



*Aquatic Enhancement  
& Survey, Inc.*



## **Aquatic Vegetation Management Plan Update 2009**

### **Meserve Lake, Steuben County**

Prepared for Life of Riley Home Estates  
By  
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## Executive Summary

Meserve Lake is a glacial “kettle” lake of approximately 18.4 acres located in Steuben County, Indiana. It has an average depth of 13 feet and maximum depth of 22 feet. Meserve Lake is “oligotrophic” generally having good water quality and clarity. The lake is lightly developed having only four lakeside residences. Many residents of a nearby off-lake neighborhood, the Life of Riley subdivision, use the lake and belong to the Life of Riley Home Estates (LRHE) which acts as the primary advocate organization for the lake. The LRHE maintains a common area property on the shoreline with a covered pavilion and gravel boat ramp.

Since about 2006 residents and users of the lake have noted the growth of a new aquatic plant. In 2008 these plants were brought to the attention of the Indiana Department of Natural Resources (IDNR) fisheries section personnel. Samples of the plant were identified as parrot feather (*Myriophyllum aquaticum*). Parrot feather is a type of milfoil native to South America. It has occasionally been introduced into the wild by aquarium or garden pond owners who do not realize the potential for damage it presents. This plant has been noted in some ponds and small impoundments in Indiana, but this stands as its first known occurrence in an Indiana natural lake. Parrot feather is known to become invasive in waters outside its native range, causing extensive problems in drainage ditches and small lakes. It is possible that this plant could, if allowed to grow and spread unchecked, cause recreational and ecological impairment to Meserve Lake and other Indiana water bodies.

Because of this possibility, a treatment regime and the development of an aquatic plant management plan was undertaken with funding provided through the IDNR Lake and River Enhancement (LARE) program in 2008. Treated areas containing parrot feather plants in the 2008 season included 2.7 acres in the deeper offshore waters of the lake, the inlet and outlet streams connected to the lake, and the entire perimeter of the lake. A management plan developed in 2008 established the following overall goals for the management of parrot feather and other invasive aquatic plants at Meserve Lake:

1. Maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species and good water quality.
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant, fish, and wildlife resources.

Recommended management activities at Meserve Lake in 2008 and 2009 have been geared toward the attainment of these goals with the objective of ultimately eradicating parrot feather and minimizing the possible escape of live plants or plant fragments downstream into other parts of the Pigeon Creek watershed. With this in mind, for the 2009 season and beyond management activities at Meserve Lake have sought to attain the following objectives:

1. Maintain zero occurrences of live parrot feather plants in the 2009 late season IDNR protocol Tier II survey.
2. Generate a significant awareness among Steuben County lake residents and the majority of Meserve Lake users that this plant is potentially invasive and measures should be taken to prevent its spread.

To achieve objective number one a regime of chemical treatment took place in 2009. A visit to the lake early in the 2009 growing season revealed the presence of stems of deepwater parrot feather plants lying on the bottom of the lake. These were apparently the remnants of plants

treated during the 2008 season. Small growth sprouting on these stems suggested these plants were still alive and slowly growing. No parrot feather growth was noted in the shallower areas of the lake or the inlet or outlet channels. On May 26 a Tier II aquatic plant survey was performed. A single parrot feather stem was recovered at one of 60 survey points (1.7%). That same day the entire littoral zone beyond 25 feet from shore (11.5 acres) was treated with Navigate<sup>®</sup> granular 2, 4-D herbicide at the rate of 200 pounds per acre. This treatment also included application to the inlet and outlet streams of Meserve Lake where parrot feather was present in 2008. The north shoreline within 25 feet of the shore was treated with DMA<sup>®</sup>4 IVM (2,4-D) liquid herbicide at the maximum label rate of 2.84 gallons per acre-ft. This treatment also included Cygnet Plus<sup>®</sup> non-ionic surfactant applied at the maximum label rate of two gallons per surface acre. The southern perimeter of the lake in a strip extending to 25 feet from shore was treated with Renovate<sup>®</sup> 3 (triclopyr) liquid herbicide at a concentration of .82 parts per million (.74 gallons per surface acre).

On July 20, rake drags and a visual check of the lake indicated that no parrot feather plants or plant stems remained in the main body of the lake. A few emergent parrot feather plants were found growing where a small spring fed stream enters the northeast part of the lake. A check of the lake was made by snorkeling and no other parrot feather plants or plant stems were found. On August 3<sup>rd</sup> a Tier II plant survey was performed. No parrot feather plants were collected during the survey, but a few more plants were spotted growing near a small spring in a marshy area connected to the lake. All noted plants were treated with DMA 4 IVM liquid 2, 4-D using a backpack sprayer on August 5.

In September, emergent parrot feather plants were noted to be present in the two treated areas along with an emergent colony growing in the inlet stream and two emergent plants in the outlet stream. These plants and others discovered along the southwest shoreline of the lake were spot treated repeatedly through November with a combination of Navigate 2,4-D granular and Renovate<sup>®</sup> 3 (triclopyr). In November a complete treatment of the lakes perimeter within 25 feet of shore was also completed using DMA<sup>®</sup> 4 IVM liquid 2,4-D at the rate of 2.84 gallons per acre-foot and Cygnet Plus non-ionic surfactant at the rate of two gallons per surface acre. All plants had been controlled by the end of November.

For 2010 a regime incorporating a combination of hand removal of free floating plants and herbicide applications is proposed as the best way to proceed toward the goals of this plan. A control regime is proposed utilizing three main management elements as follows:

1. Monthly hand removal of free floating plants.
2. At least one herbicide application per month to the entire perimeter of the lake and both the inlet and outlet streams should be performed. To provide good control in conditions of water movement all inlet and outlet treatments should be performed with Navigate 2,4-D at the rate of 200 pounds per acre. To comply with label limitations and provide a variety of control strategies perimeter treatments should rotate between the use of Navigate 2,4-D applied at 200 pounds per acre, DMA 4 IVM liquid 2,4-D applied at the rate of 2.84 gallons per acre-foot, and Renovate 3 liquid (triclopyr) at the rate of .82 parts per million (.74 gallons per acre).
3. Navigate 2,4-D granular herbicide should be applied at the rate of 200 pounds per acre to the entire littoral zone of the lake including the perimeter and inlet/outlet streams in June of 2010. If any plants are noted growing in deep water or beyond 25 feet from shore later in the season this treatment should be repeated. These treatments will substitute for the monthly perimeter and inlet/outlet treatment in the month they are performed.

Drawbacks associated with this aggressive regime include water-use restrictions imposed and possible impacts on non-target plant and animal species. Efforts to monitor the lakes plant community by performing two tier II surveys should continue. Efforts to educate area residents about the potential spread of invasive aquatic plants and animals should also be continued including the planning of at least one public meeting in 2010. The total cost estimate for all monitoring, educational, and treatment activities proposed for the 2010 season is \$40,123.00.

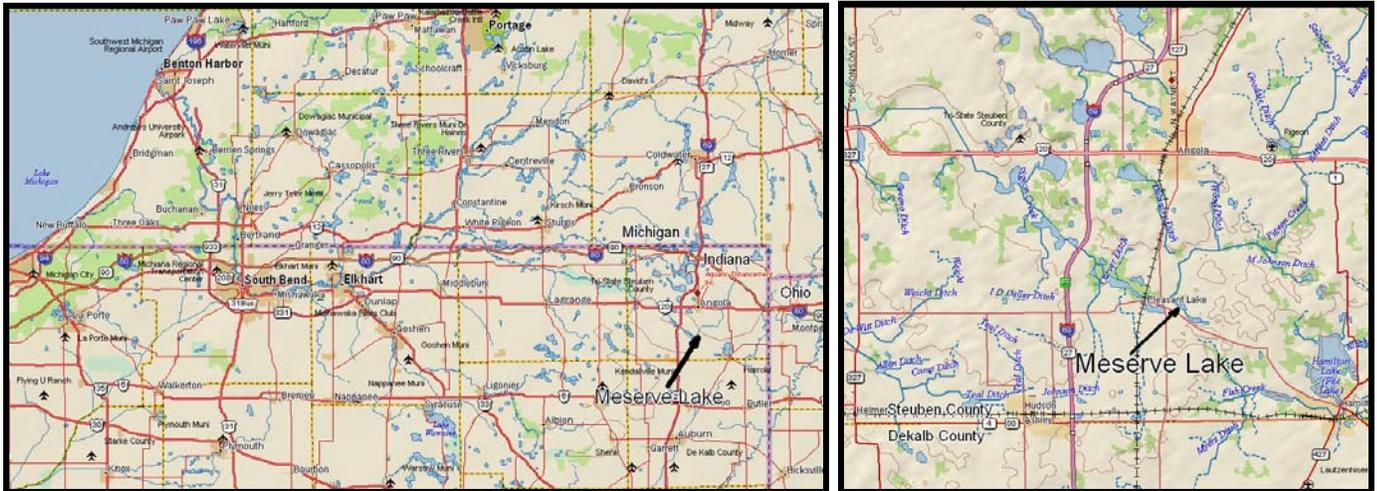


Figure 1. Scale maps showing general location of Meserve Lake, Scale: 1, 900,000 (left) and 1 175,000 (right).

## 1. Problem Statement

The potential exists for parrot feather plants growing in Meserve Lake to become a new aquatic problem species that can cause extensive damage to the recreational, aesthetic, and ecological integrity of Indiana’s lakes. Invasive aquatic plants like parrot feather have demonstrated the ability to out-complete more beneficial native plant species radically altering fish and wildlife habitat, affecting plant community diversity and the growth rates of certain species of sport fish. In drainage canals thick growths of invasive aquatic plants like parrot feather can also hinder flow rates causing irrigation or drainage problems in agriculturally productive or developed areas. This is the first known discovery of this plant in a public lake in Indiana. Meserve Lake, the site of the first known occurrence of this potentially invasive plant in an Indiana public lake, discharges through a tributary stream to Pigeon Creek. Because parrot feather, like other milfoils, is capable of spreading by fragmentation several lake basins downstream in the same drainage could be susceptible to colonization by fragments flowing out of Meserve Lake. Introduced parrot feather has already shown invasive tendencies by growing excessively in ponds and canals in various other parts of the United States.

## 2. Management History and Goals

Both plan development and treatment began at Meserve Lake in 2008. In September, LARE funding was available to initiate a management regime and prepare the plan. After LARE sponsorship was obtained by the LRHE Aquatic Enhancement & Survey, Inc. was hired to initiate a three tiered treatment approach incorporating three separate herbicide formulations. Plan development began with mapping of parrot feather growth areas and Tier II plant surveys. The Tier II surveys for Meserve Lake were conducted on August 30 and October 20 of 2008. Summary data from the 2008 surveys is included in table 4 on page 16. In August, water clarity was considered to be good with a Secchi depth of 8 feet recorded. It should be noted that this survey occurred before any treatments took place on Meserve Lake. Plants were found to a depth of 19 feet. Ten species were identified in the August 30 survey, slightly above the average number of 8 species for a set of 21 other northern Indiana lakes compiled by IDNR (Pearson

2004). The highest occurrence in August was chara (56.7 %) followed by Spiny naiad (30 %) and Illinois pondweed (16.7 %). Parrot feather was fourth at 10 %. Curlyleaf pondweed occurred at 1.7 % of sites. No Eurasian watermilfoil or other submersed invasive plants were noted in Meserve Lake. A number of purple loosestrife (*Lythrum salicaria*) plants were noted growing along the Meserve Lake shoreline. Purple loosestrife is an invasive wetland plant species.

The October 20 Tier II survey took place 32 days after all treatments had been completed. Water clarity was good with a Secchi depth of 8.3 feet recorded. Nine species were identified in the sampling. Plants occurred to a depth of 18 feet. Chara was again most common occurring at 61.7 % of sites, spiny naiad was again second (26.7 %) and Illinois pondweed was again third (20 %). Parrot feather had been reduced to a 5% occurrence. Overall the lake's plant community appeared to be healthy with above average diversity.

Treated areas included 2.7 acres of parrot feather growth in the deeper offshore waters of the lake. This area was treated on September 17, 2008 with 200 pounds per acre Navigate 2,4-D granular aquatic herbicide. On September 17, 2008 a .4 acre area of the lakes outlet stream immediately downstream of the lake and a .1 acre area of the lake's inlet stream immediately upstream of the lake were treated with 200 pounds per acre Navigate 2,4-D. Scattered parrot feather plants growing along the north shoreline of the lake were treated with Weedar<sup>®</sup> 64 2, 4-D liquid herbicide at the rate of 10 gallons per surface acre. Scattered near-shore plants along the southern perimeter of the lake were treated with Renovate 3 (triclopyr) liquid aquatic herbicide at the rate of 2.5 ppm. Cygnet Plus non-ionic surfactant was also applied during each perimeter treatment at the rate of 1.5 gallons per surface acre. This was followed up on September 18 by treatment of emerged parrot feather plant tops in the inlet and outlet streams utilizing a backpack sprayer and a five percent solution of Weedar 64. Two quarts per acre Cygnet Plus was also used.

The 2008 management plan established the following overall goals for the management of parrot feather and other invasive aquatic plants at Meserve Lake:

1. Maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species and good water quality.
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant, fish, and wildlife resources.

Recommended management activities at Meserve Lake in 2008 and 2009 have been geared toward the attainment of these goals with hopes of ultimately eradicating parrot feather and preventing the possible escape of live plants or plant fragments downstream into other parts of the Pigeon Creek watershed. While efforts at control in other areas of the U.S. have not confirmed that complete eradication of this plant is possible, the ideal objective for Meserve Lake will be complete and permanent eradication of parrot feather. With this in mind, for the 2009 season and beyond management activities at Meserve Lake have sought to attain the following objectives:

1. Prevent the occurrence of live parrot feather plants in the 2009 late season IDNR protocol Tier II survey.

2. Generate a significant awareness among Steuben County lake residents and the majority of Meserve Lake users that this plant is potentially invasive and requires that measures are taken to prevent its spread.

### **3. Watershed and Water Body Characteristics**

Meserve Lake is glacial “kettle” lake of approximately 18.4 acres located in Steuben County in Northeast Indiana (Figure 1). For the 2008 plan two estimates were calculated for the lake’s hydraulic residence time. One calculation was based on the estimated annual runoff produced by the Meserve Lake watershed and produced an estimated residence time of 258 days. An additional calculation was based on a flow rate measured just downstream of the Meserve Lake outlet on November 23, 2008 and produced an estimated residence time of 106 days.

Prior Studies completed at Meserve Lake include Indiana Department of Environmental Management water quality data collection which took place in the 1970’s and a cisco (lake whitefish) survey performed by IDNR in 1992. For more information on these studies, see the 2008 plan (Aquatic Enhancement, Inc. 2008). Aquatic Enhancement & Survey, Inc. is unaware of any new studies performed for Meserve Lake or it’s watershed in 2009 outside the scope of the ongoing plant management activities detailed in this work.

### **4. Present Water Body Uses, Meserve Lake**

Uses of Meserve Lake by the public and its residents remain essentially the same as in 2008. Habitat within the lake and watershed remained largely the same as in 2008. No new fisheries data was compiled for Meserve Lake in 2009. For more information see the original 2008 APMP (Aquatic Enhancement, Inc. 2008).

### **5. Plant Community Characterization**

#### **5.1 Methods**

Two primary methods of observation were used to characterize the Meserve Lake’s plant community during the 2009 season. Location of exotic plant growth including parrot feather and curlyleaf pondweed was done mainly by visual observation from the boat or shoreline. Extensive time was spent running a zigzag pattern over the lake’s littoral zone to look for submersed parrot feather plants. Shorelines were also walked and searched from the boat to locate emergent parrot feather plants. This was complimented by random rake drags performed in deep areas where parrot feather was present in 2008. The lake was also snorkeled in August to look for the presence of submersed parrot feather plants. To characterize the lake’s plant community quantitatively and produce objective data for analysis and tracking of overall plant community composition Tier II Plant surveys were utilized as described in the original Aquatic Plant Management Plan (APMP) for Meserve Lake (Aquatic Enhancement, Inc. 2008).

#### **5.2 Exotic Plant Growth**

Parrot feather growth in 2009 was very limited. In the spring no parrot feather plants appeared along the shoreline of the lake or in the inlet or outlet streams where they had been present in 2008. Repeated lake drags produced no viable plants in deepwater areas of the lake. A live parrot feather stem however, was recovered during the Tier II sampling on May 26 (figure 2). The initial treatments of the shoreline and deep areas of the lake were performed that same day. In July and August, attempts to locate any remaining parrot feather plants or plant parts included rake drags, visual observation, snorkeling, and the August Tier II survey. No signs of parrot feather were discovered in the main body of the lake; however, small emergent plants had begun to appear in the mouth of the small tributary that flows into the lake along its northeast shore. Small emergent plants were also discovered in a spring-fed marshy area (figure 11) adjacent to

the lake. As the season continued, small colonies of emergent parrot feather plants appeared in the outlet stream, inlet stream, and along the southwest shoreline of the lake (figures 11 through 14). All sites were treated repeatedly through November. Nearly all plants had disappeared completely by the time of the last treatment on November 20.



**Figure 2.** Location of live parrot feather stem recovered in May of 2009.

Plant common name	Scientific name
Parrot feather	<i>Myriophyllum aquaticum</i>
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>
Curlyleaf pondweed	<i>Potamogeton crispus</i>
Chara	<i>Chara sp.</i>
Spiny naiad	<i>Najas marina</i>
Illinois pondweed	<i>Potamogeton illinoensis</i>
Creeping bladderwort	<i>Utricularia gibba</i>
Common bladderwort	<i>Utricularia macrorhiza</i>
Small pondweed	<i>Potamogeton pusillus</i>
Variable pondweed	<i>Potamogeton gramineus</i>
Sago pondweed	<i>Stuckenia pectinata</i>
Elodea	<i>Elodea canadensis</i>
Curlyleaf pondweed	<i>Potamogeton crispus</i>
Marsh arrow grass	<i>Triglochin palustris</i>
White water lily	<i>Nymphia odorata</i>
Spaddeedock	<i>Nuphar sp.</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Coontail	<i>Ceratophyllum demersum</i>

**Table 1. List of common and scientific names for plants present at Meserve Lake.**

### 5.3 Tier II Sampling Results

The 2009 Tier II surveys for Meserve Lake were conducted on May 26 and August 3 in good weather conditions. Sampling points for Meserve Lake are shown in figure 3 below. Water clarity was considered to be good with a Secchi depth of 8.4 feet recorded in May and a Secchi depth of 12 feet recorded in August. This was somewhat improved over last year's measurements on August 20 and October 20, 2008 when Secchi depths of 8 feet and 8.3 feet were recorded respectively. The 2009 season water clarity at Meserve is considered to be consistent with water clarity measured at the lake in the past. Plants were found to a depth of 17.5 feet during the two 2009 surveys. Last year's maximum plant depth was 19 feet. Because chara could possibly be found below 20 feet in future seasons, and the fact that it is important to maintain a consistent sampling protocol across seasons, it is advised that the 25 foot sampling depth for Meserve Lake be maintained.

During the May 26 survey plants were found growing to a depth of 17 feet. A summary of May data is shown in table 2. A total of 8 species were identified in the survey, equal to the average number of 8 species for a set of 21 other northern Indiana lakes compiled by IDNR (Pearson 2004). The highest occurrence in May was chara (63.3% of sampling sites) followed by Illinois pondweed (10 %) and sago pondweed (6.7 percent). Parrot feather was only found at one site (1.7 %). Curlyleaf pondweed occurred at 5% of sites. No Eurasian watermilfoil or other submersed invasive plants were noted in Meserve Lake. A number of Purple loosestrife plants, an invasive wetland species, were noted growing along the Meserve Lake shoreline. The plant map for May Tier II parrot feather is displayed in figure 2. The plant maps for May; chara, Illinois pondweed, and Sago pondweed are displayed in figures four, five, and six.

Plants were found growing to a depth of 17.5 feet during the August 3 survey. A summary of August data is shown in table three. Four species were identified in the sampling, half the average of the set of 21 other northern Indiana lakes. Chara was again most common occurring at 50 % of sites, variable pondweed was second most common (10 %) and common bladderwort was third (5%). Tier II plant maps for these species are displayed in figures 7, 8, and 9 below. Neither parrot feather nor curlyleaf pondweed appeared in the survey. A summary of all Tier II

data collected from Meserve Lake is displayed in table four. Overall, the lake's plant community appeared to be healthy with slightly below average diversity in comparison to other Indiana lakes.



**Figure 3.** Meserve Lake Tier II waypoints.

**Occurrence and Abundance of Submersed Aquatic Plants in Meserve**

County: Steuben	Total Sites: 60	Mean species/site: 0.92
Date: 5/26/2009	Sites with plants: 41	SE Mean species/site: 0.10
Secchi (ft): 8.4	Sites with native plants: 40	Mean native species/site: 0.85
Maximum Plant Depth (ft): 17.0	Number of species: 8	SE Mean natives/site: 0.09
Trophic Status: Oligotrop.	Number of native species: 6	Species diversity: 0.50
	Maximum species/site: 3	Native species diversity: 0.42

<b>All Depths (0 to 20 ft)</b>		<b>Rake score frequency per species</b>				<b>Plant Dominance</b>
<b>Species</b>	<b>Frequency of Occurrence</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>5</b>	
chara	63.3	36.7	40.0	6.7	16.7	28.7
Illinois pondweed	10.0	90.0	6.7	1.7	1.7	4.0
sago	6.7	93.3	6.7	0.0	0.0	1.3
curlyleaf pondweed	5.0	95.0	5.0	0.0	0.0	1.0
elodea	1.7	98.3	1.7	0.0	0.0	0.3
parrot feather	1.7	98.3	0.0	1.7	0.0	1.0
variable pondweed	1.7	98.3	1.7	0.0	0.0	0.3
small pondweed	1.7	98.3	1.7	0.0	0.0	0.3
<b>Depth: 0 to 5 ft</b>		<b>Rake score frequency per species</b>				<b>Plant Dominance</b>
<b>Species</b>	<b>Frequency of Occurrence</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>5</b>	
chara	90.0	10.0	40.0	10.0	40.0	54.0
Illinois pondweed	15	85.0	10.0	0.0	5.0	7.0
sago pondweed	15	85.0	15.0	0.0	0.0	3.0
variable pondweed	5	95.0	5.0	0.0	0.0	1.0
<b>Depth: 5 to 10 ft</b>		<b>Rake score frequency per species</b>				<b>Plant Dominance</b>
<b>Species</b>	<b>Frequency of Occurrence</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>5</b>	
chara	90.0	10.0	70.0	10.0	10.0	30.0
Illinois pondweed	30.0	70.0	20.0	10.0	0.0	10.0
elodea	10.0	90.0	10.0	0.0	0.0	2.0
curlyleaf pondweed	10.0	90.0	10.0	0.0	0.0	2.0
<b>Depth: 10 to 15 ft</b>		<b>Rake score frequency per species</b>				<b>Plant Dominance</b>
<b>Species</b>	<b>Frequency of Occurrence</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>5</b>	
chara	60.0	40.0	60.0	0.0	0.0	12.0
curlyleaf pondweed	20.0	80.0	20.0	0.0	0.0	4.0
parrot feather	10.0	90.0	0.0	10.0	0.0	6.0
small pondweed	10.0	90.0	10.0	0.0	0.0	2.0
sago pondweed	10.0	90.0	10.0	0.0	0.0	2.0
<b>Depth: 15 to 20 ft</b>		<b>Rake score frequency per species</b>				<b>Plant Dominance</b>
<b>Species</b>	<b>Frequency of Occurrence</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>5</b>	
chara	50.0	50.0	30.0	10.0	10.0	22.0
Filamentous Algae	1.7					

**Table 2. Summary of Meserve Lake 5/26/09 Tier II results.**

**Occurrence and Abundance of Submersed Aquatic Plants in Meserve Lake**

County: Steuben	Total Sites: 60	Mean species/site: 0.67
Date: 8/3/2009	Sites with plants: 31	SE Mean species/site: 0.09
Secchi (ft): 12.0	Sites with native plants: 31	Mean native species/site: 0.67
Maximum Plant Depth (ft): 17.5	Number of species: 4	SE Mean natives/site: 0.09
Trophic Status: Oligo.	Number of native species: 4	Species diversity: 0.41
	Maximum species/site: 2	Native species diversity: 0.41

All Depths (0 to 25 ft)		Rake score frequency per species				Plant Dominance
Species	Frequency of Occurrence	0	1	3	5	
chara	50.0	50.0	25.0	3.3	21.7	28.7
variable pondweed	10.0	90.0	6.7	1.7	1.7	4.0
common bladderwort	5.0	95.0	5.0	0.0	0.0	1.0
sago pondweed	1.7	98.3	1.7	0.0	0.0	0.3
Depth: 0 to 5 ft		Rake score frequency per species				Plant Dominance
Species	Frequency of Occurrence	0	1	3	5	
chara	72.7	27.3	40.9	4.5	27.3	38.2
variable pondweed	22.7	77.3	13.6	4.5	4.5	10.0
common bladderwort	13.6	86.4	13.6	0.0	0.0	2.7
sago pondweed	4.5	95.5	4.5	0.0	0.0	0.9
Depth: 5 to 10 ft		Rake score frequency per species				Plant Dominance
Species	Frequency of Occurrence	0	1	3	5	
chara	66.7	33.3	33.3	0.0	33.3	40.0
Depth: 10 to 15 ft		Rake score frequency per species				Plant Dominance
Species	Frequency of Occurrence	0	1	3	5	
chara	58.3	41.7	16.7	8.3	33.3	41.7
variable pondweed	8.3	91.7	8.3	0.0	0.0	1.7
Depth: 15 to 20 ft		Rake score frequency per species				Plant Dominance
Species	Frequency of Occurrence	0	1	3	5	
chara	23.1	76.9	15.4	0.0	7.7	10.8

**Table 3. Summary of 8/3/09 Tier II results.**

**Summary of Season's Treatments**

parrot feather pre-treatment pre-treatment 2,4-D 3 ac. 200 lb/ac 2,4-D 11.5 ac. 200 lb/ac

Meserve Lake Date	AES 5/26/09	AES 8/30/08	AES 10/20/08	AES 8/3/09
Depth range (ft)	0-25	0-25	0-25	0-25
Sample sites (n)	60	60	60	60
Secchi (ft)	8.4	8.0	8.3	12.0
Littoral depth (ft)	17.0	19.0	18.0	17.5
Occurrence (%)	0.7	0.77	0.73	0.5
Species (N)	8	10	9	4
Native species (N)	6	8	8	4
Species/site (max)	3	4	4	2
Mean species/site	0.92	1.35	1.30	0.67
Mean Native species/site	0.85	1.23	1.25	0.67
Species diversity	0.50	0.75	0.70	0.41
Native diversity	0.42	0.71	0.68	0.41
<b>Species occurrence</b>				
Chara	63.3	56.7	61.7	50.0
parrot feather	1.7	10	5.0	
creeping bladderwort		6.7	1.7	
Sago pondweed	6.7	3.3	3.3	1.7
common bladderwort		5	5.0	5.0
Illinois pondweed	10	16.7	20.0	
Curlyleaf pondweed	5	1.7		
Slender naiad			1.7	
Variable pondweed	1.7			10.0
Small pondweed	1.7	3.3		
Elodea	1.7	1.7		
Spiny naiad		30	26.7	
vallisneria			5.0	
<b>Algae occurrence (%)</b>				
<b>Species dominance</b>				
Chara	28.7	38	37.7	28.7
parrot feather	1	3.3	1.7	
creeping bladderwort		1.3	0.3	
Sago pondweed	1.3	0.7	1.3	0.3
common bladderwort		1	1.0	1.0
Illinois pondweed	4	6.7	8.7	
Spiny naiad		12.7		
Curlyleaf pondweed	1	0.3		
Slender naiad			0.3	
Variable pondweed	0.3			4.0
Small pondweed	0.3	0.7		
Elodea	0.3	0.3		
Spiny naiad			10.7	
vallisneria			2.3	

**Table 4. Summary of 2008 and 2009 Tier II data.**



Figure 4. 5/26/09 Tier II Chara.



Figure 5. 5/26/09 Tier II Illinois pondweed.



Figure 6. 5/26/09 Tier II Sago pondweed.

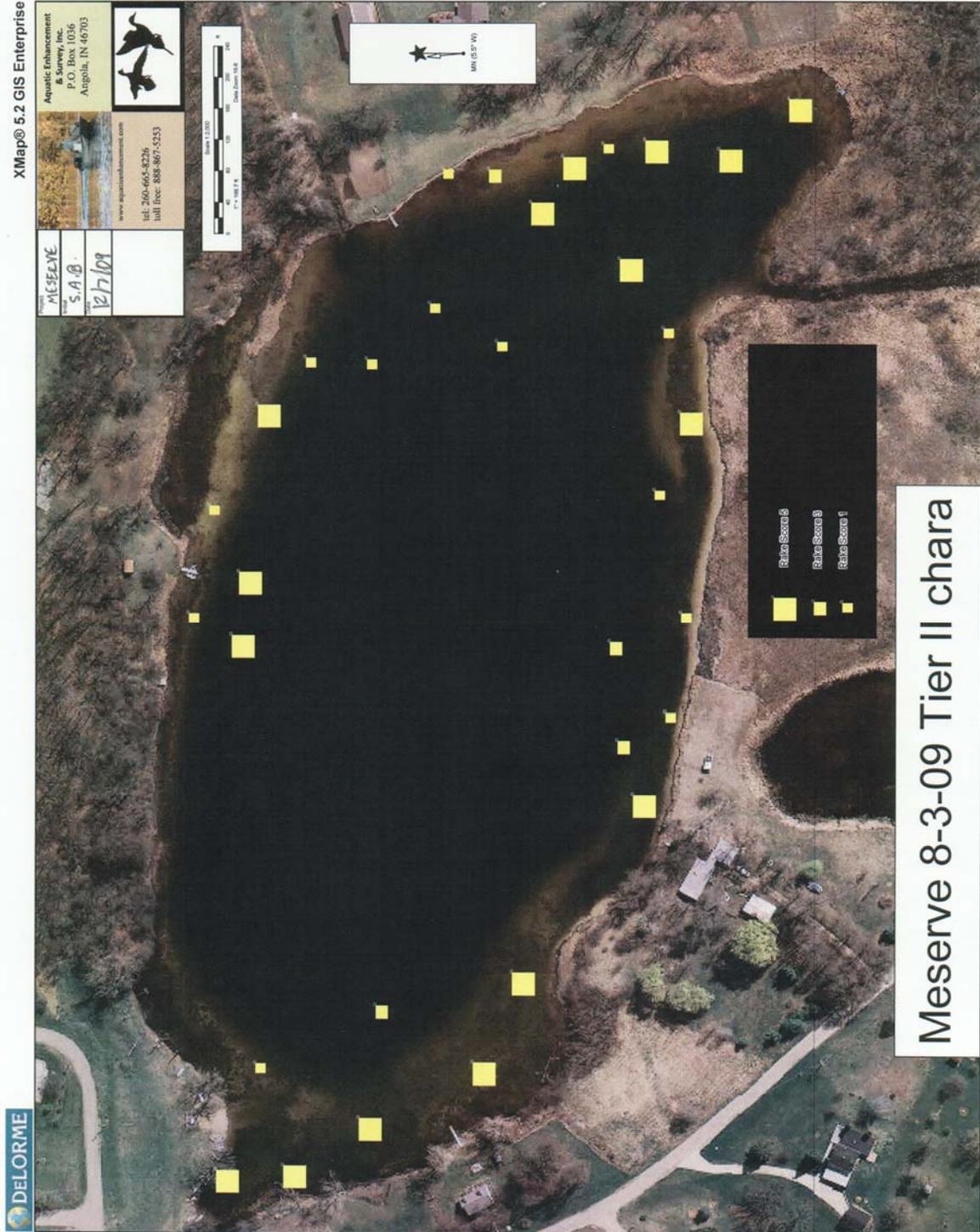


Figure 7. 8/3/09 Tier II Chara.



Figure 8. 8/3/09 Tier II Variable pondweed.



Figure 9. 8/3/09 Tier II Great bladderwort.



Figure 10. May 26 Treatment map for Meserve Lake.

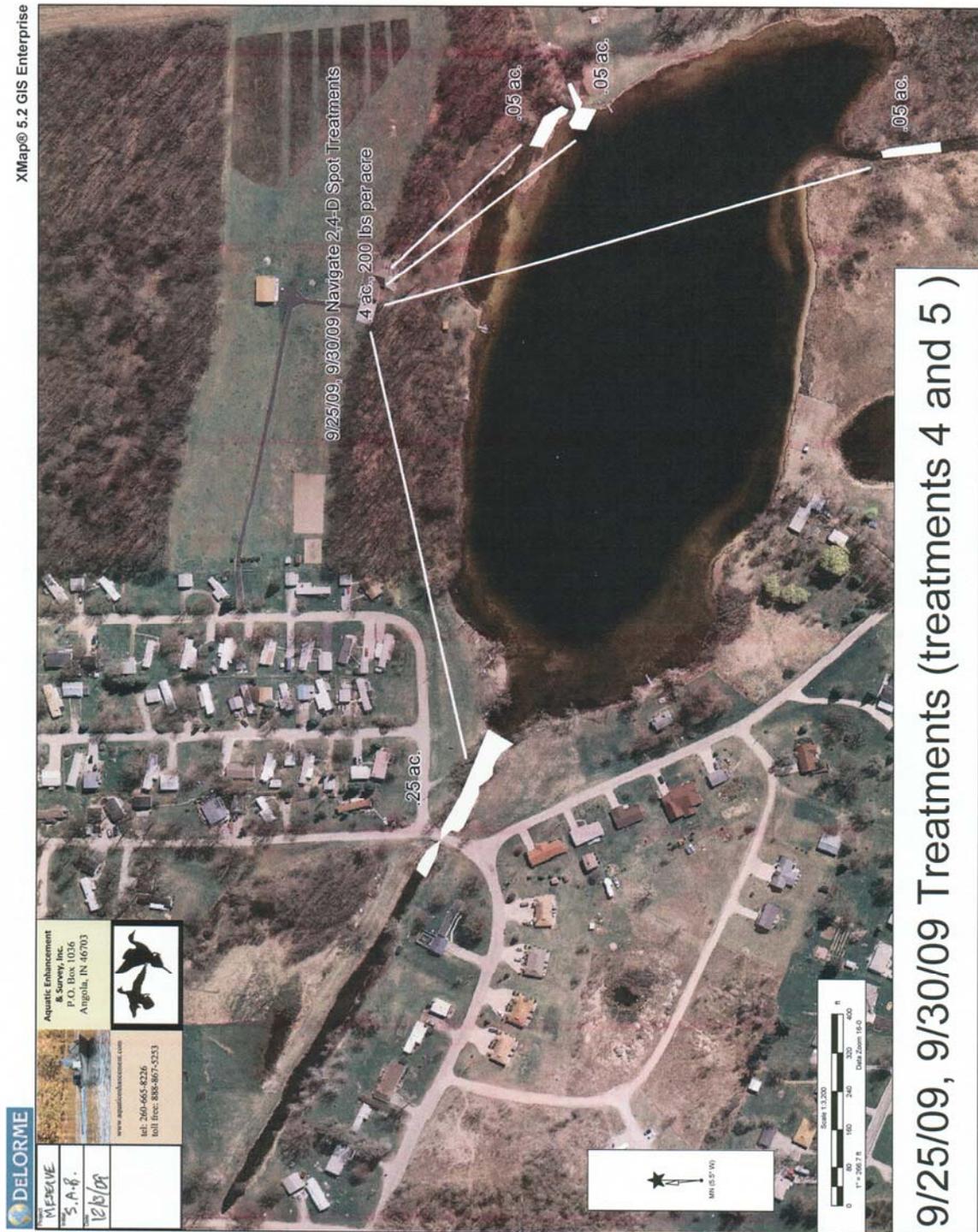


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Figure 11. August 5 Treatment map for Meserve Lake.

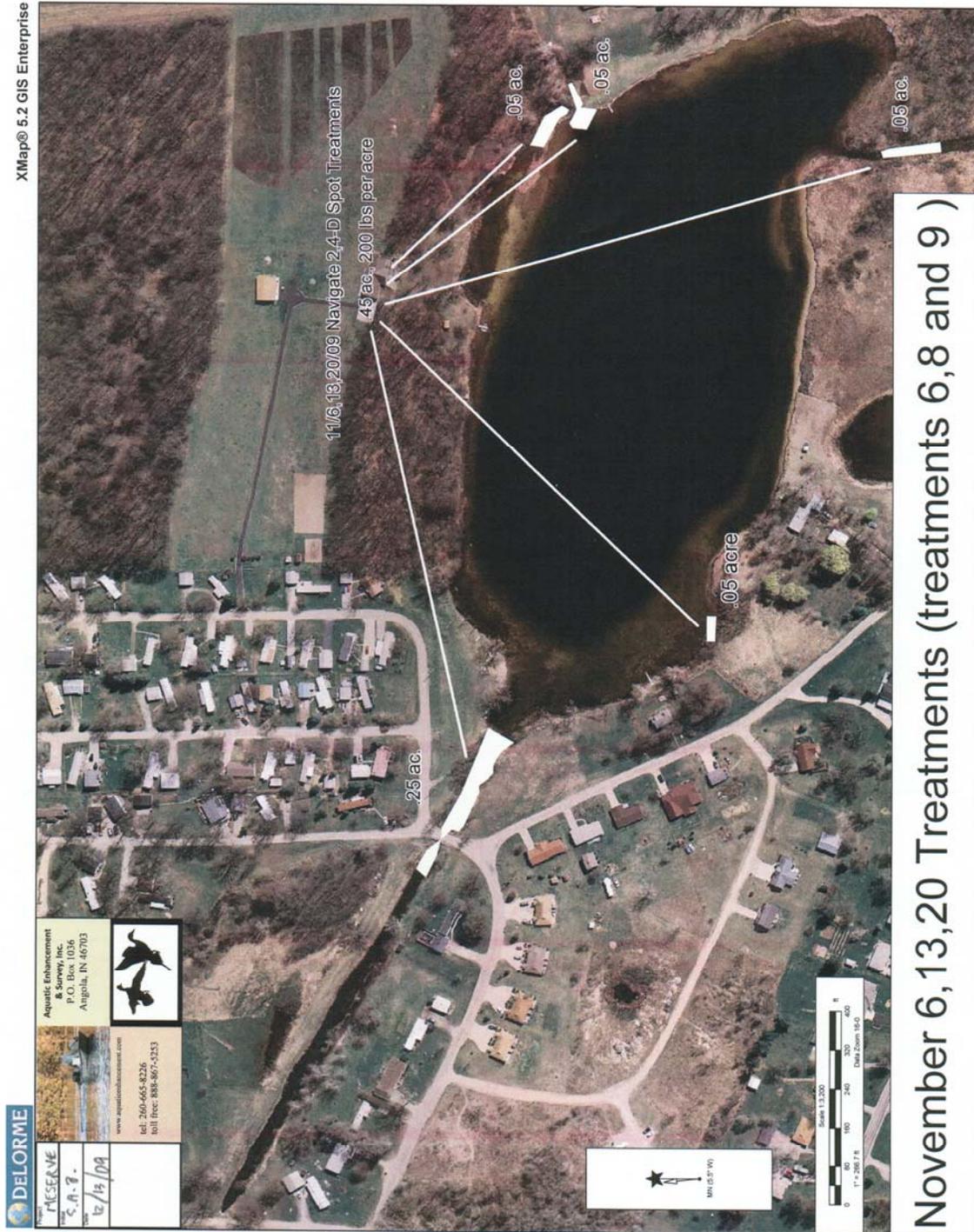


Figure 12. September 23 Treatment map for Meserve Lake.



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Figure 13. September 25 and 30 Treatment map for Meserve Lake.



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Figure 14. November 6, 13 and 20 treatment map for Meserve Lake.



Figure 15. November 9 treatment map for Meserve Lake.

## **6. 2009 Season Management Activities**

To achieve established objective number one a regime of chemical treatment took place in 2009. A number of rake drags performed on the lake early in the 2009 growing season revealed the presence of stems of deepwater parrot feather plants lying on the bottom of the lake. These were apparently the remnants of plants treated during the 2008 season. New foliage sprouting on these stems suggested these plants were still alive and slowly growing. No parrot feather growth was noted in the shallower areas of the lake or the inlet or outlet channels.

On May 26 a Tier II aquatic plant survey was performed. A single parrot feather stem was recovered at one of 60 survey points (1.7%). That same day the entire littoral zone beyond 25 feet from shore (11.5 acres) was treated with Navigate 2,4-D at the rate of 200 pounds per acre. The treatment extended to a depth of 19 feet. This treatment also included the inlet and outlet streams of Meserve Lake where parrot feather was present in 2008. On the same day a 25 foot wide strip along the entire north shoreline was treated with DMA4 IVM 2,4-D liquid herbicide at the maximum label rate of 2.84 gallons per acre-ft. This treatment also included Cygnet Plus non-ionic surfactant applied at the maximum label rate of two gallons per surface acre. The southern perimeter of the lake in a strip extending to 25 feet from shore was treated with Renovate 3 triclopyr liquid herbicide at a concentration of .82 parts per million (.74 gallons per surface acre). Treatment maps for the 2009 season are contained in figures 10 through 15 on pages 23 through 28.

On July 20 rake drags and a visual check of the lake indicated that no parrot feather plants or plant stems remained in the main body of the lake. A few emergent parrot feather plants were found growing where a small spring fed stream enters the northeast part of the lake. A check of the lake was also made by snorkeling and no other plants or plant stems were located. On August 3 a Tier II plant survey was performed. No parrot feather plants were collected during the survey, indicating that objective number one had been met. The same day a few more plants were located growing near a small spring in a marshy area connected to the lake. All noted plants were treated with DMA 4 IVM liquid 2,4-D using a backpack sprayer on August 5.

In September emergent parrot feather plants were noted to be present in the two most recently treated areas along with an emergent colony growing in the inlet stream and two emergent plants in the outlet stream. These plants were all treated with Renovate 3 triclopyr herbicide using a backpack sprayer on September 23. On September 25 and again on September 30 Navigate granular 2,4-D was applied to these areas by hand at the rate of 200 lbs per acre.

On November 3 a few emergent parrot feather plants were located along the southwest shore of the lake. It had become apparent that plants were persisting in shallow areas, especially those areas where a constant source of groundwater flow, surface water flow, or both had provided some degree of refuge for parrot feather roots. To address this, a regime of repeated treatments was employed through November using liquid and granular 2, 4-D applications. This was intended to provide opportunity for uptake to both submersed and emersed parrot feather plant foliage present.

For the liquid application the entire perimeter of the lake within 25 feet of the shore was treated with DMA 4 IVM 2, 4-D liquid herbicide at the maximum label rate of 2.84 gallons per acre-ft. and Cygnet Plus non-ionic surfactant applied at the maximum label rate of two gallons per surface acre. For the granular applications Navigate 2,4-D was hand applied to each of the sites of late-season parrot feather growth at the rate of 200 pounds per acre. The total area of the perimeter application was estimated to be 2.33 acres (2.33 acre-ft). The total area of each granular application was estimated to be .4 acres. Granular applications were completed on November 6, 13, and 20. The Liquid application was performed

on November 9th. At the time of the November 20 treatment no healthy parrot feather plants were noted. Parrot feather plant remnants were noted to be present at only one of the treatment sites.

To work toward objective number two a presentation was made to the Steuben County Lakes Council in February of 2008 to provide information on the identification and potential spread of parrot feather and other non-native plants. Printed materials were distributed to those present to aid in non-native plant identification. Audio from the meeting ran repeatedly during newscasts on a local radio station and the local newspaper published an article on the presence of the plants in Meserve Lake with commentary contributed by IDNR. Information was also presented at a public meeting organized by the Life of Riley Home Estates on June 13.

## **7. Threatened and Endangered Species Surveys**

No specially listed plants or animals were noted during work at Meserve Lake in 2009. No plant voucher specimens were collected. For more information on rare, threatened, or endangered species noted at Meserve Lake in the past see the original Meserve Lake APMP (Aquatic Enhancement, Inc. 2008).

## **8. Description of Beneficial and Problem Plant Areas**

Residents reported no lake use impairment caused by exotic plants in Meserve Lake in 2009. Because it is a noxious plant with the potential to do great damage if it spreads, any areas where parrot feather grew in 2009 are considered to be problem areas. Because parrot feather appears to have been eradicated from all but the shallowest parts of the lake and its contiguous streams and wetlands, deeper areas of the lake are no longer considered to be problem areas, but will still need treatment and monitoring to prevent a possible recolonization. Areas containing significant stands of native plants were similar to those noted in 2008 and remain worthy of protection as beneficial areas. For more specific information see the original Meserve Lake APMP (Aquatic Enhancement, Inc. 2008).

## **9. Aquatic Plant Management Alternatives Options for Controlling Parrot Feather**

### **No Action**

Because of its invasive nature a discontinuance of active parrot feather control at Meserve Lake is likely to result in a rapid rebound in colonization. This will result in a threat of ecological and recreational damage at Meserve Lake and other lakes downstream of Meserve that could receive floating parrot feather fragments. Doing nothing does not appear to be a wise option at this time. Aggressive controls implemented thus far appear to have been very effective and results suggest that complete eradication may be possible if ongoing active and aggressive control measures are continued.

### **Granular 2,4-D Herbicide**

Granular formulations of 2,4-D herbicide have been used for many years to control milfoil species. Granular 2,4-D is currently available under the trade name Navigate. In lawn, agricultural and aquatic applications 2,4-D is used to selectively control plants which are biologically classified as "broadleaves". Aquatic plants in this category include Eurasian and Native milfoils and Coontail. Selectivity is a major advantage of using a broad-leaf specific herbicide formulation. The native submersed plants in Meserve Lake have remained largely unaffected by treatments with 2,4-D. Most rushes and sedges in shoreline areas will also be unaffected. As a "translocated" or "systemic" herbicide 2,4-D is absorbed by target plants and

transported through their vascular systems, affecting remote parts of the plant including the root structure. This offers the theoretical advantage of actually killing more plants than non-systemic types of herbicides and providing long term control. Well-timed 2,4-D applications in some cases provide seasonal control of milfoils. Occasionally reapplication is needed within the same season.

Because granular pellets sink into plant foliage or to the lake bottom and slowly release their active ingredients they can sometimes be more effective than liquid formulations in deepwater or applications to areas where there is water movement. In the case of Meserve Lake a granular 2,4-D formulation offers the advantage of providing a longer contact time liquid herbicides would for submersed plant foliage in the moving waters of the inlet and outlet streams.

The use of 2,4-D use typically imposes restrictions on swimming near the treatment area for one day following treatment. To prevent damage to non-target ornamental plants a waiting period is also typically imposed on the use of treated lake water for lawn irrigation.

It was noted by U.S. Army Corps of Engineers Researchers in *Aquatic plant identification and herbicide use guide; Volume II: Aquatic plants and susceptibility to herbicides* that 2,4-D was effective in controlling parrot feather (Westerdahl and Getsinger 1988). Sources in Washington State have indicated that granular formulations of 2,4-D were needed to provide control of parrot feather lasting longer than 12 months (Washington Dept. of Ecology). The Texas Agrilife Extension Service in the Department of Wildlife and Fisheries at Texas A&M University has summarized personal experience, available literature, and contacts with a number of applicators and given 2,4-D an overall rating of “excellent” in terms of its ability to control parrot feather.

One disadvantage of the use of 2,4-D at Meserve Lake is that white water lilies and spadderdock, both desirable native emergent plants, are affected by treatment with granular 2,4-D, especially at maximum application rates. Lily and spadderdock plant beds that were treated at Meserve showed damage to most plants and a significant thinning of plant density. Some amount of growth has persisted in most treated areas that were previously colonized by these plants.

A significant disadvantage to the use of granular herbicides is that they are bulky and dusty. This can lead to a more costly and time consuming application, adding additional expense above the cost of the herbicide. Thus far, granular 2,4-D has proven to provide very effective control at Meserve Lake, eliminating deep water parrot feather plants from the lake completely. Granular 2,4-D has also proven effective in small area applications in shallow water, including flowing water.

### **Liquid 2,4-D Herbicide**

Liquid 2,4-D herbicide formulations are available under the trade names Weedar 64, and DMA 4 IVM. Liquid formulations of 2,4-D produce the same active ingredient after application that granular formulations do. One advantage of a liquid formulation is the ease of application in certain situations. Liquid formulation applications lack the product bulk of granular applications and liquids can be easily transported and applied using a backpack sprayer for conducting spot-treatments in areas inaccessible to boats and equipment. They offer the same selectivity as granular formulations. Liquid formulations also offer the advantage of allowing application directly to emersed parrot feather foliage. One disadvantage is that they do not produce the time-release effect of granulars, especially in a moving-water situation. Flowing waters may carry an applied liquid formulation downstream quickly before the plants have had sufficient contact time. As with granular formulations water use restrictions are typically imposed after treatment.

At Meserve Lake in 2008 and 2009 liquid 2,4-D formulations have provided rapid control when applied directly to emerged parrot feather plant foliage in spot treatments, but regrowth of treated plants appears to occur within approximately one month. Broadcast liquid applications that produce a target concentration of active ingredient along the entire lake margin appear to provide more lasting effects with the liquid products than emerged foliar applications.

### **Liquid Triclopyr**

Available under the trade names Renovate 3 or Kraken™, liquid triclopyr formulations offer broadleaf specific systemic control of aquatic plants. Results in many cases have been similar to those obtained with the use of 2-4-D. Improved application techniques and the use of adjuvants show some promise of possible multi-seasonal control of broadleaf plants with the use of triclopyr. Current labeling allows the restricted use of dosed lake water to be adjusted in accordance with lake-water assay results, greatly reducing the time of restriction in most cases. The label application rates for liquid triclopyr can make deep water applications rather expensive when compared with label rates for granular 2,4-D applications.

Triclopyr has been noted by U.S. Army Corps of Engineers Researchers in *Aquatic plant identification and herbicide use guide; Volume II: Aquatic plants and susceptibility to herbicides* to provide control of parrot feather (Westerdahl and Getsinger 1988). The Texas Agrilife Extension Service in the Department of Wildlife and Fisheries at Texas A&M University has summarized personal experience, available literature, and contacts with a number of applicators and given triclopyr an overall rating of “good” in terms of its ability to control parrot feather.

One significant advantage of triclopyr is its systemic action. Chances are better for providing a complete kill than with contact herbicides. As with 2,4-D selectivity is another major advantage. The native submersed plants in Meserve Lake will remain largely unaffected by triclopyr applications. Rushes and sedges in shoreline areas will also be unaffected. As with 2,4-D white water lilies and spatterdock may be damaged. Temporary water use restrictions on irrigation and swimming are imposed with the use of triclopyr. As with liquid 2,4-D liquid triclopyr has provided rapid control when applied directly to emerged parrot feather plant foliage in spot treatments at Meserve, but regrowth of treated plants occurred within approximately one month. As with 2,4-D broadcast applications, Renovate applications that produce a target concentration of active ingredient along the entire lake margin appeared to provide more lasting effects than spot treatments.

### **Hand Removal**

Removal of plants by hand can sometimes be a practical control technique for aquatic invasives. In cases where the number of plants is low hand removal can be highly effective, especially if the entire plant including the root can be removed. At Meserve this technique could prove to be an excellent control technique as long as the number of plants to be removed remains small. If a great many parrot feather plants are present the process of hand removal would be very labor intensive and could be complicated by the possibility of the plants inadvertently becoming fragmented during pulling.

### **Recommended Control Options for 2010**

For the 2010 season a combination of herbicidal control and hand removal of parrot feather appears to be the best option, especially if the overall number of parrot feather plants observed is small as it was in 2009.

Hand pulling offers the advantage of actually removing the plant rather than simply applying treatment and hoping the plants and their root structures die completely. However, this advantage

is dependent on the entire plant being successfully removed, roots and all. It was noted in 2009 that most of the scattered plants treated had some amount of root structure extending into the hydrosol. Not knowing how far into the soil these roots extend calls into question whether rooted plants can be removed in their entirety, even if some amount of hydrosol beneath the plant is also removed. Since the plants grow in colonies sharing common root structures, it's possible that some individual plants that are visible may be connected to an extensive root structure that will continue to produce new plant tops even if the visible plants and some amount of soil below the plants is removed. If these plants are successfully dosed with herbicide rather than pulled, translocation to the roots could potentially kill root structures below and around the area of the visible plant yielding a better long term result than simply removing the upper part of the plant. Because of this, removal should be employed only if the plants noted are completely free-floating. Treatment should be employed for rooted plants.

There are two reasons that a completely unrooted plant may have limited susceptibility to herbicide treatment and would be better suited to removal. Direct treatment of the emergent plant tops, the most effective way to insure herbicide contact with a transient free floating plant, has been shown to provide relatively short-term control, with sprayed plant colonies re-emerging the same season in some cases. Treatment of the growth area with granular herbicide has shown more promise, but a free-floating plant can easily be moved away from the treatment area by currents or wind after the application occurs. This fact, combined with the fact that a free floating plant removed leaves behind no root structure weighs on the side of removal. Another advantage of removal of free-floating plants is the immediate assurance that removed mobile plants will not drift to the lake's outlet and move downstream to colonize other waterbodies.

The main disadvantage associated with removing free-floating plants is the difficulty associated with finding and accessing plants to be removed. Some shoreline areas where the growth of small emergent plants has persisted are marshy and difficult to wade or completely obstructed by overhanging shrubs. If the number of plants is large in 2010 a considerable amount of time will be required. If the growth noted in 2010 is similar to 2009 this combined approach should be quite feasible.

If the combination of hand removal and herbicides does not show promise in terms of eradication by the end of 2010 the removal of significant amounts of soil in areas of growth should be seriously examined as an option. If viable roots persist in very limited areas of surface water flow or groundwater flow where proper dosing with herbicides is not possible, targeted hand or equipment assisted removal could be used to remove soil embedded root structures.

For their selectivity, systemic mode-of-action, and effectiveness, 2,4-D and triclopyr remain the best options among the herbicides available. To address scattered recurring emergent plants growing around the lake's perimeter, the locations of which have not been completely predictable, regular broadcast applications of herbicides should be continued around the lakes perimeter. To maximize control and chances at eradication of these plants it is recommended that a regular schedule of lake-perimeter treatments be maintained using a combination of liquid and granular 2,4-D herbicide treatments. Granular 2,4-D should be used in deeper waters to insure these areas are not recolonized. See Section 12 (Action Plan) on page 36 for more treatment details.

## **10. Public Involvement**

Information about parrot feather was presented at a Steuben County Lakes Council meeting on February 2, 2009. The Steuben County Lakes Council serves as a county-wide lake residents advocate organization for Steuben County in Northeast Indiana. An article appearing on the front page of the local newspaper and a local radio ad provided publicity to help interested area residents learn of the problem. The president and vice president of the LRHE were in attendance at the meeting as well as residents from many other area lakes and local natural resource management officials. Thirty six people were in attendance. Aquatic Enhancement & Survey, Inc. presented information about parrot feather identification, the potential for spread from Meserve Lake, and management activities completed in 2008. The Steuben County Lakes Council provided written material to help guide attendees in spotting parrot feather if it should occur on their lake. Opportunity was provided for attendees to ask questions. Attendees expressed concern about the possibility of spread and were generally in favor of continued management activities that could prevent it. On June 13, 2009 a public meeting concerning management efforts at Meserve was incorporated into the regular meeting of the LRHE. The meeting was held lakeside at the association's common area pavilion. Fourteen people were in attendance. A short survey was distributed to the attendees with instructions to complete one survey per household. Results are displayed in the graphs below.

6/13/09 Meserve Lake Public Meeting Survey, 8 total respondents

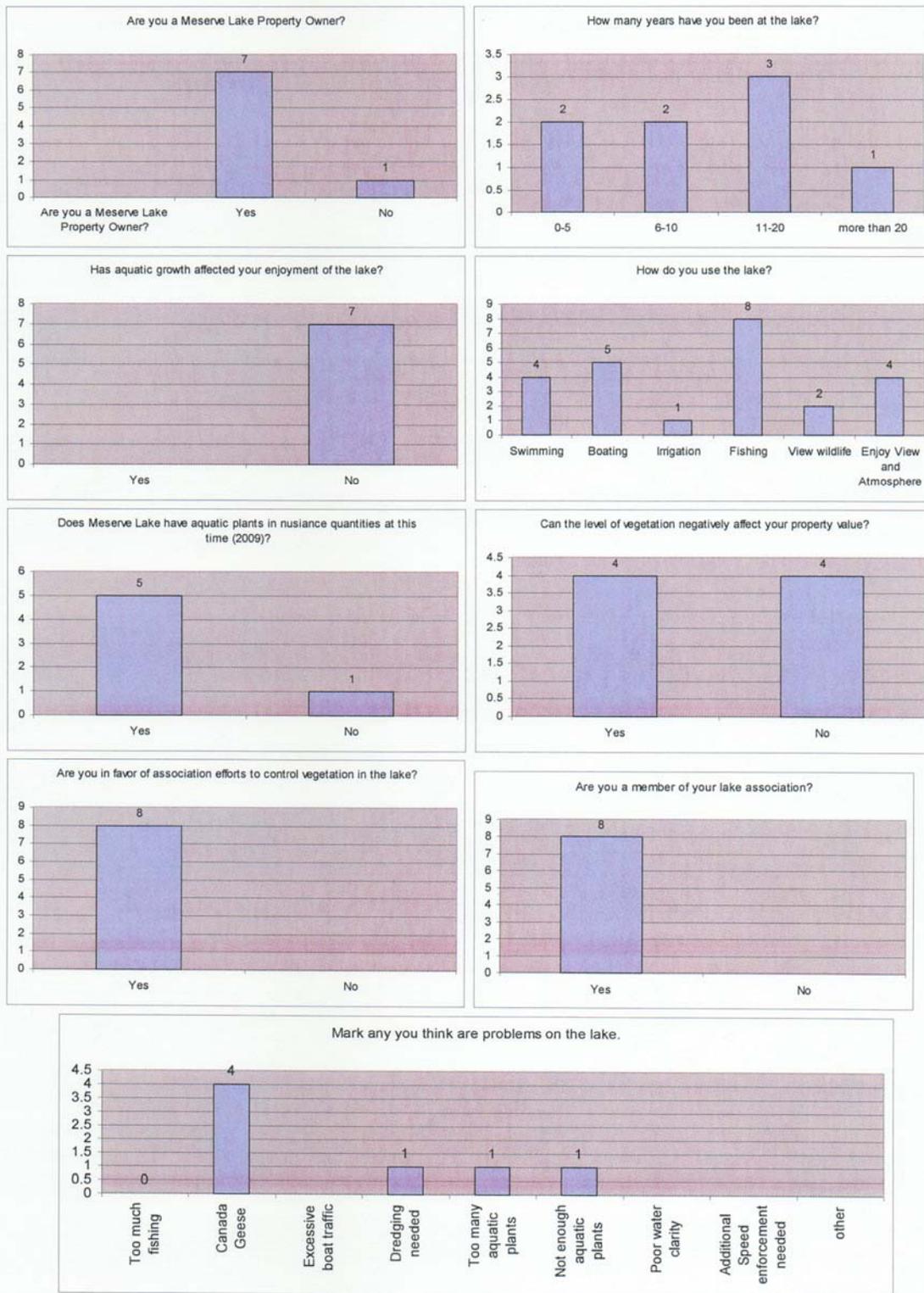


Figure 16. Meserve Lake Public Meeting Survey Results.

## **11. Implementation Strategy**

Management of parrot feather at Meserve Lake should take an approach consisting of two tiers of action working toward this plan's primary goals and objectives over the next five years:

### **Tier 1. Exotic Plant Control**

Addressing the parrot feather present aggressively on a lake wide basis using both hand removal of free-floating plants and professional applications of EPA approved aquatic pesticides is advised. Along with sufficient monitoring for non-target damage this strategy can continue to limit spread and preserve the native plant community while working toward the goal of eventual eradication. All parties involved including the LRHE have expressed an interest in preventing the spread of these potentially damaging plants beyond Meserve Lake.

Specifically the herbicides utilizing 2, 4-D and triclopyr as their active ingredients were chosen because they will not affect most native submersed plant species present, thereby preserving the Meserve Lake plant community. Granular 2,4-D in particular appears to offer the longest lasting control at present and results from 2009 season treatments have been encouraging. For shoreline parrot feather plants that are spread among native vegetation, a combination of liquid 2,4-D, liquid triclopyr, and granular 2,4-D should be used around the entire perimeter of the lake to achieve an efficient and penetrating application in hard-to-access riparian areas. Liquid 2,4-D can also be effectively mixed and applied via backpack sprayer in hard to access areas where it is needed. Granular 2,4-D can be hand applied to the same areas. The proposed treatment regime is detailed in the action plan in the next section. An objective of maintaining a live parrot feather occurrence of zero in a late-season Tier II survey should be pursued for 2010. Curlyleaf pondweed does not appear to be a significant enough problem to warrant treatment at this time, but should be monitored as it could eventually present a secondary issue. The LRHE has expressed agreement with this course of action.

### **Tier 2. Nutrient and Sediment control**

The LRHE should be vigilant in spotting and addressing nutrient and sediment sources in the watershed, stopping pollutants at their source before water quality can be impacted. While parrot feather obviously is not dependant on highly disturbed conditions to thrive in Meserve Lake, the protection of water quality will still be important in the protection of the lake and its overall plant community. Poor water quality could boost the current problem with parrot feather or encourage the growth of other non-natives such as curlyleaf pondweed.

## **12. Action Plan**

### **12.1. Proposed Management Regime for the 2010 Season**

For 2010 a regime incorporating a combination of hand removal of free floating plants and herbicide applications is proposed as the best way to proceed toward the goals and objectives of this plan. Proposed treatment/hand removal areas and acreages are shown on figure 17, page 39. A multiple-treatment regime is proposed utilizing three main management elements as follows:

1. To address persistent growth in shoreline, stream, and wetland areas: Once each month, April through November, free floating plants should be located and hand removed from the perimeter of the lake.
2. Once each month during which shallow parrot feather plants (within 25 feet of shore) are deemed to be present, applications to the entire perimeter of the lake and both the inlet and outlet streams should be performed. To provide good control in conditions of water movement all inlet

and outlet treatments should be performed with Navigate 2,4-D at the rate of 200 pounds per acre. To comply with label limitations and provide a variety of control strategies perimeter treatments should rotate between the use of Navigate 2,4-D applied at 200 pounds per acre, DMA 4 IVM liquid 2,4-D applied at the rate of 2.84 gallons per acre-foot, and Renovate 3 liquid triclopyr applied at the rate of .82 ppm (.74 gallons per acre). There will be a limit of two respective Renovate 3 and DMA 4 IVM shoreline applications performed during the season in compliance with label limitations. No such limitation is currently in effect for Navigate 2,4-D granular. A non-ionic surfactant should be applied with liquid herbicides at the maximum label rate to enhance effectiveness. The treatment schedule/rotation is displayed in more detail in table six, page 40.

**3.** Navigate granular 2,4-D should be applied to the entire littoral zone of the lake (to a depth of 19 feet), including the perimeter and inlet/outlet streams at the rate of 200 pounds per acre in early June. This treatment will be especially important for addressing any plants that attempt to recolonized deeper areas of the lake where parrot feather growth will be most difficult to detect. A period of 60 days should be allowed for that treatment to take effect in the deeper areas of the lake. After that period if any plants are noted growing in deep water or beyond 25 feet from shore Navigate 2,4-D granular herbicide should again be applied at the rate of 200 pounds per acre to the entire littoral zone of the lake including the perimeter and inlet/outlet streams. This treatment will substitute for the regular monthly perimeter treatment if it occurs.

Concerns associated with this aggressive regime include the water-use restrictions that will be imposed and possible impacts on non-target plant and animal species. Triclopyr and 2, 4-D affect primarily plants that are classified as “broadleaf” species. The proposed treatment regime will likely affect the beneficial emergent aquatic plants white water lily and spatterdock as these species are broadleaves. The exact effects the treatments will have are unknown but non-target damage to these plants is expected. If eradication of parrot feather can be achieved these plants can then be reestablished in areas where they have been lost. Wetland shrubs along the shore of the lake such as Common buttonbush (*Cephalanthus occidentalis* L.), could be affected by the treatments. Shoreline vegetation should be inspected for damage periodically as the season progresses. Submersed aquatic plants and other emergent plants present in Meserve are not expected to be significantly affected by this regime and will continue to provide valuable habitat.

As in 2008 many elements of the proposed program are charting new territory. There are no known reports of parrot feather aggressively growing in another Midwest glacial lake. Parrot feather is widely known to be more resistant to herbicides than other species of non-native aquatic plants. Most available information suggests that if eradication is achievable with the current tools available it will take multiple treatments and perhaps multiple seasons to achieve. At present it is recommended that this regime be repeated through 2012. Adjustment may, no doubt, be necessary in 2010 and in future seasons based on plant response or lake user concerns. Alternative control techniques or newly labeled herbicides may also be needed as planning is adjusted in future seasons and new products become available. Table 6 contains a proposed timeline and cost schedule for Meserve Lake. Important program dates for the LRHE in the 2010 season are presented in table 5.

March 15, 2010	IDNR funding decisions
March 20	Send a request for proposals to planning and application contractors due in one week
March 27	Receive bids from contractors
March 31	Select and notify contractor(s)
April 10	Obtain signed contract
May 15	Schedule Lake Association Meeting(s) with contractor (s)
November 1	Last day for contractors to provide maps for management plan or plan updates and schedule a meeting with DNR Fisheries and LARE biologists
December 15	First draft of management plan or plan updates due from contractors
January 15	Grant application due for current year funding
March 1	Final copy of revised plan or update due from contractors

**Table 5. Important dates for the LRHE in 2010.**



	●Success Benchmark A late-season Tier II occurrence of <i>Myriophyllum aquaticum</i> of zero.	Acres	Cost per acre	2010 cost
<b>Month</b>	<b>2010 Season Activity</b>			
<b>April</b>	April, Map and GPS mark deepwater growth if present, check shallow areas for emersed plants, remove free-floating plants			200.00
	If shallow plants present treat entire perimeter with liquid 2,4-D (2.84 gal/ac-ft), treat entire inlet and outlet with granular 2,4-D (200 lbs/ac) remove free-floating plants	3.2	574.00	1836.80
<b>May</b>	May Tier II			1000.00
	Map and GPS mark deepwater growth if present, check shallow areas for emersed plants, remove free-floating plants			200.00
	If shallow plants present treat entire perimeter with liquid 2,4-D (2.84 gal/ac-ft), treat entire inlet and outlet with granular 2,4-D, remove free-floating plants	3.2	574.00	1836.80
<b>June</b>	Map and GPS mark deepwater growth if present, check shallow areas for emersed plants, remove free-floating plants			200.00
	Treat entire littoral zone, inlet/outlet, and entire perimeter with 2,4-D gran. (200 lbs/ac)	14.7	698.00	10260.60
	June, public meeting as arranged with IDNR and Life of Riley			200.00
<b>July</b>	Map and GPS mark deepwater growth if present, check shallow areas for emersed plants, remove free floating plants			200.00
	If shallow plants present treat entire perimeter with triclopyr liquid .82 ppm, .74 gal/ac., treat entire inlet and outlet with granular 2,4-D (200 lbs/ac) remove free-floating plants	3.2	333.00	1065.60
<b>August</b>	Map and GPS mark deepwater growth if present, check shallow areas for emersed plants, remove free-floating plants			200.00
	If deep plants present, treat entire littoral zone, inlet/outlet, and entire perimeter with 2,4-D gran. (200 lbs/ac) remove free-floating plants (optional timing as needed through the end of the 2010 season)	14.7	698.00	10260.60
	If shallow plants present treat entire perimeter with triclopyr liquid .82 ppm, .74 gal/ac., treat entire inlet and outlet with granular 2,4-D (200 lbs/ac) remove free-floating plants	3.2	333.00	1065.60
	August, late season Tier II Survey			1000.00
<b>September</b>	Map and GPS mark deepwater growth if present, check shallow areas for emersed plants, remove free-floating plants			200.00
	If only shallow plants present treat entire perimeter, inlet and outlet with granular 2,4-D (200 lbs per acre) ( if no littoral treatment takes place) remove free-floating plants	3.2	698.00	2233.60
<b>October</b>	Map and GPS mark deepwater growth if present, check shallow areas for emersed plants, remove free-floating plants			200.00
	If only shallow plants present treat entire perimeter, inlet and outlet with granular 2,4-D (200 lbs per acre) ( if no littoral treatment takes place) remove free-floating plants	3.2	698.00	2233.60
	October/November, Permit Meeting			200.00
<b>November</b>	Map and GPS mark deepwater growth if present, check shallow areas for emersed plants, remove free-floating plants			200.00
	If only shallow plants present treat entire perimeter, inlet and outlet with granular 2,4-D (200 lbs per acre) ( if no littoral treatment takes place) remove free-floating plants	3.2	698.00	2233.60
	Misc. spot treatments with granular 2,4-D or liquid 2,4-D	2	698.00	1396
<b>December</b>	Plan Update Document Due			1700.00
	<b>Total Cost</b>			<b>40123.00</b>

**Table 6. 2010 Meserve Lake proposed treatment regime.**

### 13. Education

Proper education of lake users and other area residents can help prevent the spread of parrot feather from Lake Meserve. An active and ongoing effort should be made to make lake users aware of the possible presence of this plant, especially in Steuben County.

In 2009 educational efforts included the presentation of information about parrot feather and other invasive plants at the February 2009 Steuben County Lakes Council (SCLC) and June 2009 meeting Life of Riley Estates meetings discussed in section 10. The February meeting was also followed up by a series of radio announcements about the topic and an article published in the local newspaper. In September 2009 the SCLC also held a fall lake management forum at which IDNR presented a workshop to help local residents understand, identify, and prevent the spread of parrot feather and other invasive aquatic species. Events like these should continue to serve as forums for disseminating information about parrot feather and other invasives.

The Indiana Lakes Management Society's annual conference and sponsored workshops will be excellent opportunities to increase awareness of this plant as a potential new invader. A short article provided to lake associations for inclusion in their newsletters or information presented on association websites could also prove helpful. Educating local lake users can also potentially prevent a very costly new infestation of invasive plants or animals at Meserve Lake. Meserve Lake does not appear to contain Eurasian watermilfoil. This plant could easily be transported into the lake on a boat trailer.

Most crucial will be the prevention of the transport of parrot feather plant fragments out of the lake. LRHE personnel should carefully screen incoming and outgoing boat trailers to insure no plant fragments are transported. Signage should be placed at the boat ramp to inform those who use the lake of precautions to be taken. Lake users should be informed that parrot feather plants present should not be disturbed as fragmentation can occur very rapidly, spreading the plants. The present LRHE policy of discouraging the use of gasoline outboards at the lake is helpful in preventing fragmentation and spread.

#### **14. Monitoring and Evaluation of Plan**

Two Tier II surveys should be planned in 2010 utilizing the same Tier II waypoints as in previous seasons. Careful monthly observations should be made at the lake to determine the extent of shallow or deep growing plants present. Ultimately the reaction the parrot feather plants will have to the treatment regimes underway is not well understood as a track record of treatment of this plant in this particular situation does not exist. Management activities must be adjusted as needed in accordance with plant response. This plan should be updated annually and contractors and consultants should correspond with IDNR frequently to provide relevant information about the progress of field work and treatment.

## **15. Literature Cited**

Pearson, J. 2004, A sampling method to assess occurrence, abundance and distribution of submersed aquatic plants in Indiana lakes, Indiana Department of Natural Resources, Division of Fish and Wildlife, Tri-Lakes Fisheries Station, 5570 North Hatchery Road Columbia City, Indiana 46725

Tier II Aquatic Vegetation Survey Protocol. Indiana Department of Natural Resources. Division of Fish and Wildlife. 402 W. Washington St. Rm W-273. Indianapolis, IN 46204. May 2007

Aquatic Enhancement 2008, Aquatic Vegetation Management Plan 2008-2012, Meserve Lake, Steuben County, Aquatic Enhancement & Survey, Inc., Angola, Indiana 46703

**Appendix A**  
**Tier II Plant Survey Data Sheets**

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

CHA 1

WATERBODY NAME: MESERVE				DATE: 5/26/09														
COUNTY: STEUBEN				SECCHI DEPTH (FT): 8.5"														
SITE ID:				MAX PLANT DEPTH (FT):														
SURVEYING ORGANIZATION: AQUATIC ENHANCEMENT				WEATHER: CLOUDY, 60° E 5MPH - 10 MPH														
CREW LEADER: S.A.B.				COMMENTS (Include voucher codes - V1, V2...):														
RECORDER: K.A.B.																		
CONTACT INFO: 260-665-8226				Rake score (1, 3, 5) = algae, emergent or species observed but not sampled.														
				Species Codes:														
Point #	R/T	Latitude	Longitude	Depth (ft)	CHA	POTILL	STU/EC	NAJFLE	NAJMAR	UTRANAC	MYR ARV	POTPOV	ELCAN	AGRI/DE RIK.	POTCRI	VALAME	FA	Notes
1				4	5													
2				2.5	1	1												
3				8.5		1												
4				16	3													
5				21														
6				16														
7				8	1								1					
8				2	3													
9				15.1	1													
10				1.5	5													
11				13	1													
12				1.5	1													
13				14	1													
14				1.8	1													
15				18														
16				21														
17				22														
18				19														
19				17	1													
20				12	1										1			
21				1.5	1													
22				2														
23				6	1													P
24				14.5											1			
25				10.2							3							
26				1	5													
27				3.5		5												
28				1	1	1												
29				18.5														
30				20.1														
Other plant species observed at lake:																		

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

WATERBODY NAME: <u>MESERVE</u>				DATE: <u>5/26/09</u>												
COUNTY: <u>STEBEN</u>				SECCHI DEPTH (FT):												
SITE ID:				MAX PLANT DEPTH (FT):												
SURVEYING ORGANIZATION: <u>AQUATIC ENHANCEMENT</u>				WEATHER: <u>CLOUDY, 60° E 5MPH - 10 MPH</u>												
CREW LEADER: <u>S.A.B.</u>				COMMENTS (Include voucher codes - V1, V2...):												
RECORDER: <u>K.A.B.</u>																
CONTACT INFO: <u>260-665-8226</u>				Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.												
Species Codes:																
Point #	R/T	Latitude	Longitude	Depth (ft)	CHA	POTILL	STUPEC	NAJFLE	NET MAR	UTRIMAC	MYR AQU	POTPVS	ELCAN	Variable FW	POTCRI	Notes
1				1.5	1		1									
2				1	1											
3				6	1											
4				21												
5				6	1											
6				21.5												
7				15.2	5											
8				5.5	3											
9				3.5	5											
10				2	5		1									
11				1.5	5											
12				4.5	5											
13				3.5	3		1							1		
14				19.5												
15				22												
16				8.5	1	3										
17				14.9	1											
18				16	1											
19				9	1											
20				6	1											
21				5.1	5	1										
22				1	5	1										
23				14.5	1		1								1	
24				21.5												
25				20.5												
26				10.5	1											
27				21.5												
28				1.5	1											
29				14	1							1				
30				13												
Other plant species observed at lake:																

T2  
T2  
↓

North 411573643 (2)  
W 084.997608

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

WATERBODY NAME: <u>Meserve</u>					DATE: <u>8-3-2009</u>													
COUNTY: <u>Steuben</u>					SECCHI DEPTH (FT): <u>(At T215) 12 ft</u>													
SITE ID:					MAX PLANT DEPTH (FT):													
SURVEYING ORGANIZATION: <u>Aquatic Enhancement</u>					WEATHER: <u>Sunny 3V 5 mph</u>													
CREW LEADER: <u>Scott Benfield</u>					COMMENTS (include voucher codes - V1, V2...):													
RECORDER: <u>Joseph Closson</u>																		
CONTACT INFO: <u>(260) 665-8226</u>					Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled. Species Codes:													
Point #	R/T	Latitude	Longitude	Depth (ft)	Chara	ALGAE	POTGRA											Notes
1	T			4	5													
13 T2	<del>T2</del>			4	5													
3	T			12														
7	<del>T26</del>			12.5		9												
	T214			18.5														
2	T			2.5	1		1											
	T212			3.5	5													
	T211			1.5	5													
4	<del>T212</del>			14.5	3													
	T210			3.5	5													
	T27			17														
	T225			20.5														
	T224			20														
	30			19.5														
	T215			22														
	T26			21.5														
	T227			21														
	5			20														
	6			19														
	8			4														
	T224			8.5														
	T28			9	1													
	T23			8	1													
	T223			14	3													
	T24			21														
	89			20														
	T230			13														
	T222			1	5													
	T25			10.5	1													
	28			2	1													
Other plant species observed at lake:					<u>TRM AL, VALAME</u>													

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

WATERBODY NAME: <u>Meserve</u>				DATE:												
COUNTY:				SECCHI DEPTH (FT):												
SITE ID:				MAX PLANT DEPTH (FT):												
SURVEYING ORGANIZATION:				WEATHER:												
CREW LEADER:				COMMENTS (Include voucher codes - V1, V2...):												
RECORDER:																
CONTACT INFO:				Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.												
				Species Codes:												
Point #	R/T	Latitude	Longitude	Depth (ft)	Chara	ALGAE	POTGRA	WIRMAK	STUPEE							Notes
24	T			15	5											
19	T			17.5	1											
T218	T			16.5												
27	T			3		5		1								
25	T			10.5	5											
26	T			1.5	5											
23	T			8	5											
21	T			3	3	3										
T220	T			4	5	1										
20	T			12	5	1										
23	T			6												
T21	T			1	1			1								
T217	T			14	1											
T228	T			1	1											
22	T			2		9										
T229	T			15.5	1											
T216	T			5	1	9	1									
15	T			18.5												
16	T			20.5												
17	T			22												
18	T			19												
11	T			15.5	5											
9	T			15	5											
10	T			4	1											
12	T			1	1											
13	T			13												
14	T			2	5											
T21	T			3	1			1								
T22	T			.5	1			1								
T29	T			6	5											
Other plant species observed at lake:																

**Appendix B**  
**Tier II Plant Survey Waypoint Coordinates**

Latitude(deg)	Longitude (deg)	wpt
41.574320,-84.999825		8-30-08,001
41.574207,-84.999292		8-30-08 002,
41.574179,-84.999078		8-30-08 003,
41.573783,-84.999025		8-30-08 004,
41.573916,-84.998330		8-30-08 005,
41.574328,-84.997950		8-30-08 006,
41.574471,-84.998605		8-30-08 007,
41.574530,-84.997880		8-30-08 008,
41.574269,-84.997307		8-30-08 009,
41.574443,-84.997174		8-30-08 010,
41.574244,-84.997010		8-30-08 011,
41.574372,-84.996670		8-30-08 012,
41.574110,-84.996487		8-30-08 013,
41.574179,-84.996218		8-30-08 014,
41.573807,-84.996244		8-30-08 015,
41.573543,-84.996565		8-30-08 016,
41.573611,-84.997088		8-30-08 017,
41.573953,-84.996879		8-30-08 018,
41.573364,-84.995890		8-30-08 019,
41.573221,-84.995268		8-30-08 020,
41.573389,-84.995093		8-30-08 021,
41.573800,-84.995389		8-30-08 022,
41.572821,-84.994979		8-30-08 023,
41.572911,-84.995529		8-30-08 024,
41.572562,-84.995021		8-30-08 025,
41.572318,-84.994785		8-30-08 026,
41.572599,-84.995527		8-30-08 027,
41.572781,-84.995825		8-30-08 028,
41.573190,-84.996433		8-30-08 029,
41.573274,-84.997828		8-30-08 030,

Latitude(deg)	Longitude (deg)	wpt
41.572719,-84.997164	T2	8-30-08 001
41.572774,-84.997632	T2	8-30-08 002,
41.572938,-84.997771	T2	8-30-08 003,
41.573245,-84.996956	T2	8-30-08 004,
41.572813,-84.996590	T2	8-30-08 005,
41.573945,-84.997678	T2	8-30-08 006,
41.573465,-84.998450	T2	8-30-08 007,
41.573097,-84.998216	T2	8-30-08 008,
41.572864,-84.998049	T2	8-30-08 009,
41.573285,-84.998891	T2	8-30-08 010,
41.573422,-84.999312	T2	8-30-08 011,
41.573821,-84.999576	T2	8-30-08 012,
41.574085,-84.999802	T2	8-30-08 013,
41.574206,-84.998381	T2	8-30-08 014,
41.573642,-84.997608	T2	8-30-08 015,
41.574034,-84.995967	T2	8-30-08 016,
41.573599,-84.995711	T2	8-30-08 017,
41.573231,-84.995662	T2	8-30-08 018,
41.572940,-84.996134	T2	8-30-08 019,
41.573109,-84.995058	T2	8-30-08 020,
41.572991,-84.994964	T2	8-30-08 021,
41.572700,-84.996250	T2	8-30-08 022,
41.572965,-84.997310	T2	8-30-08 023,
41.573600,-84.998004	T2	8-30-08 024,
41.573744,-84.998366	T2	8-30-08 025,
41.574357,-84.998919	T2	8-30-08 026,
41.573955,-84.998066	T2	8-30-08 027,
41.573553,-84.995085	T2	8-30-08 028,
41.573820,-84.995974	T2	8-30-08 029,
41.572947,-84.996423	T2	8-30-08 030,

**Appendix C**  
**Application for IDNR Aquatic Vegetation Control Permit**



**APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT**

State Form 26727 (R / 11-03)  
 Approved State Board of Accounts 1987  
 Whole Lake  Multiple Treatment Areas  
 Check type of permit

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

INSTRUCTIONS: Please print or type information

FEE: \$5.00
-------------

Applicant's Name Paul Clark, Life of Riley Home Estates		Lake Assoc. Name Life of Riley Home Estates	
P.O. Box 146		Phone Number 260-475-5949	
City and State Pleasant Lake, IN		ZIP Code 46779	
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number	
Rural Route or Street		Phone Number	
		ZIP Code	

Lake (One application per lake) Meserve Lake	Nearest Town Pleasant Lake	County Steuben
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 # 1	LAT/LONG or UTM's N 41 deg 34.474' W 84 deg 59.919'		
Total acres to be controlled 3.2	Proposed shoreline treatment length (ft) 4341	Perpendicular distance from shoreline (ft) 25'	
Maximum Depth of Treatment (ft) 5	Expected date(s) of treatment(s) 4/15/10, 5/15/10, 6/15/10, 7/15/10, 8/15/10, 9/15/10, 10/15/10, 11/15/10		
Treatment method: <input checked="" type="checkbox"/> Chemical <input checked="" type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical			

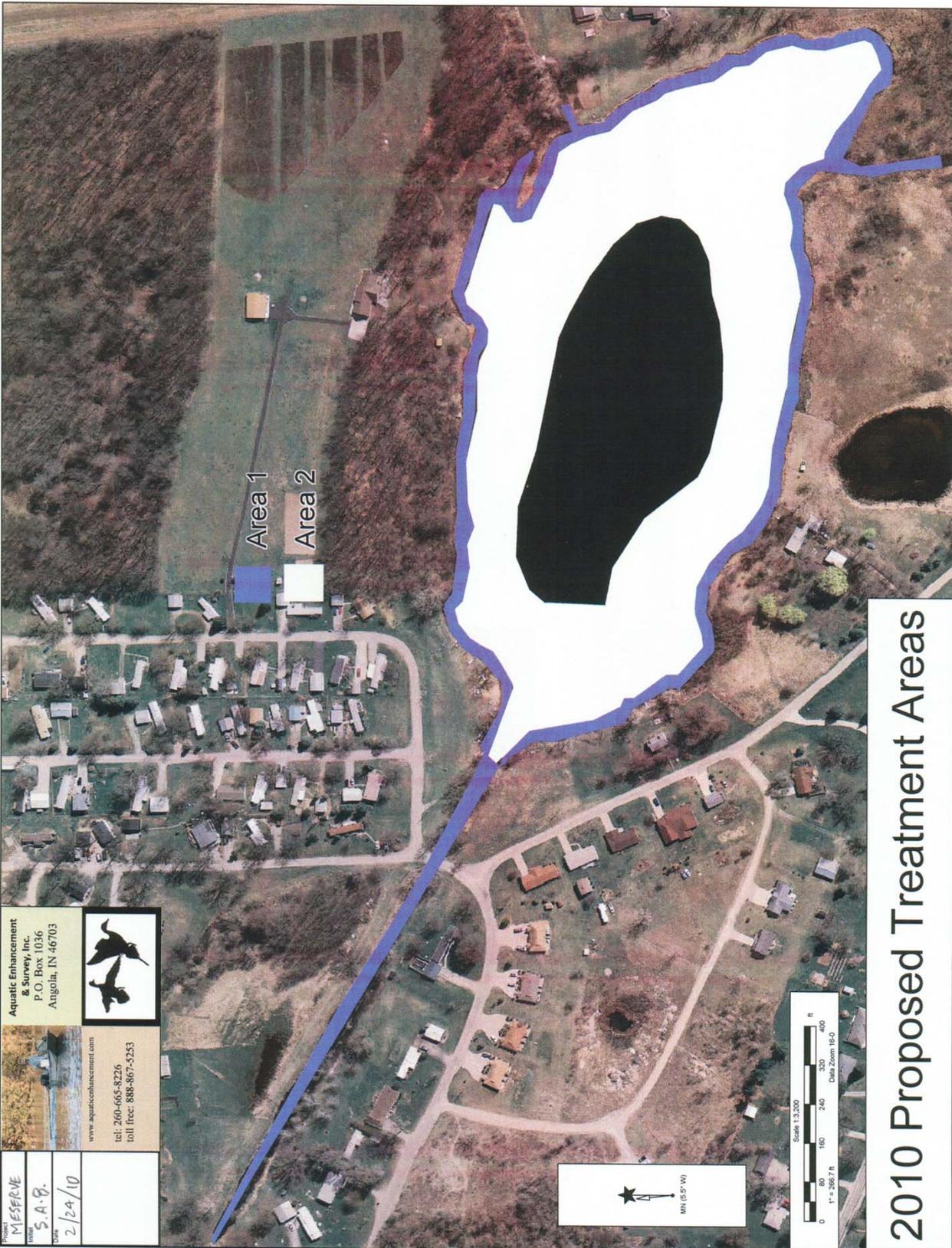
Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Renovate 3; 2,4-D liquid, or 2,4-D granular, spot or marginal broadcast treatment, or hand pulling

Plant survey method:  Rake  Visual  Other (specify) \_\_\_\_\_

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
chara		54
spiny naiad		18
Illinois pw		12
parrot feather	X	2
creeping bladderwort		6
common bladderwort		4
small pondweed		2
sago pondweed		2



		
PROJECT	MESERVE	Aquatic Enhancement & Survey, Inc. P.O. Box 1036 Angola, IN 46703
OWNER	S.A.G.	
DATE	2/24/10	www.aquaticenhancement.com
		tel: 260-665-8226 toll free: 888-867-5253



# 2010 Proposed Treatment Areas