Eurasian water milfoil (*Myriophyllum spicatum*) Pre/Post Herbicide and Fall Bed Mapping Surveys Lower Vermillion Lake – WBIC: 2098200 Barron County, Wisconsin

EWM raked out of the west bay of Lower Vermillion Lake

Eurasian water milfoil (Berg 2007)

Project Initiated by:

Vermillion Lakes Association, Short, Elliot Hendrickson Inc., and the Wisconsin Department of Natural Resources

Proposed 2012 EWM treatment areas

Survey Conducted by and Report Prepared by:
Endangered Resource Services, LLC
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St. Croix Falls, Wisconsin

May 18 and September 30, 2012

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INTRODUCTION:

Lower Vermillion Lake (WBIC 2098200) is a 215 acres stratified drainage lake in northwestern Barron County, Wisconsin in the Town of Cumberland (T35N R13W S22 SW NE). The lake reaches its maximum depth of 55 feet in the central basin and has an average depth of approximately 25ft (Busch et al 1967). Although limited historical data is available, Lower Vermillion appears to be mesotrophic and water clarity has been fair to good with Secchi readings ranging from 7-12ft (2000-2003). This clarity produced a littoral zone the reached approximately 14ft in the spring of 2012 (WDNR 2012). The north, south, and southeastern shorelines are primarily rocky/sandy while most of the east bay and main basin are organic muck or sandy muck in nature.

Figure 1: Proposed 2012 EWM Treatment Areas

In 2008, the Wisconsin Department of Natural Resources (WDNR) confirmed the presence of Eurasian water milfoil (EWM) (*Myriophyllum spicatum*) in Lower Vermillion Lake, and the Vermillion Lakes Association (VLA) has been actively managing to control this invasive exotic species ever since. Following the 2011 fall EWM bed mapping survey that found EWM in scattered patches throughout the northwest bay near the boat landing, the VLA, under the direction of Short, Elliot, Hendrickson, Inc. (SEH) and in accordance with the WDNR approved Vermillion Lakes Aquatic Plant Management Plan, decided to chemically treat two areas in 2012. Combined, they totaled 1.76 acres or 0.8% of the lake's surface area (Figure 1).

On May 18th, we conducted a pretreatment survey to gather baseline data from the scheduled treatment areas and to allow SEH biologists to finalize treatment plans. Following the August 17th herbicide application, we conducted a September 30th posttreatment survey to evaluate the effectiveness of the treatment. We also conducted a September 30th EWM bed mapping survey to determine where EWM control might be considered in 2013. This report is the summary analysis of these three field surveys.

METHODS:
Pre/Post Herbicide Survey:
As EWM was scattered throughout the northwest bay in the fall of 2011, we generated pre/post survey points throughout this area at 15m resolution. The 127 points were well over the 4-10 pts/acre required by WDNR protocol, but we felt this extra effort was justified as the goals of the survey were to both quantify pretreatment vegetation as well as potentially find new plants/beds (Appendix I).

We located each survey point using a handheld mapping GPS unit (Garmin 76CSx) and used a rake to sample an approximately 2.5ft section of the bottom. All plants on the rake were assigned a rake fullness value of 1-3 as an estimation of abundance, and a total rake fullness for all species was also recorded (Figure 2). Visual sightings of EWM were also noted if they occurred within 6ft of the point. In addition to plant data, we recorded the lake depth using a hand held sonar (Vexilar LPS-1) and the bottom substrate (bottom type) when we could see it or reliably determine it with the rake.

We entered all data collected into the standard APM spreadsheet (Appendix II). These data were then analyzed using the linked statistical summary sheet and the WDNR pre/post analysis worksheet (UWEX 2010). Pre/post treatment differences were determined to be significant at $p < .05$, moderately significant at $p < .01$, and highly significant at $p < .005$.

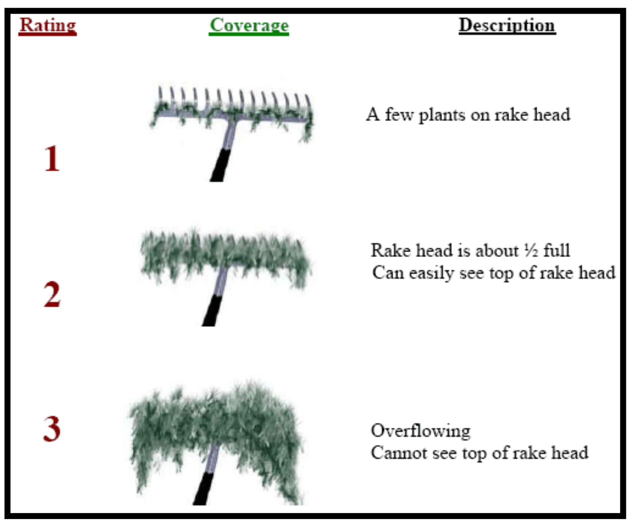


Figure 2: Rake Fullness Ratings

Fall Eurasian Water Milfoil Bed Mapping:
On September 30th, we searched the entire visible littoral zone of the lake and mapped all known beds of EWM. A “bed” was determined to be any area where we visually estimated that EWM made up >50% of the area’s plants and was generally continuous with clearly defined borders. Areas that had a large amount of EWM, but were not canopied or were not dense enough to meet the “bed” criteria, were also mapped and identified as “high density EWM areas”. Although not beds in 2012, these areas have the potential to merge, canopy, and form beds in the future.

After we located a bed, we motored around the perimeter of the area, took GPS coordinates at regular intervals, and estimated the average rake fullness rating of EWM within the bed. Using the WDNR's Forestry Tool's Extension to ArcGIS 9.3.1, we used these coordinates to generate bed shapefiles and determine the acreage to the nearest hundredth of an acre.

RESULTS AND DISCUSSION:

Finalization of Treatment Areas:

Initial expectations were to treat two beds totaling 1.76 acres with granular 2, 4-D (Navigate) at a concentration of 3 ppm in June (Table 1). However, due to a change in leadership on the VLA and uncertainly about who was in charge of applying for the permit/contacting the applicator, this treatment didn't occur until August. At that time, it was determined not to treat Bed 2 as there were high levels of filamentous algae and native plants (Figure 3) (Appendix I).

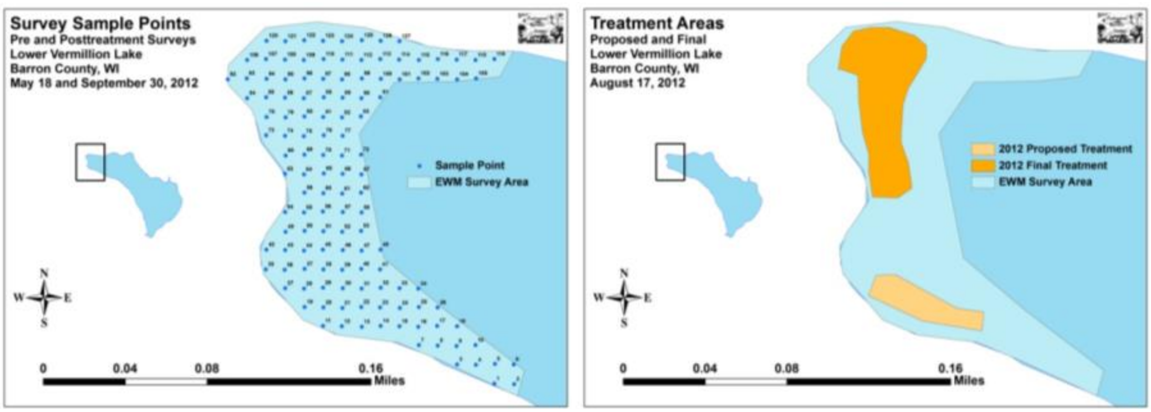


Figure 3: 2012 Survey Sample Points and Final Treatment Areas

Table 1: EWM Treatment Summary
Lower Vermillion Lake – August 17, 2012

Bed Number	Proposed Acreage	Final Acreage	Difference +/-
1	1.32	1.32	0
2	0.44	0	-0.44
Total Acres	**1.76**	**1.32**	**-0.44**

EWM Pre/Post Herbicide Survey:

The treatment area littoral zone extended to a maximum of 14.0ft during the pretreatment survey and 13.5ft during the posttreatment survey. Mean and median depths for all plants were 5.7ft and 4.5ft respectively during the pretreatment and a similar 5.6ft and 5.0ft during the posttreatment survey (Table 2). Most EWM was established over organic muck (Figure 4) (Appendix III).

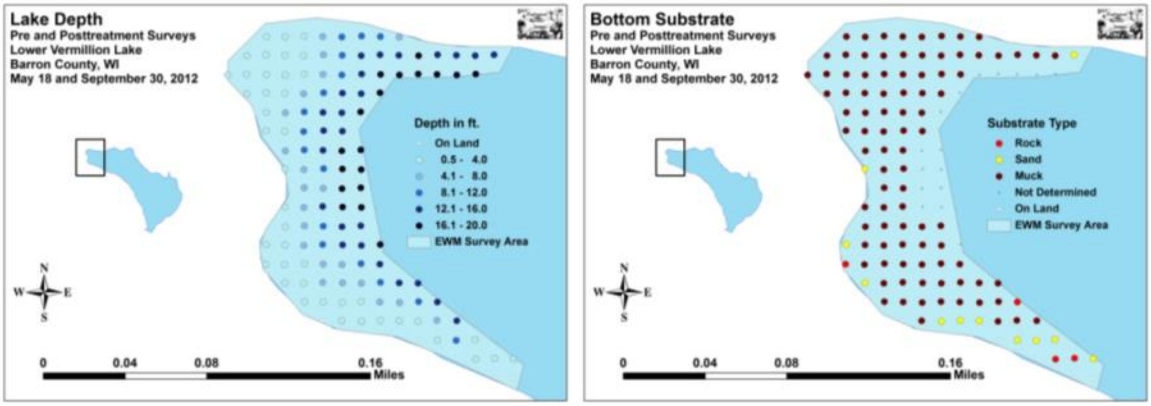


Figure 4: Treatment Area Depths and Bottom Substrate

Table 2: Pre/Post Survey Summary Statistics
Lower Vermillion Lake, Barron County
May 18 and September 30, 2012

Summary Statistics:	Pre	Post
Total number of points sampled	122	122
Total number of sites with vegetation	66	75
Total number of sites shallower than the maximum depth of plants	91	87
Frequency of occurrence at sites shallower than maximum depth of plants	72.53	86.21
Simpson Diversity Index	0.73	0.75
Maximum depth of plants (ft)	14.0	13.5
Mean depth of plants (ft)	5.7	5.6
Median depth of plants (ft)	4.5	5.0
Number of sites sampled using pole rake (P)	99	99
Average number of all species per site (shallower than max depth)	1.16	1.56
Average number of all species per site (veg. sites only)	1.61	1.81
Average number of native species per site (shallower than max depth)	0.90	1.41
Average number of native species per site (veg. sites only)	1.44	1.68
Species richness	12	12
Mean rake fullness (veg. sites only)	1.71	1.73

Initial diversity within the beds was moderate with a Simpson Diversity Index of 0.73. This value was essentially unchanged at 0.75 posttreatment. Mean native species richness at sites with vegetation was only 0.90/site pretreatment but increased slightly to 1.41/site posttreatment (Figure 5). Total rake fullness was also nearly unchanged at a low/moderate rating of 1.71 pretreatment and 1.73 posttreatment (Figure 6) (Appendix IV).

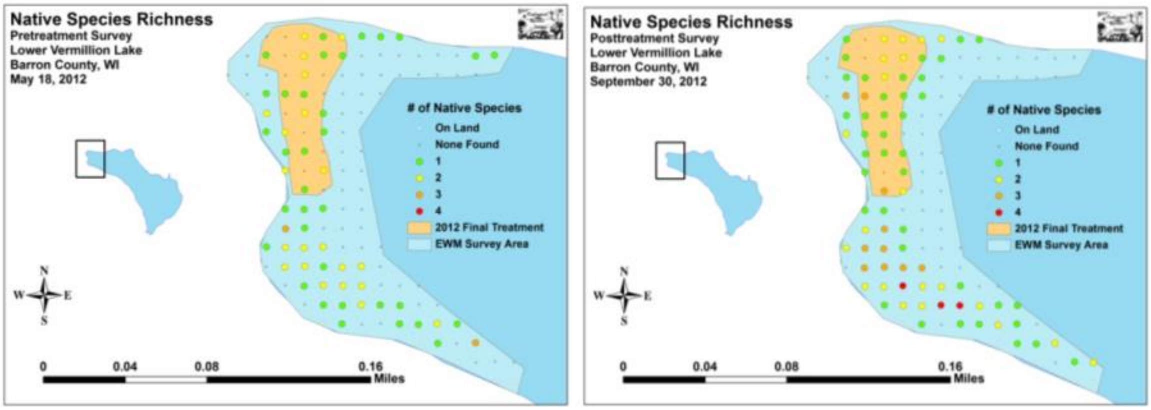


Figure 5: Pre/Post Native Species Richness

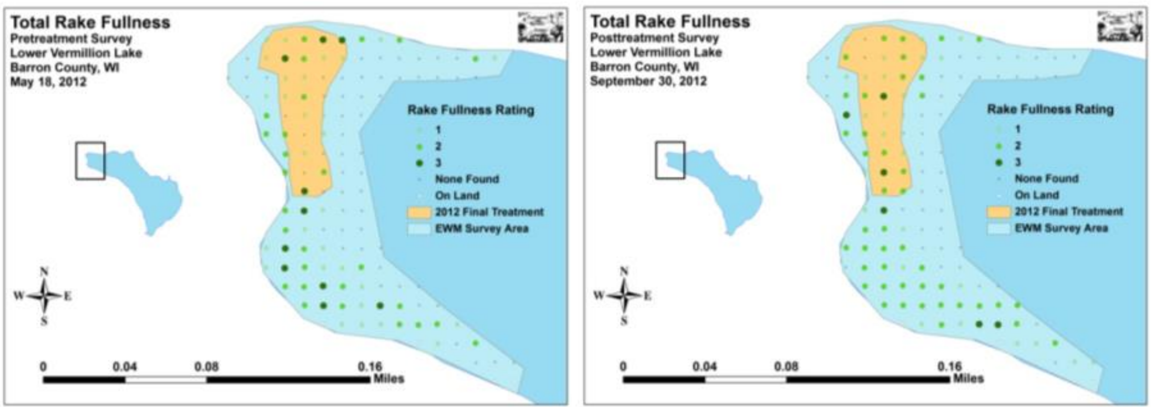


Figure 6: Pre/Post Total Rake Fullness

We found EWM at a single point during the pretreatment survey and it had a rake fullness rating of 2. It was a visual at three additional points. During the posttreatment survey, we found EWM at 11 total sites. Three rated a 3, five rated a 2, and three rated a 1 with three additional visual sightings (Figure 7) (Appendix V). Although separately none of the changes in rake fullness ratings were significant, collectively, EWM was moderately MORE common following the herbicide treatment (Figure 8). Considering the history of the location where EWM has remained rare until late July before rapidly growing and spreading in August, these results may not be surprising as the pretreatment survey occurred so far in advance of the actual treatment. Regardless, control effort has to be considered a disappointment as plants in September were common throughout the treatment area and showed evidence of continued growth and expansion. Additionally, some of these plants showed evidence of chemical burn indicating they were present at the time of treatment. Most of these were located need the spring inlet where water movement may have interfered with herbicide contact time.

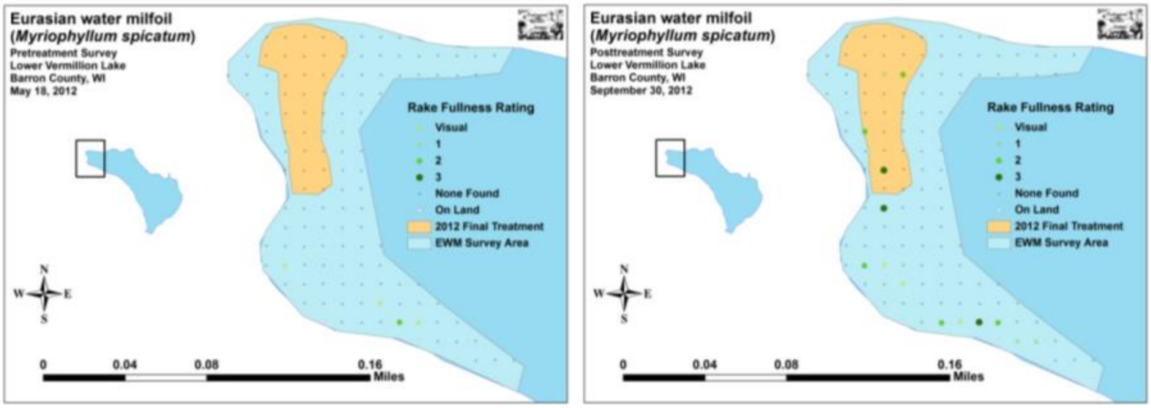
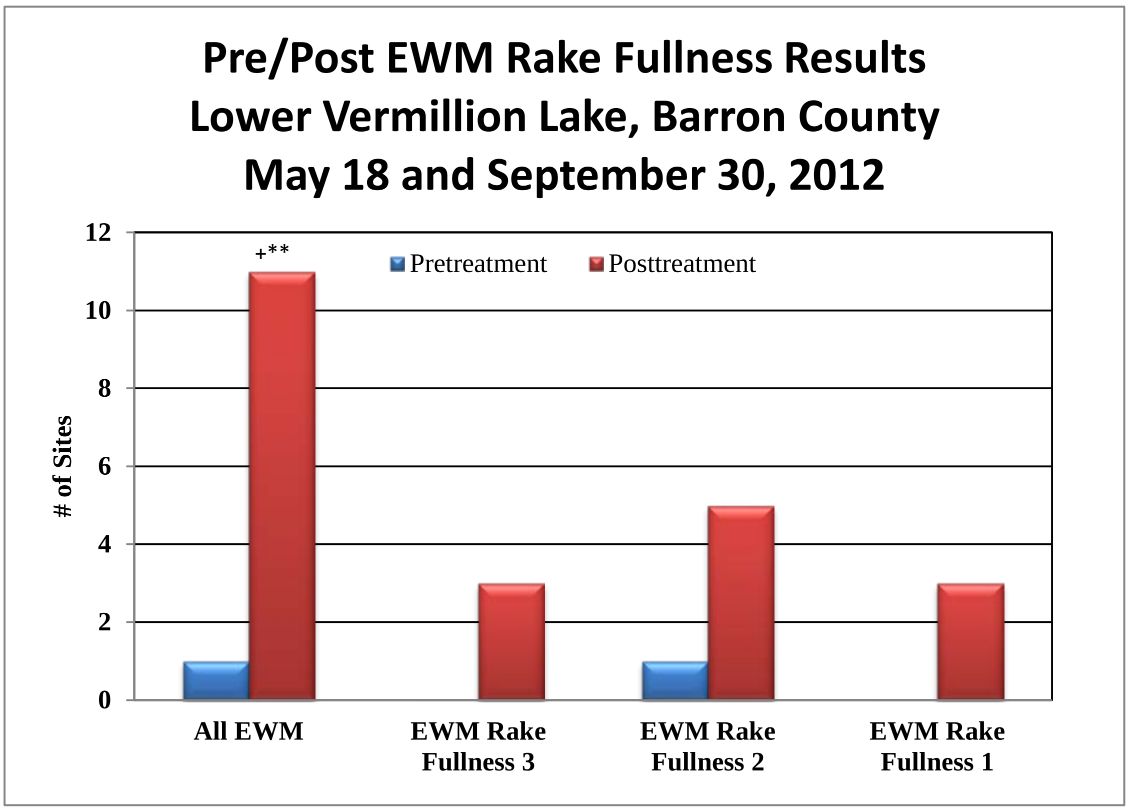


Figure 7: Pre/Post EWM Density and Distribution



Significant differences = * p <. 05, ** p <. 01, *** p <. 005

Figure 8: Pre/Post Changes in EWM Rake Fullness

Curly-leaf pondweed (*Potamogeton crispus*), another invasive exotic species, was found at 23 points in the pretreatment survey, but only two in the posttreatment survey (Figure 9). This reduction was highly significant but is likely primarily due to the normal June senescence for this species rather than the herbicide (Appendix V).

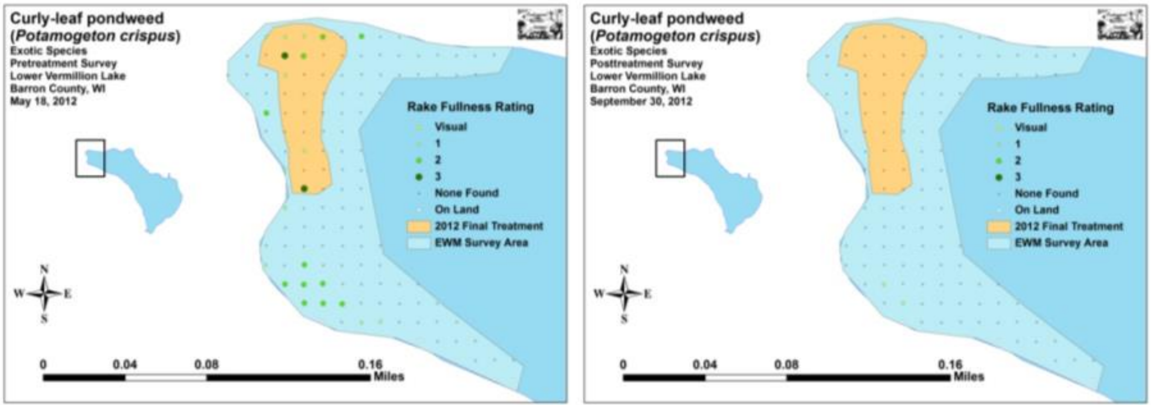


Figure 9: Pre/Post CLP Density and Distribution

Coontail (*Ceratophyllum demersum*) and Flat-stem pondweed (*Potamogeton zosteriformis*), the two most common native species in the pretreatment survey (Tables 3 and 4), showed no significant change posttreatment (Figures 10 and 11). However, Clasping-leaf pondweed (*Potamogeton richardsonii*) and Northern water milfoil (*Myriophyllum sibiricum*) both showed moderately significant increases posttreatment. Also, Filamentous algae showed a highly significant decline posttreatment (Figure 12). Maps for all species from the pre and posttreatment surveys are available in Appendixes VI and VII.

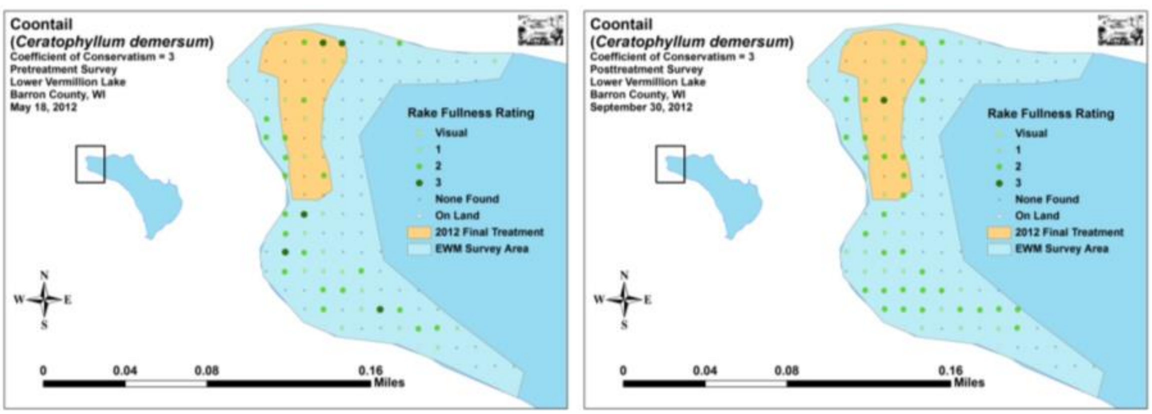


Figure 10: Pre/Post Coontail Density and Distribution

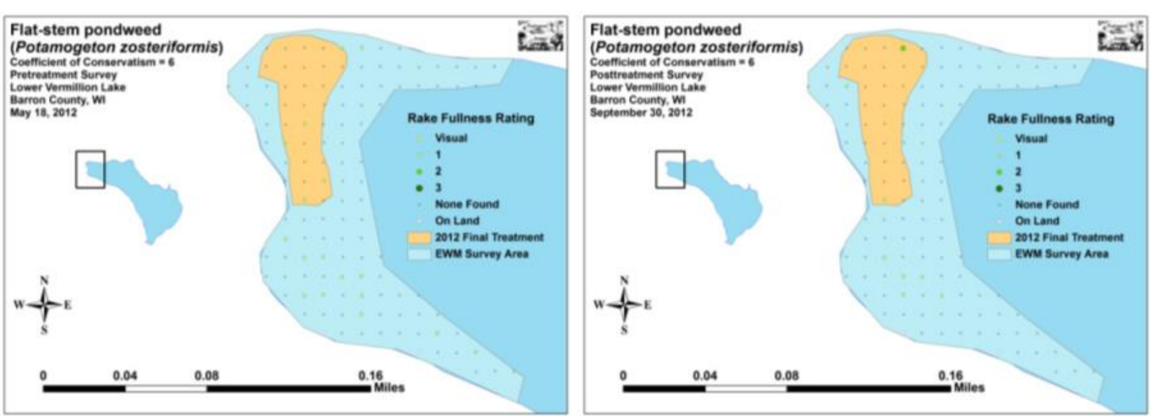
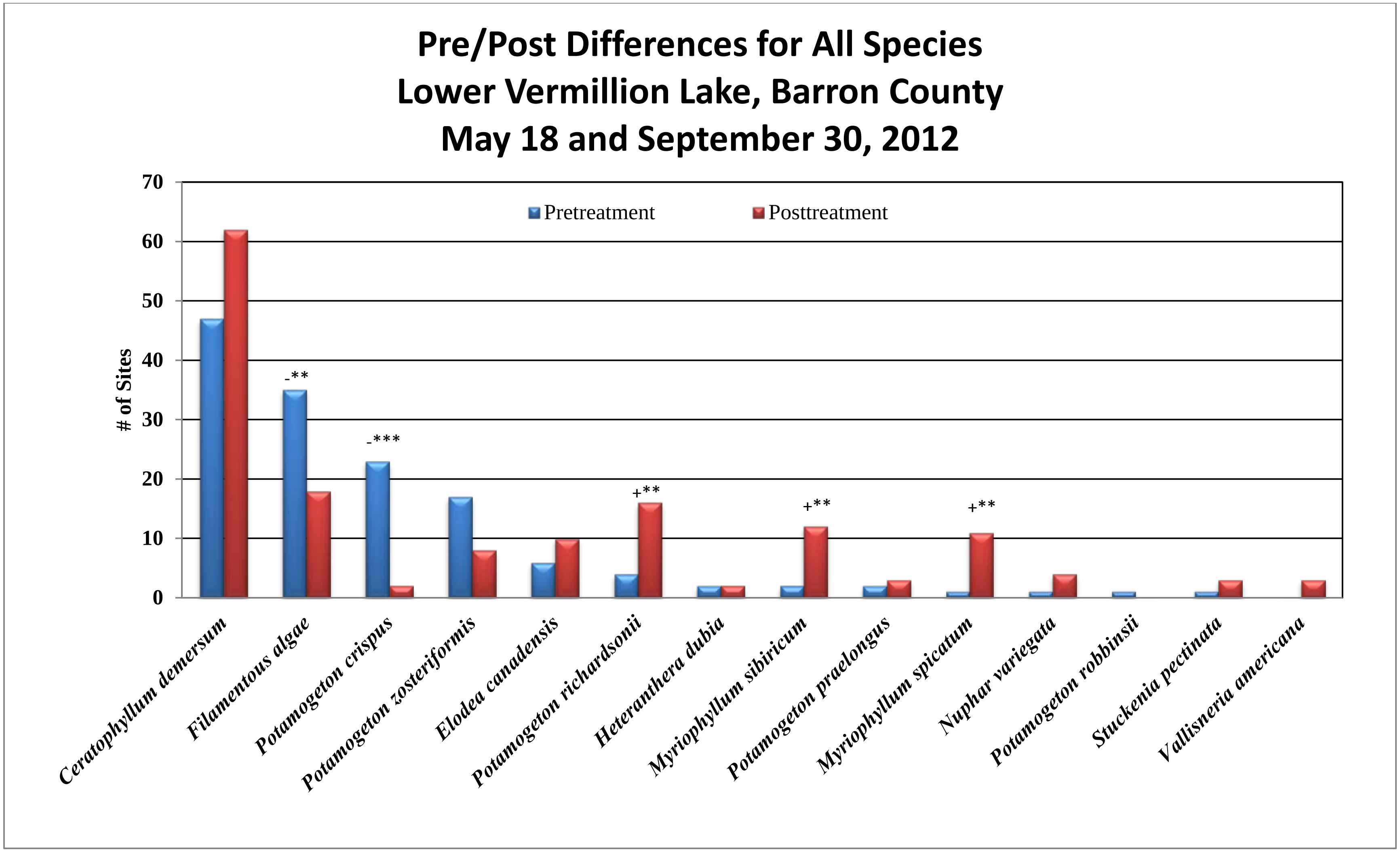


Figure 11: Pre/Post Flat-stem Pondweed Density and Distribution



Significant differences = * p <. 05, ** p <. 01, *** p <. 005

Figure 12: Pre/Post Macrophyte Changes

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Pretreatment Survey Lower Vermillion Lake, Barron County
May 18, 2012

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Ceratophyllum demersum	Coontail	47	43.93	70.15	48.96	1.64	0
	Filamentous algae	35	*	52.24	36.46	1.49	0
Potamogeton crispus	Curly-leaf pondweed	23	21.50	34.33	23.96	1.65	0
Potamogeton zosteriformis	Flat-stem pondweed	17	15.89	25.37	17.71	1.00	0
Elodea canadensis	Common waterweed	6	5.61	8.96	6.25	1.50	0
Potamogeton richardsonii	Clasping-leaf pondweed	4	3.74	5.97	4.17	1.00	0
Heteranthera dubia	Water star-grass	2	1.87	2.99	2.08	2.00	0
Myriophyllum sibiricum	Northern water-milfoil	2	1.87	2.99	2.08	1.00	0
Potamogeton praelongus	White-stem pondweed	2	1.87	2.99	2.08	1.00	0
Myriophyllum spicatum	Eurasian water milfoil	1	0.93	1.49	1.04	2.00	3
Nuphar variegata	Spatterdock	1	0.93	1.49	1.04	1.00	0
Potamogeton robbinsii	Fern pondweed	1	0.93	1.49	1.04	1.00	0
Stuckenia pectinata	Sago pondweed	1	0.93	1.49	1.04	1.00	0

* Excluded from Relative Frequency Analysis

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Posttreatment Survey Lower Vermillion Lake, Barron County
September 30, 2012

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Ceratophyllum demersum	Coontail	62	45.59	82.67	71.26	1.55	0
	Filamentous algae	18	*	24.00	20.69	1.83	0
Potamogeton richardsonii	Clasping-leaf pondweed	16	11.76	21.33	18.39	1.38	0
Myriophyllum sibiricum	Northern water-milfoil	12	8.82	16.00	13.79	1.25	0
Myriophyllum spicatum	Eurasian water milfoil	11	8.09	14.67	12.64	2.00	3
Elodea canadensis	Common waterweed	10	7.35	13.33	11.49	1.40	0
Potamogeton zosteriformis	Flat-stem pondweed	8	5.88	10.67	9.20	1.13	0
Nuphar variegata	Spatterdock	4	2.94	5.33	4.60	1.25	0
Potamogeton praelongus	White-stem pondweed	3	2.21	4.00	3.45	1.00	0
Stuckenia pectinata	Sago pondweed	3	2.21	4.00	3.45	1.33	0
Vallisneria americana	Wild celery	3	2.21	4.00	3.45	1.00	0
Heteranthera dubia	Water star-grass	2	1.47	2.67	2.30	1.50	0
Potamogeton crispus	Curly-leaf pondweed	2	1.47	2.67	2.30	1.00	0

* Excluded from Relative Frequency Analysis

Fall EWM Bed Mapping Survey:

On September 30th, 2012, we located and mapped a total of 13 beds on the lake ranging in size from 0.01 acre (Bed 4) to 0.80 acres (Bed 9) (Figure 13) (Appendix VIII). In total, these beds covered 2.70 acres (Table 5). This represented an increase of more than 320% over 2011 totals as EWM has now broken out of the northwest bay into the ideal EWM habitat that occurs on the lake's east side. All of these beds had numerous satellite plants and clusters around them, and, based on the historic rapid rate of expansion of EWM on the lake, we believe all of these beds will rapidly merge if left unchecked. Because of this, we believe treating EWM inside both of these High Density Areas is warranted. When adding the areas around the beds, it brought the total acreage for potential treatment to 10.96 acres (Table 6).

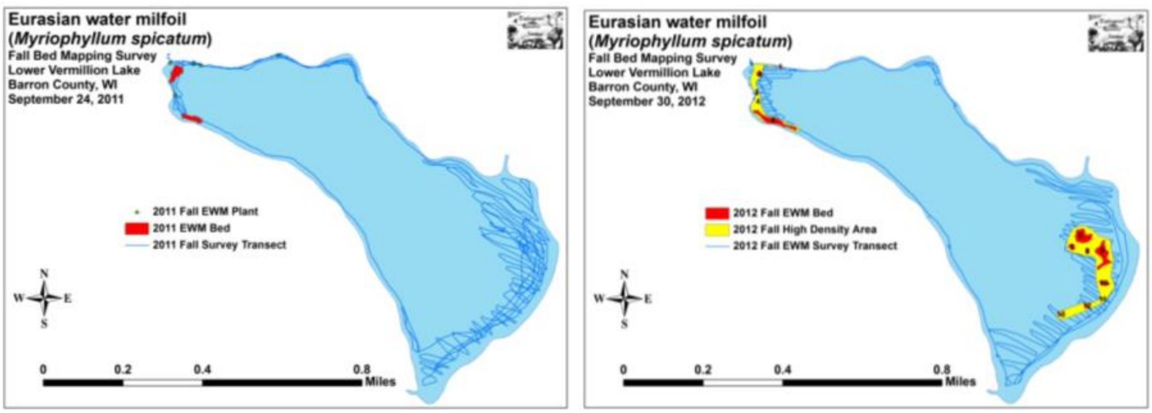


Figure 13: 2011 and 2012 Fall EWM Bed Maps

Descriptions of EWM Beds:

Beds 1 and 5 – Both areas were more high density areas than beds, but EWM plants were continuous, canopied and merging. The beds occurred in narrow strips along sharp drop-offs into 15ft+ of water which will likely make treating these areas challenging.

Bed 2-4 – EWM plants were rapidly reestablishing throughout the treatment area, and many plants were prop clipped as they were right in front of the channel away from the boat landing.

Bed 6 – A solid dense mat of plants was canopied in 5-7ft of water at the center of the bed with merging towers throughout. This area is easily the worst on the lake.

Beds 7 and 8 – These areas were similar to Bed 6 in that they were canopied and spreading rapidly, but they covered much smaller areas.

Bed 9 – Barely a bed, EWM plants were patchy throughout the area. Plants were established to the edge of the organic muck strip of sediment. East of this bed, sand, marl, and rock substrates were far less favorable for EWM growth.

Beds 10-13 – Each of these were young beds that appeared to have established relatively recently. Despite this, the main cluster of towers in each was surrounded by 10's of new sprouts.

Table 5: Fall Eurasian Water Milfoil Bed Mapping Summary
Lower Vermillion Lake, Barron County
September 30, 2012

Bed Number	2012 Fall Bed Acreage	2011 Fall Bed Acreage	2012 Change in Acreage	Estimated 2012 Mean Rakefull	2012 Bed Characteristics And Field Notes
1	0.02	0	0.02	<1-1	Continuous scattered plants; more of a HDA
2	0.07	0.49	-0.42	<1-2	Plants regrowing/fragmenting
3	0.03	0	0.03	1-3	Merging large towers
4	0.01	0	0.01	1-3	Merging large towers; many satellite plants
5	0.70	0.35	0.35	<1-2	Continuous scattered plants; more of a HDA
6	0.68	0	0.68	1-3	Canopied throughout; merging large towers
7	0.10	0	0.1	1-3	Canopied throughout; merging large towers
8	0.06	0	0.06	1-3	Canopied throughout; merging large towers
9	0.80	0	0.8	<1-3	Continuous scattered canopied plants and towers
10	0.14	0	0.14	1-3	Canopied throughout; merging large towers
11	0.01	0	0.01	1-3	Canopied throughout; merging large towers
12	0.05	0	0.05	1-3	Canopied throughout; merging large towers
13	0.03	0	0.03	1-3	Canopied throughout; merging large towers
Total	**2.70**	**0.84**	**+1.86**		

Table 6: Fall Eurasian Water Milfoil High Density Area Summary
Lower Vermillion Lake, Barron County
September 30, 2012

HDA Number	2012 Fall HDA Acreage	2012 HDA Characteristics And Field Notes
1	2.79	Continuous scattered plants; treatment ineffective near creek inlet/outer edge adjacent to deep water
2	8.17	Canopied plants in dense beds with scattered towers and plants interspersed; evidence of rapid fragmentation
Total	**10.96**	

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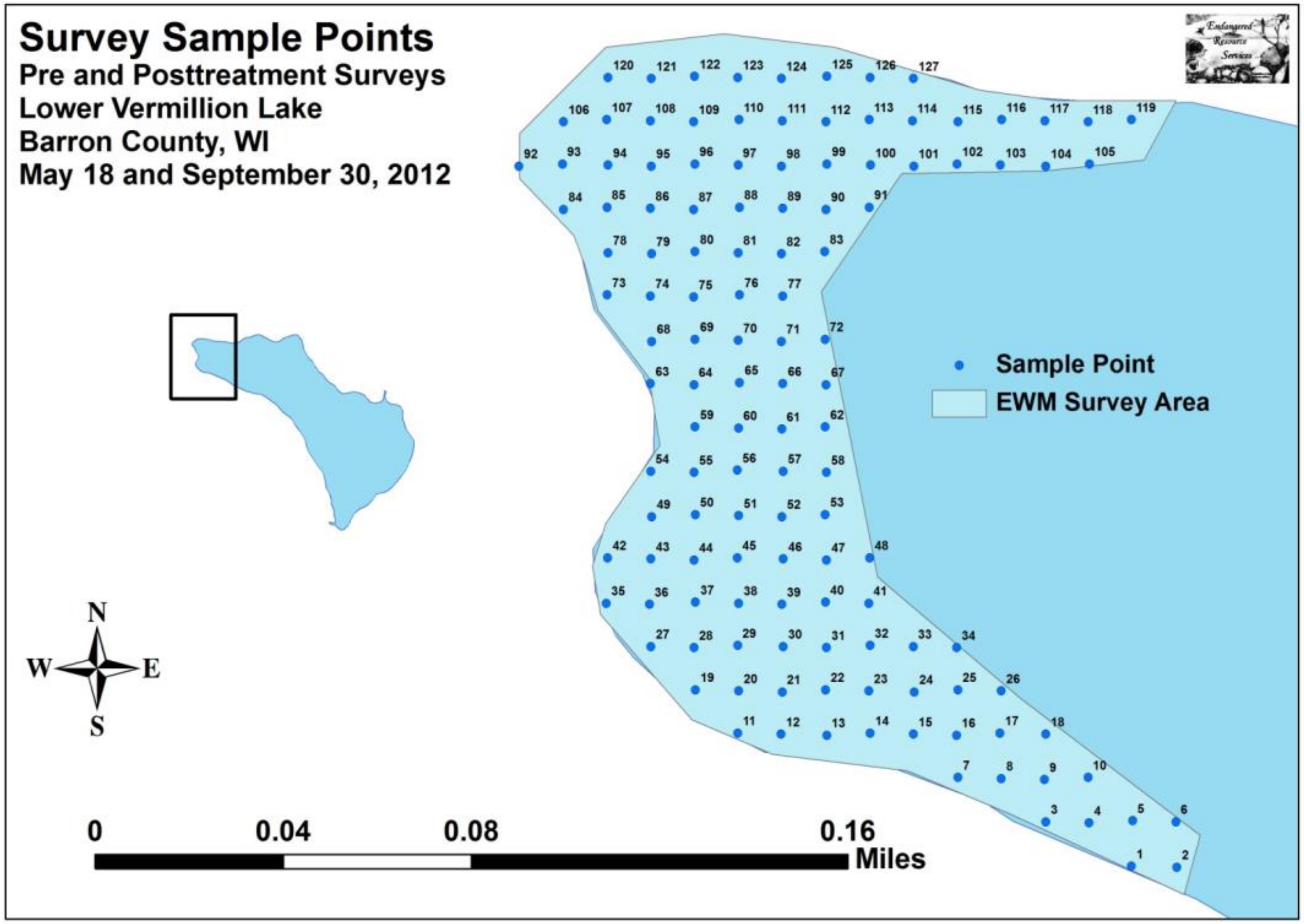
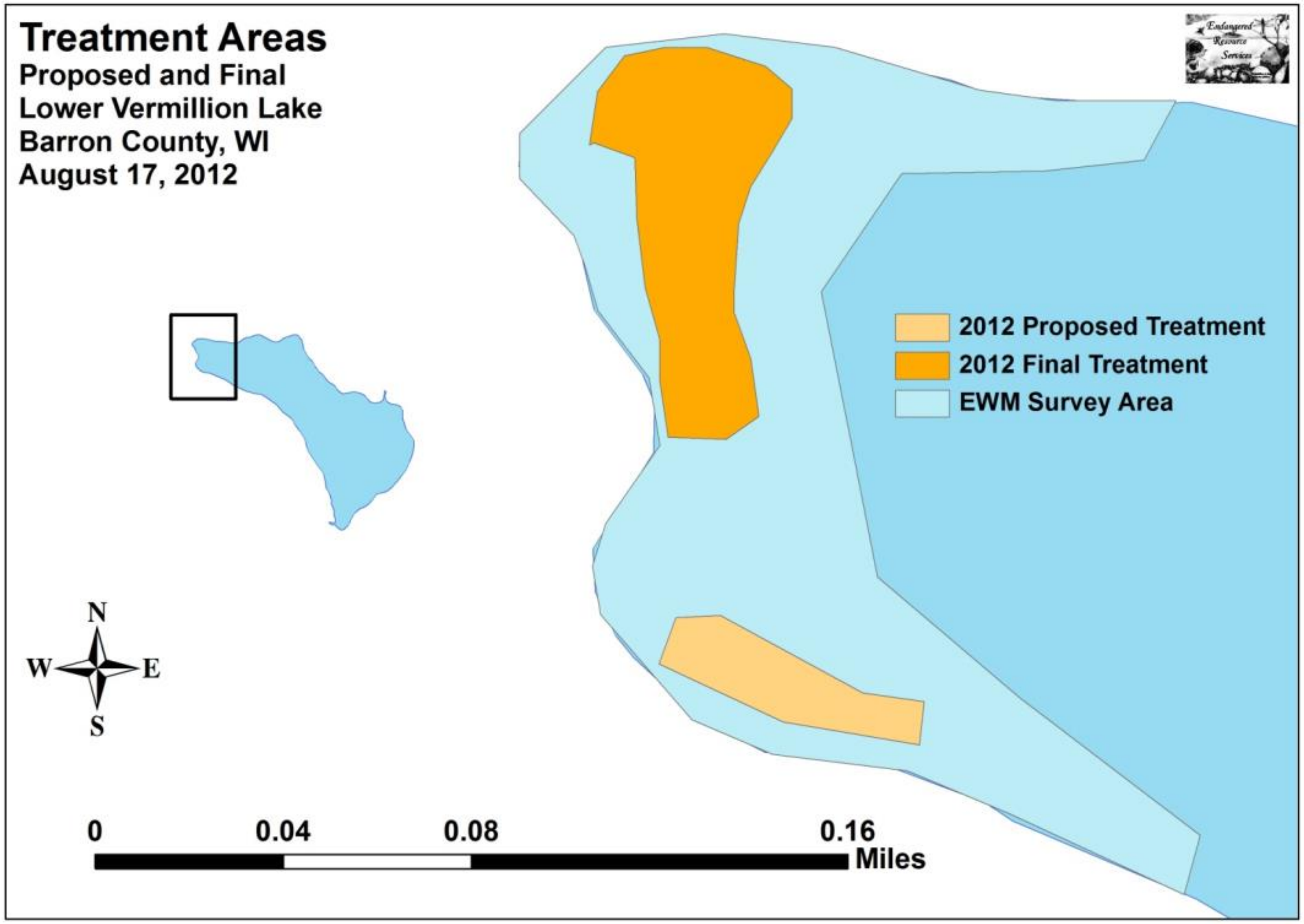
Appendix I: Survey Sample Points and EWM Treatment Areas


Survey Sample Points
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
May 18 and September 30, 2012
Sample Point
EWM Survey Area
N
S
W
E
0
0.04
0.08
0.16
Miles


Treatment Areas
Proposed and Final
Lower Vermillion Lake
Barron County, WI
August 17, 2012
2012 Proposed Treatment
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles
Endangered Resource Services

Appendix II: Vegetative Survey Data Sheet

Observers for this lake: names and hours worked by each:																									
Lake:									**WBIC**									**County**						**Date:**	
Site #	**Depth (ft)**	**Muck (M), Sand (S), Rock (R)**	**Rake pole (P) or rake rope (R)**	**Total Rake Fullness**	**EWM**	**CLP**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
1																									
2																									
3																									
4																									
5																									
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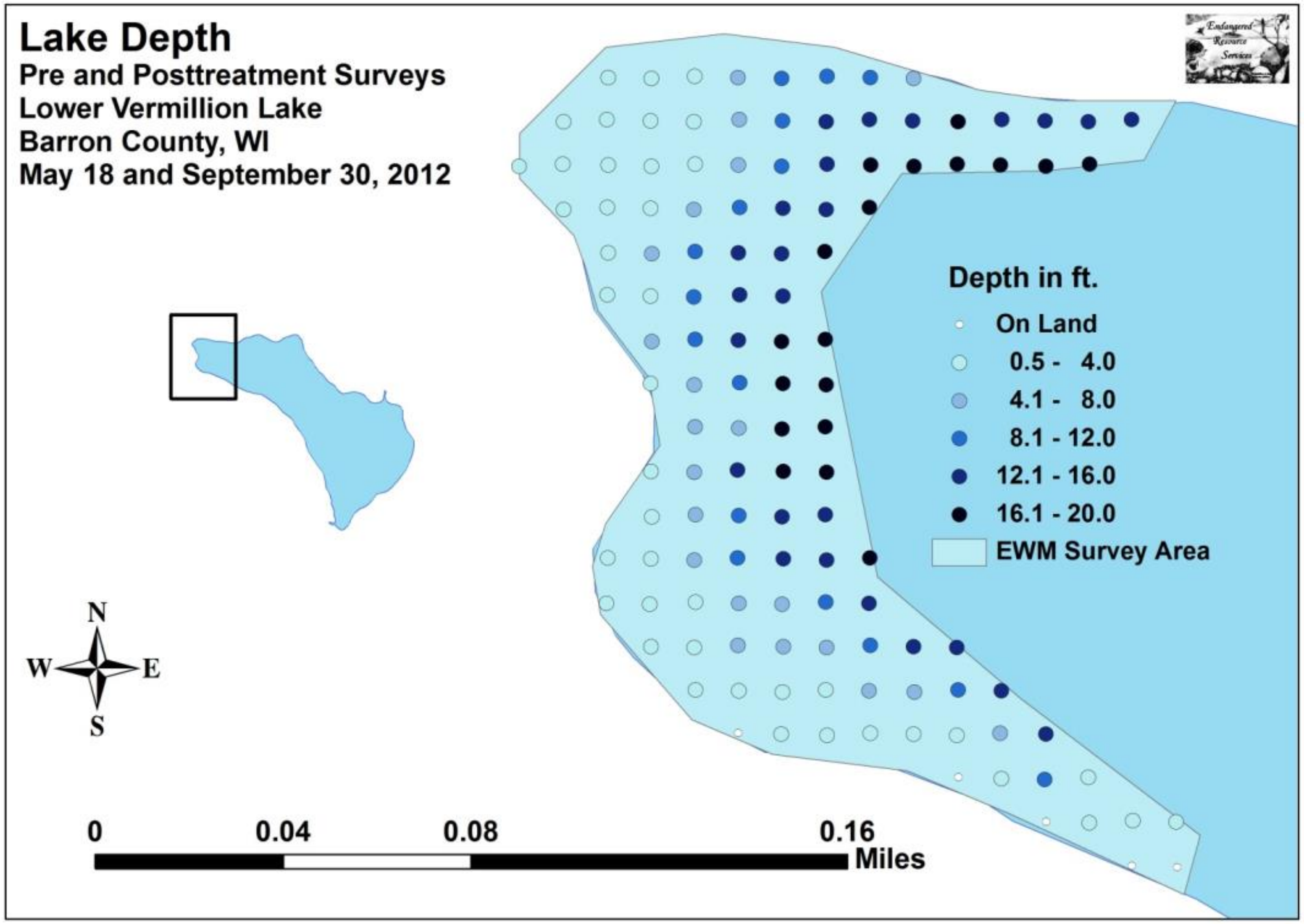
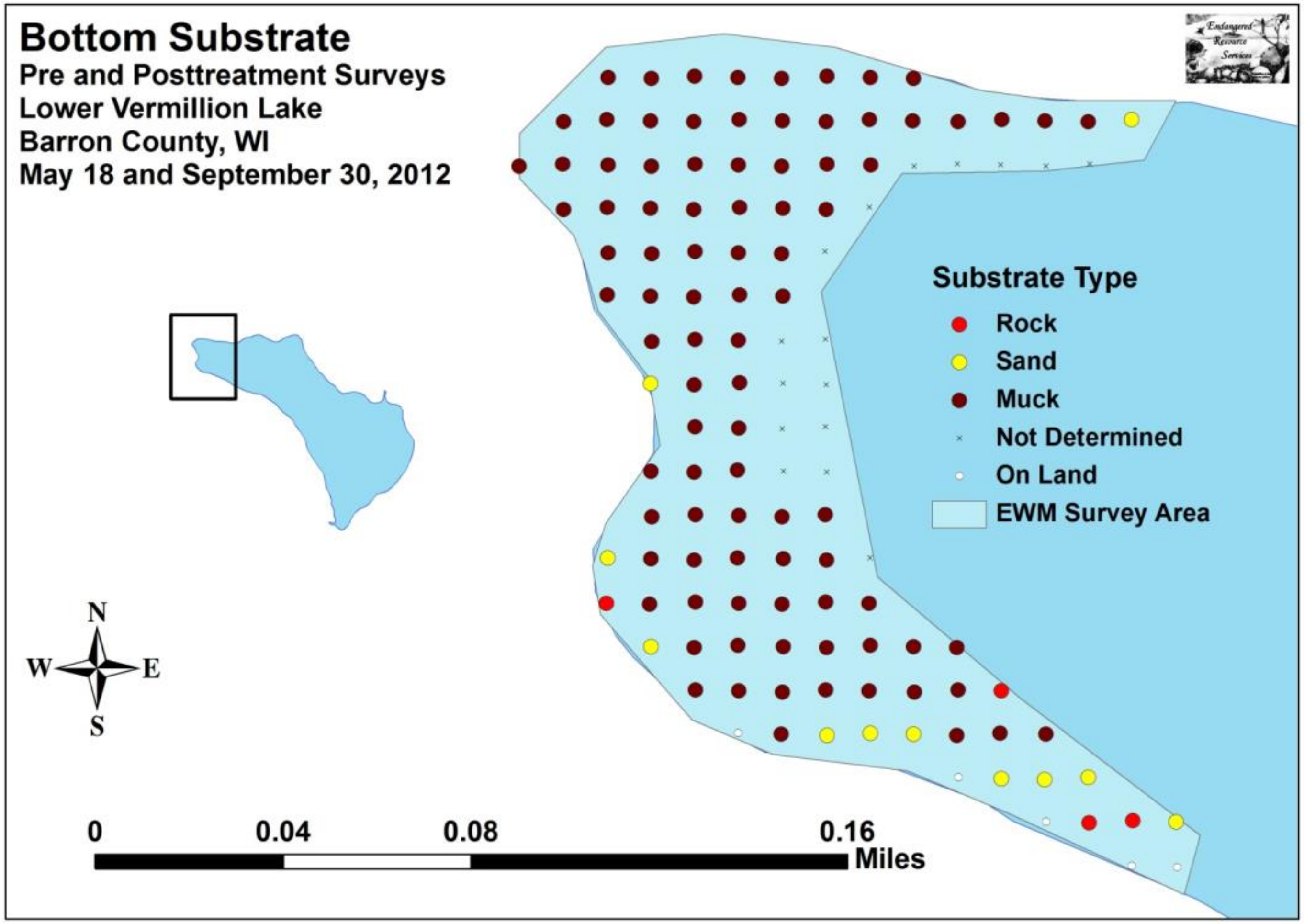
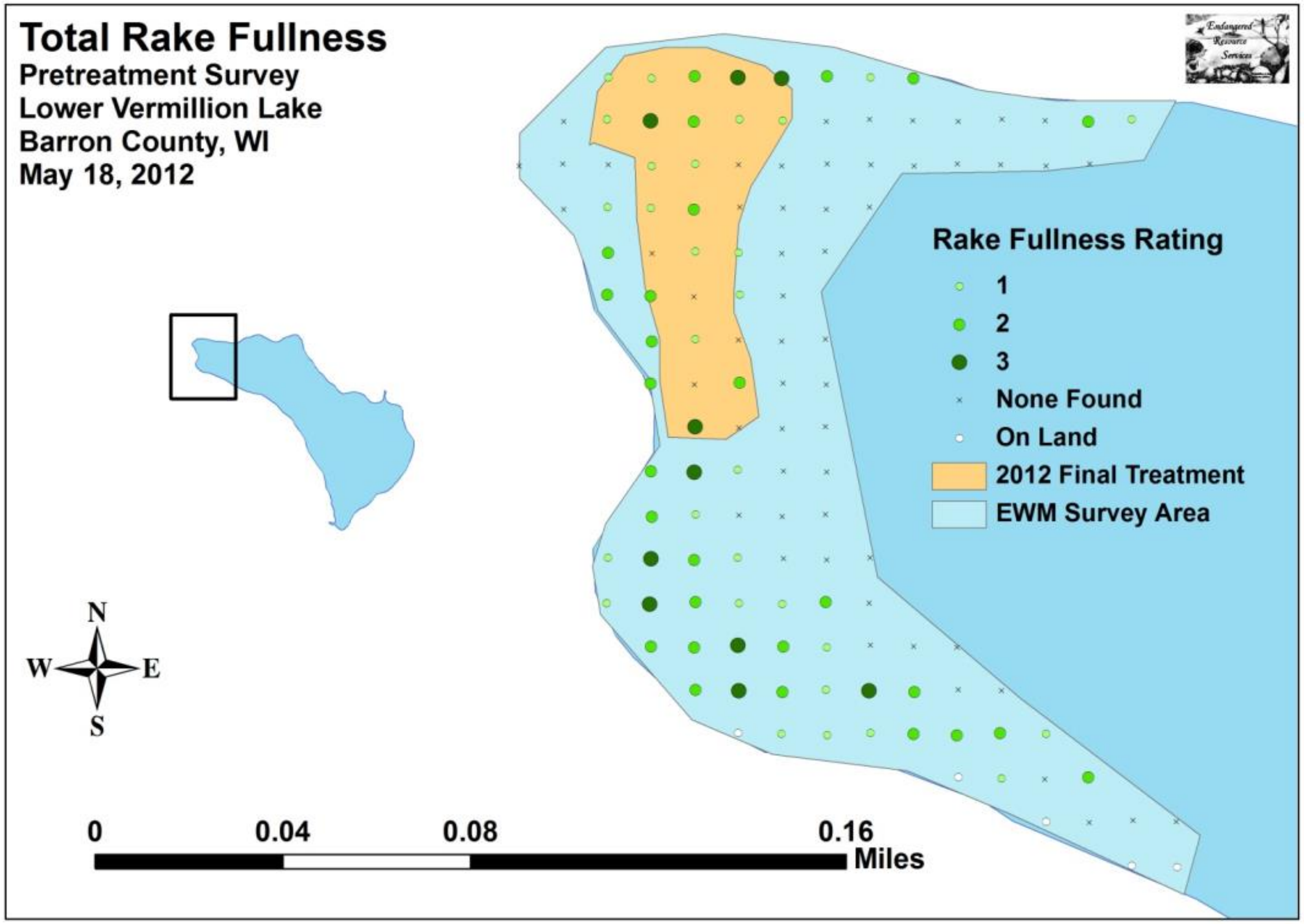
Appendix III: Pre/Post Habitat Variable Maps

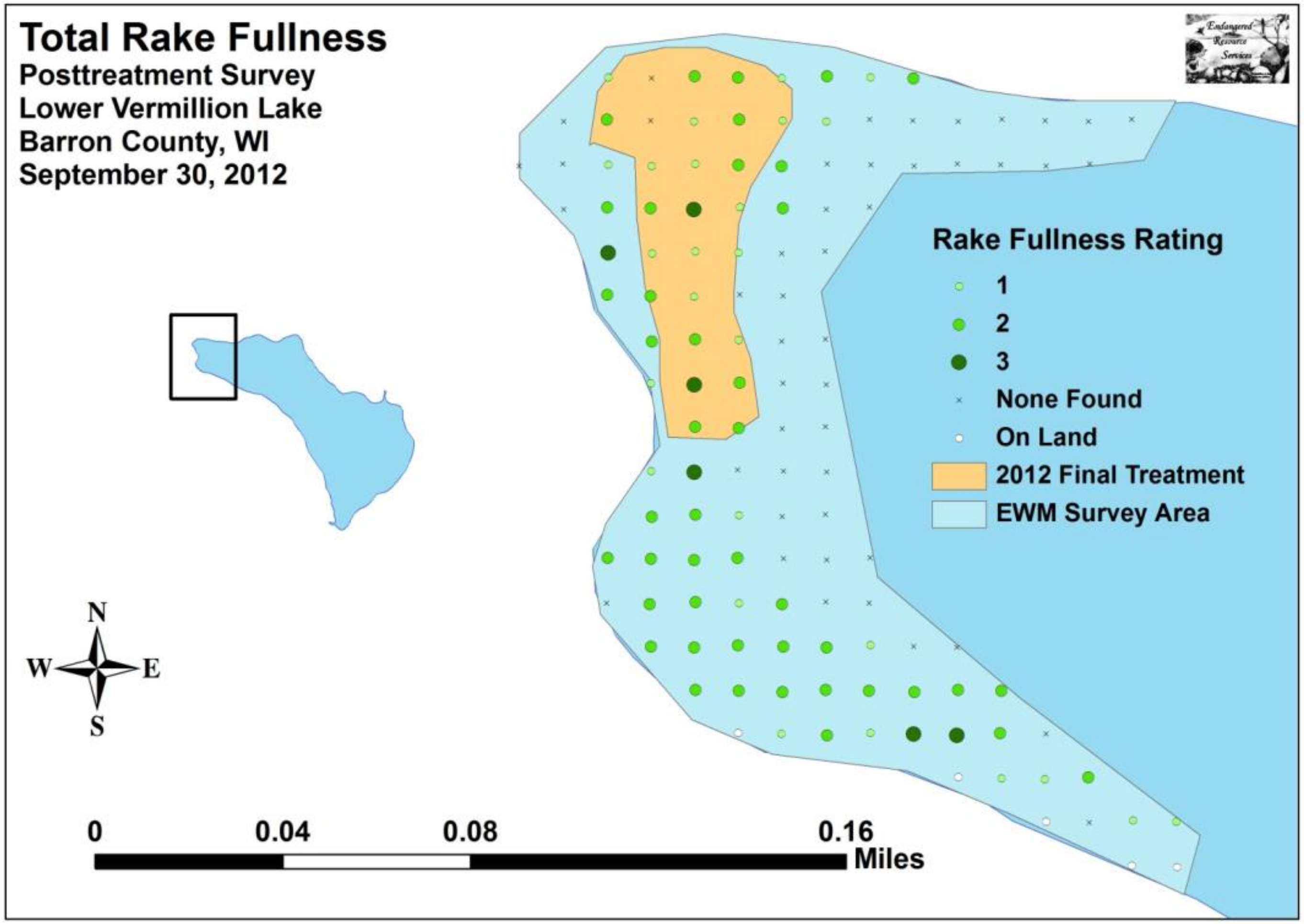

Lake Depth
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
May 18 and September 30, 2012
Depth in ft.
On Land
0.5 - 4.0
4.1 - 8.0
8.1 - 12.0
12.1 - 16.0
16.1 - 20.0
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

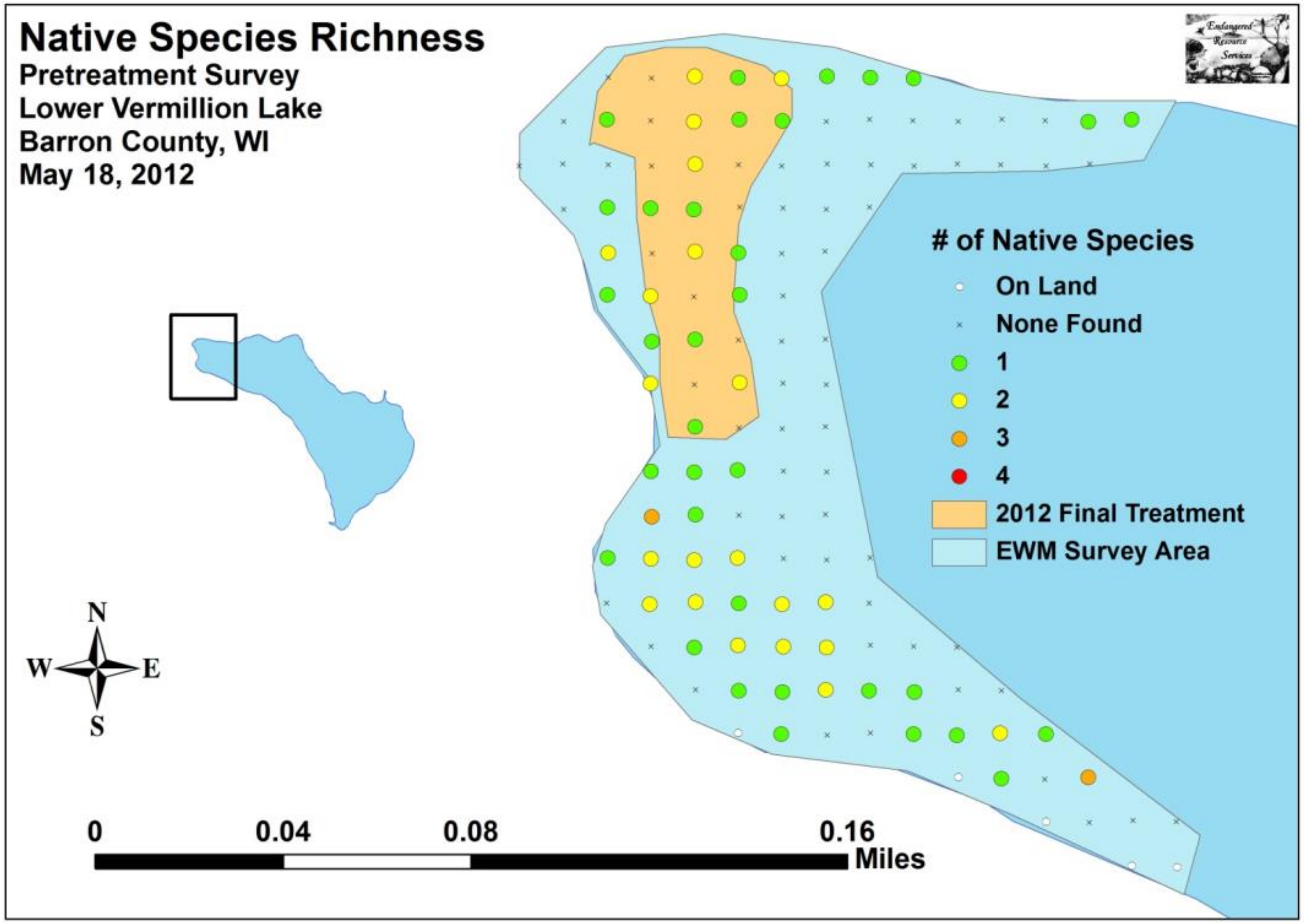

Bottom Substrate
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
May 18 and September 30, 2012
Substrate Type
Rock
Sand
Muck
Not Determined
On Land
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

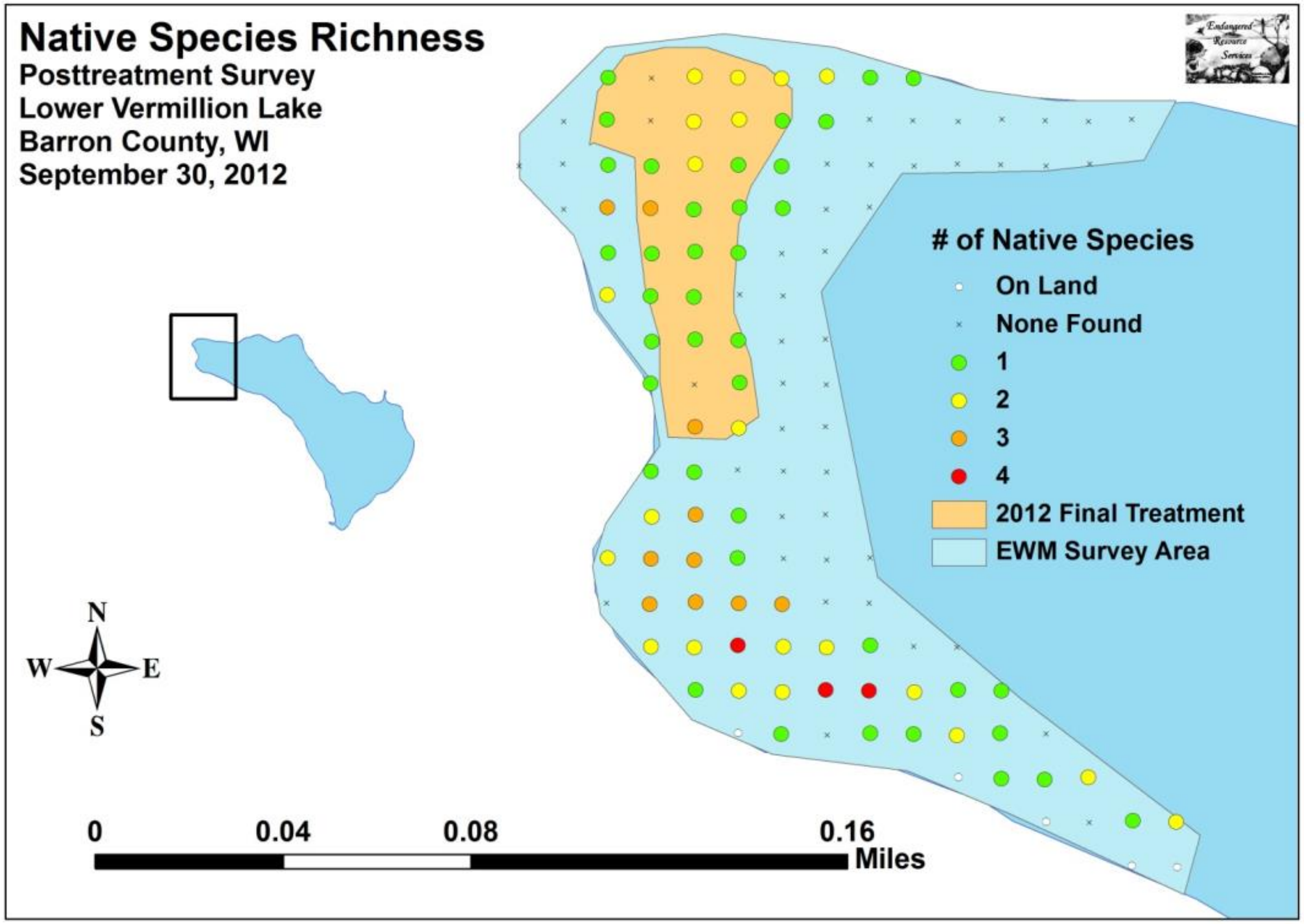
Appendix IV: Pre/Post Native Species Richness and Total Rake Fullness



Total Rake Fullness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

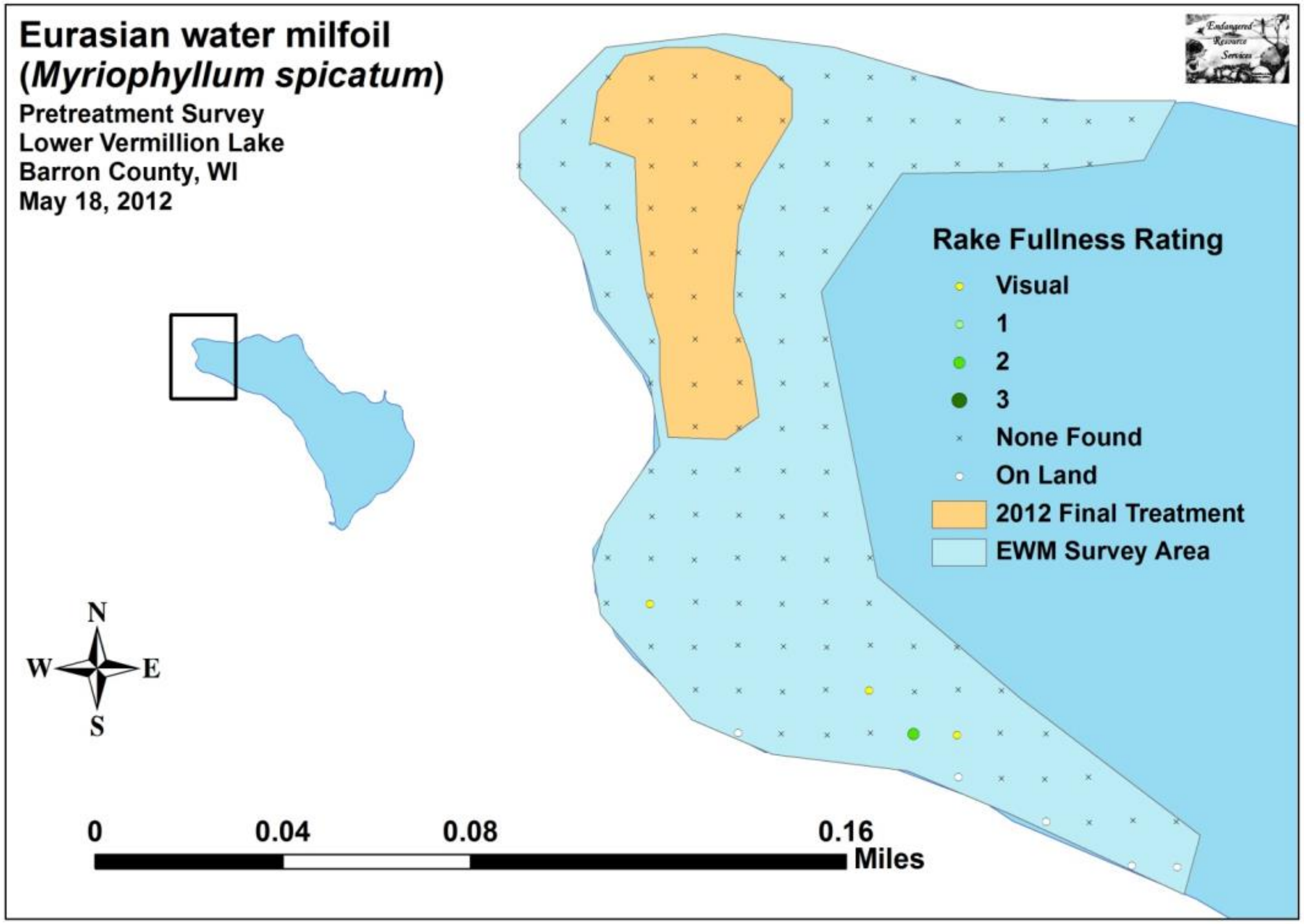

Total Rake Fullness
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

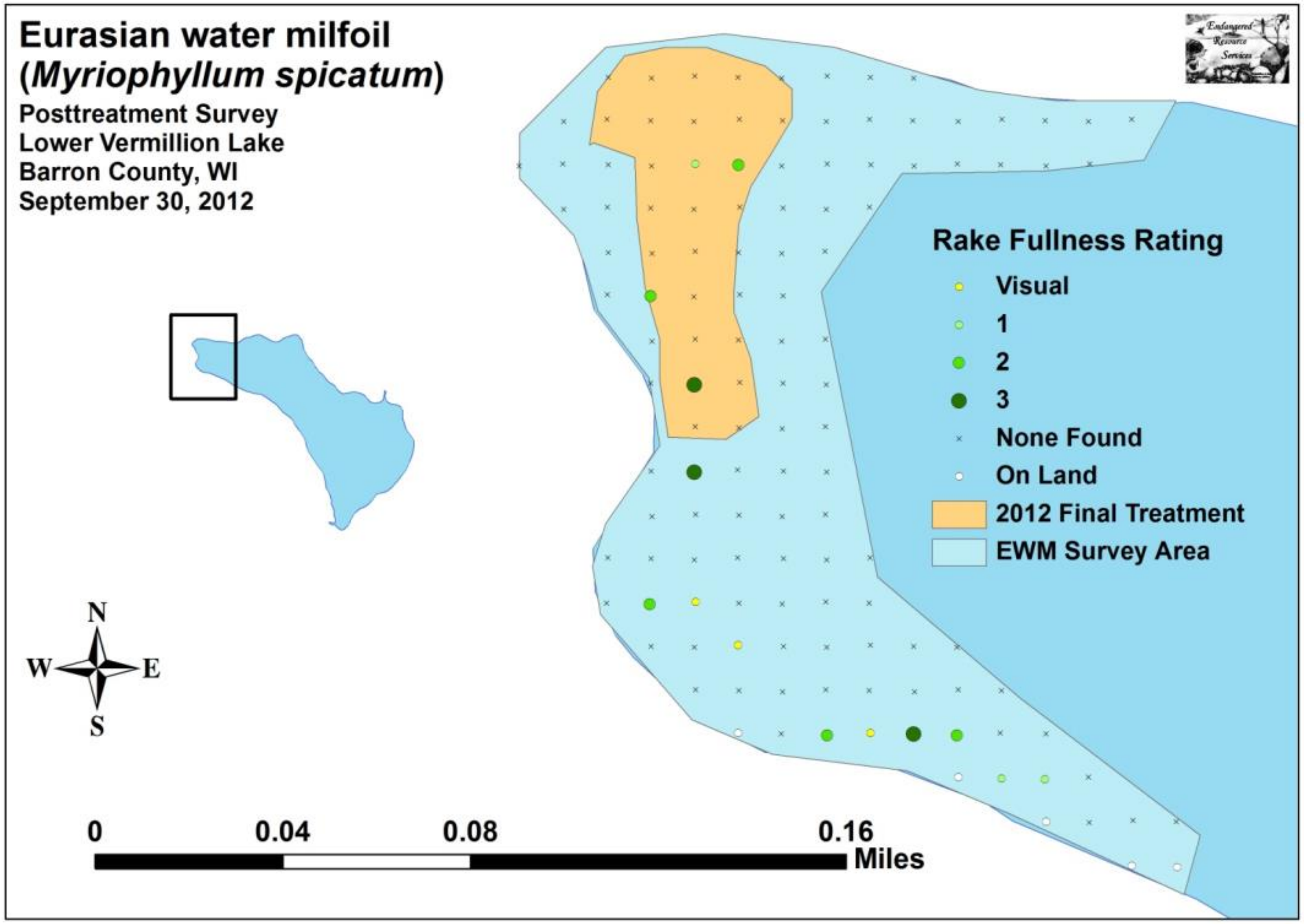

Native Species Richness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
# of Native Species
On Land
None Found
1
2
3
4
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles



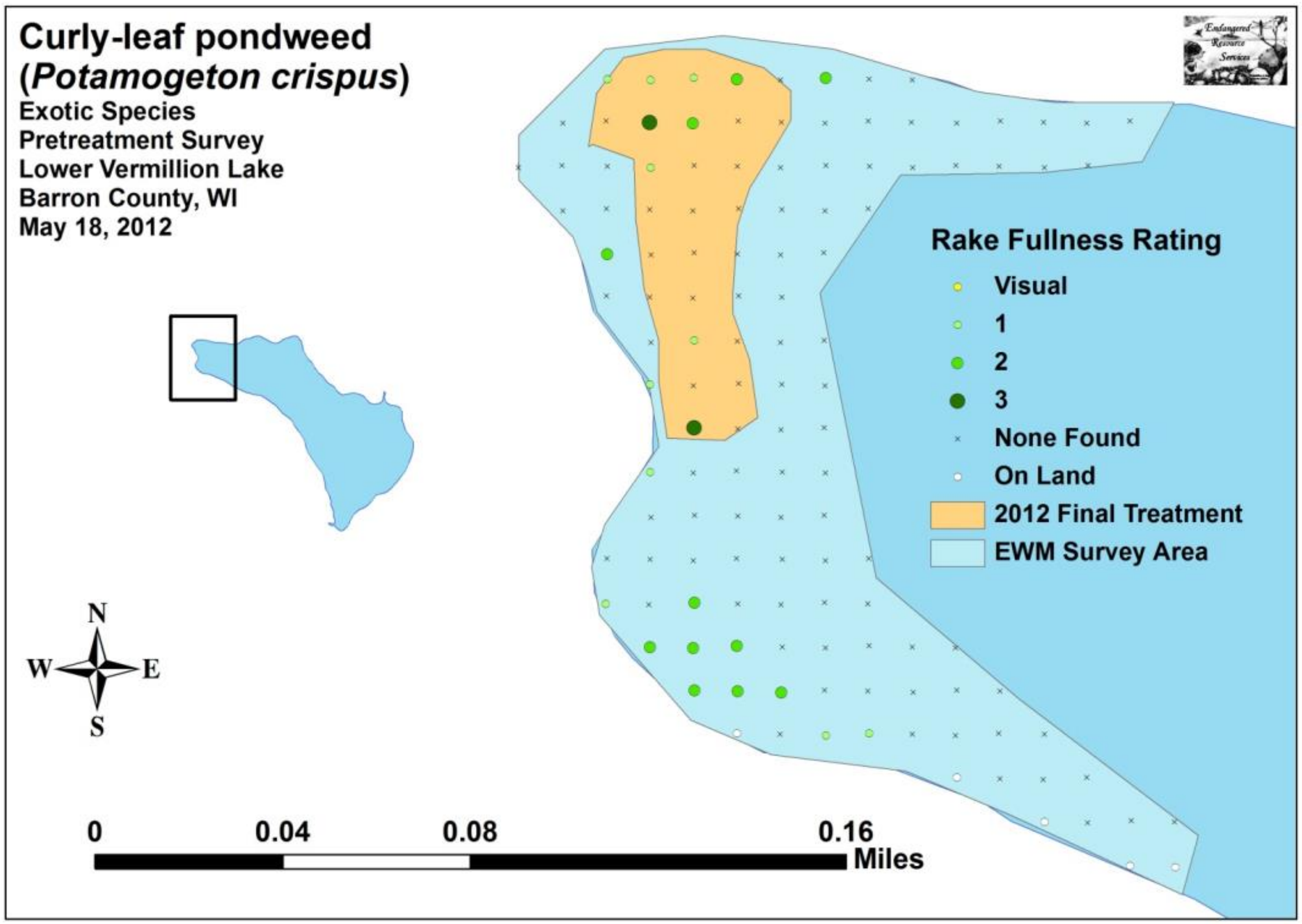
Native Species Richness
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
# of Native Species
On Land
None Found
1
2
3
4
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

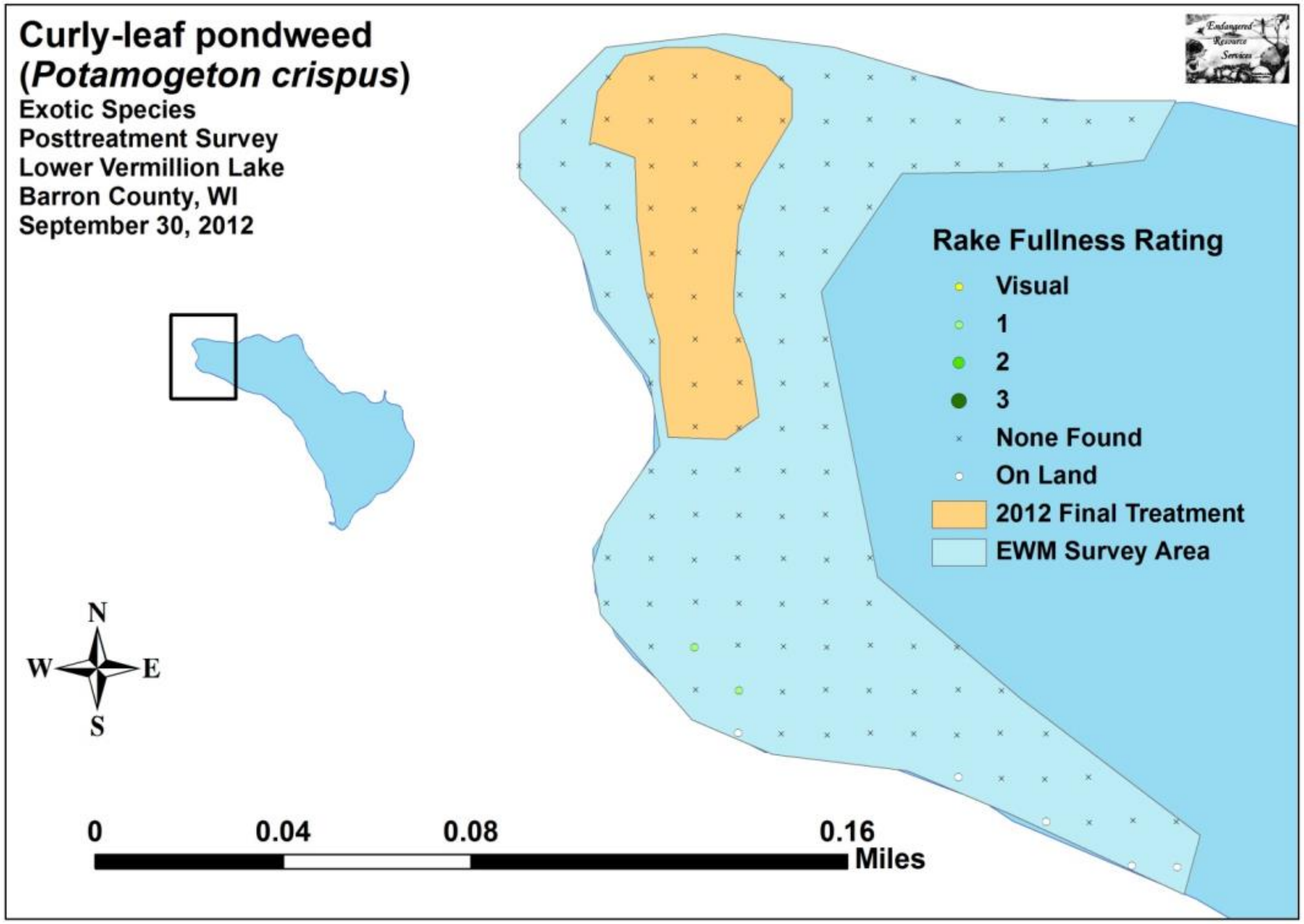
Appendix V: EWM and CLP Pre/Post Density and Distribution


Eurasian water milfoil
(*Myriophyllum spicatum*)
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

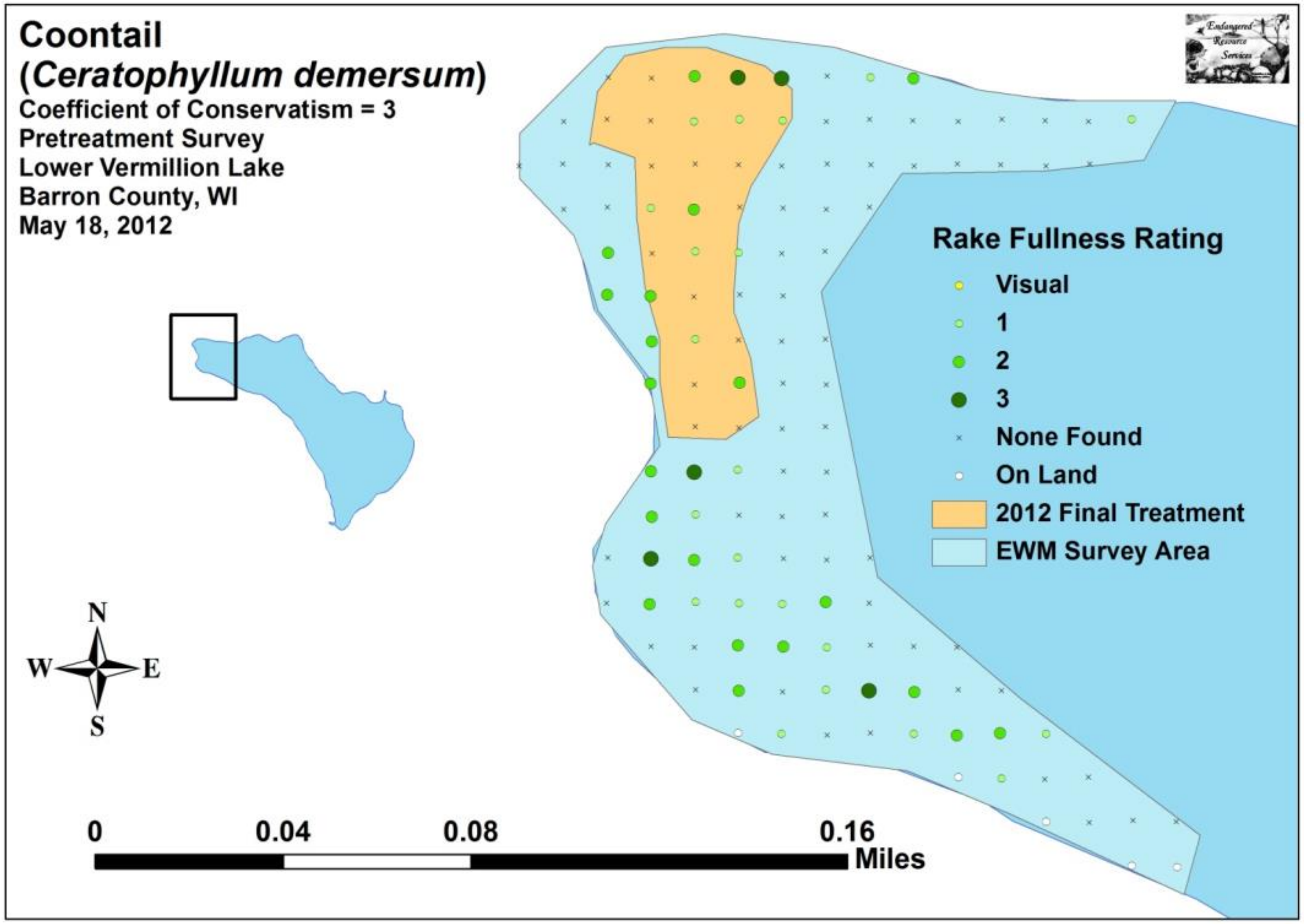


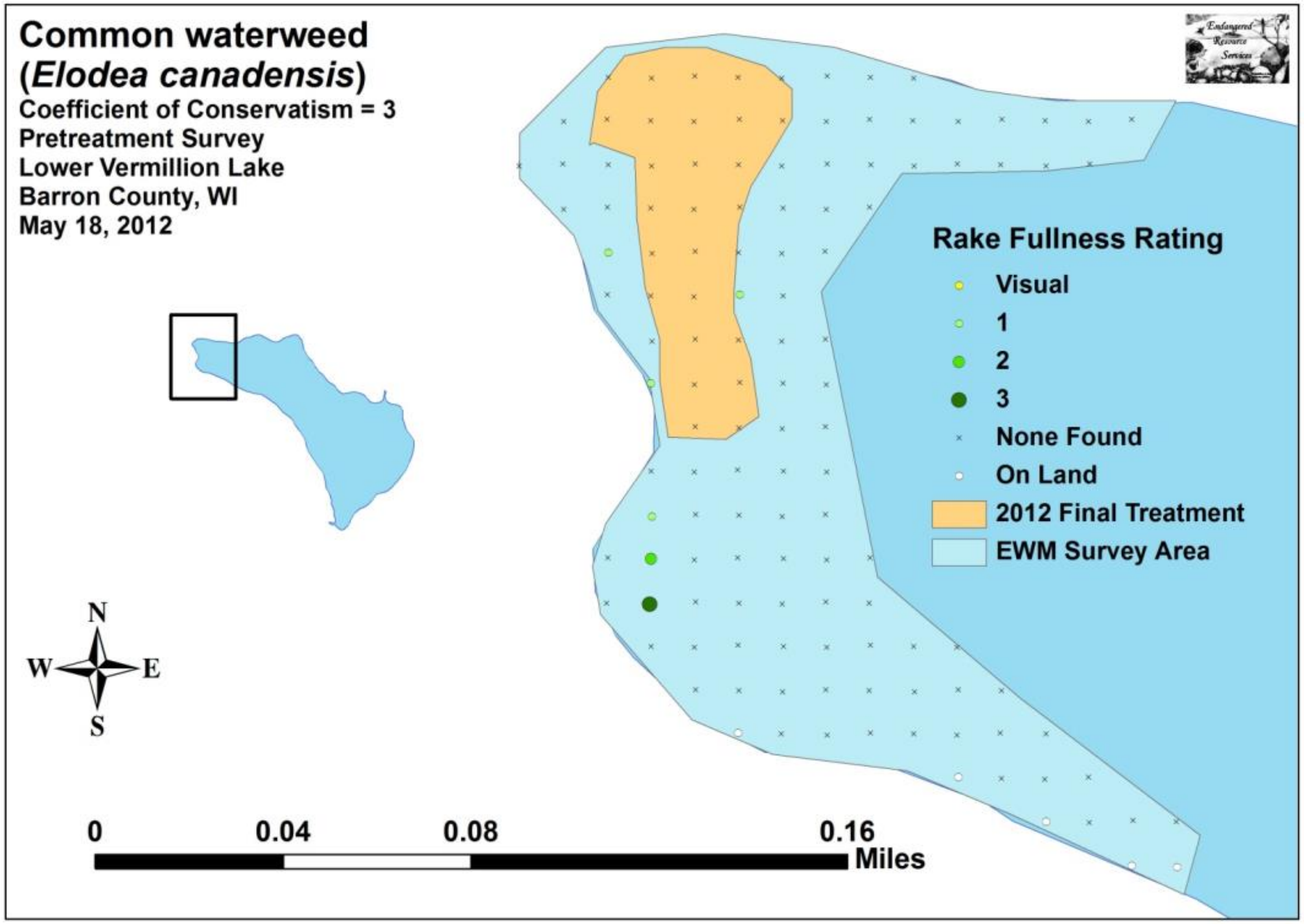
Eurasian water milfoil
(*Myriophyllum spicatum*)
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

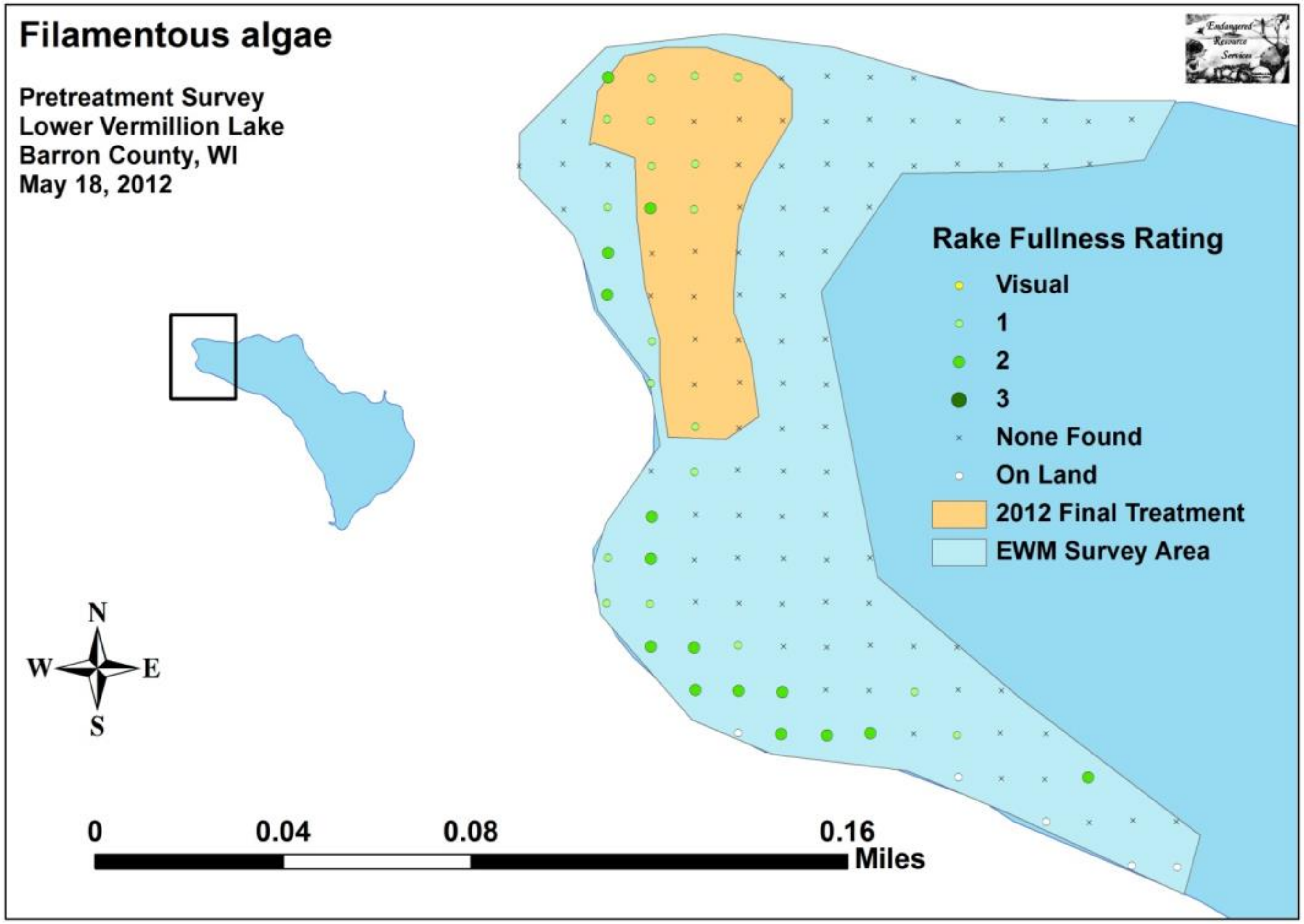

Curly-leaf pondweed
(*Potamogeton crispus*)
Exotic Species
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

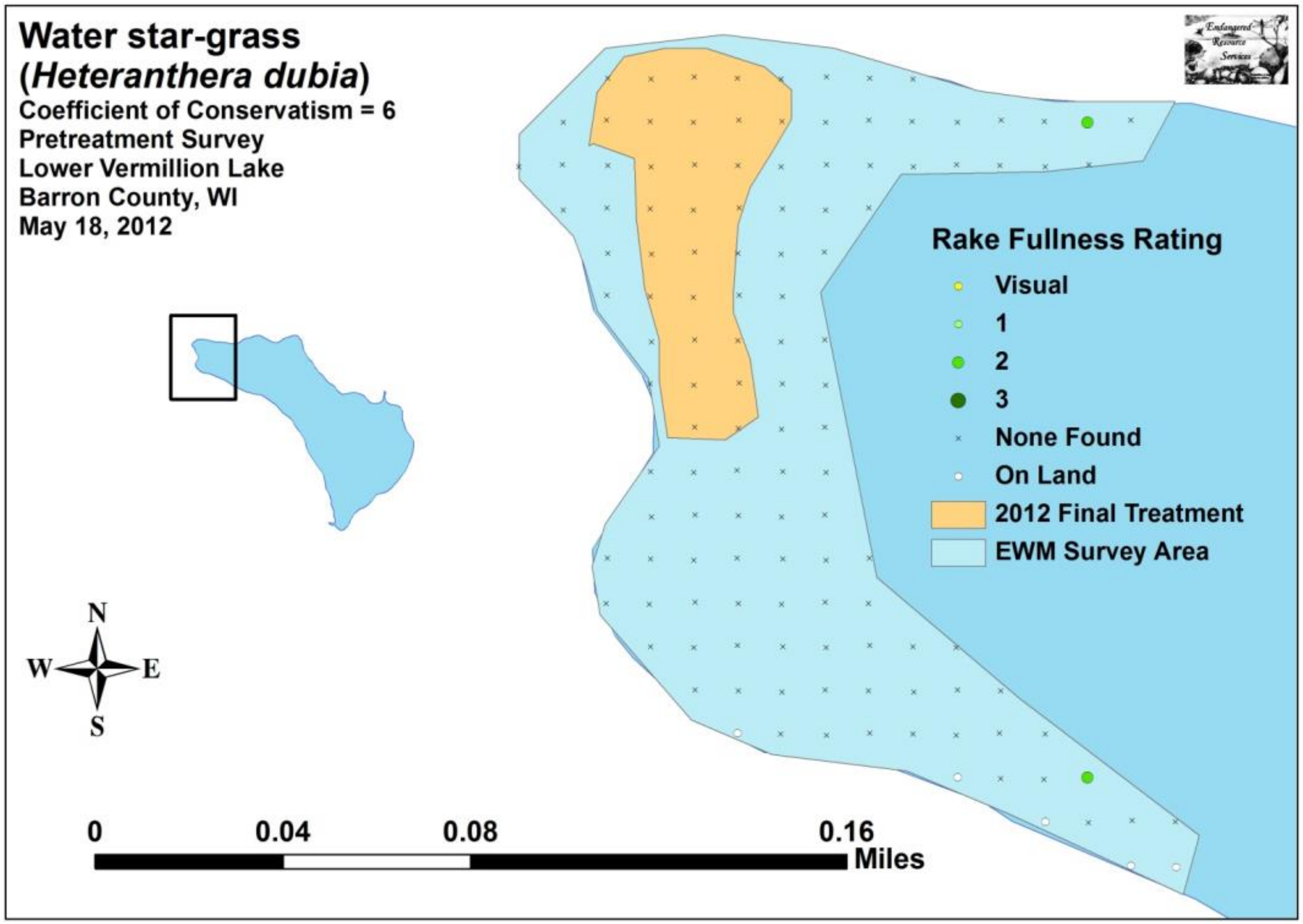

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

Appendix VI: Pretreatment Native Species Density and Distribution

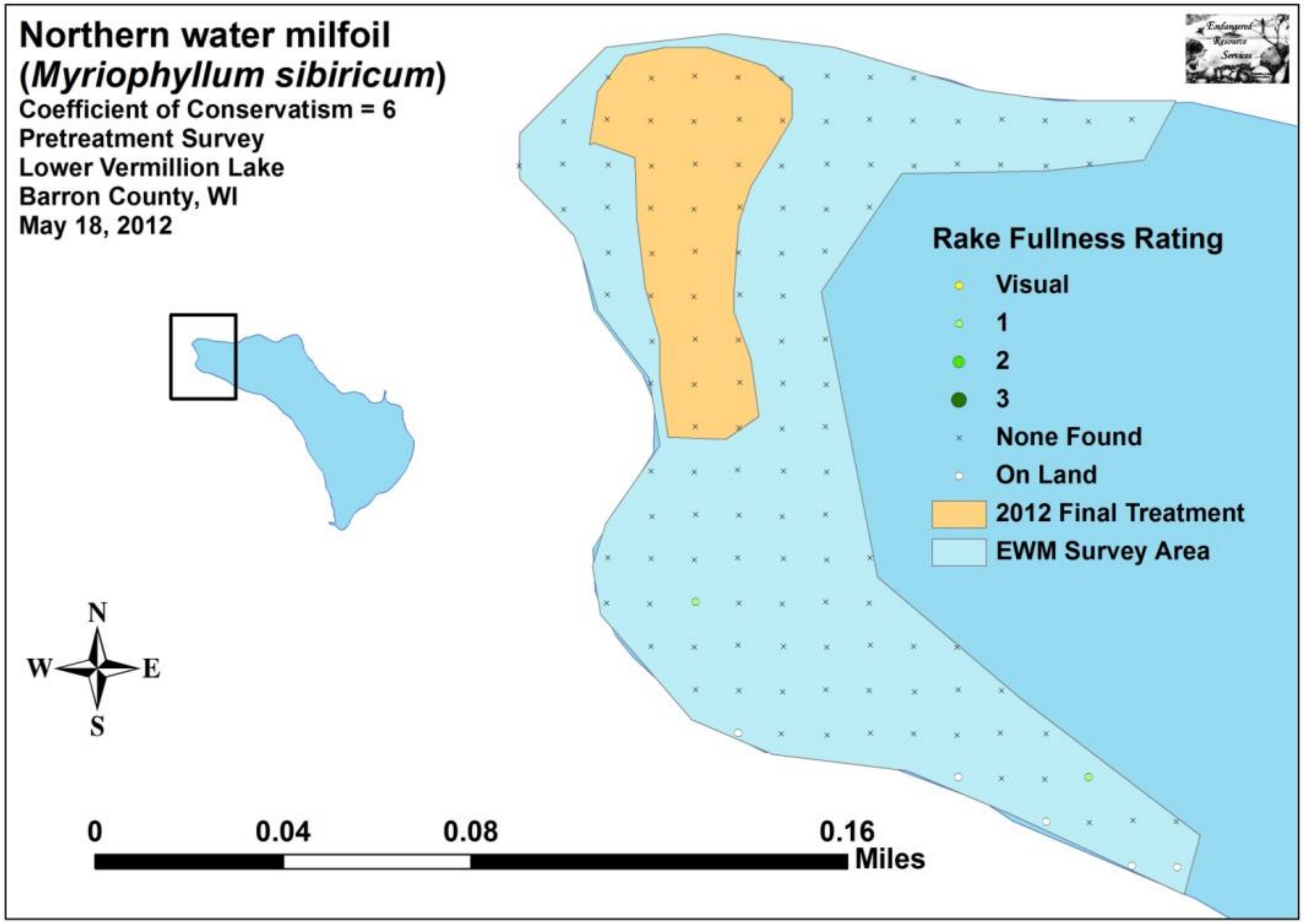

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

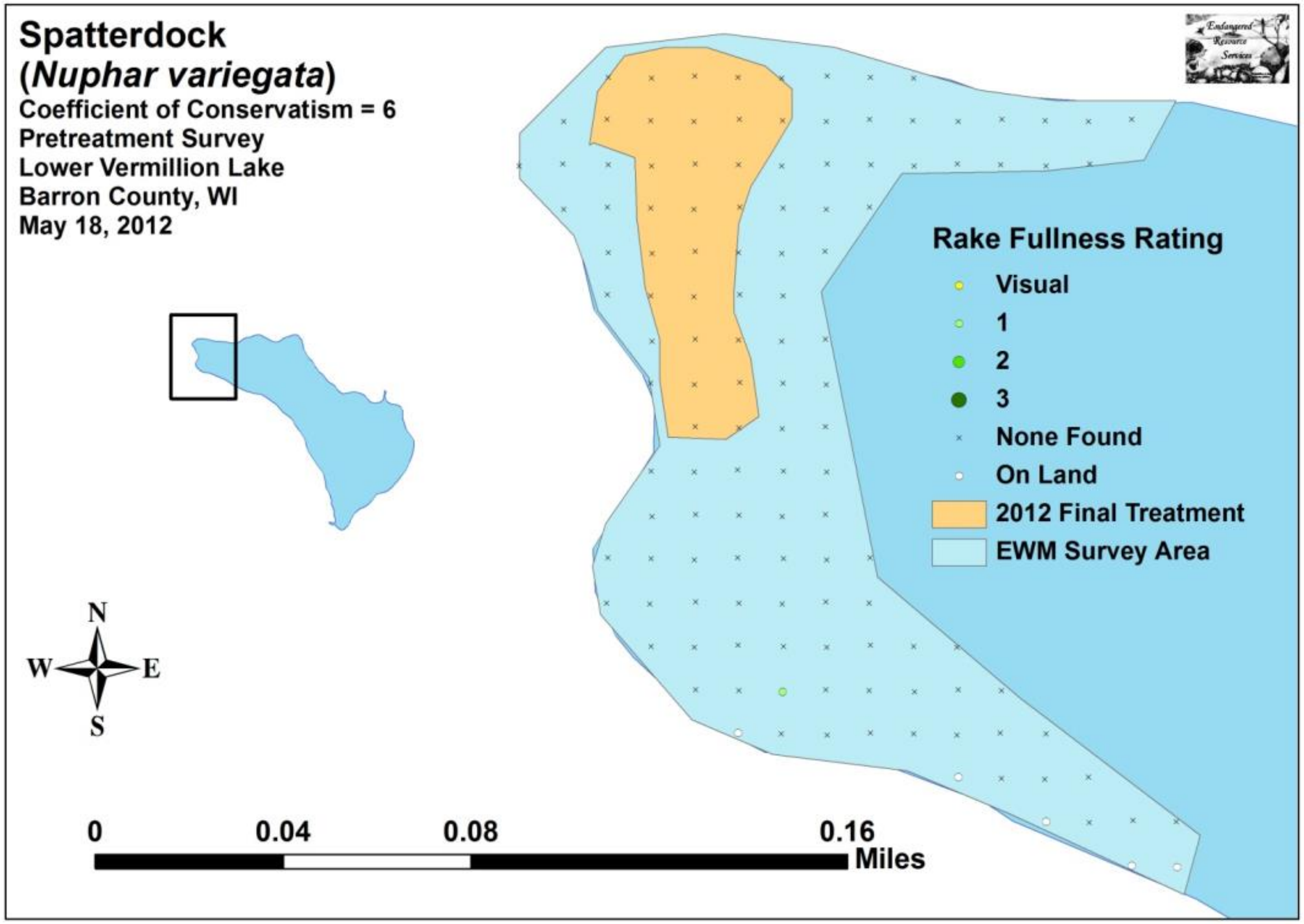

Common waterweed
(*Elodea canadensis*)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles


Filamentous algae
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

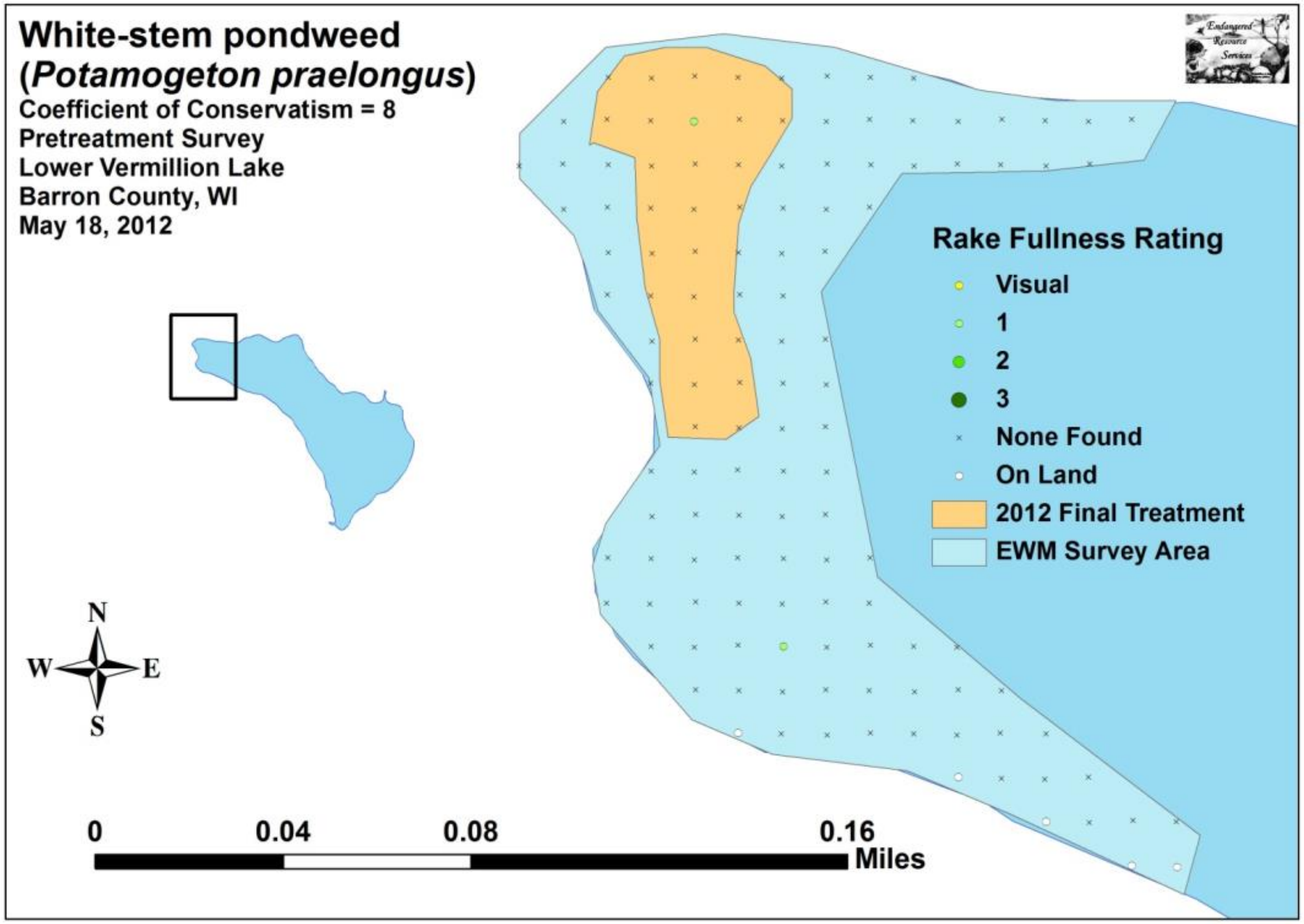


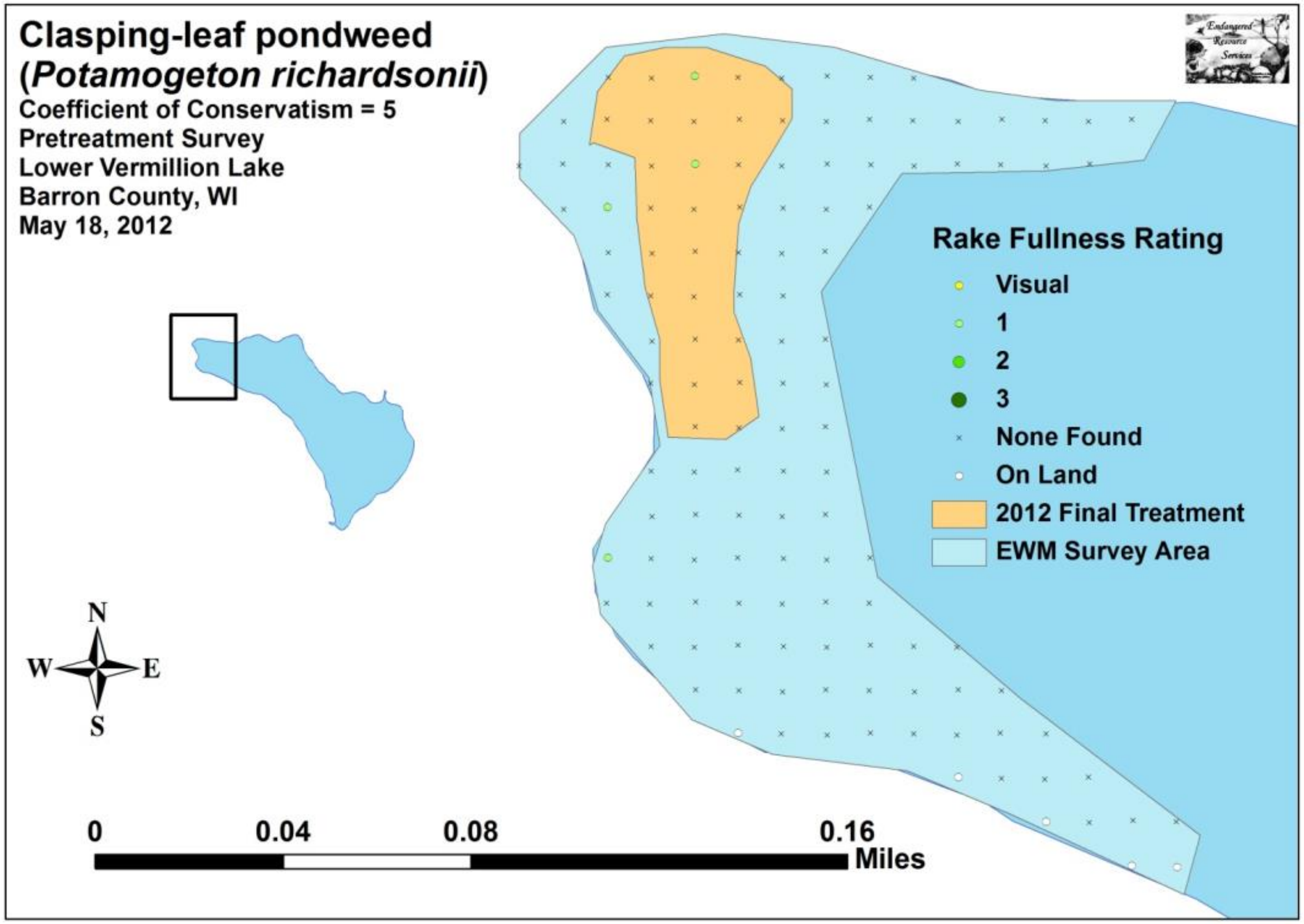
Water star-grass
(*Heteranthera dubia*)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

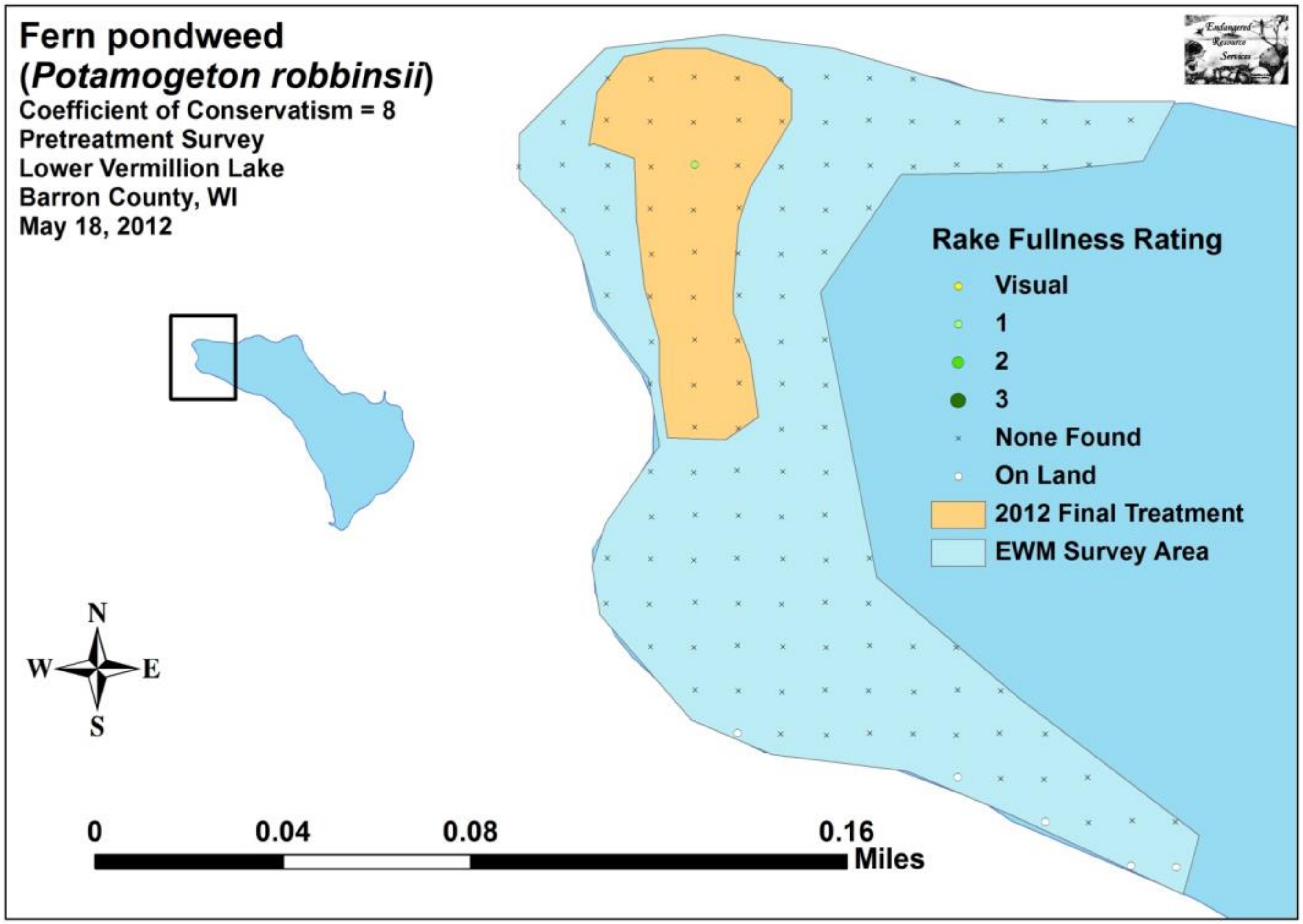

Northern water milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

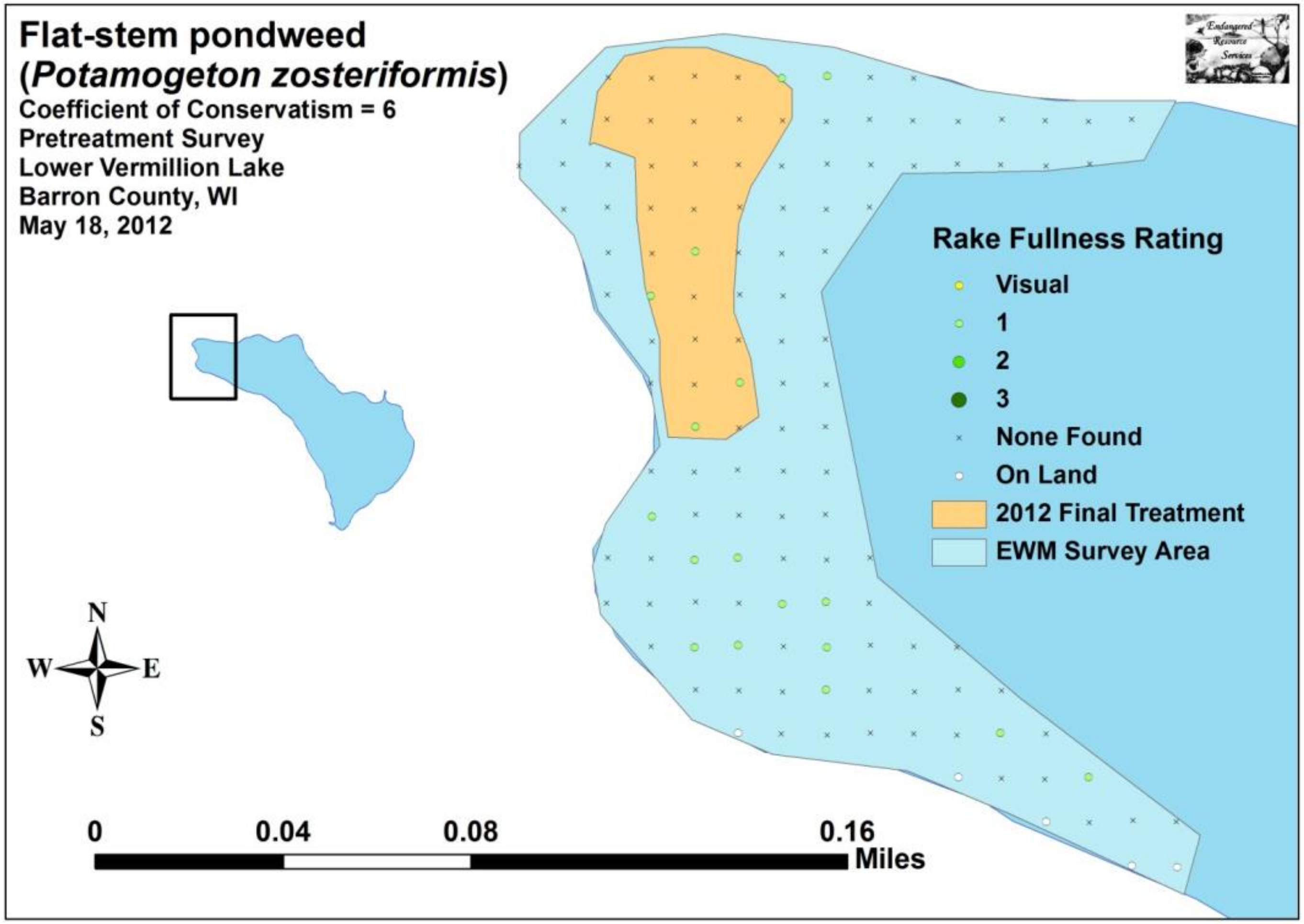


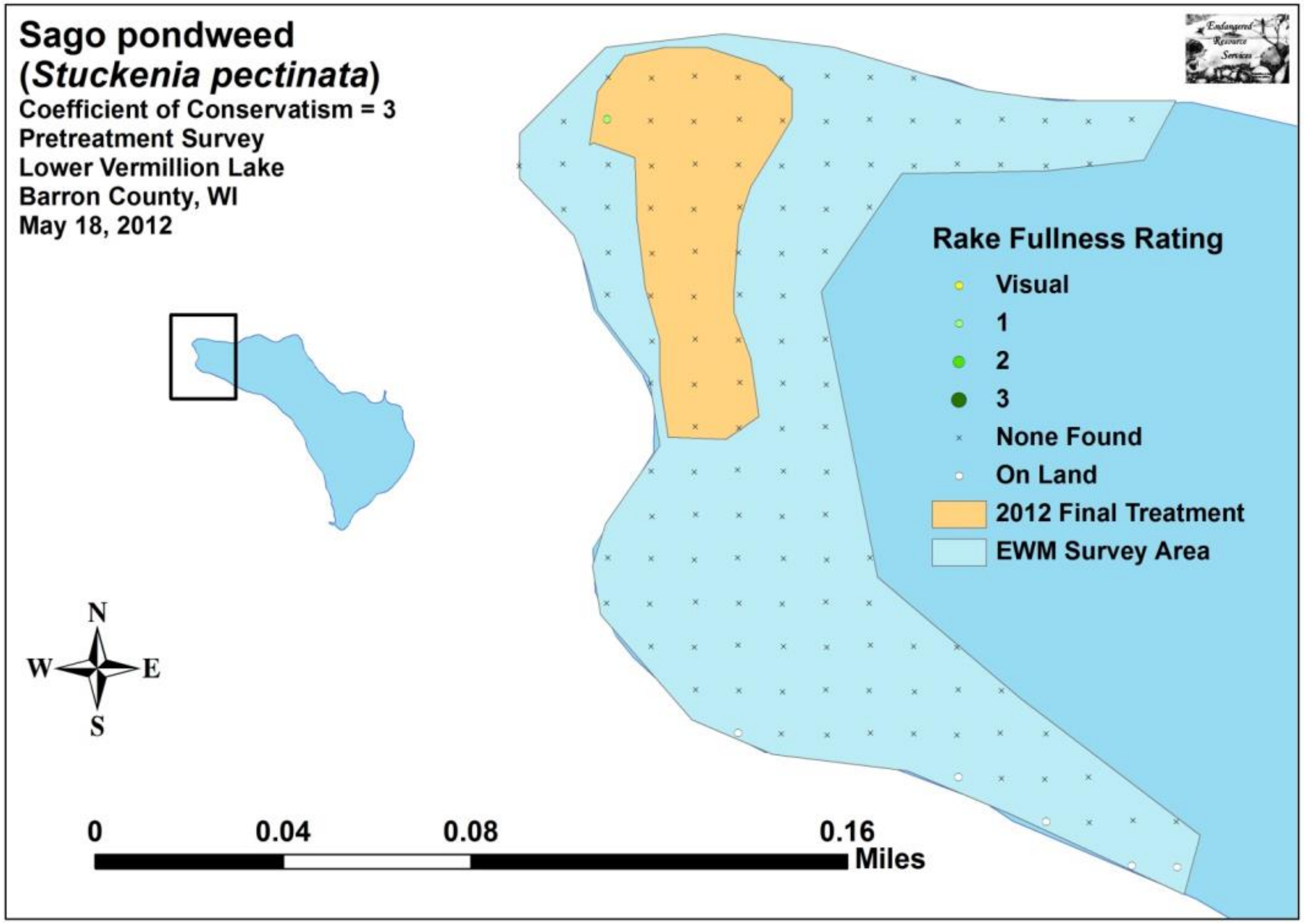
Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles


White-stem pondweed
(*Potamogeton praelongus*)
Coefficient of Conservatism = 8
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

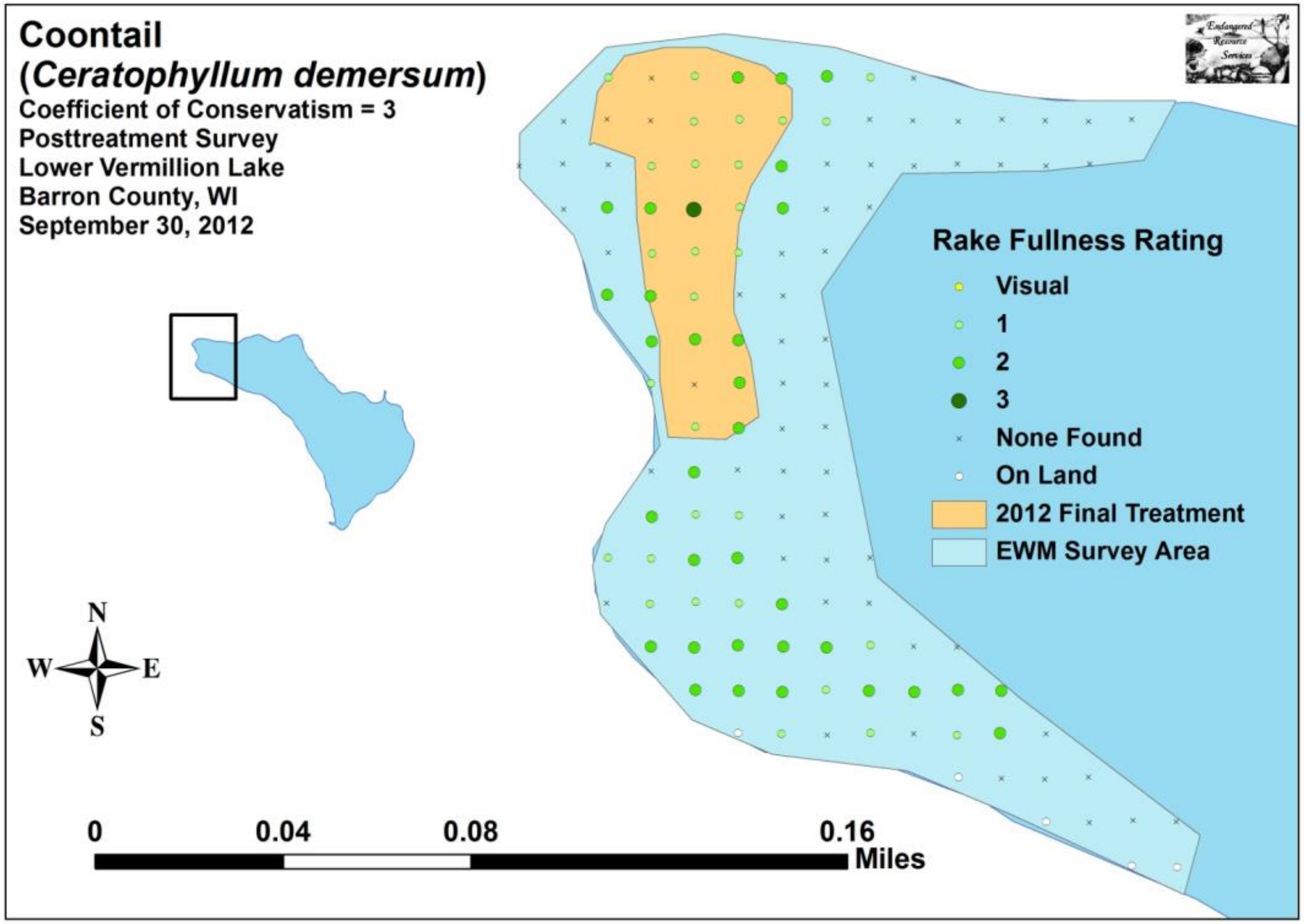

Clasping-leaf pondweed
(*Potamogeton richardsonii*)
Coefficient of Conservatism = 5
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

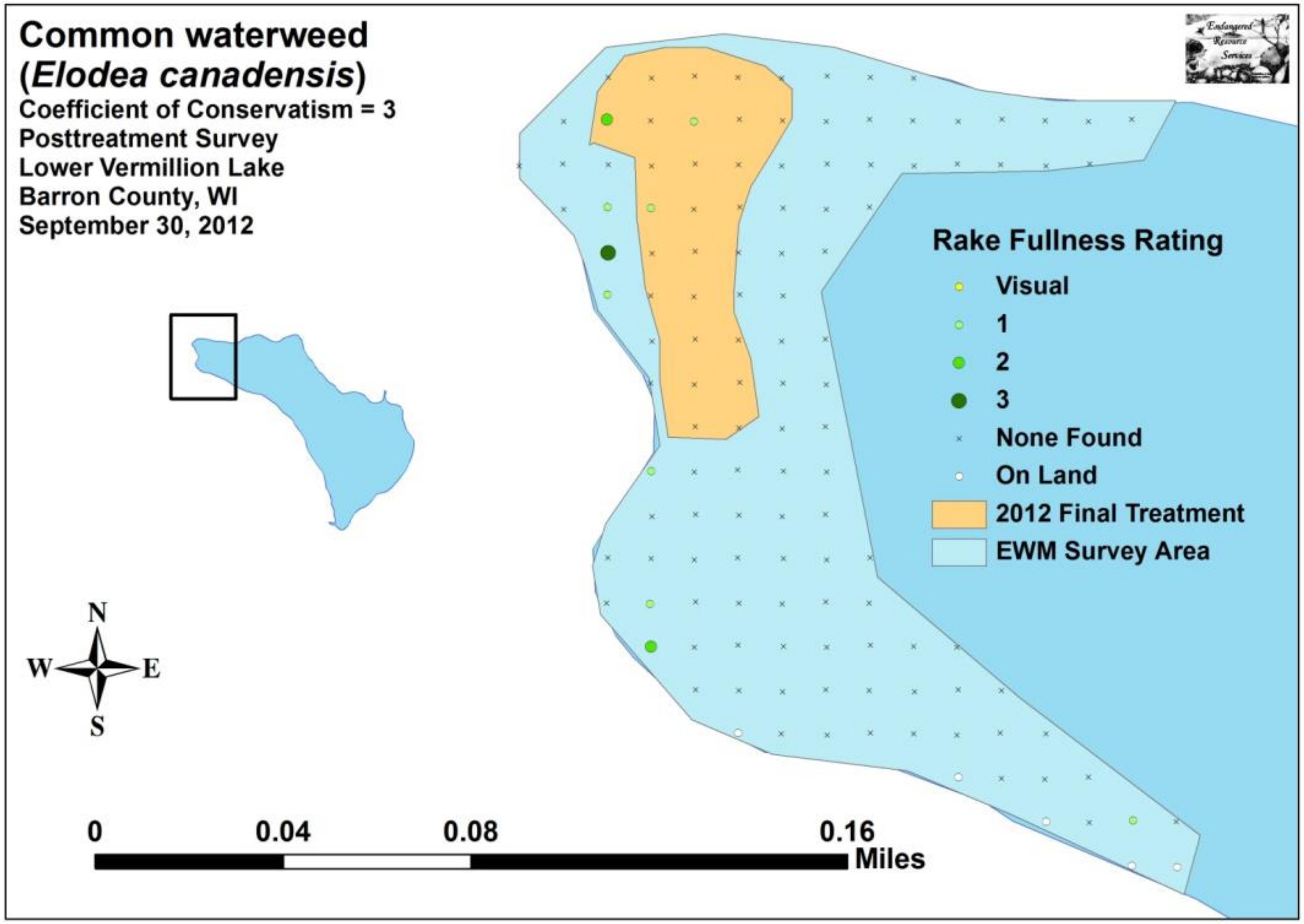

Fern pondweed
(*Potamogeton robbinsii*)
Coefficient of Conservatism = 8
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles


Flat-stem pondweed
(*Potamogeton zosteriformis*)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

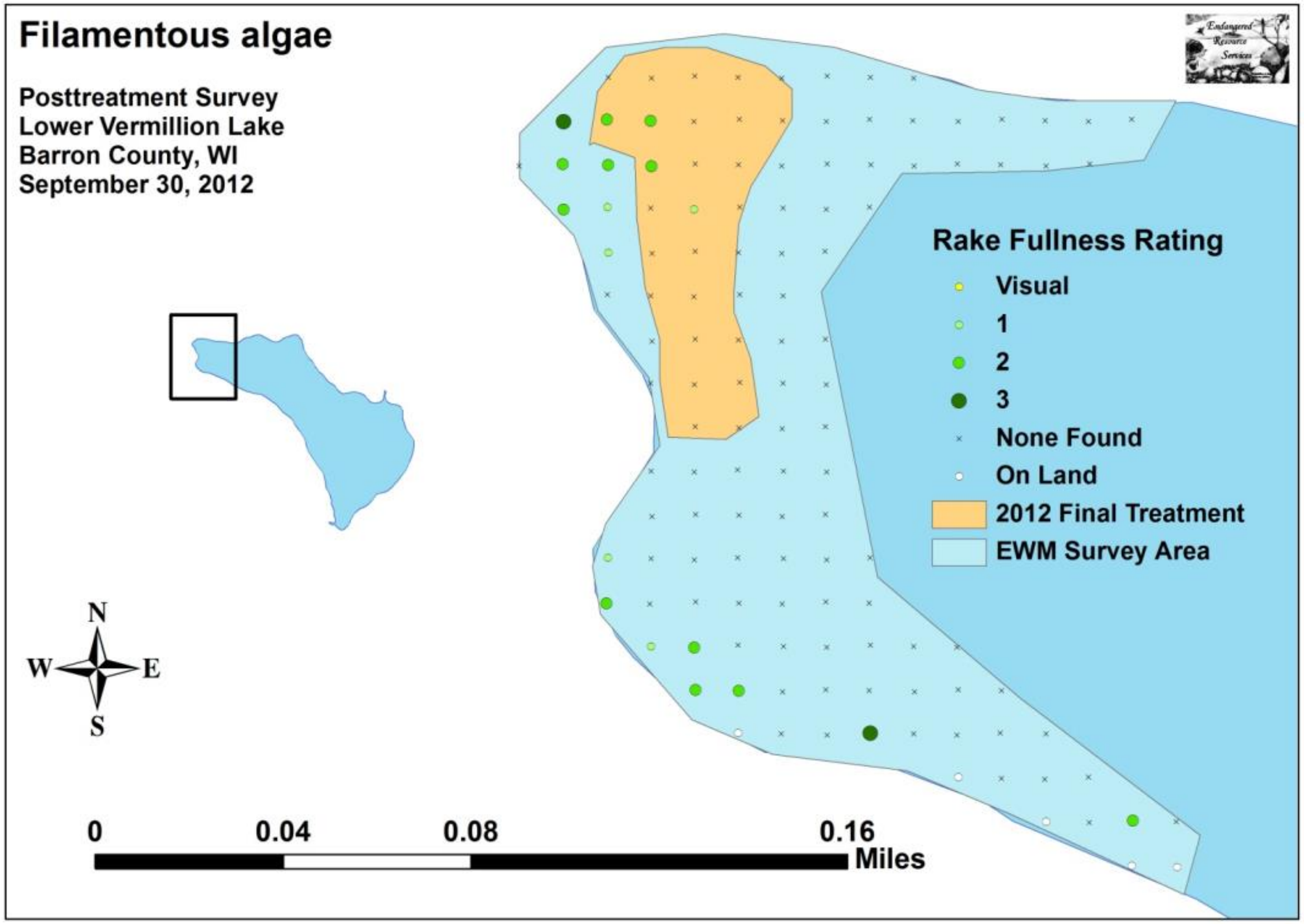

Sago pondweed
(Stuckenia pectinata)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

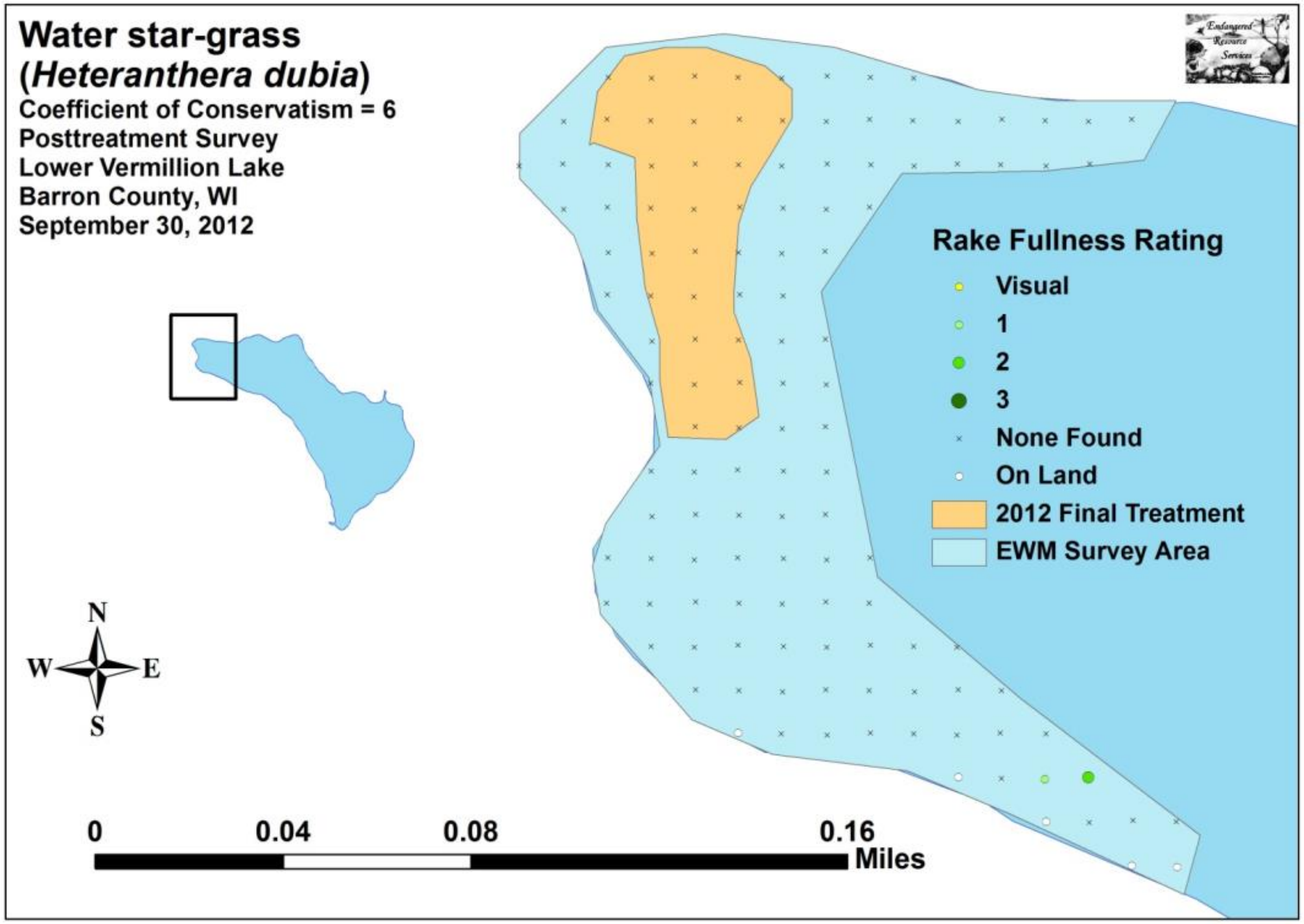
Appendix VII: Posttreatment Native Species Density and Distribution

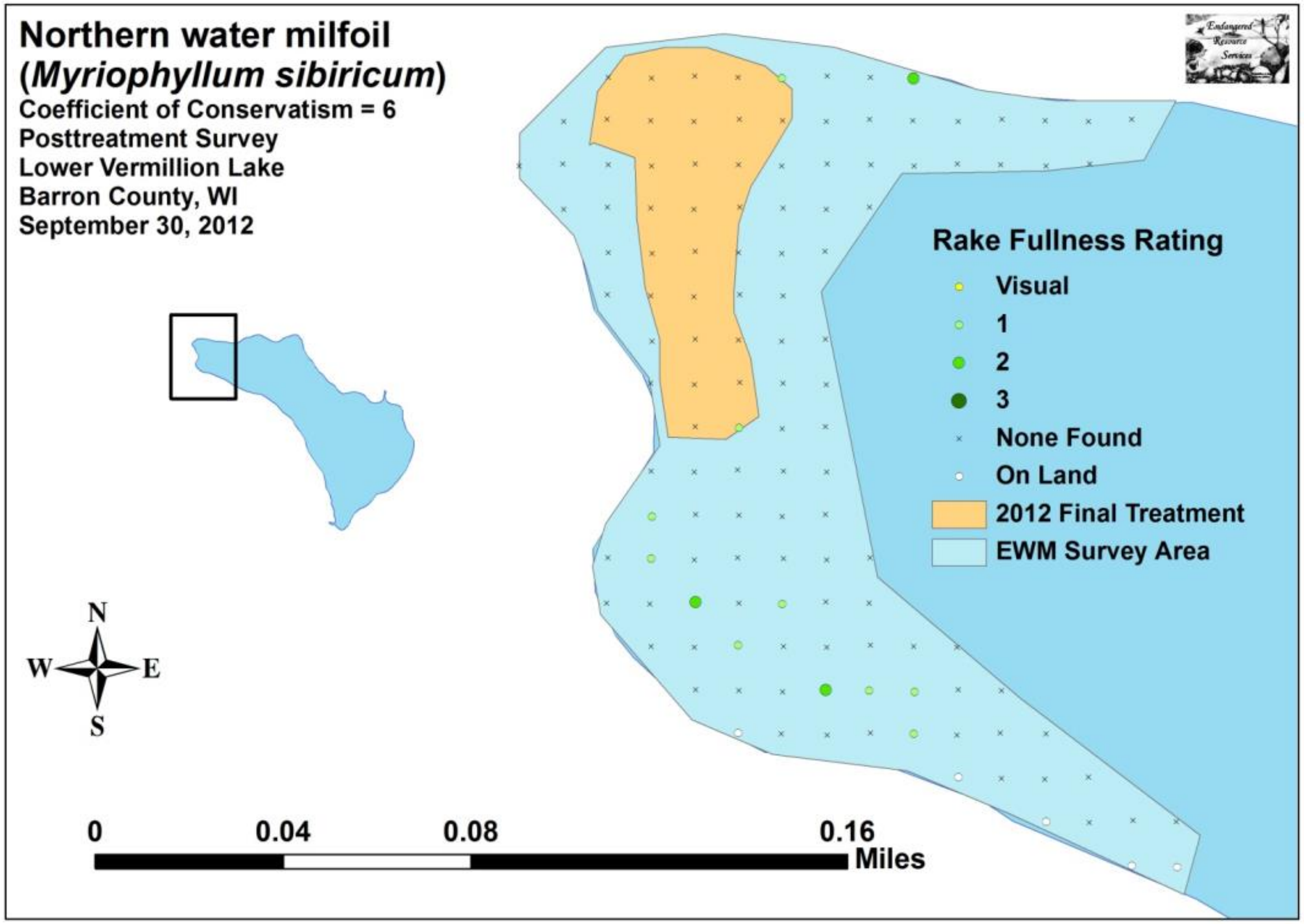

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

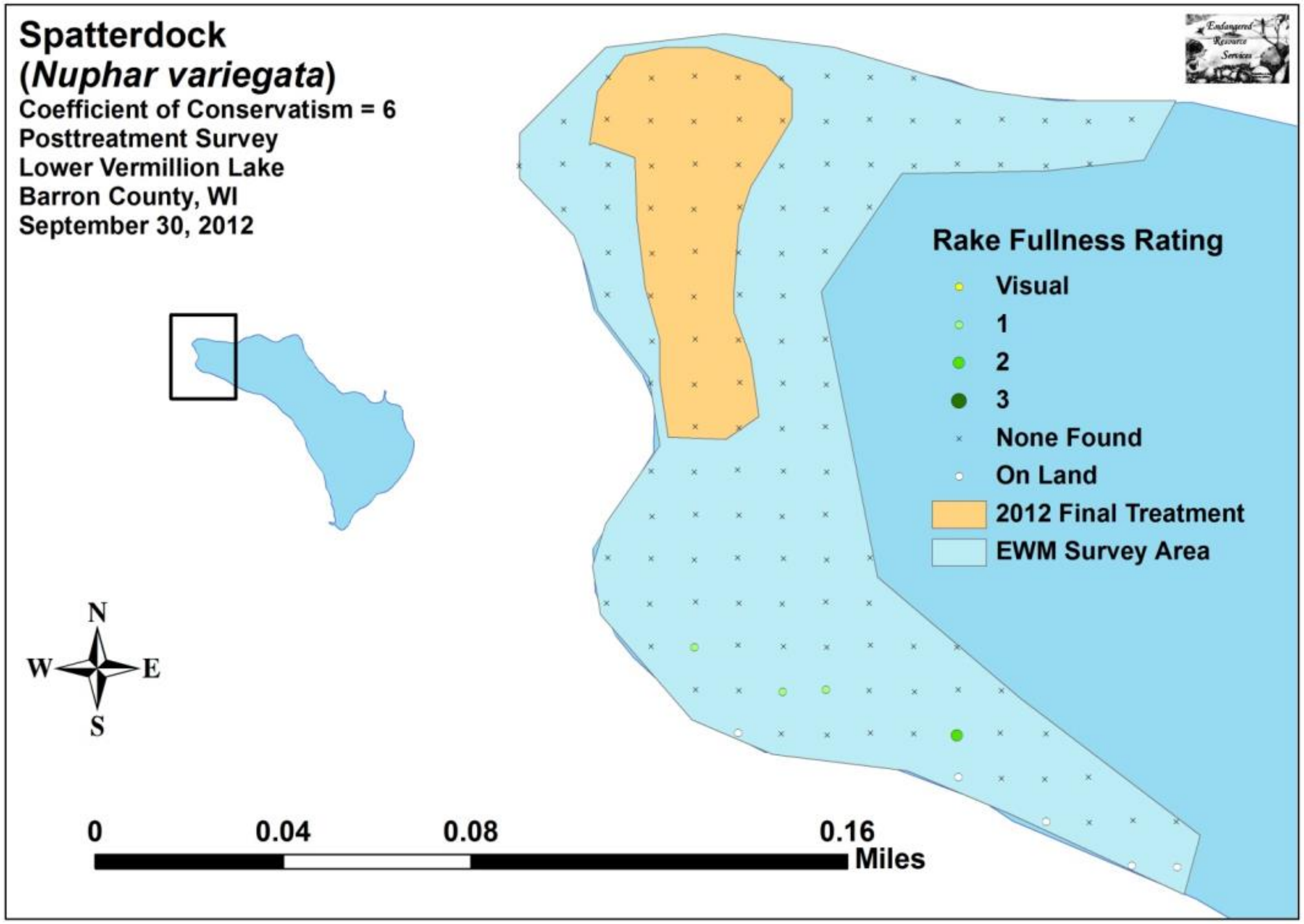


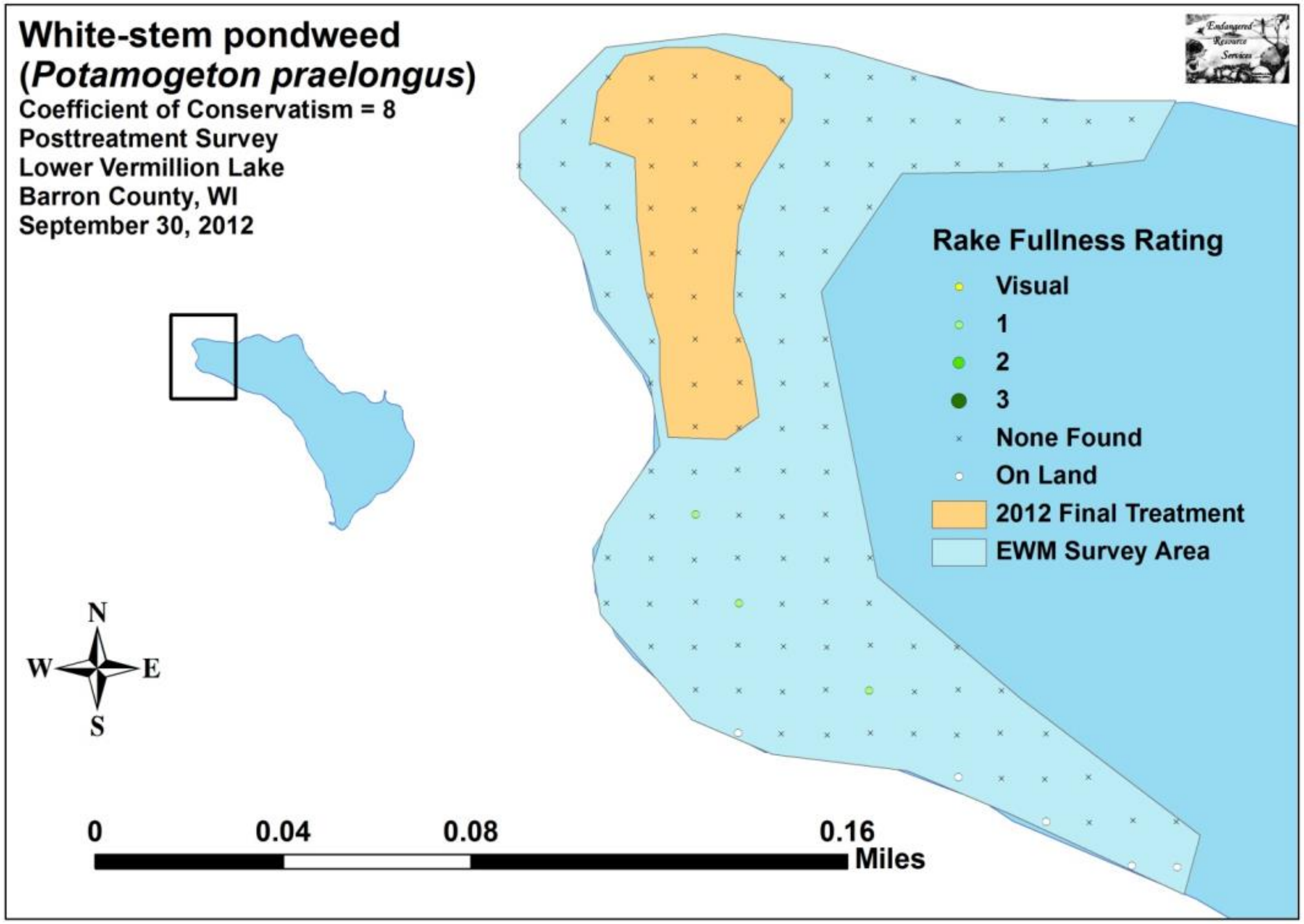
Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

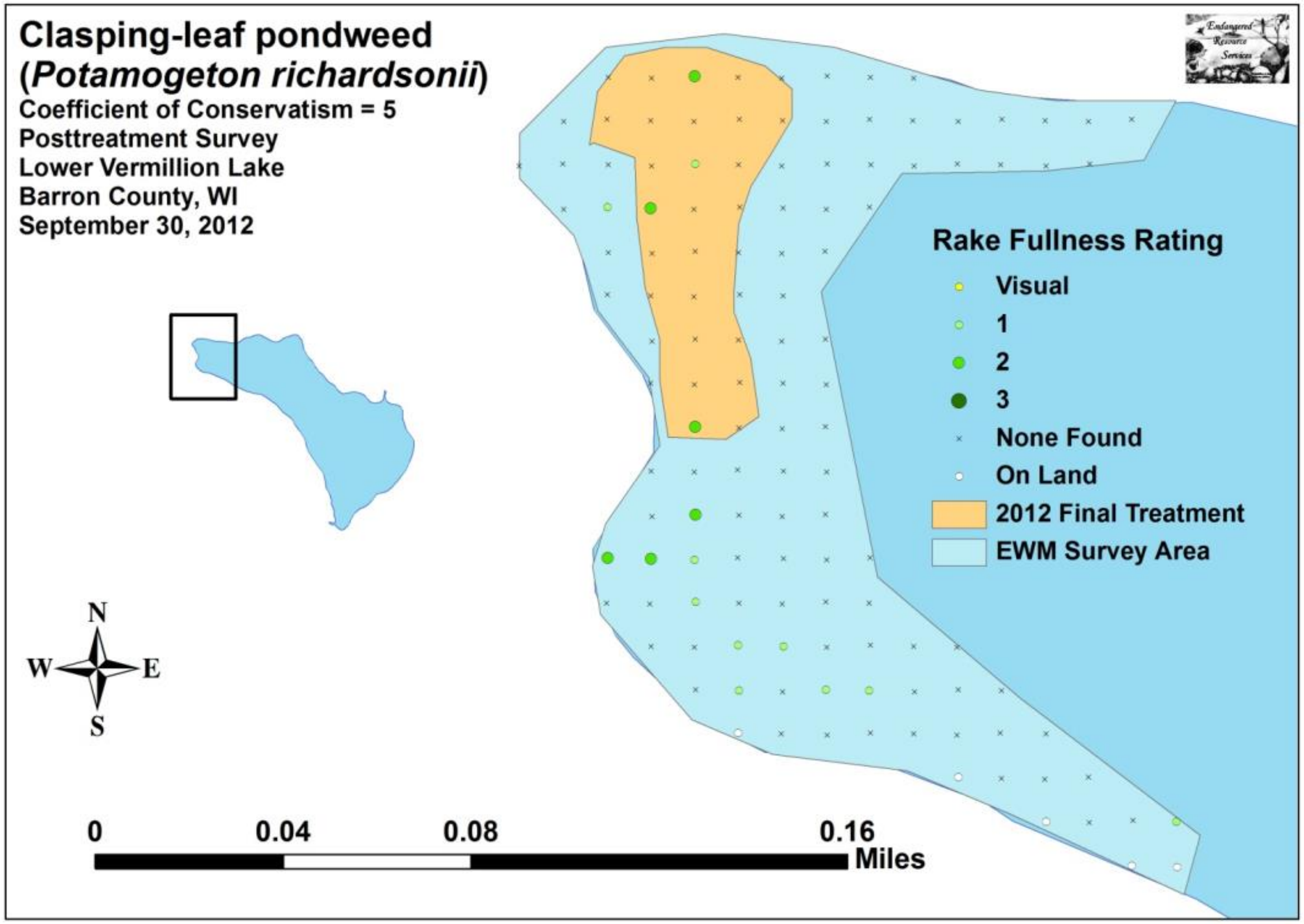

Filamentous algae
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

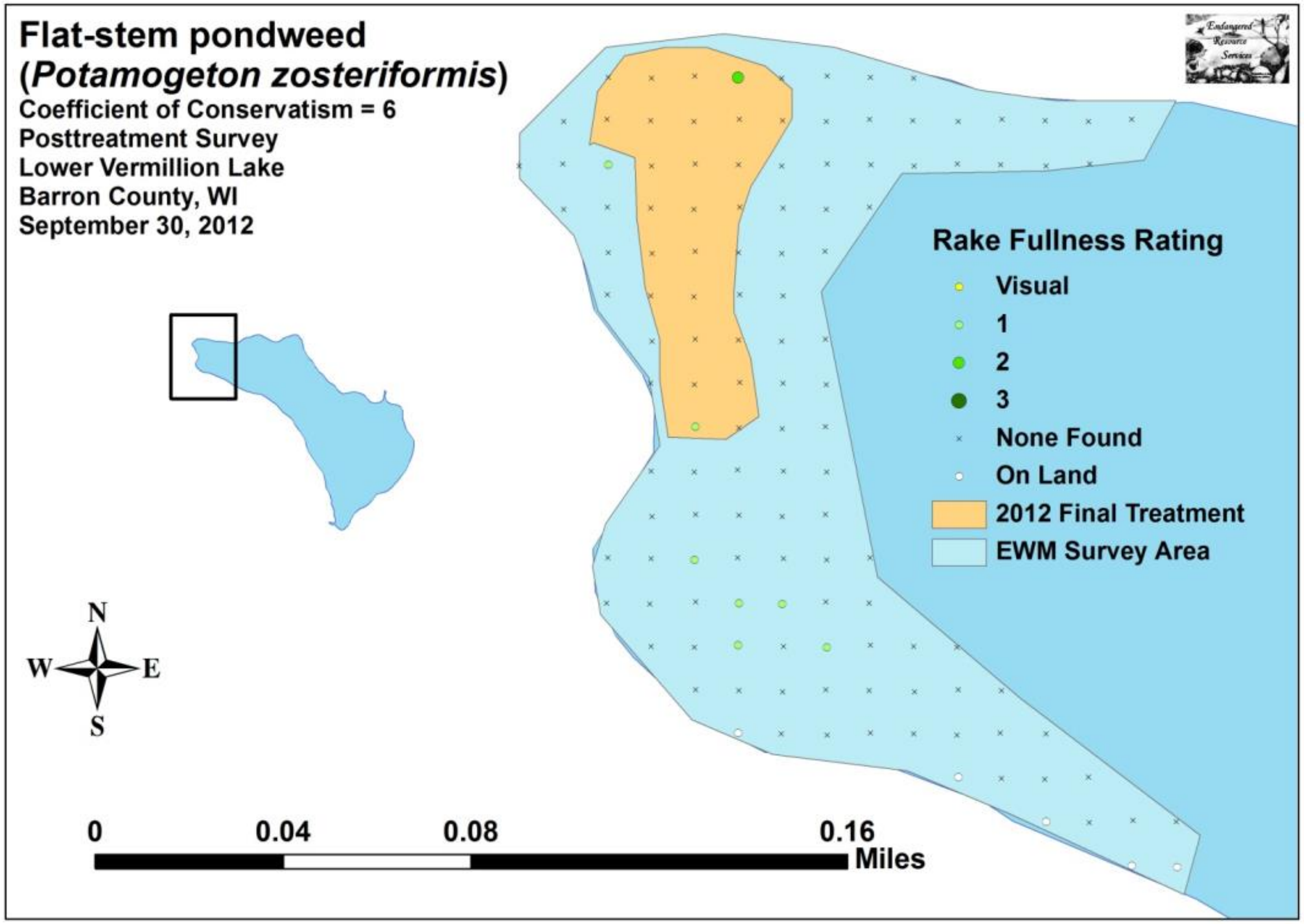

Water star-grass
(*Heteranthera dubia*)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

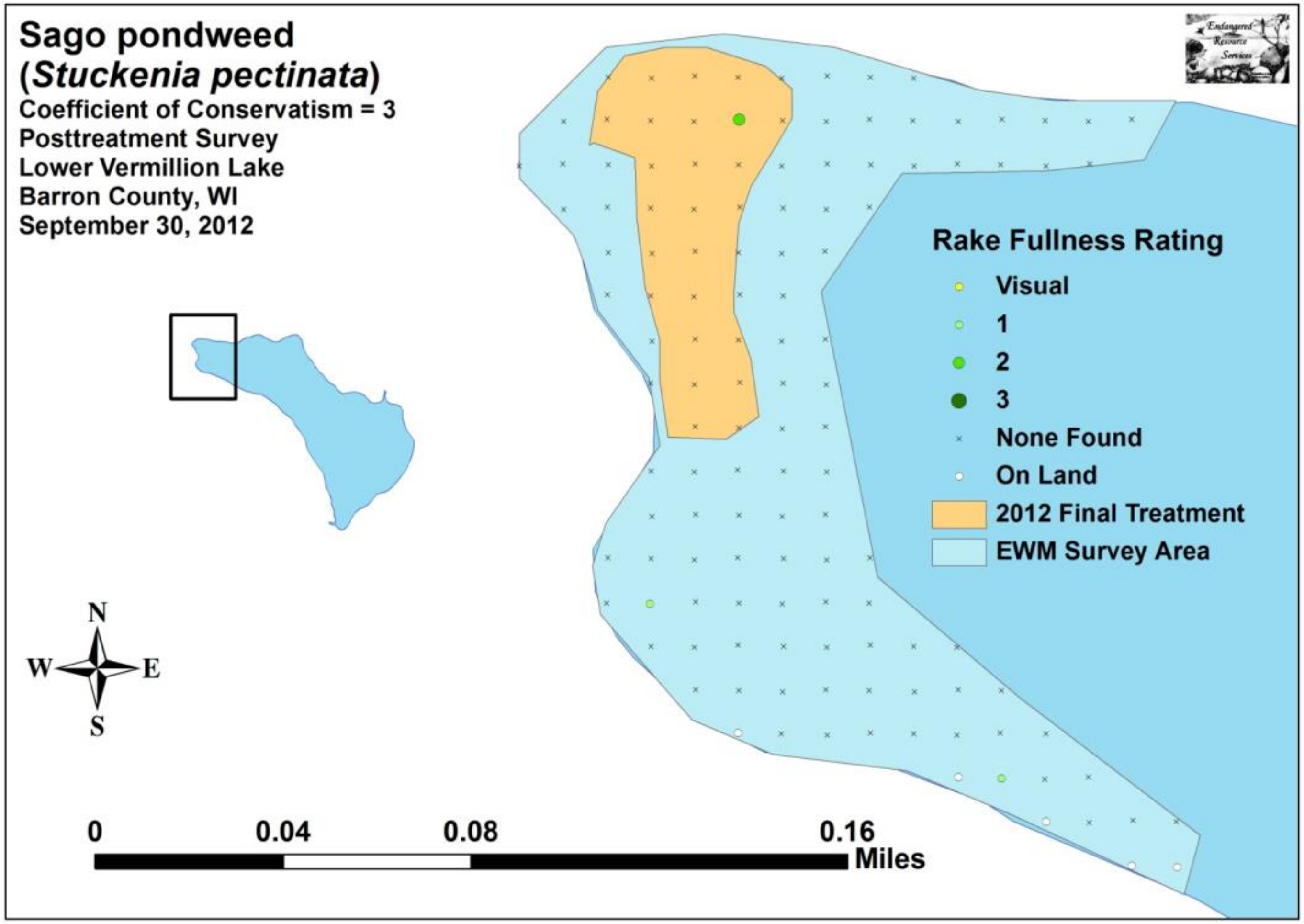

Northern water milfoil
(*Myriophyllum sibiricum*)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

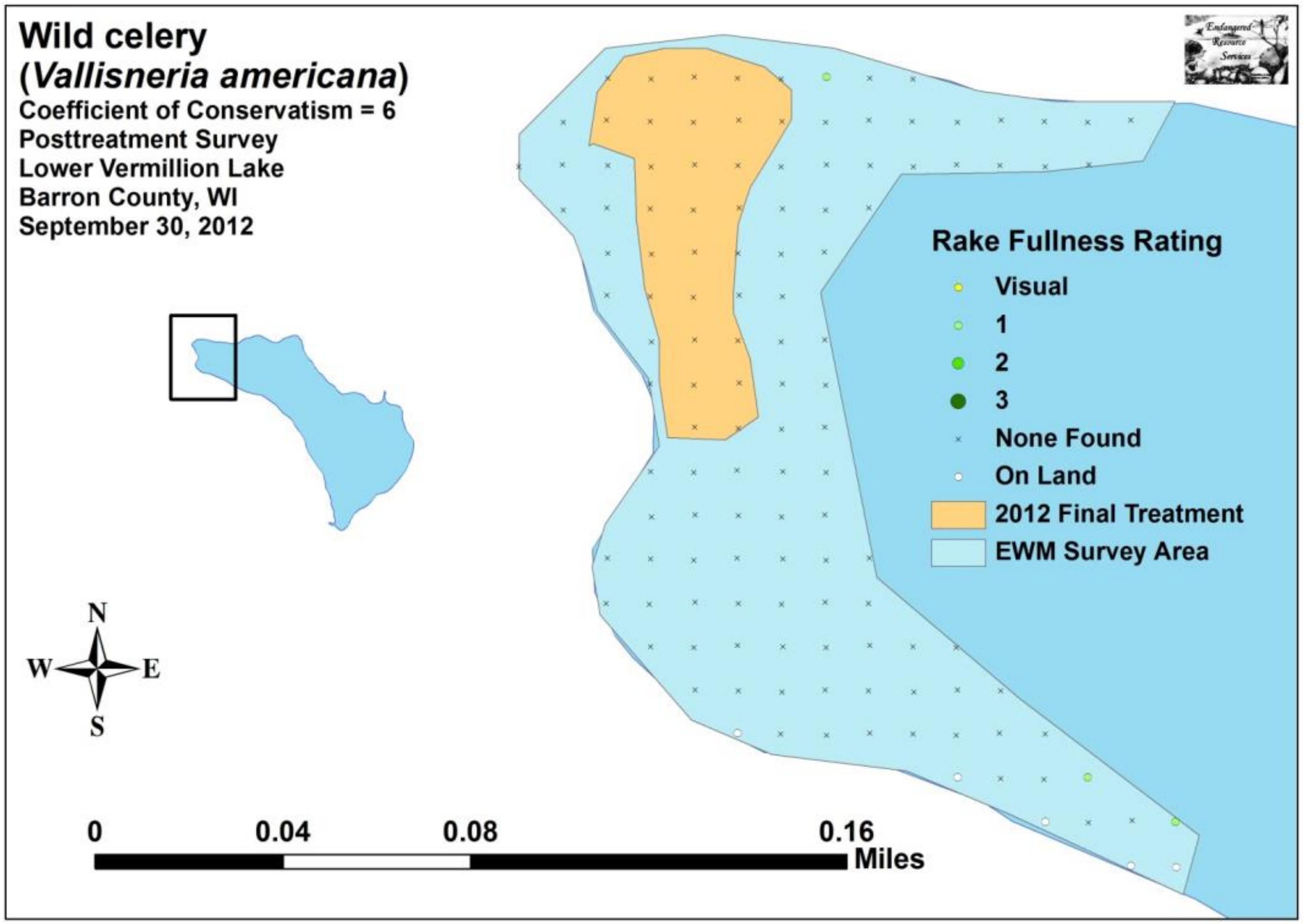

Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles


White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

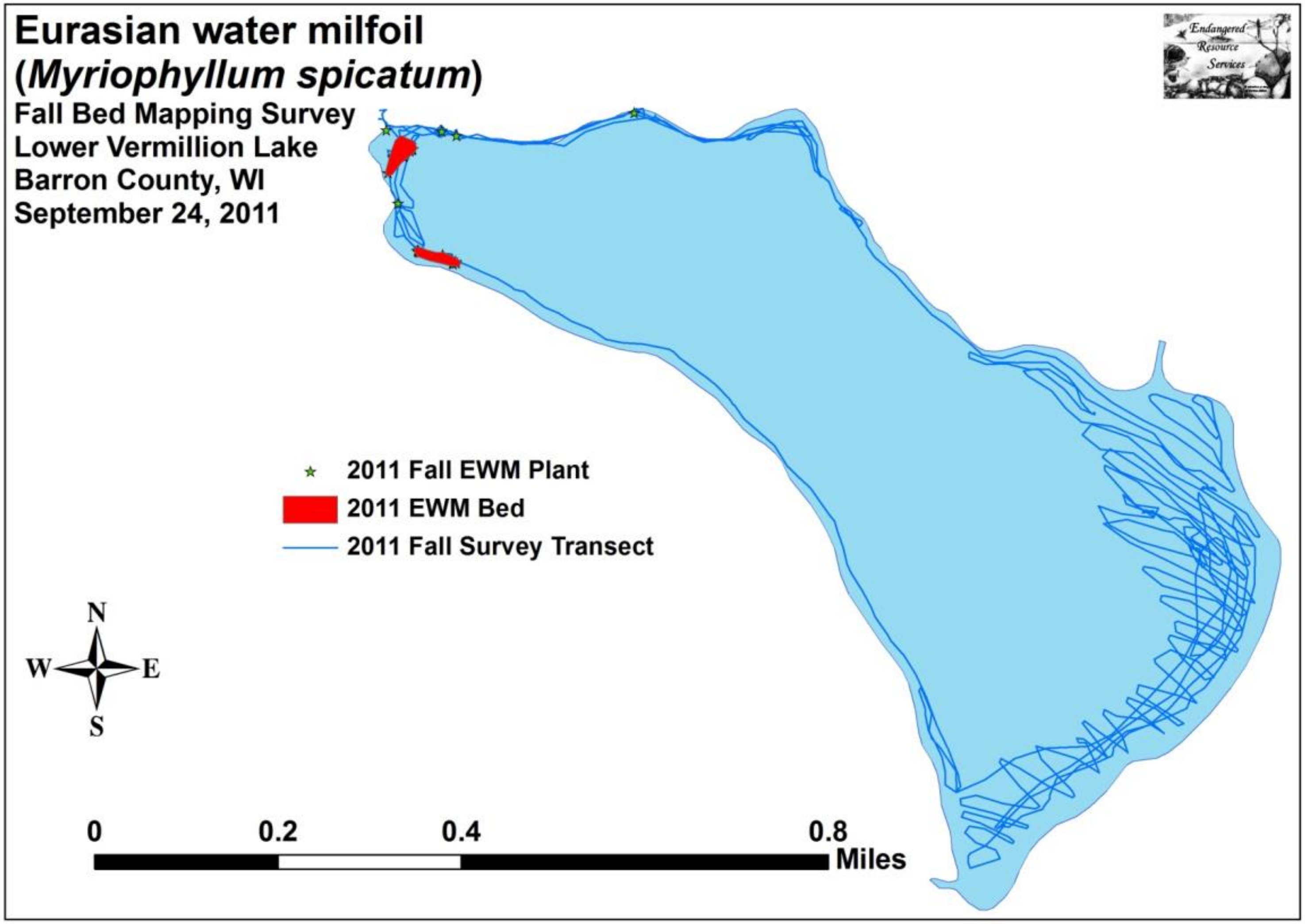

Clasping-leaf pondweed
(*Potamogeton richardsonii*)
Coefficient of Conservatism = 5
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

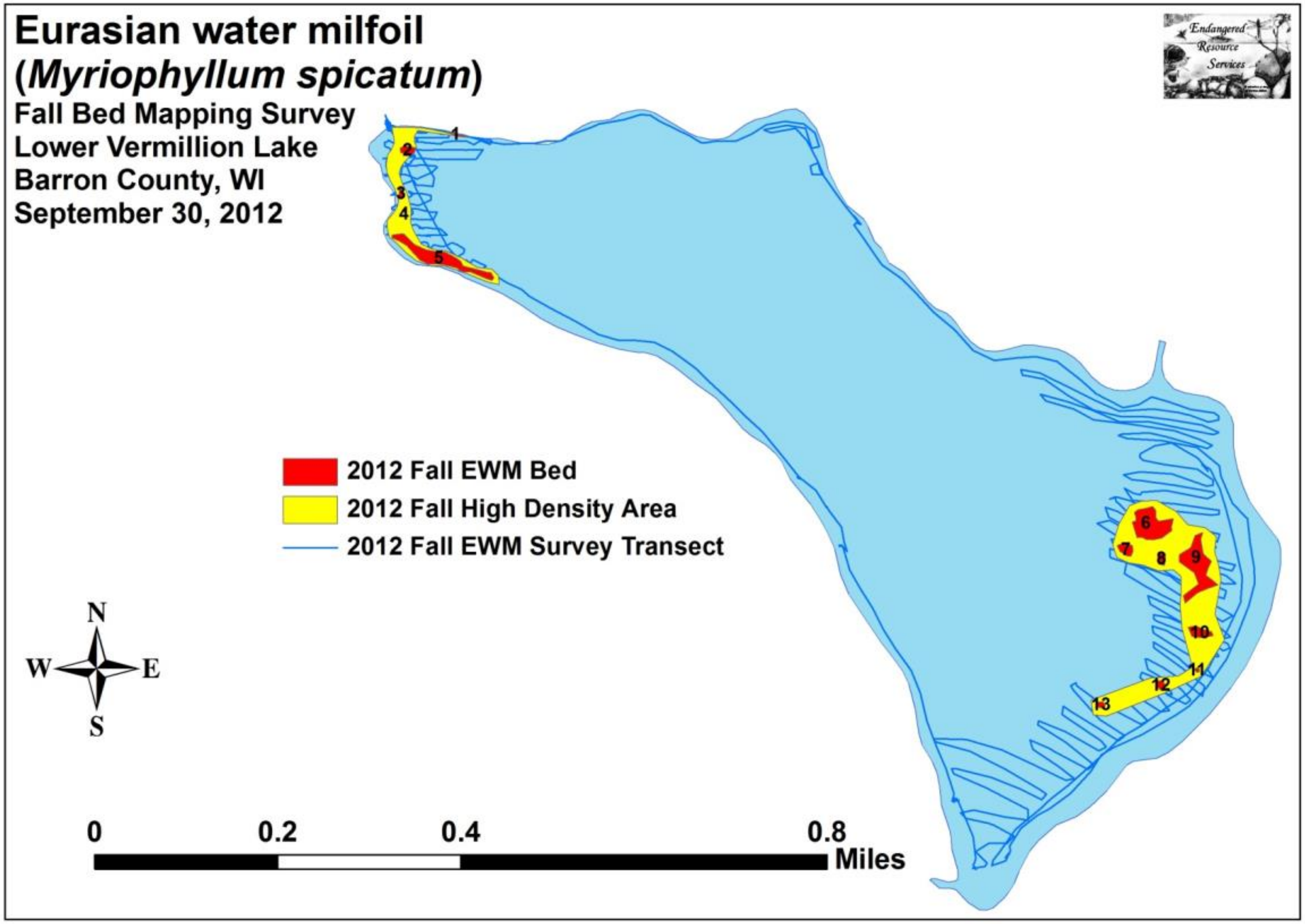

Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles


Sago pondweed
(Stuckenia pectinata)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles


Wild celery
(*Vallisneria americana*)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
On Land
2012 Final Treatment
EWM Survey Area
N
W
E
S
0
0.04
0.08
0.16
Miles

Appendix VIII: Lower Vermillion Lake Fall 2011 and 2012 EWM Bed Maps


Eurasian water milfoil
(Myriophyllum spicatum)
Fall Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
September 24, 2011
Endangered Resource Services
2011 Fall EWM Plant
2011 EWM Bed
2011 Fall Survey Transect
N
W
E
S
0
0.2
0.4
0.8
Miles


Eurasian water milfoil
(Myriophyllum spicatum)
Fall Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Endangered Resource Services
1
2
3
4
5
6
7
8
9
10
11
12
13
2012 Fall EWM Bed
2012 Fall High Density Area
2012 Fall EWM Survey Transect
N
W
E
S
0
0.2
0.4
0.8
Miles