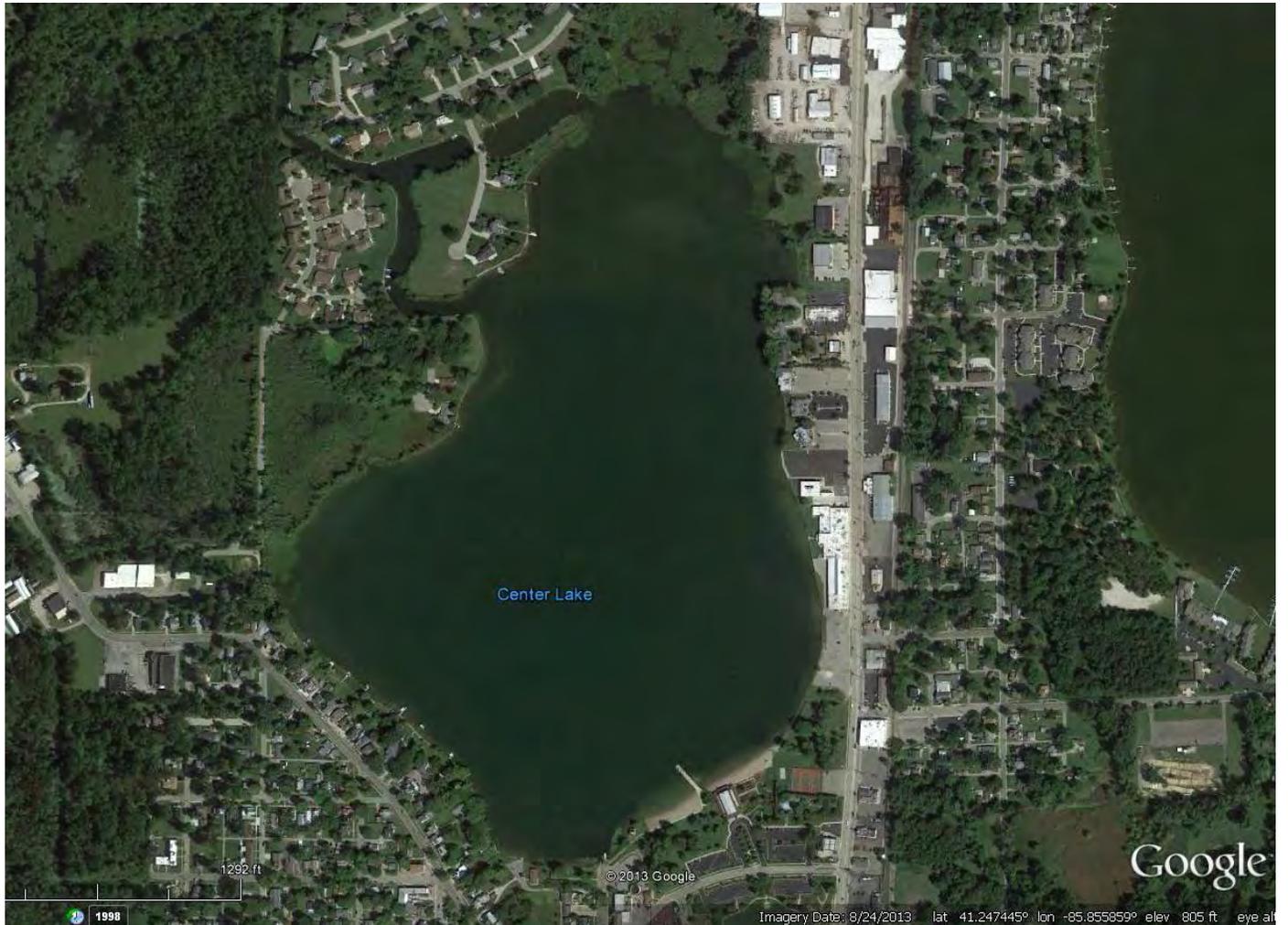


Center Lake Aquatic Vegetation Management Plan

2015 Update

Kosciusko County, Indiana



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The Center Lake Conservation Association

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Executive Summary

Center Lake is located in central Kosciusko County, within the town limits of Warsaw, Indiana. Center Lake has 120 surface acres with a maximum depth of 42 feet and an average depth of 20 feet. Eurasian watermilfoil (*Myriophyllum spicatum*) is abundant in nuisance quantities in many areas of the lake in depths less than 6 feet. The following report summarizes Eurasian watermilfoil (EWM) control practices implemented on Center Lake through the Lake and River Enhancement Program (LARE) and outlines a continued management strategy to control exotic species in Center Lake.

Center Lake has a long history of EWM infestation. The entire lake was treated with Sonar herbicide for EWM control in 1996. EWM had re-established itself in the lake by 2001 based on IDNR survey data. Another whole lake Sonar treatment was conducted in spring of 2005. In 2006, 22 acres of EWM were treated with Renovate herbicide (V3, 2008). Since 2007, a treatment strategy using DMA-4 herbicide at a rate of 2 ppm has been used to treat areas of EWM infestation on Center Lake. The DMA-4 treatments generally provide good season-long control for EWM. These treatments improve lake use and do not appear to be negatively affecting the native plant community.

Two visual surveys were conducted in spring of 2015. The first was on May 5th and the second was on May 19th. The first survey did not find much EWM present and it was decided to re-visit the lake later in spring. The May 19th survey recommended that 45.31 acres be treated for EWM control, with the understanding that EWM abundance was lower in the north end of the lake than it had been in past years.

On June 8, 2015, 45.31 acres on Center Lake were treated for Eurasian watermilfoil (EWM) control with liquid 2, 4-D at 2.0 ppm. Herbicide doses were increased in the deeper area of the north end of the lake in response to some dense re-growth in these areas in the fall of 2014. The treatment this year also took place about 12 days later than it did in 2014 which could potentially have helped to ensure more complete germination of the EWM prior to treatment. This strategy appears to have achieved effective control of EWM in 2015.

This same treatment strategy is recommended for Center Lake in 2016. Areas of EWM infestation should be treated with liquid 2, 4-D at a rate of 2.0 ppm. Assuming EWM is found in very similar locations in 2016, the same average depths used for beds in the 2015 treatment should be used. It is also recommended that the timing be very similar (around the first week of June).

While selectively treating EWM is not likely to eradicate EWM from Center Lake, it may help native plants compete with it and also provide seasonal recreational improvement in areas that are infested with EWM.

A visual survey should be sufficient in spring of 2016 to verify EWM locations with gps prior to any herbicide treatments. A summer (post treatment) tier II survey should be used to monitor both invasive and native plant populations.

Problem Statement

Eurasian watermilfoil (EWM) is impacting the use of Center Lake in many areas. The EWM forms dense mats in shallow areas, which can inhibit fishing, swimming, and boating. Dense EWM beds may also prevent the growth of beneficial native species which often provide less recreational interference and more desirable fish habitat. The north end of Center Lake is the most severely impacted location on the lake, and navigation can become difficult at times because of very dense EWM beds.

Objectives:

The following specific, quantifiable objectives have been recommended to evaluate the success of EWM management.

1. Limit the frequency of occurrence of Eurasian watermilfoil based on summer tier II sampling to 10 percent or less.
2. Maintain a minimum of 7 native species collected each year in Center Lake in the summer tier II sampling (IDNR, 2014).
3. Maintain a native plant diversity of at least 0.78 each year in summer tier II sampling (IDNR 2014).
4. Maintain a minimum of 70% coverage of native plants based on summer tier II sampling (IDNR, 2014).

Treating EWM will not eradicate it from Center Lake. However, if these objectives are met each year, the indication would be that EWM is being controlled effectively on a seasonal basis, without causing significant damage to the native plant community.

Based on the results of the post-treatment tier II survey, all of the plant management objectives were met in 2015. EWM frequency was 2.0 percent (1 site), 8 species of native plants were collected, native diversity was 0.81, and native plants were found at 84% of sample locations.

Aquatic Vegetation Management History

Table 1 summarizes the management history of EWM at Center Lake from 1996 to the present. EWM treatments have been common on Center Lake for many years.

Table 1: Center Lake EWM Management History

Year	Target species	Action	Acres	Herbicide	Rate
1996	EWM	Herbicide Treatment	Whole lake	Sonar	12 ppb
Late 90's	EWM	Mechanical Harvesting	NA	NA	NA
2000	EWM	Milfoil Weevil Stocking	Whole lake	NA	NA
2001	EWM	Milfoil Weevil Stocking	Whole lake	NA	NA
2003	EWM	Milfoil Weevil Stocking	Whole lake	NA	NA
2005*	EWM	Herbicide Treatment	Whole lake	Sonar	6.0 ppb (6 bump 6)
2006*	EWM	Herbicide Treatment	20 acres	Renovate	1.0 ppm
2007*	EWM	Herbicide Treatment	5.75 acres	DMA-4	2ppm
2008*	EWM	Herbicide Treatment	22.5 acres	DMA-4	2ppm
2009	EWM	Herbicide Treatment	30 acres	DMA-4	2ppm
2010	EWM	Herbicide Treatment	30 acres	DMA-4	2ppm
2011	EWM	Herbicide Treatment	30 acres	DMA-4	2ppm
2012	EWM	Herbicide Treatment	30 acres	DMA-4	2ppm
2013*	EWM	Herbicide Treatment	44.45 acres	DMA-4	2ppm
	EWM/natives with private funding	Herbicide Treatment	5.06 acres (channels)	Diquat (privately funded)	2 gal/surface acre
2014*	EWM	Herbicide Treatment	39.4 acres	DMA-4	2ppm
	EWM/natives with private funding	Herbicide Treatment	5.06 acres (channels)	Diquat (privately funded)	2 gal/surface acre
	EWM re-treatment	Herbicide Treatment	11.43 acres	2, 4-D	2ppm
2015*	EWM	Herbicide treatment	45.31	2, 4-D	2ppm
		Herbicide Treatment	5.06	Diquat (privately funded)	2 gal/surface acre

*LARE funded

2015 Vegetation Treatments

Two visual surveys were conducted in spring of 2015. The first was on May 5th and the second was on May 19th. The first survey did not find much EWM present, and it was decided to re-visit the lake later in spring. The May 19th survey recommended that 45.31 acres be treated for EWM control, with the understanding that EWM abundance was lower in the north end of the lake than it had been in past years.

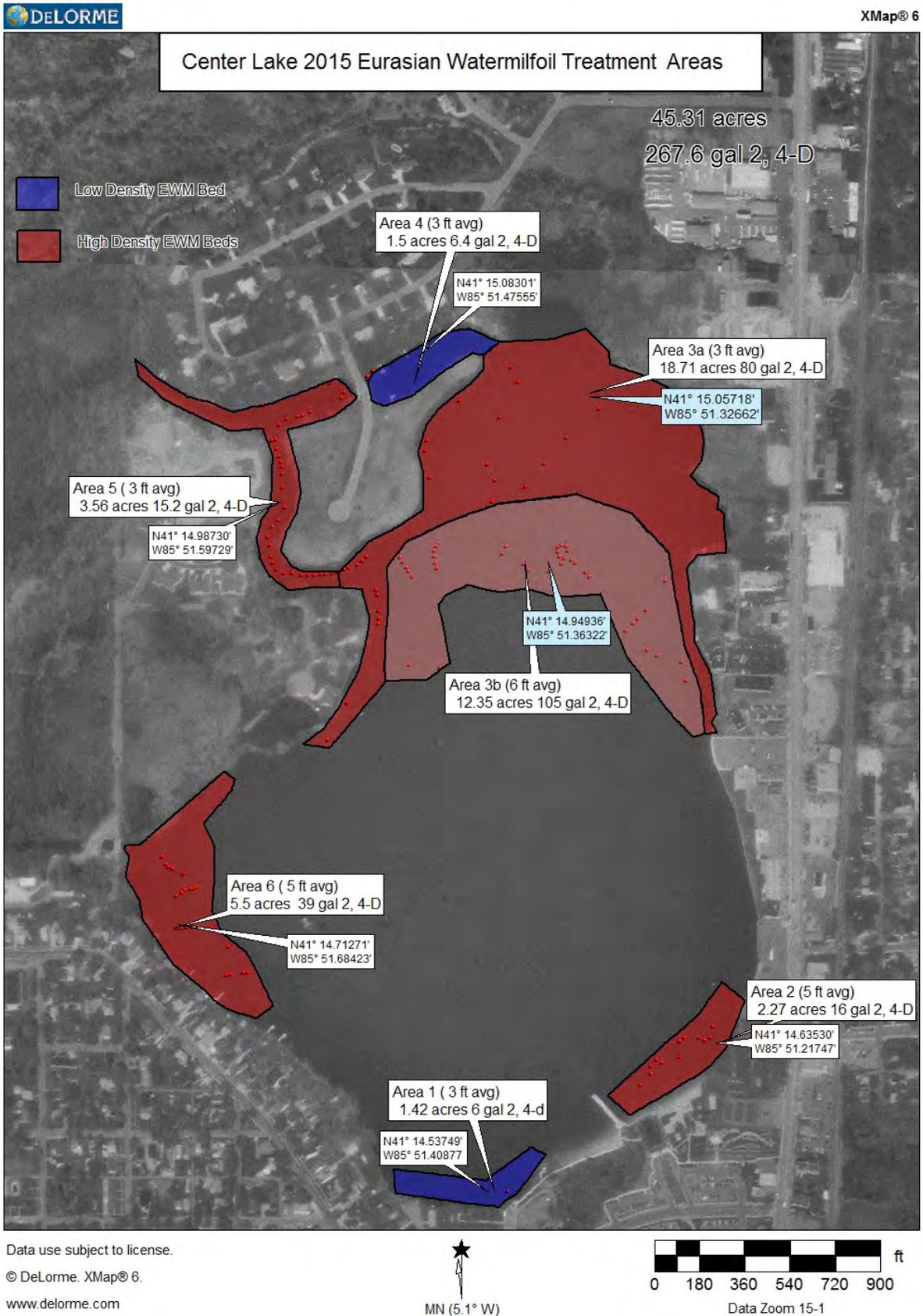
On June 8, 2015, 45.31 acres on Center Lake were treated for Eurasian watermilfoil (EWM) control with liquid 2, 4-D at 2.0 ppm. Herbicide doses were increased in the deeper area of the north end of the lake in response to some dense re-growth in these areas in the fall of 2014. The treatment this year also took place about 12 days later than it did in 2014 which could potentially have helped to ensure more complete germination of the EWM prior to treatment. This strategy appears to have achieved effective control of EWM in 2015.

Treatment information for each 2014 treatment area is found in Table 2. The areas in this table correspond to the labeled EWM areas in Figure 1.

Table 2: Center Lake 2015 LARE Treatment Details

Area	Acres	Average Depth	Herbicide	Concentration
1 LARE funded	1.42	3 ft.	DMA-4	2 ppm
2 LARE funded	2.27	5 ft.	DMA-4	2 ppm
3a LARE funded	18.71	3 ft.	DMA-4	2 ppm
3b LARE funded	12.35	6 ft.	DMA-4	2 ppm
4 LARE funded	1.5	3 ft.	DMA-4	2 ppm
5 LARE funded	3.56	3 ft.	DMA-4	2 ppm
6 LARE funded	5.5	5 ft.	DMA-4	2 ppm

Figure 1: Center Lake June 8, 2015 EWM Treatment Areas



Tier II Survey Results

The summer 2015 tier II aquatic vegetation survey on Center Lake took place on July 23, 2015. Aquatic plant sampling methods used for surveys on Center Lake are outlined in the Tier II Aquatic Vegetation Survey Protocol (IDNR 2014). Previous sampling locations established by the IDNR were used to help provide consistency in data. The sample sites used in 2013 through 2015 will continue to be used in future years to maintain consistency. Common and scientific names for aquatic plants are consistent with those listed in the original AVMP and are listed in the appendix to this report. Fifty sample sites are spaced throughout Center Lake. These sites are described in Figure 2.

Figure 2: Center Lake Tier II Sample Locations



Exotic Species

Eurasian watermilfoil, curly-leaf pondweed (CLP), and brittle naiad are the three exotic species known to be present in Center Lake. Brittle Naiad was not collected in 2015, While Eurasian watermilfoil and CLP were both collected in the tier II survey.

Eurasian Watermilfoil Abundance

In the summer 2015 tier II survey, Eurasian watermilfoil was found at only 1 of the 50 sample locations for a site frequency of 2.0 percent. This is more than likely due to the 2015 LARE funded herbicide treatments. Prior to the treatments, EWM was observed in varying abundance in 45.31 acres of the Lake. Total EWM distribution can be seen in Figure 1 while the site where EWM was collected in the tier II survey is shown in Figure 3.

Figure 3: Center Lake Summer 2015 Tier II EWM Locations



Curly-Leaf Pondweed

Curly-leaf pondweed (CLP) was collected at one sample location in the July 23, 2015 tier II survey for a site frequency of 2.0 percent. CLP is common in the spring on Center Lake as evidenced by its site frequency of 20.0 percent in spring of 2012. Curly-leaf pondweed dies out naturally as water temperatures rise in summer so it is generally not abundant in July and August. The sample location where CLP was collected on July 23, 2015 is described in Figure 4.

Figure 4: Center Lake 2015 Curly-leaf Pondweed Locations



Tier II Survey Data

Results from the July 23, 2015 tier II survey on Center Lake are summarized in Table 3. Site frequency, dominance, diversity, and other metrics are shown for the entire survey (overall) and also for each 5 foot depth contour where plants were present. In this survey, plants were found to a maximum depth of 13 feet.

Table 3: Center Lake Summer 2015 Tier II Data Analysis

Occurrence and Abundance of Submersed Aquatic Plants in Center Lake							
County: Kosciusko		Secchi (ft): 4.9	Mean species/site: 1.56				
Date: 7/23/2015		Sites with plants: 42	SE Mean species/site: 0.16				
Littoral Depth (ft): 13.0		Sites with native plants: 42	Mean native species/site: 1.52				
Littoral Sites: 47		Number of species: 10	SE Mean natives/site: 0.16				
Total Sites: 50		Number of native species: 8	Species diversity: 0.82				
		Maximum species/site: 5	Native species diversity: 0.81				
All Depths		Frequency of Occurrence	Rake score frequency per species				Plant Dominance
Species			0	1	3	5	
Coontail		50.0	50.0	16.0	28.0	6.0	26.0
Large-leaved pondweed		30.0	70.0	10.0	2.0	18.0	21.2
Sago pondweed		20.0	80.0	8.0	12.0	0.0	8.8
Slender naiad		16.0	84.0	12.0	4.0	0.0	4.8
Chara		12.0	88.0	2.0	4.0	6.0	8.8
Illinois pondweed		12.0	88.0	10.0	2.0	0.0	3.2
Small pondweed		10.0	90.0	4.0	4.0	2.0	5.2
Curly-leaf pondweed		2.0	98.0	2.0	0.0	0.0	0.4
Eurasian watermilfoil		2.0	98.0	2.0	0.0	0.0	0.4
Water stargrass		2.0	98.0	0.0	2.0	0.0	1.2
Filamentous Algae		0.0					
Occurrence and Abundance of Submersed Aquatic Plants in Center Lake							
County: Kosciusko		Secchi (ft): 4.9	Mean species/site: 1.48				
Date: 7/23/2015		Sites with plants: 20	SE Mean species/site: 0.20				
Littoral Depth (ft): 13.0		Sites with native plants: 20	Mean native species/site: 1.48				
Littoral Sites: 23		Number of species: 8	SE Mean natives/site: 0.20				
Total Sites: 23		Number of native species: 8	Species diversity: 0.80				
		Maximum species/site: 4	Native species diversity: 0.80				
Depths: 0 to 5 ft		Frequency of Occurrence	Rake score frequency per species				Plant Dominance
Species			0	1	3	5	
Large-leaved pondweed		47.8	52.2	17.4	4.3	26.1	32.2
Coontail		30.4	69.6	17.4	13.0	0.0	11.3
Chara		26.1	73.9	4.3	8.7	13.0	19.1
Slender naiad		17.4	82.6	13.0	4.3	0.0	5.2
Illinois pondweed		8.7	91.3	8.7	0.0	0.0	1.7
Sago pondweed		8.7	91.3	0.0	8.7	0.0	5.2
Small pondweed		4.3	95.7	4.3	0.0	0.0	0.9
Water stargrass		4.3	95.7	0.0	4.3	0.0	2.6
Occurrence and Abundance of Submersed Aquatic Plants in Center Lake							
County: Kosciusko		Secchi (ft): 4.9	Mean species/site: 2.18				
Date: 7/23/2015		Sites with plants: 17	SE Mean species/site: 0.27				
Littoral Depth (ft): 13.0		Sites with native plants: 17	Mean native species/site: 2.06				
Littoral Sites: 17		Number of species: 8	SE Mean natives/site: 0.28				
Total Sites: 17		Number of native species: 6	Species diversity: 0.79				
		Maximum species/site: 5	Native species diversity: 0.77				
Depths: 5 to 10 ft		Frequency of Occurrence	Rake score frequency per species				Plant Dominance
Species			0	1	3	5	
Coontail		76.5	23.5	17.6	47.1	11.8	43.5
Sago pondweed		47.1	52.9	23.5	23.5	0.0	18.8
Illinois pondweed		23.5	76.5	17.6	5.9	0.0	7.1
Large-leaved pondweed		23.5	76.5	5.9	0.0	17.6	18.8
Slender naiad		17.6	82.4	11.8	5.9	0.0	5.9
Small pondweed		17.6	82.4	5.9	5.9	5.9	10.6
Curly-leaf pondweed		5.9	94.1	5.9	0.0	0.0	1.2
Eurasian watermilfoil		5.9	94.1	5.9	0.0	0.0	1.2
Occurrence and Abundance of Submersed Aquatic Plants in Center Lake							
County: Kosciusko		Secchi (ft): 4.9	Mean species/site: 0.70				
Date: 7/23/2015		Sites with plants: 5	SE Mean species/site: 0.30				
Littoral Depth (ft): 13.0		Sites with native plants: 5	Mean native species/site: 0.70				
Littoral Sites: 7		Number of species: 3	SE Mean natives/site: 0.30				
Total Sites: 10		Number of native species: 3	Species diversity: 0.45				
		Maximum species/site: 3	Native species diversity: 0.45				
Depths: 10 to 15 ft		Frequency of Occurrence	Rake score frequency per species				Plant Dominance
Species			0	1	3	5	
Coontail		50.0	50.0	10.0	30.0	10.0	30.0
Slender naiad		10.0	90.0	10.0	0.0	0.0	2.0
Small pondweed		10.0	90.0	0.0	10.0	0.0	6.0

Tier II data for all surveys conducted on Center Lake during its involvement in the LARE program is included in Table 4. This summarization helps to track plant trends from year to year.

Table 4: Center Lake Multi-Year Data Presentation

Center Lake Multi-Year Data Presentation										
Date:	8/24/2004	5/11/2005	5/23/2012	8/2/2005	7/31/2006	7/25/2007	8/26/2008	8/7/2013	7/25/2014	7/23/2015
Total Sites:	41	60	50	60	60	50	50	50	50	50
Secchi (ft):	NR	5.0	NA	5.0	5.0	4.0	12.0	9.0	10.1	4.9
Number of Species:	9	7	8	10	15	6	6	10	10	10
Number of Native Species:	7	6	6	8	13	5	6	8	7	8
Sites with Plants	30	55	48	51	37	21	36	37	45	42
Sites with Native Plants	NA	35	46	50	37	21	36	37	43	42
Maximum Plant Depth	14.0	13.0	15.0	9.5	8.0	7.0	9.0	15.0	15.0	13.0
Species Diversity:	NA	NA	0.82	NA	0.98	NA	0.98	0.82	0.82	0.82
Native Species Diversity:	NA	NA	0.74	NA	0.98	NA	0.98	0.81	0.78	0.81
Mean Native Species/Site:	NA	NA	1.64	NA	1.22	NA	1.70	1.28	1.5	1.52
Surveying organization	Weed Patrol	IDNR	IDNR	IDNR	V3	V3	V3	AWC	AWC	AWC
Species Frequency of Occurrence - All Depths										
Chara	46.0	8.0	34.0	35.0	8.0	12.0	54.0	28.0	38.0	12.0
Eurasian watermilfoil	71.0	80.0	32.0	8.0	2.0	0.0	0.0	4.0	12.0	2.0
Illinois pondweed	0.0	0.0	24.0	3.0	8.0	2.0	0.0	2.0	4.0	12.0
Sago pondweed	25.0	0.0	42.0	15.0	66.0	20.0	38.0	30.0	26.0	20.0
Eel grass	0.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coontail	36.0	38.0	60.0	20.0	2.0	20.0	20.0	32.0	46.0	50.0
Slender naiad	32.0	2.0	2.0	0.0	2.0	0.0	36.0	14.0	8.0	16.0
Variable pondweed	0.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0
Brittle naiad	0.0	0.0	0.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
American pondweed	0.0	0.0	2.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0
Richardson's pondweed	4.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0
Flat-stemmed pondweed	14.0	2.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0
Small pondweed	0.0	0.0	0.0	2.0	0.0	0.0	12.0	2.0	4.0	10.0
Bladderwort	0.0	0.0	0.0	7.0	4.0	0.0	0.0	0.0	0.0	0.0
Curly-leaf pondweed	0.0	0.0	20.0	2.0	0.0	0.0	0.0	0.0	2.0	2.0
Canadian waterweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0
Water stargrass	0.0	0.0	0.0	28.0	6.0	0.0	0.0	0.0	0.0	2.0
Large-leaved pondweed	7.0	7.0	0.0	10.0	0.0	0.0	0.0	14.0	24.0	30.0
Species Frequency of Occurrence - 0 to 5 ft										
Chara	NA	NA	56.5	NA	NA	26.0	78.3	52.2	60.9	26.1
Illinois pondweed	NA	NA	39.1	NA	NA	4.0	0.0	4.3	8.7	8.7
Eurasian watermilfoil	NA	NA	26.1	NA	NA	0.0	0.0	8.7	8.7	0.0
Sago pondweed	NA	NA	60.9	NA	NA	39.0	60.9	34.8	30.4	8.7
Slender naiad	NA	NA	0.0	NA	NA	0.0	52.2	17.4	17.4	17.4
Eel grass	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Variable pondweed	NA	NA	0.0	NA	NA	4.0	0.0	0.0	0.0	0.0
American pondweed	NA	NA	4.3	NA	NA	0.0	0.0	0.0	0.0	0.0
Flat-stemmed pondweed	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Brittle naiad	NA	NA	0.0	NA	NA	4.0	0.0	0.0	0.0	0.0
Richardson's pondweed	NA	NA	0.0	NA	NA	0.0	17.4	0.0	0.0	0.0
Starry Stonewort	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Coontail	NA	NA	43.5	NA	NA	21.0	21.7	17.4	21.7	30.4
Canadian waterweed	NA	NA	0.0	NA	NA	0.0	0.0	8.7	0.0	0.0
Curly-leaf pondweed	NA	NA	17.4	NA	NA	0.0	0.0	0.0	4.3	0.0
Small pondweed	NA	NA	0.0	NA	NA	0.0	17.4	0.0	0.0	4.3
Southern naiad	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Large-leaved pondweed	NA	NA	0.0	NA	NA	0.0	0.0	21.7	30.4	47.8
Water stargrass	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3
Species Frequency of Occurrence - 5 to 10 ft										
Chara	NA	NA	23.5	NA	NA	0.0	52.9	5.9	29.4	0.0
Eurasian watermilfoil	NA	NA	47.1	NA	NA	0.0	0.0	0.0	23.5	5.9
Sago pondweed	NA	NA	41.2	NA	NA	6.0	29.4	35.3	29.4	47.1
Eel grass	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Illinois pondweed	NA	NA	17.6	NA	NA	0.0	0.0	0.0	0.0	23.5
Coontail	NA	NA	64.7	NA	NA	30.0	29.4	52.9	76.5	76.5
Slender naiad	NA	NA	0.0	NA	NA	0.0	29.4	11.8	0.0	17.6
Richardson's pondweed	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Small pondweed	NA	NA	0.0	NA	NA	0.0	11.8	0.0	11.8	17.6
Large-leaved pondweed	NA	NA	0.0	NA	NA	0.0	0.0	5.9	23.5	23.5
Canadian waterweed	NA	NA	0.0	NA	NA	0.0	0.0	5.9	0.0	0.0
Curly-leaf pondweed	NA	NA	23.5	NA	NA	0.0	0.0	0.0	0.0	5.9
Brittle naiad	NA	NA	0.0	NA	NA	0.0	0.0	0.0	5.9	0.0

Center Lake Multi-year data presentation continued

Species Frequency of Occurrence - 10 to 15 ft										
Eurasian watermilfoil	NA	NA	20.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Chara	NA	NA	0.0	NA	NA	0.0	0.0	10.0	0.0	0.0
Coontail	NA	NA	90.0	NA	NA	0.0	0.0	30.0	50.0	50.0
Eel grass	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Sago pondweed	NA	NA	0.0	NA	NA	0.0	0.0	10.0	10.0	0.0
Brittle naiad	NA	NA	0.0	NA	NA	0.0	0.0	10.0	0.0	0.0
Illinois pondweed	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Slender naiad	NA	NA	10.0	NA	NA	0.0	0.0	10.0	0.0	10.0
Nitella	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Bladderwort	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Richardson's pondweed	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Large-leaved pondweed	NA	NA	0.0	NA	NA	0.0	0.0	10.0	10.0	0.0
American pondweed	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Flat-stemmed pondweed	NA	NA	0.0	NA	NA	0.0	0.0	0.0	0.0	0.0
Small pondweed	NA	NA	0.0	NA	NA	0.0	0.0	10.0	0.0	10.0
Curly-leaf pondweed	NA	NA	20.0	NA	NA	0.0	0.0	0.0	0.0	0.0

Water Clarity and Water Quality

Table 5 summarizes the Secchi readings taken in each tier II survey on Center Lake since 2005. Water clarity can fluctuate greatly based on weather, rain events, and algal blooms. After several years of increased Secchi readings in the summer tier II surveys, Secchi depth had dropped to the 2005-2006 levels in 2015.

Table 5: Center Lake Secchi History

Date	5/11/05	8/2/05	7/31/06	7/25/07	8/26/08	8/7/13	7/25/14	7/23/15
Secchi Depth (ft.)	5.0	5.0	5.0	4.0	12.0	9.0	10.1	4.9

During the summer 2015 tier II survey, Aquatic Weed Control collected data to construct dissolved oxygen and temperature profiles for Center Lake. These profiles are described in Figure 5 and Figure 6. At the time of the tier II survey, Center Lake had adequate oxygen to support fish down to about 14 feet. This is down when compared to about 20 feet in 2014.

Temperature or thermal stratification was present at the time of the survey, with a thermocline starting at a depth of 9 to 10 feet. Surface temperature on the survey date was 82.0 degrees. The water temperature dropped to 50.5 at a depth of 30 feet.

Figure 5: Center Lake 2015 Dissolved Oxygen Profile

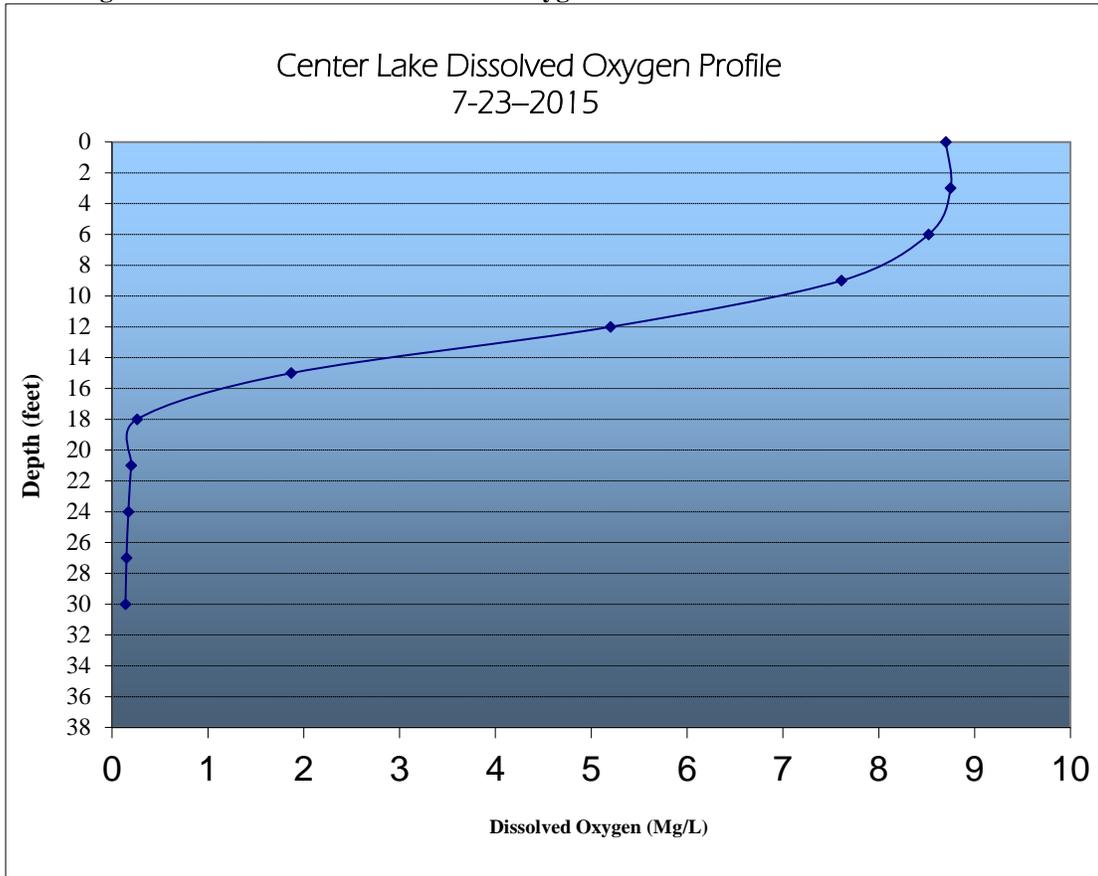
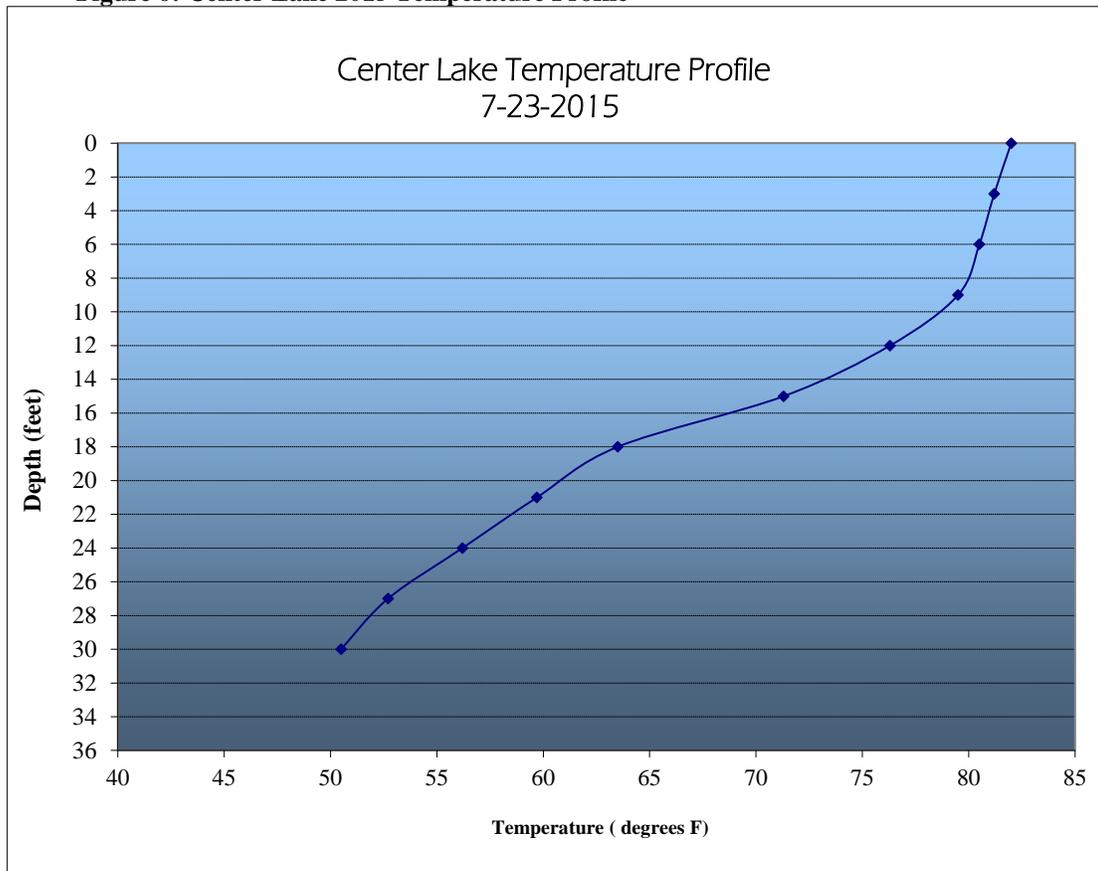


Figure 6: Center Lake 2015 Temperature Profile



Tier II Discussion

The plant community of Center Lake appears stable, with 8 native plant species found in the 2015 tier II survey with a native diversity of 0.81. There were 2 exotic plant species found in Center Lake in 2015. These species were Eurasian watermilfoil and curly-leaf pondweed. Only Eurasian watermilfoil (EWM) seems to be causing lake use problems in Center Lake.

Summer EWM frequency in Center Lake after treatment has historically been low. In the 2015 post-treatment survey, EWM frequency was just 2.0 percent (1 site). It would appear that the EWM control strategy in 2015 was effective in significantly reducing EWM abundance.

The native plant data collected in 2015 met each of the target objectives outlined in the objectives section of this report. While these objectives may not be the only measure of plant management success, it seems a good indication that the current management strategy is on target. This strategy should provide increased utility of the lake by reducing EWM abundance, while maintaining a healthy native plant community.

Action Plan

All areas of EWM infestation in Center Lake, including channels, should be treated with liquid DMA-4 herbicide at a rate of 2 parts per million. Total main lake EWM acreage on Center Lake is estimated to be approximately 40 acres, and it is recommended that funding be set aside to treat up to 45 acres.

A few adjustments have been made to the treatment protocol in order to reduce the opportunity for EWM re-growth after the initial EWM treatments each year. This was in response to above average EWM re-growth following treatments in 2014. The average depths in some treatment areas have been increased. This results in a slightly higher herbicide rate that should reduce the risk of herbicide dilution. Also, the large treatment area at the north end of the lake has been divided into two sections based on depth. This should also adjust herbicide rates to prevent any dilution. The higher herbicide rates will still be within acceptable labeled rates for 2, 4-D and are not likely to pose any additional negative impacts on the native plant community. Aquatic Weed Control also recommends that the EWM treatments take place around the first week of June to reduce the chance for any late germination after treatment.

This treatment strategy appears to have controlled EWM adequately in 2015 without causing any damage to the native plant community and it is recommended that this same strategy be used in 2016.

Surveys and Planning

A visual survey should be sufficient in spring of 2016 to verify EWM locations prior to any herbicide treatments. A summer (post-treatment) tier II survey should be used to monitor both EWM and native plant populations.

2016 Budget

Treat up to 45 acres of EWM with liquid 2, 4-D at 2 ppm (up to 6 ft avg depth)	\$ 15,750
Spring visual survey, summer Tier II survey and plan update	\$ 5,000
Total cost estimate	\$ 20,750
LARE share (80%-subject to availability)	\$ 16,600
Associations share (20%)	\$ 4,150

Public Involvement

Parties interested in the improvement of Center Lake include members of the Center Lake Conservation Association as well as others who access the lake at the IDNR owned access site or the City Park at the south end of the lake. The most common and often most effective methods for keeping the public informed about aquatic vegetation management practices are lake association meetings as well as periodical newsletters sent out by the association. It is recommended that association members encourage neighbors and other lake users to attend lake association meetings so that interested parties are well informed about the LARE program. Making sure that meetings are well advertised and planned well in advance of the meeting dates are ways to help ensure good attendance. Carry-in dinners, door prizes, contests, guest speakers, and discussion panels are all excellent ways to boost attendance, encourage involvement, and keep association members informed about lake management activities.

The Center Lake Conservation Association held a public meeting on September 29, 2015 to discuss issues related to the LARE program. Jim Donahoe of Aquatic Weed Control attended this meeting to summarize LARE activities on the lake. There are relatively few homes on Center Lake and attendance was low with only 2 people in attendance. The responses to the public survey are summarized in Figure 7. Residents were very much in favor of continuing EWM control and also expressed concerns about the flow of water coming over the outlet dam of Center Lake.

Figure 7: Center Lake 2015 Public Questionnaire

Lake Use Survey Lake name Center Lake

Are you a lake property owner? Yes 2 No

Are you currently a member of your lake association? Yes 2 No

How many years have you been at the lake? 2 or less 0
 2 – 5 years 1
 5-10 years 0
 Over 10 years 1

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

1 Swimming 1 Irrigation
1 Boating Drinking water
1 Fishing 1 Other

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 1 No 1

Do you currently participate in a weed control project on the lake? Yes 2 No 0

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 0 No 2

Does the level of vegetation in the lake affect your property values? Yes 2 No 0

Are you in favor of continuing efforts to control vegetation on the lake? Yes 2 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 2 No 0

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
- 1 Dredging needed
- Overuse by nonresidents
- Too many aquatic plants
- Not enough aquatic plants
- 1 Poor water quality
- Pier/funneling problem

Please add any comments:

Homeowners north of dam want dam open and water flow. One neighbor is putting home up for sale and river flow would help sale.

References Cited

V3 Companies LTD 2008. Aquatic Plant Management Plan Update 2007- Center Lake, Kosciusko County IN. V3 Companies 7325 Janes Avenue, Woodbridge IL 60517.

IDNR, 2014. Tier II Aquatic Vegetation Survey Protocol. IN Department of Natural Resources. Indianapolis, Indiana.

Appendix

Common and scientific plant names found in this report

Common Name	Scientific Name
American pondweed	<i>Potamogeton nodosus</i>
Bladderwort	<i>Utricularia sp.</i>
Brittle naiad	<i>Najas minor</i>
Chara	<i>Chara sp.</i>
Coontail	<i>Ceratophyllum demersum</i>
Curly-leaf pondweed	<i>Potamogeton crispus</i>
Eelgrass	<i>Vallisneria americana</i>
Canadian waterweed	<i>Elodea canadensis</i>
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>
Flat -stemmed pondweed	<i>Potamogeton zosteriformis</i>
Illinois pondweed	<i>Potamogeton illinoensis</i>
Large-leaved pondweed	<i>Potamogeton amplifolius</i>
Richardson's pondweed	<i>Potamogeton richardsonii</i>
Sago pondweed	<i>Potamogeton pectinatus</i>
Slender naiad	<i>Najas flexilis</i>
Small pondweed	<i>Potamogeton pusillus</i>
Variable pondweed	<i>Potamogeton gramineus</i>
Water stargrass	<i>Heteranthera dubia</i>

Data Sheet and GPS Coordinates

Center Lake 7/23/15
Sec depth: 4.9 ft

Center Lake		ALL	Blinoth	Sago	Coontail	Chara	EWM	Naiad	Longleaf	Slender	CLP	Sage W	W. Star
41.24227	-85.63700	4		3	3				5	1			
41.24274	-85.63828	9			3								
41.24363	-85.63921	3			1				1				
41.24405	-85.63945	13			1				1				
41.24440	-85.64032	5											
41.24512	-85.64049	13											
41.24522	-85.64077	10			1								
41.24555	-85.64132	6		1	3	1	5						
41.24590	-85.64159	4.5											
41.24620	-85.64309	6			3								
41.24637	-85.64324	15											
41.24697	-85.65959	3		1		3							
41.24719	-85.65914	6			1				5				
41.24756	-85.65875	12											
41.24766	-85.65873	4							5	1			
41.24830	-85.65926	6.5							5				
41.24855	-85.65922	4.6			3				1				
41.24879	-85.65784	9.5											
41.24904	-85.65663	12			3								
41.24933	-85.65627	9			3								
41.24935	-85.65751	5							1		3		
41.24998	-85.65750	4											
41.24979	-85.65655	4											
41.25035	-85.65614	4			1								
41.25135	-85.65606	3											
41.25202	-85.65461	3.5											
41.25200	-85.65508	4.5											
41.24967	-85.65432	4			1				5				
41.24940	-85.65439	5.5			1								
41.24970	-85.65567	13			3								
41.24847	-85.65509	9			1								
41.24890	-85.65434	6		1					5				
41.24858	-85.65448	6.4					1						
41.24736	-85.65468	11.5			5				1		3		
41.24781	-85.65390	3.5			3				1	1			
41.24697	-85.65396	6		3	1	3			5		1		
41.24641	-85.65340	3											
41.24668	-85.65327	38											
41.24671	-85.65344	8											
41.24512	-85.65321	4.5								3			3
41.24477	-85.65341	11											
41.24451	-85.65360	8											
41.24584	-85.65389	4.5							5				
41.24580	-85.65420	6			3						1		
41.24532	-85.65507	6		1	3	3			5				
41.24277	-85.65612	2											
41.24281	-85.65639	14											
41.24202	-85.65555	6		1		3					5		
41.24412	-85.64091	3											
41.24804	-85.63393	4.5							5				

SWR	Temp 8:00	8:20
1	81.2	81.75
2	80.5	81.56
3	79.5	79.61
4	76.3	75.20
5	71.3	71.87
6	63.5	62.26
7	59.7	60.20
8	56.2	56.17
9	52.7	51.15
10	50.5	50.14

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Center Lake LARE Permit



APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R5 / 9-13)
Approved by State Board of Accounts, 2013

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
ATTN: COMMERCIAL LICENSE CLERK
402 W. Washington Street, Rm W273
Indianapolis, IN 46204
Telephone Number: (317) 232-4102
Fax Number: (317) 232-8150

Check type of permit:

Whole Lake Multiple Treatment Areas

FEE \$5.00

- INSTRUCTIONS:**
1. Please print or type information.
 2. Applicant must sign the application and is the only signature required. If applicant is also the certified chemical applicator that will be performing the treatment(s), he/she will also sign as the Certified Applicator.

Applicant Name		Lake Association Name Center Lake Conservation Association	
Street or Rural Route			Telephone Number
City and State			ZIP Code
Certified Applicator Name		Company or Corporation Name Aquatic Weed Control	Certification Number
Street or Rural Route			Telephone Number
City and State			ZIP Code
Water Body Name (One application per water body) Center Lake		Nearest Town Warsaw	County Kosciusko County
Is the body of water a water supply or does it 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 number: 1	Latitude / Longitude or Universal Transverse Mercator (UTM): on map	Total acres to be controlled: 1.42	Proposed shoreline treatment length (ft): 597	Perpendicular distance from shoreline (ft): 150	
Maximum depth of treatment (ft): 6	Expected date(s) of treatment(s): early June	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 to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. <u>2, 4-D</u>					
Plant survey method: <input type="checkbox"/> Rake <input checked="" type="checkbox"/> Visual <input type="checkbox"/> Other (specify) _____					
Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
Eurasian watermilfoil	<input checked="" type="checkbox"/>	30		<input type="checkbox"/>	
Chara	<input type="checkbox"/>	30		<input type="checkbox"/>	
Sago Pondweed	<input type="checkbox"/>	20		<input type="checkbox"/>	
Coontail	<input type="checkbox"/>	20		<input type="checkbox"/>	
	<input type="checkbox"/>			<input type="checkbox"/>	
	<input type="checkbox"/>			<input type="checkbox"/>	
	<input type="checkbox"/>			<input type="checkbox"/>	
	<input type="checkbox"/>			<input type="checkbox"/>	
	<input type="checkbox"/>			<input type="checkbox"/>	
	<input type="checkbox"/>			<input type="checkbox"/>	



Treatment area number: 4	Latitude / Longitude or Universal Transverse Mercator (UTM): on map	Total acres to be controlled: 1.5	Proposed shoreline treatment length (ft): channel	Perpendicular distance from shoreline (ft): channel
-----------------------------	------------------------------------------------------------------------	--------------------------------------	------------------------------------------------------	--------------------------------------------------------

Maximum depth of treatment (ft): 6	Expected date(s) of treatment(s): early june	Treatment method: <input checked="" type="checkbox"/> Chemical <input type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical
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Based on treatment method, describe chemical to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. 2,4-D

Plant survey method: Rake Visual Other (specify) _____

Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
Eurasian watermilfoil	<input checked="" type="checkbox"/>	30		<input type="checkbox"/>	
Chara	<input checked="" type="checkbox"/>	30		<input type="checkbox"/>	
Sago Pondweed	<input checked="" type="checkbox"/>	20		<input type="checkbox"/>	
Coontail	<input checked="" type="checkbox"/>	20		<input type="checkbox"/>	
	<input type="checkbox"/>			<input type="checkbox"/>	

Treatment area number: 5	Latitude / Longitude or Universal Transverse Mercator (UTM): on map	Total acres to be controlled: 3.56	Proposed shoreline treatment length (ft): channel	Perpendicular distance from shoreline (ft): channel
-----------------------------	------------------------------------------------------------------------	---------------------------------------	------------------------------------------------------	--------------------------------------------------------

Maximum depth of treatment (ft): 6	Expected date(s) of treatment(s): early june	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 to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. 2,4-D

Plant survey method: Rake Visual Other (specify) _____

Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
Eurasian watermilfoil	<input checked="" type="checkbox"/>	30		<input type="checkbox"/>	
Chara	<input checked="" type="checkbox"/>	30		<input type="checkbox"/>	
Sago Pondweed	<input checked="" type="checkbox"/>	20		<input type="checkbox"/>	
Coontail	<input checked="" type="checkbox"/>	20		<input type="checkbox"/>	
	<input type="checkbox"/>			<input type="checkbox"/>	

Treatment area number: 6	Latitude / Longitude or Universal Transverse Mercator (UTM): on map	Total acres to be controlled: 5.5	Proposed shoreline treatment length (ft): 1509	Perpendicular distance from shoreline (ft): 336
-----------------------------	------------------------------------------------------------------------	--------------------------------------	---------------------------------------------------	----------------------------------------------------

Maximum depth of treatment (ft): 6	Expected date(s) of treatment(s): early june	Treatment method: <input checked="" type="checkbox"/> Chemical <input type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical
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Based on treatment method, describe chemical to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. 2,4-D

Plant survey method: Rake Visual Other (specify) _____

Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
Eurasian watermilfoil	<input checked="" type="checkbox"/>	30		<input type="checkbox"/>	
Chara	<input checked="" type="checkbox"/>	30		<input type="checkbox"/>	
Sago Pondweed	<input checked="" type="checkbox"/>	20		<input type="checkbox"/>	
Coontail	<input checked="" type="checkbox"/>	20		<input type="checkbox"/>	
	<input type="checkbox"/>			<input type="checkbox"/>	

Center Lake 2016 Permit Map

The red and blue areas marked on this map are recommended for treatment in 2016 pending a spring visual survey to verify EWM abundance. A map will be submitted to the IDNR for approval prior to any treatment.

