

CENTER LAKE, KOSCIUSKO COUNTY
AQUATIC VEGETATION MANAGEMENT PLAN
UPDATE 2008



PREPARED FOR:

CENTER LAKE CONSERVATION ASSOCIATION
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Executive Summary

Center Lake Conservation Association (CLCA) contracted V3 Companies (V3) to complete aquatic vegetation sampling in order to update an aquatic vegetation management plan which was created in 2005. The update was funded in part by the Lake and River Enhancement fund (LARE) as part of the Indiana Department of Natural Resources (IDNR) Division of Fish and Wildlife which was obtained by the CLCA. Funding for the LARE program is provided by an annual fee charged to boat owners. Additional Funding was provided by the CLCA. This update will serve as a prerequisite to continue LARE program funding to control exotic or nuisance species.

Center Lake is a 120-acre natural lake in Warsaw, Kosciusko County, Indiana. Aquatic vegetation is an essential part of healthy lake ecosystems. Aquatic Vegetation provides fish habitat, stabilizes sediments, and reduces shoreline erosion. The purpose of an Aquatic Vegetation Management Plan is to identify aquatic weed problem areas, describe management objectives, prescribe management strategies, and determine funding needs and sources necessary for the control of invasive aquatic vegetation. Center Lake's primary nuisance species is Eurasian watermilfoil. Eurasian watermilfoil is an exotic species that crowds out native plants reducing biodiversity, diminishes fish habitat and negatively impacts wetland habitats. The primary goal of Center Lake Conservation Association is to reduce the impact of Eurasian watermilfoil while preserving and enhancing native plant communities.

Renovate was applied to 19 acres of Eurasian watermilfoil on May 29, 2008. The 2008 post treatment Tier II sampling effort had vegetation at 72% of sites and collected six native species. Eurasian watermilfoil was observed within the vicinity of two sampling locations but was not collected. Chara algae occurred most frequently (54%) among sample sites. Sago pondweed (*Potamogeton pectinatus*) and slender naiad (*Najas flexilis*) followed chara algae in frequency of occurrence (38% and 36% respectively). Emergent species observed at Center Lake include white water lily and spatterdock. In comparison, the 2007 sampling effort had vegetation at 42% of sites post treatment, which was the lowest of all surveys conducted since 2004. Eurasian watermilfoil was observed at one location in 2007. Coontail (*Ceratophyllum demersum*) and sago pondweed were present at the highest percentage of sample sites (20%) in 2007. Chara algae increased from 12% of sample sites in 2007 to the most frequently occurring species in 2008.

Weed Patrol performed an additional survey in September in response to Center Lake residents reporting Eurasian watermilfoil within Center Lake. Weed Patrol identified 11.5 acres of late season regrowth of Eurasian watermilfoil. Weed Patrol mapped areas of dense and scattered Eurasian watermilfoil which will be used to locate treatment areas in 2009. Weed Patrol didn't perform a late season treatment as funding was limited. An increase in Eurasian watermilfoil is expected in 2009 and is estimated at 30 acres. Future regrowth will be communicated with LARE staff to determine whether additional funding would be available.



The following actions are proposed for 2009 to identify and treat areas with Eurasian watermilfoil as well as document the overall health, diversity, and distribution of desirable native aquatic vegetation. A Proposed Treatment Area Map will be created during early spring 2009 to determine the extent of follow-up chemical application that will be necessary to treat Eurasian watermilfoil. An early spring (3rd week of April to mid-May) systemic herbicide application of liquid 2,4-D is proposed to treat up to 30 acres of Eurasian watermilfoil that may re-grow from the 2008 herbicide application. A post treatment Tier II survey is proposed during the summer of 2009 to document diversity, distribution, and abundance of vegetative communities. Follow-up vegetation surveys and herbicide applications should be conducted during 2009 to monitor Eurasian watermilfoil densities and determine whether native plant communities are protected.

The proposed management schedule and budgets for 2009 and 2010 are summarized below.

2009

Target Species Distribution Map and Proposed Treatment Area Map	\$1,000
Early Spring Herbicide Application of liquid 2,4-D for Eurasian Watermilfoil (up to 30 acres of Eurasian watermilfoil)	\$15,000
Late season post treatment aquatic vegetation survey (Tier II) and plan update	\$6,000

2010

Target Species Distribution Map and Proposed Treatment Area Map	\$1,000
Late season (post treatment) aquatic vegetation survey (Tier II) and plan update	\$6,000

Any herbicide applications will depend on the results of the surveys.

These management activities and vegetation surveys are proposed to improve Center Lake's ecosystem and facilitate the achievement of overall goals established by the IDNR. These overall goals established by the IDNR for all lakes applying for LARE funding are: 1) develop or maintain a stable, diverse aquatic vegetative 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; and 3) provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.



Acknowledgements

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Introduction and Background

V3 was contracted by the Center Lake Conservation Association (CLCA) to complete aquatic vegetation sampling in order to create the Center Lake Aquatic Vegetation Management Plan Update – 2008. Center Lake is a 120-acre natural lake in Warsaw, Kosciusko County, Indiana and requires herbicide treatments to control Eurasian watermilfoil. This management plan will document changes in vegetative communities and serve as a practical plan for managing nuisance vegetation within Center Lake. The focus of aquatic vegetation management is the control of exotic species as they disrupt lake ecosystems and provide poor habitat for fish and other organisms. Topics covered in this update include a review of the 2008 vegetation control, the 2008 sampling results, and updates to the budget and action plans. This update will serve as a prerequisite to continue Lake and River Enhancement (LARE) program funding to control exotic or nuisance species. An aquatic vegetation survey was conducted on August 26, 2008 to document the post-treatment aquatic vegetative community. The results of the survey will provide the data necessary to make scientifically based recommendations for aquatic vegetation management. Once reviewed and approved, this report should be included in the original vegetation management plan, following the 2007 update.

The primary nuisance species within Center Lake is the exotic Eurasian watermilfoil (*Myriophyllum spicatum*). Eurasian watermilfoil is an aggressive invasive aquatic species that has a detrimental effect on the native aquatic plant community, provides poor fish habitat, and inhibits boat navigation and other lake uses. Eurasian watermilfoil was observed at two locations during the aquatic vegetation survey and has the potential to spread throughout Center Lake if management is not applied. Aquatic vegetation management at Center Lake must have an integrated approach and include stakeholders' concerns and views for successful implementation. This plan provides effective management recommendations that integrate scientific data with public concerns to successfully reduce Eurasian watermilfoil within Center Lake.

The overall goal of the LARE program is to ensure the continued viability of public-access lakes and streams by utilizing a watershed approach to reduce non-point source sediment and nutrient pollution of Indiana's and adjacent states' surface waters to a level that meets or surpasses state water quality standards. To accomplish this goal, the LARE program provides technical and financial assistance to qualified projects. These include: a) studies, management plans, sediment removal, and design and construction activities involving specific lakes and streams; b) land treatment practices or management plans for designated watersheds; and c) management plans and control of exotic plants and animals in targeted lakes. Funding for the LARE program is provided by an annual fee charged to boat owners.



Waterbody Characteristics

The Center Lake watershed consists of 9,611 acres and is comprised of three sub-watersheds: Center/Pike Lake (888 acres), Tippecanoe River (7,368 acres), and Walnut Creek (1,355 acres). Center Lake has a maximum depth of 42 feet and average depth of 20 feet. The City of Warsaw owns eighteen acres of land along the southern shoreline of Center Lake for recreational uses including, but not limited to, public boat launch, public beach, gardens, picnic areas and open spaces (Figure 1). A powerboat restriction is enforced on the lake limiting boats to 10 mph. Recreational boating typically includes pontoon boats, fishing boats, canoes and kayaks. Center Lake is a great resource for recreational fishing and bluegills were the most abundant species in the 2005 fisheries study. There were no additional fisheries studies conducted since the 2007 Center Lake Aquatic Vegetation Management Plan Update.



Figure 1: View of public beach area at Center Lake.

Center Lake Residence Time

Residence time is defined as the length of time required for the entire volume of the lake to be replaced with “new” water from runoff and direct precipitation. Residence time defines how dynamic the lake is and how responsive it will be to changes in nutrient loading. The lake's size, water source, and watershed size primarily determine the retention time. The result of the residence time determinations for Center Lake shows that the time necessary for the lake to renew its water lies between 58.4 and 530 days, based on time of year and volume of precipitation. An additional contributing factor to the difference between these two values is a result of the large differences in land area between the direct tributary watershed and the overall watershed that were both used in the calculation (V3, 2005).

Problem Statement

Aquatic vegetation is a vital component of lake ecosystems. When vegetation reaches nuisance levels, lake uses are inhibited. The primary nuisance species within Center Lake is Eurasian watermilfoil. Eurasian watermilfoil is an aggressive exotic species that has a detrimental effect on native aquatic vegetative communities. This nuisance species grows and spreads rapidly through fragmentation, forming dense weed beds that out compete native species for light and nutrients. In lakes where Eurasian watermilfoil is left unchecked, even well-diversified plant communities can become decimated and dominated by a single species. Stands of Eurasian watermilfoil provide poor habitat for waterfowl, fish, and other wildlife. Significant rates of plant sloughing and leaf turnover, as well as the decomposition of high biomass at the end of the growing season, increase the internal loading of phosphorus and nitrogen to the water column. Dense Eurasian watermilfoil mats alter water quality by raising pH, decreasing oxygen under the mats, and increasing temperature (Madsen et al., 1991).

Center Lake was treated with Sonar aquatic herbicide in 1996 and again in 2005 when Eurasian watermilfoil had reestablished. Renovate was used to treat 22 acres of Eurasian watermilfoil in 2006. The 2006 treatment was effective as only 4.75 acres of Eurasian watermilfoil required treatment in 2007. Renovate was used to treat 19 acres of Eurasian watermilfoil on May 29, 2008, which was a significant increase from the 2007 treatment. Eurasian watermilfoil was observed in two locations during the 2008 post-treatment Tier II survey and Weed Patrol identified 11.5 acres of Eurasian watermilfoil during their fall survey in late September. The regrowth of Eurasian watermilfoil seen in September is attributed to regrowth and reintroductions. Center Lake is used heavily for recreational boating and fishing. Fragments of Eurasian watermilfoil on boat motors and trailers are able to form new colonies within Center Lake. The channels on the north-west side of Center Lake are another source of Eurasian watermilfoil reintroduction. Eurasian watermilfoil that is present in the channels can be brought into Center Lake as recreational users access the lake. Center Lake also receives flow from Sloan Ditch and the Tippecanoe River during periods of high water, which is another possible source of Eurasian watermilfoil reintroductions. Prescribing management strategies specific to Center Lake's Eurasian watermilfoil problem and focusing on controllable vectors of exotic species introduction is necessary for achieving effective long term aquatic vegetation management.



Aquatic Vegetation Management Goals and Objectives

An aquatic vegetation management plan must have clear goals and objectives to be an effective long term management strategy. The following management goals have been established by the IDNR for all lakes applying for LARE funding. Any management practices implemented at Center Lake must facilitate the achievement of these three goals.

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

Specific objectives are proposed as follows to facilitate achievement of the success of the actions listed below to achieve the overall LARE management goals for Center Lake.

1. **Reduce Exotic Invasive Species.** Reduce Eurasian watermilfoil to less than 10% of littoral zone surface area in the late recreational season by 2010 through herbicide treatments. Littoral zone coverage will be measured based on Tier II survey data. Continue monitoring for curlyleaf pondweed presence during future aquatic vegetation surveys. If curlyleaf pondweed spreads to a nuisance level Aquathol K will be used to treat in early spring when water temperatures are at or below 56-67 degrees Fahrenheit.
2. **Maintain and Enhance Diversity of the Native Aquatic Plant Community.** Reduce reintroduction of Eurasian watermilfoil through educational outreach and control regrowth with herbicide control. Reduction in Eurasian watermilfoil will allow for native plants to establish. Some factors that influence the establishment of plants include light availability, wave action and substrate composition. The lake bottom substrate affects a lake's ability to support aquatic vegetation. Lakes that have mucky, organic, nutrient-rich substrates have an increased potential for plant growth compared to lakes with gravelly, rocky substrates. While sandy substrates typically support healthy aquatic plant communities, this is only true when sufficient organic material is mixed in with the sand to provide a nutritional base for the rooted plants (Giolitto and Olyphant, 2002). Center Lake consists largely of sand with areas of muck and clay substrate and has the ability to support healthy aquatic plant communities as demonstrated in past Tier II survey results.
3. **Control Vegetation around Public Access Sites.** Monitor the public access site for Eurasian watermilfoil and apply herbicide if present. Herbicide treatments focused in the area 100 feet from the access site may be effective in reducing the spread to other areas of Center Lake. Public access sites are a vector for the spread of exotic species therefore signage is most effective in these areas. Currently there is signage at the Center Lake public access site informing lake users of the exotic species advisory from Sea Grant and DNR Regulations. Continued maintenance of these advisory signs will encourage lake users to be cognizant of exotic species negative impact on lake ecosystems.



Specific actions are proposed as follows to facilitate achievement of the overall LARE management goals for Center Lake.

1. **Tier II Vegetation Surveys.** Tier II surveys should be conducted to monitor the distribution and abundance of Eurasian watermilfoil and determine if curlyleaf pondweed is present within Center Lake. Any changes in the native plant community of Center Lake will be documented during the vegetation surveys. Survey results will be used to determine future management strategies and evaluate the success of past management efforts.
2. **Chemical/Follow-up Treatment of Eurasian watermilfoil and curlyleaf pondweed.** Eurasian watermilfoil and curlyleaf pondweed should be closely monitored during 2009, and more concentrated dosages or aggressive treatments should be applied if necessary.
3. **Promote and Maintain the Diversity of Native Aquatic Plant Species.** Promote and maintain a healthy diversity of native aquatic plant species, while recognizing that some vegetation management may be necessary to provide reasonable public access for recreation.



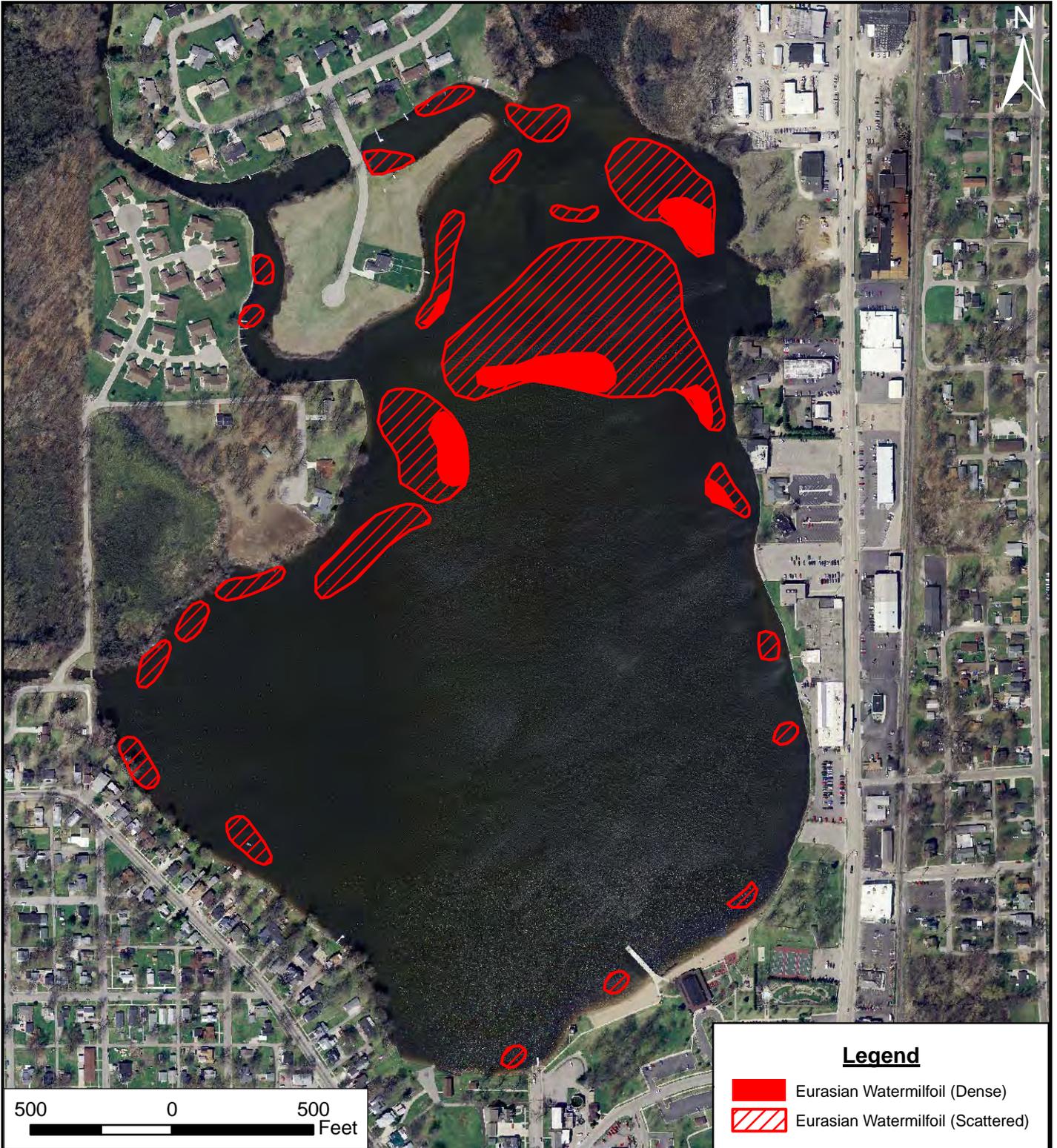
Center Lake Treatment History

In part due to water quality problems, Eurasian watermilfoil has been a dominant plant in Center Lake for many years. Herbicides have been used as an effective management tool since 1996 to control nuisance and exotic species at Center Lake. The management goal for Center Lake in 2009 is to keep the Eurasian watermilfoil population below nuisance quantities.

Eurasian watermilfoil was treated with Sonar aquatic herbicide in 1996, but Eurasian watermilfoil had reestablished its dominance by 2001 (Benson 2006). During June 2005 a whole-lake Sonar treatment was used to control Eurasian watermilfoil and 22 acres of Eurasian watermilfoil were treated with Renovate3 during June 2006. Herbicide treatments for 2007 included: 2,4-D granular applied to 4.75 acres of Eurasian watermilfoil and 1.75 acres of curlyleaf pondweed with Aquathol K.

Weed Patrol performed a vegetation survey on May 13, 2008 to identify areas where Eurasian watermilfoil was present within Center Lake (Figure 2). Renovate was used to treat 19 acres of Eurasian watermilfoil on May 29, 2008 based on the areas identified from the survey conducted on May 13th. The dosage of Renovate was 2.63 gallons per acre. Renovate is a systemic herbicide that is absorbed by the plant and transported to the root system and kills both the root system and the plant. Applications of Renovate were primarily in the northern portion of Center Lake at depths up to 10 feet (Figure 3). Treatments on Center Lake should be continued so Eurasian watermilfoil is maintained at a manageable level and recreational activities are not inhibited.





Legend

Eurasian Watermilfoil (Dense)

Eurasian Watermilfoil (Scattered)

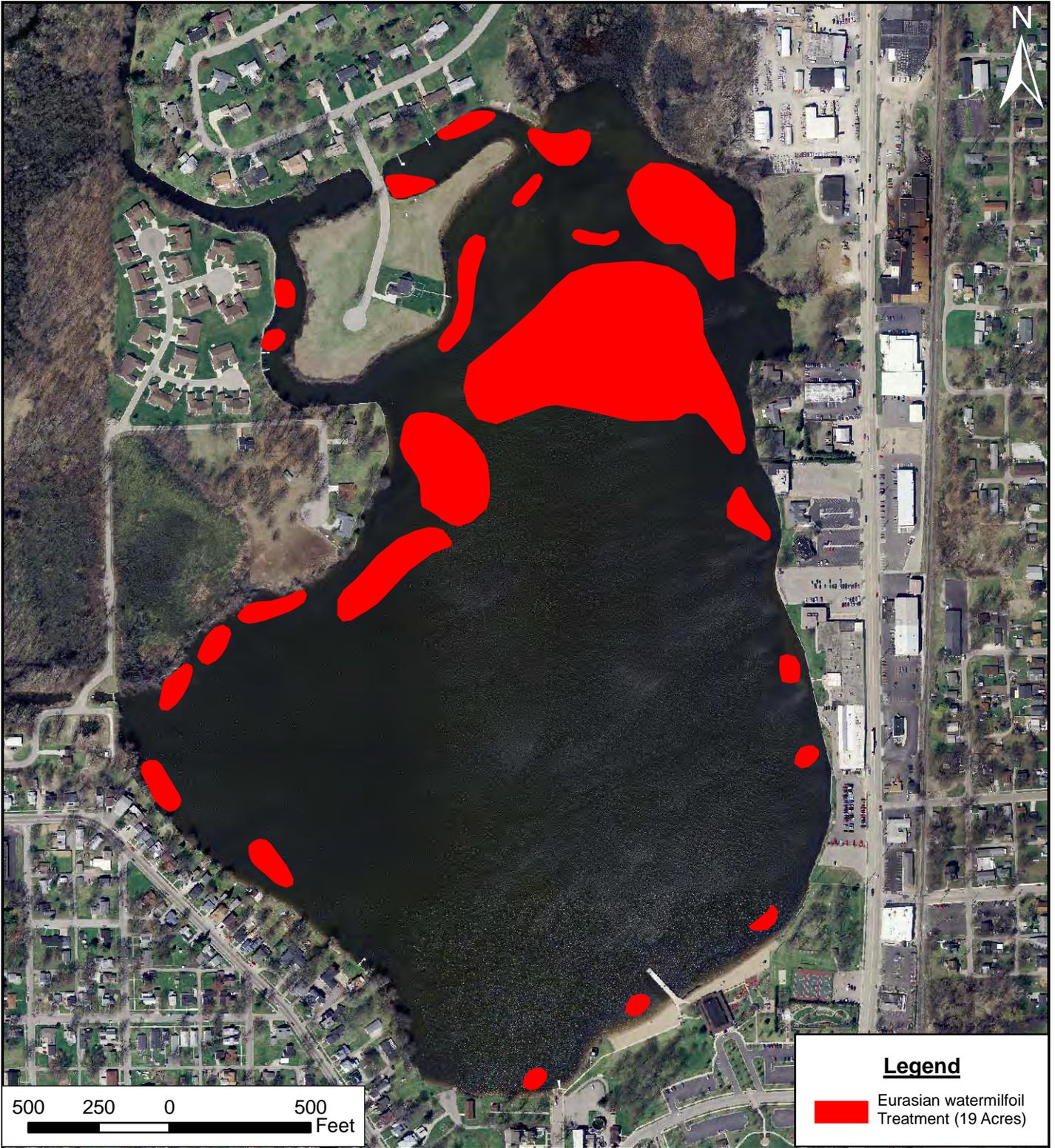
500 0 500
 Feet



V3 Companies
 7325 Janes Avenue
 Woodridge, IL 60517
 630.724.9200 phone
 630.724.9202 fax
 www.v3co.com

TITLE:	Center Lake Exotic Species Map		
BASE LAYER:	Indiana Spatial Data 2006 Orthophotography		
CLIENT:	Center Lake Conservation Association 1212 Edgewater Drive Warsaw, IN 46580		

PROJECT AND SITE LOCATION:			
Center Lake Aquatic Plant Management Plan Update -2008			
PROJECT NO.	FIGURE:	SHEET: 1	
02218.05	2	OF: 1	
QUADRANGLE:	DATE:	SCALE:	
N/A	5-13-08	1" = 500'	



Legend

Eurasian watermilfoil Treatment (19 Acres)



V3 Companies
 7325 Janes Avenue
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TITLE: Eurasian Watermilfoil Treatment Areas - 2008		PROJECT AND SITE LOCATION: Center Lake Aquatic Plant Management Plan Update -2008		
BASE LAYER: Indiana Spatial Data 2006 Orthophotography		PROJECT No. 02218.05	FIGURE: 3	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association 1212 Edgewater Drive Warsaw, IN 46580		QUADRANGLE: N/A	DATE: 5-29-08	SCALE: 1" = 500'

Sampling Results 2008

On August 26, 2008 a Tier II survey was conducted on Center Lake. The Tier II Aquatic Vegetation Survey Protocol, designated by the IDNR, serves as a standardized method to document the distribution and abundance of aquatic vegetation within selected areas at a state wide scale (IDNR, 2007). The information collected can be used to compare present trends in distribution and abundance of the aquatic plant community to past conditions. A table outlining the scientific and common names of species collected or observed in Center Lake is listed below (Table 1).

Table 1. Species collected or observed in Center Lake during Tier II sampling.

Scientific Name	Common Name
<i>Ceratophyllum demersum</i>	Coontail
<i>Chara</i>	Chara
<i>Myriophyllum spicatum</i> **	Eurasian watermilfoil
<i>Najas flexilis</i>	Slender naiad
<i>Nuphar advena</i> *	Spatterdock
<i>Nymphaea odorata</i> *	White water lily
<i>Potamogeton pectinatus</i>	Sago pondweed
<i>Potamogeton pusillus</i>	Small pondweed
<i>Potamogeton richardsonii</i>	Richardson's pondweed

* *Emergent species observed during sampling effort*

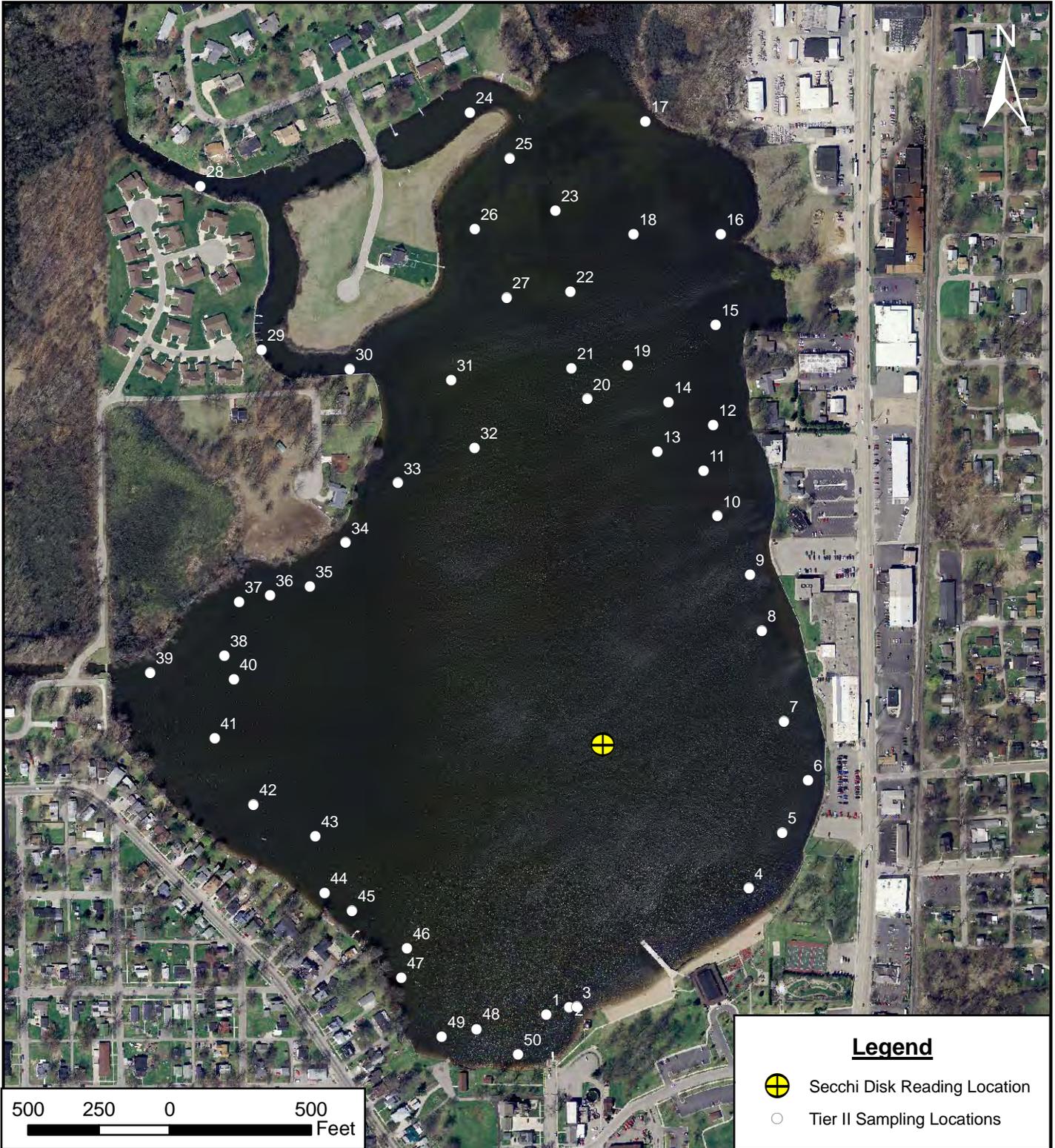
** *Species observed and not collected*

Sampling Methodology for Summer Tier II Survey

Plant communities typically reach peak diversity between July 15 and August 31. One sampling effort occurred during this time frame which included a representative sample of the species within Center Lake. According to the IDNR protocol, the number and depth of sampling locations is based on trophic status and acreage. Center Lake is classified as Oligotrophic, which would require 10 sites from 15-20 feet and 20-25 feet but the maximum sampling depth for Center Lake is 15 feet. The Tier II sampling was conducted at the eutrophic status so that sampling locations were apportioned to the required depth class. Fifty sites were sampled within the littoral zone (23 sites 0-5 ft, 17 sites 5-10 ft, and 10 sites 10-15 ft) (Figure 4). Sampling locations for the 2007 aquatic vegetation survey were located with the GPS unit and used for the 2008 survey. Tier II data sheets and sampling locations' latitude and longitude can be found in Appendix I. Using the same survey locations allows for changes in vegetative community to be documented and treatment success to be determined. Ten additional sampling stations past the 15 foot depth zone were raked with no vegetation collected. Since no vegetation was collected in greater depths there is no indication to extend vegetation sampling stations into deeper contours.

At each station a sampling rake is used for collecting vegetation samples. Once a species is identified, vegetation abundance is scored as a 1 (1-19%), 3 (20-100%), or 5 (+100%) based on the vegetation density on the rake. Species are scored as a 9 if they are observed within the vicinity of the sampling station but not collected. After completion of the sampling effort a secchi disk reading and water quality measurements are taken to complete the field effort.





Legend

-  Secchi Disk Reading Location
-  Tier II Sampling Locations

 <p>V3 Companies 7325 Janes Avenue Woodridge, IL 60517 630.724.9200 phone 630.724.9202 fax www.v3co.com</p>	TITLE: Tier II Sampling Locations		PROJECT AND SITE LOCATION: Center Lake Aquatic Plant Management Plan Update - 2008		
	BASE LAYER: Indiana Spatial Data 2006 Orthophotography		PROJECT NO. 02218.05	FIGURE: 4	SHEET: 1 OF: 1
	CLIENT: Center Lake Conservation Association 1212 Edgewater Drive Warsaw, IN 46580		QUADRANGLE: N/A	DATE: 8/26/08	SCALE: 1" = 500'

Results of Summer Tier II Survey

The Tier II survey completed on August 26, 2008 identified a total of six species within Center Lake with vegetation present up to a depth of 9 feet. A secchi disk reading was taken after sampling and was found to be at 12 feet (Figure 4). Sampling results for the species collected by rake are listed in Table 2. Species observed include spatterdock, white water lily and Eurasian watermilfoil.

Table 2: Center Lake Tier II survey results from August 26, 2008

County: Kosciusko		Total sites: 50	Mean species/site: 1.70				
Date: 8/26/2008		Sites with plants: 36	Standard error (ms/s): 0.192				
Secchi (ft): 12		Sites with native plants: 36	Mean native species/site: 1.70				
Maximum plant depth (ft): 9		Number of species: 6	Standard error (mns/s): 0.191				
Trophic status: Oligotrophic		Number of native species: 6	Species diversity: 0.9879				
Trophic status sampled: Eutrophic		Maximum species/site: 6	Native species diversity: 0.9879				
<u>All depths (0 to 15 ft)</u>	<u>Common Name</u>	<u>Frequency of Occurrence (%)</u>	<u>Rake score frequency per species</u>				<u>Plant Dominance</u>
<u>Species</u>			<u>0</u>	<u>1</u>	<u>3</u>	<u>5</u>	
<i>Chara</i>	Chara	54.0	46.0	30.0	16.0	8.0	23.6
<i>Potamogeton pectinatus</i>	Sago pondweed	38.0	62.0	24.0	14.0	0.0	13.2
<i>Najas flexilis</i>	Slender naiad	36.0	64.0	26.0	8.0	0.0	10.0
<i>Ceratophyllum demersum</i>	Coontail	20.0	80.0	10.0	4.0	6.0	10.4
<i>Potamogeton pusillus</i>	Small pondweed	12.0	86.0	8.0	4.0	0.0	4.0
<i>Potamogeton richardsonii</i>	Richardson's pondweed	8.0	92.0	8.0	0.0	0.0	1.6
<u>Depth: 0 to 5 ft</u>	<u>Common Name</u>	<u>Frequency of Occurrence (%)</u>	<u>Rake score frequency per species</u>				<u>Plant Dominance</u>
<u>Species</u>			<u>0</u>	<u>1</u>	<u>3</u>	<u>5</u>	
<i>Chara</i>	Chara	78.3	21.7	39.1	21.7	17.5	15.7
<i>Potamogeton pectinatus</i>	Sago pondweed	60.9	30.4	30.4	30.5	0.0	24.3
<i>Najas flexilis</i>	Slender naiad	52.2	47.8	39.1	13.0	0.0	15.7
<i>Ceratophyllum demersum</i>	Coontail	21.7	78.3	8.7	8.7	4.3	11.3
<i>Potamogeton pusillus</i>	Small pondweed	17.4	82.6	8.7	8.7	0.0	7.0
<i>Potamogeton richardsonii</i>	Richardson's pondweed	17.4	78.3	17.4	0.0	0.0	3.5
*Species observed include <i>Myriophyllum spicatum</i> (Eurasian watermilfoil) at depths of 2 and 3 feet							
<u>Depth: 5 to 10 ft</u>	<u>Common Name</u>	<u>Frequency of Occurrence (%)</u>	<u>Rake score frequency per species</u>				<u>Plant Dominance</u>
<u>Species</u>			<u>0</u>	<u>1</u>	<u>3</u>	<u>5</u>	
<i>Chara sp.</i>	Chara	52.9	47.1	35.3	17.6	0.0	17.6
<i>Najas flexilis</i>	Slender naiad	29.4	70.6	23.5	5.9	0.0	8.2
<i>Ceratophyllum demersum</i>	Coontail	29.4	70.6	17.6	0.0	11.8	15.3
<i>Potamogeton pectinatus</i>	Sago pondweed	29.4	70.6	29.4	0.0	0.0	5.9
<i>Potamogeton pusillus</i>	Small pondweed	11.8	82.4	11.8	0.0	0.0	2.4
<u>Depth: 10 to 15 ft</u>	<u>Common Name</u>	<u>Frequency of Occurrence</u>	<u>Rake score frequency per species</u>				<u>Plant Dominance</u>
<u>Species</u>			<u>0</u>	<u>1</u>	<u>3</u>	<u>5</u>	
*No species were found in this depth range							



Aquatic Vegetation Sampling Results Discussion

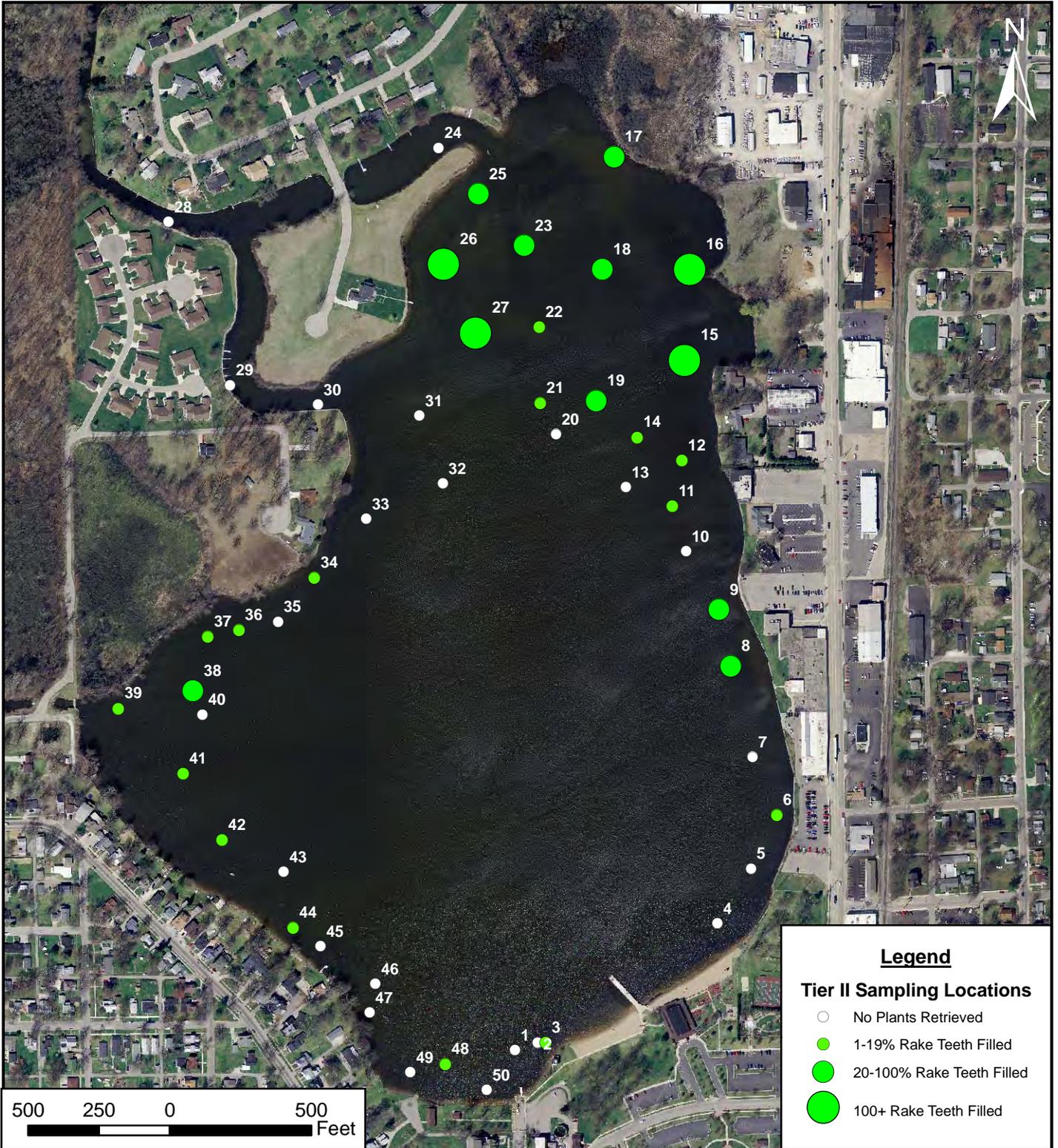
The goal of this plan is to reduce nuisance conditions caused by invasive vegetative species while still maintaining the abundance of beneficial native species. A diverse native vegetative community is vital in providing proper fish habitat, shoreline stabilization, and preventing the spread and/or establishment of invasive exotic species such as Eurasian watermilfoil.

The results of the Tier II sampling effort identified chara as the most dominant species (23.6) which was present at 54% of sample sites (Figure 5). Sago pondweed ranked second in frequency of occurrence (38%; Figure 6) followed closely by slender naiad (36%). The 0 to 5 foot depth zone was the most diverse and had six native species. The most dominant species within the 0 to 5 foot depth zone was sago pondweed (24.3) followed by chara and slender naiad. Coontail's frequency of occurrence was 21.7% within the 0 to 5 foot depth zone and 29.4% in the 5 to 10 foot depth zone (Figure 7). Species observed within the vicinity of the sampling locations include spatterdock, white water lily and Eurasian watermilfoil. Eurasian watermilfoil was found within the vicinity of two sampling locations at depths of 2 and 3 feet (Figure 8).

Eurasian watermilfoil is the primary nuisance exotic species within Center Lake. Eurasian watermilfoil was observed and not collected in both the 2007 and 2008 Tier II Studies. Eurasian watermilfoil was observed from one sampling location in 2007 and two sampling locations in 2008. Continued management efforts to maintain Eurasian watermilfoil at a low level is necessary to prevent it from becoming a dominant species at Center Lake.

There are no known state or federally protected threatened or endangered species present within Center Lake. No voucher specimens were collected during the efforts of this project. There are no anticipated adverse impacts to any state or federally protected threatened or endangered species as it relates to the use of the vegetation control herbicides recommended within this plan.





Legend

Tier II Sampling Locations

- No Plants Retrieved
- 1-19% Rake Teeth Filled
- 20-100% Rake Teeth Filled
- 100+ Rake Teeth Filled

500 250 0 500
Feet



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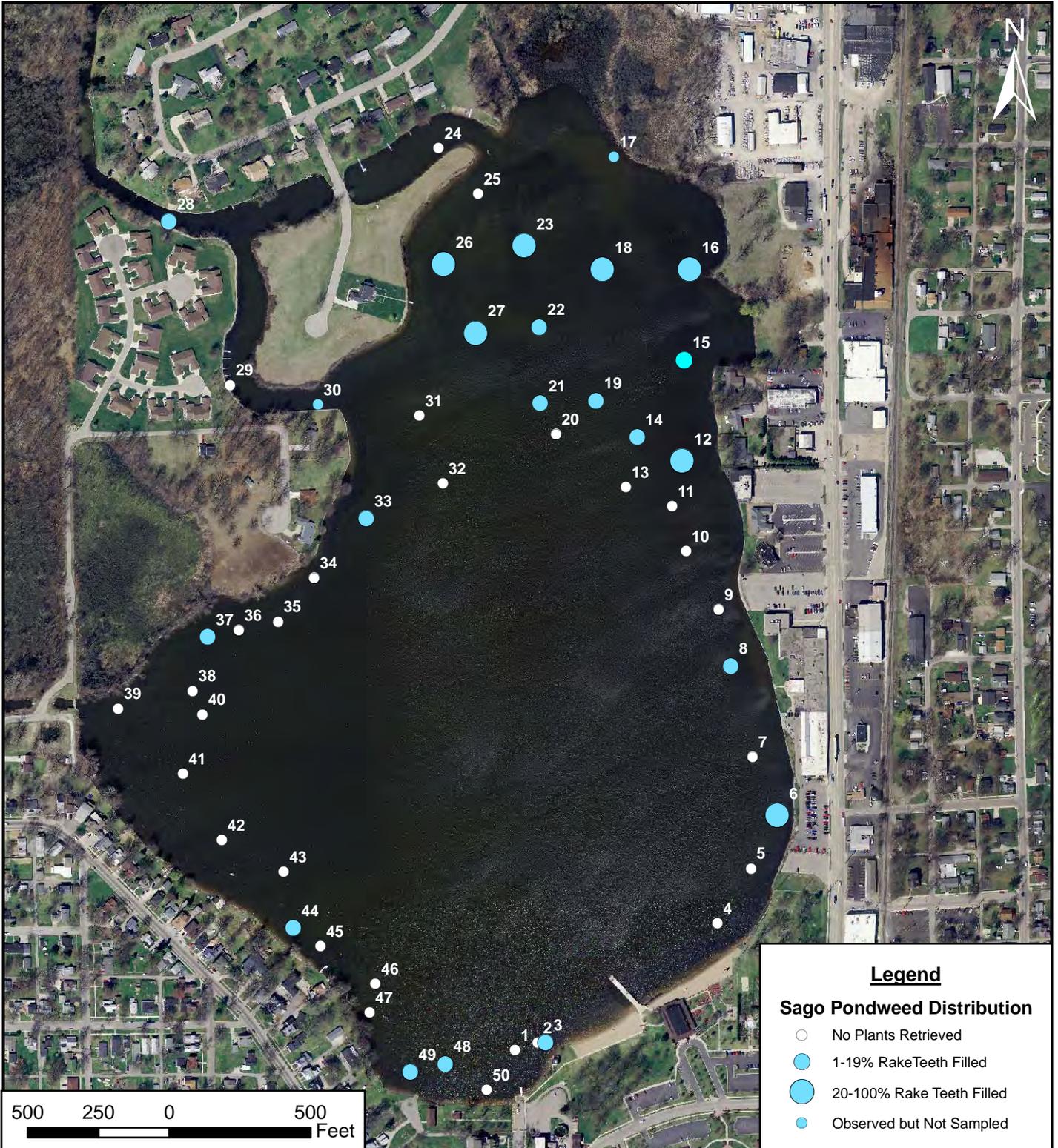
TITLE:
**Post-treatment Distribution
and Abundance of Chara**

BASE LAYER:
Indiana Spatial Data
2006 Orthophotography

CLIENT:
**Center Lake
Conservation Association
1212 Edgewater Drive
Warsaw, IN 46580**

PROJECT AND SITE LOCATION:
**Center Lake Aquatic Plant
Management Plan Update -2008**

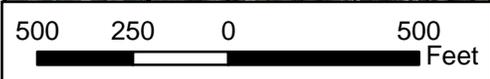
PROJECT NO. 02218.05	FIGURE: 5	SHEET: 1 OF: 1
QUADRANGLE: N/A	DATE: 8/26/08	SCALE: 1" = 500'



Legend

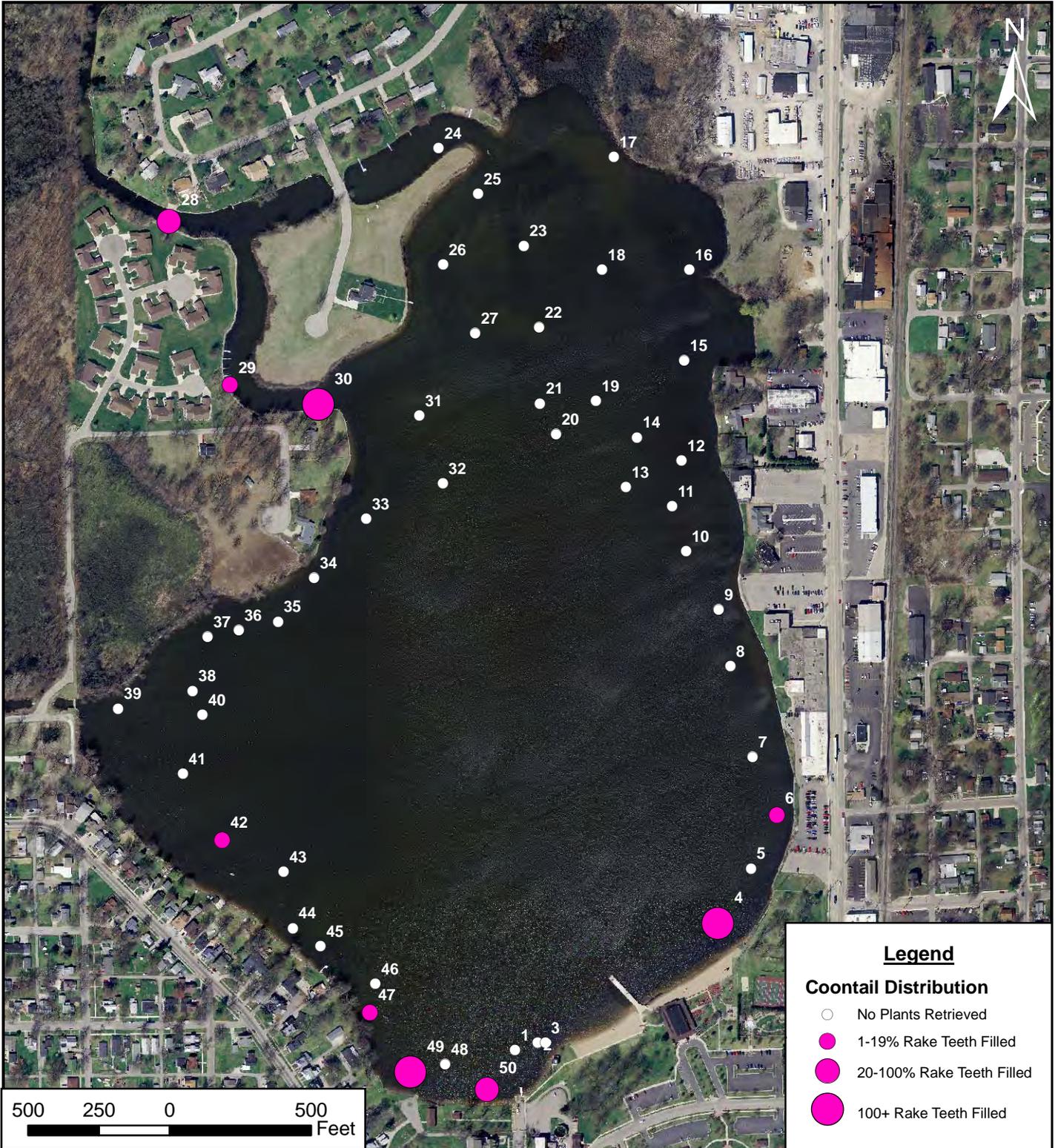
Sago Pondweed Distribution

- No Plants Retrieved
- 1-19% Rake Teeth Filled
- 20-100% Rake Teeth Filled
- Observed but Not Sampled




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TITLE: Post-treatment Distribution and Abundance of Sago Pondweed	PROJECT AND SITE LOCATION: Center Lake Aquatic Plant Management Plan Update -2008		
BASE LAYER: Indiana Spatial Data 2006 Orthophotography	PROJECT NO. 02218.05	FIGURE: 6	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association 1212 Edgewater Drive Warsaw, IN 46580	QUADRANGLE: N/A	DATE: 08/26/08	SCALE: 1" = 500'



Legend

Coontail Distribution

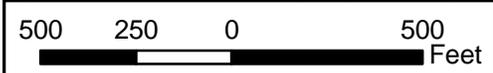
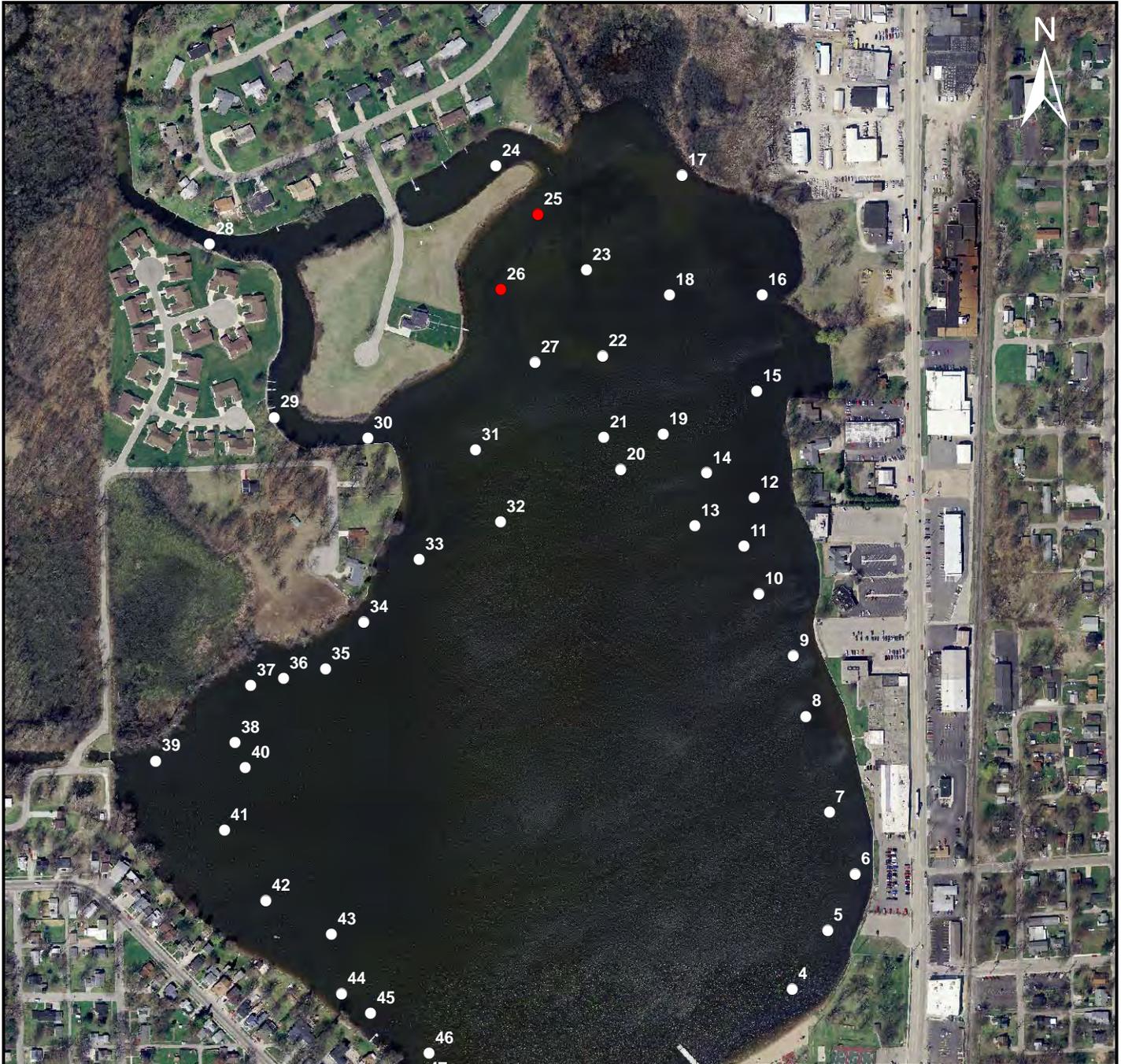
- No Plants Retrieved
- 1-19% Rake Teeth Filled
- 20-100% Rake Teeth Filled
- 100+ Rake Teeth Filled



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TITLE: Post-treatment Distribution and Abundance of Coontail
BASE LAYER: Indiana Spatial Data 2006 Orthophotography
CLIENT: Center Lake Conservation Association 1212 Edgewater Drive Warsaw, IN 46580

PROJECT AND SITE LOCATION: Center Lake Aquatic Plant Management Plan Update -2008		
PROJECT No. 02218.05	FIGURE: 7	SHEET: 1 OF: 1
QUADRANGLE: N/A	DATE: 08/26/08	SCALE: 1" = 500'



Legend

Eurasian Watermilfoil Distribution

- No Plants Retrieved
- Observed but Not Sampled



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TITLE:	Post-treatment Distribution and Abundance of Eurasian Watermilfoil
BASE LAYER:	Indiana Spatial Data 2006 Orthophotography
CLIENT:	Center Lake Conservation Association 1212 Edgewater Drive Warsaw, IN 46580

PROJECT AND SITE LOCATION:		
Center Lake Aquatic Plant Management Plan Update -2008		
PROJECT NO.	FIGURE:	SHEET: 1
02218.05	8	OF: 1
QUADRANGLE:	DATE:	SCALE:
N/A	8/26/08	1" = 500'

Comparison of 1996 – 2008 Quantitative Sampling Data

A summary of quantitative sampling conducted between 1996 and 2008 is shown in Table 3. The site frequency of each aquatic plant species is shown. Although some of the variability between sampling dates may be the result of varying sampling techniques and timing, management activities conducted at Center Lake may be the cause of more consistent trends.

Coontail was consistently recorded from more than 30% of sampling sites prior to August 2005 (Table 3). During June 2005 a whole-lake Sonar treatment was applied to Center Lake to control Eurasian watermilfoil. It was recorded from only 2% of sampling sites in July 2006 following the fluridone treatment. Coontail frequency of occurrence remained stable at 20% from 2007 to 2008.

Sago pondweed decreased to 15% in August 2005 following the fluridone treatment and fluctuated in the years following the treatment. In 2006 there was a total of 14 species collected. Sago pondweed was the most frequently encountered species (66%) in 2006 which was significantly greater than any of the other species collected. The total number of species in 2007 decreased to half of what was present in 2006 (7 species). Sago pondweed and coontail were the most frequently occurring species in 2007 (20%). Sago pondweed increased in 2008 to 38% and was the second most frequently occurring species during the survey.

Six species were collected in 2008 which was the least amount of species collected since the fluridone treatment. The reduction in species count may be attributed to a delayed reaction to the fluridone treatment from native species. However, chara is a native species that has the ability to carpet the lake bottom and crowd out other native species. Chara was not identified as a problem plant bed in Center Lake's five-year plan but the results of the 2008 Tier II study demonstrate a significant increase in dominance (23.6) and frequency of occurrence (54%) from all other studies. Chara algae dominance within Center Lake should continue to be monitored to determine whether it is reaching nuisance levels and is negatively impacting native species. If control of chara algae is needed Copper Sulfate will be used for treatment.



Table 3. Site frequency of aquatic plant species at Center Lake 1996-2008 (Frequency values greater than 30 are shown in bold)

Scientific Name	Common Name	10/96	3/97	6/97	7/97	8/04	5/05	8/05	7/06	7/07	8/08
<i>Ceratophyllum demersum</i>	Coontail	25	86	40	32	36	38	20	2	20	20
<i>Chara</i> sp.	Chara		2	25	9	46	8	35	8	12	54
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	100	68	62	5	71	80	8	2		
<i>Najas</i> sp.	Naiads	43	16			32					
<i>Najas flexilis</i>	Slender naiad						2		2		36
<i>Najas minor</i>	Spiny naiad								2	2	
<i>Nuphar variegatum</i>	Yellow pond lily				11				6	2	
<i>Nymphaea tuberosa</i>	White water lily			46	32				8		
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	2	18	24	25	7	7	10			
<i>Potamogeton crispus</i>	Curlyleaf pondweed	2			1			2			
<i>Potamogeton gramineus</i>	Variable pondweed								2	2	
<i>Potamogeton illinoensis</i>	Illinois pondweed	37		25				3	8	2	
<i>Potamogeton nodosus</i>	American pondweed	3			36				4		
<i>Potamogeton pectinatus</i>	Sago pondweed	58		49	39	25		15	66	20	38
<i>Potamogeton pusillus</i>	Small pondweed							2			12
<i>Potamogeton richardsonii</i>	Richardson's pondweed			1		4					8
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed					14	2		4		
<i>Utricularia gibba</i>	Humped bladderwort							7			
<i>Utricularia vulgaris</i>	Common bladderwort	18			9				4		
<i>Vallisneria americana</i>	Eel grass						13				
<i>Zosterella dubia</i>	Water stargrass			3	11			28	6		
Filamentous Algae						7			4		
Total Number of Species		9	5	9	11	9	7	10	14	7	6

* Data from 1996-1997 collected by Aquest (Weed Patrol 2005), data from 2004 collected by Weed Patrol (Weed Patrol 2005), data from 2005 collected by IDNR (Benson 2006), and data from 2006 collected by V3. Methods of selecting sampling locations varied between the years.



Tier II Data Comparison 2004-2008

Although the sampling methods varied through the years, a summary of sampling data from 2004 to 2008 is provided in Table 4. The secchi disk reading remained relatively constant around five feet between 2005 and 2007. The 2008 secchi disk reading was 12 feet which is three times greater than the previous studies results. The increase in vegetation coverage from 42% in 2007 to 72% in 2008 is likely related to the increase in water clarity. Factors that are related to increased water clarity include reduced nutrient input from the watershed, increased grazing of algae by zooplankton, and/or reduced soil erosion into the lake. The decrease in maximum plant depth from 13 feet in 2005 to 9 feet in 2008 is attributed to the fluridone treatment in 2005.

Table 4. Tier II data comparison from 2004 to 2008

Sampling Date:	Secchi (ft)	Number of sites	Max Plant Depth (ft):	Sites with Plants (%)	Number of Species	Number of Native Species
Aug. 24, 2004**	-	41	14	73%	9	7
May 11, 2005*	5	60	13	92%	7	6
Aug. 2, 2005*	5	60	9.5	85%	10	8
July 31, 2006	5	50	8	74%	15	13
July 25, 2007	4	50	7	42%	10	9
August 26, 2008	12	50	9	72%	6	6

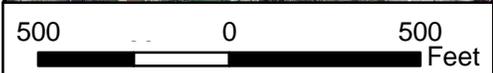
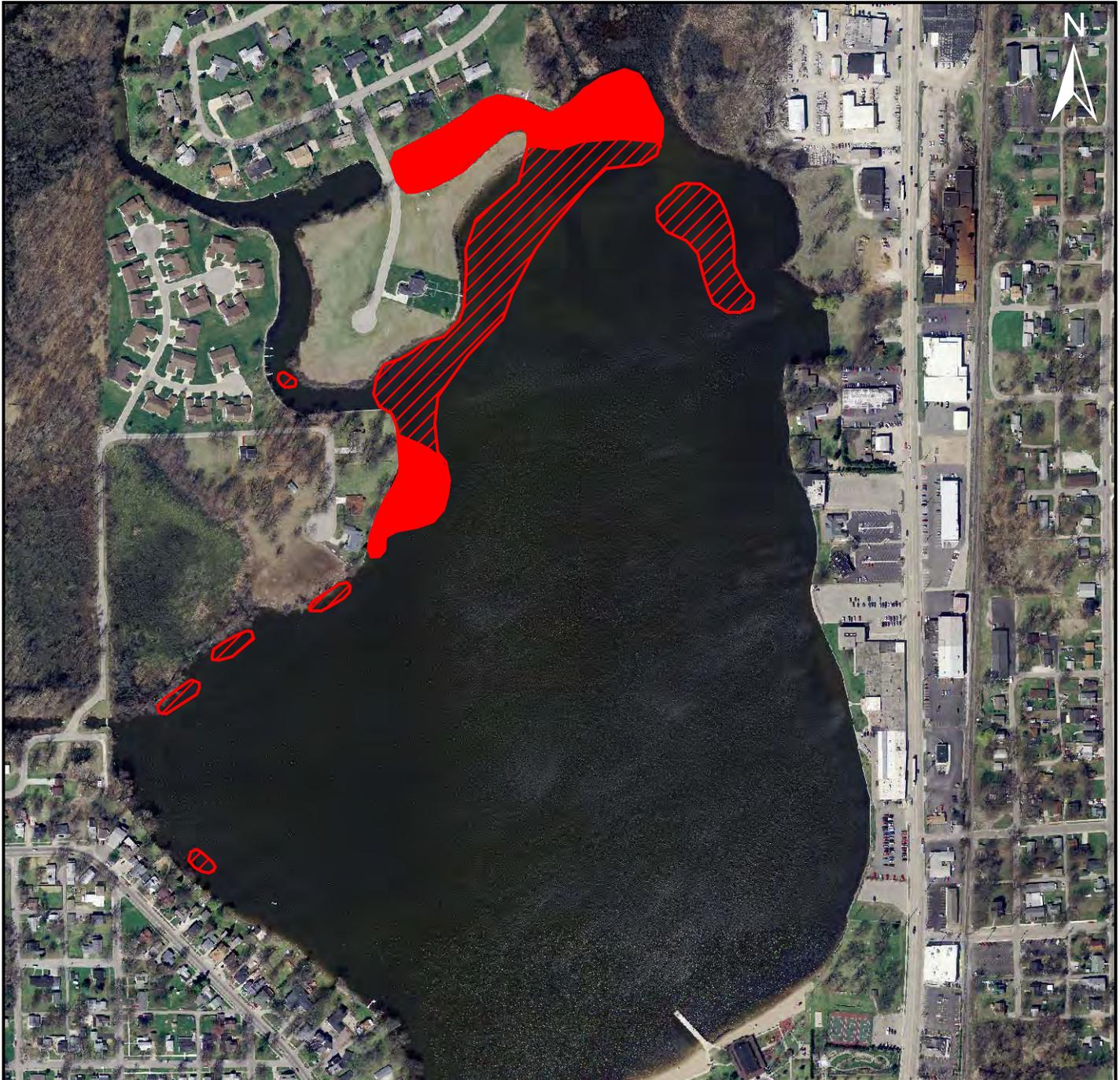
* Data from IDNR (Benson 2006)

** Data from Weed Patrol, Inc. (Weed Patrol 2005)

Fall Recurrence of Eurasian watermilfoil

Center Lake residents reported Eurasian watermilfoil throughout Center Lake approximately three months after the Renovate treatment in June. Weed Patrol performed an additional survey on September 24, 2008 in response to Center Lake resident concerns. Weed Patrol identified 11.5 acres of late season regrowth of Eurasian watermilfoil (Figure 9). Eurasian watermilfoil infestations were primarily located along the north-western shoreline of Center Lake. Weed Patrol mapped areas of dense and scattered Eurasian watermilfoil which will be used to locate treatment areas in 2009. Weed Patrol didn't perform a late season treatment as funding was limited. An increase in Eurasian watermilfoil is expected in 2009 and is estimated at 30 acres. Future regrowth will be communicated with LARE staff to determine whether additional funding would be available for late season treatment of Eurasian watermilfoil.





Legend	
	Eurasian watermilfoil (Dense)
	Eurasian watermilfoil (Scattered)



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TITLE: Weed Patrol Survey of Eurasian Watermilfoil September 24, 2008		PROJECT AND SITE LOCATION: Center Lake Aquatic Plant Management Plan Update -2008		
BASE LAYER: Indiana Spatial Data 2006 Orthophotography		PROJECT NO. 02218.05	FIGURE: 9	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association 1212 Edgewater Drive Warsaw, IN 46580		QUADRANGLE: N/A	DATE: 9-24-08	SCALE: 1" = 500'

Aquatic Vegetation Management Alternatives

At the present time, the health of Center Lake's aquatic plant communities is good. Native plant diversity is moderate. Continued management efforts to maintain the Eurasian watermilfoil population at a low level is desirable to prevent Eurasian watermilfoil from becoming the predominant species in the lake. Additionally, watershed activities to improve the water quality of Center Lake are important to enhance the native plant diversity.

Implementation projects involving best management practices for establishing native submergent or emergent aquatic plant communities within Center Lake or along the shoreline has not occurred and is currently being discussed. A public meeting was held November 27, 2007 and Jon Garber of Warsaw Parks and Recreation and Ed Belmonte of V3 spoke of a naturalized shoreline stabilization project. This project is supported by the CLCA and was well received by members of the public. This project involves establishing natural shoreline vegetation along 730 feet of Center Lake's southern shoreline. Warsaw Parks and Recreation has received a LARE grant on the feasibility and design aspects of this proposed project. Upon completion of the future implementation phase, signage will be provided along the City's property explaining the ecological benefits of naturalized shoreline stabilization.

Although dense beds of native aquatic vegetation can be a nuisance where they inhibit lake access, aquatic vegetation is important to maintaining a healthy lake ecosystem. Aquatic vegetation provides habitat for plankton, insects, crustaceans, fish, and amphibians. Aquatic vegetation has the ability to remove nutrients like phosphorus and nitrogen out of the water column, increase water clarity, prevent harmful algal blooms, produce oxygen and provide food for waterfowl. Aquatic vegetation can even remove pollutants from contaminated water and prevent the suspension of particulate matter by stabilizing sediment and preventing erosion from wave action.

One of the most basic goals of the LARE aquatic vegetation program is to maintain healthy aquatic ecosystems by maintaining or improving biodiversity in Indiana lakes, which includes protecting beneficial aquatic vegetation. As such, it is recognized that competing lake uses including access for boating and maintaining plant beds to provide habitat for juvenile fish must be incorporated into an overall management strategy for the lake.

Many management strategies have been used to control Eurasian watermilfoil in Indiana lakes. A management strategy should be chosen based on selectivity to the target species, long-term effectiveness, and potential for detrimental side-effects (i.e., effects on non-target species). The foremost objective is to choose a management strategy that will effectively control the watermilfoil population with minimal negative effects on non-target vegetation or fish species. Different types of aquatic vegetation management alternatives are discussed below. One or more of these alternatives may be employed to meet the objectives of Center Lake.

1 No Action

If no action is taken, the Eurasian watermilfoil abundance may remain stable, or it may increase from year to year. Eurasian watermilfoil spreads by fragmentation; when the plant is cut, the fragment has the ability to form an entirely new plant. Eurasian watermilfoil also over-winters as an adult plant and sprouts early in the spring. A major goal of this aquatic vegetation



management plan is to prevent Eurasian watermilfoil from becoming a monoculture, and to maintain and enhance the current diversity of native aquatic vegetation within Center Lake. Eurasian watermilfoil has a history of coming back after treatments, and diligent treatment of re-sprouts over several years is needed to provide long-term control. Taking no action is not a viable option for Center Lake because it allows for Eurasian watermilfoil population to re-sprout after the 2008 treatment and expand to a problematic level.

2 Mechanical Cutting and Harvesting

Mechanical harvesting involves using a large machine to cut and collect unwanted aquatic vegetation. The machine picks up the cut weeds but leaves small fragments behind. Since Eurasian watermilfoil is able to reproduce from cut fragments, mechanical harvesting can spread this invasive species. Additionally, mechanical harvesting is not selective and will cut both native and exotic plant species. Where both are growing together, mechanical harvesting will give an advantage to Eurasian watermilfoil over any native species that are present, given its growth and reproductive characteristics. Each fragment clipping of Eurasian watermilfoil is capable of becoming reestablished as a complete plant. For these reasons, mechanical harvesting is not recommended in any area infested by Eurasian watermilfoil. Harvesting can be accomplished by individual owners around their dock areas but is not recommended. A lake property owner can legally harvest a 625 square foot area (25 feet by 25 feet).

3 Hand-Pulling, Cutting, Raking

Manual controls such as hand pulling, cutting, and raking can be effective ways to control unwanted plants in certain situations. In very shallow clear water, small areas of vegetation can be identified and cleared by hand. Large areas of vegetation, especially those in deeper water, can be extremely difficult to control using these methods. Many of the harvested weeds will break apart, leaving the root system in the lake bottom. Failure to remove root structures will result in regrowth.

Plants such as Eurasian watermilfoil that possess the ability to reproduce through fragmentation can seldom be effectively controlled by these methods if they are distributed throughout a lake. Identifying every area of infestation would be difficult, as would harvesting the plants without causing fragmentation of plant parts. Any plant fragments not removed from the water can form new plants, meaning that hand pulling and cutting can facilitate the spread of unwanted plant species such as Eurasian watermilfoil. The high potential for expansion does not make hand-pulling, cutting, or raking viable options.

4 Chemical Controls – Aquatic Herbicides

The public's primary concern with the use of aquatic herbicides is safety. Each chemical registered for aquatic applications has undergone extensive testing prior to becoming available for use. It is imperative that any aquatic herbicide be applied by a licensed professional in accordance with its label to minimize potential side-effects. There are two major categories of aquatic herbicides: contact and systemic herbicides. Contact herbicides are not selective, and thus are best used to control vegetation around piers and in navigation channels. Given the lack of selectivity and their inability to eliminate the root systems of treated plants, contact herbicides have the potential to cause unnecessary damage to native species. Additionally, there is potential for re-infestation of Eurasian watermilfoil in bare areas. Reward (active ingredient: diquat) and Aquathol (active ingredient: endothal) are two examples of contact herbicides.



Although contact herbicides generally are not selective, timing and dosage can be adjusted to make them affect the target species with less damage to non-target species. The phenological timing method of contact herbicide treatment for Eurasian watermilfoil has shown some success (Madsen, 1993). Recent tests have shown that by adjusting the dosage higher and timing the treatment exactly, a systemic effect on Eurasian watermilfoil can be achieved with contact herbicides. This method involves treating the plants very early in the spring when carbohydrate reserves of Eurasian watermilfoil have left the root structure, promoting rapid growth in the other plant structures. Since Eurasian watermilfoil is growing more actively earlier in the spring than other species, the risk to non-target plants is relatively low if timed properly.

The contact herbicide commonly used for selective low-dose control of Eurasian watermilfoil in mid-season is Reward. A low-dose contact herbicide application can be relatively selective, since Eurasian watermilfoil is susceptible to some herbicides at a dose lower than most native plants due to their high growth rate. As a complicating factor, low-dose applications to control Eurasian watermilfoil with Reward are difficult in lakes where high levels of single-cell algae are present. Reward's mode of action is that it binds with positively charged particles in the water column. Since single-cell algae are positively charged, Reward will bind with algae in the water column and not affect the milfoil. Although Reward is not marketed as an algaecide, alga is shown on the label as controlled by this product. Since alga is moderately abundant during mid-summer at Center Lake, the effectiveness of a low-dose contact treatment may be compromised.

The contact herbicide used for curlyleaf pondweed control is Aquathol K which is commonly applied in late May and June. Aquathol K is composed of dipotassium salts of endothall and comes in both liquid and granular formulations. These endothall products are effective on curlyleaf pondweed and can be mixed with copper compounds for additional effectiveness. Contact herbicides, such as Aquathol K, act quickly and kill all plants cells that they come in contact with. Treating curlyleaf pondweed with Aquathol K is most effective in very early spring when water temperatures are at or below 56-67 degrees Fahrenheit. Curlyleaf pondweed hasn't been encountered in the 2007 and 2008 Tier II surveys and monitoring will continue for its presence. If curlyleaf pondweed is present within Center Lake and reaches nuisance level herbicide treatments with Aquathol K will be performed.

Systemic herbicides are absorbed by the plant and transported to the root systems where they kill both the roots and the plant. Examples of systemic herbicides are Sonar and Avast (active ingredient: fluridone); Navigate, Aqua Kleen, DMA4 (active ingredient: 2,4-D), and Renovate (active ingredient: triclopyr). All of these products effectively kill Eurasian watermilfoil plants and roots. Whole lake treatments of fluridone are often used in lakes that have become severely infested with Eurasian watermilfoil. Fluridone can be applied at low rates to control the Eurasian watermilfoil while causing minimal damage to most of the native plant species present. Curlyleaf pondweed is also susceptible to fluridone at the low dose used on Eurasian watermilfoil.

Triclopyr and 2,4-D are both systemic herbicides that are often used for spot treatments in small areas of Eurasian watermilfoil. These herbicides kill all dicots (broadleaf plants such as coontail, waterweed, watermilfoils, etc.) but do not affect monocots (such as eel grass or pondweeds). In preliminary studies, triclopyr may have the ability to control Eurasian watermilfoil in select areas longer than 2,4-D, but this potential benefit is outweighed by higher cost. Neither chemical affects curlyleaf pondweed.



Public Involvement

Public meetings have been held annually by the Center Lake Conservation Association to discuss the vegetation management plan. A notice of the public meeting was published in the newspaper, and the public input was requested on proposed aspects of the aquatic vegetation management plan. A public meeting was held November 4, 2008 at the Warsaw Community Library in Warsaw, Indiana. Five individuals attended the meeting which represented members of the Center Lake Conservation Association. V3 discussed current plant management activities, results of the Tier II survey, and future management. A lake use survey was handed out after the meeting and all individuals participated. An additional lake use survey was collected at the permit meeting for Center Lake. Summary totals from all completed lake use surveys are shown in Figure 10. All participants were lake property owners and current members of the Center Lake Conservation Association. Five of the six participants were lake property owners for 10 years or more. Questions concerning lake use found that all of those surveyed used the lake for boating. Using the lake for swimming and irrigation applied to 83% of participants. Nobody surveyed used the lake for drinking water. Questions concerning problems with the lake found that 100% thought dredging was needed, 83% felt there are too many aquatic plants. One participant felt that poor water quality is an issue at Center Lake. There were no other problems recorded for the lake. All of those surveyed were in favor of continuing efforts to control vegetation and were aware of LARE contributions for controlling invasive exotic species. All survey participants felt aquatic vegetation interfered with lake use, affected property values, and were aware of current weed control projects on Center Lake. All participants were in favor of continued involvement in the LARE program even if the state match was reduced to 50% or even as low as 10%. Overall there is an increased appreciation for the efforts of the Center Lake Conservation Association in acquiring funding for aquatic plant management through LARE grants. There was also a noticeable appreciation for state funding for the LARE program, specifically providing grants for weed control treatments for lakes.

Lake residents play an important role in establishing and maintaining a healthy lake community. Lake association meetings and newsletters are excellent mechanisms through which information about management practices at Center Lake can be distributed. In addition, these meetings provide a forum where issues regarding conflicting uses and goals for the lake may be discussed and keep the public informed of lake issues.



Public involvement and educational needs are critical with respect to a new threat to Indiana lakes from an invasive aquatic plant called Hydrilla (*Hydrilla verticillata*). In 2006, on Lake Manitou (adjacent to Rochester in Fulton County), an area infested with this problematic aquatic plant was identified. Efforts are currently underway to resolve the problem, but it is critical if this plant is seen on Center Lake for the state to be notified as soon as possible.

Hydrilla can be differentiated from the native elodea in that there are typically 3 leaves per whorl on the native elodea and there are as many as eight leaves per whorl in Hydrilla. Elodea is also smooth to the touch where as Hydrilla is rough. Figure 11 (Michigan Sea Grant 2007) demonstrates a means of comparative identification.

Additional information can be found from the national campaign to *Stop Aquatic Hitchhikers!* at <http://www.protectyourwaters.net/>

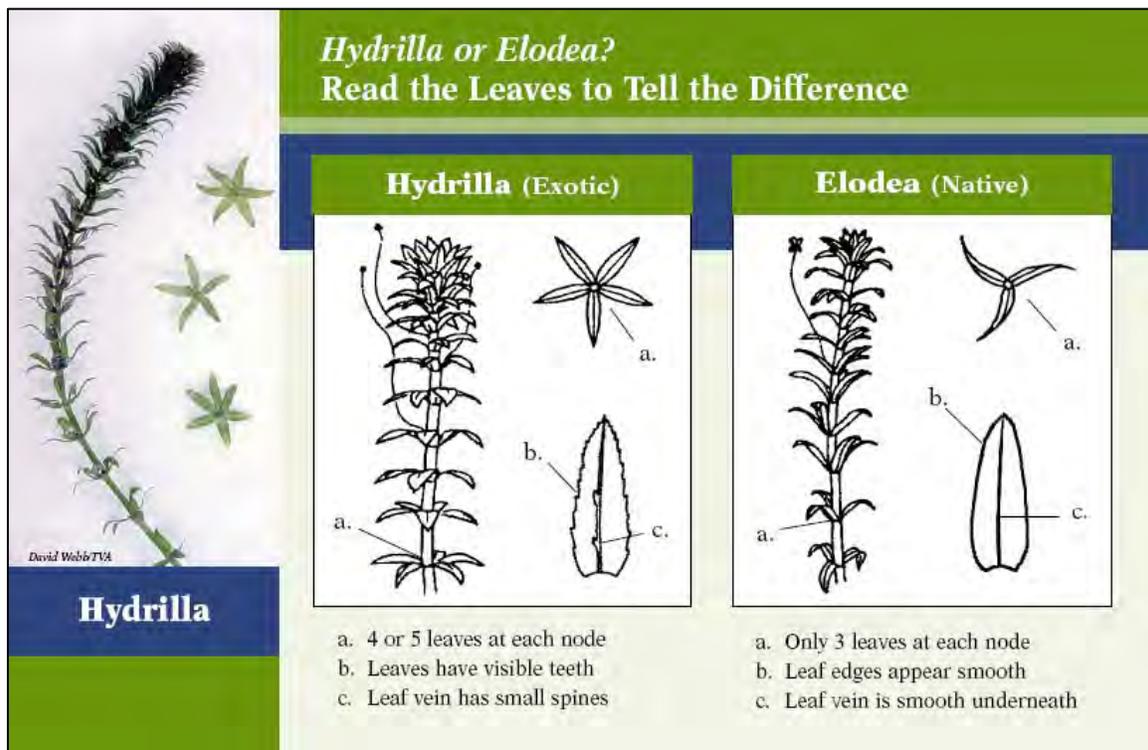


Figure 11: Illustration of Hydrilla compared to native elodea. (Illustrations provided by Michigan Sea Grant)

In addition to these state and lake-wide issues, residents can be educated regarding practical steps that can reduce nutrient loading and improve the Center Lake ecosystem, when such practices are implemented collectively.

1. **Proper Maintenance of Boat Motors.** Improperly maintained boats may leak gasoline or oil directly into the lake, which is detrimental to the lake's ecosystem. Educating lake users about the importance of properly maintaining their boat motors is an easy and effective step to improve water quality.

2. **Limit Lawn Fertilizer Use Adjacent to Lake.** If a fertilizer application must be applied, avoid spreading fertilizer directly into the lake, on sidewalks, or seawall where it will wash into the lake. Fertilizer application should be avoided within 30 feet of the lakeshore, if possible. In addition, a buffer strip of native vegetation along the lakeshore allows runoff to be filtered before it enters the lake.
3. **Promote Agricultural Best Management Practices.** Work with farmers within the upstream watershed to increase filtration and purification of agricultural runoff before water reaches the lake. Indiana offers incentives for farmers to address soil and water concerns through the U.S. Department of Agriculture. The Indiana Conservation Reserve Program (CRP) provides technical and financial aid to reduce soil erosion, reduce sediment in lakes and streams, and improve overall water quality. Farmers owning highly erodible land or property adjacent to tributary streams or lakes may be eligible for funding to implement practices that increase water quality. Further information is available from the Indiana Natural Resources Conservation Service (NRCS).
4. **Disposal of Grass Clippings.** Avoid blowing grass clippings and tree leaves into the lake. Grass clippings blown into a pond or lake quickly can turn into a floating mat of algae because cut and decaying vegetation rapidly releases nutrients into the water.
5. **Urban Stormwater Best Management Practices.** Prevent or reduce urban and industrial runoff flowing directly into the lake. Urban runoff can be one of the most detrimental factors influencing water quality. Nutrients and sediment are conveyed into the lake through storm sewers. Additionally, oil, antifreeze, gasoline, road salt, and other pollutants are washed from pavement through the storm sewer system, and are detrimental to a lake's ecosystem.



Additional Funding Sources

Identifying additional funding sources for Center Lake is important as state funding is limited. In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes such as Center Lake. Many government agencies assist in projects designed to improve environmental quality.

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

- Watershed Protection and Flood Prevention Program
- Wetlands Reserve Program
- Grasslands Reserve Program
- Wildlife Habitat Incentive Program
- Small Watershed Rehabilitation Program

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
- Bring Back the Natives Program
- Native Plant Conservation Program

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



Timeline for LARE Grant Applications

LARE grants are available on a competitive basis for actions that can address the ecology and management of public lakes and their watersheds. The Center Lake Conservation Association must comply with IDNR grant deadlines to remain eligible for funding assistance with management of invasive aquatic plants such as Eurasian watermilfoil.

Associations must apply for funding assistance by January 15 and grant application forms can be obtained through the LARE website (www.in.gov/dnr/fishwild/3302.htm). Aquatic vegetation control permits should be ideally completed by January 31st and submitted to DNR Division of Fish and Wildlife commercial license clerk. Award notices are announced in March. If a lake has received funding a request for proposals that is prepared by LARE staff should ideally be submitted to contractors by the end of March. Contractor qualifications and experience should be thoroughly reviewed before a final selection is made. Contracts for a planning consultant and herbicide treatment contractor should ideally be signed by the month of April to accommodate early spring treatments and pre-treatment surveys if applicable.



Action Plan

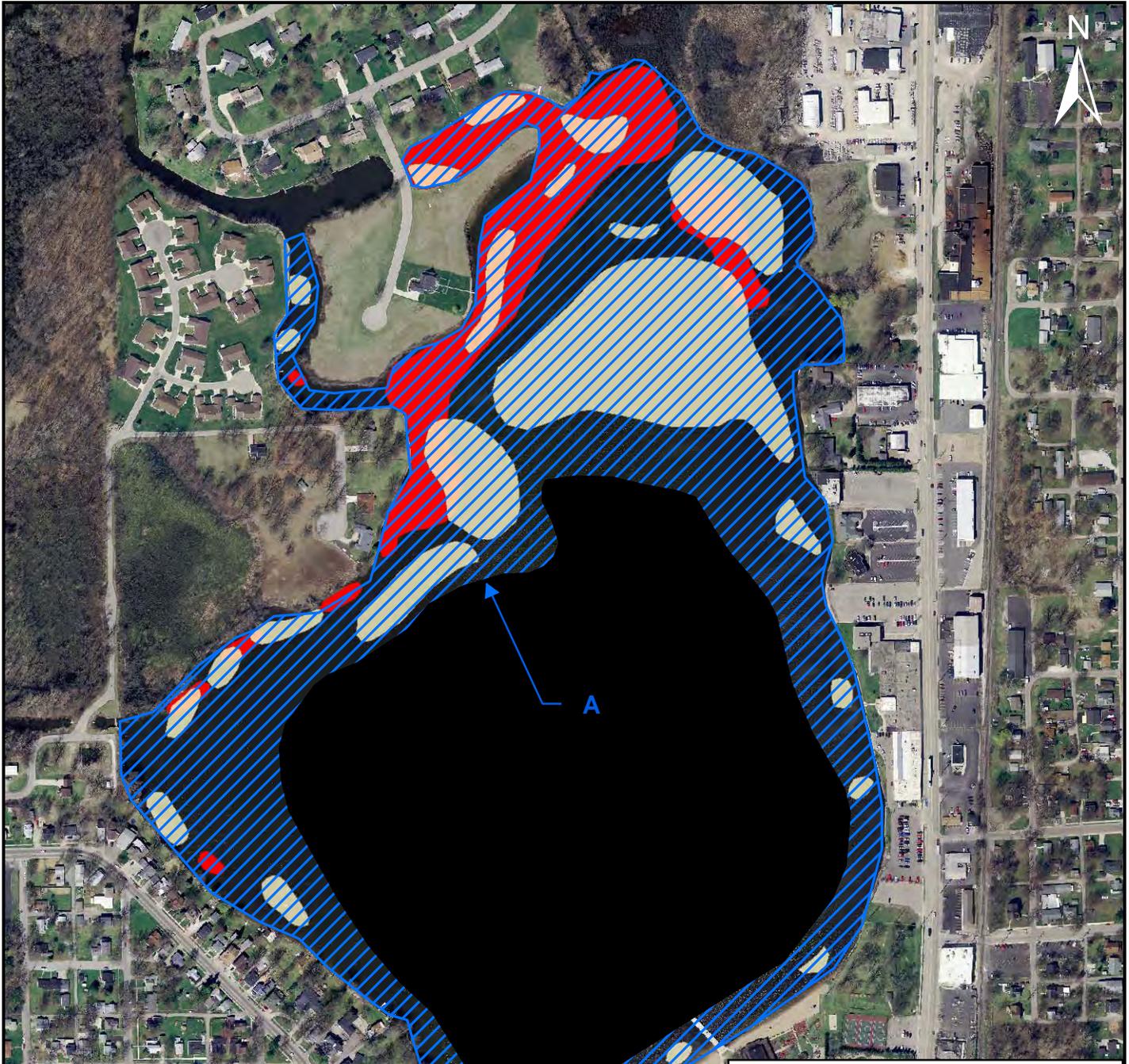
Priority treatment areas for Eurasian watermilfoil were determined based on the 2008 Renovate treatment area, the results of the post treatment Tier II survey conducted by V3, and Weed Patrol's survey conducted on September 24, 2008. Eurasian watermilfoil grows and spreads rapidly by fragmentation and must be considered in estimating future acreages of treatment. V3 anticipates approximately 30 acres of priority treatment for Eurasian watermilfoil in 2009 (Figure 12). Priority treatment areas location and acreage are described in the Application for Aquatic Vegetation Control Permit located in Appendix II. The budget allotted for Eurasian watermilfoil is \$15,000 for up to thirty acres of treatment using liquid 2,4-D. The 2009 herbicide application will use 2,4-D instead of Renovate because of Eurasian watermilfoil's ability to develop resistance. It is imperative to perform early maintenance of Eurasian watermilfoil before it is able to spread as it did in the northern portion of Center Lake this year.

We are hesitant to recommend another fluridone treatment as Center Lake's vegetation is still recovering in depths greater than eight feet. Prior to the fluridone treatment in 2005, the average maximum plant depth was approximately 12 feet, whereas after the fluridone treatment the average maximum plant depth was only 8 feet. Allowing native plants to recover will inhibit Eurasian watermilfoil from establishing in bare areas. If fluridone is necessary in the future the retention time of Center Lake along with SePro's results of the PlanTest conducted on Eurasian watermilfoil from Center Lake this fall will be used to determine the proper dosage and bump necessary for Center Lake. The purpose of the PlanTest is to identify any fluridone resistance that Eurasian watermilfoil within Center Lake could have.

Reintroduction of Eurasian watermilfoil in Center Lake involves many factors and educational outreach is essential. The public access site is a vector for reintroduction as fragments of Eurasian watermilfoil on boat motors and trailers are able to form new colonies. Recreational users access Center Lake through the channels. Eurasian watermilfoil can be carried from the channels into Center Lake as vegetation is shredded or fragmented as users access the lake on canoes or kayaks. During periods of high water, Center Lake receives flow from Sloan Ditch and the Tippecanoe River, which is another possible source of Eurasian watermilfoil reintroductions. There has been much discussion over the Pike Lake connection to Center Lake and should be further explored. It is the recommendation of this plan, as well as the diagnostic study, to close off any connection on the Pike Lake side as Eurasian watermilfoil fragments can be introduced to Center Lake through the pipe. Focusing on manageable vectors of exotic species introduction as well as herbicide treatments is vital for management effectiveness.

As the action plan is implemented, aquatic vegetation surveys will help monitor the effectiveness of the management strategy. The abundance and distribution of Eurasian watermilfoil will be recorded using the IDNR Tier II sampling protocol. After the Spring 2009 Target Species Distribution Map is created, the distribution and abundance of Eurasian watermilfoil will be identified and treatment maps will be prepared. The new data analysis results will be incorporated into the current lake management plan. Incorporating these results will provide property owners, applicators, and the IDNR with detailed records describing the changes within the plant communities of Center Lake. In years to follow, additional surveys will be conducted to determine how the Eurasian watermilfoil population and the native vegetative beds are responding to treatment. These surveys will provide a basis for evaluation of the management strategy and can be presented to the public, should the management strategy need to be modified.





Up to 30 acres of Eurasian watermilfoil will be treated within the search and destroy area.



Legend	
	Search and Destroy Area
	Eurasian watermilfoil 2008 Treatment
	Eurasian watermilfoil Survey 9-24-08



V3 Companies
 7325 Janes Avenue
 Woodridge, IL 60517
 630.724.9200 phone
 630.724.9202 fax
 www.v3co.com

TITLE: Eurasian Watermilfoil Priority Treatment Area 2009	PROJECT AND SITE LOCATION: Center Lake Aquatic Plant Management Plan Update - 2008		
BASE LAYER: Indiana Spatial Data 2006 Orthophotography	PROJECT NO. 02218.05	FIGURE: 12	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association 1212 Edgewater Drive Warsaw, IN 46580	QUADRANGLE: N/A	DATE: 10/30/08	SCALE: 1" = 500'

Implementation of Action Plan

1. Proposed Treatment Area Map created. The site visit and investigation necessary to create this map will allow for the determination of the extent of follow-up chemical treatment that will be necessary to treat Eurasian watermilfoil. The Spring 2009 mapping will determine the extent and location of milfoil regrowth.
2. Follow-up Herbicide Treatment to Eurasian watermilfoil. An early spring (3rd week of April to mid-May) systemic herbicide application of liquid 2,4-D is proposed during 2009 to treat up to thirty acres of Eurasian watermilfoil that has re-grown since the 2008 herbicide application.
3. Summer 2009 Tier II Aquatic Vegetation Survey. A Tier II aquatic vegetation survey should be done in summer 2009 to document the diversity, distribution and abundance of aquatic vegetation. This data is important to monitor the health of native plant communities and that the Eurasian watermilfoil population is kept under control.

The management goal for 2009 is to keep the Eurasian watermilfoil populations below nuisance quantities. The overall goal for Center Lake is the results of the 2009 sampling are equal to or less than the 2008 Eurasian watermilfoil density and abundance which would demonstrate effective herbicide treatments and management. Although chara is a native species, it has the ability to carpet the lake bottom and crowd out other native species and should be monitored in future vegetation surveys.



Budget Update

The following costs are estimated based on lake size, average depth, chemical and application costs, as well as LARE survey requirements. The proposed management schedule and budgets for 2009 and 2010 are summarized below.

2009

Target Species Distribution Map and Proposed Treatment Area Map	\$ 1,000
Early Spring Herbicide Application of liquid 2,4-D for Eurasian Watermilfoil (up to 30 acres of Eurasian watermilfoil)	\$15,000
Late season post treatment aquatic vegetation survey (Tier II) and plan update	\$ 6,000

2010

Target Species Distribution Map and Proposed Treatment Area Map	\$1,000
Late season (post treatment) aquatic vegetation survey (Tier II) and plan update	\$6,000

Any herbicide applications will depend on the results of the surveys.

These management activities and vegetation surveys are proposed to improve Center Lake's ecosystem and facilitate the achievement of overall goals established by the IDNR. These overall goals established by the IDNR for all lakes applying for LARE funding are: 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; and 3) provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.



Monitoring and Plan Updates

The results of the 2008 post-treatment sampling reflect progress toward the goals stated in the 5 year plan. Chara, sago pondweed, and slender naiad, all native species, accounted for the three most dominant species within Center Lake. Native species accounted for 100% of the aquatic vegetation collected. There were only two locations where Eurasian watermilfoil was found within the vicinity of a sampling location. There were no species found within the 10-15 foot depth zone and should be monitored within the following years so Eurasian watermilfoil doesn't establish.

As the action plan is implemented, aquatic vegetation surveys will help to monitor the effectiveness of the management strategy. The abundance distribution of Eurasian watermilfoil will be recorded using the current IDNR Tier II sampling protocol.

In years to follow, additional surveys will be conducted to monitor the Eurasian watermilfoil population and determine how native vegetative beds are reacting to treatment regimes. These surveys will provide a basis for evaluation of the management strategy and can be presented to the public should the management strategy need to be modified. They will also serve to keep the public informed about management practices at the lake so they will be motivated and educated to actively participate in conservation of the Center Lake ecosystem.



References

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APPENDIX I

DATA SHEETS, TIER II LATITUDE / LONGITUDE
AND SURVEY QUESTIONNAIRES

Aquatic Vegetation Random Sampling (Tier 2)

Waterbody Cover Sheet

Surveying Organization:

Contact Information:

Waterbody Name:

Lake ID:

County(s):

Date:

Habitat Stratum:

Avg. Lake Depth (ft):

Lake Level:

GPS Metadata

Crew

Leader:

Datum:

Zone:

Accuracy:

Recorder:

Method:

Secchi Depth (ft):

Total # of Points Surveyed:

Total # of Species:

Littoral Zone Size (acres):

Measured

Estimated

Littoral Zone Max. Depth (ft):

Measured

Estimate (historical Secchi)

Estimated (current Secchi)

Notable Conditions:

pH = 8.13	Turb. = 1.26
D.O. = 8.19	Temp. = 25.0 °C
Cond. = 509 µS	
Sp. Cond. = 516	
Sal. = 0.2	

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page of

WATERBODY NAME: <i>Cedar Lake</i>	DATE: <i>8/26/08</i>
COUNTY:	SECCHI DEPTH (FT): <i>12</i>
SITE ID:	MAX PLANT DEPTH (FT): <i>9</i>
SURVEYING ORGANIZATION: <i>V3</i>	WEATHER:
CREW LEADER: <i>Brad Mills</i>	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: <i>W. Werner</i>	

CONTACT INFO: *E. Belmont* Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.

Point #	R/T	Latitude	Longitude	Depth	Species Codes:							Notes	
					<i>Najas</i>	<i>Potamo</i>	<i>Chara</i>	<i>pot. PR</i>	<i>Nymtub</i>	<i>Verdem</i>			
<i>143</i>				<i>4</i>	<i>13</i>	<i>1</i>	<i>1</i>						
<i>144</i>				<i>14</i>									<i>no veg</i>
<i>145</i>				<i>9</i>			<i>1</i>						
<i>146</i>				<i>4</i>			<i>1</i>	<i>1</i>					
<i>147</i>				<i>8</i>			<i>3</i>		<i>1</i>				
<i>148</i>				<i>2</i>			<i>1</i>		<i>1</i>				
<i>149</i>				<i>11</i>									<i>no veg</i>
<i>150</i>				<i>8</i>			<i>1</i>						<i>no veg</i>
<i>151</i>				<i>7</i>	<i>1</i>		<i>1</i>			<i>1</i>			
<i>152</i>				<i>15</i>									<i>no veg</i>
<i>153</i>				<i>3</i>	<i>1</i>	<i>1</i>	<i>1</i>	<i>1</i>					
<i>154</i>				<i>9</i>						<i>1</i>			
<i>155</i>				<i>12</i>									<i>no veg</i>
<i>156</i>				<i>6</i>	<i>1</i>					<i>1</i>			<i>no veg - large pot det down</i>
110				<i>4</i>	<i>1</i>		<i>1</i>	<i>1</i>		<i>1</i>			
58				<i>8</i>	<i>1</i>			<i>1</i>		<i>1</i>			
159				<i>4</i>						<i>3</i>			

Other plant species observed at lake: *UTCVUL*

**Center Lake Aquatic Plant Management Plan Update-2008
Tier II Sampling, August 2008**

Tier II Sampling Location Number	Latitude	Longitude
1	41.24266	-85.85664
2	41.24273	-85.85635
3	41.24273	-85.85625
4	41.24386	-85.85402
5	41.24439	-85.85358
6	41.24449	-85.85324
7	41.24547	-85.85354
8	41.24635	-85.85381
9	41.2469	-85.85395
10	41.24747	-85.85436
11	41.24791	-85.85453
12	41.24835	-85.8544
13	41.2481	-85.85512
14	41.24858	-85.85497
15	41.24932	-85.85435
16	41.2502	-85.85427
17	41.2513	-85.85522
18	41.25021	-85.85539
19	41.24894	-85.85549
20	41.24862	-85.85601
21	41.24892	-85.85621
22	41.24966	-85.85621
23	41.25045	-85.85639
24	41.25141	-85.85747
25	41.25096	-85.85697

Tier II Sampling Location Number	Latitude	Longitude
26	41.25028	-85.85743
27	41.24961	-85.85703
28	41.25073	-85.86095
29	41.24914	-85.86019
30	41.24894	-85.85906
31	41.24882	-85.85776
32	41.24816	-85.85747
33	41.24783	-85.85846
34	41.24726	-85.85914
35	41.24684	-85.85961
36	41.24676	-85.86012
37	41.2467	-85.86052
38	41.24618	-85.86072
39	41.24602	-85.86168
40	41.24595	-85.8606
41	41.24538	-85.86086
42	41.24473	-85.86037
43	41.24442	-85.85958
44	41.24387	-85.85947
45	41.24369	-85.85912
46	41.24332	-85.85842
47	41.24304	-85.8585
48	41.24253	-85.85754
49	41.24246	-85.85799
50	41.24228	-85.85701

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes No

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

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

How do you use the lake (mark all that apply)

- | | |
|--|--|
| <input checked="" type="checkbox"/> Swimming | <input checked="" type="checkbox"/> Irrigation |
| <input checked="" type="checkbox"/> Boating | <input type="checkbox"/> Drinking water |
| <input checked="" type="checkbox"/> Fishing | <input type="checkbox"/> Other _____ |

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

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

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

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

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

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 No

Mark any of these you think are problems on your lake:

- | | |
|---|--|
| <input type="checkbox"/> Too many boats access the lake | <input type="checkbox"/> Use of jet skis on the lake |
| <input type="checkbox"/> Too much fishing | <input type="checkbox"/> Fish population problem |
| <input checked="" type="checkbox"/> Dredging needed (<i>channels</i>) | <input type="checkbox"/> Overuse by nonresidents |
| <input checked="" type="checkbox"/> Too many aquatic plants | <input type="checkbox"/> Not enough aquatic plants |
| <input type="checkbox"/> Poor water quality | <input type="checkbox"/> Pier/funneling problem |

Are you in favor of the LARE funding continuing even if the state match was reduced from 90% to 50% or even as low as a 10% contribution from the LARE program? Yes No

Please add any comments:

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes No

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

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

How do you use the lake (mark all that apply)

<input checked="" type="checkbox"/> Swimming	<input type="checkbox"/> Irrigation
<input checked="" type="checkbox"/> Boating	<input type="checkbox"/> Drinking water
<input type="checkbox"/> Fishing	<input type="checkbox"/> Other _____

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

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

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

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

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

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 No

Mark any of these you think are problems on your lake:

<input type="checkbox"/> Too many boats access the lake	<input type="checkbox"/> Use of jet skis on the lake
<input type="checkbox"/> Too much fishing	<input type="checkbox"/> Fish population problem
<input checked="" type="checkbox"/> Dredging needed	<input type="checkbox"/> Overuse by nonresidents
<input checked="" type="checkbox"/> Too many aquatic plants	<input type="checkbox"/> Not enough aquatic plants
<input type="checkbox"/> Poor water quality	<input type="checkbox"/> Pier/funneling problem

Are you in favor of the LARE funding continuing even if the state match was reduced from 90% to 50% or even as low as a 10% contribution from the LARE program? Yes No

Please add any comments:

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

*city of Warsaw - Parks
Dept. property

Are you a lake property owner? Yes No

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

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

How do you use the lake (mark all that apply)

Swimming Irrigation
 Boating Drinking water
 Fishing Other _____

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

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

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

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

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

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 No

Mark any of these you think are problems on your lake:

Too many boats access the lake Use of jet skis on the lake
 Too much fishing Fish population problem
 Dredging needed Overuse by nonresidents
 Too many aquatic plants Not enough aquatic plants
 Poor water quality Pier/funneling problem

Are you in favor of the LARE funding continuing even if the state match was reduced from 90% to 50% or even as low as a 10% contribution from the LARE program? Yes No

Please add any comments:

APPENDIX II

VEGETATION CONTROL PERMIT



APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

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

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 2
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: \$5.00

Applicant's Name Charlie Wheeler		Lake Assoc. Name Center Lake Conservation Association	
Rural Route or Street 1212 Edgewater Drive		Phone Number (574) 267-2930	
City and State Warsaw, IN		ZIP Code 46580	
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) Center Lake	Nearest Town Warsaw	County Kosciusko
Does water flow into a water supply		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

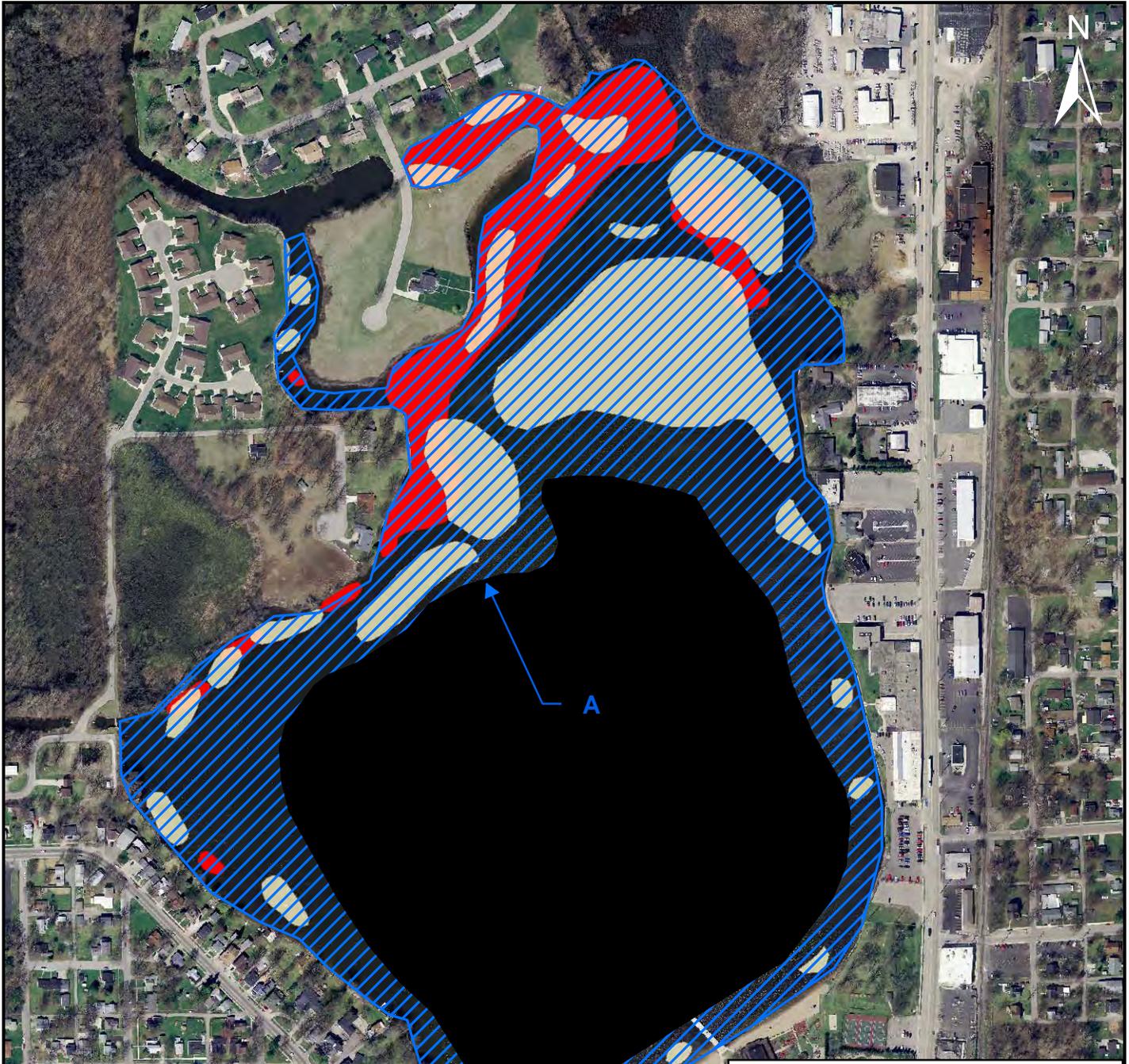
Please complete one section for EACH treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area # A (30 acres)	LAT/LONG or UTM's Lat: 41.24966 Lon: -85.85621		
Total acres to be controlled sum of 30 acres for lake	Proposed shoreline treatment length (ft) 7,171 ft	Perpendicular distance from shoreline (ft) adjacent	
Maximum Depth of Treatment (ft) 15 ft	Expected date(s) of treatment(s) 03/15/09 - 08/15/09		
Treatment method: <input checked="" type="checkbox"/> Chemical <input type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> 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. **A search and destroy area for Eurasian watermilfoil priority treatment for Center Lake in 2009 consists of 65 acres based on depths shallower than 15 feet. The 30 acres will be treated with an herbicide application of liquid 2,4-D in 2009. Search and destroy area for Eurasian watermilfoil is shown in the attached Eurasian watermilfoil priority treatment exhibit.**

Plant survey method: Rake Visual Other (specify) **Based on Tier II sampling conducted during August 2008**

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Chara		54
Sago pondweed		38
Eurasian watermilfoil	x	observed



Up to 30 acres of Eurasian watermilfoil will be treated within the search and destroy area.



Legend	
	Search and Destroy Area
	Eurasian watermilfoil 2008 Treatment
	Eurasian watermilfoil Survey 9-24-08



V3 Companies
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 Woodridge, IL 60517
 630.724.9200 phone
 630.724.9202 fax
 www.v3co.com

TITLE: Eurasian Watermilfoil Priority Treatment Area 2009
BASE LAYER: Indiana Spatial Data 2006 Orthophotography
CLIENT: Center Lake Conservation Association 1212 Edgewater Drive Warsaw, IN 46580

PROJECT AND SITE LOCATION: Center Lake Aquatic Plant Management Plan Update - 2008		
PROJECT NO. 02218.05	FIGURE: 12	SHEET: 1 OF: 1
QUADRANGLE: N/A	DATE: 10/30/08	SCALE: 1" = 500'

