Silver Lake Vegetation Management Plan Update

Kosciusko County, Indiana

2006

http://129.79.145.7/arcims/statewide%5Fmxd/viewer.htm

Prepared for:

The Silver Lake Association

3332 West Neher Road
Silver Lake, IN 46982

Prepared by:

Aquatic Weed Control

P. O. Box 325
Syracuse, IN 46567

Executive Summary

Two aquatic vegetation surveys were conducted on Silver Lake in 2006. The first survey was conducted on April 20, 2006 and the second was conducted on July 26, 2006. The purpose of these surveys was to document any changes in the plant community from the 2005 surveys, and to monitor the lake's curly leaf pondweed (CLP) population, along with the native plant community.

Approximately 30 acres of Silver Lake were chemically treated with Aquathol K on April 26, 2006. This treatment was part of an ongoing project designed to reduce the curly leaf pondweed population in Silver Lake. Curly leaf pondweed is abundant throughout Silver Lake. The entire littoral zone of Silver Lake was treated, as well as the littoral zone of North Little Lake. These treatments are not expected to eliminate curly leaf pondweed in Silver Lake but should help to prevent its spread and help beneficial native plants compete with the invader.

The July 2006 survey found that curly leaf pondweed was not abundant in the lake after chemical treatment, although natural die offs of the weed are expected as water temperatures reach 75 degrees in summer.

The 2007 management strategy will remain much the same as in 2005 and 2006. The early season Aquathol treatment program must be continued to reduce the amount of curly leaf pondweed turions in the sediment of Silver Lake. Eurasian watermilfoil is also increasing in North Little Lake, and will also be treated with 2, 4-D in spring of 2007 to prevent its spread. Coontail, a native plant is also very abundant in the lake, and reaches nuisance levels in many areas. Coontail causes many recreational problems for Silver Lake residents, but coontail treatments are currently not eligible for LARE funding, as the IDNR considers coontail a beneficial native plant.

2007 Cost Estimates:

1. Chemically Treat Areas Infested by Curly Leaf Pondweed

*All cost figures are estimates only. All prices are subject to change pending 2007 chemical pricing.

A. Treat the entire littoral zone (Silver and North Little) with Aquathol K $ 9,700

B. North Little Lake Eurasian Watermilfoil
Treat 10 acres with 2, 4-D $ 3,750

2. Conduct 2 aquatic vegetation surveys (spring and July) to monitor both invasive and native plant populations.

A. Spring Tier II Survey and Plan Update $ 4,000

Acknowledgements

Aquatic vegetation surveys conducted on Silver Lake were made possible by funding from the Silver Lake Association and the Indiana Department of Natural Resources through the Lake and River Enhancement Program. Aquatic Weed Control would like to extend special thanks to Indiana Department of Natural Resources (IDNR) District 3 biologist Jed Pearson for providing procedural training for both Tier I and Tier II aquatic vegetation surveys. IDNR District 4 Fisheries Biologist Ed Braun and Assistant Fisheries Biologist Angela Benson provided consultation in the development of this management strategy. Gwen White and Angela Sturdevant, aquatic biologists for the IDNR Division of Fish and Wildlife provided valuable consultation regarding the requirements and objectives of this lake management plan. Brad Fink, and Jason Doll provided assistance and training for data analysis computer programs. Aquatic Weed Control would also like to thank the members of the Silver Lake Association for their commitment to improving this lake and for valuable discussion and input brought forward at the informational meeting held on June 10, 2006.

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1.0 Introduction

Silver Lake has been involved in the Lake and River Enhancement Program (LARE) since 2004, when the first LARE funded aquatic vegetation survey took place on July 12, 2004. Based on the results of this survey, curly leaf pondweed was very prevalent in some areas of Silver Lake, and the heaviest areas of infestation were targeted for herbicide treatments. The following chart summarizes all LARE funded activities on Silver Lake.

Table 1: Silver Lake LARE History

Year	Action	Date	Funding Source
2004	Late Season Aquatic Vegetation Survey. Lake Management Plan Development	Late Season Survey August 25, 2004	Lake and River Enhancement Silver Lake Association
2005	Spring and Late Season Aquatic Vegetation Surveys as well Aquathol K application and Management Plan Update	Spring Survey April 14, 2005 Aquathol K Application ~30 acres – April 15, 2005 July Survey July 15, 2005	Lake and River Enhancement Silver Lake Association
2006	Spring and Late Season Aquatic Vegetation Surveys as well Aquathol K application and Management Plan Update	Spring Survey April 20, 2006 Aquathol K Application ~30 acres- April 26, 2006 Late Season Survey July 26, 2006	Lake and River Enhancement Silver Lake Association

2.0 Watershed and Lake Characteristics Update

(See 2004 Lake Management Plan)

Secchi disk readings remain low in Silver Lake at around 3-5 feet. There have been no known significant changes to the watershed and water quality remains much the same.

3.0 Lake Uses Update

(See 2004 Lake Management Plan)

Silver Lake continues to receive very high levels of public use during the summer months. Boaters and fishermen enter the lake from the private access points on Silver Lake. The lake is popular with many fishermen, as the major sport species are panfish and largemouth bass.

4.0 Fisheries Update

The IDNR has conducted a new fisheries survey on Silver Lake in 2006. The following species list was provided by District 4 Fisheries Biologist Ed Braun, and was written by Angela Benson. It summarizes population statistics for every species of fish collected in past fisheries surveys.

The executive summary of the fish management report describes the fish population and is included below. This is an excerpt and not the entire report.

SILVER LAKE

Kosciusko County

2006 Fish Management Report

Angela C. Benson

Assistant Biologist

EXECUTIVE SUMMARY

- A general lake survey was completed on Silver Lake from June 5 to 6, 2006. During this survey, water chemistry data was also collected. Aquatic vegetation surveys were conducted on April 19 and July 18, 2006.

- The Secchi disk reading was 3 ft on April 19 and and 7 ft July 18 and dissolved oxygen concentration was adequate for fish survival above 14 ft on June 6. Submersed vegetation was found to a maximum depth of 11 ft on April 19 and 9 ft on July 18. Coontail *Ceratophyllum demersum* dominated the plant population in the spring and summer vegetation surveys.

- A total of 521 fish, representing 17 species and 1 hybrid sunfish, was collected during the general survey. Bluegill ranked first by number, followed by largemouth bass and gizzard shad. Largemouth bass ranked first by weight, followed by gizzard shad and carp. Overall, the quality of the largemouth bass fishery was good based on the relatively high PSD (70) and RSD-14 (51). Largemouth bass reached 14.0 in TL at age 4. Similarly, the bluegill population was good quality because PSD was 32 and RSD-8 was 8.

- In Silver Lake, the DFW should maintain a 14-in minimum size limit on largemouth bass; the District Biologist should not permit the control of native aquatic vegetation beyond the creation of boating lanes; the DFW should work with IDEM and the SWCD to encourage the lakeshore landowners to participate in best management practices to improve Silver Lake water quality.

Table 2: IDNR Fish Species List (Benson, 2006)

Species	1972	1980	1986	1989	2006
Bluegill	1,009	360	422	259	199
Largemouth bass	103	105	61	195	99
Yellow perch		147	118	124	16
Gizzard shad	2	385	447	302	97
Warmouth		34	38	38	8
Golden shiner	2	19	85	84	10
Yellow bullhead	1	14	6	19	6
Black crappie	19	172	79	16	12
Brown bullhead	2	34	13	18	9
Common shiner	3				
Pumpkinseed	14	49	34	33	1
Carp		16	4	5	4
Lake chubsucker			2	2	3
Rock bass		1			
White bass			12	19	5
Grass pickerel		1			
Creek chub			1		
White sucker	49	264	171	20	13
Spotted sucker		22	32	5	4
Hybrid sunfish			2	1	7
Black bullhead	1	7	30	5	
Green sunfish		2		1	
Northern pike		1	4	1	
Redear sunfish					28
Total	1,205	1,633	1,561	1,147	521
1972 effort: gill net = 4 lifts; AC EF: Day = 1 h					
1980 effort: gill net = 9 lifts, trap net = 9 lifts, DC EF: Night = 1.29 h; PSDs calculated using only EF data					
1986 effort: gill net = 7 lifts, trap net = 5 lifts, DC EF = 1 h; PSDs calculated using only EF data					
1989 effort: gill net = 6 lifts, trap net = 4 lifts, DC EF = 1 h; PSDs calculated using only EF data					
2006 effort: gill net = 4 lifts, trap net = 2 lifts, DC EF = 1 h; PSDs calculated using only EF data					

5.0 Problem Statement

Curly leaf pondweed will continue to be the major challenge in maintaining a healthy plant community at Silver Lake. Herbicide treatments provide effective control on a yearly basis for curly leaf pondweed and overall infestation should decrease as a result of the treatment program. Coontail, a native species in Silver Lake is also present at nuisance levels in many areas. Coontail treatments are not eligible for LARE funding.

6.0 Management Goals and Objectives

The management goals outlined by the IDNR Division of Fish and Wildlife have not changed. They are restated below:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.

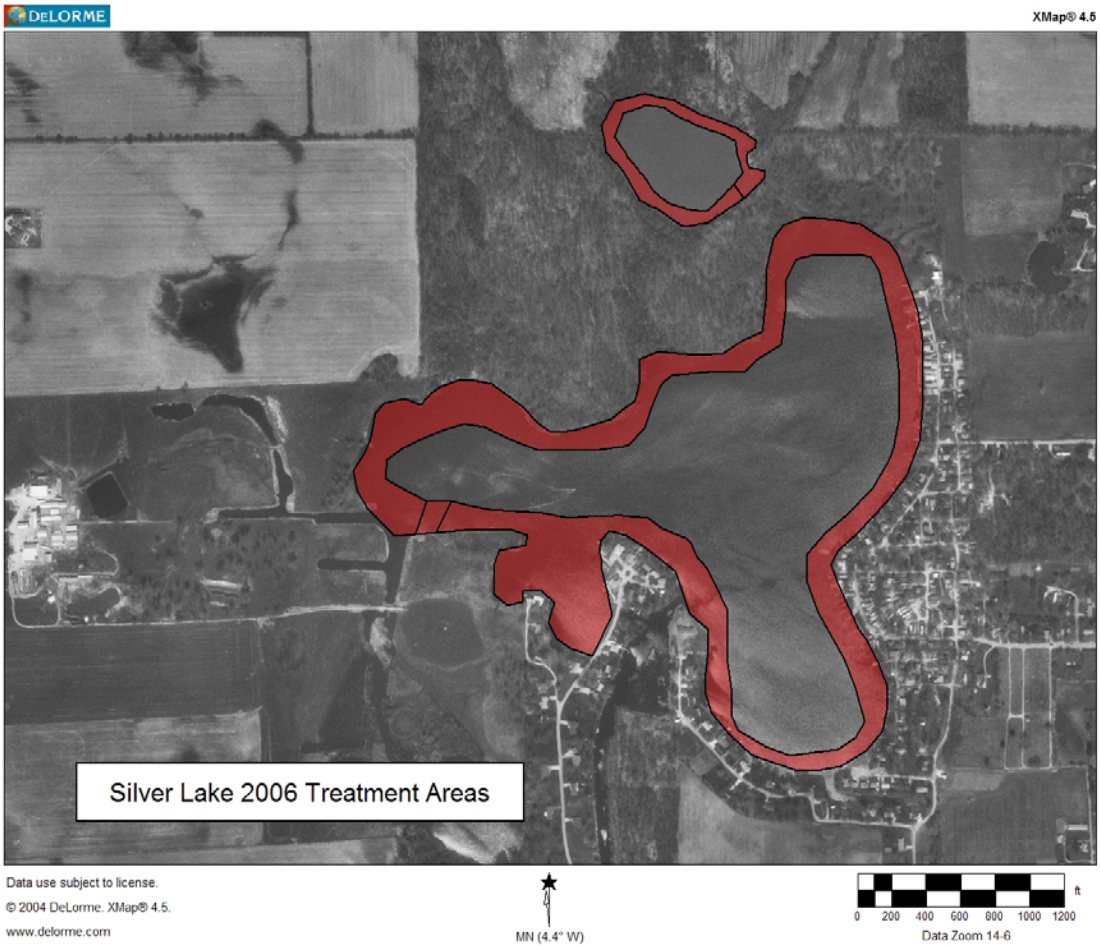
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.

3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

7.0 Plant Management History Update

The major changes to the plant management history have been the LARE funded Aquathol treatments for Curly leaf pondweed in both Silver and North Little Lakes. Permit acreages for the treatment of private lots have not changed significantly. A treatment map is included (Figure 1) that shows an outline of the 2006 treatment areas for both lakes. North Little Lake will be treated for Eurasian watermilfoil in addition to curly leaf pondweed in 2007.

Figure 1: 2006 Silver Lake Treatment Areas



8.0 Aquatic Plant Community Characterization Update

Two major changes have been adopted in LARE protocol that change the process of characterizing the plant community of Indiana lakes.

The first change is the switch from 2 Tier II surveys each year to just one Tier II survey per year. Prior to 2006, both a Tier I and a Tier II survey were required in both spring and July. This year's protocol changed to require a Tier I survey each spring, and A Tier II survey if the July, accompanied by a Tier I July survey to document any changes in the to plant community from spring to July.

The second change is in the formation of a new Tier II protocol. These changes are outlined in the methods section (8.1).

8.1 Methods Update

The Tier II survey protocol was changed by the IDNR in 2006. New LARE Tier II protocol requires that sample sites be stratified by depth contour. Prior to 2006 sites were to be spaced evenly through the littoral zone.

Before 2006, the number of sample sites required each lake were determined strictly by lake size. In the 2006 protocol, the number of sample sites needed is based on both lake size and trophic state. Trophic state describes the productivity of a lake and is correlated with plant growth, secchi disk, and nutrient availability. There are 4 different trophic states listed by the IDNR: Oligotrophic, Mesotrophic, Eutrophic, and Hypereutrophic. Oligotrophic Lakes usually have clear water and few nutrients, while Hypereutrophic lakes usually have deeply stained water and are nutrient rich. Table 3 is taken from the IDNR 2006 Tier II protocol and shows the maximum depth that must be sampled for a lake in each trophic state. In oligotrophic lakes, where water is clear, plants may be able to grow in up to 25 feet of water because sunlight may still reach the lake bottom in deep water. In hypereutrophic lakes where water is turbid, lack of sunlight will prevent plants from growing in deep water, so the maximum sampling depth is only 10 feet.

Table 3: Sample depth by Trophic State

Trophic State	Maximum Depth of Sampling (ft)
Hypereutrophic	10
Eutrophic	15
Mesotrophic	20
Oligotrophic	25

Table 4 is used to calculate the number of sample sites need in each depth contour by using lake size and trophic status. The new protocol attempts to more accurately describe the entire littoral zone of a lake and provide more detailed data analysis by separating the littoral zone into 5 foot depth segments.

Table 4: Sample Sites by Lake Size and Trophic State

Tier II Sampling 3

Table 3. Sample size requirements as determined by lake size, trophic state, and apportioned by depth class.

		Hypereutrophic		Eutrophic			Mesotrophic				Oligotrophic				
Lake Acres	Total # of Sites	0-5 foot contour	5-10 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	20-25 foot contour
<10	20	10	10	10	7	3	10	5	3	2	10	4	3	2	1
10-49	30	20	10	10	10	10	10	10	7	3	10	10	5	3	2
50-99	40	30	10	17	13	10	10	10	10	10	10	10	10	7	3
100-199	50	40	10	23	17	10	14	14	12	10	10	10	10	10	10
200-299	60	50	10	30	20	10	18	16	16	10	14	12	12	12	10
300-399	70	60	10	37	23	10	22	20	18	10	17	15	14	14	10
400-499	80	70	10	43	27	10	25	23	22	10	19	18	17	16	10
500-799	90	80	10	50	30	10	29	27	24	10	22	21	19	18	10
>=800	100	90	10	57	33	10	33	31	26	10	25	23	22	20	10

Silver Lake is classified as Eurtrophic, and has 102 surface acres. Based on these categorizations 50 sample sites were needed, and these sites were distributed by 5 foot depth contour to a maximum depth of 15 feet. An additional 20 sample were taken in North Little Lake. These sites were divided by five foot contour as well.

8.2.1 Tier I Results

The submersed plant community of Silver and North Little Lakes covers roughly 33 acres. Silver Lake's plant community is characterized by low diversity with coontail being by far the most dominant plant in the lake. Curly leaf pondweed is abundant in spring, and is replaced by coontail as water temperatures rise in summer.

During the 2006 Tier I surveys, 6 major plant beds were identified. The composition of these plant beds show slight changes from spring to July. Eurasian watermilfoil becomes more prevalent in North Little lake as the growing season progresses and curly leaf pondweed dies off.

Problem Plant Areas:

Plant bed #5 (Figure 2) has extremely high amounts of plant growth. Both curly leaf pondweed and coontail choke this area, severely limiting recreational opportunities. Plant bed #2 should also be watched closely for Eurasian watermilfoil. This invasive plant is more prevalent in North Little Lake and could be spread to Silver Lake through the small channel connecting the two lakes.

Beneficial Plant Areas:

One of the most beneficial plant areas in Silver Lake is the undeveloped wetland and forest area along the north shore of the lake. Wetland areas provide excellent water filtration and shoreline stability. This area should be protected to help preserve good water quality in Silver Lake. Also, the plant community of North Little Lake showed more diversity than Silver Lake in July of 2006. It should continue to be monitored to protect native plants from both curly leaf pondweed and Eurasian watermilfoil.

Figure 2: 2006 Tier I Plant Beds

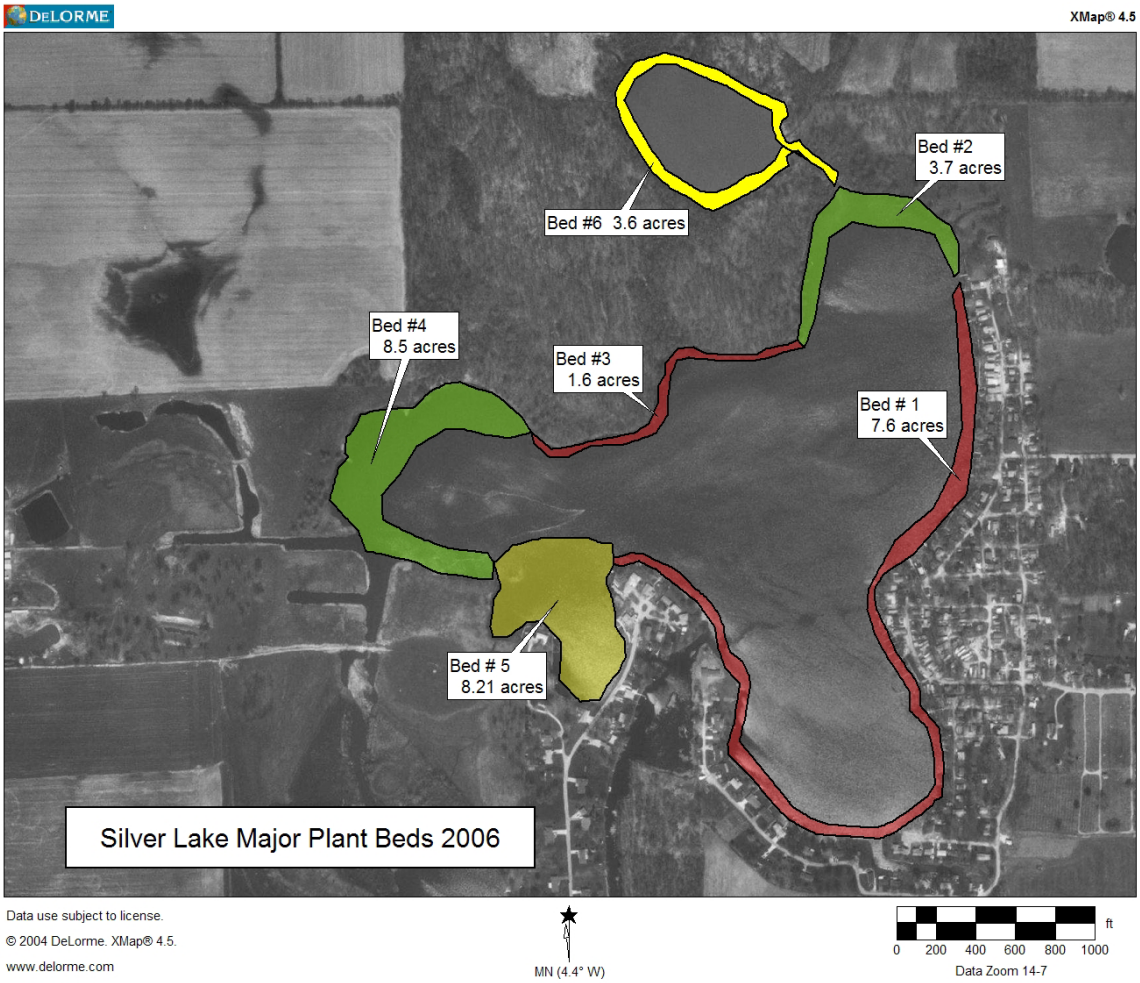


Table 5 shows all of the plant species found in the Tier I surveys and there abundance rating for each plant bed. Tier I surveys on April 20 and July 26 were used to construct Table 5 and Figure 2, which characterize the major plant beds in Silver Lake and North Little Lake. Blanks indicate that the plant was not present in a particular bed.

Table 5: Tier I Plant Bed Summary

Silver Lake 2006 Tier I Submersed Plants

Species Abundance by Plant Bed #

	#1	#2	#3	#4	#5	North Little #6
Plant Species						
Chara				1		
Eurasian Watermilfoil						2
American Elodea	2			2		1
Curly-Leaf Pondweed	3	1	1	1	3	4
Coontail	4	4	4	4	4	2
Total # of Species	**3**	**2**	**2**	**4**	**2**	**4**
Size (Acres)	*7.6*	*3.7*	*1.6*	*8.5*	*8.2*	*3.6*

Plant Bed #1
Size: 7.6 acres
Substrate: Silt/Clay
Number of Species: 3
Description: This plant bed covers the majority of the developed shoreline of Silver Lake. Coontail is the most dominant plant in this bed. Curly leaf pondweed was also fairly abundant in spring of 2006, and American elodea was also found in lower abundance.

Plant Bed #2
Size: 3.7 acres
Substrate: Sand/Silt
Number of Species: 2
Description: This plant bed runs along the north shore of Silver lake near the channel to North Little Lake. Only two species were found in this plant bed in spring of 2006. Coontail dominated the plant bed, and curly leaf pondweed was present, although its abundance was low in this bed.

Plant Bed #3
Size: 1.6 acres
Substrate: Silt/Clay
Number of Species: 4
Description: This narrow plant bed runs along the shoreline by the undeveloped forest area on the north side of the lake. The drop-off is abrupt in this area, making the plant bed very narrow. Two plant species were observed in this bed in spring of 2006. Coontail was dominant, while curly leaf pondweed was present in lower abundance.

Plant Bed #4
Size: 8.5 acres
Substrate: Silt/Sand
Number of Species: 4
Description: This plant bed makes up the large bay in the west end of Silver Lake. Coontail was again dominant, while elodea was found in moderate abundance. Chara and curly leaf pondweed were found as well, though they had lower abundances.

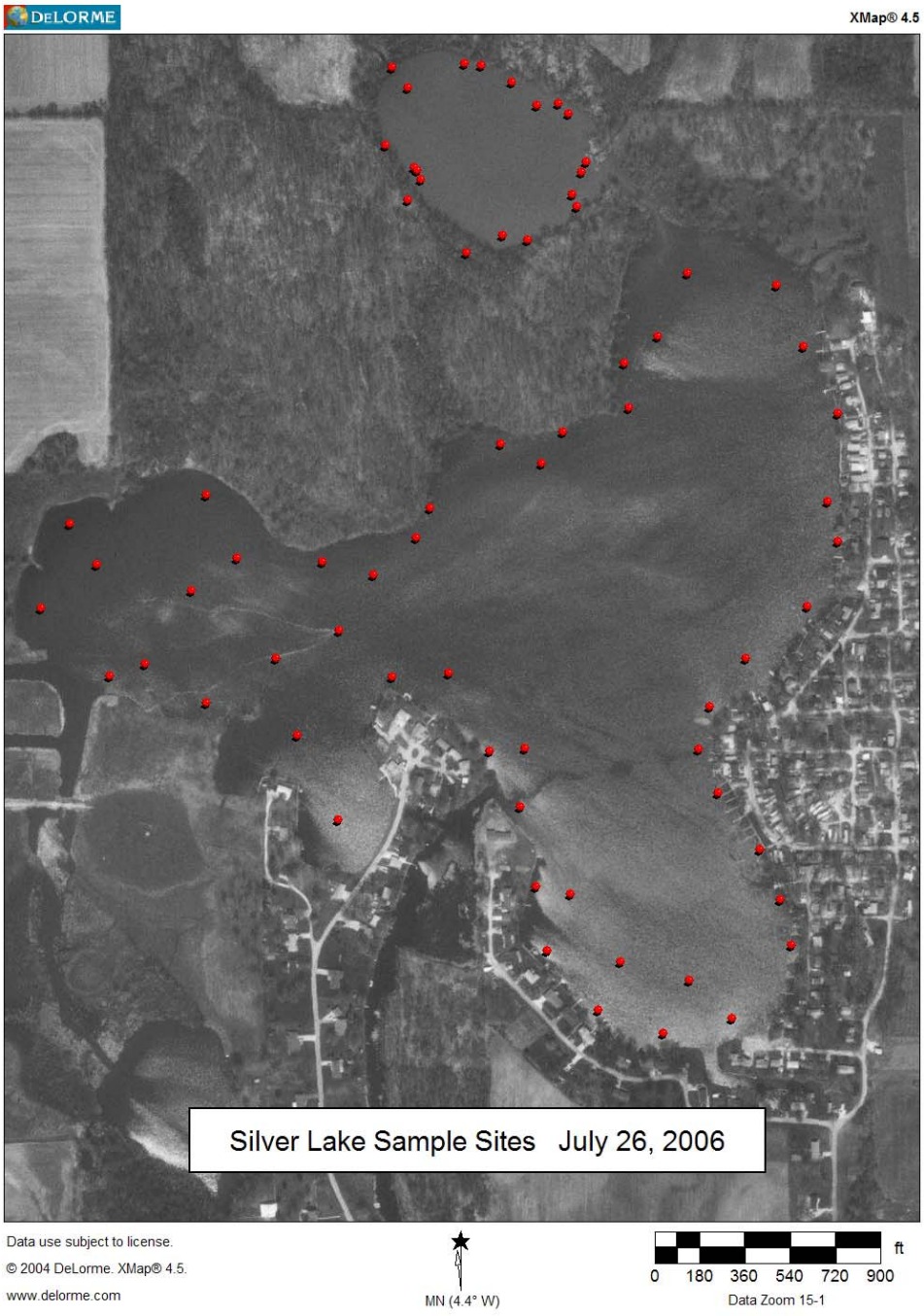
Plant Bed #5
Size: 8.2 acres
Substrate: Silt/Clay
Number of Species: 2
Description: This plant bed fosters some of the most excessive plant growth in Silver Lake. Only two plant species were observed in spring of 2006. Coontail was very thick in this area, and curly leaf pondweed was present as well in lower abundance.

Plant Bed #6
Size: 3.6 acres
Substrate: Silt/Clay
Number of Species: 4
Description: This plant bed makes up the entire littoral zone of North Little Lake. Four plant species were observed in spring of 2006. Curly Leaf Pondweed was very abundant in North Little Lake. Coontail and Eurasian watermilfoil were present in moderate abundance and elodea was present in very low abundance.

8.2.2 Tier II Results

Secchi depth was estimated at 4.0 feet in the July 2006 Tier II survey. Fifty rake samples were distributed throughout each 5 foot depth contour of Silver Lake's littoral zone. Twenty sample sites were distributed throughout the littoral zone of North Little Lake. A total of 3 species of submersed aquatic plants were collected in Silver Lake, while 6 plant species were found in North Little Lake. The following map shows the locations of all sample sites during the 2006 Tier II survey. Sample sites differ from 2005, reflecting the change in Tier II protocol for 2006.

Figure 3: Silver Lake 2006 Tier II Sample Sites



Tier II Data Analysis

Tables 6 through 11 are data summaries for the 2006 aquatic vegetation survey. These tables help to describe the plant community, and will help identify any changes that take place in the years to come. Table 6 analyzes every sample site in Silver Lake and table 9 analyzes all sample sites in North Little Lake. The other tables describe each depth contour of the littoral zones (0-5 feet, 5-10 feet, etc).

Data shown in Tables 6 and 9 includes null values from sample sites where plants were not collected.

Table 6: Silver Lake July 2006 Data Analysis: All Sites

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/26/06	Littoral sites with plants:	25	Species diversity:	0.33
Littoral depth (ft):	15.0	Number of species:	3	Native diversity:	0.33
Littoral sites:	50	Maximum species/site:	3	Rake diversity:	0.17
Total sites:	50	Mean number species/site:	0.62	Native rake diversity:	0.17
Secchi:	3.0	Mean native species/site:	0.62	*Mean rake score:	1.58

Common Name	Site frequency	Rel. Freq.	Relative density	Mean density	Dominance
Coontail	50.0	80.6	1.54	3.08	30.8
Slender Naiad	6.0	9.7	0.10	1.67	2.0
Elodea sp	6.0	9.7	0.06	1.00	1.2

Table 7: Silver Lake July 2006 Data Analysis: 0-5 foot depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/26/06	Littoral sites with plants:	20	Species diversity:	0.38
Littoral depth (ft):	5.0	Number of species:	3	Native diversity:	0.38
Littoral sites:	23	Maximum species/site:	3	Rake diversity:	0.19
Total sites:	23	Mean number species/site:	1.13	Native rake diversity:	0.19
Secchi:	3.0	Mean native species/site:	1.13	*Mean rake score:	3.13

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	87.0	3.04	3.50	60.9
Slender Naiad	13.0	0.22	1.67	4.3
Elodea sp	13.0	0.13	1.00	2.6

Table 8: July 2006 Data Analysis: 5-10 Foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/26/06	Littoral sites with plants:	5	Species diversity:	0.00
Littoral depth (ft):	10.0	Number of species:	1	Native diversity:	0.00
Littoral sites:	17	Maximum species/site:	1	Rake diversity:	0.00
Total sites:	17	Mean number species/site:	0.29	Native rake diversity:	0.00
Secchi:	3.0	Mean native species/site:	0.29	*Mean rake score:	0.41

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	29.4	0.41	1.40	8.2

No plants were found in the 10 – 15 foot depth contour in Silver Lake.

Table 9: North Little Lake Data Analysis: All Sites

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/26/06	Littoral sites with plants:	13	Species diversity:	0.72
Littoral depth (ft):	15.0	Number of species:	6	Native diversity:	0.57
Littoral sites:	20	Maximum species/site:	5	Rake diversity:	0.68
Total sites:	20	Mean number species/site:	1.35	Native rake diversity:	0.50
Secchi:	3.0	Mean native species/site:	0.90	*Mean rake score:	1.35

Common Name	Site frequency	Rel. Freq	Relative density	Mean density	Dominance
Coontail	50.0	37.0	0.90	1.80	18.0
Eurasian Watermilfoil	40.0	29.6	0.60	1.50	12.0
Elodea sp	30.0	22.2	0.40	1.33	8.0
Chara	5.0	3.7	0.05	1.00	1.0
Curly-leaf Pondweed	5.0	3.7	0.05	1.00	1.0
Sago Pondweed	5.0	3.7	0.05	1.00	1.0

Table 10: North Little Lake Data Analysis: 0-5 Foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/26/06	Littoral sites with plants:	10	Species diversity:	0.73
Littoral depth (ft):	5.0	Number of species:	6	Native diversity:	0.58
Littoral sites:	10	Maximum species/site:	5	Rake diversity:	0.67
Total sites:	10	Mean number species/site:	2.30	Native rake diversity:	0.50
Secchi:	3.0	Mean native species/site:	1.60	*Mean rake score:	2.20

Common Name	Site frequency	Relative density	Mean density	Dominance
Coontail	90.0	1.70	1.89	34.0
Eurasian Watermilfoil	60.0	0.80	1.33	16.0
Elodea sp	50.0	0.70	1.40	14.0
Chara	10.0	0.10	1.00	2.0
Curly-leaf Pondweed	10.0	0.10	1.00	2.0
Sago Pondweed	10.0	0.10	1.00	2.0

Table 11: North Little Lake Data Analysis: 5-10 Foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	7/26/06	Littoral sites with plants:	3	Species diversity:	0.63
Littoral depth (ft):	10.0	Number of species:	3	Native diversity:	0.50
Littoral sites:	5	Maximum species/site:	2	Rake diversity:	0.50
Total sites:	5	Mean number species/site:	0.80	Native rake diversity:	0.50
Secchi:	3.0	Mean native species/site:	0.40	*Mean rake score:	1.00

Common Name	Site frequency	Relative density	Mean density	Dominance
Eurasian Watermilfoil	40.0	0.80	2.00	16.0
Coontail	20.0	0.20	1.00	4.0
Elodea sp	20.0	0.20	1.00	4.0

No plants were found in the 10-15 foot depth contour of North Little Lake.

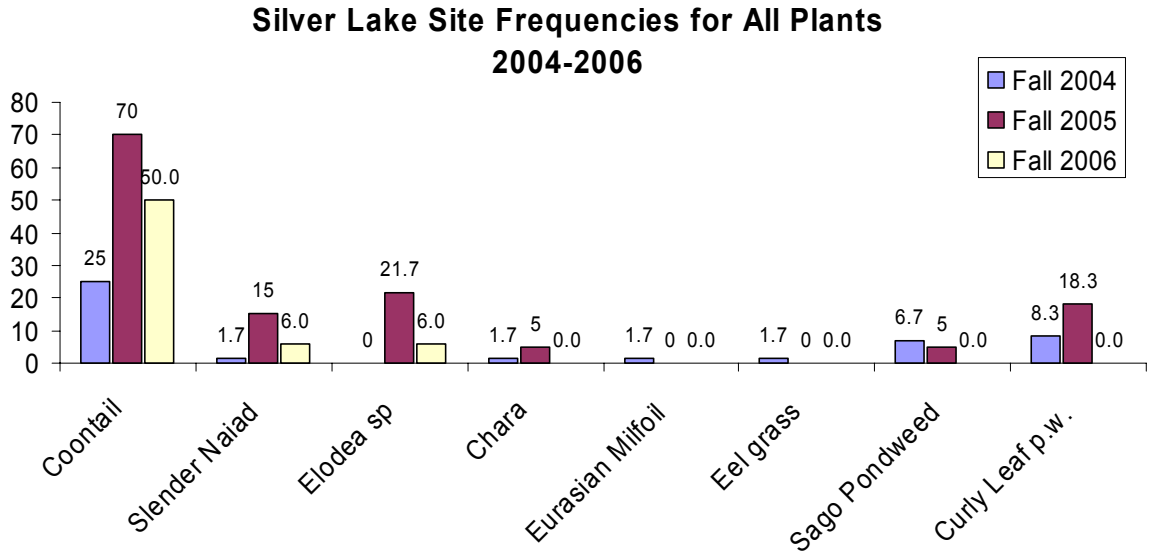
Site Frequency

Site frequency is a measure of how often a species was collected during the Tier II survey. It can be calculated by the following equation:

$$\text{Site Frequency} = \frac{(\text{\# of sites where the species was collected})}{\text{Total \# of littoral sample sites}} \times 100$$

Table 12 shows site frequencies for every plant collected in any of the late season Tier II surveys since the lake was involved in the LARE program. Curly leaf pondweed was not found in July of 2006 although natural die offs make it difficult to gage the curly leaf pondweed population. Coontail remains the most frequently collected plant in every survey.

Table 12: 2004-2006 Site Frequencies



Mean Density and Relative Density

Mean Density is a measure the abundance of a species in areas where it is growing. For example, a species can have a high site frequency, but still have a very low mean density. This means that a species may be prevalent throughout an entire lake, but it may also be sparsely scattered. Mean density can be calculated using the following equation:

$$\text{Mean Density} = \frac{(\text{The sum of all rake scores for a species})}{(\text{Total \# of sites where the species was collected})}$$

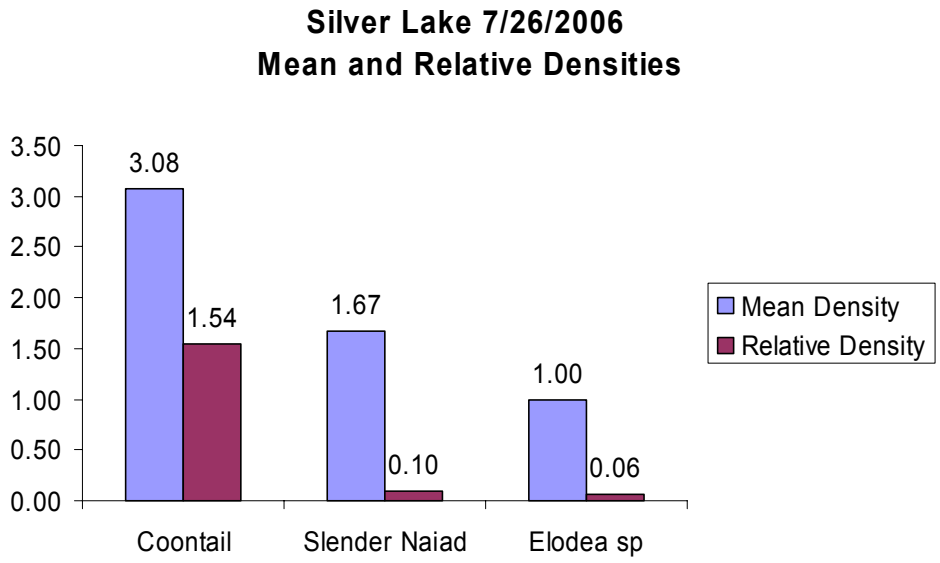
Relative Density is calculated much like mean density, only in this case, the sum of the rake scores for a species is divided by the total number of sample sites in the survey. Unless a species was collected at every sample site, the relative density will always be smaller than the mean density.

$$\text{Relative Density} = (\text{The sum of all rake scores for a species})$$

(Total # of littoral sample sites)

Table 13 shows mean and relative densities for each plant found in the July 2006 Tier II survey. Coontail had both the highest mean density and the highest relative density. Slender naiad and elodea were the only other species collected in July of 2006.

Table 13: July 2006 Mean and Relative Densities



Species Diversity

The species diversity indices listed in tables 6 through 11 help to describe the overall plant community. A species diversity index is actually measured as a value of uncertainty (H). If a species is chosen at random from a collection containing a certain number of species, the diversity index (H) is the probability that a chosen species will be different from the previous random selection. The diversity index (H) will always be between 0 and 1. The higher the H value, the more likely it is that the next species chosen from the collection at random will be different from the previous selection (Smith, 2001). This index is dependent upon species richness and species evenness, meaning that species diversity is a function of how many different species are present and how evenly they are spread throughout the ecosystem.

The species diversity index for Silver Lake in July of 2006 was 0.33 which is very low. Native plant diversity in July of 2006 was also 0.33 which indicates that all species collected in the survey were native plants. Rake diversity and native rake diversity were both 0.17 which was also very low.

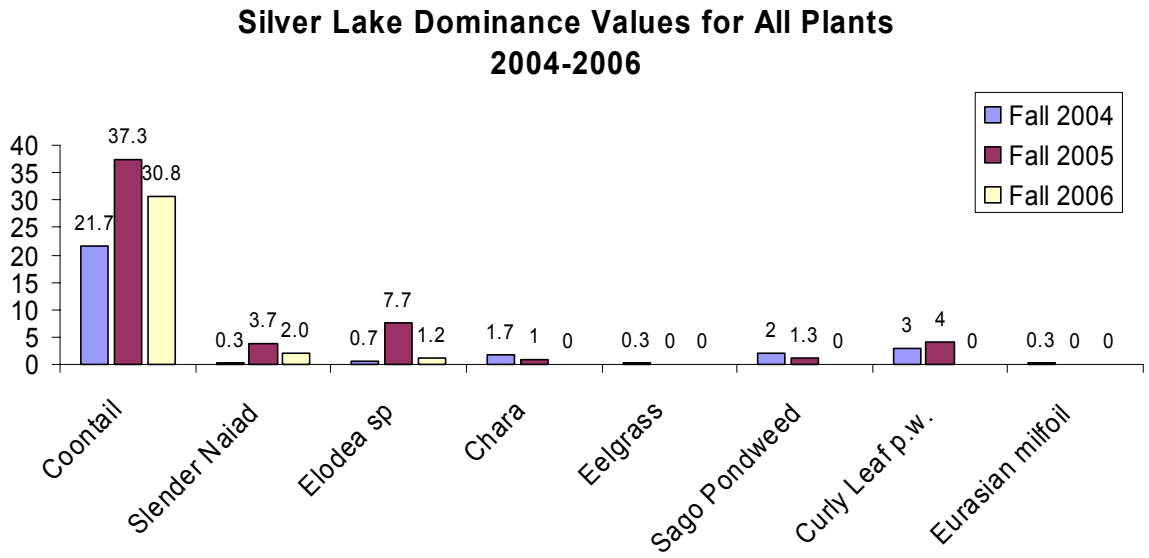
North Little Lake species diversity was better at 0.72 which is slightly below average for area lakes. Native diversity was 0.57. Rake diversity in North Little Lake was 0.68, while native rake diversity was 0.50.

Species Dominance

Species dominance is dependent upon how many times a species occurs, and its relative coverage area or biomass within the system. In this survey, the abundance rating given to each species at each sample site was used to determine dominance. The dominance of a particular species in this Tier II survey increases as its site frequency and relative abundance increase.

Table 14 tracks dominance values for each plant collected at Silver Lake during its involvement in the LARE program. Trends are similar to sight frequency, with coontail being by far the most dominant plant collected in each survey. Elodea and slender naiad are two of the other most dominant plants from year to year, although they have low dominance values. Curly leaf pondweed is under-represented in this graph as it usually dies off naturally before the July tier II survey.

Table 14: 2004-2006 Plant Dominance



Relative Frequency of Occurrence

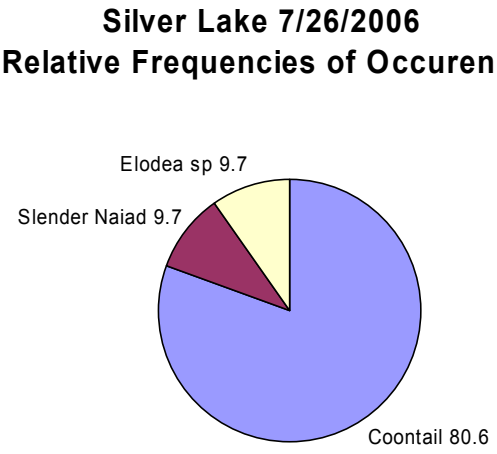
Relative frequency of occurrence is a measure of how often a plant is collected in relation to all of the other plants collected in a Tier II survey. It is demonstrated with the following equation:

$$\text{Relative Freq. of Occurrence} = \frac{\text{The site Frequency for a species}}{\text{The sum of all site frequencies including the species in question}} \times 100$$

The sum of all relative frequency of occurrence values will always add up to 100. For this reason it is displayed in a pie graph.

Figure 4 shows relative frequency of occurrence values for each plant collected in the July 2006 survey. Coontail had an extremely high relative frequency at 80.6, while elodea and slender naiad each had a relative frequency of 9.7.

Figure 4: July 2006 Relative Frequency of Occurrence



8.3 Macrophyte Inventory Discussion

The submersed plant community of Silver Lake covers roughly 33 acres of Silver and North Little Lakes. Based upon 2006 survey data, Silver Lake has a submersed aquatic plant community with very low diversity when compared with many area lakes. Species richness in Silver Lake was only 3 species in the July of 2006, while it was greater in North Little Lake, at 6 species. The plant community is dominated by coontail, which is a native plant. Curly leaf pondweed is abundant is the spring, although it does not appear to be increasing in abundance. As more data is collected in the years to come, long term trends can be identified, and the health and diversity of the plant community can be more closely tracked.

In summary, Silver Lake is characterized by a submersed plant community with low diversity (0.33), low water clarity (secchi depth ~4 ft.) an overabundant population of coontail, and a moderately abundant population of curly leaf pondweed.

9.0 Aquatic Vegetation Management Alternatives

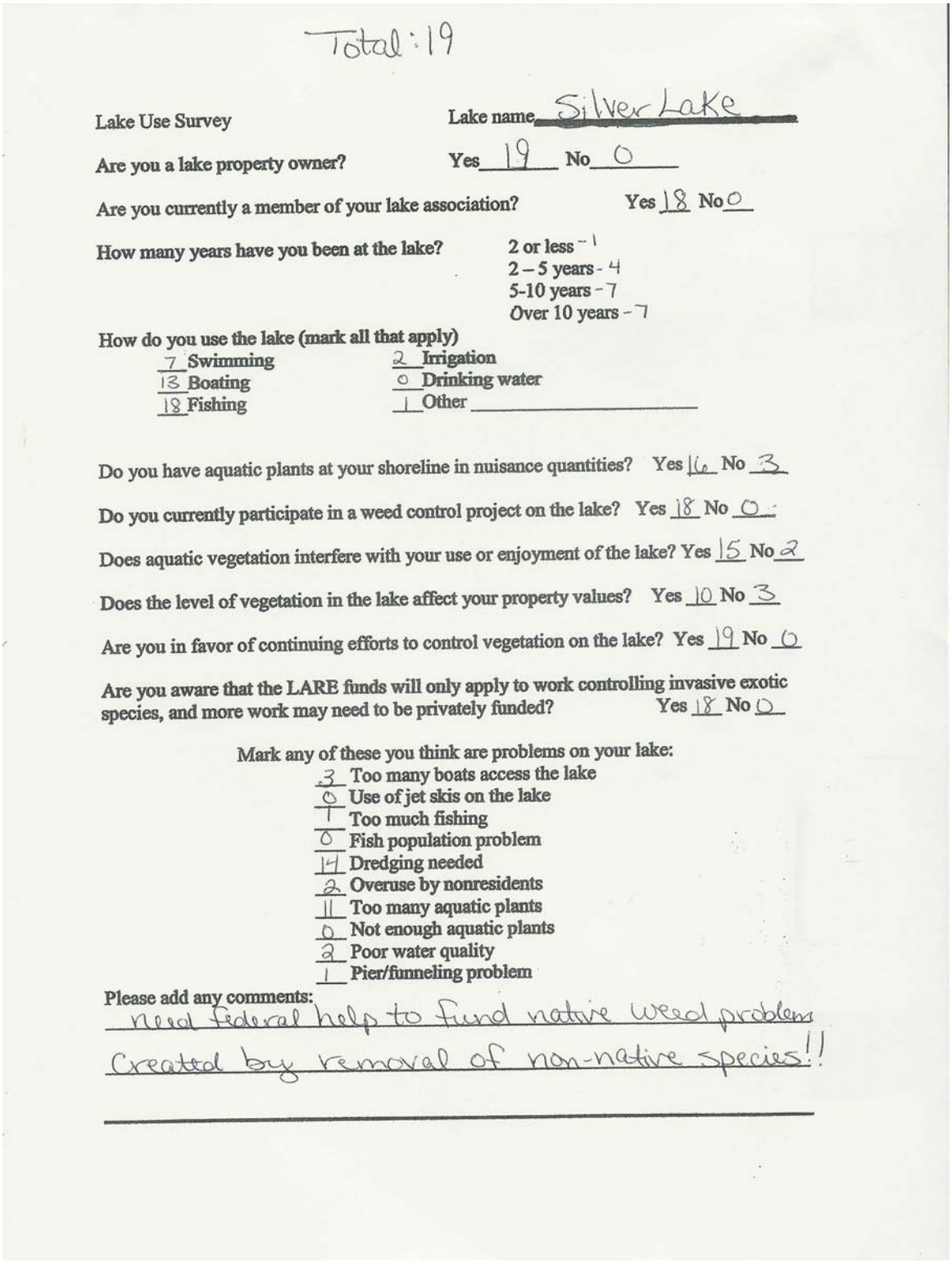
(See 2004 Lake Management Plan)
Major Curly leaf pondweed control practices have not changed significantly from the 2004 alternatives.

10.0 Public Involvement

A LARE meeting was held on October 31, 2006 to discuss issues pertaining to Silver Lake. District 4 Fisheries Biologist Ed Braun, lake representatives, Aquatic Weed Control and LARE Aquatic biologist Angela Sturdevant were all present and discussed the plant community of Silver Lake.

A public lake meeting was held for Silver Lake on June 10, 2006. Jim Donahoe of Aquatic Weed Control summarized LARE management activities and outlined the treatment strategy to help contain the curly leaf pondweed population in the lake.

Public questionnaires were handed out at the public lake association meeting. The responses to the questionnaires are summarized in Appendix 16.5. Some Citizens were concerned and angry because of the amount of coontail in Silver Lake. Coontail is extremely abundant and causes major recreational interference in parts of Silver Lake. At this time, LARE will not fund any treatment for coontail, as it is a native plant. Any coontail treatments must be privately funded.



Total: 19

Lake Use Survey — Lake name Silver Lake

Are you a lake property owner? Yes 19 No 0

Are you currently a member of your lake association? Yes 18 No 0

How many years have you been at the lake?
- 2 or less - 1
- 2 – 5 years - 4
- 5-10 years - 7
- Over 10 years - 7

How do you use the lake (mark all that apply)
- 7 Swimming
- 13 Boating
- 18 Fishing
- 2 Irrigation
- 0 Drinking water
- 1 Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 16 No 3

Do you currently participate in a weed control project on the lake? Yes 18 No 0

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 15 No 2

Does the level of vegetation in the lake affect your property values? Yes 10 No 3

Are you in favor of continuing efforts to control vegetation on the lake? Yes 19 No 0

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 18 No 0

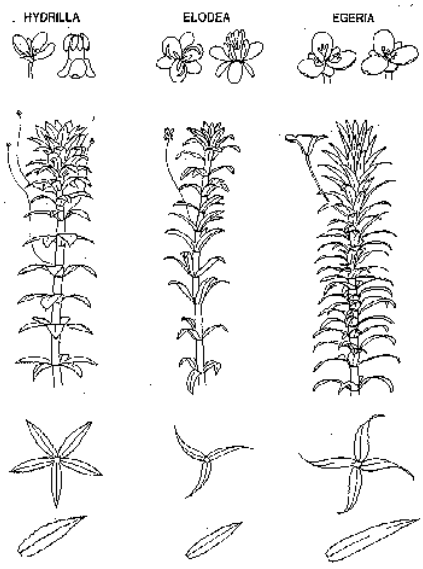
Mark any of these you think are problems on your lake:
- 3 Too many boats access the lake
- 0 Use of jet skis on the lake
- 1 Too much fishing
- 0 Fish population problem
- 14 Dredging needed
- 2 Overuse by nonresidents
- 11 Too many aquatic plants
- 0 Not enough aquatic plants
- 2 Poor water quality
- 1 Pier/funneling problem

Please add any comments:
need federal help to fund native weed problem
Created by removal of non-native species!!

11.0 Public Education

11.1 Hydrilla

Hydrilla (*Hydrilla verticillata*) is an invasive aquatic plant species common throughout the southern United States. It is listed as a federally noxious weed and causes severe ecological and recreational problems wherever it grows. It is considered to be much more destructive than other invasives like Eurasian watermilfoil and curly leaf pondweed because of its reproductive adaptations. It grows by fragmentation, as does Eurasian watermilfoil, but it also produces turions which can remain dormant in the sediment for 4 years or more (Van and Steward, 1990). It produces tubers at its root tips which can also reproduce after multiple years of dormancy. It can grow 1 inch each day and it quickly out-competes native plants. It forms dense beds that eliminate native plants, stunt fish populations, impede recreation and cause a drastic decrease in biodiversity (Colle and Shireman, 1980). Millions of dollars are spent each year for hydrilla maintenance each year in Florida alone. Eradication is unlikely once a population has been well established, although eradication has been achieved in newly infested waters using a herbicide called Sonar. Sonar is applied at a rate of 6 parts per billion and this concentration is maintained in the water for 180 days. Early detection can be crucial to an effective eradication program, and all lake residents and users are encouraged to be on the look-out for this invader.



In fall of 2006, this plant was found in Lake Manitou, in Rochester, Indiana. This is the first instance of hydrilla in the upper Midwest. Prior to its appearance in Lake Manitou, The closest infestations of hydrilla were in Tennessee and Pennsylvania.

Hydrilla can easily be confused with native elodea. The major difference is that elodea has sets of leaves on the stem in whorls of three, while hydrilla usually has whorls of 5 leaves, although 4 to 9 leaves per whorl are possible with hydrilla. Hydrilla will also have small serrations on the leaf edges. More information on hydrilla can be found at the University of Florida's Center for Aquatic Invasive Plants (http://plants.ifas.ufl.edu/). More general information on aquatic invaders can be found at www.protectyourwaters.net.

12.0 Integrated Management Action Strategy

The entire littoral zone of Silver Lake will be treated again in 2007 using Aquathol K to provide control of Curly leaf pondweed. North Little Lake will be treated with Aquathol K for curly leaf pondweed, as well as 2, 4-D for Eurasian watermilfoil control. These treatments are not expected to eradicate the two invasive species, but should help native plants to compete with them. However, treating the curly leaf population early each year should reduce the amount of curly leaf turions left in the sediment, therefore reducing the amount of curly leaf pondweed. A spring Tier II survey will be conducted on Silver and North Little Lakes in 2007, to determine the extent of curly leaf pondweed distribution and abundance. The Lake and River Enhancement Program will not distribute funds for the control of native species, so additional treatments to control coontail will have to be privately funded.

13.0 Project Budget

2007 Cost Estimates:

2. Chemically Treat Areas Infested by Curly Leaf Pondweed

*All cost figures are estimates only. All prices are subject to change pending 2007 chemical pricing.

A.	Treat the entire littoral zone (Silver and North Little) with Aquathol K	$ 9,700
B.	North Little Lake Eurasian Watermilfoil Treat 10 acres with 2, 4-D	$ 3,750

2. Conduct a spring Tier II survey to evaluate curly leaf pondweed population.

A. Spring Tier II survey and Plan Update	$ 4,000

Survey and planning costs

Four thousand dollars are currently budgeted for surveying and planning but this cost may be less should LARE reduce the survey intensity and planning required.

14.0 Monitoring and Plan Update Procedures

A Tier II quantitative survey should be conducted in spring of 2007 to evaluate the curly leaf pondweed population. This survey should take place prior to any herbicide treatment, to ensure that the curly leaf pondweed is actively growing when it is treated. No late season survey will be necessary in 2007, as the lake has been extensively surveyed over the last three years.

15.0 References

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16.0 Appendices

16.1 Common Aquatic Plants of Indiana

The following appendix was compiled using information found in the 5th edition of How to Identify Water Weeds and Algae, edited by James C. Schmidt and James R. Kannenberg. All pictures, with the exception of Illinois pondweed and northern milfoil were taken from the Category 5 Aquatic Pest Control Management Manual, written by Dr. Carole Lembi, Head of the Department of Botany and Plant Pathology at Purdue University.

American Pondweed

Scientific name: *Potamogeton americanus*

Classification: Native to Indiana

Distribution: Common throughout the U.S.

Description: American pondweed can be identified by its oval shaped leaves floating on the top of the water. The base of each leaf tapers to a very long petiole that connects the leaf with the stem of the plant. Plant leaves are arranged alternately on the stem and leaves are usually sparsely scattered.

Chara

Scientific name: *Chara sp*.

Classification: Native to Indiana

Distribution: Extremely common worldwide. Usually found in hard water.

Description: Chara is often mistaken for a vascular plant, but it is actually an advanced form of algae. It can be gray, green or yellow in color and is usually forms extremely dense beds that may cover an entire lake. It can be identified by its distinct musky odor and calcium deposits on the algae's surface make it feel bristly to the touch. It possesses leaf-like structures that are whorled around the hollow stem, and it attaches itself to the lake bottom, although it has no actual roots. It usually grows in shallow, clear water.

Coontail

Scientific name: *Ceratophyllum demersum*

Classification: Native to Indiana

Distribution: Common throughout the U.S., usually in hard water.

Description: Coontail plants are submersed and have no roots, though they appear to be attached to the lake bottom when viewed from above the surface of the water. The free-floating nature of coontail allows it to colonize new areas of a lake quickly, and it often times forms extremely dense weed beds where sufficient light and nutrients are available. Coontail has dark green leaves arranged in whorls around the stem and usually grows in long, bushy strands resembling evergreen trees beneath the surface of the water. Coontail's structure is very similar to Eurasian milfoil but coontail has forked leaves, which distinguishes it from the feather-like projections of milfoil leaves.

Curley Leaf Pondweed

Scientific name: *Potamogeton crispus*

Classification: Exotic to Indiana

Distribution: Found throughout the U.S. in fresh and brackish water.

Description: Curley leaf pondweed usually grows and spreads rapidly in early spring and begins to dies out by midsummer as water temperatures approach 70 degrees Fahrenheit. Curley leaf has extremely thin, membranous leaves arranged alternately on the stem with small teeth-like projections visible along the edge of each leaf. A reproductive spike may be seen protruding from the surface of the water. Curley leaf pondweed may also leave small reproductive structures called turions in the sediment on the lake bottom that can lie dormant throughout the winter and then sprout when spring arrives.

Eel Grass (Wild Celery)

Scientific name: *Vallisneria Americana*

Classification: Native to Indiana

Distribution: Found from the Great Plains to the East Coast of the U.S.

Description: Eel grass has tufts of ribbon-like leaves with a horizontal stem embedded in the sediment connecting each tuft. This native plant grows thick weed beds anchored in the mud by roots. These dense beds often shade out other forms of weeds and provide excellent escape cover for small fish. The flowers of this plant are visible in late summer and sit on the top of a coiled structure protruding to the surface. This plant is found in both lakes and river, but is seldom found in stagnant systems. It is considered an extremely valuable plant to aquatic ecosystems.

Elodea

Scientific Name: *Elodea Canadensis*

Classification: Native to Indiana

Distribution: Common throughout the north and north central united states. Its ranges extends as far south as northern Tennnessee.

Description: Elodea grows in long strands resembling milfoil, but its leaves are broad and oval shaped. Leaves are arranged in whorls with three leaves usually occurring at each node. Leaves near the tip of the plant are closely packed together, with the distance between nodes increasing further down the stem.

Eurasian Milfoil

Scientific Name: *Microphyllum spicatum*

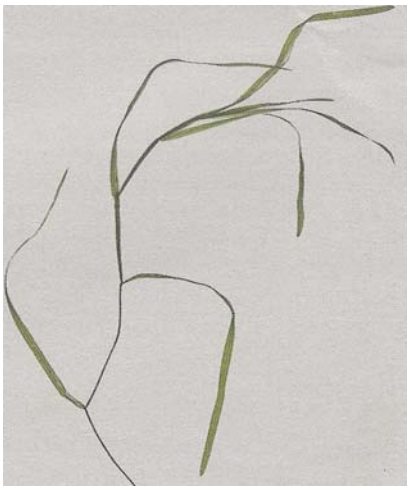
Classification: Exotic in Indiana

Distribution: Common in the Midwest and Eastern U.S. Also spreading along the Pacific coast.

Description: This extremely aggressive and extremely destructive plant has leaves in whorls of 4 around a reddish stalk. This plant grows rapidly and can reach lengths of over 10 feet. This plant has the ability to over winter, meaning it can lie dormant during the winter months instead of dying out completely each year. This gives it a distinct advantage over many native species, as it competes for sunlight in early spring. The dormant milfoil plants reach the surface much faster than the native plants sprouting from the lake bottom. This enables the Eurasian milfoil to shade out other plants and form the dense beds that choke the littoral zone of many lakes.

A reproductive process called fragmentation aids the rapid dispersion of Eurasian milfoil. If a milfoil plant is damaged and some fragments are removed from the macrophyte, each small piece of the plant has the ability to grow roots and create a new milfoil plant. Eurasian milfoil is considered one of the most dangerous aquatic nuisance species because of its ability to rapidly disrupt and destroy lake ecosystems.

Flat-stemmed Pondweed



Scientific Name: *Potamogeton zosteriformis*

Classification: Native to Indiana

Distribution: Common throughout the northern half of the U.S.

Description: the most noticeable characteristic is the large, very flat stem. It cannot be rolled between the fingers easily. The ribbon-like leaves extend from the stem toward the surface of the water.

Illinois Pondweed

www.wvu.edu

Scientific name: *Potamogeton illinoensis*

Classification: Native to Indiana

Distribution: Very widespread and very common throughout the upper Midwest and the U.S

Description: Illinois pondweed is common in Indiana, especially in the northern third of the state. This leafy weed has leaves with very broad bases that extend three-fourths of the way around the stem. The upper part of its slender stem is usually branched and very leafy.

Large Leaf Pondweed

Scientific name*:* *Potamogeton amplifolius*
Classification: Native to Indiana
Distribution: Common throughout the upper Midwest and the northern United States in hard water.

Description: This plant has both submersed and floating leaves. The floating leaves are oval shaped and are similar to those of American pondweed. Submersed leaves are arranged alternately with

each leaf becoming extremely narrow as it nears the stem of the plant. Mineral deposits on its leaves often give large leaf pondweed a dark brown appearance.

Naiad

Scientific name: *Najas minor* (brittle naiad)

Classification: Native to Indiana

Distribution: Common throughout the U.S.

Description: The leaves of naiad plants are usually widest at the base and gradually become thinner near the tip of the leaf. Plants are extremely leafy and appear bush-like when viewed from above the surface of the water. Many species of naiad are very common in this area. Plant structure often resembles chara, but the absence of calcium deposits on the surface of the plant help in identification. The leaves of brittle naiad have multiple spines along the margins that are visible to the naked eye.

Nitella

Scientific name: *Nitella sp.*

Classification: Native to Indiana

Distribution: Found worldwide, usually in hard water.

Description: Nitella is very similar to chara, and it is also an advanced form of algae. It has leaf-like projections that are whorled around the stem. It is often found growing in very thick patches, usually in shallow, clear water.

www.io.uwinnipeg.ca

Northern Milfoil

Scientific name: *Myriophyllum sibericum*

Classification: Native to Indiana

Distribution: Found throughout the northern half of the U.S. and also in Europe and Western Asia

Description: Northern milfoil has submersed, feather-like, whorled leaves that closely resemble the leaves of Eurasian milfoil. Distinguishing the native northern milfoil from Eurasian milfoil can be difficult. The leaflet pairs of northern milfoil are generally fewer and more widely spaced than those of Erasian milfoil. This plant is known to hybridize with Eurasian milfoil, and at times, chemical analysis is necessary to distinguish between the two plants.

Sago Pondweed

Scientific name: *Potemogeton pectinatus*

Classification: Native to Indiana

Distribution: Found throughout the U.S., Common in the northern 2/3 of Indiana.

Description: Sago Pondweed has a bushy appearance with narrow, thread-like leaves that spread out to resemble a fan. Leaves are usually 1/16 of an inch wide and 1 to 6 inches long. Nutlets are formed on a string-like structure and protrude from the surface of the water. While sago pondweed can form dense beds, many times it is found in sparse, loosely distributed arrangements.

16.2 Pesticide Use Restrictions Summary:

The following table was produced by Purdue University and included in the Professional Aquatic Applicators Training Manual. It gives a summary of water use restrictions on all major chemicals available for use in the aquatics market.

Table 15: Pesticide Use Restrictions

Table 1. Aquatic Herbicides and Their Use Restrictions. Always check the label because these restrictions are subject to change.

	Human			Animal	Irrigation		
	Drinking	Swimming	Fish Consumption	Drinking	Turf	Forage	Food Crops
	waiting period, in days						
Copper Chelate	0	0[a]	0	0	0	0	0
Copper Sulfate	0	0[a]	0	0	0	0	0
Diquat	1–3	0[a]	0	1	1–3	1–3	5
Endothall (granular)[b]	7	0[a]	3	0	7	7	7
Endothall (liquid)[b]	7–25	0[a]	3	7–25	7–25[d]	7–25	7–25
Endothall 191 (granular)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Endothall 191 (liquid)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Fluridone	0[e]	0[a]	0	0	7–30	7–30	7–30
Glyphosate	0[e]	0[a]	0	0	0	0	0
2,4-D (granular)	*	0[a]	0	*	*	*	*

[a]Although this compound has no waiting period for swimming, it is always advisable to wait 24 hours before permitting swimming in the direct area of treatment.

[b]Trade name is Aquathol®.

[c]Trade name is Hydrothol®.

[d]May be used for sprinkling bent grass immediately.

[e]Do not apply this product within 1/4 (fluridone) to 1/2 (glyphosate) mile upstream of potable water intakes.

*Do not use treated water for domestic purposes, livestock watering (2,4-D, dairy animals only), or irrigation.

16.3 Resources for Aquatic Management

In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes. Many government agencies assist in projects designed to improve environmental quality.

The USDA has many programs to assist environmental improvement. More information on the following programs can be found at www.usda.gov.

Watershed Protection and Flood Prevention Program (USDA

Conservation Reserve Program (USDA)

Wetlands Reserve Program (USDA)

Grassland Reserve Program (USDA)

Wildlife Habitat Incentive Program (USDA)

Small Watershed Rehabilitation Program (USDA)

The following programs are offered by the U.S. Fish and Wildlife Service. More information about the Fish and Wildlife service can be found at www.fws.gov

Partners for Fish and Wildlife Program (U.S. Fish and Wildlife Service)

Bring Back the Natives Program (U.S. Fish and Wildlife Service)

Native Plant Conservation Program (U.S. Fish and Wildlife Service)

The Environmental Protection Agency, the Indiana Department of Environmental Management, and the U.S. Forest Service also have numerous programs for funding. A few of these are listed below. More information can be found at www.in.gov/idem and www.fs.fed.us/

U.S. Environmental Protection Agency Environmental Education Program (EPA)

NPDES Related State Program Grants (IDEM)

Community Forestry Grant Program (U.S. Forest Service)

16.4 State Regulations for Aquatic Plant Management

The following information is found on the IDNR website and outlines general regulations for the management of aquatic plants in public waters.

AQUATIC PLANT CONTROL PERMIT REGULATIONS
Indiana Department of Natural Resources

Note: In addition to a permit from IDNR, public water supplies cannot be treated without prior written approval from the IDEM Drinking Water Section. **Amended state statute adds biological and mechanical control (use of weed harvesters) to the permit requirements, reduces the area allowed for treatment without a permit to 625 sq ft, and updates the reference to IDEM.** *These changes become effective on July 1, 2002.*

Chapter 9. Regulation of Fishing
IC 14-22-9-10

Sec. 10. (a) This section does not apply to the following:
(1) A privately owned lake, farm pond, or public or private drainage ditch.
(2) A landowner or tenant adjacent to public waters or boundary waters of the state, who chemically, mechanically, or physically controls aquatic vegetation in the immediate vicinity of a boat landing or bathing beach on or adjacent to the real property of the landowner or tenant if the following conditions exist:
(A) The area where vegetation is to be controlled does not exceed:
(i) twenty-five (25) feet along the legally established, average, or normal shoreline;
(ii) a water depth of six (6) feet; and
(iii) a total surface area of six hundred twenty-five (625) square feet.
(B) Control of vegetation does not occur in a public waterway of the state.
(b) A person may not chemically, mechanically, physically, or biologically control aquatic vegetation in the public waters or boundary waters of the state without a permit issued by the department. All procedures to control aquatic vegetation under this section shall be conducted in accordance with rules adopted by the department under IC 4-22-2.
(c) Upon receipt of an application for a permit to control aquatic vegetation and the payment of a fee of five dollars ($5), the department may issue a permit to the applicant. However, if the aquatic vegetation proposed to be controlled is present in a public water supply, the department may not, without prior written approval from the department of environmental management, approve a permit for control of the aquatic vegetation.
(d) This section does not do any of the following:
(1) Act as a bar to a suit or cause of action by a person or governmental agency.
(2) Relieve the permittee from liability, rules, restrictions, or permits that may be required of the permittee by any other governmental agency.
(3) Affect water pollution control laws (as defined in IC 13-11-2-261) and the rules adopted under water pollution control laws (as defined in IC 13-11-2-261).
As added by P.L.1-1995, SEC.15. Amended by P.L.1-1996, SEC.64.

312 IAC 9-10-3 Aquatic vegetation control permits
Authority: IC 14-22-2-6; IC 14-22-9-10
Affected: IC 14-22-9-10

Sec. 3. (a) Except as provided under IC 14-22-9-10(a), a person shall obtain a permit under this section before applying a substance to waters of this state to seek aquatic vegetation control.
(b) An application for an aquatic vegetation control permit shall be made on a departmental form and must include the following information:
(1) The common name of the plants to be controlled.
(2) The acreage to be treated.
(3) The maximum depth of the water where plants are to be treated.
(4) The name and amount of the chemical to be used.
(c) A permit issued under this section is limited to the terms of the application and to conditions imposed on the permit by the department.

(d) Five (5) days before the application of a substance permitted under this section, the permit holder must post clearly, visible signs at the treatment area indicating the substance that will be applied and what precautions should be taken.

(e) A permit issued under this section is void if the waters to be treated are supplied to the public by a private company or governmental agency. *(Natural Resources Commission; 312*

16.5 Public Input Questionnaire

Table 16: 2006 Public Questionnaire

Total: 19

Lake Use Survey — Lake name Silver Lake

Are you a lake property owner? Yes 19 No 0

Are you currently a member of your lake association? Yes 18 No 0

How many years have you been at the lake?
- 2 or less - 1
- 2 – 5 years - 4
- 5-10 years - 7
- Over 10 years - 7

How do you use the lake (mark all that apply)
- 7 Swimming
- 13 Boating
- 18 Fishing
- 2 Irrigation
- 0 Drinking water
- 1 Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 16 No 3

Do you currently participate in a weed control project on the lake? Yes 18 No 0

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 15 No 2

Does the level of vegetation in the lake affect your property values? Yes 10 No 3

Are you in favor of continuing efforts to control vegetation on the lake? Yes 19 No 0

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 18 No 0

Mark any of these you think are problems on your lake:
- 3 Too many boats access the lake
- 0 Use of jet skis on the lake
- 1 Too much fishing
- 0 Fish population problem
- 14 Dredging needed
- 2 Overuse by nonresidents
- 11 Too many aquatic plants
- 0 Not enough aquatic plants
- 2 Poor water quality
- 1 Pier/funneling problem

Please add any comments:
need federal help to fund native weed problem
Created by removal of non-native species!!

16.6 Species Distribution Maps

*Rake scores are included for each sample site where a species was collected

Figure 5: Silver Lake Chara Sites

Figure 6: Silver Lake Coontail Sites

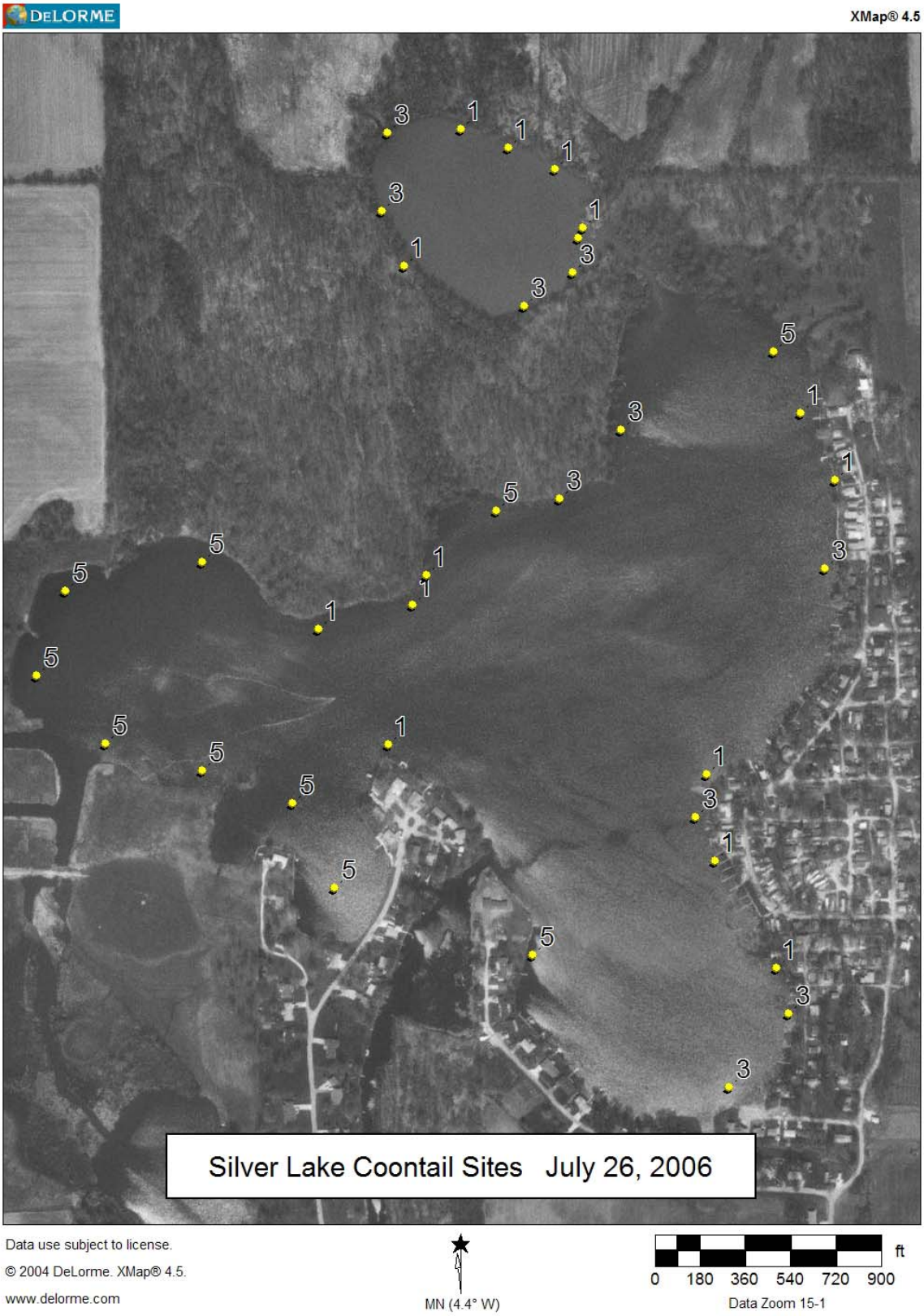


Figure 7: Silver Lake Curly Leaf Pondweed Sites

Figure 8: Silver Lake Elodea Sites

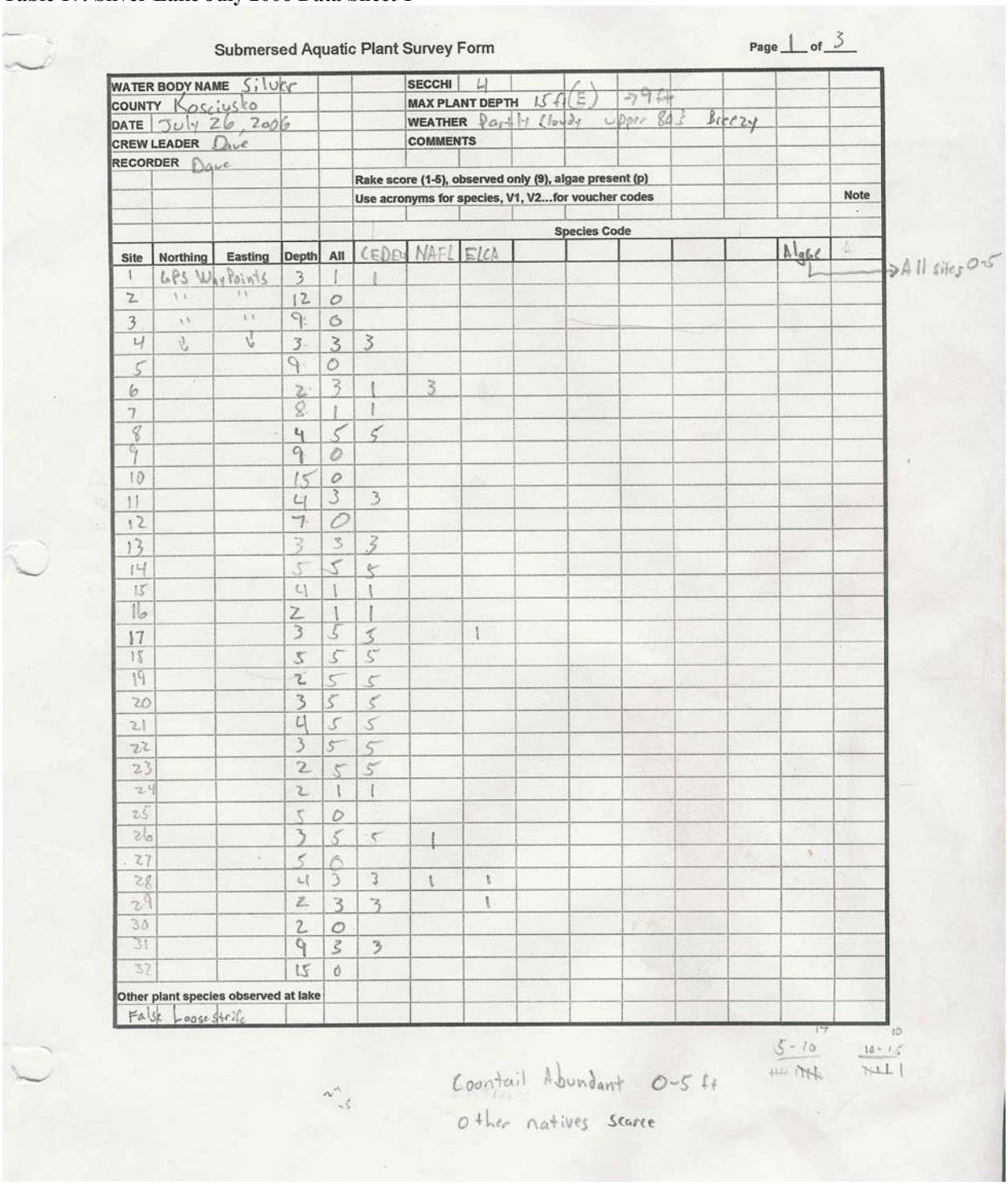
Figure 9: Silver Lake Slender Naiad Sites

Figure 10: Silver Lake Eurasian Watermilfoil Sites

Figure 11: Silver Lake Sago Pondweed Sites

16.7 Data sheets

Table 17: Silver Lake July 2006 Data Sheet 1



Submersed Aquatic Plant Survey Form

Page 1 of 3

WATER BODY NAME Silver
COUNTY Kosciusko
DATE July 26, 2006
CREW LEADER Dave
RECORDER Dave

SECCHI 4
MAX PLANT DEPTH 15 ft (E) =9 ft
WEATHER Partly Cloudy upper 80's Breezy
COMMENTS

Rake score (1-5), observed only (9), algae present (p)
Use acronyms for species, V1, V2...for voucher codes

Site	Northing	Easting	Depth	All	CEDE	NAFL	ELCA	Algae	Note
1	GPS Waypoints		3	1	1				→ All sites 0-5
2	"	"	12	0					
3	"	"	9	0					
4	"	"	3	3	3				
5			9	0					
6			2	3	1	3			
7			8	1	1				
8			4	5	5				
9			9	0					
10			15	0					
11			4	3	3				
12			7	0					
13			3	3	3				
14			5	5	5				
15			4	1	1				
16			2	1	1				
17			3	5	5		1		
18			5	5	5				
19			2	5	5				
20			3	5	5				
21			4	5	5				
22			3	5	5				
23			2	5	5				
24			2	1	1				
25			5	0					
26			3	5	5	1			
27			5	0					
28			4	3	3	1	1		
29			2	3	3		1		
30			2	0					
31			9	3	3				
32			15	0					

Species Code

Other plant species observed at lake
Falsk Loosestrife

19: 5-10 ||||
10: 10-15 |||

Coontail Abundant 0-5 ft
other natives Scarce

Table 18: Silver Lake July 2006 Data Sheet 2

Submersed Aquatic Plant Survey Form

Page 2 of 3

WATER BODY NAME Silver
COUNTY Kosciusko
DATE July 26, 2006
CREW LEADER Dave
RECORDER Dave

SECCHI 4
MAX PLANT DEPTH 9 ft
WEATHER Partly cloudy cloudy
COMMENTS

Rake score (1-5), observed only (9), algae present (p)
Use acronyms for species, V1, V2...for voucher codes

Site	Northing	Easting	Depth	All	Species Code: CEDEL	Note
33	GPS Waypoints		7	1	1	
34	"	"	11	0		
35			9	0		
36			14	0		
37			9	0		
38			10	0		
39			8	0		
40			8	0		
41			15	0		
42			12	0		
43			7	0		
44			15	0		
45			15	0		
46			14	0		
47			9	0		
48			14	0		
49			7	1	1	
50			7	1	1	

Other plant species observed at lake

Table 19: Silver Lake July 2006 Data Sheet 3

Submersed Aquatic Plant Survey Form

Page 3 of 3

WATER BODY NAME	North Little				SECCHI	4								
COUNTY	Kosciusko				MAX PLANT DEPTH	9 ft								
DATE	July 26, 2006				WEATHER	Partly Cloudy, upper 80's, breezy								
CREW LEADER	Dave				COMMENTS									
RECORDER	Dave													
					Rake score (1-5), observed only (9), algae present (p)									
					Use acronyms for species, V1, V2...for voucher codes									Note
					Species Code									
Site	Northing	Easting	Depth	All	LEDE4	EICA7	MYSP2	POPE6	CHAR5	POCR3				
1	Waypoints		4	1	1	1	1							
2	"	"	3	5	1	3	3	1	1					
3			3	1	1									
4			4	1	1		1			1				
5			5	3	3	1	1							
6			2	3	3									
7			3	1	1									
8			2	1			1							
9			3	3	3	1	1							
10			3	3	3	1								
11			9	1	1	1								
12			8	1			1							
13			8	3			3							
14			9	0										
15			10	0										
16			9	0										
17			10	0										
18			14	0										
19			13	0										
20			15	0										
Other plant species observed at lake														

Aquatic Vegetation Plant Bed Data Sheet

Page 1 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Silver Lake Assoc

DATE: 4/20/06

SITE INFORMATION

Plant Bed ID: S1

Bed Size: 7.6 ac

Substrate: 1

Marl? 0

High Organic? 1

Waterbody Name: Silver Lake

Waterbody ID:

Total # of Species: 3

Canopy Abundance at Site: S: 4 M: - P: - E: -

SITE COORDINATES

Center of the Bed

Latitude: N41 4.887

Longitude: W85 53.854

Max. Lakeward Extent of Bed

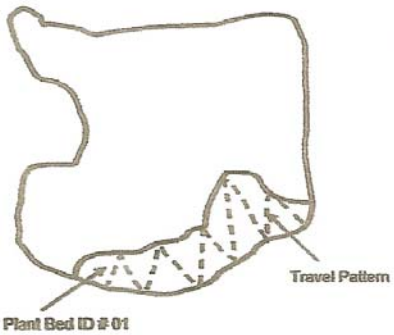
Latitude: N41 4.851

Longitude: W85 53.875

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POCR3	3			
CEDE4	4			
FIAL7	2			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspected
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not verified
2 = Taken, verified

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 2 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Silver

DATE: 4/20/06

SITE INFORMATION

Plant Bed ID: S 2

Waterbody Name: Silver

Bed Size: 3.7 ac

Substrate: 1

Waterbody ID:

Marl? 0

Total # of Species 2

High Organic? 1

Canopy Abundance at Site

S: 4 E: — F: — E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 5.113

Longitude: W85 53.982

Max. Lakeward Extent of Bed

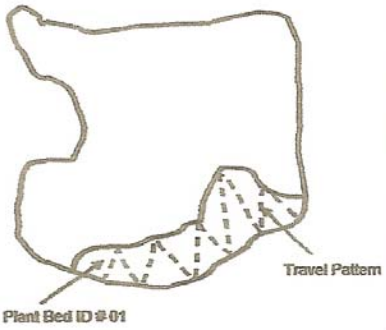
Latitude: N41 5.098

Longitude: W85 53.943

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POAR3	1			
CEDE4	4			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species susp
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not verified
2 = Taken, verified

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 3 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Silver

DATE: 4/20/06

SITE INFORMATION

Plant Bed ID: S 3

Waterbody Name: Silver

Bed Size: 1.6ac

Substrate: 1

Waterbody ID:

Marl? 0

Total # of Species 2

High Organic? 1

Canopy Abundance at Site

S: 4 E: — F: — E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 4.955

Longitude: W85 54.186

Max. Lakeward Extent of Bed

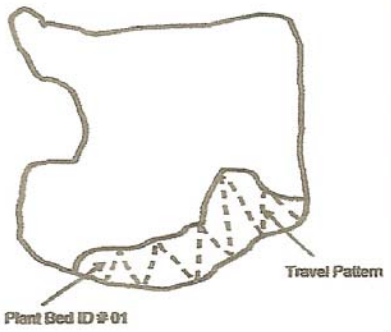
Latitude: N41 4.946

Longitude: W85 54.180

SPECIES INFORMATION

Species Code	Abundance	QE	Voln.	Ref. ID
POCR3	1			
CEDE4	4			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
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3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
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2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
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1 = Species susp.
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not verified
2 = Taken, verified

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 4 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Silver

DATE: 4/20/06

SITE INFORMATION

Plant Bed ID: S 4

Bed Size: 8.5 ac

Substrate: 1

Marl? 0

High Organic? 1

Waterbody Name: Silver

Waterbody ID:

Total # of Species: 4

Canopy Abundance at Site

S: 4 M: — F: — E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 4.901

Longitude: W85 54.414

Max. Lakeward Extent of Bed

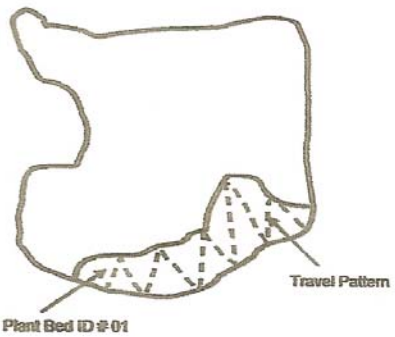
Latitude: N41 4.899

Longitude: W85 54.466

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
PotR3	1			
CEDE4	4			
CHARA	1			
ELCA7	2			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
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2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
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2 = 2-20%
3 = 21-60%
4 = >60%

Abundance:
1 = <2%
2 = 2-20%
3 = 21-60%
4 = >60%

QE Code:
0 = as defined
1 = Species susp
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varified

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 5 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Silver

DATE: 4/20/06

SITE INFORMATION

Plant Bed ID: 5 5

Waterbody Name: Silver

Bed Size: 8

Substrate: 1

Waterbody ID:

Marl? 0

Total # of Species 2

High Organic? 1

Canopy Abundance at Site

S: 4 M: — F: — E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 4.743

Longitude: W85 54.258

Max. Lakeward Extent of Bed

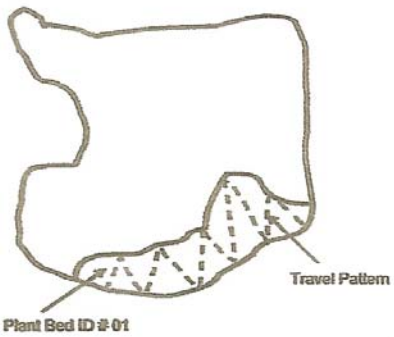
Latitude: N41 4.837

Longitude: W85 54.294

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POCR3	3			
CEDE4	4			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

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2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
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High Organic
1 = Present
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Overall Surface Cover
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S = Submersed

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4 = > 60%

Abundance:
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2 = 2-20%
3 = 21-60%
4 = > 60%

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1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
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1 = Taken, not verified
2 = Taken, verified

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 6 of 6

State of Indiana Department of Natural Resources

ORGANIZATION: Silver

DATE: 4/20/06

SITE INFORMATION

Plant Bed ID: S 6

Waterbody Name: Silver

Bed Size: 3.6 ac

Substrate: 1

Waterbody ID:

Marl? 0

Total # of Species 4

High Organic? 1

Canopy Abundance at Site

S: 4 N: — F: — E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 5.218

Longitude: W85 54.219

Max. Lakeward Extent of Bed

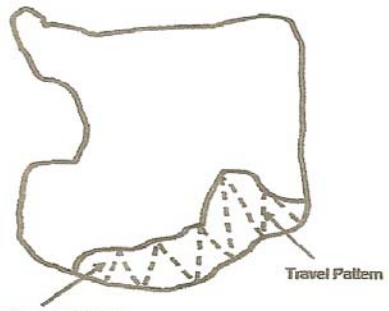
Latitude: N41 5.217

Longitude: W85 54.214

SPECIES INFORMATION

Species Code	Abundance	QE	Voln.	Ref. ID
POCR3	4			
CEDEH	2			
MYSP2	2			
ELA7	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
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2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
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2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
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1 = Species susp.
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not verified
2 = Taken, verified

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

16.8 IDNR Aquatic Vegetation Permit

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R4 / 2-04)
Approved State Board of Accounts 2004

[X] Whole Lake [ ] Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to: Page 1 of
DEPARTMENT OF NATURAL RESOURC
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W2
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name: Jim Walker	Lake Assoc. Name: Silver Lake Conservation Association Inc,	
Rural Route or Street: 3332 West Neher Road		Phone Number: 260-352-0806
City and State: Silver Lake IN		ZIP Code: 46982
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake): Silver Lake	Nearest Town: Silver Lake	County: Kosciusko
Does water flow into a water supply		[ ] Yes [X] No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply int

Treatment Area # 1	LAT/LONG or UTM's Entire perimeter of Lake		
Total acres to be controlled 29.39	Proposed shoreline treatment length (ft) 10,244	Perpendicular distance from shoreline (ft) 125	
Maximum Depth of Treatment (ft) 5	Expected date(s) of treatment(s) Late March early April		

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Aquathal K

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian Milfoil	X	20
Curley Leaf	X	60
Coontail		20

Page ____ of

Treatment Area #	LAT/LONG or UTM's	
Total acres to be controlled	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s)	

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. _____

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify) _____

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

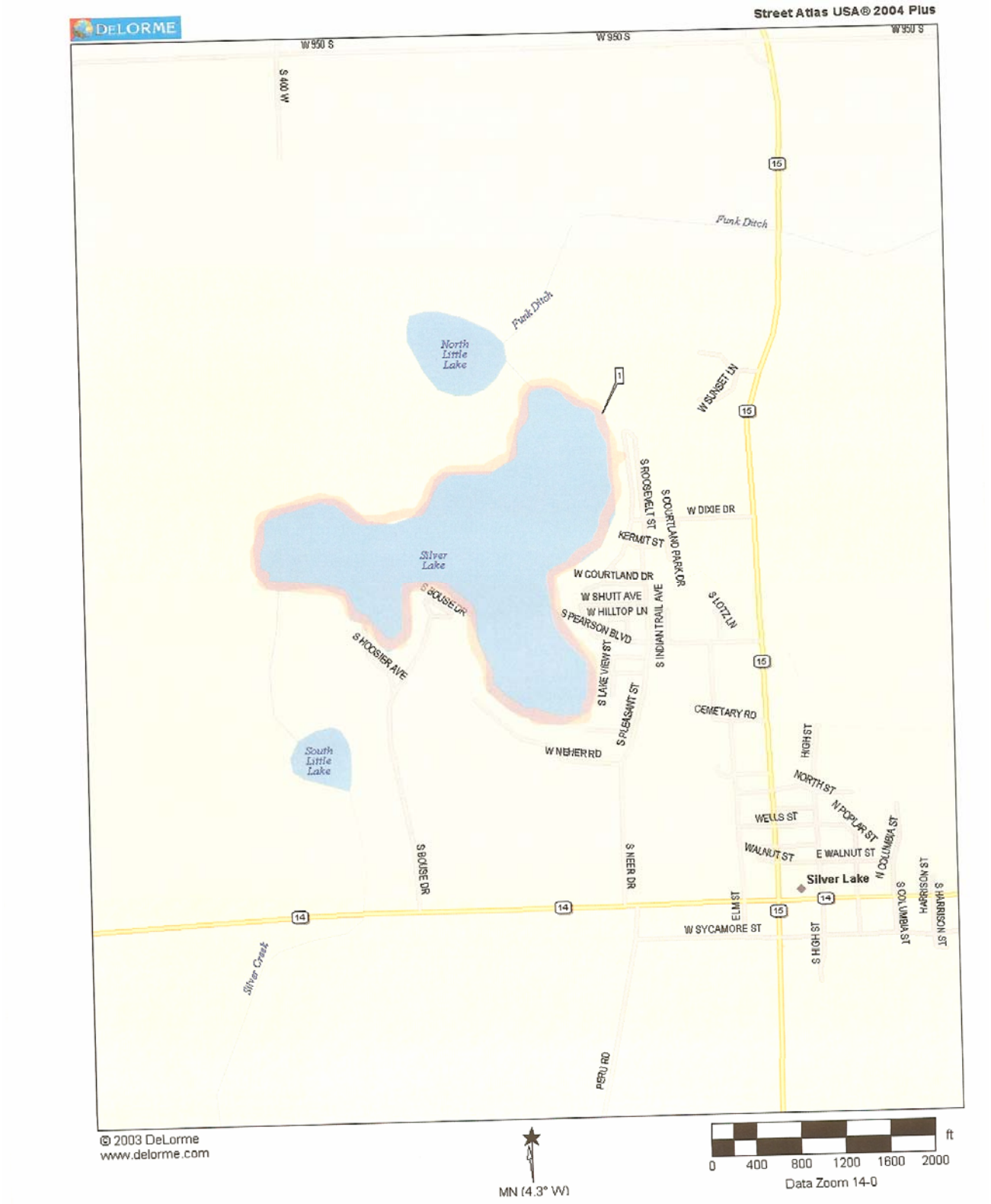
Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

☐ Approved ☐ Disapproved	Fisheries Staff Specialist
☐ Approved ☐ Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204


DeLORME
Street Atlas USA® 2004 Plus
W 950 S
S 600 W
Funk Ditch
North Little Lake
Silver Lake
South Little Lake
W SUNSET LN
S ROOSEVELT ST
S COURTLAND PARK DR
W DIXIE DR
KERMIT ST
W COURTLAND DR
W SHUTT AVE
W HILLTOP LN
S PEARSON BLVD
S INDIAN TRAIL AVE
S LOTZ LN
S LAKE VIEW ST
S PLEASANT ST
CEMETARY RD
W NEHER RD
S HOOSIER AVE
S BOUSE DR
S NEER DR
HIGH ST
NORTH ST
N POPLAR ST
WELLS ST
WALNUT ST
E WALNUT ST
N COLUMBIA ST
Silver Lake
S COLUMBIA ST
S HARRISON ST
ELM ST
W SYCAMORE ST
S HIGH ST
PERU RD
Silver Creek
15
14
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MN (4.3° W)
0 400 800 1200 1600 2000 ft
Data Zoom 14-0