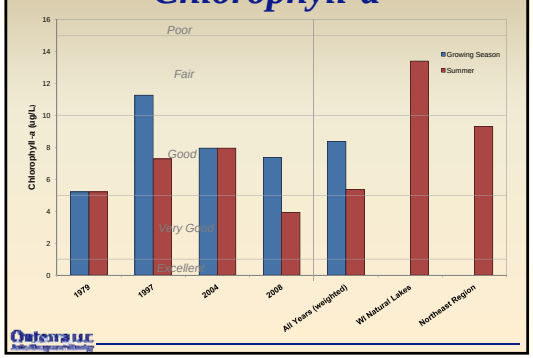
Chlorophyll-a



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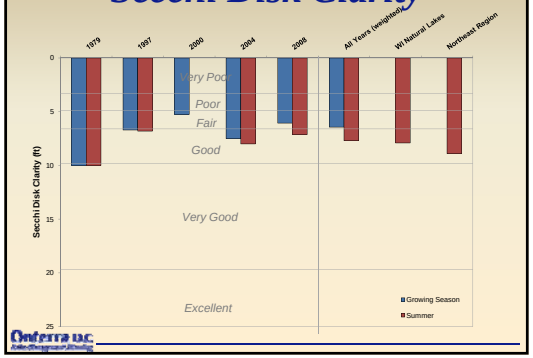
Secchi Disk Clarity



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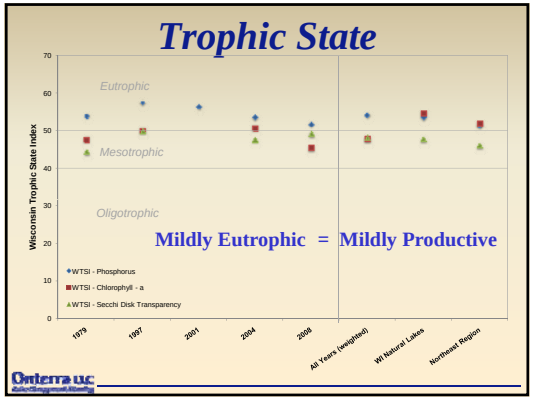
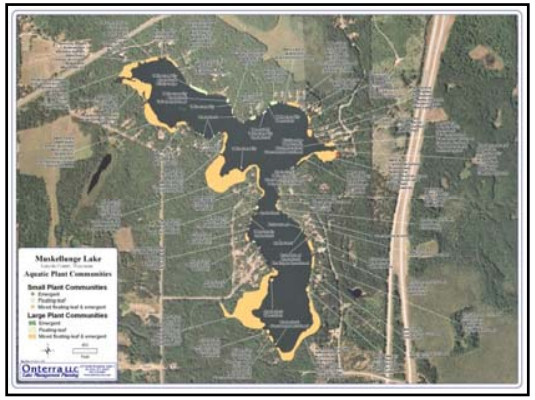
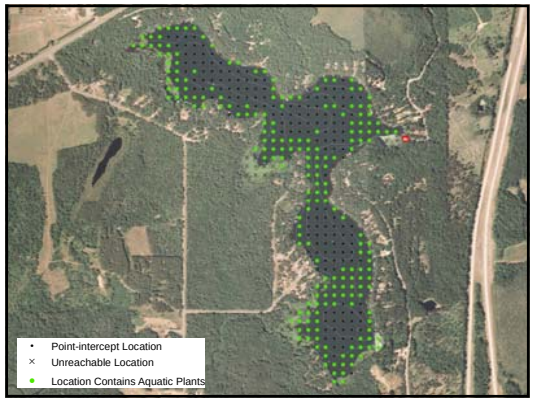

Trophic State
Eutrophic
Mesotrophic
Oligotrophic
Wisconsin Trophic State Index
Mildly Eutrophic = Mildly Productive
WTSI - Phosphorus
WTSI - Chlorophyll - a
WTSI - Secchi Disk Transparency
1979
1997
2001
2004
2008
All Years (weighted)
WI Natural Lakes
Northeast Region
Onterra LLC

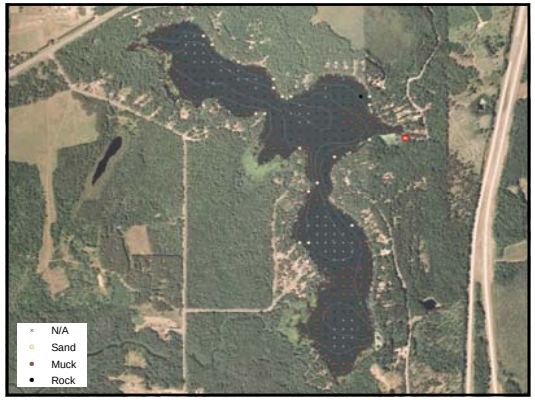

Comprehensive Plant Survey
•Accurately Map Communities
•Floating-leaf
•Emergent


Muskellunge Lake
Aquatic Plant Communities
Small Plant Communities
Large Plant Communities
Onterra LLC


Comprehensive Plant Survey
•Accurately Map Communities
•Floating-leaf
•Emergent
•Point-Intercept Survey


Point-intercept Location


Point-intercept Location
Unreachable Location
Location Contains Aquatic Plants

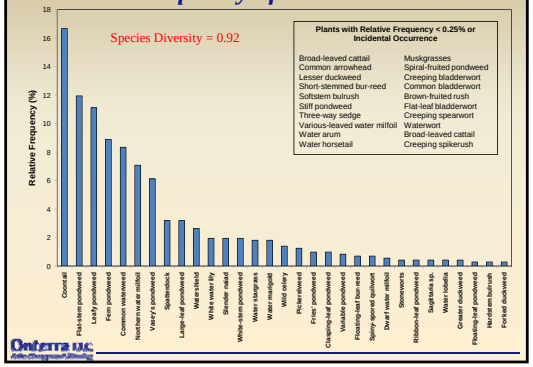


Species List

- 49 Native Species
  - Species of Special Concern
    - Vasey's pondweed
  - Species with C-value = 10
    - Floating-leaf bur-reed
    - Water lobelia
    - Dwarf water milfoil
- 0 Non-native Species

Life Form	Scientific Name	Common Name	Coefficient of Conservatism (c)
Emergent	*Calla palustris**	Water arum	9
	*Dulichium arundinaceum**	Three-way sedge	9
	Eleocharis palustris	Creeping spikerush	6
	*Equisetum fluviatile**	Water horsetail	7
	Juncus pelocarpus	Brown-fruited rush	8
	Pontederia cordata	Pickerelweed	9
	*Sagittaria latifolia**	Common arrowhead	3
	Schoenoplectus acutus	Hardstem bulrush	6
	*Schoenoplectus tabernaemontani**	Softstem bulrush	4
	*Typha latifolia**	Broad-leaved cattail	1
FL	*Brasenia schreberi*	Watershield	7
	Nuphar variegata	Spatterdock	6
	Nymphaea odorata	White water lily	6
FLE	*Sparganium emersum**	Short-stemmed bur-reed	8
	Sparganium fluctuans	Floating-leaf bur-reed	10
FF	*Lemna minor**	Lesser duckweed	5
	Lemna trisulca	Forked duckweed	6
	Spirodela polyrrhiza	Greater duckweed	5
Submergent	*Ceratophyllum demersum*	Coontail	3
	Chara sp.	Muskgrasses	7
	Elodea nuttallii	Waterwort	9
	Elodea canadensis	Common waterweed	3
	Heteranthera dubia	Water stargrass	6
	Isoetes echinospora	Spiny-spored quillwort	8
	Lobelia dortmanna	Water lobelia	10
	Megalodonta beckii	Water marigold	8
	*Myriophyllum heterophyllum**	Various-leaved water milfoil	7
	Myriophyllum sibiricum	Northern water milfoil	7
	Myriophyllum tenellum	Dwarf water milfoil	10
	Najas flexilis	Slender naiad	6
	Nitella sp.	Stoneworts	7
	Potamogeton amplifolius	Large-leaf pondweed	7
	Potamogeton epihydrus	Ribbon-leaf pondweed	8
	Potamogeton foliosus	Leafy pondweed	6
	Potamogeton friesii	Fries' pondweed	8
	Potamogeton gramineus	Variable pondweed	7
	Potamogeton natans	Floating-leaf pondweed	5
	Potamogeton praelongus	White-stem pondweed	8
	Potamogeton richardsonii	Clasping-leaf pondweed	5
	Potamogeton robbinsii	Fern pondweed	8
	Potamogeton spirillus	Spiral-fruited pondweed	8
	*Potamogeton strictifolius**	Stiff pondweed	8
	Potamogeton vaseyi	Vasey's pondweed	10
	Ranunculus aquatilis	White water crowfoot	8
	Ranunculus flammula	Creeping spearwort	9
	Utricularia gibba	Creeping bladderwort	9
	Utricularia intermedia	Flat-leaf bladderwort	9
	Utricularia vulgaris	Common bladderwort	7
	Vallisneria americana	Wild celery	6

Frequency of Occurrence

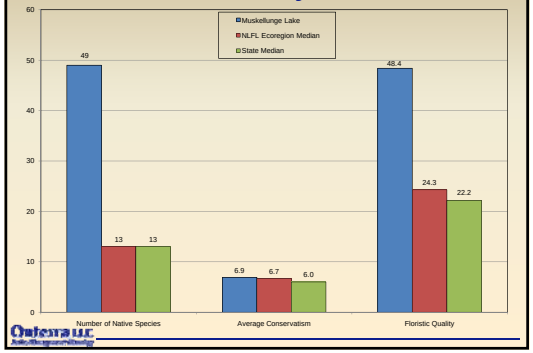


Study Results

Aquatic Plants

Wisconsin Ecoregions

Floristic Quality Assessment



Conclusions

- Watershed
  - Land cover within watershed is excellent
    - Minimal loading – best to be expected
  - Immediate watershed (shorelands) very important
- Water quality
  - Lake is mildly eutrophic – supports plant growth well
- Aquatic plant community is exceptional
  - Provides excellent habitat
  - Competes heavily against AIS introductions
  - Is control beyond manual methods needed?
- Sediment
  - If ***silt*** is building up, at what rate and what is the source?
- Watercraft
  - Safety , ecology, nusiance?

Discussion

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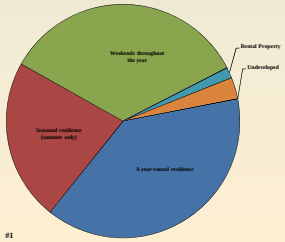
Stakeholder Survey

Returned Surveys	66
Sent Surveys	111
Response Rate (%)	59.5

What type of property do you own?

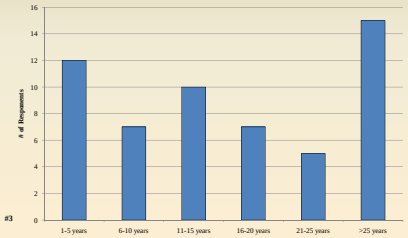


#1

Ontera LLC

Stakeholder Survey

How many years have you owned property?

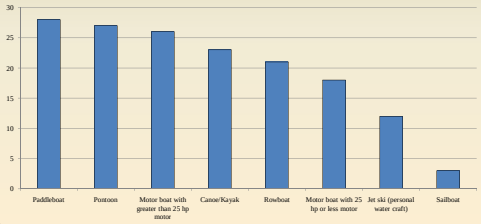


#3

Ontera LLC

Stakeholder Survey

What type of watercraft do you or others that use your property currently use on the lake?

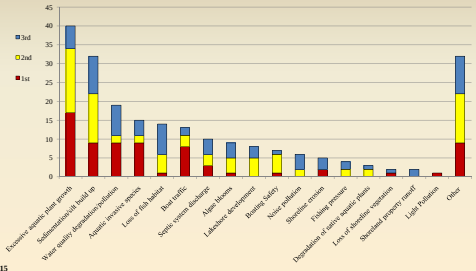


#8

Ontera LLC

Stakeholder Survey

Rank your top three concerns regarding the lake

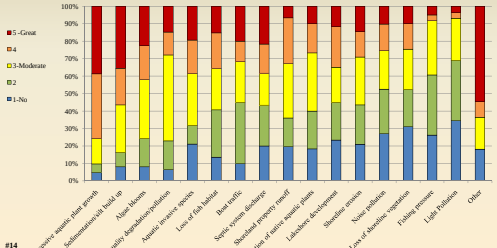


#15

Ontera LLC

Stakeholder Survey

*To what level do you believe each of the following Factors are **negatively** impacting Muskellunge Lake?*



#14

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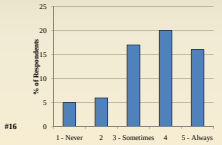
Stakeholder Survey

How often does aquatic plant growth impact your enjoyment of Muskellunge Lake?



#16

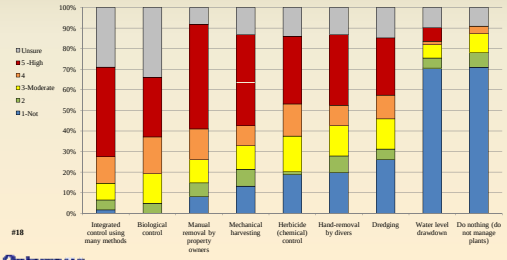
#17

Do you believe aquatic plant control is needed on Muskellunge Lake?

Onterra LLC

Stakeholder Survey

*What is your level of support for the **responsible** use of the following techniques on Muskellunge Lake?*



#18

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Stakeholder Survey

- Comments
  - Excessive Aquatic Plants(15 out of 66 or 23%)
  - Sedimentation (9 out of 66 or 14%)
  - Jet Skis/Large Boats (8 out of 66 or 12%)

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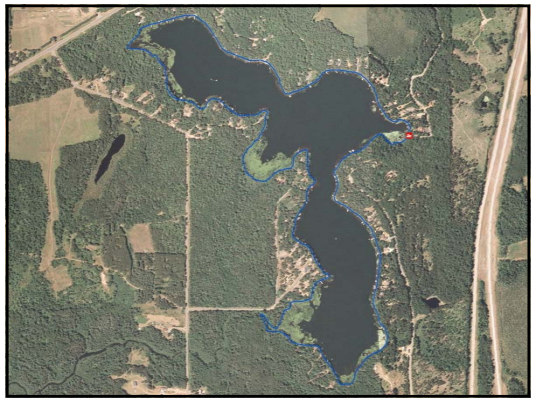
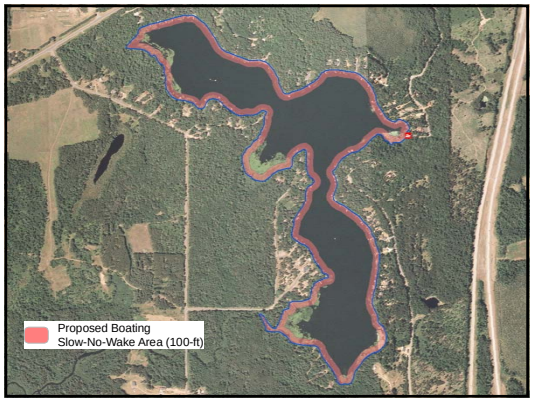
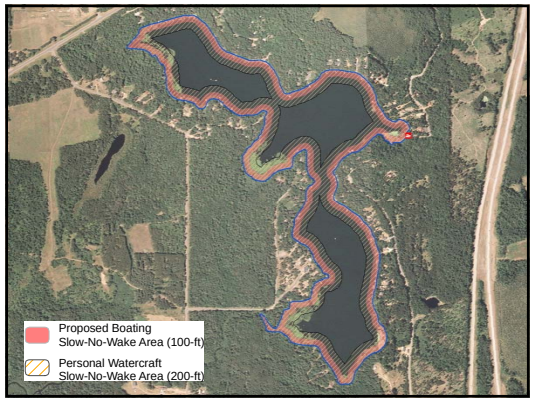
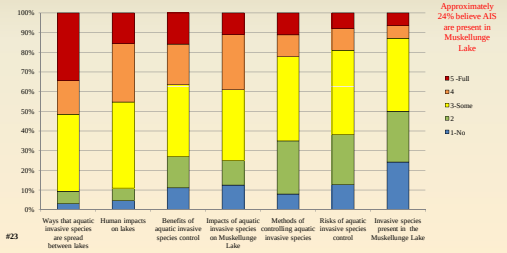






Stakeholder Survey

Please describe your level of understanding of each of the following lake management issues

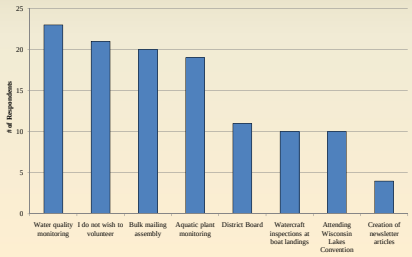


#23

Onterra LLC

Stakeholder Survey

Please circle the activities you would be willing to participate in if called upon.



#22

Onterra LLC

Thank You

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

Wisconsin Lakes Partnership

Extension

Wisconsin Dept. of Natural Resources

Onterra LLC

B

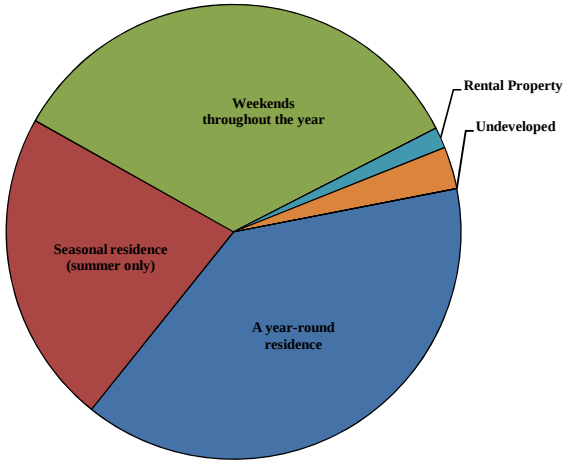
APPENDIX B

Stakeholder Survey Response Charts and Comments

Returned Surveys	66
Sent Surveys	111
Response Rate (%)	59.5

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

	Total	*%*
A year-round residence	26	*38.8*
Seasonal residence (summer only)	15	*22.4*
Weekends throughout the year	23	*34.3*
Resort	0	*0.0*
Rental Property	1	*1.5*
Undeveloped	2	*3.0*
Other	0	*0.0*
	67	*100.0*



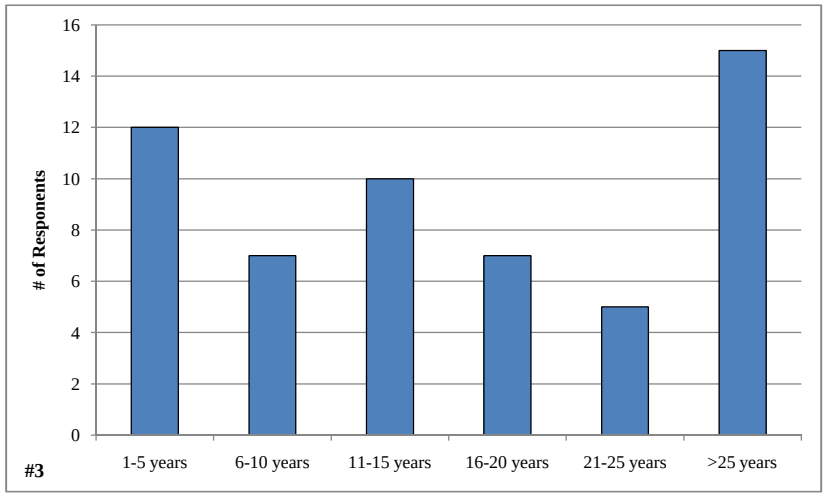
#1

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

Answered Question	37
Average	74.0
Standard deviation	48.7

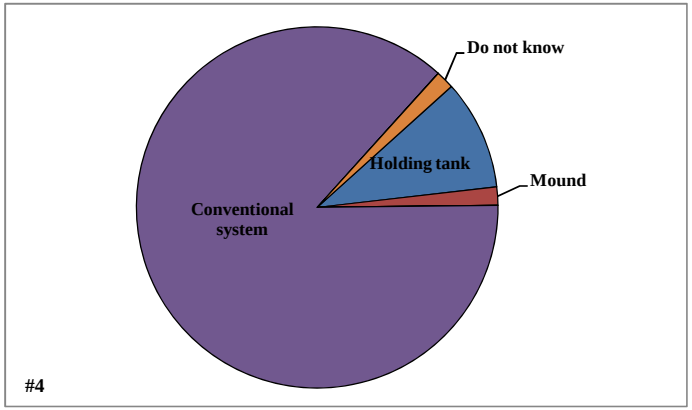
#3 How many years have you owned property on Muskellunge Lake?

	Total	%
1-5 years	12	*21.4*
6-10 years	7	*12.5*
11-15 years	10	*17.9*
16-20 years	7	*12.5*
21-25 years	5	*8.9*
>25 years	15	*26.8*
	56	*100.0*



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

	Total	%
Holding tank	6	*9.8*
Mound	1	*1.6*
Advanced treatment system	0	*0.0*
Conventional system	53	*86.9*
Municipal Sewer	0	*0.0*
Do not know	1	*1.6*
	61	*100.0*

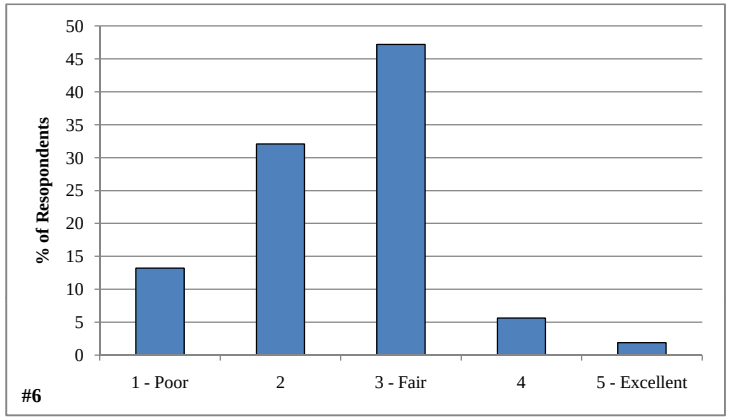


#5 Have you fished on Muskellunge Lake in the past 3 years?

	Total	%
No	12	*18.2*
Yes	54	*81.8*
	66	*100.0*

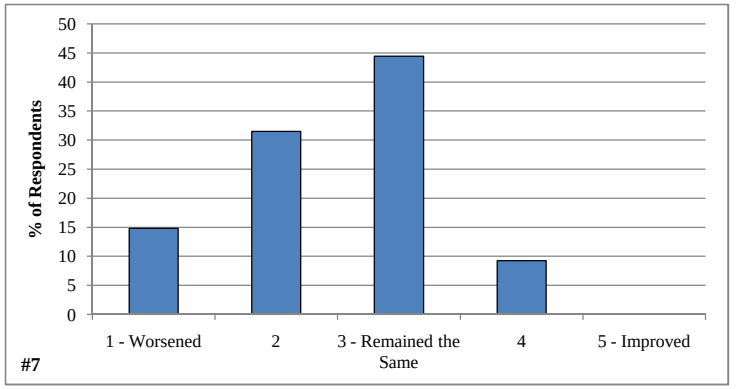
#6 How would you describe the current quality of fishing on Muskellunge Lake?

	Total	%
1 - Poor	7	*13.2*
2	17	*32.1*
3 - Fair	25	*47.2*
4	3	*5.7*
5 - Excellent	1	*1.9*
	53	*100.0*



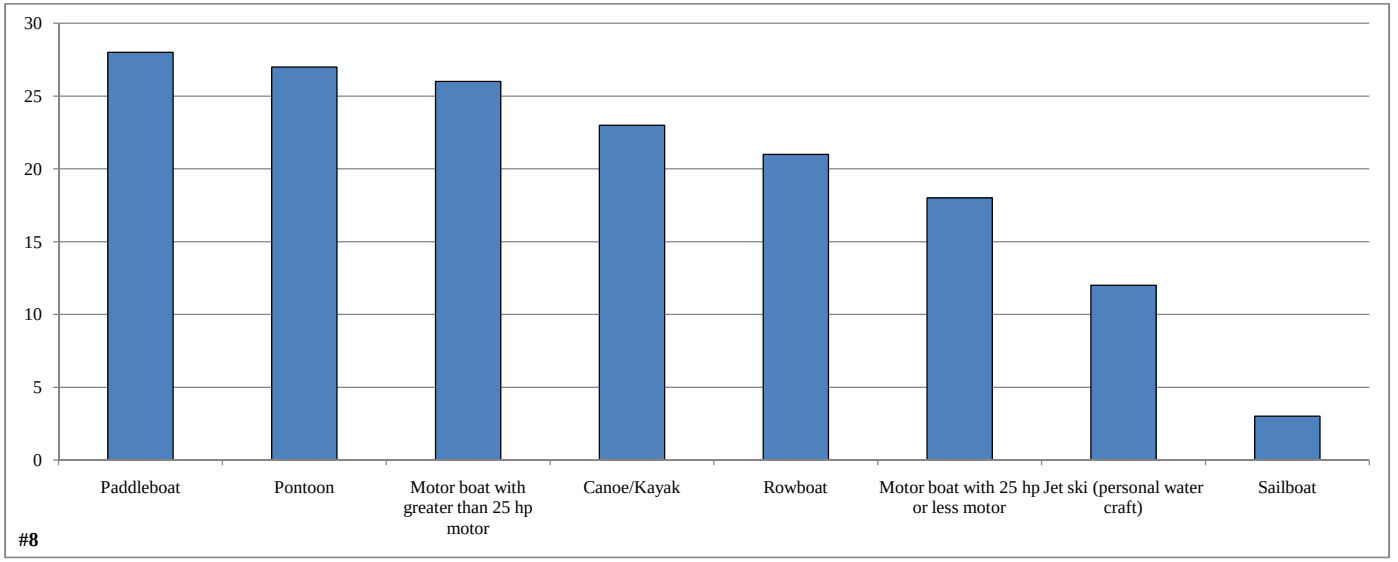
#7 How has the quality of fishing changed on Muskellunge Lake since you obtained your property?

	Total	%
1 - Worsened	8	*14.8*
2	17	*31.5*
3 - Remained the Same	24	*44.4*
4	5	*9.3*
5 - Improved	0	*0.0*
	54	*100.0*



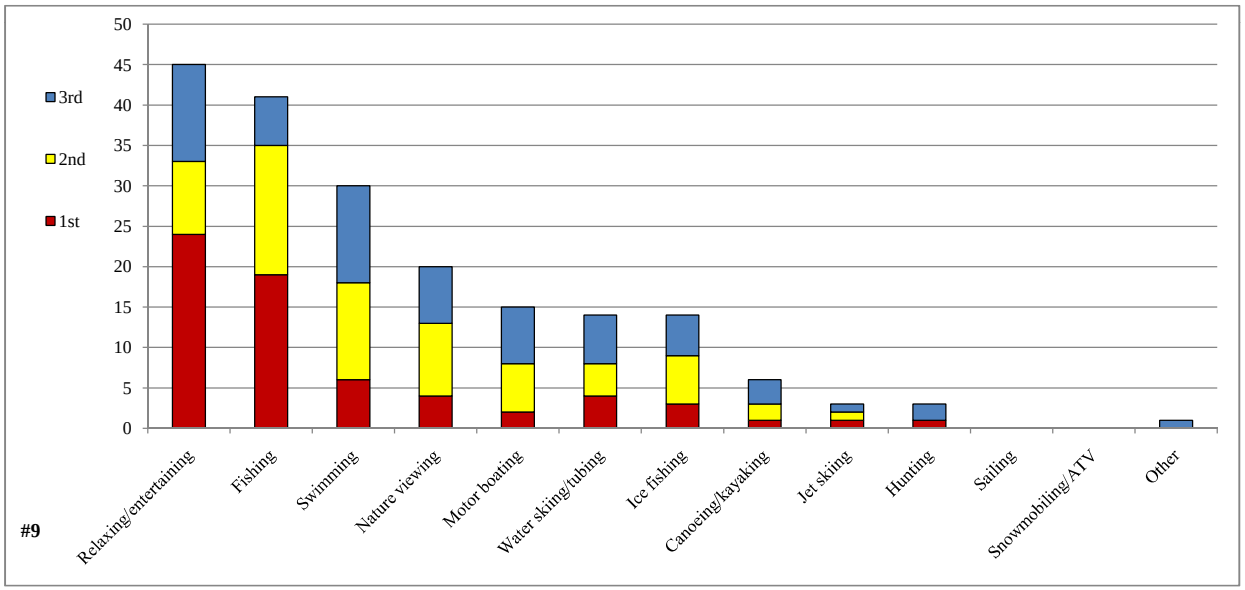
#8 What types of watercraft do you or others that use your property, currently use on the lake?

	Total
Paddleboat	28
Pontoon	27
Motor boat with greater than 25 hp motor	26
Canoe/Kayak	23
Rowboat	21
Motor boat with 25 hp or less motor	18
Jet ski (personal water craft)	12
Sailboat	3
	158



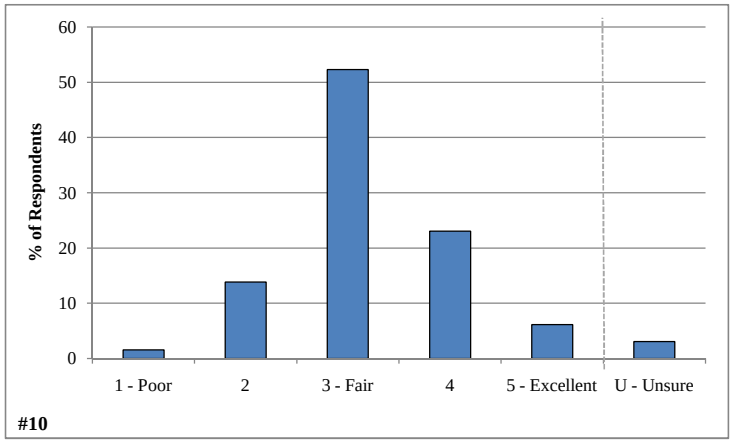
#9 Please rank the activities below that are the most important or enjoyable to you on Muskellunge Lake?

	1st	2nd	3rd	*% ranked*
Relaxing/entertaining	24	9	12	*23.1*
Fishing	19	16	6	*21.0*
Swimming	6	12	12	*15.4*
Nature viewing	4	9	7	*10.3*
Motor boating	2	6	7	*7.7*
Water skiing/tubing	4	4	6	*7.2*
Ice fishing	3	6	5	*7.2*
Canoeing/kayaking	1	2	3	*3.1*
Jet skiing	1	1	1	*1.5*
Hunting	1	0	2	*1.5*
Sailing	0	0	0	*0.0*
Snowmobiling/ATV	0	0	0	*0.0*
Other	0	0	1	*0.5*
	65	65	62	*98.5*



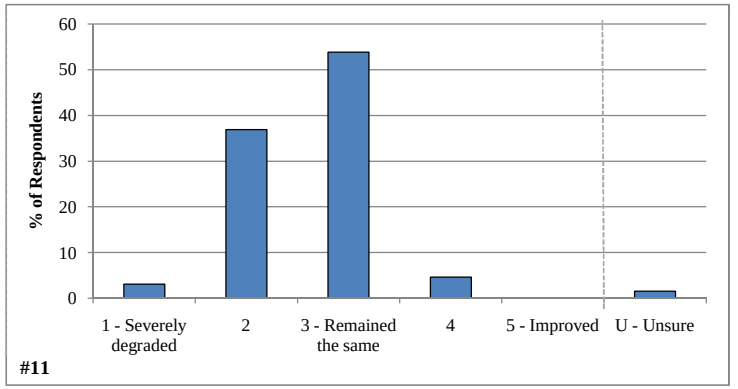
#10 How would you describe the current water quality of Muskellunge Lake?

	Total	%
1 - Poor	1	*1.5*
2	9	*13.8*
3 - Fair	34	*52.3*
4	15	*23.1*
5 - Excellent	4	*6.2*
U - Unsure	2	*3.1*
	65	*100.0*



#11 How has the water quality changed in Muskellunge Lake since you obtained your property?

	Total	%
1 - Severely degraded	2	*3.1*
2	24	*36.9*
3 - Remained the same	35	*53.8*
4	3	*4.6*
5 - Improved	0	*0.0*
U - Unsure	1	*1.5*
	65	*100.0*



#12 Have you ever heard of aquatic invasive species?

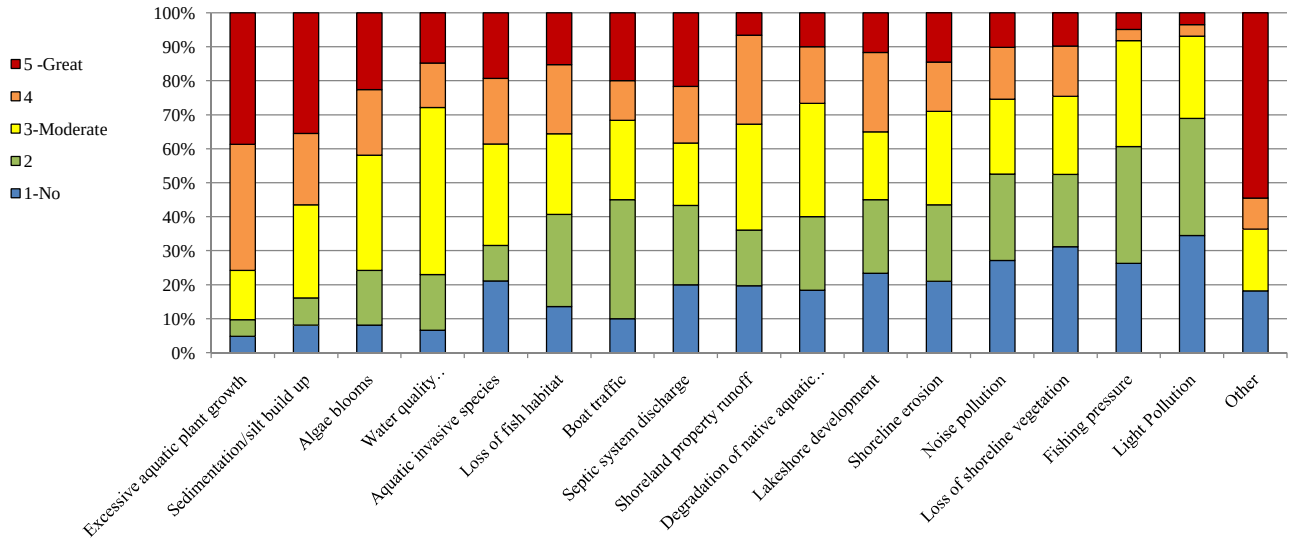
	Total	%
Yes	62	*95.4*
No	3	*4.6*
	65	*100.0*

#13 Are you aware of aquatic invasive species in Muskellunge Lake?

	Total	%
Yes	15	*24.2*
No	47	*75.8*
	62	*100.0*

#14 To what level do you believe each the following factors are negatively impacting Muskellunge Lake?

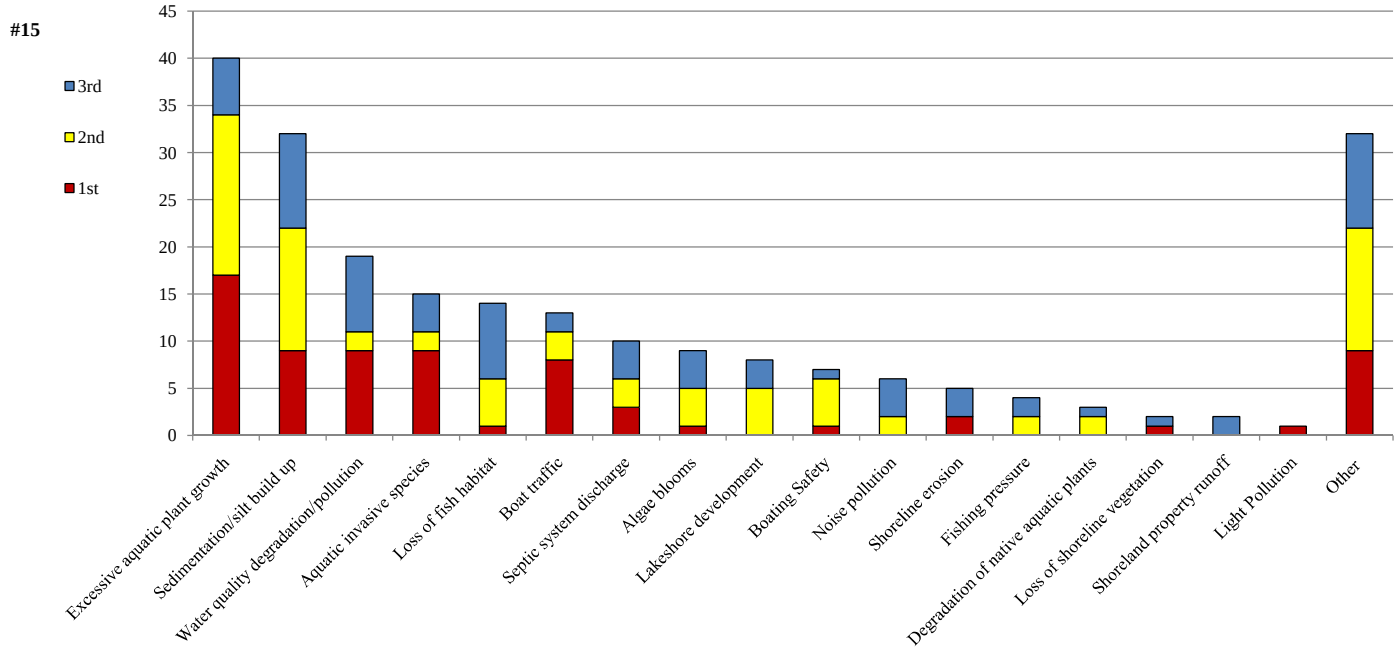
	1-No	2	3-Moderate	4	5 -Great	*Total*	*Average*
Excessive aquatic plant growth	3	3	9	23	24	*62*	*4.1*
Sedimentation/silt build up	5	5	17	13	22	*62*	*3.8*
Algae blooms	5	10	21	12	14	*62*	*3.5*
Water quality degradation/pollution	4	10	30	8	9	*61*	*3.2*
Aquatic invasive species	12	6	17	11	11	*57*	*3.2*
Loss of fish habitat	8	16	14	12	9	*59*	*3.1*
Boat traffic	6	21	14	7	12	*60*	*3.1*
Septic system discharge	12	14	11	10	13	*60*	*2.9*
Shoreland property runoff	12	10	19	16	4	*61*	*2.9*
Degradation of native aquatic plants	11	13	20	10	6	*60*	*2.9*
Lakeshore development	14	13	12	14	7	*60*	*2.8*
Shoreline erosion	13	14	17	9	9	*62*	*2.8*
Noise pollution	16	15	13	9	6	*59*	*2.6*
Loss of shoreline vegetation	19	13	14	9	6	*61*	*2.6*
Fishing pressure	16	21	19	2	3	*61*	*2.4*
Light Pollution	20	20	14	2	2	*58*	*2.0*
Other	2	0	2	1	6	*11*	*3.8*



#14

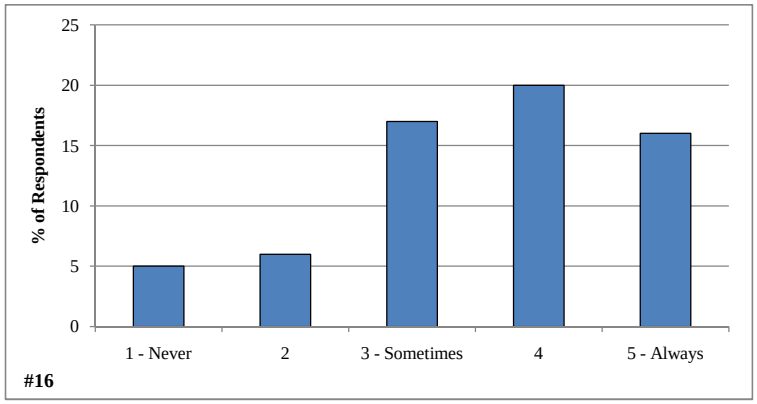
#15 From the list below, please rank your top three concerns regarding Muskellunge Lake?

	1st	2nd	3rd	*% Ranked*
Excessive aquatic plant growth	17	17	6	*51.3*
Sedimentation/silt build up	9	13	10	*41.0*
Water quality degradation/pollution	9	2	8	*24.4*
Aquatic invasive species	9	2	4	*19.2*
Loss of fish habitat	1	5	8	*17.9*
Boat traffic	8	3	2	*16.7*
Septic system discharge	3	3	4	*12.8*
Algae blooms	1	4	4	*11.5*
Lakeshore development	0	5	3	*10.3*
Boating Safety	1	5	1	*9.0*
Noise pollution	0	2	4	*7.7*
Shoreline erosion	2	0	3	*6.4*
Fishing pressure	0	2	2	*5.1*
Degradation of native aquatic plants	0	2	1	*3.8*
Loss of shoreline vegetation	1	0	1	*2.6*
Shoreland property runoff	0	0	2	*2.6*
Light Pollution	1	0	0	*1.3*
Other	9	13	10	*41.0*
	71	78	73	*284.6*



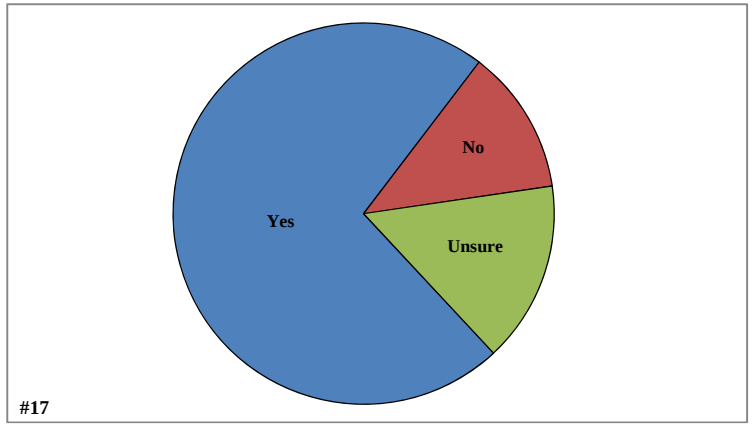
#16 How often does aquatic plant growth impact your enjoyment of Muskellunge Lake?

	Total	%
1 - Never	5	*7.8*
2	6	*9.4*
3 - Sometimes	17	*26.6*
4	20	*31.3*
5 - Always	16	*25.0*
	64	*100.0*



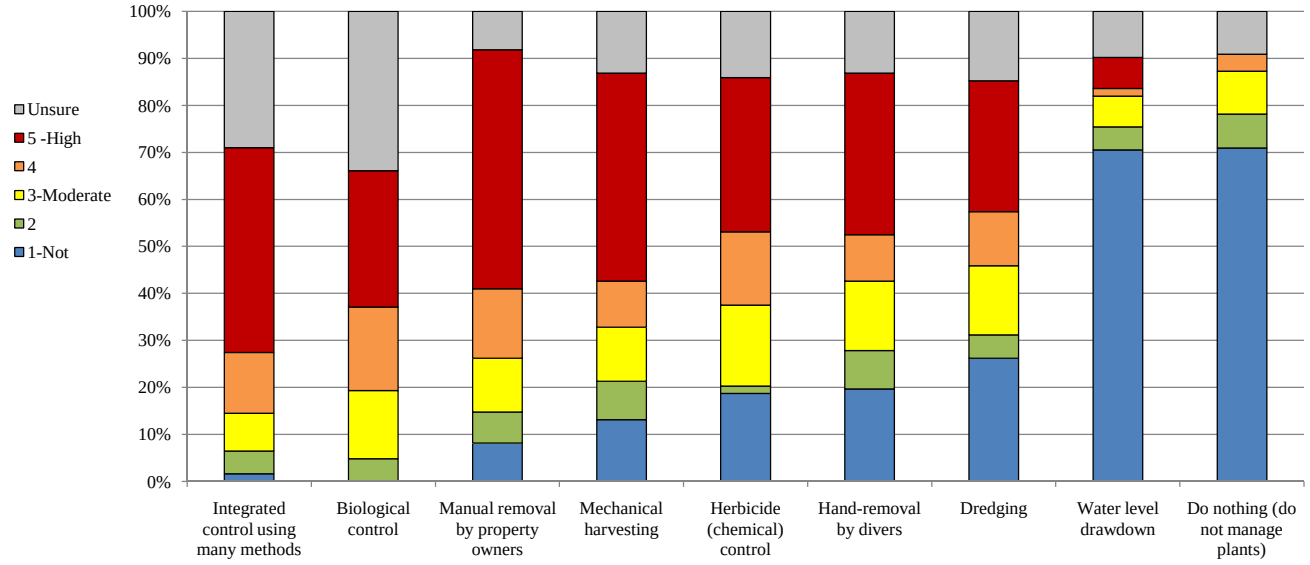
#17 Considering your answer to the question above, do you believe aquatic plant control is needed on Muskellunge Lake?

	Total	%
Yes	47	*72.3*
No	8	*12.3*
Unsure	10	*15.4*
	65	*100.0*



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

	0	1-Not	2	3-Moderate	4	5 -High	Unsure	*Total*	*Average*	
Integrated control using many methods		1	3	5	8	27	18	*62*	*4.8*	
Biological control		0	3	9	11	18	21	*62*	*4.6*	
Manual removal by property owners		5	4	7	9	31	5	*61*	*4.1*	
Mechanical harvesting		8	5	7	6	27	8	*61*	*4.0*	
Herbicide (chemical) control		12	1	11	10	21	9	*64*	*3.9*	
Hand-removal by divers		12	5	9	6	21	8	*61*	*3.8*	
Dredging		16	3	9	7	17	9	*61*	*3.5*	0.540984
Water level drawdown		43	3	4	1	4	6	*61*	*2.0*	
Do nothing (do not manage plants)		39	4	5	2	0	5	*55*	*1.8*	



#18

#19 Before receiving this mailing, have you ever heard of the Muskellunge Lake Protection & Rehabilitation District?

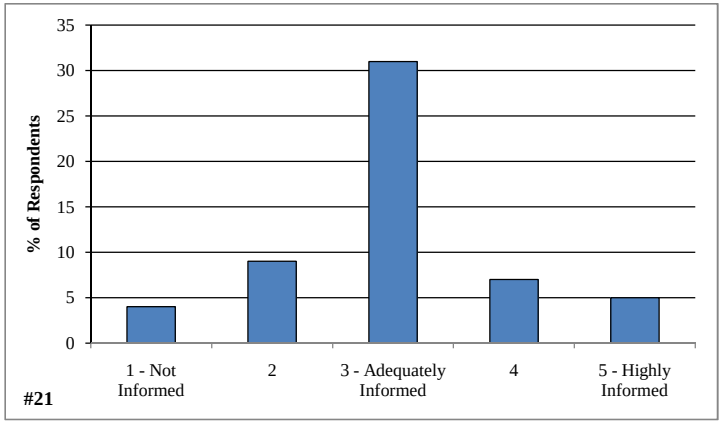
	Total	%
Yes	56	*86.2*
No	8	*12.3*
	64	*98.5*

#20 Are you currently a member of the Muskellunge Lake Protection & Rehabilitation District?

	Total	%
Yes	41	*63.1*
No	11	*16.9*
	52	*80.0*

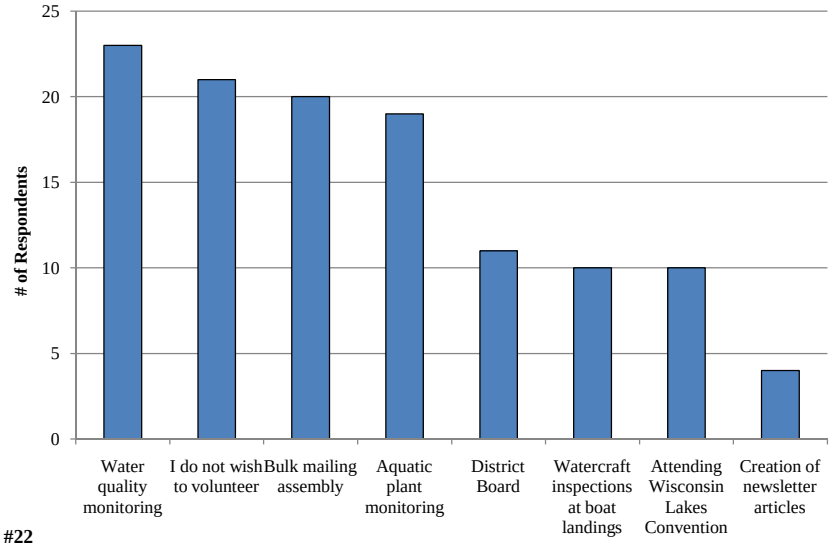
#21 Do you believe the Muskellunge Lake Protection & Rehabilitation District has kept you adequately informed regarding issues with Muskellunge Lake and its management?

	Total	%
1 - Not Informed	4	*7.1*
2	9	*16.1*
3 - Adequately Informed	31	*55.4*
4	7	*12.5*
5 - Highly Informed	5	*8.9*
	56	*100.0*



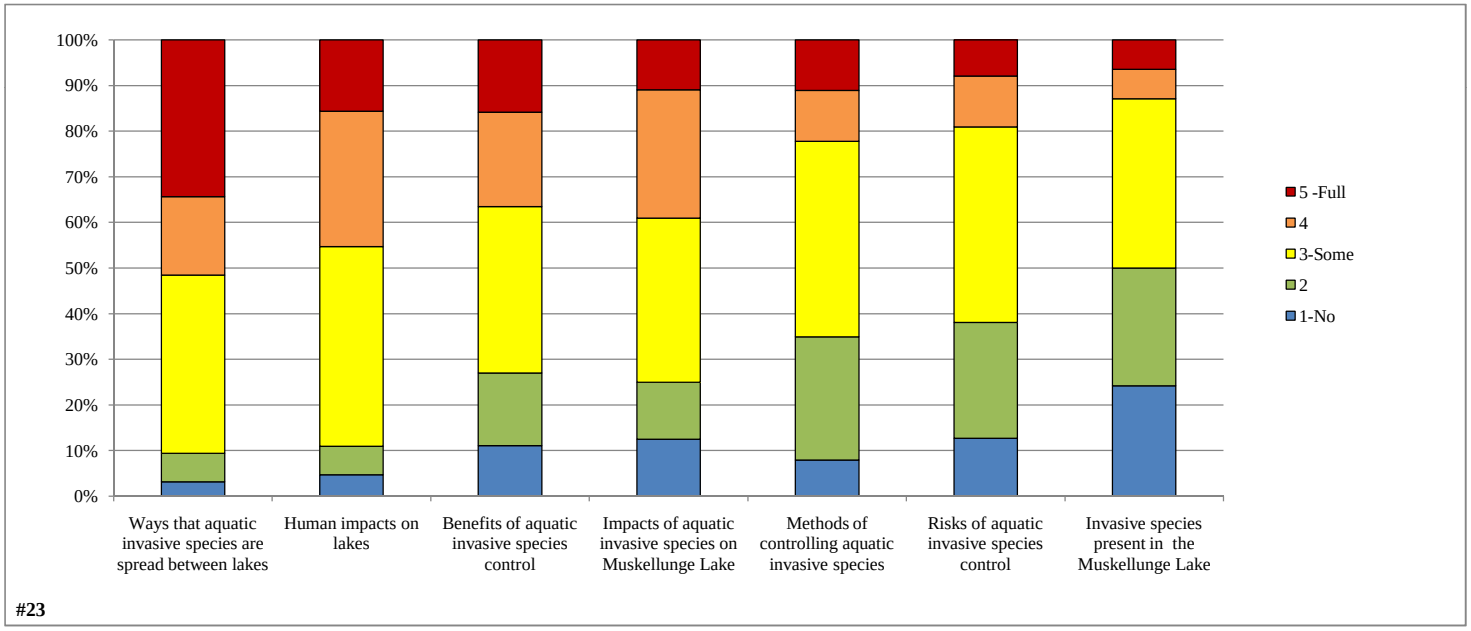
#22 Please circle the activities you would be willing to participate in if called upon.

	Total
Water quality monitoring	23
I do not wish to volunteer	21
Bulk mailing assembly	20
Aquatic plant monitoring	19
District Board	11
Watercraft inspections at boat landings	10
Attending Wisconsin Lakes Convention	10
Creation of newsletter articles	4
	118



#23 **Please describe your level of understanding of each of the following lake management issues.**

	1-No	2	3-Some	4	5 -Full	*Total*	*Average*
Ways that aquatic invasive species are spread b	2	4	25	11	22	*64*	*3.7*
Human impacts on lakes	3	4	28	19	10	*64*	*3.3*
Benefits of aquatic invasive species control	7	10	23	13	10	*63*	*3.1*
Impacts of aquatic invasive species on Muskellunge Lake	8	8	23	18	7	*64*	*3.0*
Methods of controlling aquatic invasive	5	17	27	7	7	*63*	*2.8*
Risks of aquatic invasive species control	8	16	27	7	5	*63*	*2.7*
Invasive species present in the Muskellunge Lake	15	16	23	4	4	*62*	*2.3*



NUMBER	COMMENTS
1	No Comments
2	#24: DNR personnel in the Big City which they cannot regulate. They have little or no Hands on Knowledge of what really it's like to manage a lake. We as property owner must take back control of our property and lakes from DNR and work to improve our property Just like "Big" City Folks.
3	No Comment
4	#24: We had 3 very small walleye plantings. For a while we had a fishable number of walleyes, I know there is little natural reproduction on the lake. Planting would be needed. What fish that were planted turned into quality fish. There are some against planting. A vote at meetings are close but losing. A survey of all property owners might give a better idea of all opinions. I think we are missing out on a way of improving fishing for a lot of people.
5	#14q. Weeds #24: Weeds & Sediment has been a problem in our lake since we bought our property. If any thing it has gotten worse instead of better. It has been talked about and discussed many times, but nothing is done to change it and it continually gets worse. If nothing else allow the owners to do what is needed in the water by them to pull and or get rid of all weeds and sediment. Clean out all of the weeds or make a wider path by the channel that flows out of our lake so the dead weeds will move OUT!
6	No Comments
7	No Comments
8	No Comments
9	#15r. Wish we could use our dock for boating again. #24: We wish you would control the excessive weed growth by docks so people can use our lake. Not it is useless to us.
10	No Comments
11	No Comments
12	#24: Should have a no-wake zone for lake. Lakeshore development more closely watched and managed.
13	15r. -Jet Ski traffic #24: In the interest of safety boats pulling skiers should follow on way along shore line on the right side.
14	14q. too many jet ski's and boat traffic – come way to close to our shoreline and pier.
15	No Comments
16	No Comments
17	No Comments
18	No Comments
19	No Comments

NUMBER	COMMENTS
20	#24: The lake association has been studying this lake for the past many years. But other than putting in some cribs, we have not seen any follow through as a result of these studies. We hope that this will not be the case as a result of this study. It would be nice if those of us that are blocked in by aquatic plants could get some assistance from the lake association in removing enough of these plants so that we again could enjoy our lake.
21	#14q. sediment muck
22	No Comments
23	No Comments
24	No Comments
25	#24: As a property owner on the southwest side of the lake, by the creek, my biggest concern is the abundant amount of weeds in area. I would like to see about 75% of these weeds removed and keep approx. 25% of weeds in area for fish shelter/habitat. I really like getting up to the cabin & getting out fishing & just relaxing. I have about 1 ½ years before I retire & will be a full time resident. I think the lake association is doing a good job with its management program with all the issues.
26	No Comments
27	No Comments
28	No Comments
29	No Comments
30	#24: Boat launch Channel has a muck / silt problem that is getting worse. Weed control is a must. Need stocking of game fish – muskies and walleyes to eat stunted blue gills that contain parasites. Crappie fishing is good in spring but need more game fish.
31	#24: Cut weed plant fish
32	#24: Taxes are to High. Property owners even if not residents should be allowed to vote in elections.
33	#24: Currently is there any control of chemical weed removal by residents on the lake?
34	#24: It would be great to thin down the amount of weeds.
35	#24: Thank you!
36	No Comments
37	No Comments
38	No Comments
39	#24: I am writing in response to the survey that you sent to me regarding the Muskellunge Lake Management Planning Project. I have owned this property for about four years. When the property was purchased the intent was to retire on this property but over the years it is becoming increasingly evident we are going to re-evaluate this based on our concerns as the frontage is becoming more of a fisherman's frontage. There appears to be no concern for the overgrowth of aquatic weeds and the silt. Our shoreline has become unusable because of the silt build up and overgrowth of aquatic

NUMBER	COMMENTS
	weeds. The excessive silt makes the ability to use our property for swimming frontage impossible because you sink to your waist in muck as you walk from the shoreline. Pier placement and removal is also difficult because of the excessive silt. The overgrowth of aquatic weeds is so excessive that it makes getting out to the center of the lake extremely difficult. Clearly if you want residents to stay and attract people to the lake so that they can enjoy swimming and fishing the lake needs to be dredged and the aquatic plant life controlled. If this isn't done you will loose the ability to market this area as nothing more than a fishing lake with fisherman's frontage and not as a recreational lake. If this is happening it will decrease the value of the overall area and will prevent future property development on the lake.
40	#24: North end of the lake the weeds are going into big part of lake. South end of lake weeds growth Planting fish like Muskie & Walleye fish no bluegill or sunfish Since we have been attending meeting in 10 – 12 years of going to meeting. Things get vetoed (voted) on and then the Lake Board doesn't go through with it. Lake Board does nothing worth while for the lake especially the weed growth on the lake. The Board doesn't listen to the people who use the lake.
41	#14e. 5 Could #14q. 5 Not planting fish #24: We have done several studies of the lake since I have been here (14 years) no action or little action has been taken. I think we will just be wasting our money on this study. I'll be waiting to see what happens.
42	#24: Concerned about dick lice in lake.
43	No Comments
44	#9m – Pontooning #24: We have been here for almost 2 years. Many people have stated to us that there have been other surveys and nothing has been done to improve this lake. Please don't let this happen with this survey. Also run off from septic systems should be exposed and fixed.
45	No Comments
46	#15r- Jet Skies #24: I have nothing against Jet Skies but doubt if this lake is capable for their use. After their heavy use, there are large amounts of sediment stirred up.
47	No Comments
48	#24: New property owners are either not aware or do not care about observing rules & respect for the lake. Too many people have not obtained permission to alter shoreline. They

NUMBER	COMMENTS
	should have to show proof of permission. Pay a fine if not & made to remove rocks or whatever built on shoreline. Enforce laws pertaining to distance from shore that boats speed & ski. Citizens need to be able to report repeated offenders & know they will be reprimanded Too many offensive "yard lights." Fireworks out of control – offenders should be fined.
49	#14q. Personal water crafts (Jet skies) #15r. Jet Skies #24: Some questions refer to boat traffic, silt & H2O quality. I feel we can start the process by either eliminating PWC traffic or restricting it. I am not against PWC'S, but I am strongly against there use on our lake. Because of the size and shape of our lake. Because of the propulsion system they damage underlying shoreline & plant life, & fish habitat. I also feel there will be an accident, it is a matter of time. I also think the new fish regs are helping a lot regulating fishing quality. Bigger Bluegill I do not feel the boat inspections will help because we will not be able to inspect all boats 24/7 and there are limits to what can be enforced by us. As civilians we can only inform & suggest. We need to have home owners stop shoreline beautification and keep shorelines more natural. I am sure this is NOT enforced over the past 6 years I have owned the property. i.e. many retaining block walls, three removed for the view etc.
50	No comments
51	#14 q. To many Jet Ski lack of education in operation #24: I would like to see the silt build up improve all over the lake especially the boat landing also weed control.
52	No Comments
53	No Comments
54	No Comments
55	#14q. Beaver dams: Open up the water flow #15q. No bottom – die-ing lake #24: It's becoming a lake with no bottom.
56	#24: I think the 2 main concerns of mine are the Aquatic invasive weeds & sewer run off or discharge. I don't think any home owner should be able to discharge any water waste of any kind into the water. This makes for bad water quality and it helps the weeds grow.

NUMBER	COMMENTS
57	#9m. Pontoon #13a. Plants #14q. Ban lawn fertilizer #24 No Comments
58	No Comments
59	#14q. There are too many boats suitable for Lake Michigan on this small 163 acre lake. #21 3 to 2 Usually Adequately Informed, but more uninformed #24: I believe that the heavy large boat traffic on Muskellunge lake is creating the following problems. 1. The wake from some boats is above 3 to 4 feet when hitting the shore line. Also, some of these wakes are big enough to go over the backs and sides of 16 ft. fishing boats. 2. Disturbing the muck on the bottom possibly releasing locked in pollution. 3. The cutting of aquatic vegetation and muck that washes up on my beach
60	#24: Since I've lived here – we had 2 DNR fish counts – both times I requested counts made – Did not receive any. Please put in next mailing 8 years ago- Lake specialist we paid for recommend. Leaving northern (pike) to eat pan fish taking only northern (pike) over 25". Seamed to work well as pan fish got bigger. The last person who was from DNR said we should look at making this a bass lake and keep all northern. Tomahawk is not a southern city lake where everybody wants a bass lake. If we want to ADD walleye and Muskellunges to our lake we should. This last specialist was not in agreement with. I just wonder what this next specialist will ADVISE. We should look at all 3 when this one is done – and vote on only one recommendation and stick with it. Thank you.
61	No Comments
62	No Comments
63	No Comments
64	No Comments
65	No Comments
66	Cut aquatic plants. Remove all muck from lake, plant fish, walleye, perch, musky a lot of them. Do all this now. Set up a long term program to keep up with removing plants, muck, and planting walleye, musky year after year. Looking forward to seeing a great lake!!

C

APPENDIX C

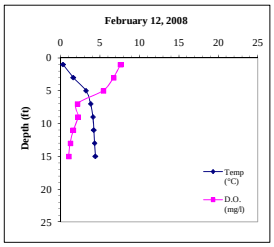
Water Quality Data

Muskellunge

Date: 02-12-08
Time:
Weather: Hazy Sun 5°F
Ent: BTB **Verf:**

Max Depth (ft): 17.0
MLS Depth (ft): 3.0
MLB Depth (ft): 15.0
Secchi Depth (ft): 8.2

Depth (ft)	Temp (°C)	D.O. (mg/l)	pH	Sp. Cond (µS/cm)
1.0	0.3	7.6	6.5	136
3.0	1.6	6.7	6.4	136
5.0	3.2	5.4	6.7	132
7.0	3.8	2.1	6.5	132
9.0	4.1	2.2	6.5	134
11.0	4.2	1.6	6.4	136
13.0	4.3	1.2	6.4	136
15.0	4.4	1.0	6.4	138



Parameter	MLS	MLB
Total P (µg/L)	15.000	18.000
Dissolved P (µg/L)	ND	17.000
Chl a (µg/L)	NA	NA
TKN (µg/L	320.00	430.00
NO3+NO2-N (µg/L)	242.000	282.000
NH3-N (µg/L)	ND	44.000
Total N (µg/L)	562.00	712.00
Lab Cond. (µS/cm)	136	138
Lab pH	6.40	6.40
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	ND	ND
Calcium (mg/l)	ND	ND

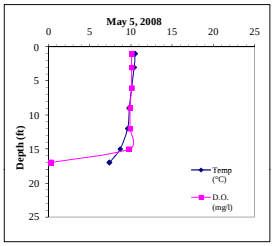
Data collected by TAH and EJH (Onterra)
ICE - 1.2 ft

Muskellunge

Date: 05-05-08
Time: 1:50
Weather: Sunny, light breeze, 55F
Ent: BTB **Verf:**

Max Depth (ft): 21.0
MLS Depth (ft): 3.0
MLB Depth (ft): 19.0
Secchi Depth (ft): 4.1

Depth (ft)	Temp (°C)	D.O. (mg/l)	pH	Sp. Cond (µS/cm)
1.0	10.5	10.1	8	112
3.0	10.4	10.1	7.6	113
6.0	10.1	10.1	7.4	112
9.0	9.8	9.9	7.3	113
12.0	9.6	9.9	7.2	112
15.0	8.7	9.8	7	113
17.0	7.4	0.3	6.8	263



Parameter	MLS	MLB
Total P (µg/L)	28.000	23.000
Dissolved P (µg/L)	ND	6.000
Chl a (µg/L)	7.80	NA
TKN (µg/L	430.00	350.00
NO3+NO2-N (µg/L)	118.000	117.000
NH3-N (µg/L)	31.000	45.000
Total N (µg/L)	548.00	467.00
Lab Cond. (µS/cm)	119	119
Lab pH	7.44	7.32
Alkal (mg/l CaCO3)	33	33
Total Susp Sol (mg/l)	3	2
Calcium (mg/l)	10.8	NA

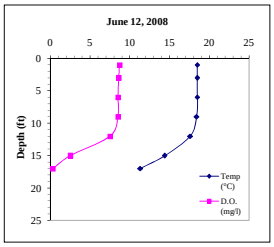
Data collected by BTB and SNK (Onterra)

Muskellunge

Date: 06-12-08
Time: 11:15
Weather: 100% Clouds, Rain in Vicinity, 62°F
Ent: BTB **Verf:**

Max Depth (ft): 18.6
MLS Depth (ft): 3.0
MLB Depth (ft): 17.0
Secchi Depth (ft): 6.4

Depth (ft)	Temp (°C)	D.O. (mg/l)	pH	Sp. Cond (µS/cm)
1.0	18.5	8.7	7.7	115
3.0	18.5	8.6	7.7	115
6.0	18.5	8.5	7.7	115
9.0	18.4	8.5	7.7	114
12.0	17.6	7.5	7.3	115
15.0	14.4	2.5	6.8	119
17.0	11.3	0.3	6.6	122



Parameter	MLS	MLB
Total P (µg/L)	21.000	47.000
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	3.88	NA
TKN (µg/L	450.00	NA
NO3+NO2-N (µg/L)	ND	NA
NH3-N (µg/L)	ND	NA
Total N (µg/L)	450.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	7.70	6.60
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	3	NA
Calcium (mg/l)	NA	NA

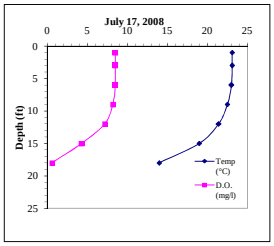
Data collected by BTB and SNK (Onterra)

Muskellunge

Date: 07-17-08
Time: 9:00
Weather: 100 % Clouds, 64 F
Ent: BTB **Verf:**

Max Depth (ft): 19.7
MLS Depth (ft): 3.0
MLB Depth (ft): 18.0
Secchi Depth (ft): 9.0

Depth (ft)	Temp (°C)	D.O. (mg/l)	pH	Sp. Cond (µS/cm)
1.0	23.1	8.5	8.1	119.0
3.0	23.1	8.5	8.0	119.0
6.0	23.0	8.5	8.1	119.0
9.0	22.5	8.2	7.8	120.0
12.0	21.4	7.2	7.2	120.0
15.0	19.0	4.3	6.8	122.0
18.0	14.0	0.6	6.9	239.0



Parameter	MLS	MLB
Total P (µg/L)	18.00	111.00
Dissolved P (µg/L)	4.000	6.000
Chl a (µg/L)	0.94	NA
TKN (µg/L	480.00	1730.00
NO3+NO2-N (µg/L)	ND	ND
NH3-N (µg/L)	ND	ND
Total N (µg/L)	480.00	1730.00
Lab Cond. (µS/cm)	122	133
Lab pH	7.95	7.23
Alkal (mg/l CaCO3)	36	43
Total Susp Sol (mg/l)	ND	17
Calcium (mg/l)	NA	NA

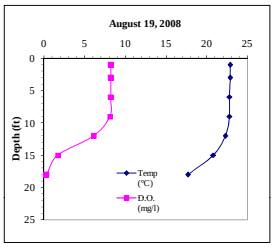
Data collected by BTB and SNK (Onterra)

Muskellunge

Date: 08-19-08
Time: 10:15
Weather: Full sun, 65F, breezy
Ent: BTB **Verf:**

Max Depth (ft): 19.6
MLS Depth (ft): 3.0
MLB Depth (ft): 18.0
Secchi Depth (ft): 6.0

Depth (ft)	Temp (°C)	D.O. (mg/l)	pH	Sp. Cond (µS/cm)
1.0	22.9	8.2	7.8	124.0
3.0	22.9	8.2	7.8	124.0
6.0	22.8	8.2	7.8	124.0
9.0	22.8	8.1	7.7	124.0
12.0	22.3	6.1	7.2	125.0
15.0	20.8	1.7	6.7	129.0
18.0	17.7	0.3	6.9	210.0



Parameter	MLS	MLB
Total P (µg/L)	20.000	39.000
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	6.96	NA
TKN (µg/L	300.00	NA
NO3+NO2-N (µg/L)	ND	NA
NH3-N (µg/L)	ND	NA
Total N (µg/L)	300.00	NA
Lab Cond. (µS/cm)	NA	NA
Lab pH	7.80	6.90
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	ND	NA
Calcium (mg/l)	NA	NA

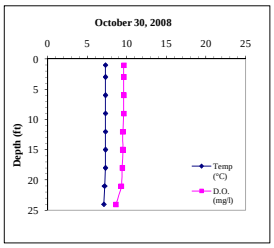
Data collected by BTB (Onterra)

Muskellunge

Date: 10-30-08
Time: 10:00
Weather: 40 F, clear, light breeze
Ent: BTB **Verf:**

Max Depth (ft): 25.5
MLS Depth (ft): 3.0
MLB Depth (ft): 22.0
Secchi Depth (ft): 4.8

Depth (ft)	Temp (°C)	D.O. (mg/l)	pH	Sp. Cond (µS/cm)
1.0	7.3	9.6	6.8	123
3.0	7.3	9.6	6.5	123
6.0	7.3	9.6	6.5	123
9.0	7.3	9.6	6.5	124
12.0	7.3	9.5	6.7	124
15.0	7.3	9.5	6.7	124
18.0	7.3	9.4	6.8	124
21.0	7.2	9.3	6.7	124
24.0	7.1	8.6	6.6	126



Parameter	MLS	MLB
Total P (µg/L)	27.000	29.000
Dissolved P (µg/L)	NA	NA
Chl a (µg/L)	17.20	NA
TKN (µg/L	440.00	NA
NO3+NO2-N (µg/L)	ND	NA
NH3-N (µg/L)	24.000	NA
Total N (µg/L)	440.00	NA
Lab Cond. (µS/cm)	123	124
Lab pH	6.50	6.70
Alkal (mg/l CaCO3)	NA	NA
Total Susp Sol (mg/l)	4	4
Calcium (mg/l)	NA	NA

Data Collected by TAH, AAH, MJH (Onterra)

Water Quality Data

2008	Surface		Bottom	
Parameter	Count	Mean	Count	Mean
Secchi Depth (feet)	6	6.4	NA	NA
Total P (µg/L)	6	21.5	6	44.5
Dissolved P (µg/L)	1	4.0	3	9.7
Chl a (µg/L)	5	7.4	NA	NA
TKN (µg/L	6	403.3	3	836.7
NO3+NO2-N (µg/L)	6	180.0	2	199.5
NH3-N (µg/L)	6	27.5	2	44.5
Total N (µg/L)	6	463.3	3	969.7
Lab Cond. (µS/cm)	4	125.0	4	128.5
Lab pH	6	7.3	6	6.9
Alkal (mg/l CaCO3)	2	34.3	2	38.4
Total Susp Sol (mg/l)	6	3.3	3	7.7
Calcium (µg/L)	1	10.8	NA	NA

Wisconsin Trophic State Index (WTSI)			
Year	TP	Chla	SD
1979	53.50	47.14	43.93
1997	57.23	49.64	49.49
2000			
2001	56.03		
2004	53.19	50.31	47.15
2008	51.32	45.03	48.81
All Years (weighted)	53.75	47.37	47.70
WI Natural Lakes	53.19	54.23	47.33
Northeast Region	51.05	51.49	45.61

Morphological / Geographical Data

Parameter	Value
Acreage	159
Volume (acre-feet)	1771.3
Perimeter (miles)	3.9
Shoreland Development	
Maximum Depth (feet)	26
County	Lincoln County
WBIC	1555500
Lillie Mason Region(1983)	Northeast Region
Nichols Ecoregion(1999)	NLFF

Watershed Data

WiLMS Class	Acreage	kg/yr	lbs/yr
Forest	902.7		
Open Water	159.0		
Pasture/Grass	119.4		
Row Crops	7.7		
Urban - Rural Residential			
Wetland	305.7		

Watershed to Lake Area	8	:1

	Secchi (feet)				Chlorophyll a (µg/L)				Phosphorus (µg/L)				Phosphorus (µg/L)				Nitrogen (µg/L)			
	Growing Season		Summer		Growing Season		Summer		Growing Season				Spring Turnover		Fall Turnover		Spring Turnover		Fall Turnover	
Year	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean
1979	1	10	1	10	1	5.21	1	5.21	1	26	1	26								
1997	3	6.7	1	6.8	3	11.26	1	7.27	3	45.33	1	42								
2000	4	5.25																		
2001									2	37.5	1	36								
2004	2	7.5	1	8	1	7.95	1	7.95	2	22.5	1	25								
2008	5	6.06	3	7.13	5	7.36	3	3.93	5	22.8	3	19.67	1	28	1	27	1	548	1	440
All Years (weighted)		6.4		7.7		8.4		5.4		30.5		26.9								
WI Natural Lakes				7.9				13.4				25								
Northeast Region				8.9				9.3				19								

D

APPENDIX D

Watershed Analysis WiLMS Results

Date: 3/24/2010 Scenario: Muskellunge_Current

Lake Id: Muskellunge
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 1335.5 acre
Total Unit Runoff: 11.70 in.
Annual Runoff Volume: 1302.1 acre-ft
Lake Surface Area <As>: 159.0 acre
Lake Volume <V>: 1771.3 acre-ft
Lake Mean Depth <z>: 11.1 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 1371.0 acre-ft/year
Areal Water Load <qs>: 8.6 ft/year
Lake Flushing Rate <p>: 0.77 1/year
Water Residence Time: 1.29 year
Observed spring overturn total phosphorus (SPO): 28.0 mg/m^3
Observed growing season mean phosphorus (GSM): 22.8 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	7.7	0.50	1.00	3.00	3.8	2	3	9
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	119.4	0.10	0.30	0.50	17.6	5	14	24
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	305.7	0.10	0.10	0.10	15.1	12	12	12
Forest	902.7	0.05	0.09	0.18	40.0	18	33	66
Lake Surface	159.0	10.10	0.30	1.00	23.5	650	19	64

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)	1514.4	181.1	388.0	100.0
Total Loading (kg)	686.9	82.2	176.0	100.0
Areal Loading (lb/ac-year)	9.52	1.14	2.44	
Areal Loading (mg/m^2-year)	1067.58	127.70	273.50	
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)	81.6	138.6	246.1	100.0
Total NPS Loading (kg)	37.0	62.9	111.6	100.0

Phosphorus Prediction and Uncertainty Analysis Module

Date: 3/24/2010 Scenario: 6
Observed spring overturn total phosphorus (SPO): 28.0 mg/m^3
Observed growing season mean phosphorus (GSM): 22.8 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	212	25	54	2	9
Canfield-Bachmann, 1981 Natural Lake	104	23	41	0	0
Canfield-Bachmann, 1981 Artificial Lake	76	22	35	-1	-4
Rechow, 1979 General	72	9	19	-14	-61
Rechow, 1977 Anoxic	301	36	77	13	57
Rechow, 1977 water load<50m/year	144	17	37	-6	-26
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	211	25	54	-3	-11
Vollenweider, 1982 Combined OECD	115	20	38	-5	-20
Dillon-Rigler-Kirchner	106	13	27	-15	-54
Vollenweider, 1982 Shallow Lake/Res.	103	16	31	-9	-35
Larsen-Mercier, 1976	190	23	49	-5	-18
Nurnberg, 1984 Oxic	111	13	28	-10	-44

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	0	45	FIT	0	GSM
Canfield-Bachmann, 1981 Natural Lake	7	66	FIT	1	GSM
Canfield-Bachmann, 1981 Artificial Lake	7	63	FIT	1	GSM
Rechow, 1979 General	0	16	FIT	0	GSM
Rechow, 1977 Anoxic	0	64	FIT	0	GSM
Rechow, 1977 water load<50m/year	0	31	FIT	0	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	0	48	FIT	0	SPO
Vollenweider, 1982 Combined OECD	0	37	FIT	0	ANN
Dillon-Rigler-Kirchner	0	23	FIT	0	SPO
Vollenweider, 1982 Shallow Lake/Res.	0	30	FIT	0	ANN
Larsen-Mercier, 1976	0	40	P Pin	0	SPO
Nurnberg, 1984 Oxic	0	24	FIT	0	ANN

Water and Nutrient Outflow Module

Date: 3/24/2010 Scenario: 6
Average Annual Surface Total Phosphorus: 22.8mg/m^3
Annual Discharge: 1.37E+003 AF => 1.69E+006 m^3
Annual Outflow Loading: 81.1 LB => 36.8 kg

E

APPENDIX E

2008 Aquatic Plant Survey Data

Number	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Comments	Brasenia schreberi	Ceratophyllum demersum	Chara sp.	Elatine minima	Elodea canadensis	Heteranthera dubia	Isoetes echinospora	Juncus pelocarpus	Lemna trisulca	Lobelia dortmanna	Megalodonta beckii	Myriophyllum sibiricum	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Pontederia cordata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton foliosus	Potamogeton friesii	Potamogeton gramineus	Potamogeton natans	Potamogeton praelongus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton vaseyi	Potamogeton zosteriformis	Ranunculus flammula	Sagitaria sp. (rosette)	Schoenoplectus acutus	Sparganium fluctuans	Spirodella polyrrhiza	Utricularia intermedia	Utricularia vulgaris	Utricularis gibba	Vallisneria americana
1	-89.69573	45.53656	1	M	P			1																																				
2	-89.69521	45.53692	1	M	P																			1									1								1			
3	-89.69521	45.53656	1	M	P			1																																	1			
4	-89.69470	45.53692	5	M	P			2																										1			1							
5	-89.69470	45.53656	4	M	P												1	1				1													1									
7	-89.69419	45.53728	4	M	P			1												1		1		1									1		1	1							
8	-89.69419	45.53692	4	M	P			1										1									1									1							
9	-89.69419	45.53656	6	M	P			2																							1					1							
10	-89.69419	45.53620	3	M	P						1											1												1									
12	-89.69367	45.53728	6	M	P			1										1									1				1		1		1							
13	-89.69368	45.53692	14	-	R	No Vegetation																																					
14	-89.69368	45.53656	9	-	R			2																			1								1								
15	-89.69368	45.53620	4	M	P		1	2			2											1												1								
16	-89.69368	45.53584	3	M	P		1	1			1											1	1																			1		
17	-89.69368	45.53548	4	M	P			1			1						1																3									
18	-89.69369	45.53512	4	M	P						1							1					1													1							
19	-89.69369	45.53476	3	M	P			1															1																		1			
20	-89.69369	45.53440	2	M	P		1	1				1					1						1													1							
21	-89.69316	45.53728	6	-	R			3																			1																
22	-89.69316	45.53692	17	-	R	No Vegetation																																					
23	-89.69317	45.53656	16	-	R	No Vegetation																																					
24	-89.69317	45.53620	6	M	P			1			1																																
25	-89.69317	45.53584	6	M	P			1																			1								1								
26	-89.69317	45.53548	7	M	P			1										1																									
27	-89.69317	45.53512	6	M	P			2										1									1									1							
28	-89.69318	45.53476	4	M	P												1										1																
29	-89.69318	45.53440	4	M	P		1	1										1							1		2						1		1	1							
30	-89.69265	45.53727	12	-	R																						1									1							
34	-89.69266	45.53583	15	-	R	No Vegetation																																					
35	-89.69266	45.53547	14	-	R	No Vegetation																																					
36	-89.69266	45.53511	12	-	R																						2																
37	-89.69266	45.53475	6	M	P			1										1																			1							
38	-89.69267	45.53439	7	M	P			1																										2			1							
39	-89.69214	45.53727	12	-	R			1																			1																
44	-89.69215	45.53547	16	-	R			1																																			
45	-89.69215	45.53511	16	-	R	No Vegetation																																					
46	-89.69215	45.53475	13	-	R	No Vegetation																																					

Number	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Comments	Brasenia schreberi	Ceratophyllum demersum	Chara sp.	Elatine minima	Elodea canadensis	Heteranthera dubia	Isoetes echinospora	Juncus pelocarpus	Lemna trisulca	Lobelia dortmanna	Megalodonta beckii	Myriophyllum sibiricum	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Pontederia cordata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton foliosus	Potamogeton friesii	Potamogeton gramineus	Potamogeton natans	Potamogeton praelongus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton vaseyi	Potamogeton zosteriformis	Ranunculus flammula	Sagitaria sp. (rosette)	Schoenoplectus acutus	Sparganium fluctuans	Spirodella polyrrhiza	Utricularia intermedia	Utricularia vulgaris	Utricularis gibba	Vallisneria americana
47	-89.69215	45.53439	5	M	P			1										1																		1									
48	-89.69215	45.53403	4	M	P						1							1		1															1	1								
49	-89.69163	45.53691	4	S	P			1																		1			1							1								
53	-89.69163	45.53547	12	-	R	No Vegetation																																						
54	-89.69164	45.53511	16	-	R	No Vegetation																																						
55	-89.69164	45.53475	15	-	R	No Vegetation																																						
56	-89.69164	45.53439	6	M	P			3																			1										1								
57	-89.69164	45.53403	2	S	P					1																												1								
58	-89.69112	45.53655	3	S	P			1										1																										
59	-89.69112	45.53619	15	-	R	No Vegetation																																						
61	-89.69112	45.53547	18	-	R	No Vegetation																																						
62	-89.69112	45.53511	16	-	R	No Vegetation																																						
63	-89.69113	45.53475	14	-	R	No Vegetation																														1								
64	-89.69113	45.53439	1	-	R																																							
68	-89.69061	45.53511	16	-	R	No Vegetation																																						
69	-89.69061	45.53475	15	-	R	No Vegetation																																						
70	-89.69062	45.53439	10	M	P			3																																				
71	-89.69062	45.53403	1	-	R								1			1																						1		1						
72	-89.69010	45.53583	16	-	R																						1																		
74	-89.69010	45.53511	17	-	R	No Vegetation																																						
75	-89.69010	45.53475	17	-	R	No Vegetation																																						
76	-89.69010	45.53439	16	-	R	No Vegetation																																						
77	-89.69011	45.53403	10	M	P			1																			3																		
79	-89.68958	45.53583	4	S	P														1			1					1																		
82	-89.68959	45.53475	17	-	R	No Vegetation																																						
83	-89.68959	45.53439	17	-	R	No Vegetation																																						
84	-89.68959	45.53403	15	-	R	No Vegetation																																						
85	-89.68960	45.53367	9	M	P																						1									1		1								
86	-89.68907	45.53546	16	-	R	No Vegetation																																						
88	-89.68908	45.53474	17	-	R	No Vegetation																																						
89	-89.68908	45.53438	17	-	R	No Vegetation																																						
90	-89.68908	45.53402	17	-	R	No Vegetation																					1																		
91	-89.68908	45.53366	6	M	P			2																																				
95	-89.68856	45.53546	12	M	P													1																										
98	-89.68857	45.53438	17	-	R	No Vegetation																																						
99	-89.68857	45.53402	16	-	R	No Vegetation																																						
100	-89.68857	45.53366	2	S	P	No Vegetation																					1																		

Number	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Comments	Brasenia schreberi	Ceratophyllum demersum	Chara sp.	Elatine minima	Elodea canadensis	Heteranthera dubia	Isoetes echinospora	Juncus pelocarpus	Lemna trisulca	Lobelia dortmanna	Megalodonta beckii	Myriophyllum sibiricum	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Pontederia cordata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton foliosus	Potamogeton friesii	Potamogeton gramineus	Potamogeton natans	Potamogeton praelongus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton vaseyi	Potamogeton zosteriformis	Ranunculus flammula	Sagitaria sp. (rosette)	Schoenoplectus acutus	Sparganium fluctuans	Spirodella polyrrhiza	Utricularia intermedia	Utricularia vulgaris	Utricularis gibba	Vallisneria americana
101	-89.68858	45.53222	4	M	P		1				1	1								1			1												1									
105	-89.68805	45.53546	2	M	P													1							1								1											
106	-89.68805	45.53510	14	-	R																																								
107	-89.68805	45.53474	15	-	R																																								
108	-89.68805	45.53438	18	-	R	No Vegetation																																							
109	-89.68806	45.53402	16	-	R	No Vegetation																																								
110	-89.68806	45.53366	2	S	P																	1		1																1						
111	-89.68806	45.53330	4	M	P						1		1					1																											
112	-89.68806	45.53294	5	M	P			2	1		1							1				1	1				2										1								
113	-89.68806	45.53258	5	M	P																				1						1		2											
114	-89.68807	45.53222	7	M	P			2			1							1							1						1				1									
115	-89.68807	45.53186	4	M	P			3																									1											
119	-89.68754	45.53510	1	S	P								1						1																										1
120	-89.68754	45.53474	3	S	P			1												1		1											1											
121	-89.68754	45.53438	13	-	R																1						1																	
122	-89.68754	45.53402	17	-	R	No Vegetation																																							
123	-89.68755	45.53366	16	-	R	No Vegetation																																								
124	-89.68755	45.53330	11	-	R																						2										1								
125	-89.68755	45.53294	10	M	P			1																			2										1								
126	-89.68755	45.53258	7	M	P			2										1							1								1				1							
127	-89.68755	45.53222	7	M	P			2																									1											
128	-89.68756	45.53186	3	M	P			1									1																											
131	-89.68703	45.53438	2	S	P														1										1															
132	-89.68703	45.53402	16	-	R																						1																	
133	-89.68703	45.53366	17	-	R	No Vegetation																																							
134	-89.68704	45.53330	17	-	R	No Vegetation																																								
135	-89.68704	45.53294	16	-	R	No Vegetation																																							
136	-89.68704	45.53258	6	M	P			2			1							1																1											
137	-89.68704	45.53222	5	M	P			1			1							1															1			1								
138	-89.68704	45.53186	4	M	P			1			1							1									1							1	1	1								
139	-89.68705	45.53150	3	M	P		1	1										1				1	1	1					1														
142	-89.68652	45.53438	4	S	P													1		1												1	1										
143	-89.68652	45.53402	16	-	R	No Vegetation																																							
145	-89.68652	45.53330	17	-	R	No Vegetation																																							
146	-89.68653	45.53294	15	-	R	No Vegetation																																							
147	-89.68653	45.53258	12	-	R			1														1					1										1							
148	-89.68653	45.53222	5	M	P			1										1									1								1	1							1

Number	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Comments	Brasenia schreberi	Ceratophyllum demersum	Chara sp.	Elatine minima	Elodea canadensis	Heteranthera dubia	Isoetes echinospora	Juncus pelocarpus	Lemna trisulca	Lobelia dortmanna	Megalodonta beckii	Myriophyllum sibiricum	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Pontederia cordata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton foliosus	Potamogeton friesii	Potamogeton gramineus	Potamogeton natans	Potamogeton praelongus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton vaseyi	Potamogeton zosteriformis	Ranunculus flammula	Sagitaria sp. (rosette)	Schoenoplectus acutus	Sparganium fluctuans	Spirodella polyrrhiza	Utricularia intermedia	Utricularia vulgaris	Utricularis gibba	Vallisneria americana
152	-89.68657	45.52502	3	M	P		1				1												1		1								1		2	1									
155	-89.68601	45.53438	5	M	P			1										1		1							1	1					1		1	1									
159	-89.68601	45.53294	16	-	R																																								
160	-89.68602	45.53258	12	M	P						1																																		
161	-89.68602	45.53222	2	S	P			1										1															2											
162	-89.68603	45.52934	5	M	P			1									1														1		1										
163	-89.68604	45.52898	6	M	P			1			1							1									1				1					1								
164	-89.68604	45.52862	8	M	P			1																	1		2																
165	-89.68604	45.52826	2	S	P								1			1													1														
166	-89.68606	45.52538	4	M	P		1	1			1						1							1							1			1									
167	-89.68606	45.52502	3	M	P		1				1	1						1					1									2		1									
168	-89.68606	45.52466	4	M	P																											3											
169	-89.68606	45.52430	3	M	P		1				1	1										1	1									1		1								1	
171	-89.68549	45.53437	15	-	R	No Vegetation																																					
172	-89.68550	45.53401	17	-	R	No Vegetation																																					
175	-89.68550	45.53293	16	-	R																																						
176	-89.68550	45.53257	13	-	R			1																			1																
177	-89.68551	45.53221	6	M	P			1										1									1									1							1
178	-89.68551	45.53185	6	M	P						1							1		1							1						1			1							
179	-89.68551	45.53149	5	M	P			2																			1									1							
180	-89.68551	45.53113	7	M	P															1																1							1
181	-89.68552	45.53041	4	S	P																								1														
182	-89.68552	45.53005	6	M	P			1										1		1							1								1							1
183	-89.68552	45.52969	6	M	P																						1																
184	-89.68552	45.52933	15	-	R																																						
186	-89.68553	45.52861	15	-	R	No Vegetation																																					
187	-89.68553	45.52825	5	S	P			3																									1	1			1						
189	-89.68554	45.52573	4	M	P			1									1								1								2		1								
190	-89.68554	45.52537	4	M	P		1	2			1							1				1																					
191	-89.68555	45.52501	9	M	P			1									1								1								2										
192	-89.68555	45.52465	5	M	P			1																										1			1						
193	-89.68555	45.52429	6	M	P		1															1			1						1		1									
194	-89.68555	45.52393	6	M	P			1			1																						2			1							
195	-89.68498	45.53473	9	M	P			1										1									2									1							
196	-89.68498	45.53437	17	-	R																																						
197	-89.68498	45.53401	17	-	R	No Vegetation																																					
198	-89.68498	45.53365	17	-	R	No Vegetation																																					

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199	-89.68499	45.53329	17	-	R	No Vegetation																																						
200	-89.68499	45.53293	17	-	R			1																			1																		
201	-89.68499	45.53257	14	-	R	No Vegetation																																						
202	-89.68499	45.53221	12	-	R																						2																	
203	-89.68499	45.53185	10	M	P																						1																	
204	-89.68500	45.53149	7	M	P																						2										1						
205	-89.68500	45.53113	9	M	P																						1																
206	-89.68500	45.53077	7	S	P			2																			1										1						
207	-89.68500	45.53041	6	M	P			1																			2							1									
208	-89.68500	45.53005	12	M	R																						1																
209	-89.68501	45.52969	17	-	R	No Vegetation																																						
214	-89.68502	45.52789	15	-	R	No Vegetation																																						
215	-89.68502	45.52753	12	M	P			1																			1																	
217	-89.68502	45.52645	3	M	P			1			1	1																								2			1					
218	-89.68503	45.52609	3	M	P			1			1											1	1										2									
219	-89.68503	45.52573	5	M	P			1			1											1												1	1							
220	-89.68503	45.52537	7	M	P						1							2									1								1							
221	-89.68503	45.52501	8	M	P			1			2																																
222	-89.68503	45.52465	6	M	P			1																			1									1						
223	-89.68504	45.52429	6	M	P													1															2									
224	-89.68504	45.52393	4	M	P						2	1											1										1		1							
225	-89.68446	45.53509	10	M	P																						2																
228	-89.68447	45.53401	16	-	R																																1						
229	-89.68447	45.53365	17	-	R	No Vegetation																																						
230	-89.68447	45.53329	17	-	R	No Vegetation																																						
231	-89.68448	45.53293	17	-	R																																						
232	-89.68448	45.53257	17	-	R																																						
233	-89.68448	45.53221	15	-	R																																						
234	-89.68448	45.53185	14	-	R			1			1																1																
235	-89.68448	45.53149	14	-	R			1			1																																
236	-89.68449	45.53113	14	-	R	No Vegetation																																						
237	-89.68449	45.53077	15	-	R			1			1																																
238	-89.68449	45.53041	9	M	P			3																												1	1						
239	-89.68449	45.53005	7	M	P															1																1					1			
240	-89.68449	45.52969	15	-	R	No Vegetation																																						
246	-89.68451	45.52753	17	-	R	No Vegetation																																						
247	-89.68451	45.52717	10	M	P																						2																

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248	-89.68451	45.52681	4	M	P		1	1										1				1		1										1	1			1							
249	-89.68451	45.52645	4	M	P			1																	1								2		1	1								
250	-89.68451	45.52609	6	M	P													1							1						1					1							
251	-89.68452	45.52573	7	M	P			1									1																2										
252	-89.68452	45.52537	9	M	P	No Vegetation																																						
253	-89.68452	45.52501	13	-	R	No Vegetation																																						
254	-89.68452	45.52465	14	-	R	No Vegetation																																						
255	-89.68452	45.52429	196	-	R	No Vegetation																																						
256	-89.68453	45.52393	10	M	P						1																																	
257	-89.68453	45.52357	9	M	P						1							1								1	2																	
258	-89.68453	45.52321	4	M	P						1											1												1		1								
259	-89.68395	45.53509	12	M	P			2																			1																
260	-89.68395	45.53473	20	-	R																																						
261	-89.68396	45.53437	18	-	R	No Vegetation																																						
262	-89.68396	45.53401	16	-	R																																		1					
263	-89.68396	45.53365	16	-	R	No Vegetation																																						
264	-89.68396	45.53329	18	-	R	No Vegetation																																						
265	-89.68396	45.53293	18	-	R	No Vegetation																																						
266	-89.68397	45.53257	18	-	R	No Vegetation																																						
267	-89.68397	45.53221	16	-	R	No Vegetation																																						
268	-89.68397	45.53185	4	S	P			1				1					1								1							1				1							1
270	-89.68398	45.52969	3	M	P						1	1													1											1							
271	-89.68398	45.52933	15	-	R	No Vegetation																																						
277	-89.68400	45.52717	16	-	R	No Vegetation																																						
278	-89.68400	45.52681	8	M	P						2																1									1								
279	-89.68400	45.52645	6	M	P						2							1									1										1							
280	-89.68400	45.52609	6	M	P						2																1																	
281	-89.68400	45.52573	13	-	R			1			1																																	
282	-89.68401	45.52537	15	-	R																																							
283	-89.68401	45.52501	16	-	R																																							
287	-89.68402	45.52357	14	-	R	No Vegetation																																						
288	-89.68402	45.52321	9	M	P			1			1														1		2									1							
289	-89.68402	45.52285	4	M	P																				1								3										
290	-89.68402	45.52249	2	M	P		1	1			1				1								1	1						1						1							
291	-89.68344	45.53509	9	M	P			2																																				
292	-89.68344	45.53473	17	-	R	No Vegetation																																						
293	-89.68344	45.53437	18	-	R	No Vegetation																																						

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294	-89.68345	45.53401	16	-	R	No Vegetation																																							
295	-89.68345	45.53365	7	M	P			2				1																								1									
296	-89.68345	45.53329	9	M	P	No Vegetation																																							
297	-89.68345	45.53293	15	-	R	No Vegetation																																							
298	-89.68345	45.53257	19	-	R	No Vegetation																																							
299	-89.68346	45.53221	15	-	R	No Vegetation																																							
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301	-89.68347	45.52933	12	-	R			2				1															1									1								
302	-89.68347	45.52897	17	-	R	No Vegetation																																							
307	-89.68348	45.52717	10	M	P						2																1									1								
308	-89.68349	45.52681	5	M	P						2							1																	1								
309	-89.68349	45.52645	6	M	P			1			1																2									1								
310	-89.68349	45.52609	10	M	P			1										1									1																
311	-89.68349	45.52573	15	-	R	No Vegetation																																							
312	-89.68349	45.52537	16	-	R	No Vegetation																																							
317	-89.68350	45.52357	13	-	R																						3									1								
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319	-89.68351	45.52285	5	M	P																														2								
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323	-89.68293	45.53437	18	-	R	No Vegetation																																							
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325	-89.68294	45.53365	8	M	P	No Vegetation																																							
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335	-89.68297	45.52717	6	M	P			2																			1																
336	-89.68297	45.52681	4	M	P						2														1	1				1					1	1							
337	-89.68298	45.52645	6	M	P						1							1									1										1							
338	-89.68298	45.52609	8	M	P																						2								1			1					
339	-89.68298	45.52573	12	-	R																						2											1					
340	-89.68298	45.52537	16	-	R	No Vegetation																																							

Number	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Comments	Brasenia schreberi	Ceratophyllum demersum	Chara sp.	Elatine minima	Elodea canadensis	Heteranthera dubia	Isoetes echinospora	Juncus pelocarpus	Lemna trisulca	Lobelia dortmanna	Megalodonta beckii	Myriophyllum sibiricum	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Pontederia cordata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton foliosus	Potamogeton friesii	Potamogeton gramineus	Potamogeton natans	Potamogeton praelongus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton vaseyi	Potamogeton zosteriformis	Ranunculus flammula	Sagitaria sp. (rosette)	Schoenoplectus acutus	Sparganium fluctuans	Spirodella polyrrhiza	Utricularia intermedia	Utricularia vulgaris	Utricularis gibba	Vallisneria americana
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348	-89.68242	45.53473	5	M	P			2																							1		1		1									
349	-89.68242	45.53437	9	R	P	No Vegetation																																						
350	-89.68242	45.53401	7	M	P			1																				2																
351	-89.68242	45.53365	8	M	P			1																				3																
352	-89.68243	45.53329	9	M	P			1			1																	1							2	1								
353	-89.68243	45.53293	8	M	P			1																			1	1							2									
354	-89.68243	45.53257	5	M	P			1										1															1		1	1								
355	-89.68245	45.52861	12	-	R			1																			3																
356	-89.68245	45.52825	8	M	P																1						2																
357	-89.68246	45.52789	16	-	R																						2																
358	-89.68246	45.52753	13	-	R	No Vegetation																																						
359	-89.68246	45.52717	8	M	P																						2																
360	-89.68246	45.52681	8	M	P						1													1							1		1			1							
361	-89.68246	45.52645	6	M	P			1			1							1									2								1								
362	-89.68247	45.52609	6	M	P			1			1																2								1								1
363	-89.68247	45.52573	9	M	P													1						1							1		2		1							
364	-89.68247	45.52537	7	M	P	No Vegetation																																						
365	-89.68247	45.52501	14	-	R	No Vegetation																																						
366	-89.68247	45.52465	16	-	R	No Vegetation																																						
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370	-89.68191	45.53436	4	S	P			1			1							1		1			1										1		1	1							1
371	-89.68191	45.53400	4	S	P			1												1												1	1										
372	-89.68191	45.53364	5	M	P		1	2							1			1				1			1						1		1	1								1
373	-89.68191	45.53328	5	M	P			1																				1			1		2			1							
374	-89.68192	45.53292	4	M	P			1																							1		1			1							
375	-89.68192	45.53256	2	S	P								1																									1						
376	-89.68194	45.52824	3	M	P			1			1							1				1		1												1							
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380	-89.68195	45.52680	5	M	P																												2			1							

Number	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Comments	Brasenia schreberi	Ceratophyllum demersum	Chara sp.	Elatine minima	Elodea canadensis	Heteranthera dubia	Isoetes echinospora	Juncus pelocarpus	Lemna trisulca	Lobelia dortmanna	Megalodonta beckii	Myriophyllum sibiricum	Myriophyllum tenellum	Najas flexilis	Nitella sp.	Nuphar variegata	Nymphaea odorata	Pontederia cordata	Potamogeton amplifolius	Potamogeton epihydrus	Potamogeton foliosus	Potamogeton friesii	Potamogeton gramineus	Potamogeton natans	Potamogeton praelongus	Potamogeton richardsonii	Potamogeton robbinsii	Potamogeton spirillus	Potamogeton vaseyi	Potamogeton zosteriformis	Ranunculus flammula	Sagitaria sp. (rosette)	Schoenoplectus acutus	Sparganium fluctuans	Spirodella polyrrhiza	Utricularia intermedia	Utricularia vulgaris	Utricularis gibba	Vallisneria americana
381	-89.68195	45.52644	6	M	P			1			1	1					1			1													1	1		1										
382	-89.68196	45.52536	1	M	P											1													1																
383	-89.68196	45.52500	7	M	P																												3												
384	-89.68196	45.52464	6	M	P			1										1							1								1		1	2								
385	-89.68196	45.52428	7	M	P			3										1																		1								
386	-89.68197	45.52392	5	M	P		1	1			2																						1			1				1				
387	-89.68140	45.53328	5	M	P						1																						1			1								
388	-89.68140	45.53292	5	M	P			1																									3		1									
390	-89.68145	45.52428	4	M	P		1	1			1							1																	1							1	1			
391	-89.68145	45.52392	2	M	P		1	1			1	1													1										1							1				
392	-89.68089	45.53292	4	M	P																							1					2			1				1				
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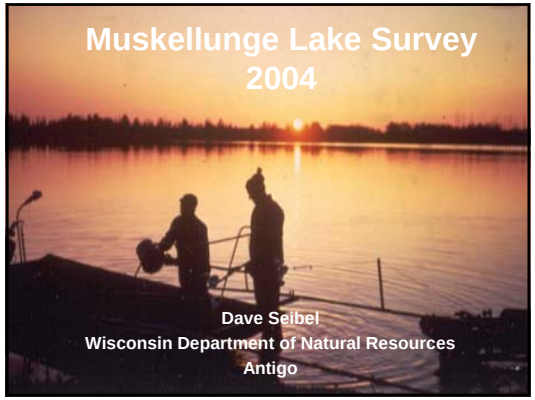
F

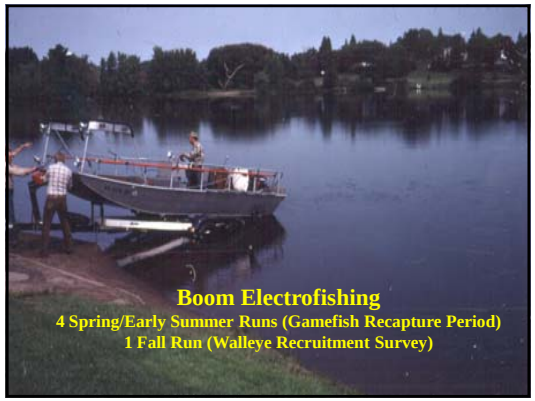
APPENDIX F

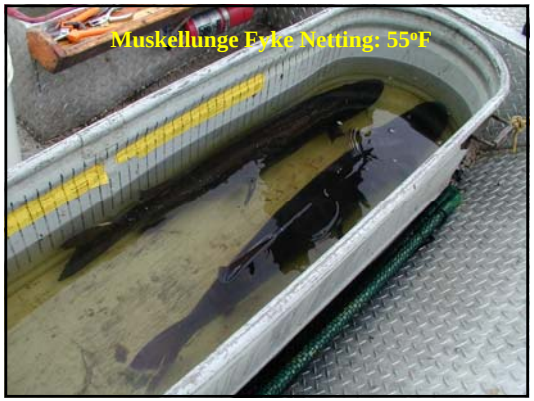
Muskellunge Lake Fisheries Survey - 2004



Comprehensive Surveys

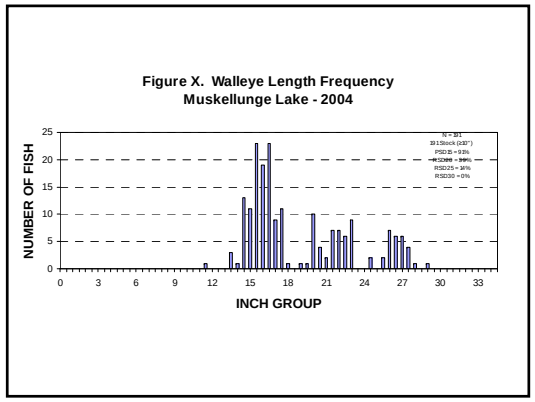
- Ice-Out Fyke Netting
- First Boom Electrofishing (EF) Run: 45ºF
- Muskellunge Fyke Netting: 55ºF
- Second Boom EF Run: 55-60ºF (14-17 days after 1st run)
- Third Boom EF Run: <70ºF (5-7 days after 2nd run)
- Fourth Boom EF Run: <70ºF (7-14 days after 3rd run)
- Panfish Fyke Netting: <70ºF (June)
- Mini-Fyke Netting: Late August
- Fall Boom EF Run: 65-45ºF

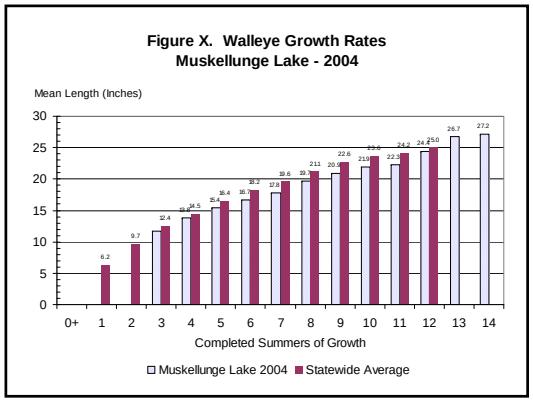

Boom Electrofishing
4 Spring/Early Summer Runs (Gamefish Recapture Period)
1 Fall Run (Walleye Recruitment Survey)


Muskellunge Eyke Netting: 55ºF

Water: Muskellunge Lake Gear: Fyke Nets & EF
Year: 2004 Effort: N/A

Species	Early Fyke Measured	Early Fyke Counted	Boom EF Measured	Boom EF Counted	Panfish Fyke Measured	Panfish Fyke Counted	Mini Fyke Measured	Mini Fyke Counted	Total Measured	Total Counted	Totals	%
Walleye	138	0	46	0	7	0	0	0	191	0	191	2.6
Northern Pike	136	0	115	0	21	0	0	0	272	0	272	3.6
Muskellunge	13	0	2	0	0	0	0	0	15	0	15	0.2
Smallmouth Bass	1	0	0	0	1	0	0	0	2	0	2	0.0
Largemouth Bass	65	0	246	0	19	0	30	0	360	0	360	4.8
Yellow Perch	328	0	6	0	2	0	2	0	338	0	338	4.5
Black Crappie	891	0	17	0	109	0	6	0	1023	0	1023	13.7
Bluegill	1214	0	390	0	2081	827	156	7	3841	834	4675	62.5
Pumkinseed	85	0	6	0	165	0	0	0	236	0	236	3.2
Rock Bass	2	0	1	0	1	0	0	0	4	0	4	0.1
Warmouth	74	0	0	0	81	0	14	0	169	0	169	2.3
Yellow Bullhead	21	0	0	0	53	0	0	0	74	0	74	1.0
Black Bullhead	1	0	0	0	0	0	0	0	1	0	1	0.0
White Sucker	10	0	24	0	0	0	0	0	34	0	34	0.5
Bowfin	4	0	0	0	0	0	0	0	4	0	4	0.1
Golden Shiner	19	0	1	0	10	0	2	0	32	0	32	0.4
Blackchin Shiner	0	0	1	0	0	0	0	0	1	0	1	0.0
Bluntnose Minnow	0	0	35	0	0	0	18	0	53	0	53	0.7
Fathead Minnow	0	0	0	0	0	0	0	0	0	0	0	0.0
Johnny Darter	0	0	1	0	0	0	0	0	1	0	1	0.0
	0	0	0	0	0	0	0	0	0	0	0	0.0
Totals	2982	0	891	0	2550	827	228	7	6651	834	7485	100.0





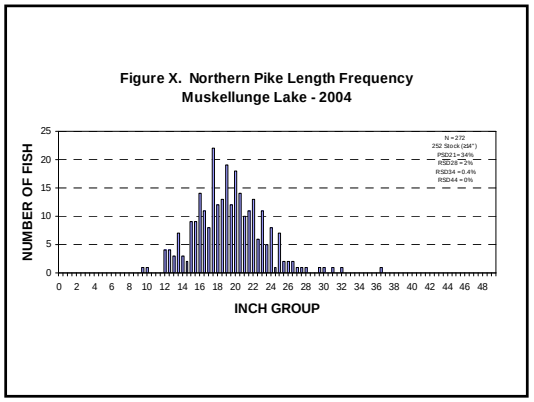


Figure X. Northern Pike Growth Rates
Muskellunge Lake - 2004

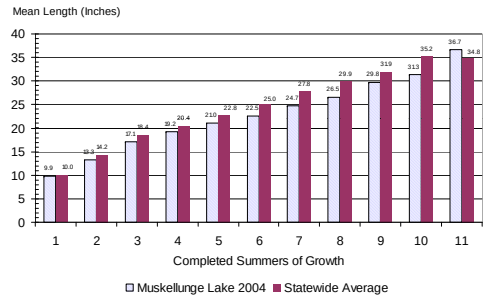


Figure X. Muskellunge Length Frequency
Muskellunge Lake - 2004

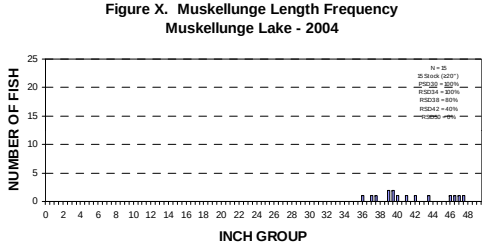


Figure X. Muskellunge Growth Rates
Muskellunge Lake - 2004

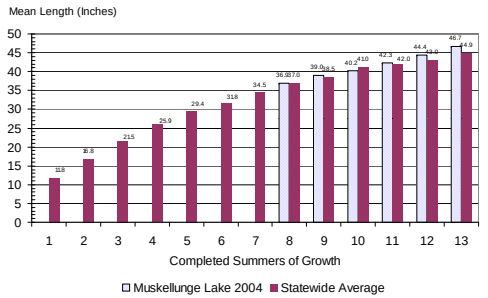


Figure X. Smallmouth Bass Length Frequency
Muskellunge Lake - 2004

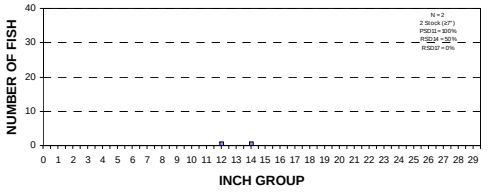


Figure X. Smallmouth Bass Growth Rates
Muskellunge Lake - 2004

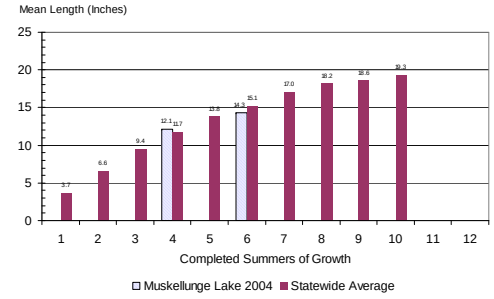


Figure X. Largemouth Bass Length Frequency
Muskellunge Lake - 2004

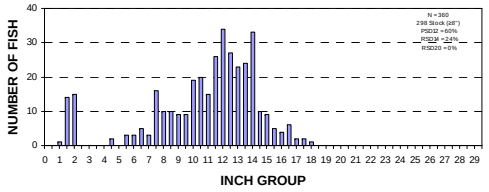


Figure X. Largemouth Bass Growth Rates
Muskellunge Lake - 2004

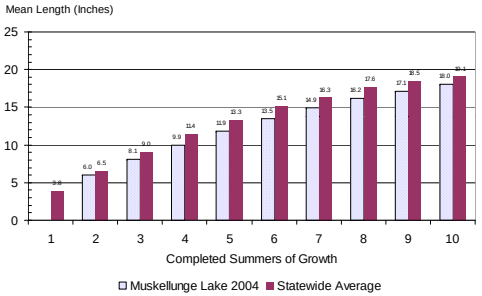


Figure X. Bluegill Length Frequency
Muskellunge Lake - 2004

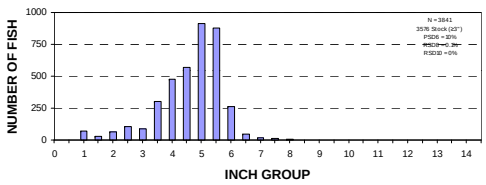


Figure X. Bluegill Growth Rates
Muskellunge Lake - 2004

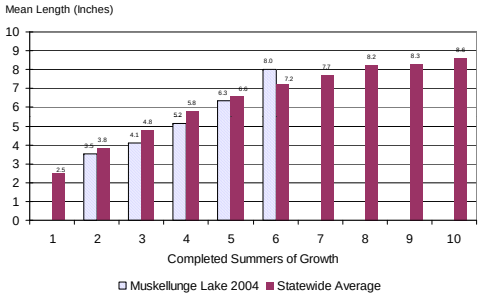


Figure X. Black Crappie Length Frequency
Muskellunge Lake - 2004

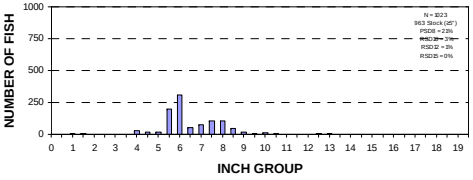


Figure X. Black Crappie Growth Rates
Muskellunge Lake - 2004

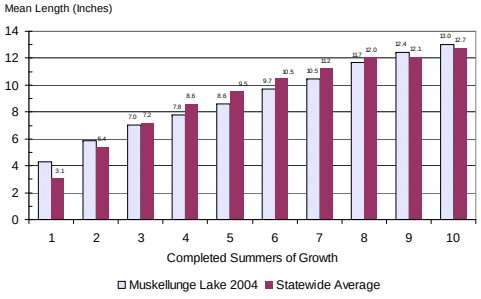


Figure X. Yellow Perch Length Frequency
Muskellunge Lake - 2004

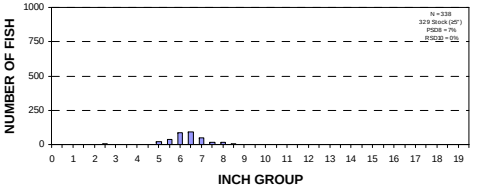


Figure X. Yellow Perch Growth Rates
Muskellunge Lake - 2004

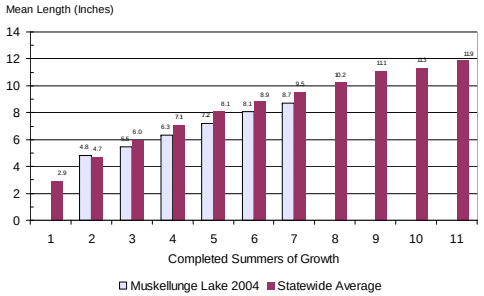


Figure X. Pumpkinseed Length Frequency
Muskellunge Lake - 2004

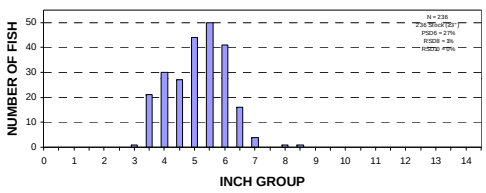


Figure X. Pumpkinseed Growth Rates
Muskellunge Lake - 2004

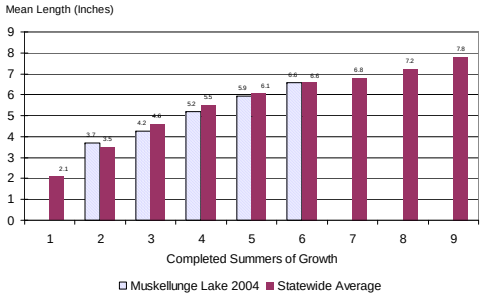


Figure X. Warmouth Length Frequency
Muskellunge Lake - 2004

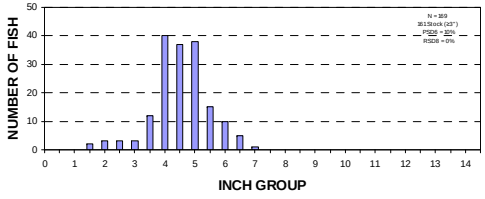


Figure X. Warmouth Growth Rates
Muskellunge Lake - 2004

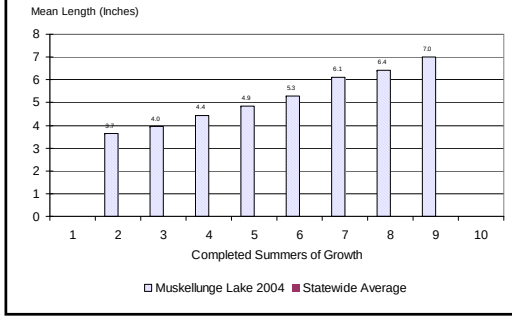


Figure X. Yellow Bullhead Length Frequency
Muskellunge Lake - 2004

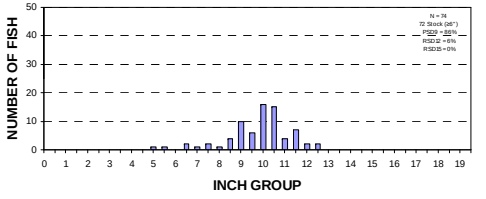


Figure X. White Sucker Length Frequency
Muskellunge Lake - 2004

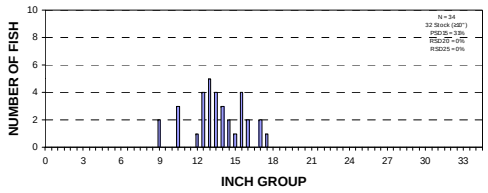


Figure X. Golden Shiner Length Frequency
Muskellunge Lake - 2004

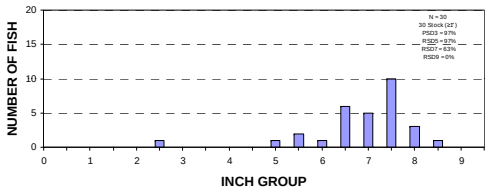
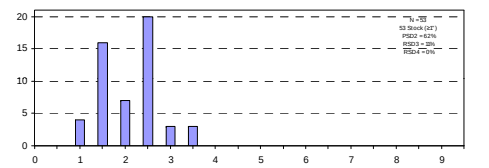


Figure X. Bluntnose Minnow Length Frequency
Muskellunge Lake - 2004



Common Stocking Myths

- It can't hurt (genetics, disease, unbalanced populations, unwanted species)
- The more fish you stock, the more fish you catch
- Every stocked fish survives
- You can create an "instant" fishery

Walleye Stocking Example

- 100 acre lake (10 per acre stocking rate)
- 1,000 7-8" walleye fingerlings ($2 each = $2,000) stocked in fall of year 0
- Assume good survival of these fish - 20% = 200 ($10 each) left at the end of year 1
- 10-11" at the end of year 1
- Assume continued good survival of these fish - 50% = 100 ($20 each) left after year 2

Stocking Example Cont'd

- 12-13" at the end of year 2
- 50% survival from year 2-3 = 50 ($40 each) and they are still not legal size (14-15") 3 full years after stocking
- 4 years after stocking some fish will become legal size of 15"
- Only have about 35 fish still left at a cost of $57 each (3.5% survival over 4 years)
- Now you have to catch one of those 35 fish in a 100 acre lake!

- Let mother nature provide fish if she can (better fishery, cheaper, balanced populations)
- Control harvest
- Protect habitat (spawning areas, nursery areas, bug and insect production areas, adult fish habitat)
- Use stocking as a tool to fix something broken
- Stocking goal should be to create a naturally reproducing population

Management Recommendations

- Manage primarily for LMB & BG (67%)
- Secondarily for NP & Crappie (17%)
- ↑abundance and size quality of LMB = ↓abundance and ↑size quality of BG
- 18” size limit and daily bag limit of 1 LMB
- Encourage harvest of BG and NP
- No stocking recommended

Species	Fishery, Population, or Ecosystem-level Objective			
	Consumptive Opportunity; Utilize self-sustained, high density, slow-growing populations; Maximize yield; Reduce predation/ Competition	Quality Opportunity; Sustain/Increase Densities; Maintain current conditions	Memorable Opportunity; Maintain/increase density of moderate/large adults; improve reproduction; Increase predation beyond current conditions	Trophy Opportunity; Increase survival/density of large/old individuals; Maximize predation on smaller fishes
Largemouth and Smallmouth bass	No minimum, (optional 14" to 18"protected slot, 1 > 18"); 3/day	14" minimum length limit 5/day	18" minimum length limit 1/day	22" minimum length limit 1/day
Walleye, Sauger and hybrids	No minimum length limit**; 5/day	15" minimum length limit; 5/day	18" minimum length limit; 3/day	28" minimum length limit; 1/day
Northern Pike	No minimum length limit; 5/day	26" minimum length limit; 2/day	32" minimum length limit; 1/day	40" minimum length limit; 1/day
Muskellunge	28" minimum	34" minimum	40" minimum	45" or 50" minimum
Trout and Salmon	No minimum length limit; 10/day	7" (or 9") minimum; 5 (or 3)/day	12" (or 8") minimum length limit; 3/day	Varies by water
Catfish	No minimum length limit; 25/day	No minimum length limit; 10/day	--	--
Panfish	No minimum length limit; no daily bag limit	No minimum length limit; 25/day	No minimum length limit; 10/day	--

Bass/Bluegill Relationship

- Predator & Prey
- Same habitats - live side-by-side all year
- LMB is the most effective predator of BG
- Currently, the relationship is unbalanced
- Too many small, slow-growing BG
- Need more and larger LMB
- Need to convert 4-5” BG biomass into 14-18” LMB biomass

Stocking Discussion

- LMB - reproduction not the problem nor are smaller fish; need more larger fish to eat 4-5” BG
- Walleye - outcompete and prey on LMB which contributes to a larger imbalance between LMB & BG; not effective predators of BG
- Muskellunge - larger fish eat larger prey (bass, northern pike, walleye, suckers); might contribute to LMB/BG imbalance

G

APPENDIX G

WDNR Dredging Permit Fact Sheet

Permit Fact Sheet

General Permit

Permit Number:	WI-0046558-05-0
Permit Name:	Carriage and/or Interstitial Water from Dredging Operations General Permit
Permittee	Owners or operators of dredging projects
Discharge Location:	Statewide
Receiving Water:	Surface water or groundwater in the state of Wisconsin

Section 283.35, Wisconsin Statutes authorizes the Department to issue general discharge permits for categories of point source discharges. It is more efficient for the Department to cover multiple facilities under a general permit (GP) rather than issuing individual permits for each facility when no special circumstances warrant site specific permit requirements or limitations. The general permit program is intended to minimize effort for the permittee and the Department.

When a GP is issued, all facilities meeting its requirements may be covered by the GP. For facilities that are eligible for coverage under a general permit, the Department sends a letter granting coverage and a copy of the permit to the facility. A facility may need to be covered under more than one GP, depending on the different types of waste streams that a facility discharges.

If the Department determines it is necessary or appropriate to withhold or withdraw coverage by a general permit, an individual site specific WPDES permit may be issued containing additional limitations to regulate the discharge because it contains pollutants that are not typical for the general permit category and the pollutants could exceed a water quality standard. A written request from the discharger to voluntarily withdraw from coverage under the general permit may also be requested.

Description

Dredging operations includes the removal of material in the beds of waterways for navigation, the removal of sediment or bed material for a construction project such as laying a pipeline, or the removal of contaminated sediment as part of a clean-up. This permit is applicable to dredging operations that discharge carriage and/or interstitial water as defined below.

Carriage Water: Sediment in many large projects is removed by hydraulic dredging with the use of pumps. In order for pumps to move sediment it must be relatively low in total solids and thus large amounts of water are pumped along with the dredged material. Carriage water is defined as the water portion of slurry that is pumped from the dredging site to the disposal site.

Interstitial Water: The water that is squeezed out of the interstices when sediment is dewatered. Another name for interstitial water is pore water. This water becomes the "carriage water" for dredging projects where the material is moved using clam shell buckets or backhoe (mechanical dredging).

The WPDES permit program does not regulate the actual dredging nor does it address the suitability of the disposal site for long term disposal of the material. The sediment characterization and issuance of the permit to dredge is regulated under ch. 30, Wis. Stats., ch. NR 345, Wis. Adm. Code, and ch. NR 347, Wis. Adm. Code. The ch. 30 permit may impose limitations in the water body for total suspended solids allowed in suspension, and the need for a silt curtain. The characterization data required under ch. NR 347, Wis. Adm. Code, is used to determine the applicable monitoring requirements, and must be completed prior to requesting coverage under the WPDES general permit. The potential list of permit monitoring parameters consists of the sediment contaminants listed in Table 1 of ch. NR 347, Wis. Adm. Code. Appendix A to the fact sheet lists the parameters.

The WPDES permit issuance process includes a review of the data collected under ch. NR 347, Wis. Adm. Code. When this data indicates the sediment is contaminated, those contaminants detected at a level of concern should also be analyzed for in an elutriate test to determine if the contaminant may be present in a wastewater discharge. The sediment elutriate test simulates the quality of water that would discharge from dewatered sediment. The Elutriate test is a better indicator of the contaminant level that may be in the carriage return water or interstitial water. It provides a better comparison of what an effluent quality would be to compare with groundwater standards and surface water effluent limits. For a description of the elutriate test procedure refer to the "*Guidance for Applying the Sediment Sampling and Analysis Requirement of Chapter NR 347, Wis. Ad. Code*", Section 5.4. on pages 16-17. Also note comment (b) on page 9.

This general permit is primarily intended for dredging operations involving uncontaminated or moderately contaminated sediments that are unlikely to have environmental concerns. In many cases, the removed sediment is essentially innocuous, or may have low potential risk to aquatic life. Consequently, any return of water and small amounts of the dredged material from the disposal site to waters of the state are also innocuous. The Department's guidance document, "*Consensus-Based Sediment Quality Guidelines*" (CBSQG), will be used in a qualitative fashion to determine the relative degree of risk that a sediment possess, and we will extrapolate this to evaluate the probability of affecting the quality of the dredging wastewater.

If the sediment is contaminated, a wastewater treatment system to remove contaminants of concern may be necessary. Prior to the granting of general permit coverage the need for treatment of the carriage or interstitial water must be evaluated. A treatment pilot study is recommended to demonstrate if the wastewater discharged would comply with all applicable effluent limits. Alternatively, if there is documentation of a similar project to show the proposed treatment system complies with discharge limits, that may be acceptable. An elutriate test may also be conducted on the sediment to demonstrate contaminants will not be present in the effluent at a concentration of concern, or that wastewater treatment is unnecessary.

An individual permit for dredging may be necessary at remediation sites or harbor dredging projects that involve sediments contaminated with bioaccumulative chemicals of concern at concentrations where toxicity is probable. In these situations specialized environmental controls may be necessary and closer oversight is needed with an individual WPDES permit. Because of the higher contamination levels associated with this type of project there's a greater possibility of violating surface water or groundwater quality standards. The general permit may only be used if effluent limit compliance is demonstrated with a pilot study prior to granting coverage under the permit.

1 Applicability Criteria

1.1 Activities Covered

The WPDES general permit is applicable to facilities discharging carriage and/or interstitial water from dredging operations. It does not regulate the actual dredging process within the water body (the ch. 30 permit does). The applicability criteria allows coverage of innocuous dischargers from uncontaminated sediment, and also contaminated sediment provided water quality is protected. In some cases wastewater treatment must be provided to comply with effluent limits. The CBSQG is used as a screening tool to determine the applicability of the general permit, defining what is "uncontaminated" or "contaminated" sediment, and the monitoring parameters.

The general permit may be used for contaminated sediment that exceeds the probable effect concentration (PEC) for sediment toxicity listed in the CBSQG, but additional information must be provided to the Department. When requesting coverage under the general permit, the applicant must demonstrate that contaminated sediment carriage and/or interstitial water can be treated to comply with effluent limits. This would usually require that a pilot treatability study be completed.

1.2 Activities Not Covered

The permit identifies several conditions that the general permit will not cover or for which it does not apply. These include the following:

- Discharges may not significantly adversely impact wetlands and must meet the wetland protection requirements. For discharges that impact wetlands, information must be submitted that allows the Department to determine if a discharge meets code requirements.
- Discharges to outstanding or exceptional resource waters are not authorized by this permit. Regulation of discharges to outstanding or exceptional resource waters requires an individual permit to provide the oversight and discharge limitations necessary to protect this type of receiving water.
- Discharges with substances that will violate surface water or groundwater quality standards are not eligible for the general permit.
- Dredging involving contaminated sediment when one or more contaminants exceed the "Consensus-Based Sediment Quality Guidelines" probable effect concentration, unless the applicant provides a demonstration for complying with effluent limits.
- Some US Army Corps of Engineers and Department of Transportation dredging projects are exempt from this permit. Other statutory exemptions apply to certain types of dredging projects.
- Discharges of wastewater from mechanical dredging in the water body, such as from the clam shell or drainage off a barge, are not regulated under this permit. These discharges or other water quality issues would be regulated in the dredging permit issued under ch. 30 Wis. Stats. For example, the ch. 30 permit may require the installation of a silt curtain to contain re-suspended sediment in the water body.
- Discharges with Indian Country, because the Department lacks this authority in the state delegation agreement with EPA. In such instances, EPA regulates the discharge and would issue a permit.

1.3 Granting of Coverage

To obtain coverage under the general permit, the proposed dredging project must submit a completed "*General Permit Request for Coverage*" form. If the information provided fulfills the criteria for a general permit, the Department will then convey coverage by sending a letter with a copy of the permit. The letter will identify the sediment as "uncontaminated" or "contaminated" based on the characterization sampling conducted during the application process, and which monitoring requirements and limitations table applies. If the sediment is contaminated, the letter will identify any additional monitoring parameters to include in the monitoring requirements table and the applicable effluent limit.

Determining eligibility of a potential discharge situation for the general permit is somewhat subjective and qualitative because of the many environmental factors that can influence the availability of contaminants associated with bedded sediments and the same sediments suspended in a discharge or in the water column. The Department will rely on staff expertise and knowledge of site specific situations to determine if there is a concern about the potential discharge relative to surface or ground water standards.

Sediment sampling is generally required for dredging projects, in accordance with ch. NR 347, Wis. Adm. Code, unless the Department waives sampling because existing data or historical information indicates contamination is unlikely or the contaminants of concern have already been documented. Sediment characterization data may be of some or only limited value in characterizing a wastewater discharge, since bulk chemistry data is designed to evaluate the quality of the in place sediment as it relates to potential impacts to primarily benthic macroinvertebrate organisms and other aquatic organisms present on or in the sediment for various stage of their life cycles. The bulk sediment data may also be used to determine the suitability of the material for different disposal options. For discharge situations the sediment data provides a conservative indication of what could be present in dredging wastewater. It may be more helpful in showing what's absent and doesn't need to be monitored in the WPDES permit.

Permit applicants should refer to the following three guidance documents for assistance. The documents may be obtained from the Department's web site at the locations listed:

(a) "*The State of Wisconsin Approval Process for Dredging of Commercial Ports*", Publication FH-061, provides an overview of the entire permitting process for a dredging project. It was prepared for the Wisconsin Commercial Ports Association, but the information is applicable to just about all dredging projects.

http://dnr.wi.gov/org/aw/wm/publications/solid/commercialdredge.pdf

(b) "*Consensus-Based Sediment Quality Guidelines*", Publication WT-732, provides detailed information for using the effect-based concentration values for evaluating the sediment quality for determining potential environmental risks. If contaminant concentrations are below the threshold effect concentration (TEC,) toxicity is unlikely in the sediment. Concentrations above the probable effect concentration (PEC), indicates the likely presence of sediment toxicity. And between the TEC and PEC the risk of toxicity increases. Before making a direct comparison of the dredging sediment data with the TEC and PEC values in the CBSQG, it may be necessary to normalize the data to 1% total organic carbon (TOC). Nonpolar organic contaminants have less bioavailability in sediment with higher TOC. Consequently, an adjustment should be made to data when the TOC exceeds 1% in order to make a relative comparison with the TEC and PEC, which are based on 1% TOC.

http://dnr.wi.gov/org/aw/rr/technical/cbsqg_interim_final.pdf

(c) "*Guidance for Applying the Sediment Sampling and Analysis Requirement of Chapter NR 347, Wis. Ad. Code*", Publication WT-778, provides guidance to assist in interpreting the code requirements. It addresses sampling procedures and analyses to characterize sediment quality for dredging project.

http://dnr.wi.gov/org/water/wm/sms/NR347_Guidance_Final.pdf

2 Requirements for All Discharges

2.1 Other Permits and Requirements

The permittee is responsible for obtaining all other necessary approvals for dredging. For example, any work performed below, or within 500 feet of the ordinary high water mark of navigable waters, in wetland areas, or within areas subject to local floodplain and shoreland regulations, must conform to all county or local ordinances. All applicable state permits and/or contracts required by Chapters 30, 31, and 87, Wis. Stats. (or Wisconsin Administrative Code adopted under these laws), and federal permits, must be obtained as necessary. Dredging operations are to be performed in accordance with s. 30.20, Wis. Stats., ch. NR 345, Wis. Adm. Code, and ch. NR 347, Wis. Adm. Code.

2.2 Settling, Filtration, and Wastewater Treatment Systems

A plan approval is required when the sediment is considered contaminated. In these instances, a wastewater treatment system may be necessary and Department review of the proposed plans is required, in accordance with s. 281.41, Wis. Stats., and ch. NR 108, Wis. Adm. Code. For a surface water discharge, a settling basin must have sufficient capacity to allow adequate retention time for settling suspended solids, to which most of the contaminants are sequestered, with the exception of ammonia.

A dredging project may be exempt from the design requirements for settling basins or other storage or treatment facilities, and the land treatment design standards for soil absorption or land application. If the sediment is considered uncontaminated, there would be reduced wastewater concerns and a plan approval is unnecessary. A liner for a settling basin may be unnecessary, and the same settling basin could function as a groundwater absorption system.

However, even when the plans for a wastewater treatment system are exempt from the Department's plan review, the conditions regarding dikes and berms, and adequate storm water capacity are applicable. In the absence of a plan review, inclusion of these design standards in the permit is appropriate. Settling basins used to dewater sediment may not overflow. For the construction of dikes and berms, the Department is applying the appropriate standards contained in the guidance document "Recommended Standards for Wastewater Facilities", and s. NR 110.24(f), Wis. Adm. Code. Settling basin must also be capable of handling the water resulting from a storm having a 10-year, 24-hour event frequency which falls within or flows into the area of the treatment/disposal system. The design rainfall amount and

probable intensity of 10-year and 25-year, 24-hour rainfall events for Wisconsin counties are contained in ch. NR 205, Wis. Adm. Code.

2.3 Water Treatment Additives

Sometimes the use of water treatment additives, such as the addition of polymers to aid in settling, is necessary to comply with the total suspended solids limits and the removal of other substances in the wastewater. Many additives have the potential to cause aquatic toxicity. Water treatment additives must be approved prior to use to assure compliance with water quality standards. The permit identifies what must be submitted to the Department for approval.

2.4 Discharge Monitoring Reports

Effluent monitoring results must be provided as soon as possible to the Department during the first 5 weeks of operation. This may be done with a telephone call, fax, or email to the basin engineer or wastewater specialist identified in the letter granting permit coverage. It's important to confirm effluent compliance quickly because the duration of dredging projects are typically short. Waiting for an annual report at the end of the year, as is typically done with other general permits, isn't appropriate for dredging projects. Reporting with a typical monthly discharge monitoring report (DMR), and a final summary report upon completion of the dredging project, are also required. The Department has an example format for submitting monthly discharge monitoring reports.

3 Discharge Requirements

3.1 Sampling Points

A table lists five sampling points that represent the types of discharges regulated under the general permit. Depending on the quality of the sediment removed in a dredging project, the regulated outfall from the dredging will be subject to the requirements under one of the listed sampling points.

3.2 Groundwater Discharge Requirements

A discharge to groundwater includes wastewater infiltration from irrigation, drain fields, ditches, and ponds that may impact water beneath the ground surface. Depending on whether the sediment quality characterization is "uncontaminated" or "contaminated", one of the two monitoring requirements and limitations tables applies - 3.2.1 for "uncontaminated" sediment or 3.2.2 "contaminated" sediment. Information on sediment quality is collected during the ch. 30 dredging permit application process, as required under ch. NR 347, Wis. Adm. Code. The "*Consensus-Based Sediment Quality Guidelines*" is used to evaluate sediment quality.

3.2.1 Uncontaminated Sediment

For sediment that qualifies as "uncontaminated", the only monitoring is for flow.

3.2.2 Contaminated Sediment

When the sediment is characterized as "contaminated", additional monitoring may be required depending on the contaminants found in the sediment or elutriate test, and if they're at a concentration of concern. The "*Consensus-Based Sediment Quality Guidelines*" is used to make this determination using the threshold effect concentration (TEC) as the criteria for determining if the sediment is considered contaminated for the purpose of this general permit. The initial determination is any contaminant parameter that exceeds the TEC is monitored and limited in the permit.

If natural background concentrations exceed the TEC, the background concentrations may be used instead of the TEC (refer to paragraph 7.2 in the "*Guidance for Applying the Sediment Sampling and Analysis Requirements of ch. NR 347, Wis. Adm. Code*", and Appendix B of the CBSQG).

When a TEC is exceeded for a parameter, it's recommended that an elutriate test be conducted as a second optional determination of whether the contaminant is present in the wastewater at a concentration of concern. If the elutriate concentration exceeds the groundwater preventive action limit (PAL) of the contaminant parameter, monitoring is required in the permit. If the concentration is less than the PAL, monitoring isn't required.

There may be situations when a contaminant is present in the sediment does not have a TEC. In this situation, an elutriate test is necessary to determine if the wastewater could exceed the groundwater PAL and whether the parameter needs to be monitored and limited in the permit.

The groundwater enforcement standards (ES) in ch. NR 140, Wis. Adm. Code will be used for effluent limits for those parameters that have a concentration in the sediment greater than the TEC, or an elutriate test that exceeds the PAL. Because dredging projects are usually a short duration discharge, and not a continuous discharge in the same location, the ES was chosen as the limit. However, the effluent quality goal should be the more stringent PAL to assure compliance.

An exception applies for nitrogen, where instead of using the 10 mg/L nitrate+nitrite ES, a 10 mg/L total nitrogen limit is used as being more appropriate (refer to ch. NR 206, Wis. Adm. Code, land disposal of municipal and domestic wastewater). A total nitrogen limit is more protective because it accounts for all the different forms of nitrogen that may be present in the discharge. Also, limits for organic nitrogen, and total Kjeldahl nitrogen would not be known because these indicator parameters are calculated based on background groundwater monitoring, but there are no groundwater monitoring wells required under the permit to establish these limits.

3.2.3 Sample Frequency

Flow volume must be monitored every day for the duration of the project. For any other monitoring parameters the frequency is twice a week the first week, and then weekly during the next four weeks of discharge to confirm effluent quality to assure the contaminants are below limits. The Department may require daily sampling during the start-up of a treatment system to monitor treatment performance, or if an effluent limit exceedance occurs. If the discharge is in substantial compliance with effluent limits (always below limits), the monitoring frequency may be reduced from weekly to monthly, but it must resume to weekly if there is an exceedance. The permittee may make this change in monitoring frequency without concurrence from the Department.

3.2.4 Grab Sample

The definition of a grab sample is provided. Because the groundwater samples are based on dissolved concentrations, the sample must be filtered prior to analysis.

3.2.5 Flow Volume

Acceptable estimated flow volumes are described. Report the actual flow if it's measured.

3.2.6 Solids Removal

Occasional removal of solids from seepage areas is necessary to insure that these areas can continue to absorb wastewater. Solids in wastewater can cover soils and clog spaces between soil particles, resulting in decreased seepage capacity.

3.3 Surface Water Discharge Requirements

A discharge to surface water includes ditches, storm sewers and pipes that convey wastewater to creeks, streams, rivers and lakes. Depending on whether the sediment quality characterization is "uncontaminated" or "contaminated", one of the two monitoring requirements and limitations tables applies - 3.3.1 for "uncontaminated" sediment or 3.3.2

"contaminated" sediment. Information on sediment quality is collected during the ch. 30 dredging permit application process, as required under ch. NR 347, Wis. Adm. Code. The "*Consensus-Based Sediment Quality Guidelines*" is used to evaluate sediment quality.

3.3.1 Uncontaminated Sediment

For sediment that qualifies as "uncontaminated", the only monitoring is for flow and total suspended solids. A total suspended solids effluent limit of 80 mg/L applies, which is based on the ability of simple settling equipment to easily remove suspended solids. This limit was the result of a hearing examiner's decision on a Mississippi River dredging case, which decided 80 mg/L is the appropriate limit for gravity sedimentation treatment technology for sediments consisting of primarily sand and some silt. The first issuance of this general permit in 1982 included the 80 mg/L limit, and it has been used in subsequent reissuances.

3.3.2 Contaminated Sediment

When the sediment is characterized as "contaminated", additional monitoring may be required depending on the contaminants found in the sediment or elutriate test, and if they're at a concentration of concern. The "*Consensus-Based Sediment Quality Guidelines*" is used to make this determination using the threshold effect concentration (TEC) as the criteria for determining if the sediment is considered contaminated for the purpose of this general permit. The initial determination is any contaminant parameter that exceeds the TEC is monitored and limited in the permit.

If natural background concentrations exceed the TEC, the background concentrations may be used instead of the TEC (refer to paragraph 7.2 in the "*Guidance for Applying the Sediment Sampling and Analysis Requirements of ch. NR 347, Wis. Adm. Code*", and Appendix B of the CBSQG).

When a TEC is exceeded for a parameter, it's recommended that an elutriate test be conducted as a second optional determination of whether the contaminant is present in the wastewater at a concentration of concern. If the elutriate concentration exceeds 1/5 the water quality based effluent limit of the contaminant parameter, monitoring is required in the permit. If the concentration is less than 1/5 the water quality based effluent limit, monitoring isn't required.

If data indicates sediment or elutriate concentrations may be at a level of concern, the Department would calculate site specific water quality based effluent limits in accordance with chs. NR 105 and 106, Wis. Adm. Code (the limits can't be taken directly from a table like groundwater PALs and ESs). Because the procedures for determining the need for a limit and the method to calculate a limit are specified in the permit, the Department may incorporate the limits in the general permit with the cover letter that grants permit coverage.

For contaminated sediment all discharges are subject to a 40 mg/L total suspended solids limit that's based on best professional judgment. Greater sediment removal is needed to prevent contaminants from being discharged, compared to the less stringent 80 mg/L limit that applies to uncontaminated sediment. Contaminants are usually associated with the suspended solids. Controlling suspended solids is also a good indicator for the removal of other contaminants.

A best professional judgment limit of 15 mg/L for oil and grease limit may apply if oil and grease is a contaminant of concern. The oil and grease, and total suspended solids limits, are the same as in the petroleum contaminated water general permit, and are believed to be appropriate for this permit as well.

Phosphorus monitoring and 1 mg/L limit technology based limit or calculated water quality based from chs. NR 102 and NR 217, Wis. Adm. Code may apply if phosphorus is a contaminant of concern. Lacking a correlation between the sediment phosphorus concentration and the potential to exceed the limit in the dredging wastewater, an elutriate test is likely needed to make this determination. The permit would include phosphorus monitoring and a limit if there is a potential to exceed the phosphorus limit in the effluent.

3.3.3 Sample Frequency

Flow volume must be monitored every day, and total suspended solids must be monitored at least once per week for the duration of the project as a key indicator of effluent quality. For any other monitoring parameters the frequency is twice a

week the first week, and then weekly during the next four weeks of discharge to confirm effluent quality to assure the contaminants are below limits. The Department may require daily sampling during the start-up of a treatment system to monitor treatment performance, or if an effluent limit exceedance occurs. If the discharge is in substantial compliance with effluent limits (always below limits), the monitoring frequency may be reduced from weekly to monthly, but it must resume to weekly if there is an exceedance. The permittee may make this change in monitoring frequency without concurrence from the Department.

3.3.4 Grab Sample

The definition of a grab sample is provided.

3.3.5 Flow Volume

Acceptable estimated flow volumes are described. Report the actual flow if it's measured.

3.3.6 Visible Foam and Floating Solids

This is a historical requirement that pre-dates the clean water Act, and represents a narrative water quality standard for no floating solids or foam.

3.3.7 Solids Removal

Over time, settling equipment fills up with settled solids, resulting in decreased volume and residence time for wastewater and ultimately, ineffective solids treatment. Solids must be removed upon occasion to insure effective settling occurs and that permit limits are met. For some short term operations, solids may not need to be removed to maintain the hydraulic and absorptive capacities of the treatment system.

3.3.8 Impaired Waters on 303(d) List and TMDLs

If a facility discharges a pollutant of concern to an 303(d) listed impaired water body, the pollutant discharge needs to be minimized as much as possible as part of an overall state effort to reduce the pollutant loading to the water body. The 303(d) list of Wisconsin impaired water bodies may be identified by contacting the Department or by searching for the 303(d) list on the Department's internet site referenced in the permit. For a dredging operation the most common pollutant of concern may be a total suspended solids (TSS) discharge to a sediment impaired water body.

The permit requires that an annual check be conducted, by February 15th each calendar year, to determine whether the permittee discharges process wastewater to a 303(d) listed impaired water body. If so, the permittee shall evaluate, within 180 days of the annual check, whether additional control measures and practices could be used to voluntarily minimize, with the goal of elimination, the discharge of pollutants of concern that contribute to the impairment of the water body. The permittee should keep a record of the amount of pollutant discharge reduction that has been voluntarily achieved. The exact amount of pollutant reduction will be legally established in the State and Federal approved Total Daily Maximum Load (TMDL) allocation established for the discharge.

Federal Statutes, 40 CFR 122.4, prohibit the issuance of a WPDES permit to a new source or new discharger that will contribute to a violation of a water quality standard in a 303(d) listed water. Also, an increased discharge of a pollutant of concern that would cause or contribute to a violation of a water quality standard in a 303(d) listed water is not allowed. Therefore, this general permit specifies that a permittee may not discharge a new pollutant of concern to a 303(d) listed impaired water body or significantly increase the discharge of a pollutant of concern to an impaired water body unless the new or increased discharge does not contribute to the receiving water impairment, or the new discharge is consistent with an approved TMDL allocation for the impaired water body. The general permit may not be used if this requirement is not met for a new discharge.

For a new dredging operation requesting coverage under this general permit, the Department will evaluate the proposed new pollutant discharge amount and receiving water to determine if the above requirement can be met. A variety of

options may be available to insure any proposed new discharge does not contribute to the receiving water impairment such as on-site capture of the pollutant of concern, an alternate discharge location, wastewater reuse opportunities, directing the discharge to a seepage area, or enhanced treatment options so the discharge would meet the water quality standard.

Permit applicants should refer to the following two Department web sites for information on the 303(d) list and TMDLs:

http://dnr.wi.gov/org/water/wm/wqs/303d

http://dnr.wi.gov/org/water/wm/wqs/303d/Approved_TMDLs.html

3.4 Beach Nourishment and Unconfined Disposal of Sediment in the Great Lakes

Provisions are included in the GP for the disposal of dredged sediments in Lake Michigan and Lake Superior via beach nourishment and unconfined disposal as defined below.

Beach nourishment: The disposal of dredged material on the beaches or in the water landward from the high water mark of Lakes Michigan and Superior for the purpose of adding, replenishing or preventing erosion of beach material.

Unconfined disposal: The deposition of dredged sediments, in water, on the bed of a waterway. Typically, state law prohibits disposal of dredged sediments via unconfined disposal. However, unconfined disposal may be allowed where the bed of Lake Michigan or Lake Superior in the dredged disposal area has been granted to a local government entity.

Beach nourishment and unconfined disposal were originally allowed for some US Army Corps of Engineer projects, where it was believed beneficial to use clean sandy sediment for disposal in shore land location that had been scoured by wave action. Beach nourishment and unconfined disposal practices may not be used in other waters of the state, because of the concern with loss of or harm to aquatic life habitat and spawning locations. Disposal via these means is allowed only if the particle size and contaminant concentrations conditions described below are met.

3.4.1 Particle Size

The particle size of the dredged material must meet the requirements of s. NR 347.07(4)(a)1, Wis. Adm. Code. This requirement is designed to ensure that dredged sediments are similar to those of the beach or lake bed and to insure that settling of sediments will occur. Use of silt material should be avoided because it could more easily wash out.

3.4.2 Contaminant Concentration

If dredged material is used for beach nourishment or unconfined disposal, the sediment may not contain any contaminants above the threshold effect concentrations in the CBSQG. These concentrations are very similar to the concentrations listed in the previous permit that were based on EPA reference numbers for what is considered clean sediment in the Great Lakes. When beach nourishment or unconfined disposal is allowed, requirements to confine and treat the carriage and interstitial water to 80 mg/L total suspended solids is waived by this permit.

4 Standard Requirements

These requirements apply to all permittees, and reflect some of the general conditions contained in ch. NR 205, Wis. Adm. Code. They consist of permittee obligations and reporting requirements.

Other Comments:

The permit includes some minor changes, clarifications, and minor edits to the previous issuance. The changes are summarized below:

(a) Addition of language regarding requirements for 303(d) listed impaired waters and TMDLs to the surface water discharge requirements in Subsection 3, which may be applicable depending on the water body.

(b) In the last issuance of dredging general permit, elutriate testing was included as a means to help determine whether the sediment pore water or interstitial water were contaminated at a concentration of concern in a wastewater discharge. Elutriating testing is not required, but is a method to characterize the sediment if the permittee chooses to use it. The elutriate test may be used to demonstrate whether a sediment contaminant that exceeds the TEC won't partition into the water at a concentration of concern, and thus doesn't have to be monitored or limited in the permit. If the permittee doesn't conduct an elutriate test, all the contaminants exceeding the TEC must be monitored and limited.

Questions were raised about the procedures for elutriate testing because of confusion with various procedures. The effluent elutriate testing referenced in the ch. 347 Guidance is more applicable to evaluating the contaminant transfer between the sediment and water at a confined disposal facilities. For the purpose of evaluating what parameters trigger monitoring and limits under this permit in Subsections 3.2.2 or 3.3.2, a simpler screening procedure may be appropriate. An elutriate test is a sample preparation technique to obtain the water fraction of a sediment slurry. The Department may accept filtering of the supernatant from a representative sediment slurry sample and analyzing the filtrate. This process could serve as the elutriate test to characterize what contaminants would be present in the pore water or interstitial water from dredging. The filtering would be as described in Subsection 3.2.4, which is the method for compliance monitoring of a groundwater discharge.

An explanatory note was added to Subsections 3.2 and 3.3 to clarify what is acceptable for elutriate testing for evaluating what the contaminants of concern are in a groundwater or surface water discharge.

(c) For surface water discharges regulated under Subsection 3.3.2, the default technology based limit of 1mg/L for phosphorus was removed. Phosphorus limits may now need to be a site specific water quality based limit calculated according to ch. NR 102 and ch. NR 217, Wis. Adm. Code, and would apply if it's more stringent. The Oil and grease limit of 15 mg/L that may be applicable was also removed from this section, and instead reference was made to Appendix A of the fact sheet where all the potential limits are identified.

(d) Appendix A was updated to include the new groundwater PAL and ES for ammonia, and PAL and ES for manganese was revised to reflect the change from a welfare standard to health standard.

(e) The style of the permit was revised to reflect the other WPDES permit issued by the Department. New are a table of contents, and summary of reports due section.

Proposed Expiration Date:

June 30, 2016

Paul W. Luebke

Prepared By:

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Date: June 14, 2011

Appendix A

The following table is based on Table 1 in ch. NR 347, Wis. Adm. Code. It lists parameters that may be of potential concern in dredged sediment, and the threshold effect concentration (TEC) and probable effect concentration (PEC) from the *Consensus-Bases Sediment Quality Guidelines* (CBSQG). If the parameter has a ch. NR 140, Wis. Adm. Code groundwater quality standard, the preventive action limits (PAL) and enforcement standards (ES) are listed. If the parameter has a ch. NR 105, Wis. Adm. Code surface water quality criterion, "Calculated" is shown in the "Limit" column to indicate a limit could be applicable, but a numeric value isn't provided because the limit is site specific and needs to be calculated by the Department in accordance with ch. NR 106, Wis. Adm. Code.

Parameter	Sediment TEC	Sediment PEC	Groundwater		Surface Water Limit
			PAL	ES	
PCB (total)	60 µg/Kg	676 µg/Kg	3 ng/L	30 ng/L	Calculated
Dioxin 2.3.7.8 -TCDD^{TEQ}	0.10 µg/Kg	0.19 µg/Kg	3 pg/L	30 pg/L	Calculated
Aldrin	2 µg/Kg	80 µg/Kg	N/A	N/A	Calculated
Diedrin	1.9 µg/Kg	62 µg/Kg	N/A	N/A	Calculated
Chlordane	--	--	0.2 µg/L	2 µg/L	Calculated
Endrin	3 µg/Kg	1300 µg/Kg	0.4 µg/L	2 µg/L	Calculated
Heptachlor	--	--	0.04 µg/L	0.4 µg/L	Calculated
Lindane	--	--	0.02 µg/L	0.2 µg/L	Calculated
Toxaphene	1 µg/Kg	2 µg/Kg	0.3 µg/L	3 µg/L	Calculated
DDT	4.2 µg/Kg	63 µg/Kg	N/A	N/A	Calculated
Arsenic	9.8 mg/Kg	33 mg/Kg	1 µg/L	10 µg/L	Calculated
Barium	--	--	0.4 mg/L	2 mg/L	Calculated
Cadmium	0.99 mg/Kg	5.0 mg/Kg	0.5 µg/L	5 µg/L	Calculated
Chromium	43 mg/Kg	110 mg/Kg	10 µg/L	100 µg/L	Calculated
Copper	32 mg/Kg	150 mg/Kg	130 µg/L	1300 µg/L	Calculated
Cyanide	--	--	40 µg/L	200 µg/L	Calculated
Iron	20 g/Kg	40 g/Kg	0.15 mg/L	0.3 mg/L	Calculated
Lead	36 mg/Kg	130 mg/Kg	1.5 µg/L	15 µg/L	Calculated
Manganese	460 mg/Kg	1100 mg/Kg	60 µg/L	300 µg/L	Calculated
Mercury	0.18 mg/Kg	1.1 mg/Kg	0.2 µg/L	2 µg/L	Calculated
Nickel	23 mg/Kg	49 mg/Kg	20 µg/L	100 µg/L	Calculated
Selenium	--	--	10 µg/L	50 µg/L	Calculated
Zinc	120 mg/Kg	460 mg/Kg	2.5 mg/L	5 mg/L	Calculated
Ammonia Nitrogen	--	--	0.97 mg/L	9.7 mg/L	Calculated
Nitrogen (total)	--	--	N/A	10 mg/L	N/A
Oil and Grease	1000 mg/Kg*	--	N/A	N/A	15 mg/L
Phosphorus	--	--	N/A	N/A	Calculated
Total Organic Carbon	N/A	N/A	N/A	N/A	N/A

N/A = Not Applicable, a standard is not contained in ch. NR 105 or ch. NR 140, Wis. Adm. Code.

Calculated = Monitoring and a limit may apply to this parameter, pending an effluent limit calculation.

-- = No data available.

* = Based on best professional judgment. The CBSQG does not have a TEC for this parameter.

Normalized Data: The TEC and PEC values in the table are based on sediment with 1% total organic carbon (TOC). When comparing sediment data with the TEC and PEC it may necessary normalize it to 1% TOC. Higher TOC in sediment reduces the bioavailability of nonpolar organic contaminants. To normalize sediment data to 1% TOC divide the dry weight concentration by the % TOC. For metals make a direct comparison with the TEC and PEC, without any adjustment for either TOC or the fine fraction. Refer to Sections 9.1, 9.2, and Appendix D of the CBSQG.