



Curlyleaf Pondweed in Fish Lake, Scott County, MN, on April 17, 2012

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## Fish Lake, Scott County, Curlyleaf Pondweed Assessment for 2012

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Assessment Dates: April 17 and June 5, 2012

Prepared for:  
Prior Lake/Spring Lake  
Watershed District  
Prior Lake, Minnesota



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# Fish Lake, Scott County, Curlyleaf Pondweed Assessment for 2012

**Overview:** Two assessments were conducted in Fish Lake within the 15.5 acre area that was treated with an endothall herbicide from 2005-2008 (shaded dark blue in Figure 1). The first assessment was on April 17 and the second one was on June 5, 2012. No herbicides have been used in the 15.5 acre area in 2009 through 2012. In the first assessment in 2012 curlyleaf pondweed was found at 10 out of the 11 sites monitored. On the second assessment, curlyleaf had increased in abundance at several areas. Overall curlyleaf growth has been mostly light to moderate in the last few years but there were several acres of heavy curlyleaf growth in 2012.

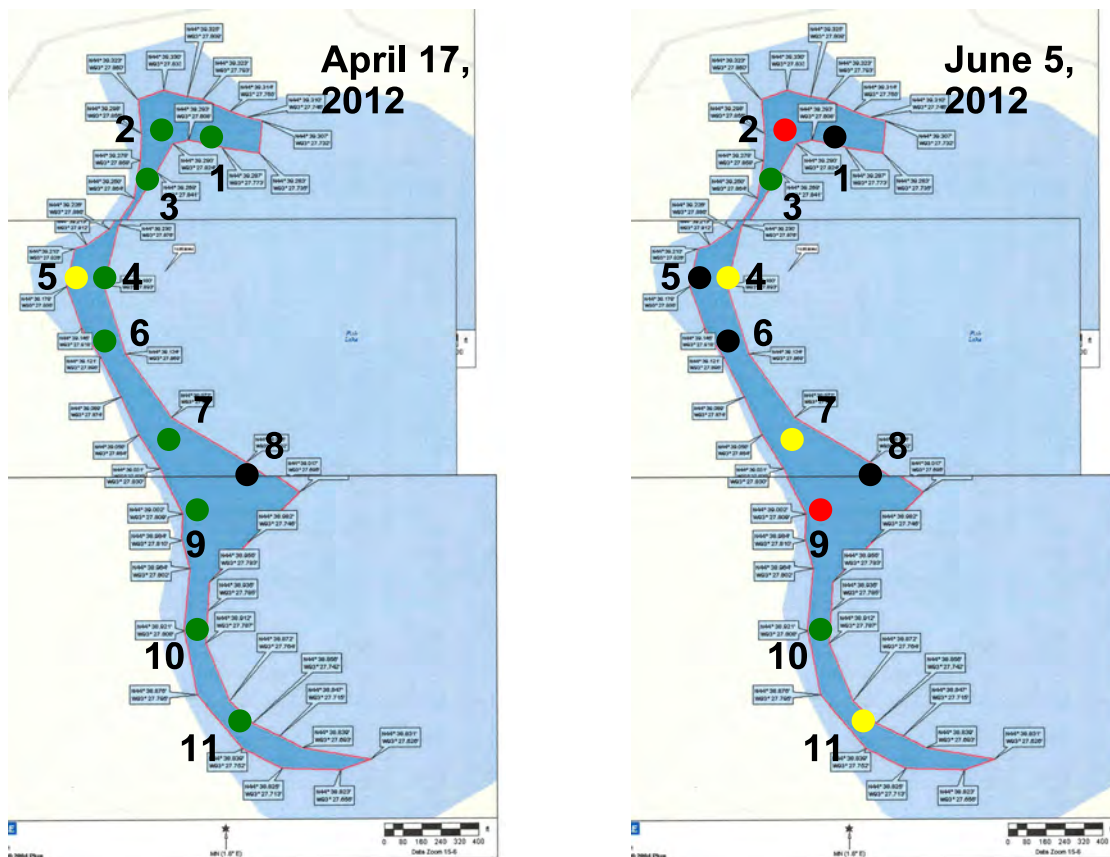
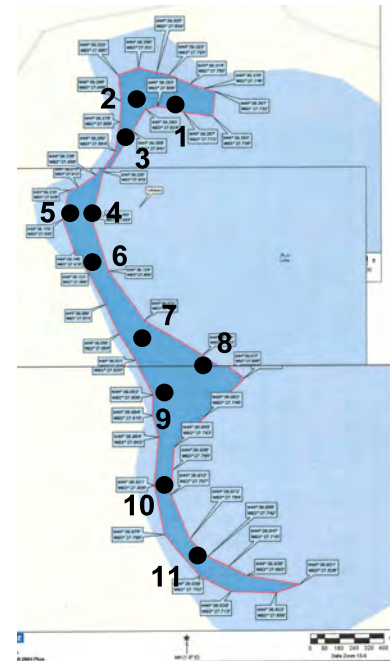


Figure 1. [left] Eleven sites within an area that was treated from 2005-2008 (dark blue shading) were monitored in April and curlyleaf was detected at nine sites at low densities (green dots) and at one site at a moderate density (yellow dot). [right] In June, the same sites were monitored and curlyleaf was detected at seven sites. Growth of curlyleaf pondweed was heavy at Sites 2 and 9, moderate at Sites 4, 7, and 11 and light at Sites 3 and 10.

**Curlyleaf Pondweed Distribution in 2012:** Curlyleaf density on April 17, 2012 was light, with a density of 1 at nine sites with the number of stems on the rake ranging from 1-13 (Table 1). Site 5 had the most stems, but treatment was not recommended. On June 5, 2012 the same 11 sites were checked again. Curlyleaf had increased in density and was highest at Sites 2 and 9 (Table 1 and Figure 2). Although curlyleaf was fairly widely distributed, its density was mostly light to moderate except for Sites 2 and 9 in June.

**Table 1. Curlyleaf density on a scale from 1 to 5 with 5 the highest and the number of stems collected on the sample rake. Curlyleaf growth was light in April and more abundant in June, but not excessive.**

Site	Depth (ft)	April 17, 2012		June 5, 2012	
		Density	Stems/Rake	Density	Stems/Rake
1	5-7	1	3	--	
2	4-5	1	4-7	4.5	
3	4-7	1	3	1	
4	6	1	2	3	
5	4	2	13	--	
6	3-5	1	1	--	
7	5-8	1	3-4	3	
8	8-11	--		--	
9	5-6	1	2	4.5	
10	5-6	1	2	1-2	1
11	6-9	1	1	3	



**Sample site locations.**



**Figure 2. [left] Curlyleaf pondweed, underwater view, on April 17, 2012. [right] Curlyleaf pondweed was reaching the surface at a couple areas on June 5, 2012.**



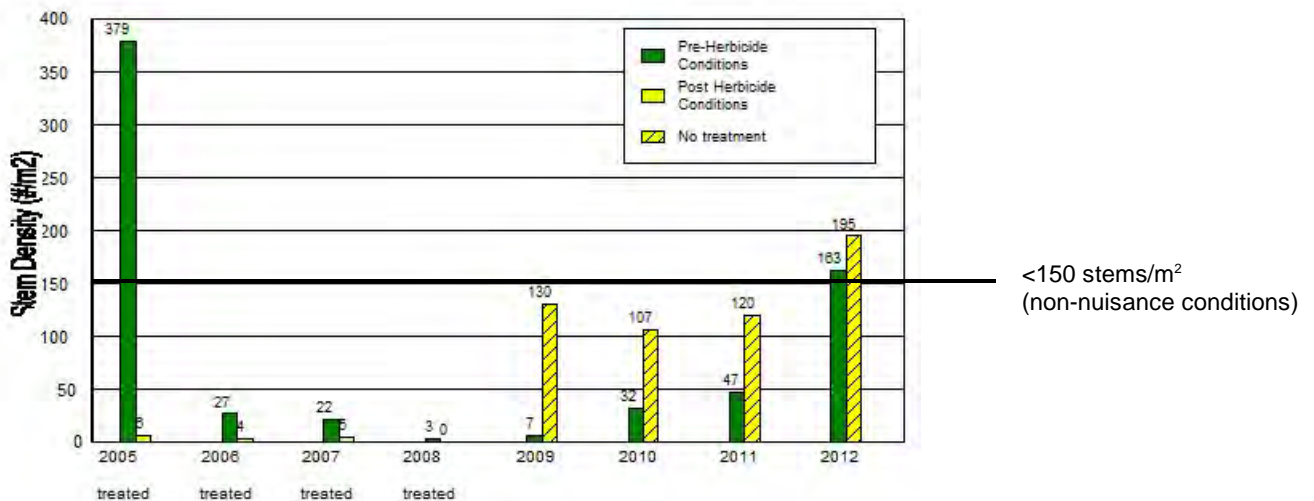
**Curlyleaf Pondweed Stem Densities at Site 4:** Curlyleaf has been monitored at the same site on early and late season dates from 2005 through 2012 (Figure 3). Curlyleaf stem densities were initially high on April 18, 2005. Curlyleaf was treated within this site for four years (2005-2008). No herbicide was used in 2009 through 2012. The early season stem density was 163 stems/m<sup>2</sup> on April 17, 2012, which was higher compared to Years 2006-2011. The next sample date on June 5, 2012, curlyleaf stem density increased to 195 stems/m<sup>2</sup> (Table 1 and Figure 4).

**Table 1. Summary of curlyleaf pondweed stem densities for both pre and post herbicide conditions in Fish Lake.**

	Stem Density (#/m <sup>2</sup> )	
	Pre-Herbicide Conditions	Late Spring Conditions
<b>2005 (treated)</b>	<b>379</b> (n=10) (April 18)	<b>6</b> (n=10) (May 23)
<b>2006 (treated)</b>	<b>27</b> (n=10) (April 25)	<b>4</b> (n=10) (June 2)
<b>2007 (treated)</b>	<b>22</b> (n=10) (April 16)	<b>5</b> (n=10) (June 5)
<b>2008 (treated)</b>	<b>3</b> (n=10) (April 29)	<b>0</b> (n=10) (June 13)
<b>2009</b>	<b>7</b> (n=10) (April 23)	<b>130</b> (n=10) (June 10)
<b>2010</b>	<b>32</b> (n=10) (April 27)	<b>107</b> (n=10) (June 2)
<b>2011</b>	<b>47</b> (n=10) (May 12)	<b>120</b> (n=10) (June 13)
<b>2012</b>	<b>163</b> (n=10) (April 17)	<b>195</b> (n=10) (June 5)



**Figure 3. Underwater monitoring site (shown with a black dot).**



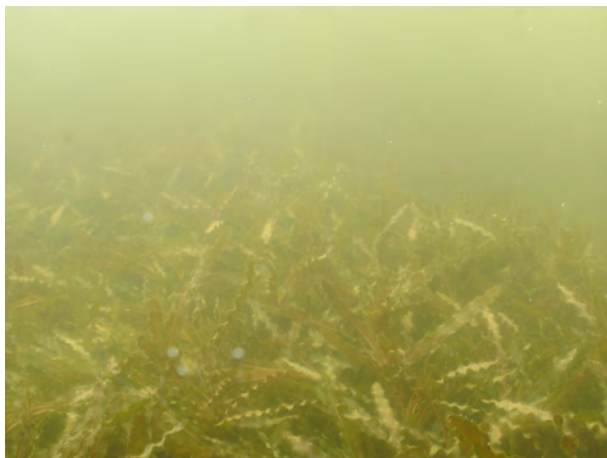
**Figure 4. Average of Fish Lake curlyleaf pondweed stem densities for early season and late season conditions in 2005 through 2012 at a 6.0-foot water depth at the monitoring site shown above.**

**Curlyleaf Pondweed Growth Characteristics in 2012 at the Underwater Monitoring Site (monitoring site is shown in Figure 3)**

**April 17, 2012**



**June 5, 2012**



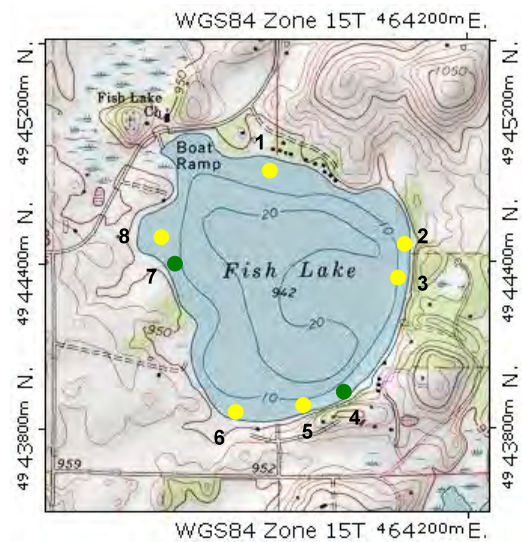
## Fish Lake Curlyleaf Pondweed Growth Potential Based on Lake

**Sediment Characteristics:** Lake sediment sampling results from 2006 have been used to predict lake bottom areas that have the potential to support nuisance curlyleaf pondweed plant growth in Fish Lake. Based on the key sediment parameters of pH, organic matter, and the Fe:Mn ratio (McComas, unpublished), the predicted growth characteristics of curlyleaf pondweed are shown in Table 2 and Figure 5.

Without herbicide applications in Fish Lake, curlyleaf pondweed growth is predicted to produce mostly light to moderate growth (where plants occasionally top out) for a number of locations around Fish Lake (Figure 5).

**Table 2. Fish Lake sediment data and ratings for potential curlyleaf pondweed growth. Sediment collected in 2006.**

Site	Depth (ft)	pH (su)	Organic Matter (%)	Fe:Mn Ratio	Potential for Curlyleaf Pondweed Growth
Light Growth		6.8	5	4.6	Light (green)
Moderate Growth		6.2	11	5.9	Moderate (yellow)
Heavy Growth		>7.7	>20	<1.6	Heavy (red)
1	5	7.6	3.5	2.38	Moderate
2	5	7.7	2.5	4.39	Moderate
3	5	7.7	5.1	3.12	Moderate
4	5	7.6	6.4	4.13	Light
5	5	8.1	0.9	13.33	Moderate
6	5	7.6	3.7	2.56	Moderate
7	5	7.5	2.2	3.32	Light
8	5	7.5	35.7	2.74	Moderate



**Figure 5. Sediment sample locations are shown with a circle. The circle color indicates the potential for nuisance curlyleaf pondweed to occur at that site. Key: green = light; yellow = moderate;**

Light to moderate growth typically is a non-nuisance condition. Non-nuisance growth refers to curlyleaf growth that is mostly below the surface and is not a recreational nor an ecological problem. Heavy growth refers to nuisance matting curlyleaf pondweed. This is the kind of nuisance growth predicted by high sediment pH and a low iron to manganese ratio. A chart showing the three types of growth conditions is shown on the next page.



# Examples of Curlyleaf Pondweed Growth Characteristics

## Light Growth Conditions

Plants rarely reach the surface.

Navigation and recreational activities are not generally hindered.

Stem density: 0 - 160 stems/m<sup>2</sup>

Biomass: 0 - 50 g-dry wt/m<sup>2</sup>

Estimated TP loading: <1.7 lbs/ac

*MnDNR rake sample density equivalent for light growth conditions: 1, 2, or 3.*



## Moderate Growth Conditions

Broken surface canopy conditions.

Navigation and recreational activities may be hindered.

Lake users may opt for control.

Stem density: 100 - 280 stems/m<sup>2</sup>

Biomass: 50 - 85 g-dry wt/m<sup>2</sup>

Estimated TP loading: 2.2 - 3.8 lbs/ac

*MnDNR rake sample density equivalent for moderate growth conditions: 2, 3 or sometimes, 4.*



## Heavy Growth Conditions

Solid or near solid surface canopy conditions.

Navigation and recreational activities are severely limited.

Control is necessary for navigation and/or recreation.

Stem density: 400+ stems/m<sup>2</sup>

Biomass: >300 g-dry wt/m<sup>2</sup>

Estimated TP loading: >6.7 lbs/ac

*MnDNR rake sample density has a scale from 1 to 4. For certain growth conditions where plants top out at the surface, the scale has been extended: 4.5 is equivalent to a near solid surface canopy and a 5 is equivalent to a solid surface canopy. Heavy growth conditions have rake densities of a 4 (early to mid-season with the potential to reach the surface), 4.5, or 5.*



# Curlyleaf Pondweed Density and Abundance in Fish Lake, Scott County, 2012

## Introduction

After four years of herbicide applications (2005-2008), no herbicide treatments with Aquathol K (active ingredient is an endothal salt) were conducted in Fish Lake (171 acres) in 2009 through 2012.

The short term objective has been to reduce, to the greatest extent possible, the occurrence of the non-native plant, curlyleaf pondweed. The long-term objective is to reduce the standing crop of curlyleaf pondweed to non-nuisance conditions.

This report summarizes the curlyleaf abundance after four years of annual herbicide treatment. Curlyleaf density was sampled by scuba diving at one site on Fish Lake at a 6-foot depth and was assessed at 11 sites within a 15.5-acre treatment area.



**Figure 1. Herbicides were applied to a 15-acre area from 2005 through 2008. No herbicides were applied in 2009 through 2012.**



## Methods

After four years of herbicide treatments on 15.5 acres (from 2005-2008), no Aquathol K was applied to Fish Lake in 2009 through 2012. Two types of surveys, curlyleaf distribution and curlyleaf stem densities were conducted on two dates in 2012. In 2012, plants were sampled on April 17, 2012 when curlyleaf was starting to grow and on June 5, 2012, when curlyleaf was at its peak biomass. Locations of the sample sites are shown in Figure 2.

**Aquatic Plant Distribution Surveys:** In 2012, eleven sites within a former treatment area were monitored with a rake sampler. At each sampling site, water depth, plant species, and abundance of the plant species were recorded.

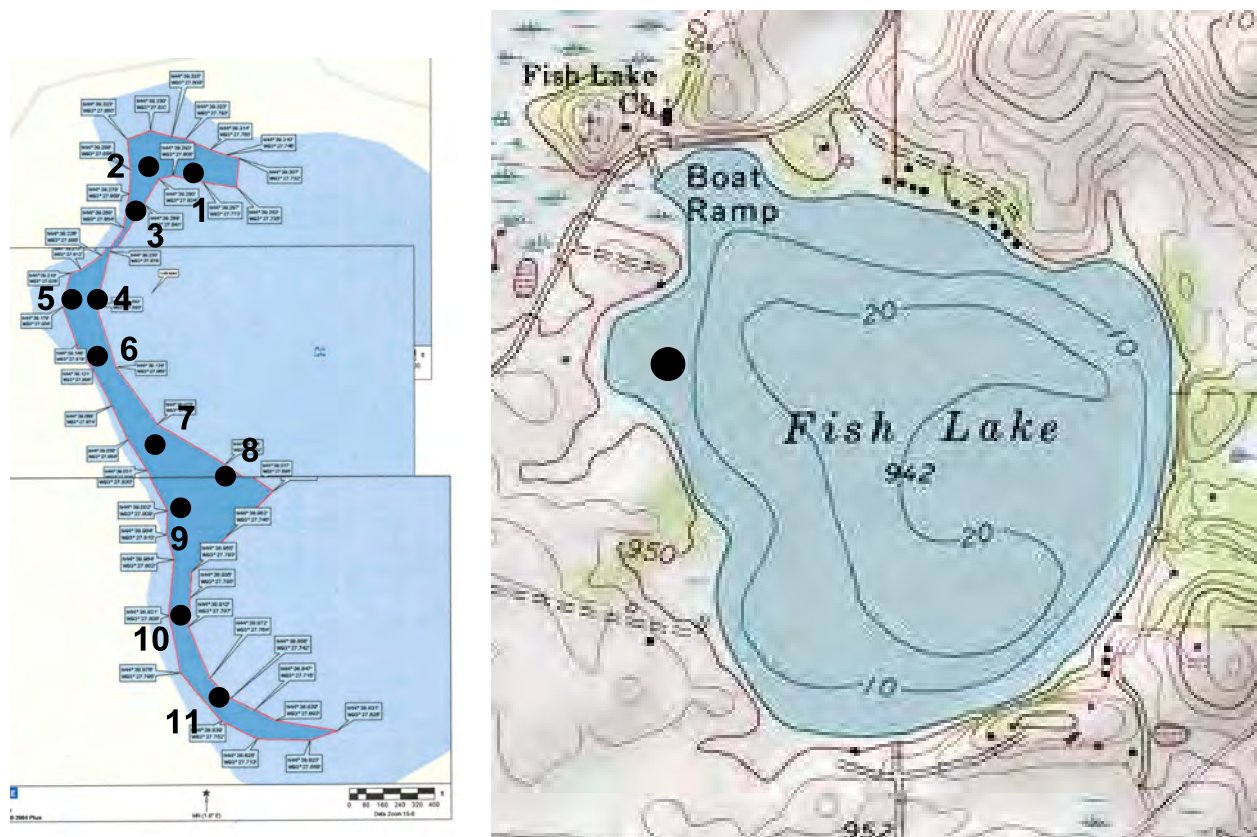
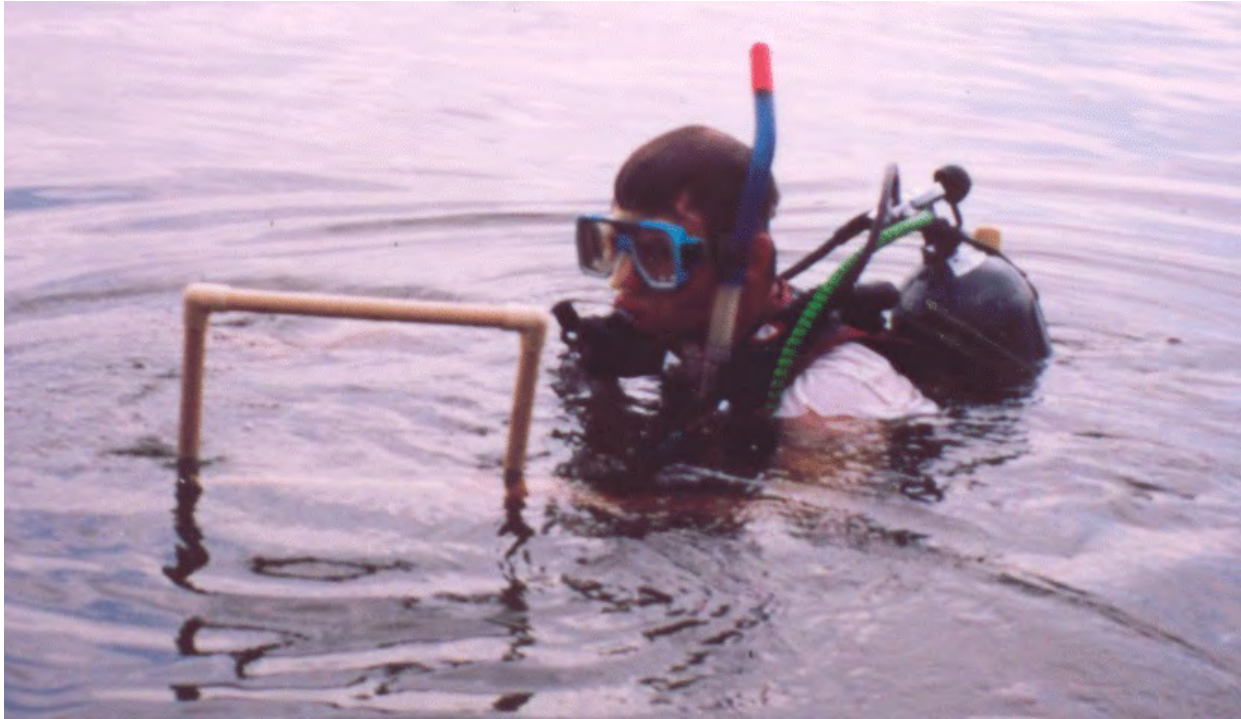


Figure 2. [left] The area treated from 2005-2008 is shown in dark blue is shown on the map to the left. The black dots shows the individual sample sites in the treatment area. Eleven sites were samples on April 17 and June 5, 2012.

[right] Stem density determinations (10 samples) were collected from one site within an area treated from 2005-2012. Stem densities were determined using scuba diving and a 0.1 m<sup>2</sup> quadrat.

**Curlyleaf Stem Density Methods:** In 2012, one depth (5-6 feet) was sampled at one site on two sample dates. At the site, a total of ten curlyleaf stem density samples were taken using a 0.10 m<sup>2</sup> quadrat (Figure 3). The stem density samples were randomly collected along a 50 meter transect line that ran parallel to the shoreline at each station. Other plant species were also counted if present. The counts were made by scuba diving.



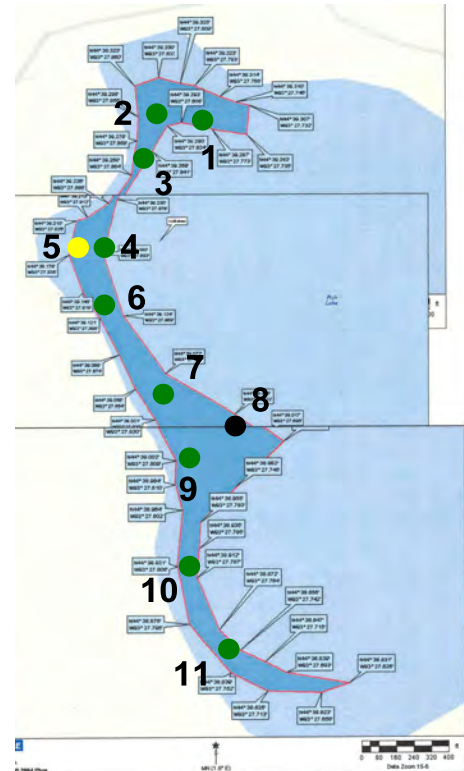
**Figure 3.** A 0.10 m<sup>2</sup> quadrat was used to quantify curlyleaf stem densities.

## Early Spring Curlyleaf Pondweed Assessment in Fish Lake

A total of 11 sites were monitored with rake sampling on April 17, 2012 in areas that previously had been treated for four consecutive years with an endothal herbicide (Figure 4). Curlyleaf was found at 10 sample sites out of the 11 that were monitored (Table 1). In April curlyleaf was present in the treated area but was sparse in density and in distribution.

**Table 1. Aquatic plant densities based on rake sampling for April 17, 2012. Densities are based on a scale from 1 to 3 with 3 being the densest. Curlyleaf stems per rake sample were also noted. Areas with green shading are predicted to have light to moderate growth at the peak of the curlyleaf growth cycle. Areas with yellow shading are predicted to have moderate to heavy curlyleaf growth.**

Sample Site	Depth (ft)	Curly-leaf pondweed	Curlyleaf stems on the rake sampler	Coon-tail	North. water milfoil	Fila algae - benthic	No plants
1	5	1	3			3	
2	4	1	4				
	4	1	7			1	
3	4	1	3	1	1		
	7	--		1			
4	6	1	2	1			
5	4	2	13	1			
6	5	1	1	3	1		
	6	1	3				
8	8	--		2			1
	11	--					
9	6	1	2	2		1	
10	6	1	2	2			
11	6	1	1	2			
	9	--		2			



**Figure 4. Map of sample locations for the April 17, 2012 curlyleaf assessment. Green dots represents curlyleaf pondweed was found at low densities. Black dots represent sample location and no curlyleaf pondweed found. Dark blue shading indicates area of treatment from 2005-2008.**

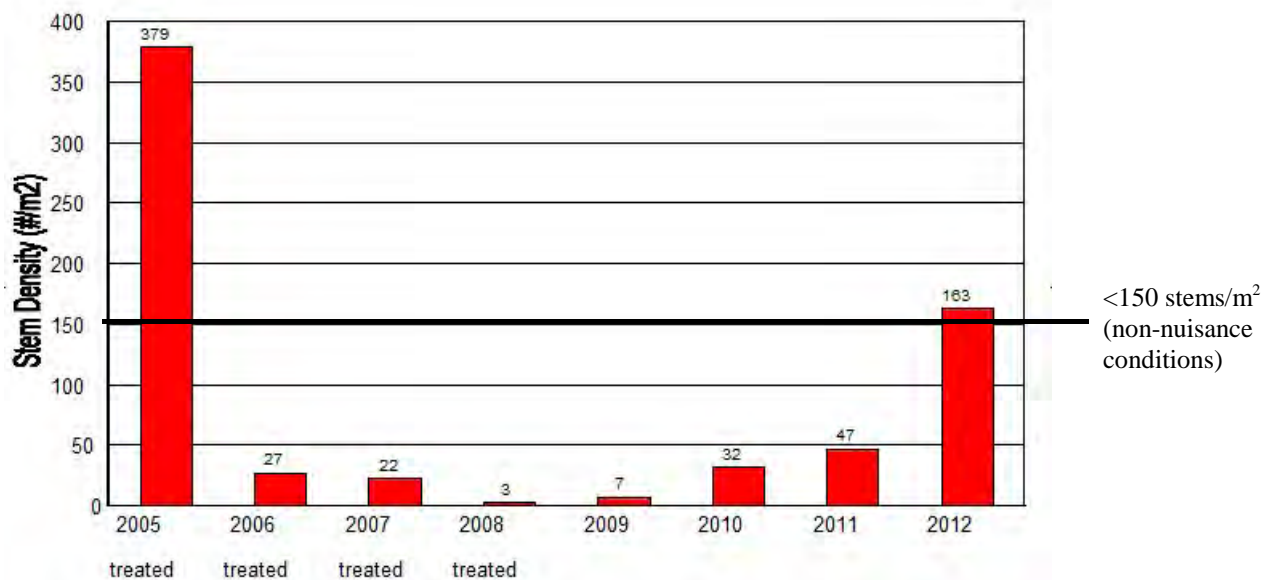


## Curlyleaf Stem Densities at One Location, April 17, 2012

Curlyleaf stem densities were determined by scuba diving at a location between sample sites 4-5 (Figure 1). Ten quadrat samples were taken at this location. The results for 2012 show curlyleaf was found at above nuisance stem densities for the first time since 2006 but are still lower compared to pre-treatment stem densities from 2005 (Table 2 and Figure 5).

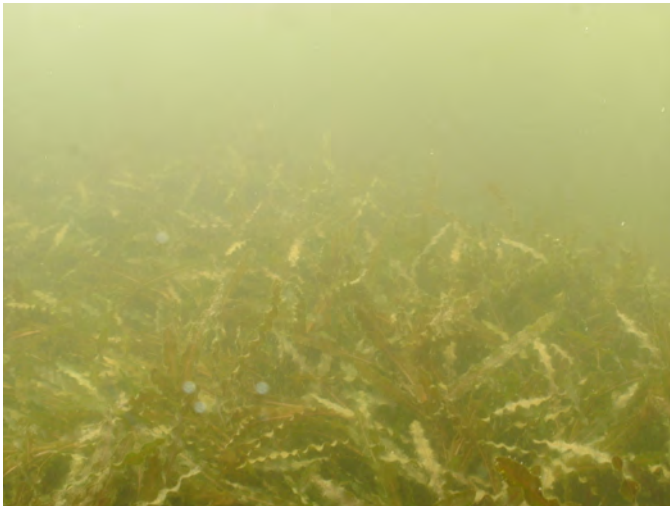
**Table 2. Curlyleaf pondweed stem densities found on April 17, 2012 at Site 5.**

Sample	Site 5	
	4 feet (#/m <sup>2</sup> )	5.5 feet (#/m <sup>2</sup> )
1	120	20
2	180	30
3	90	0
4	220	50
5	90	0
6	240	0
7	30	0
8	280	0
9	360	0
10	20	0
<b>Average</b>	<b>163</b>	<b>10</b>



**Figure 5. Curlyleaf stem densities for early season monitoring (using scuba diving) for 2005-2012.**

## Curlyleaf Conditions in Fish Lake, April 17, 2012



**Figure 6. [top] Curlyleaf was found at low densities at some of the sample sites monitored by scuba diving. [middle and bottom] Curlyleaf pondweed was found at moderate densities at some of the sample sites sampled on April 17, 2012.**

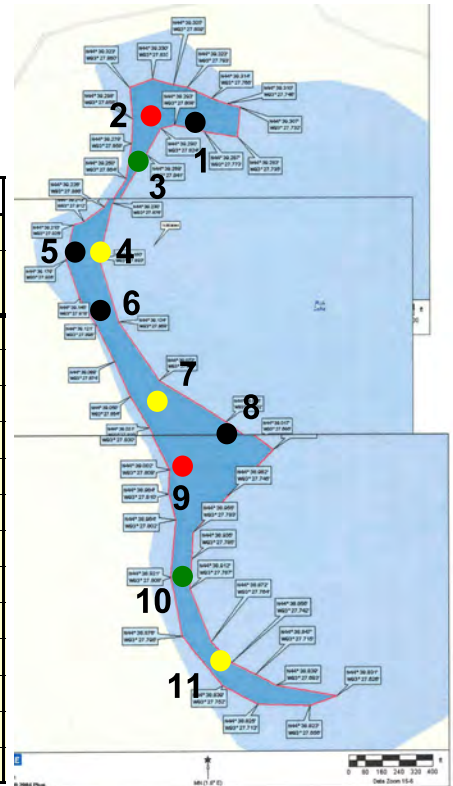
# Late Spring Curlyleaf Pondweed Assessment in Fish Lake

A total of 11 sites were monitored with rake sampling on June 5, 2012 in areas that previously had been treated for four consecutive years with an endothall herbicide. There was no herbicide use in 2012. Curlyleaf was found at 7 out of 11 sample sites. Coontail was found at 9 out of 11 sample sites.

Curlyleaf at Sites 2 and 9 had moderate to heavy growth. This type of growth is sometimes controlled.

**Table 3. Aquatic plant abundance was based on rake sampling for June 5, 2012. Densities are based on a scale from 1 to 5 with 5 being the densest.**

Aquatic Plant Assessment (sampling with a rake)							
Site	Depth (ft)	June 5, 2012					
		Curly-leaf	Spatter-dock	Coon-tail	Flatstem pondweed	Northern watermilfoil	Sago pondweed
1	7			2			
2	5	4.5					
3	6	1		3			
4	6	3		2			
5	4			5			
6	3					2	2
6	4			2		3	
7	5	3		3		2	
8							
9	5	4.5		3			1
10	5	1	2	4	1		
10	6	2					
11	6	3		4			



**Figure 7. Map of sample locations for the June 5, 2012 curlyleaf assessment. Green dots represents curlyleaf pondweed was found at low densities. Yellow dots represents curlyleaf was found at moderate densities. Red dots represents curlyleaf was found at heavy densities. Black dots represents sample location and no curlyleaf found. Dark blue shading indicates area of treatment from 2005-2008.**



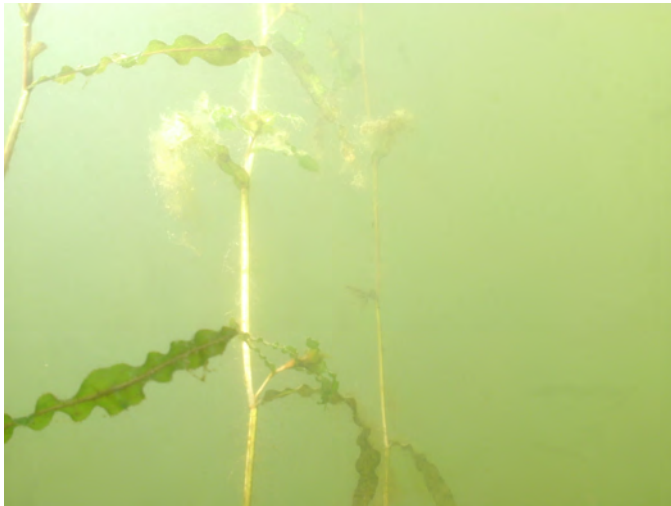
## Curlyleaf Stem Densities at One Location, June 5, 2012

Curlyleaf stem densities were determined by scuba diving at a location between sample sites 4-5 (Figure 1). Ten quadrat samples were taken at this location. The results for 2012 show curlyleaf was found at low stem densities (Table 4).

**Table 4. Curlyleaf pondweed stem densities for June 5, 2012. Samples collected at the 6 foot depth.**

Scuba Diving - June 5, 2012			
Site 4 - 5 Quadrat	Curlyleaf (stems/m <sup>2</sup> )	Coontail (stems/m <sup>2</sup> )	Northern Watermilfoil (stems/m <sup>2</sup> )
1	60	90	0
2	240	10	10
3	290	10	0
4	320	0	10
5	190	0	0
6	170	0	0
7	320	0	0
8	250	0	0
9	50	0	0
10	60	0	0
<b>Ave</b>	<b>195</b>	<b>11</b>	<b>2</b>

## Curlyleaf Conditions in Fish Lake, June 5, 2012



**Figure 8. Curlyleaf pondweed was found at low to moderate densities on June 5, 2012. Samples were monitored by scuba diving.**

## Results for 2005-2012

A summary from the sampling site for curlyleaf pondweed stem densities for pre-herbicide and post herbicide conditions is shown in Table 5.

Stem density results for April conditions were higher in 2012 than in 2006 - 2011. Curlyleaf stem densities for April conditions in 2012 averaged 163 stems/m<sup>2</sup>.

In 2012, stem densities in June were higher compared to years with herbicide treatments but slightly lower compared to 2006.

**Table 5. Summary of curlyleaf pondweed stem densities prior to the effects of herbicide treatment and after the herbicide treatment.**

Site	Stem Density (stems/m <sup>2</sup> )							
	Spring Status							
	5 - 6 foot Depth							
	2005 (Apr 18) (n=10)	2006 (Apr 25) (n=10)	2007 (Apr 16) (n=10)	2008 (Apr 29) (n=10)	2009 (Apr 23) (n=10)	2010 (Apr 27) (n=10)	2011 (May 12) (n=10)	2012 (Apr 17) (n=10)
1	290	50	0	10	10	20	60	120
2	460	0	0	20	10	60	70	180
3	270	0	0	0	20	60	100	90
4	260	10	0	0	0	80	50	220
5	480	20	30	0	30	0	60	90
6	250	80	40	0	0	40	30	240
7	540	60	30	0	0	40	30	30
8	370	20	80	0	0	20	50	280
9	270	30	20	0	0	0	20	360
10	600	30	20	0	0	0	20	20
<b>Ave</b>	<b>379</b>	<b>27</b>	<b>22</b>	<b>3</b>	<b>7</b>	<b>32</b>	<b>47</b>	<b>163</b>

Site	Stem Density (stems/m <sup>2</sup> )							
	Early Summer Status							
	5 - 6 foot Depth							
	2005 (May 23) (n=10)	2006 (June 2) (n=10)	2007 (June 5) (n=10)	2008 (June 13) (n=10)	2009 (June 10) (n=10)	2010 (June 2) (n=10)	2011 (June 13) (n=10)	2012 (June 5) (n=10)
	treated	treated	treated	treated				
1	10	10	0	0	50	70	200	60
2	20	10	0	0	50	120	160	240
3	30	10	0	0	220	20	40	290
4	0	10	10	0	130	20	240	320
5	0	0	30	0	90	10	100	190
6	0	0	10	0	50	360	60	170
7	0	0	0	0	100	140	110	320
8	0	0	0	0	150	90	120	250
9	0	0	0	0	110	230	60	50
10	0	0	0	0	320	10	100	60
<b>Ave</b>	<b>6</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>130</b>	<b>107</b>	<b>119</b>	<b>195</b>



# Subsurface Curlyleaf Pondweed Conditions in Fish Lake in 2005 Through 2012. Herbicides Were Used in 2005-2008.

## Pre-Herbicide (Early) Conditions

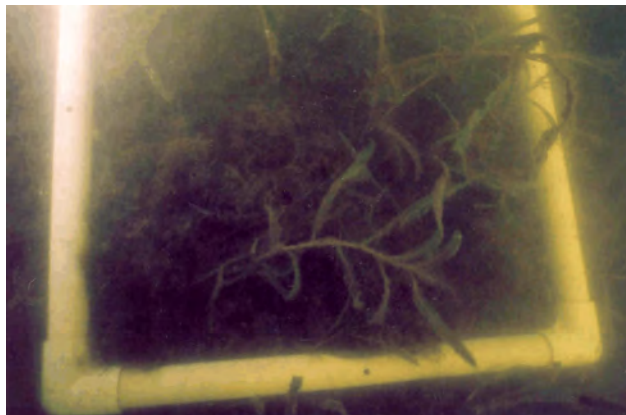
## Post Herbicide (Late) Conditions



April 18, 2005



May 23, 2005



April 25, 2006



June 2, 2006



April 16, 2007



June 5, 2007

**Pre-Herbicide (Early) Conditions**

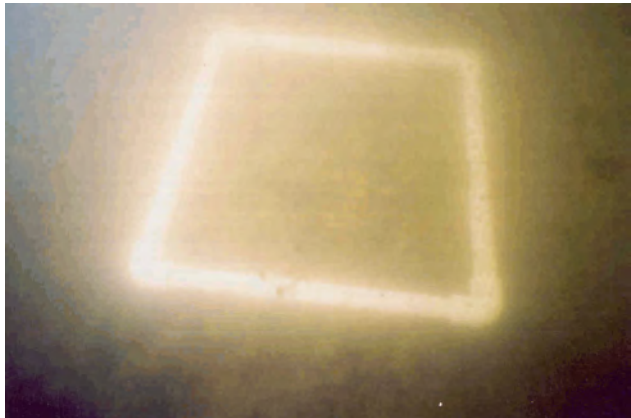
**Post Herbicide (Late) Conditions**



**April 29, 2008**



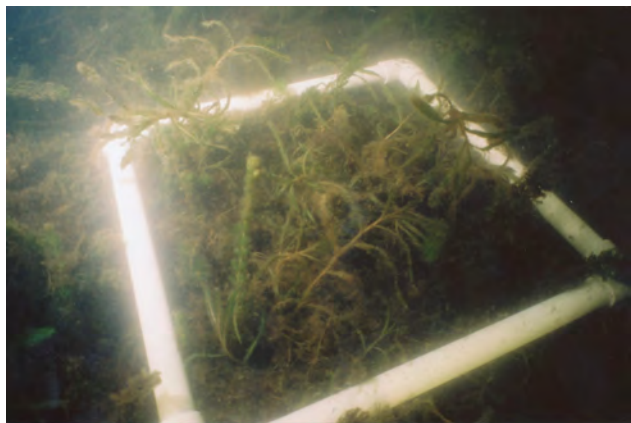
**June 13, 2008**



**April 23, 2009**



**June 10, 2009**



**April 27, 2010**



**June 2, 2010**



**Pre-Herbicide (Early) Conditions**

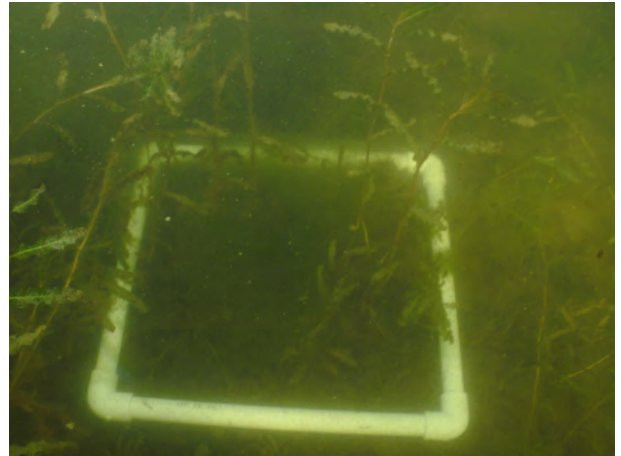


**May 12, 2011**



**April 17, 2012**

**Post Herbicide (Late) Conditions**



**June 13, 2011**



**June 5, 2012**



## Curlyleaf Pondweed Conditions in early June in 2003 and 2005-2012



2003



2005



2006



2007



2008



2009

## Curlyleaf Pondweed Conditions in early June in 2003 and 2005-2012



2010



2011



2012

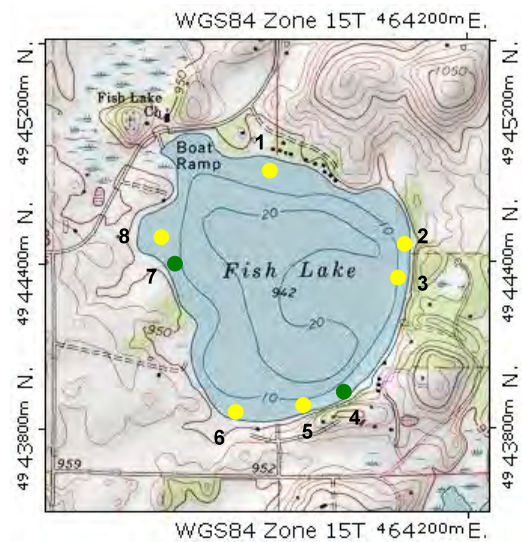
# Predicted Curlyleaf Pondweed Growth Based on Lake Sediment Characteristics

Lake sediment sampling results from 2006 have been used to predict lake bottom areas that have the potential to support nuisance curlyleaf pondweed plant growth in Fish Lake. Based on the key sediment parameters of pH, organic matter, and the Fe:Mn ratio (McComas, unpublished), the predicted growth characteristics of curlyleaf pondweed are shown in Table 6 and Figure 10.

If herbicide applications were to stop in Fish Lake, curlyleaf pondweed growth is predicted to produce mostly light nuisance growth (where plants occasionally top out) for a number of locations around Fish Lake (Figure 10).

**Table 6. Fish Lake sediment data and ratings for potential curlyleaf pondweed growth. Sediment collected in 2006.**

Site	Depth (ft)	pH (su)	Organic Matter (%)	Fe:Mn Ratio	Potential for Heavy Curlyleaf Pondweed Growth
Light Growth		6.8	5	4.6	Low (green)
Moderate Growth		6.2	11	5.9	Medium (yellow)
Heavy Growth		>7.7	>20	<1.6	High (red)
1	5	7.6	3.5	2.38	
2	5	7.7	2.5	4.39	
3	5	7.7	5.1	3.12	
4	5	7.6	6.4	4.13	
5	5	8.1	0.9	13.33	
6	5	7.6	3.7	2.56	
7	5	7.5	2.2	3.32	
8	5	7.5	35.7	2.74	



**Figure 10. Sediment sample locations are shown with a circle. The circle color indicates the potential for nuisance curlyleaf pondweed to occur at that site. Key: green = low; yellow = medium; red = high potential.**

Light nuisance growth has intermediate growth characteristics between non-nuisance and nuisance growth. Non-nuisance growth refers to curlyleaf growth that is mostly below the surface and is not a recreational nor an ecological problem. Heavy growth refers to nuisance matting curlyleaf pondweed. This is the kind of nuisance growth predicted by high sediment pH and a low iron to manganese ratio. A chart showing the three types of growth conditions is shown on the next page.



# Examples of Curlyleaf Pondweed Growth Characteristics

## Light Growth Conditions

Plants rarely reach the surface.

Navigation and recreational activities are not generally hindered.

Stem density: 0 - 160 stems/m<sup>2</sup>  
 Biomass: 0 - 50 g-dry wt/m<sup>2</sup>  
 Estimated TP loading: <1.7 lbs/ac

*MnDNR rake sample density equivalent for light growth conditions: 1, 2, or 3.*



## Moderate Growth Conditions

Broken surface canopy conditions.

Navigation and recreational activities may be hindered.

Lake users may opt for control.

Stem density: 100 - 280 stems/m<sup>2</sup>  
 Biomass: 50 - 85 g-dry wt/m<sup>2</sup>  
 Estimated TP loading: 2.2 - 3.8 lbs/ac

*MnDNR rake sample density equivalent for moderate growth conditions: 2, 3 or sometimes, 4.*



## Heavy Growth Conditions

Solid or near solid surface canopy conditions.

Navigation and recreational activities are severely limited.

Control is necessary for navigation and/or recreation.

Stem density: 400+ stems/m<sup>2</sup>  
 Biomass: >300 g-dry wt/m<sup>2</sup>  
 Estimated TP loading: >6.7 lbs/ac

*MnDNR rake sample density has a scale from 1 to 4. For certain growth conditions where plants top out at the surface, the scale has been extended: 4.5 is equivalent to a near solid surface canopy and a 5 is equivalent to a solid surface canopy. Heavy growth conditions have rake densities of a 4 (early to mid-season with the potential to reach the surface), 4.5, or 5.*



**Conclusions:** At the curlyleaf monitoring site used in this study, prior to a herbicide application in 2005, curlyleaf stem densities were recorded at an average stem density of 379 stems/m<sup>2</sup>. This would put curlyleaf growth into the moderate to heavy growth category. After one season of an herbicide treatment program (in 2005), curlyleaf stem densities were dramatically reduced the following season (2006) in Fish Lake. Stem densities in April of 2006 (prior to the 2006 herbicide treatment) were 27 stems/m<sup>2</sup>.

Because of the low pH in the lake sediments at the sample Site 4 it is predicted that curlyleaf stem densities in the future could regrow to a moderate abundance condition. A low sediment pH (less than 7.7) seems to be a key variable that is correlated with light to moderate curlyleaf growth. In 2006 the sediment pH at the assessment Site 4 was 7.5.

On a lakewide basis, lake sediment results indicate a potential for light to moderate growth for curlyleaf pondweed in Fish Lake. It should be noted that moderate growth of curlyleaf pondweed can be perceived by lake users as a condition that should be managed. This type of curlyleaf growth, which would be predicted to occur if herbicide applications are discontinued in Fish

Lake, represents a slight navigational problem and a moderate phosphorus loading condition.

Within the 15.5 acre treatment area, up to 10 acres could be a candidate area for curlyleaf control with herbicides in 2013 although a treatment area of up to 3 acres is more likely.

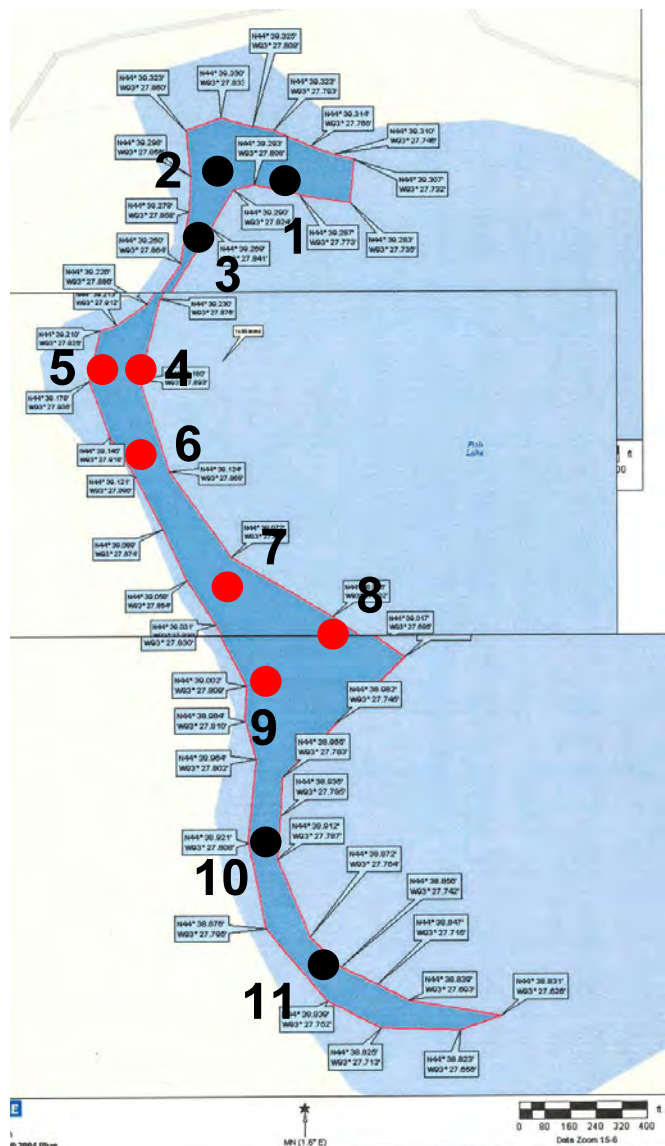


Figure 11. The red dots represent potential treatment areas totaling about 10 acres for 2013.