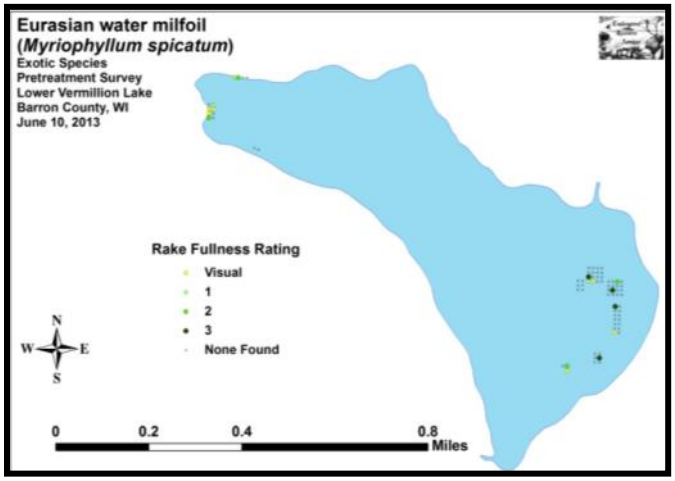
Eurasian water milfoil (*Myriophyllum spicatum*) Pre/Post Herbicide and Fall Bed Mapping Surveys Lower Vermillion Lake – WBIC: 2098200 Barron County, Wisconsin



2013 EWM Pretreatment Distribution Lower Vermillion Lake


Eurasian water milfoil (Berg 2007)

Project Initiated by:
Vermillion Lakes Association, Short Elliott Hendrickson Inc., and the Wisconsin Department of Natural Resources (Grant AIRR-108-12)


2013 EWM treatment areas

Survey Conducted by and Report Prepared by:
Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
June 10, July 20, and October 13, 2013

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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 a 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 summer Secchi readings ranging from 7-12ft (WDNR 2013). This clarity produced a littoral zone that reached approximately 12ft in the spring of 2013. 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.

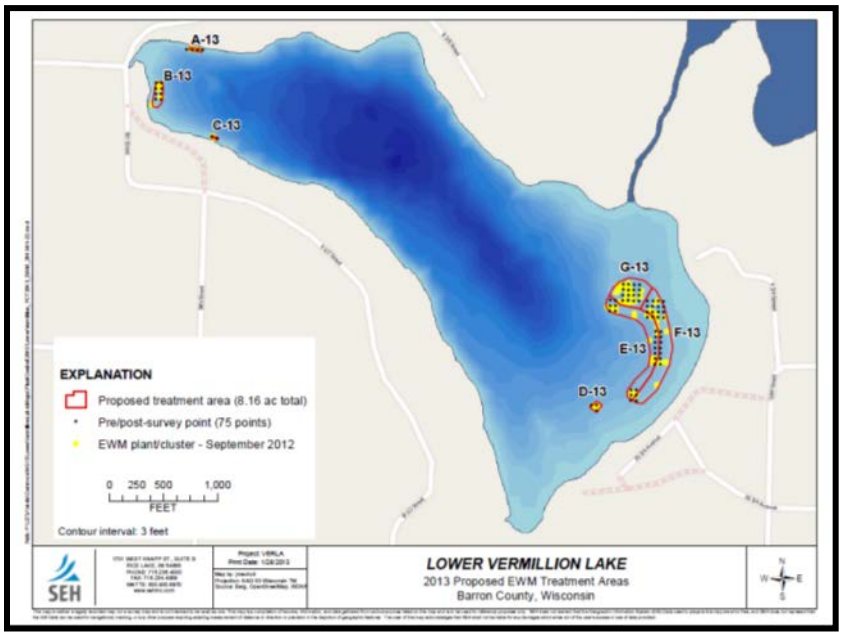


Figure 1: 2013 EWM Treatment Areas

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 working to control this invasive exotic species ever since. Following the 2012 fall EWM bed mapping survey that found EWM in scattered patches throughout the northwest bay near the boat landing and newly established in the broad eastern flat, the VLA, under the direction of Short Elliott Hendrickson Inc. (SEH) and in accordance with the WDNR approved Vermillion Lakes Aquatic Plant Management Plan, decided to chemically treat seven areas in 2013. Combined, they totaled 8.16 acres or 3.8% of the lake's total surface area (Figure 1).

On June 10th, 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 June 25th herbicide application, we conducted a July 20th posttreatment survey to evaluate the effectiveness of the treatment. We also conducted an October 13th EWM bed mapping survey to determine where EWM control might be considered in 2014. This report is the summary analysis of these three field surveys.

METHODS:

Pre/Post Herbicide Survey:

SEH biologists created 75 pre/post survey points based on the size and shape of the proposed treatment areas. This was on the high end of the 4-10 pts/acre required by WDNR protocol (Appendix I).

During the surveys, we located each of these points 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 and Curly-leaf pondweed (*Potamogeton crispus*), another exotic invasive species, were 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 WDNR 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 $p < .005$.

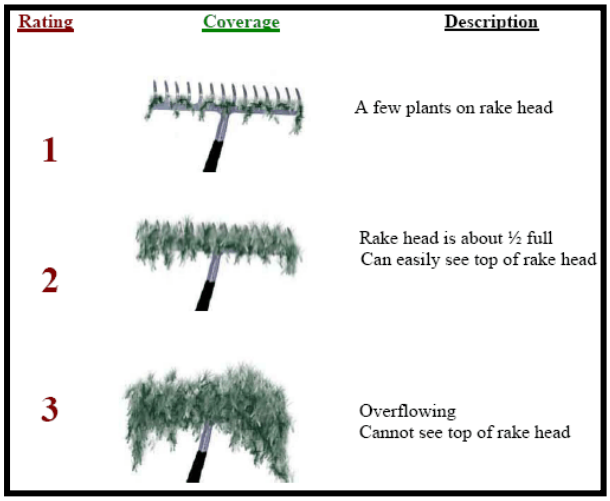


Figure 2: Rake Fullness Ratings

Fall Eurasian Water Milfoil Bed Mapping:

On October 13th, 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. 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. We also GPS marked individual EWM plants outside of the beds as they were few in number.

RESULTS AND DISCUSSION:

Finalization of Treatment Areas:

Initial expectations were to treat seven beds totaling 8.16 acres with granular or liquid 2, 4-D (Navigate) at a concentration of 3-4 ppm (Table 1). Following the pretreatment survey, it was determined to maintain all seven of these areas as planned. The final treatment was conducted by Northern Aquatic Services on June 25th (Figure 3) (Appendix I).

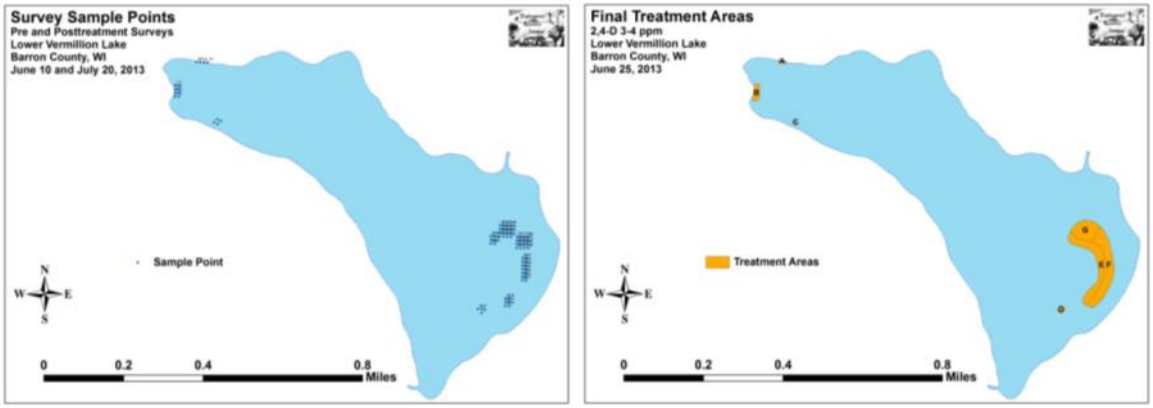


Figure 3: 2013 Survey Sample Points and Final Treatment Areas

Table 1: EWM Treatment Summary
Lower Vermillion Lake – June 25, 2013

Bed	Proposed Acreage	Final Acreage	Difference +/-
A	0.07	0.07	0
B	0.40	0.40	0
C	0.03	0.03	0
D	0.13	0.13	0
E	2.65	2.65	0
F	3.16	3.16	0
G	1.72	1.72	0
Total Acres	**8.16**	**8.16**	**0.00**

EWM Pre/Post Herbicide Survey:

The treatment area littoral zone extended to a maximum of 12.0ft during the pretreatment survey and 10.0ft during the posttreatment survey. Mean and median depths for all plants were 7.2ft and 7.0ft respectively during the pretreatment and a similar 7.5ft and 7.0ft during the posttreatment survey (Table 2). Most EWM was established over organic muck with a few low density patches occurring on sandy bottoms near the shoreline (Figure 4) (Appendix III).

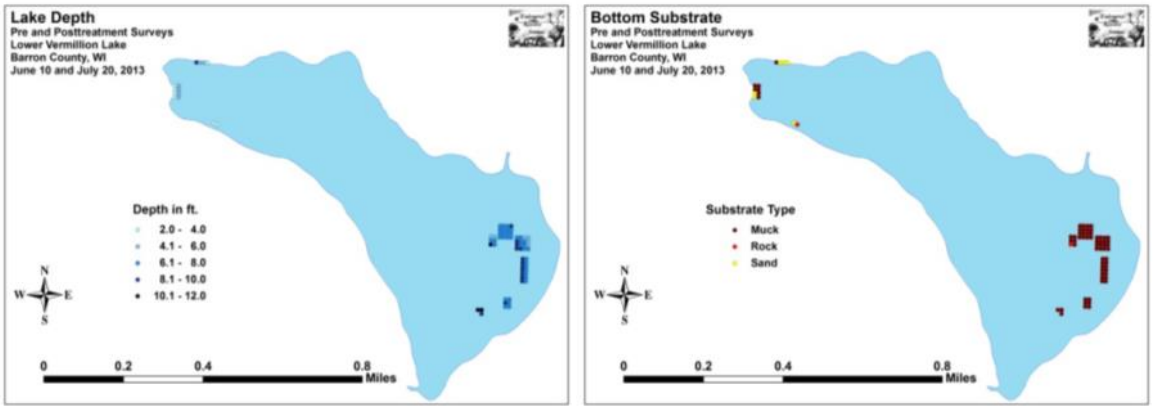


Figure 4: Treatment Area Depths and Bottom Substrate

Table 2: Pre/Post Survey Summary Statistics
Lower Vermillion Lake, Barron County
June 10 and July 20, 2013

Summary Statistics:	Pre	Post
Total number of points sampled	75	75
Total number of sites with vegetation	73	72
Total number of sites shallower than the maximum depth of plants	75	73
Frequency of occurrence at sites shallower than maximum depth of plants	97.33	98.63
Simpson Diversity Index	0.79	0.77
Floristic Quality Index	18.0	21.6
Maximum depth of plants (ft)	12.0	10.0
Mean depth of plants (ft)	7.2	7.0
Median depth of plants (ft)	7.5	7.0
Average number of all species per site (shallower than max depth)	2.47	2.62
Average number of all species per site (veg. sites only)	2.53	2.65
Average number of native species per site (shallower than max depth)	2.25	2.62
Average number of native species per site (veg. sites only)	2.32	2.65
Species richness	11	14
Mean rake fullness (veg. sites only)	2.40	2.29

Initial diversity within the beds was moderate with a Simpson Diversity Index of 0.79. This value was essentially unchanged at 0.77 posttreatment. However, the Floristic Quality Index, a measure of only native species, showed a slight increase from 18.0 pretreatment to 21.6 posttreatment. Mean native species richness at sites with vegetation was 2.32/site pretreatment and also increased slightly to 2.65/site posttreatment (Figure 5). Total rake fullness declined from a moderately dense average of 2.40 pretreatment to 2.29 posttreatment (Figure 6) (Appendix IV).

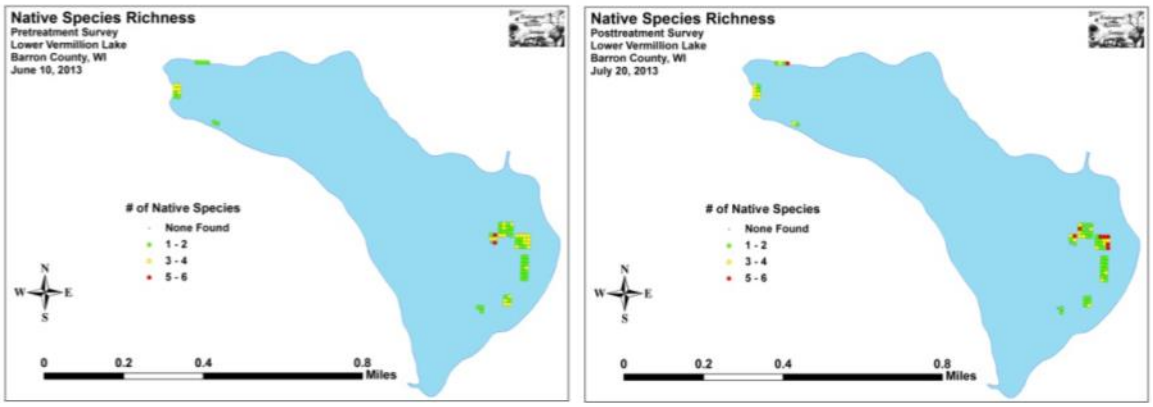


Figure 5: Pre/Post Native Species Richness

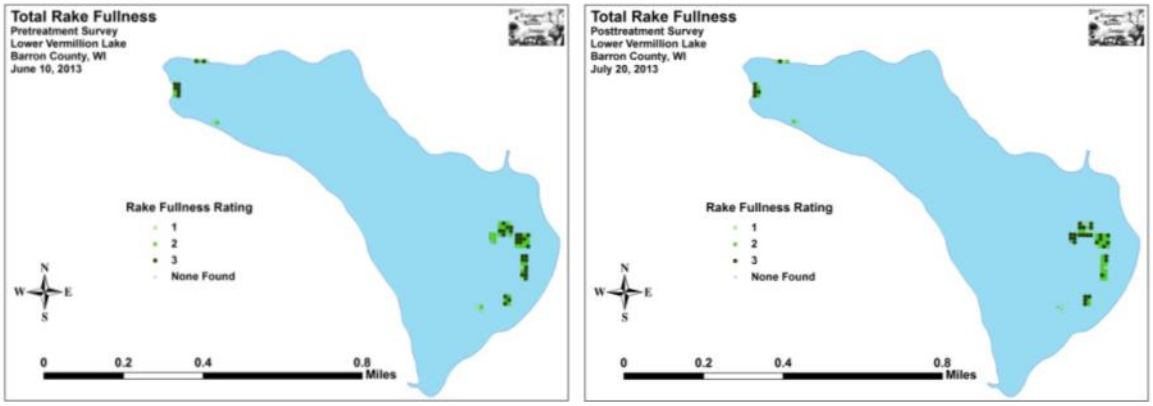


Figure 6: Pre/Post Total Rake Fullness

We found EWM at 11 points during the pretreatment survey. Of these, three had a rake fullness of 1, and four had a rake fullness of 2 and 3 each. We also noted EWM as a visual at six additional points. During the posttreatment survey, we did not find EWM at any point in the survey. We also did not see any EWM plants inter-point or anywhere else in the lake (Figure 7) (Appendix V). Our findings suggested a highly significant reduction in overall EWM as well as significant reductions in rake fullness 1 and 2 (Figure 8).

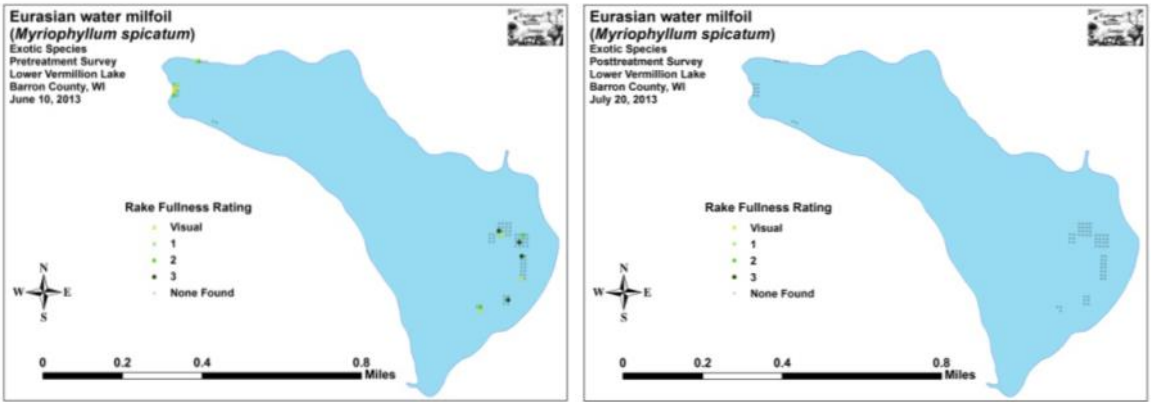
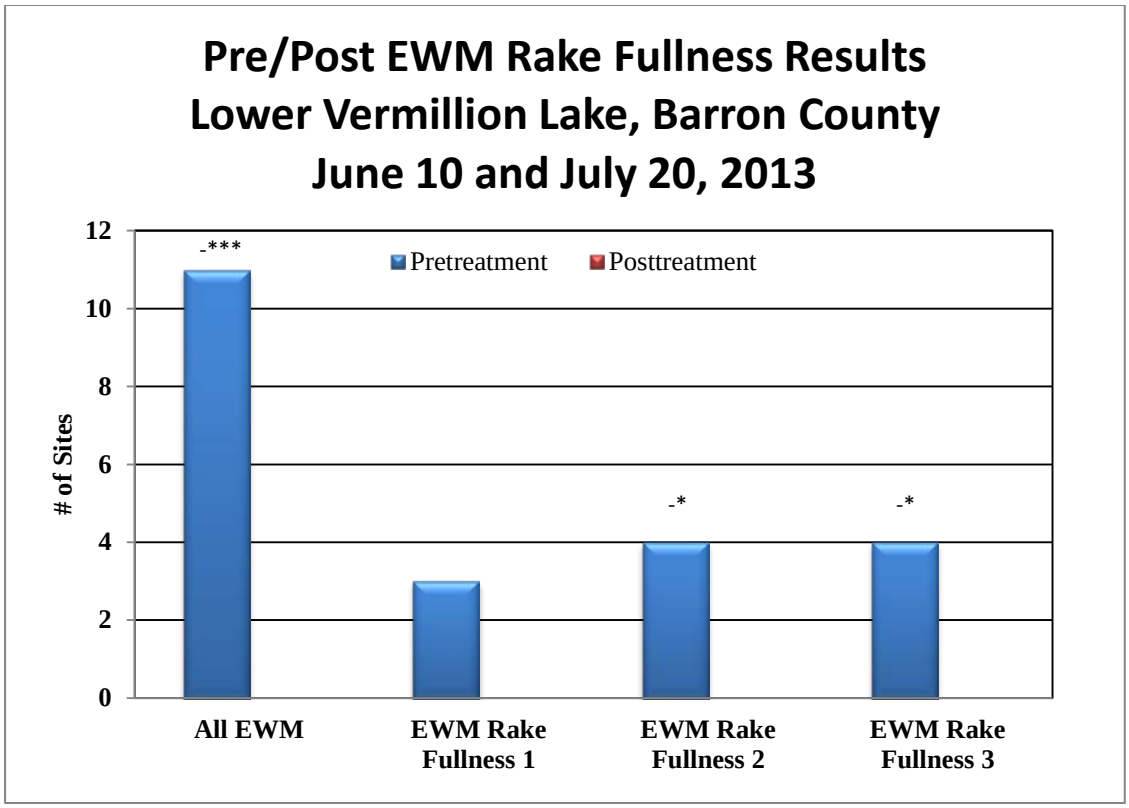


Figure 7: Pre/Post EWM Density and Distribution



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 five points in the pretreatment survey, but none in the posttreatment survey (Figure 9). This significant reduction was likely primarily due to the normal late June senescence for this species rather than the herbicide (Appendix V).

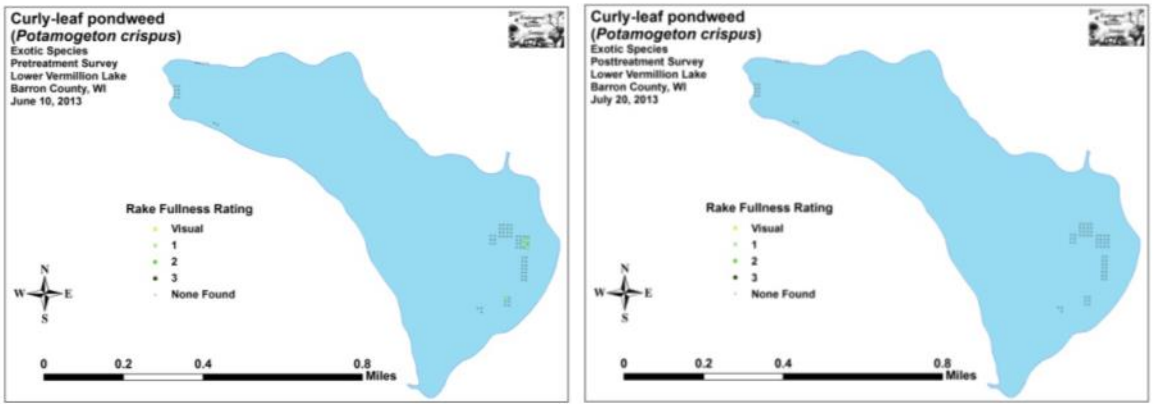


Figure 9: Pre/Post CLP Density and Distribution

Coontail (*Ceratophyllum demersum*) and Flat-stem pondweed (*Potamogeton zosteriformis*), the two most common native species in both the pre and posttreatment surveys (Tables 3 and 4), showed no significant change posttreatment (Figures 10 and 11). Northern water milfoil (*Myriophyllum sibiricum*) was the only native species that showed evidence of being impacted by the treatment. Along with EWM, it was completely eliminated from the treatment areas and this reduction was highly significant. Conversely, Small pondweed (*Potamogeton pusillus*) and Clasping-leaf pondweed (*Potamogeton richardsonii*) both demonstrated moderately significant increases posttreatment (Figure 12). These increases are likely the product of normal growing season expansion. Maps for all native species from the pre and posttreatment surveys are available in Appendixes VI and VII.

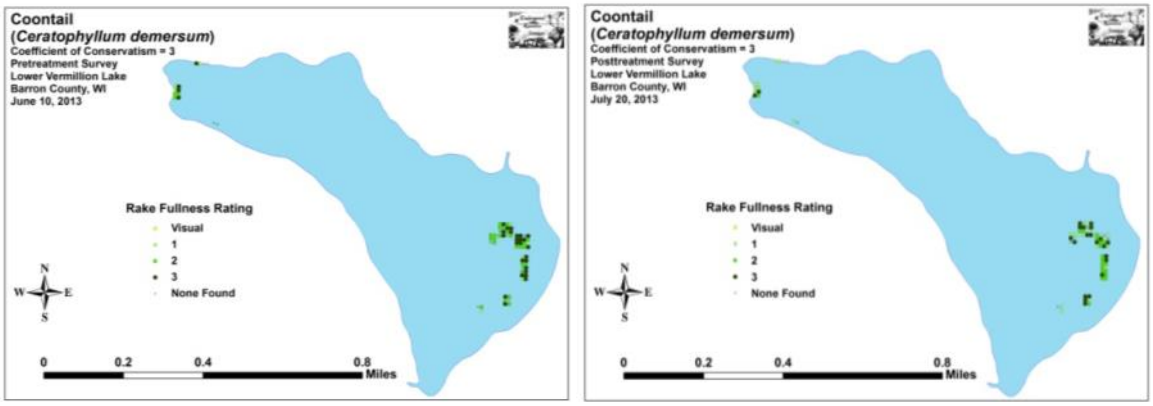


Figure 10: Pre/Post Coontail Density and Distribution

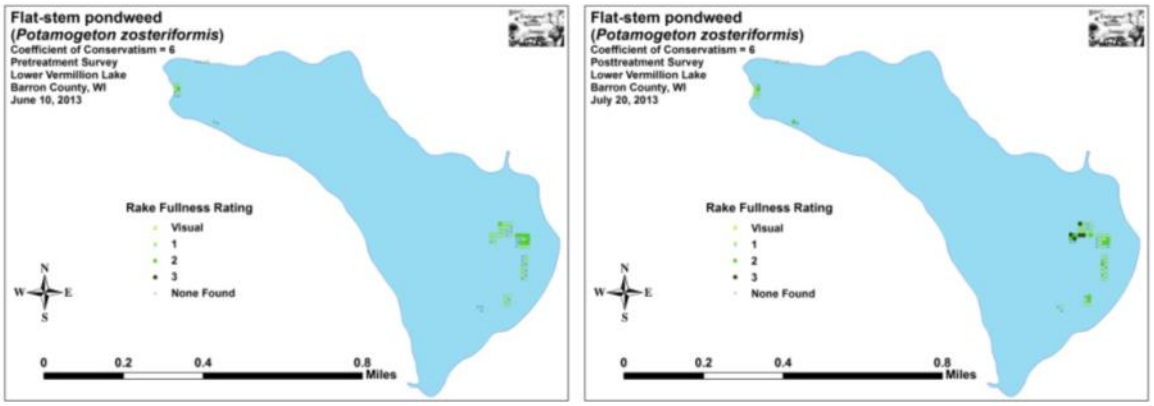
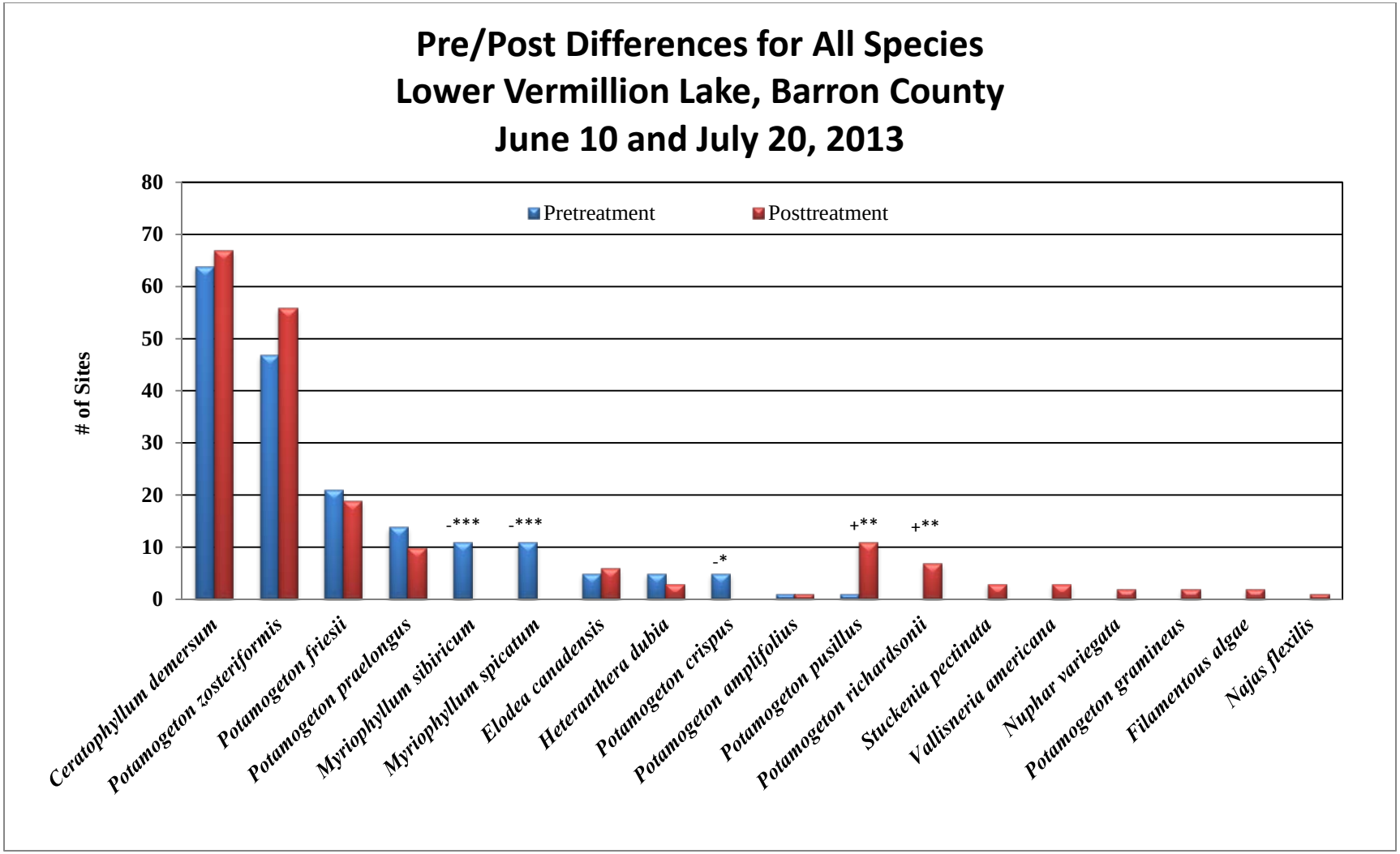


Figure 11: Pre/Post Flat-stem Pondweed Density and Distribution



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
June 10, 2013

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Ceratophyllum demersum	Coontail	64	34.59	87.67	85.33	2.33	0
Potamogeton zosteriformis	Flat-stem pondweed	47	25.41	64.38	62.67	1.21	0
Potamogeton friesii	Fries' pondweed	21	11.35	28.77	28.00	1.14	0
Potamogeton praelongus	White-stem pondweed	14	7.57	19.18	18.67	1.00	0
Myriophyllum sibiricum	Northern water-milfoil	11	5.95	15.07	14.67	1.00	0
Myriophyllum spicatum	Eurasian water milfoil	11	5.95	15.07	14.67	2.09	6
Elodea canadensis	Common waterweed	5	2.70	6.85	6.67	2.40	0
Heteranthera dubia	Water star-grass	5	2.70	6.85	6.67	1.60	0
Potamogeton crispus	Curly-leaf pondweed	5	2.70	6.85	6.67	1.00	0
Potamogeton amplifolius	Large-leaf pondweed	1	0.54	1.37	1.33	1.00	0
Potamogeton pusillus	Small pondweed	1	0.54	1.37	1.33	1.00	0

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Posttreatment Survey Lower Vermillion Lake, Barron County
July 20, 2013

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Ceratophyllum demersum	Coontail	67	35.08	93.06	89.33	1.94	0
Potamogeton zosteriformis	Flat-stem pondweed	56	29.32	77.78	74.67	1.38	0
Potamogeton friesii	Fries' pondweed	19	9.95	26.39	25.33	1.47	0
Potamogeton pusillus	Small pondweed	11	5.76	15.28	14.67	1.00	0
Potamogeton praelongus	White-stem pondweed	10	5.24	13.89	13.33	1.10	0
Potamogeton richardsonii	Clasping-leaf pondweed	7	3.66	9.72	9.33	1.29	0
Elodea canadensis	Common waterweed	6	3.14	8.33	8.00	2.17	0
Heteranthera dubia	Water star-grass	3	1.57	4.17	4.00	1.00	0
Stuckenia pectinata	Sago pondweed	3	1.57	4.17	4.00	1.33	0
Vallisneria americana	Wild celery	3	1.57	4.17	4.00	1.00	0
Nuphar variegata	Spatterdock	2	1.05	2.78	2.67	1.50	0
Potamogeton gramineus	Variable pondweed	2	1.05	2.78	2.67	1.00	0
	Filamentous algae	2	*	2.78	2.67	1.50	0
Najas flexilis	Slender naiad	1	0.52	1.39	1.33	1.00	0
Potamogeton amplifolius	Large-leaf pondweed	1	0.52	1.39	1.33	1.00	0

* Excluded from Relative Frequency Analysis

Fall EWM Bed Mapping Survey:

On October 13th, 2013, we located and mapped a total of 5 beds on the lake ranging in size from <0.01 acre (Bed 3) to 0.43 acres (Bed 2) (Figure 13) (Appendix VIII). In total, these beds covered 0.71 acres (Table 5). This represented a decrease of 1.99 acres over 2012 totals which equated to a nearly 74% decline in coverage. Despite this positive news, water clarity during the fall survey was poor making it hard to see down more than a few feet so there may be more plants in the eastern bay than we could detect. This may warrant adding "exploratory" points in former beds if a pretreatment survey is planned for 2014.

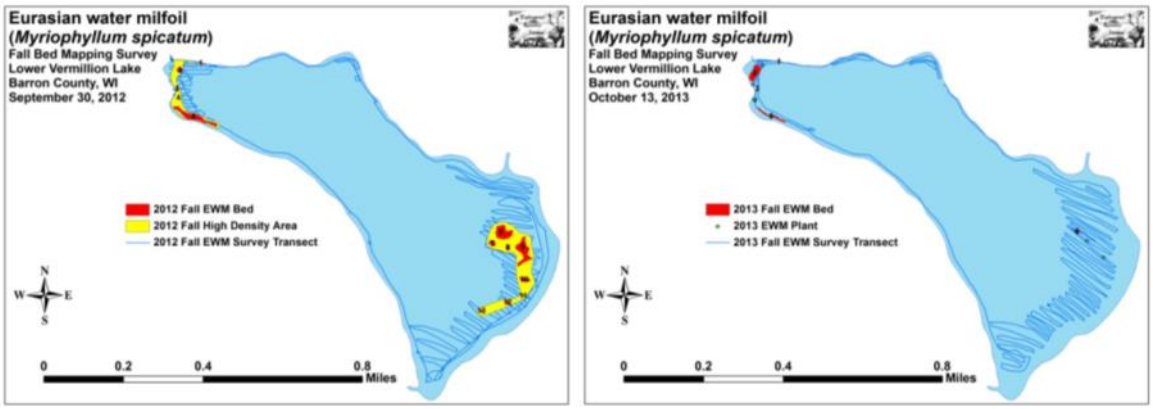


Figure 13: 2012 and 2013 Fall EWM Bed Maps

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. They occurred in narrow strips along sharp drop-offs into 15ft+ of water which will likely again make treating these areas challenging.

Bed 2-3 – 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 public boat landing.

Bed 4 – We noted only three individual plants near this former bed.

Bed 6 – Although EWM plants were greatly reduced from fall 2012, we found several canopied clusters in 5-7ft of water on the western end of the formerly expansive bed.

Beds 7-8 – These areas continue to be EWM free as we saw no evidence of plants anywhere during the posttreatment or fall bed mapping surveys.

Bed 9 – A single EWM plant was found and rake removed from this area during the fall survey.

Beds 10-13 – These areas were also EWM free during both the July and October surveys.

Table 5: Fall Eurasian Water Milfoil Bed Mapping Summary
Lower Vermillion Lake, Barron County
October 13, 2013

Bed Number	2013 Fall Bed Acreage	2012 Fall Bed Acreage	2011 Fall Bed Acreage	2013 Change in Acreage	Estimated 2013 Mean Rakefull	2013 Bed Characteristics And Field Notes
1	0.02	0.02	0	0	<1-1	Continuous scattered plants; more of a HDA
2	0.43	0.07	0.49	0.36	<1-2	Plants regrowing, fragmenting, and merging
3	<0.01	0.03	0	-0.03	<1-2	A few merging towers
4	0	0.01	0	-0.01	<<1	Only three plants seen in the area
5	0.22	0.70	0.35	-0.48	<1-1	Continuous scattered plants; more of a HDA
6	0.04	0.68	0	-0.64	<1-3	A few large canopied towers
7	0	0.10	0	-0.10	0	No EWM found
8	0	0.06	0	-0.06	0	No EWM found
9	0	0.80	0	-0.80	0	No EWM found
10	0	0.14	0	-0.14	0	No EWM found
11	0	0.01	0	-0.01	0	No EWM found
12	0	0.05	0	-0.05	0	No EWM found
13	0	0.03	0	-0.03	0	No EWM found
Total	**0.71**	**2.70**	**0.84**	**-1.99**		

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Busch, C, G. Winter, L. Sather, and R. Ripp [online]. 1967. Upper and Lower Vermillion Lake Maps. Available from http://dnr.wi.gov/lakes/maps/DNR/2098200a.pdf (2013, November).

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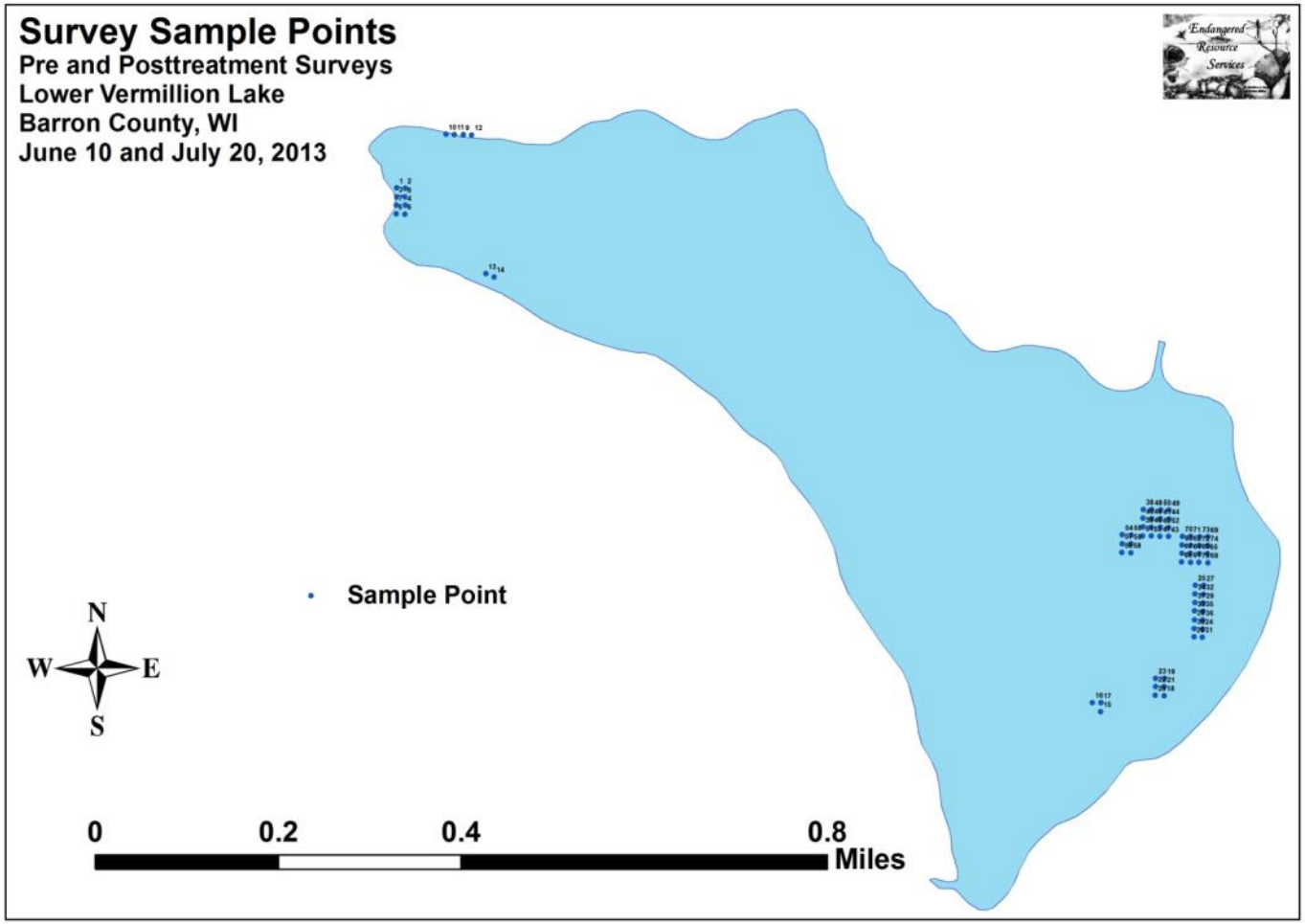
Appendix I: Survey Sample Points and EWM Treatment Areas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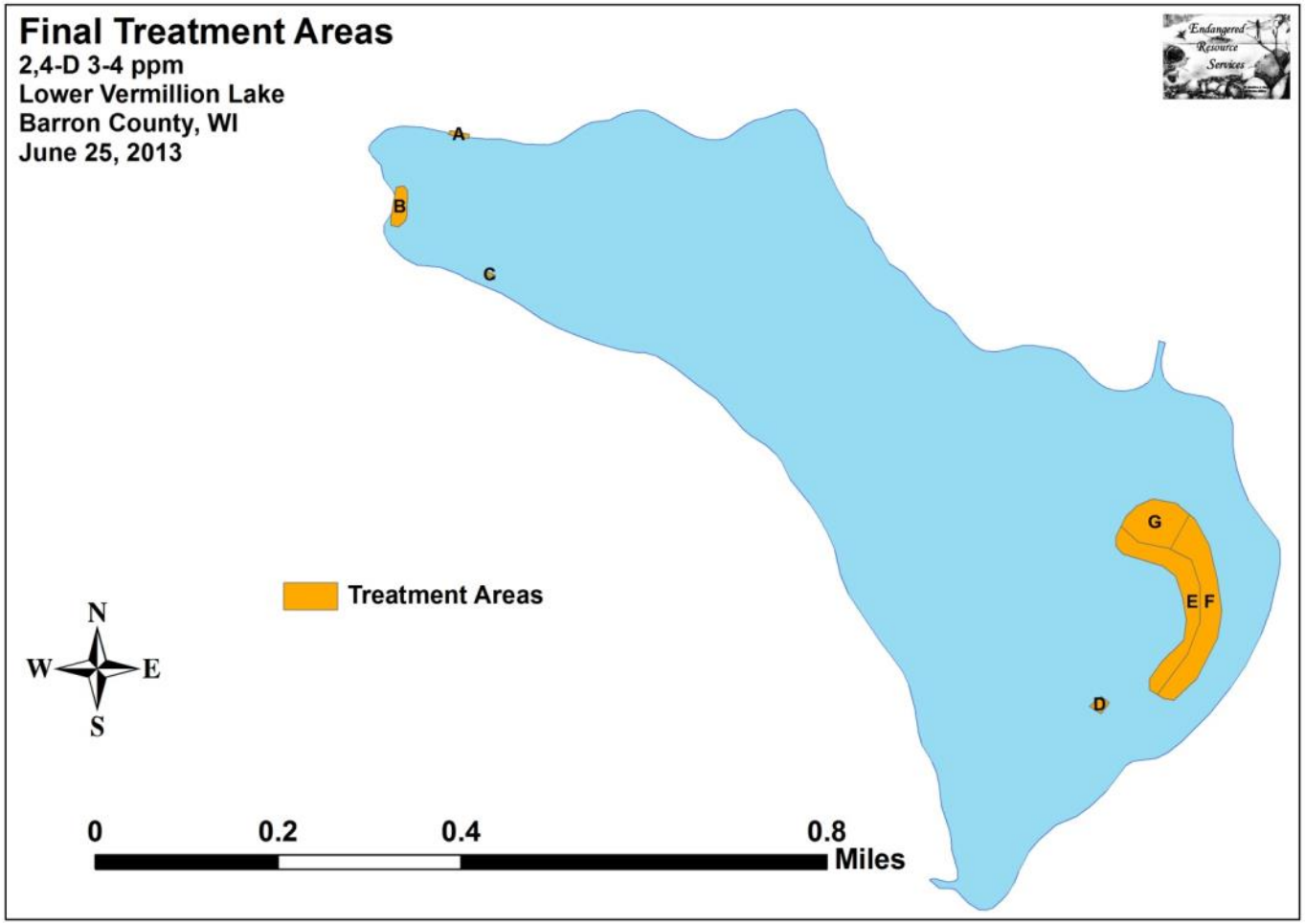
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
June 10 and July 20, 2013
Endangered Resource Services
Sample Point
N
W
E
S
0
0.2
0.4
0.8
Miles


Final Treatment Areas
2,4-D 3-4 ppm
Lower Vermillion Lake
Barron County, WI
June 25, 2013
Endangered Resource Services
A
B
C
G
E F
D
Treatment Areas
N
W
E
S
0
0.2
0.4
0.8
Miles

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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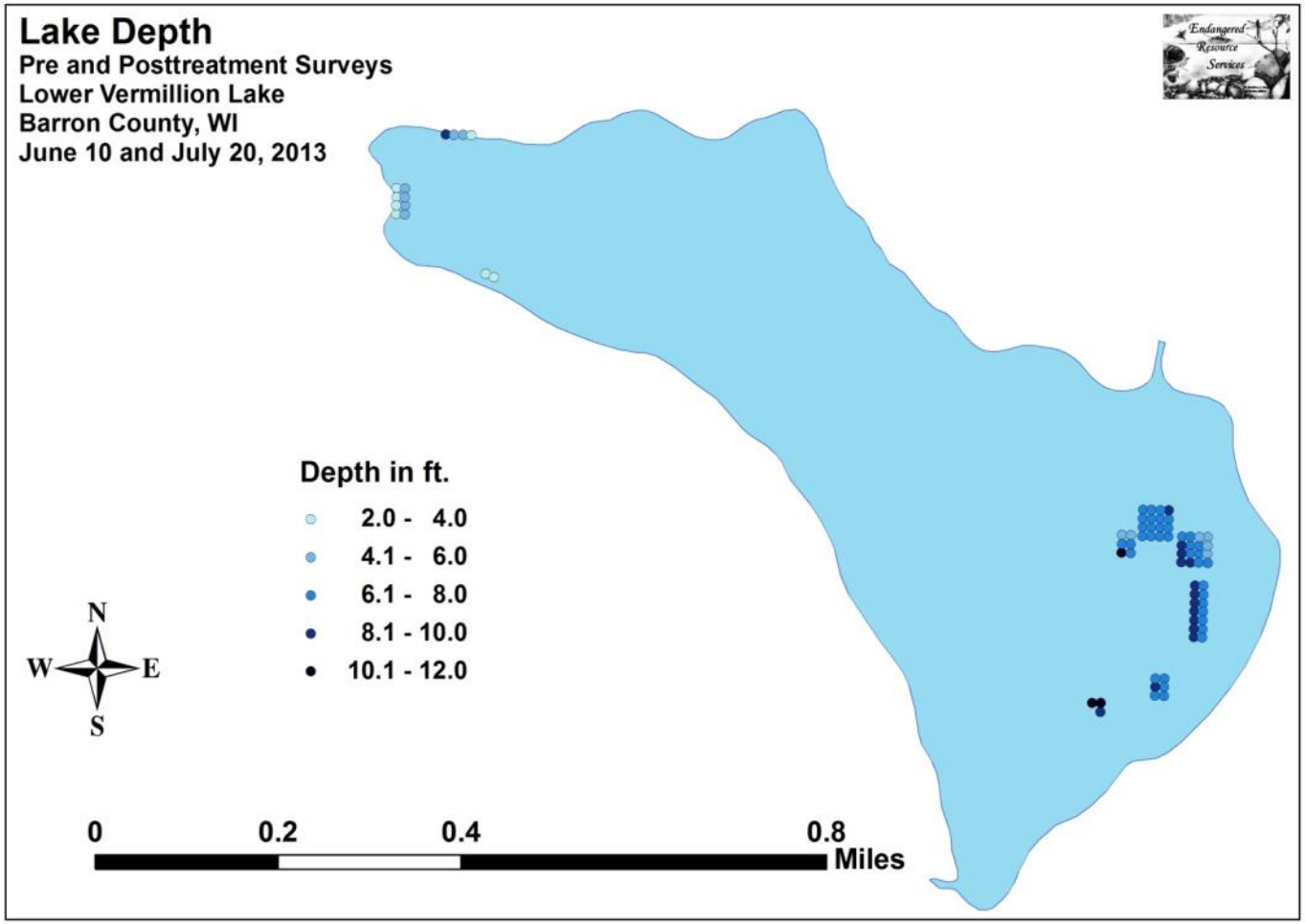
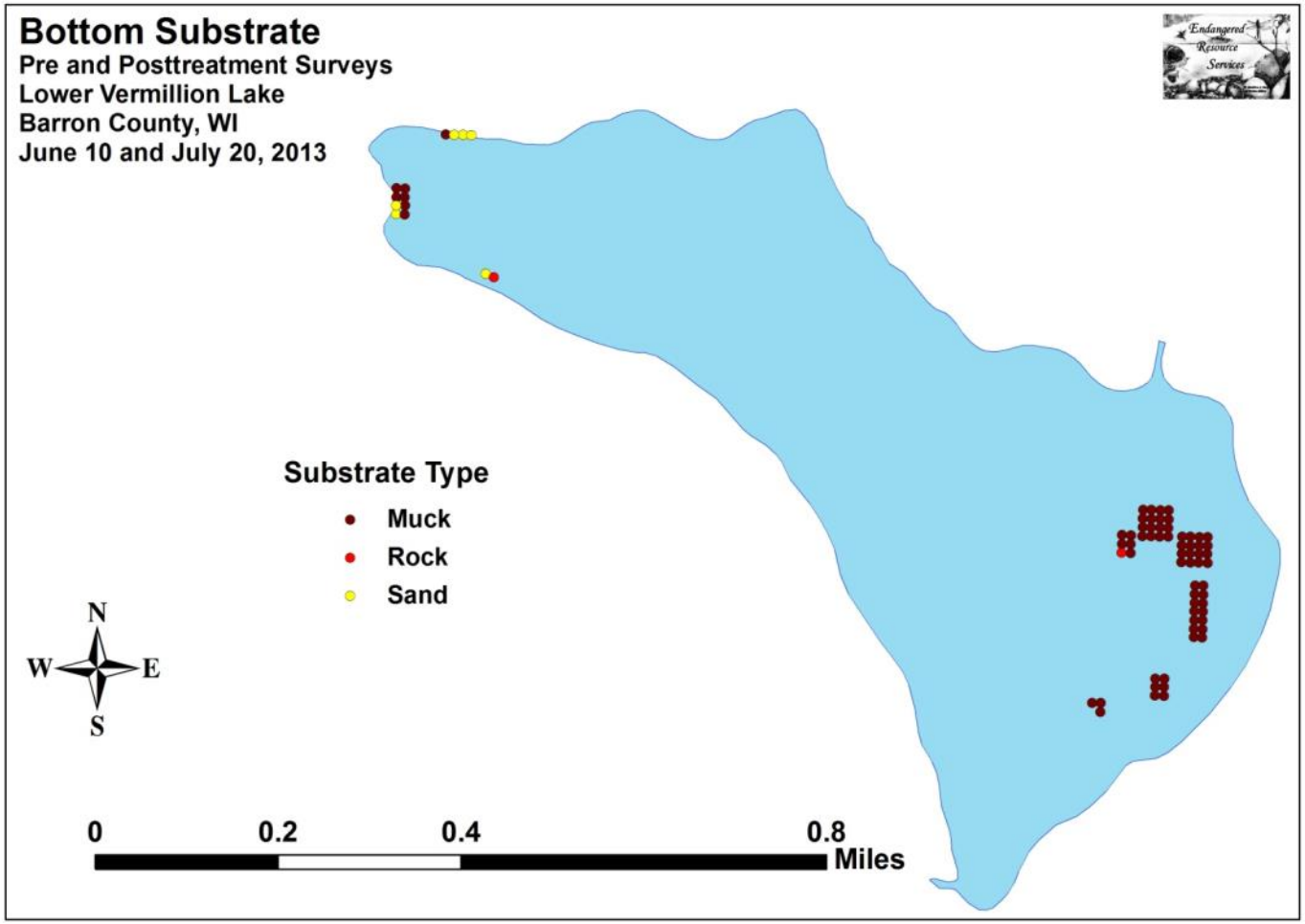
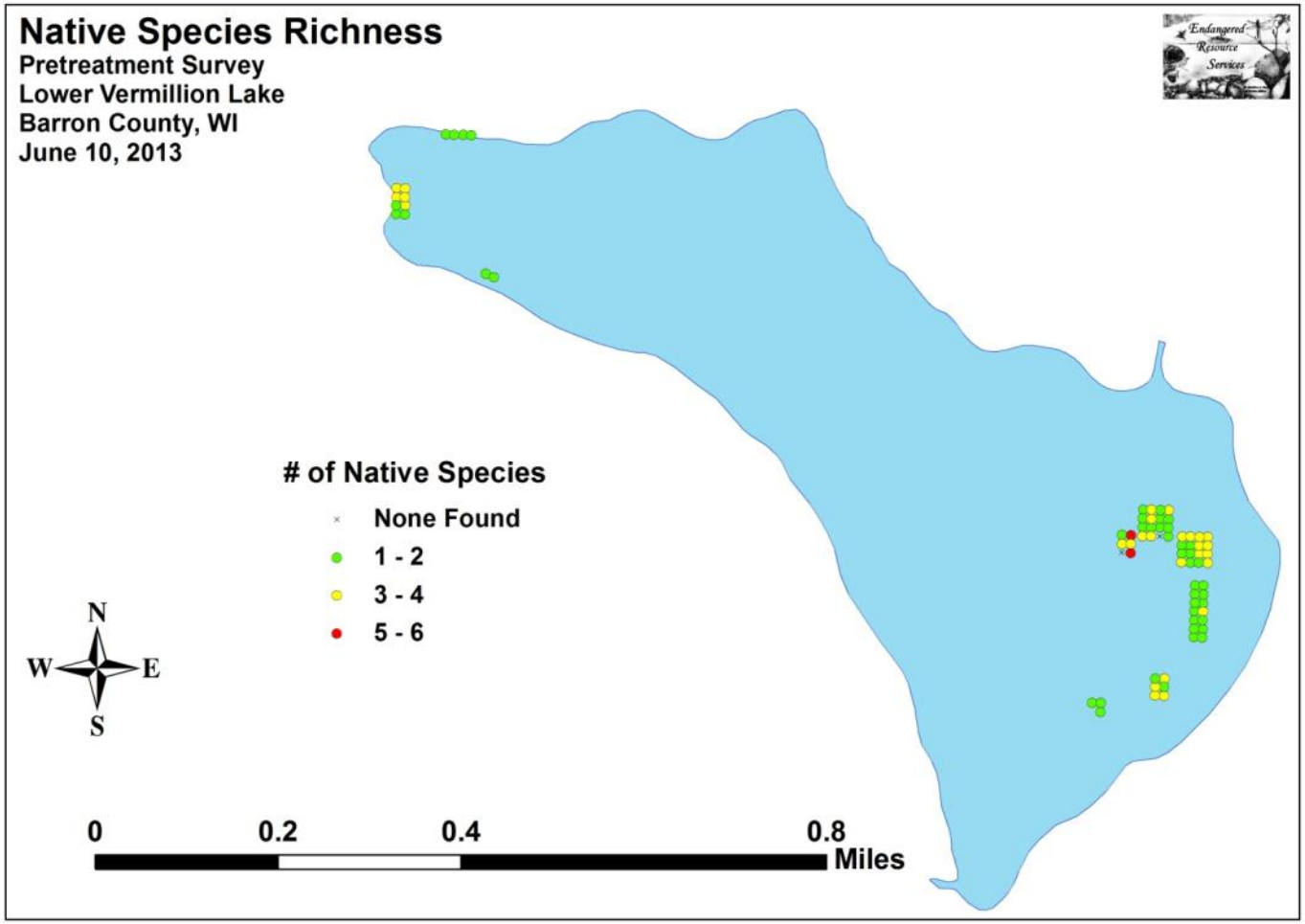
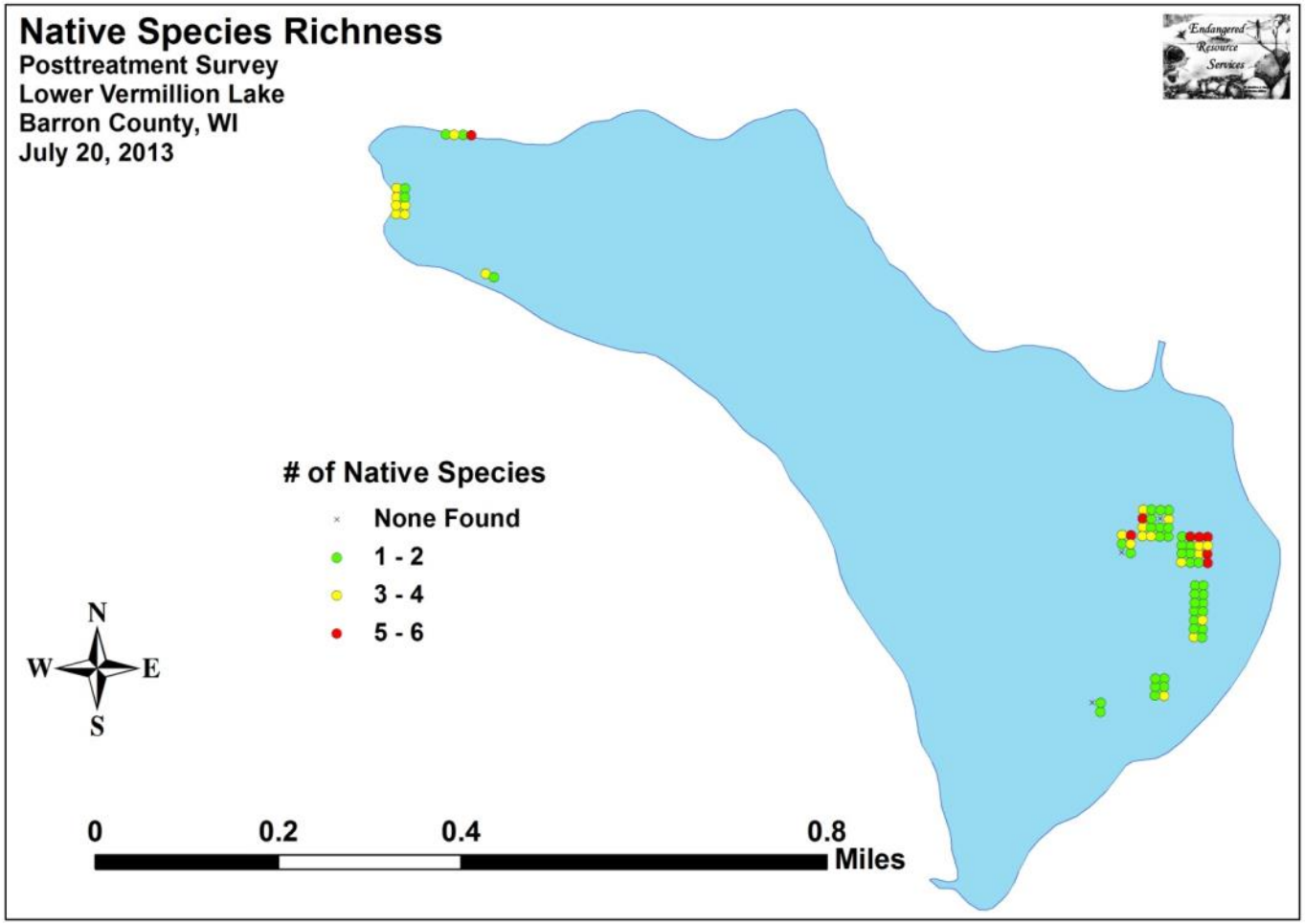
Appendix III: Pre/Post Habitat Variable Maps

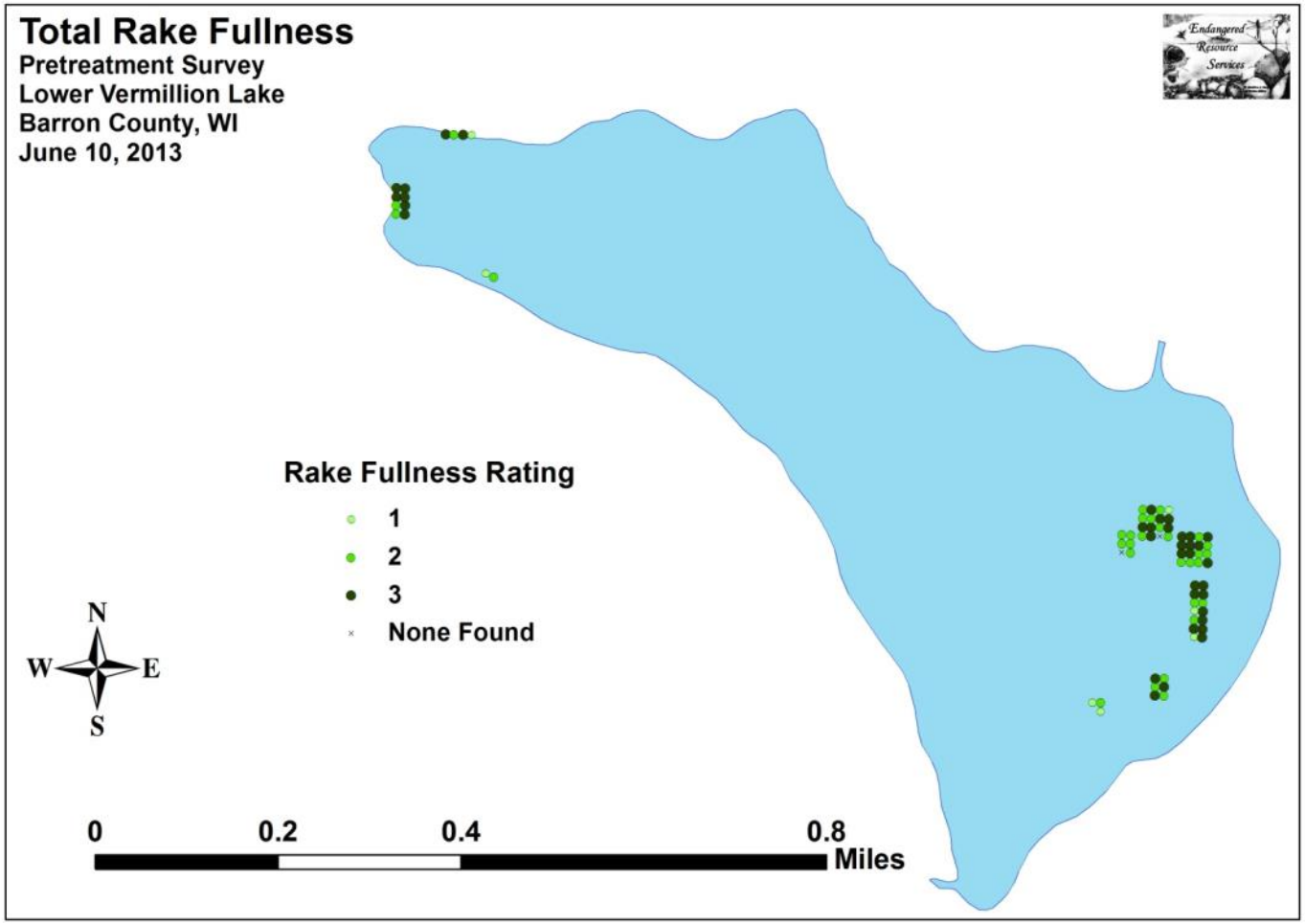

Lake Depth
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
June 10 and July 20, 2013
Endangered Resource Services
Depth in ft.
2.0 - 4.0
4.1 - 6.0
6.1 - 8.0
8.1 - 10.0
10.1 - 12.0
N
W
E
S
0
0.2
0.4
0.8
Miles

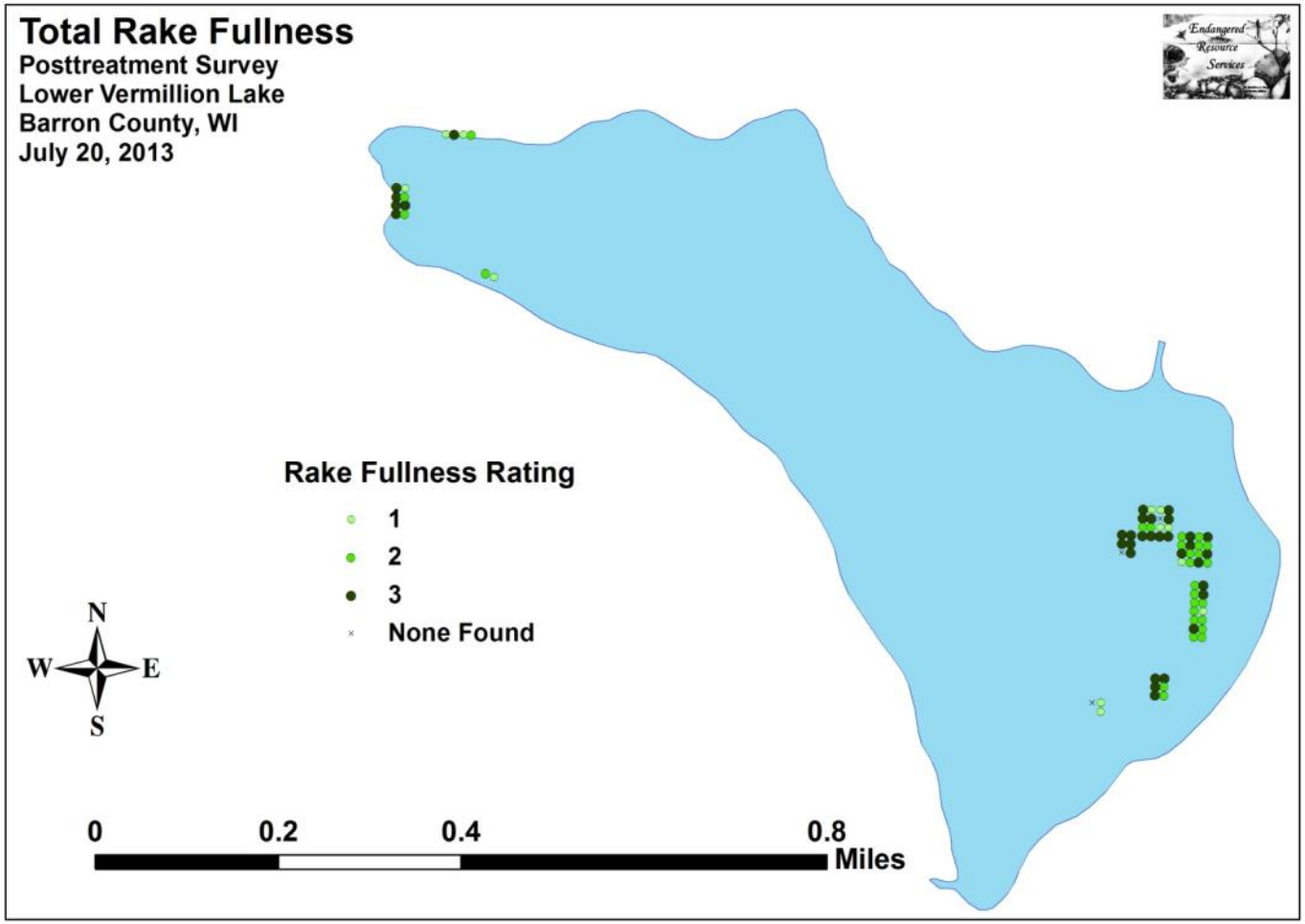

Bottom Substrate
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
June 10 and July 20, 2013
Endangered Resource Services
Substrate Type
Muck
Rock
Sand
N
W
E
S
0
0.2
0.4
0.8
Miles

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

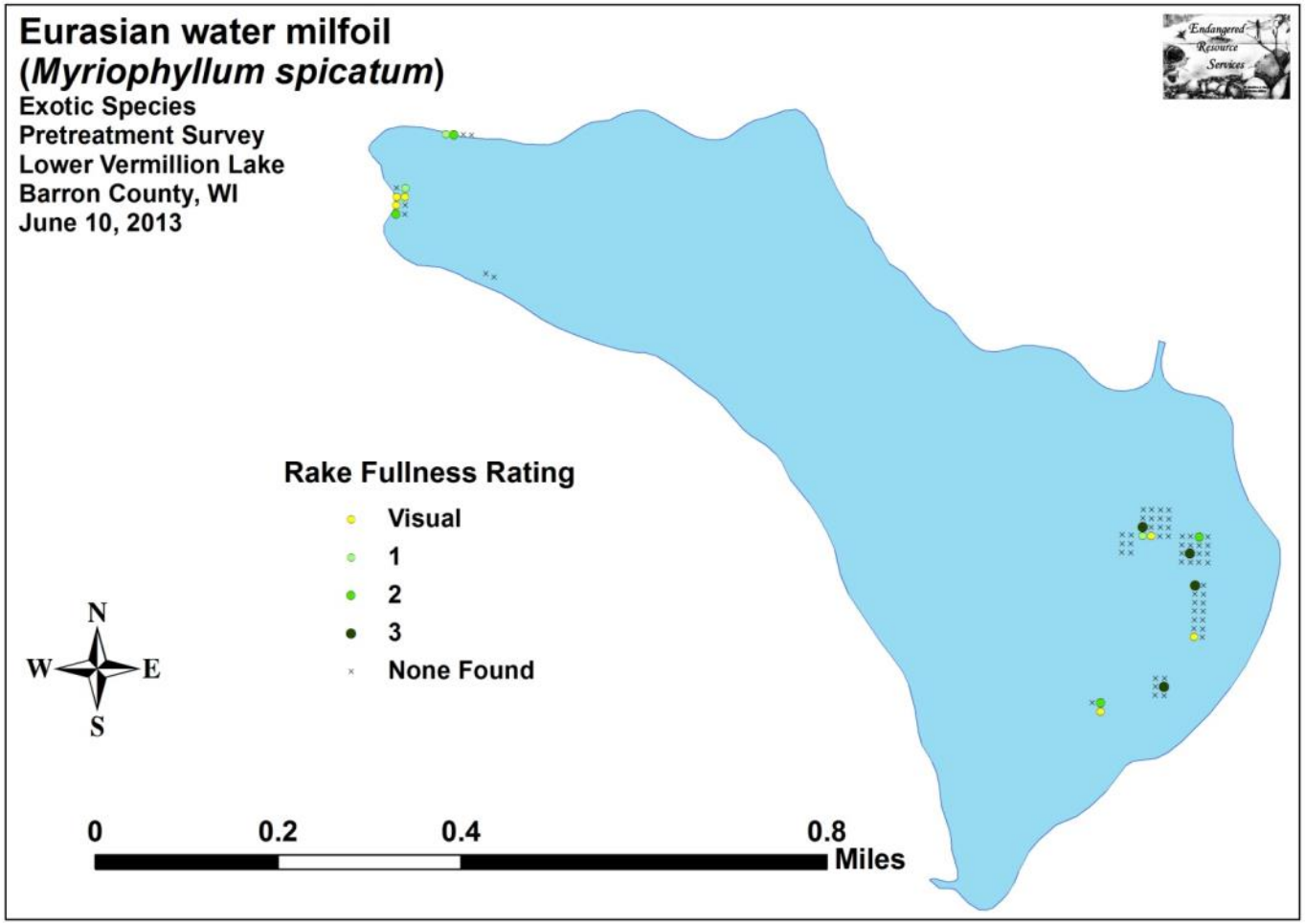

Native Species Richness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
N
W
E
S
0
0.2
0.4
0.8
Miles

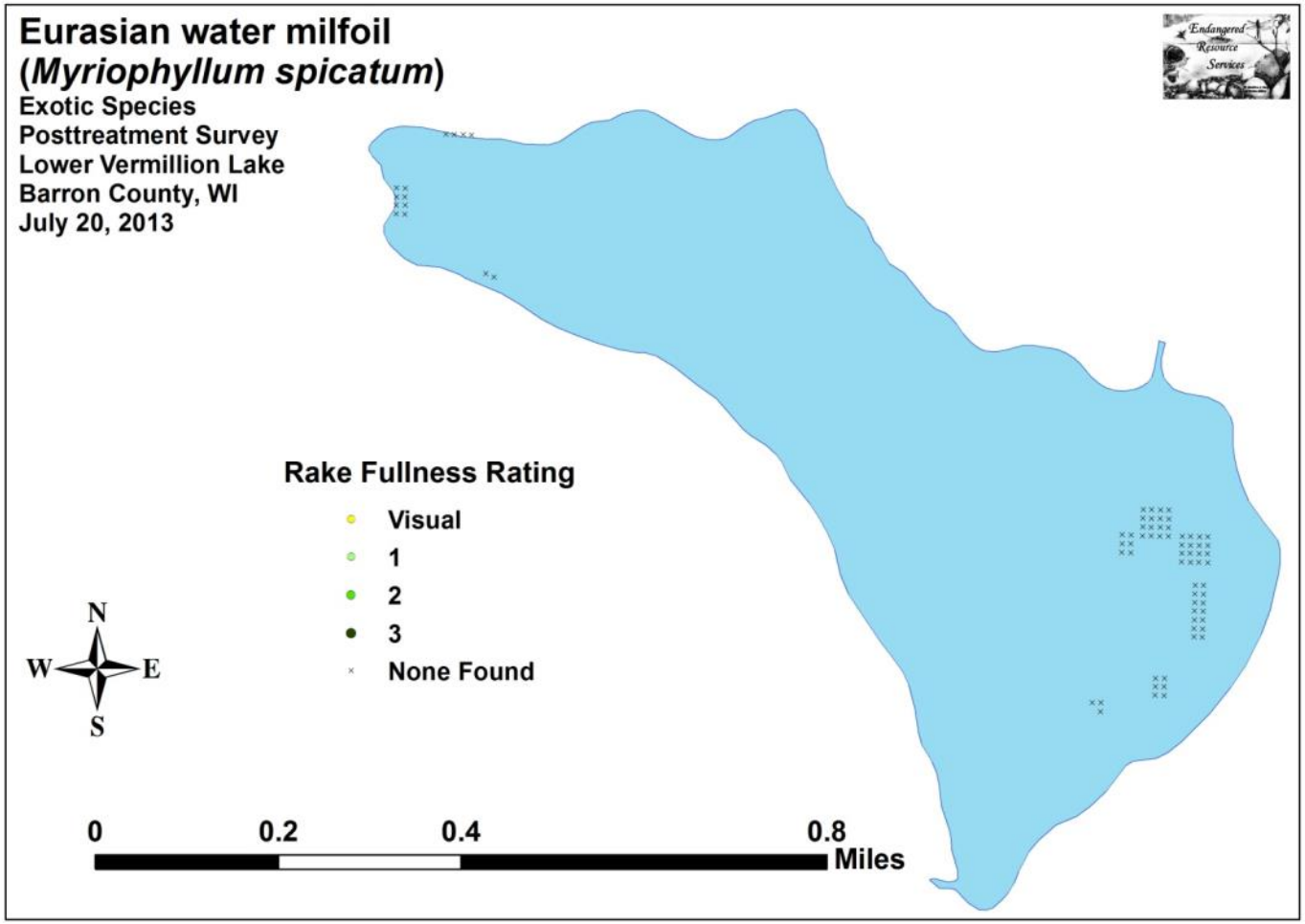

Native Species Richness
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
N
W
E
S
0
0.2
0.4
0.8
Miles

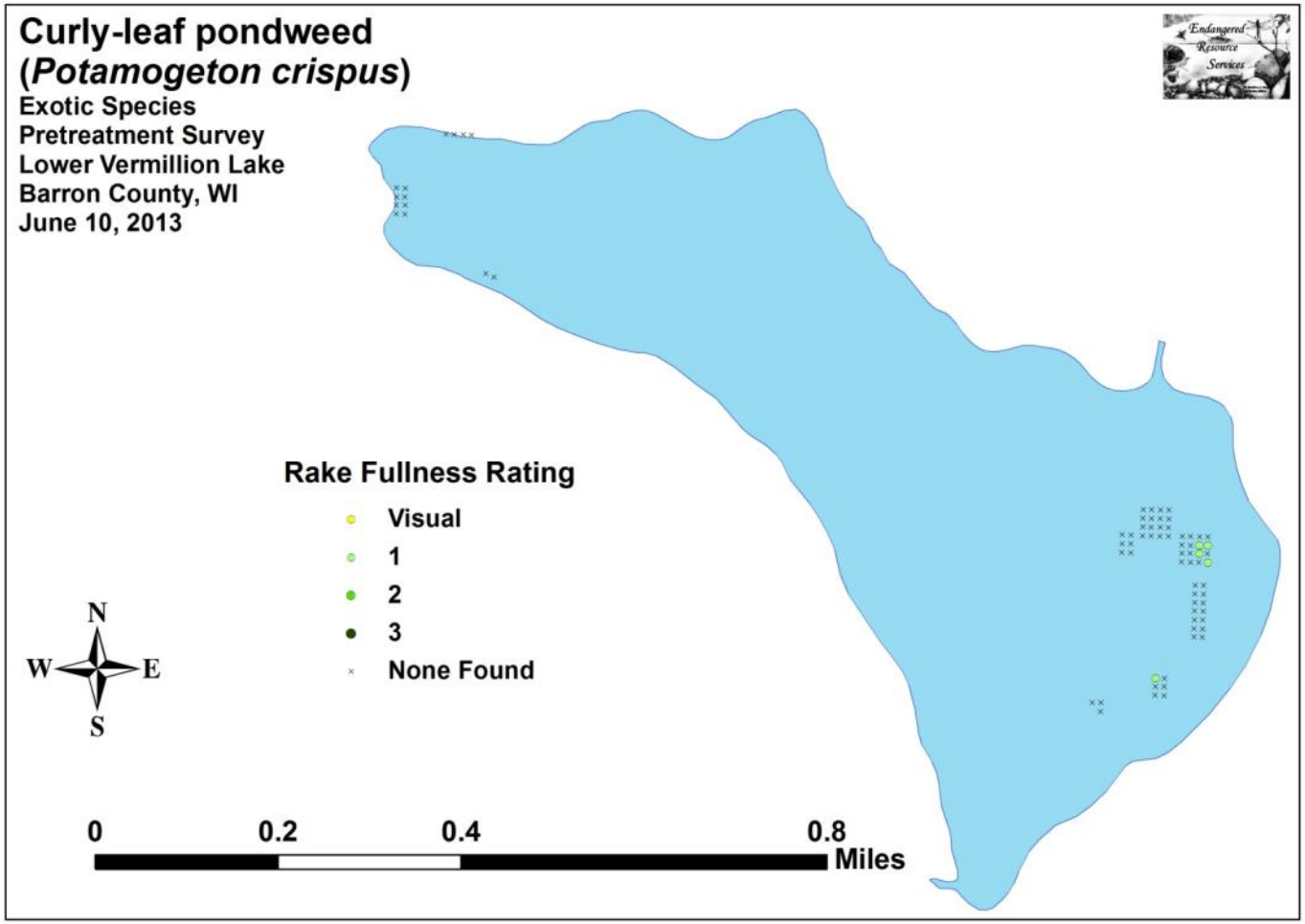

Total Rake Fullness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

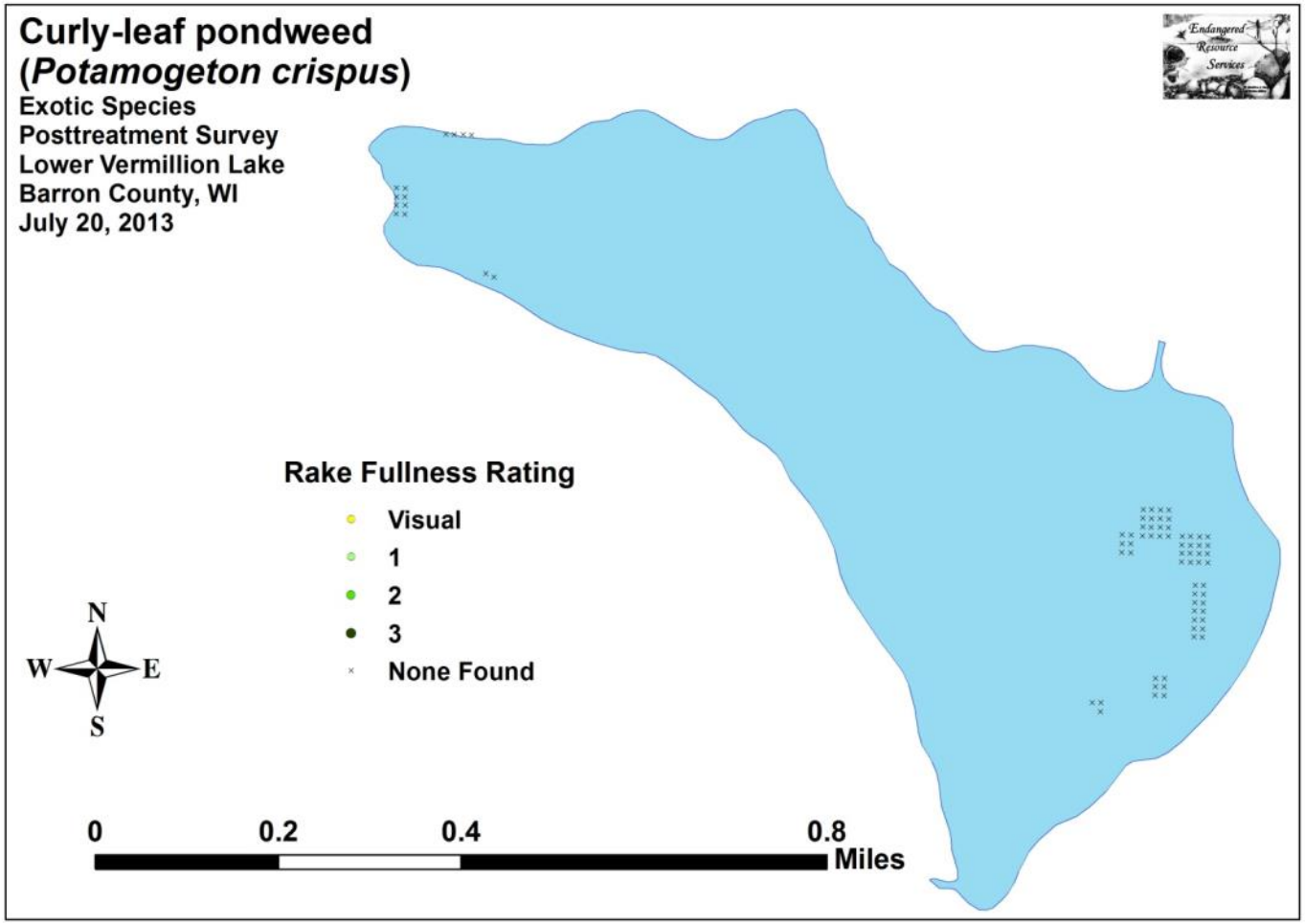

Total Rake Fullness
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

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

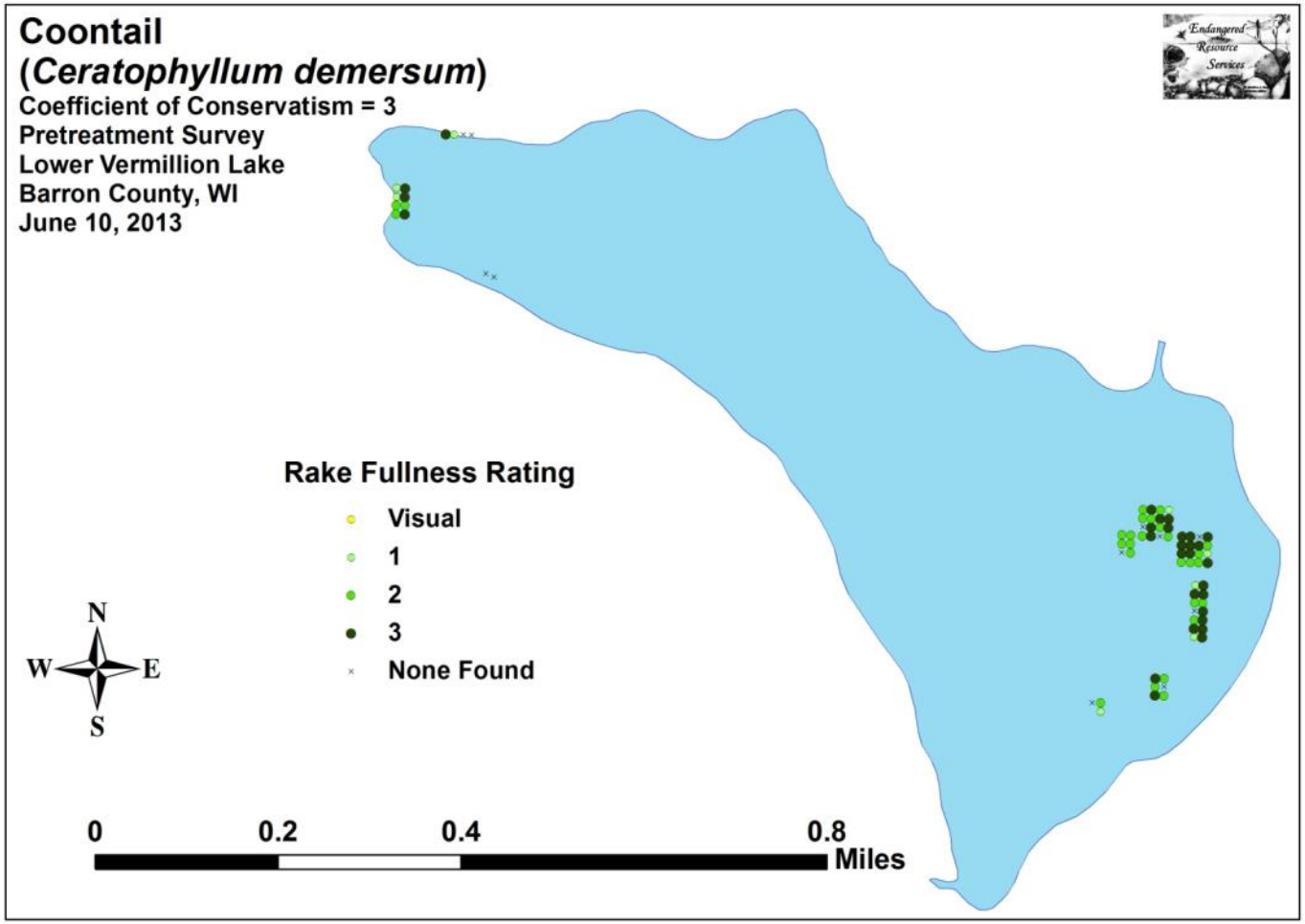

Eurasian water milfoil
(Myriophyllum spicatum)
Exotic Species
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

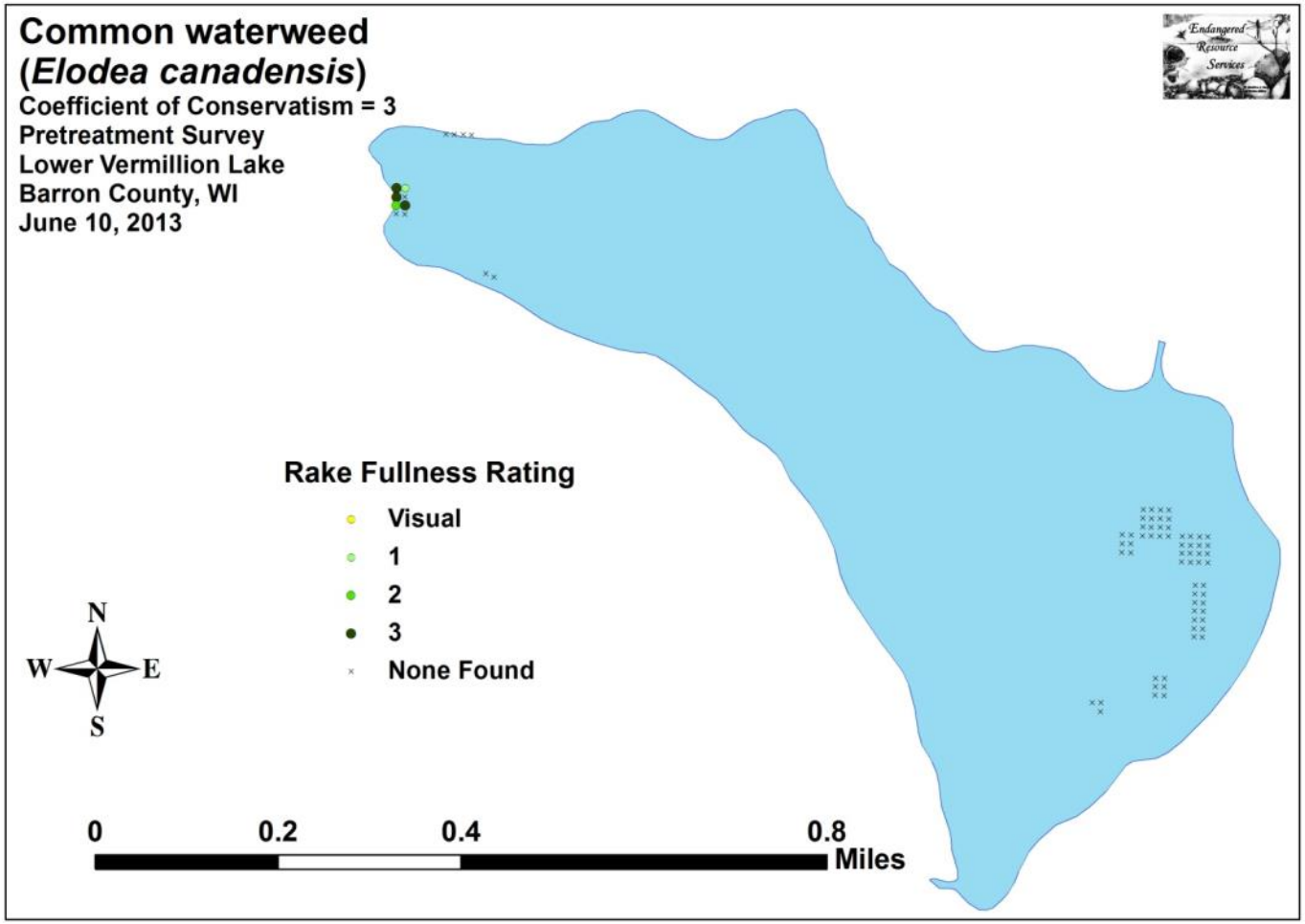

Eurasian water milfoil
(Myriophyllum spicatum)
Exotic Species
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

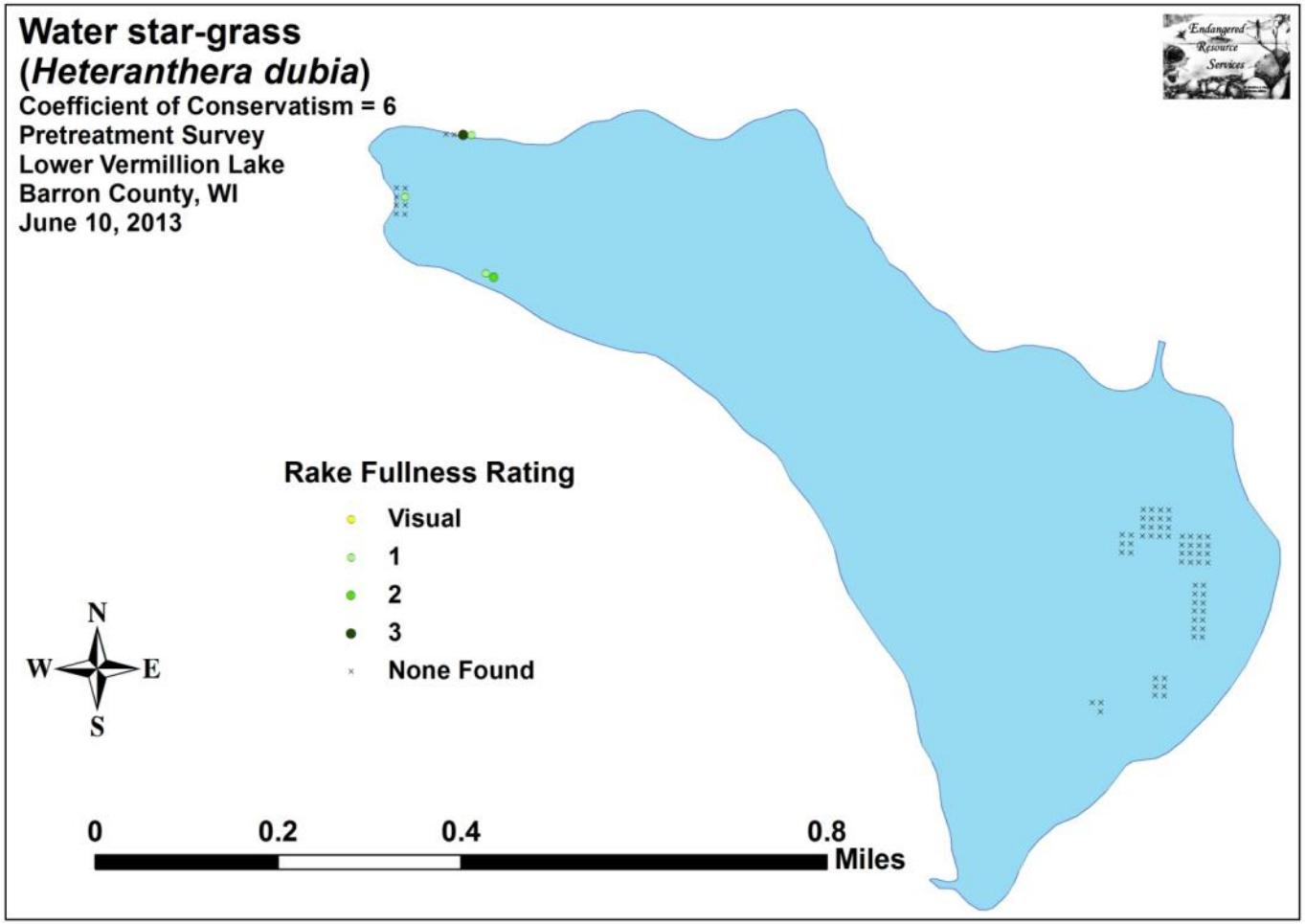

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

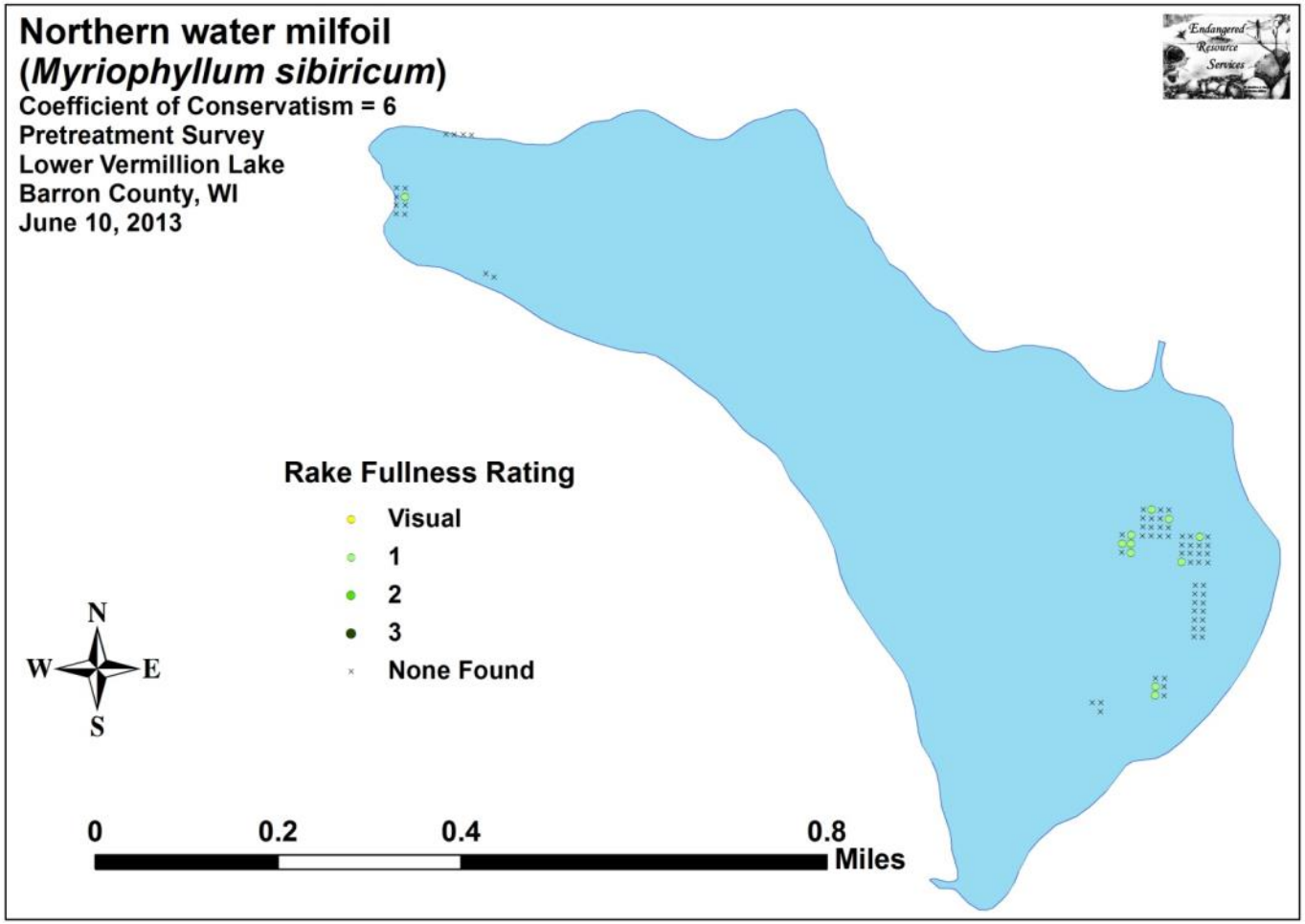

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

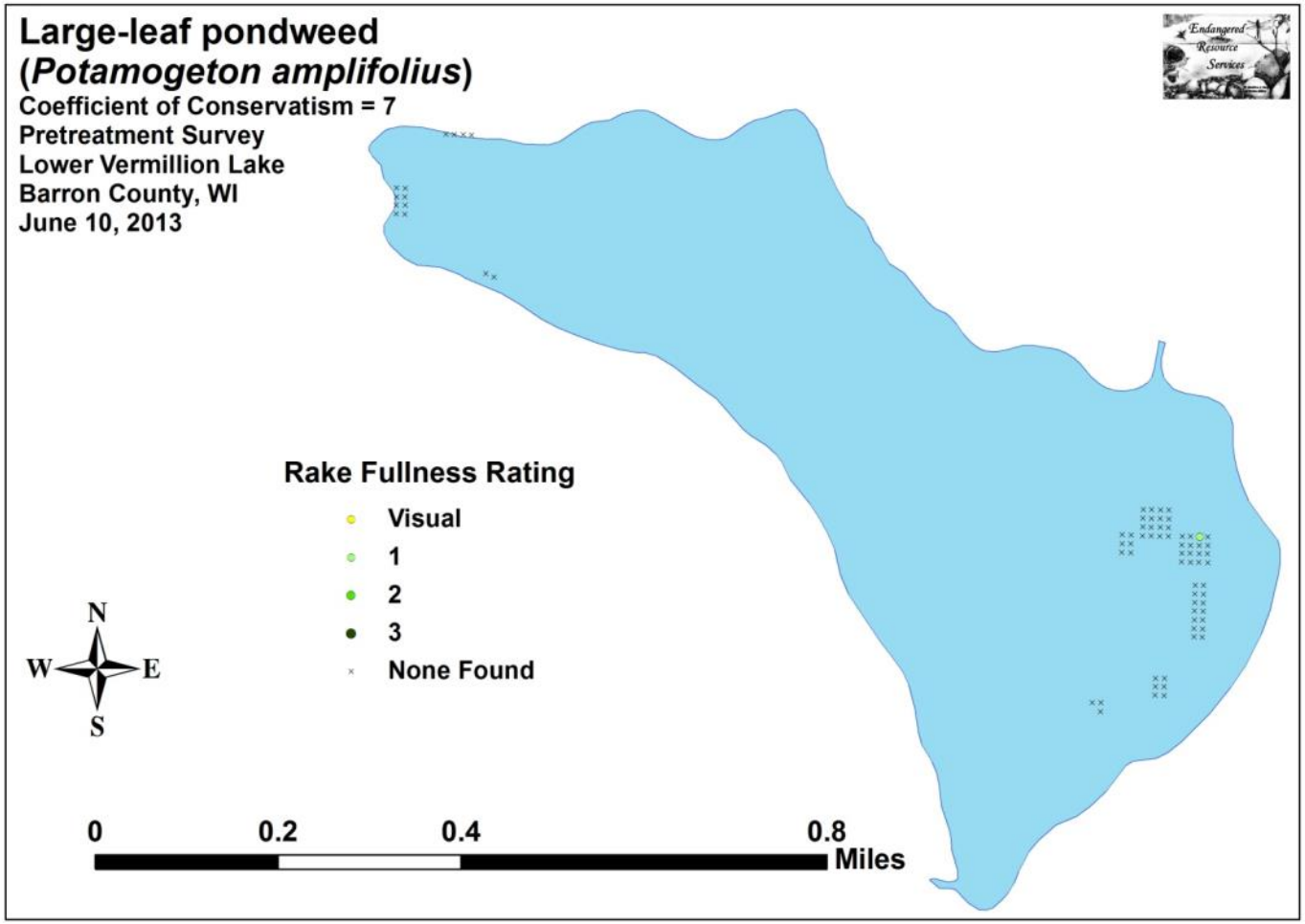
Appendix VI: Pretreatment Native Species Density and Distribution

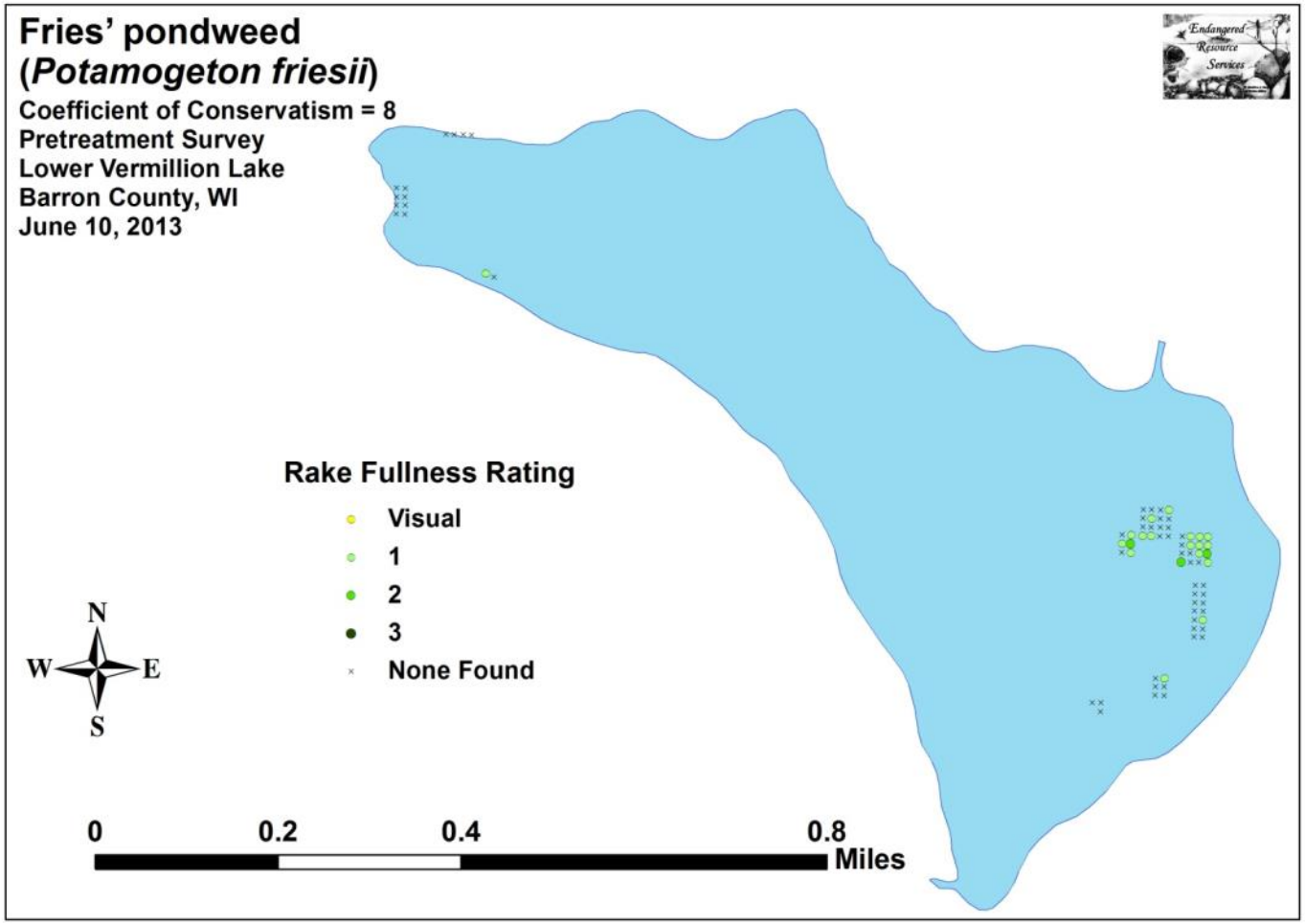

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

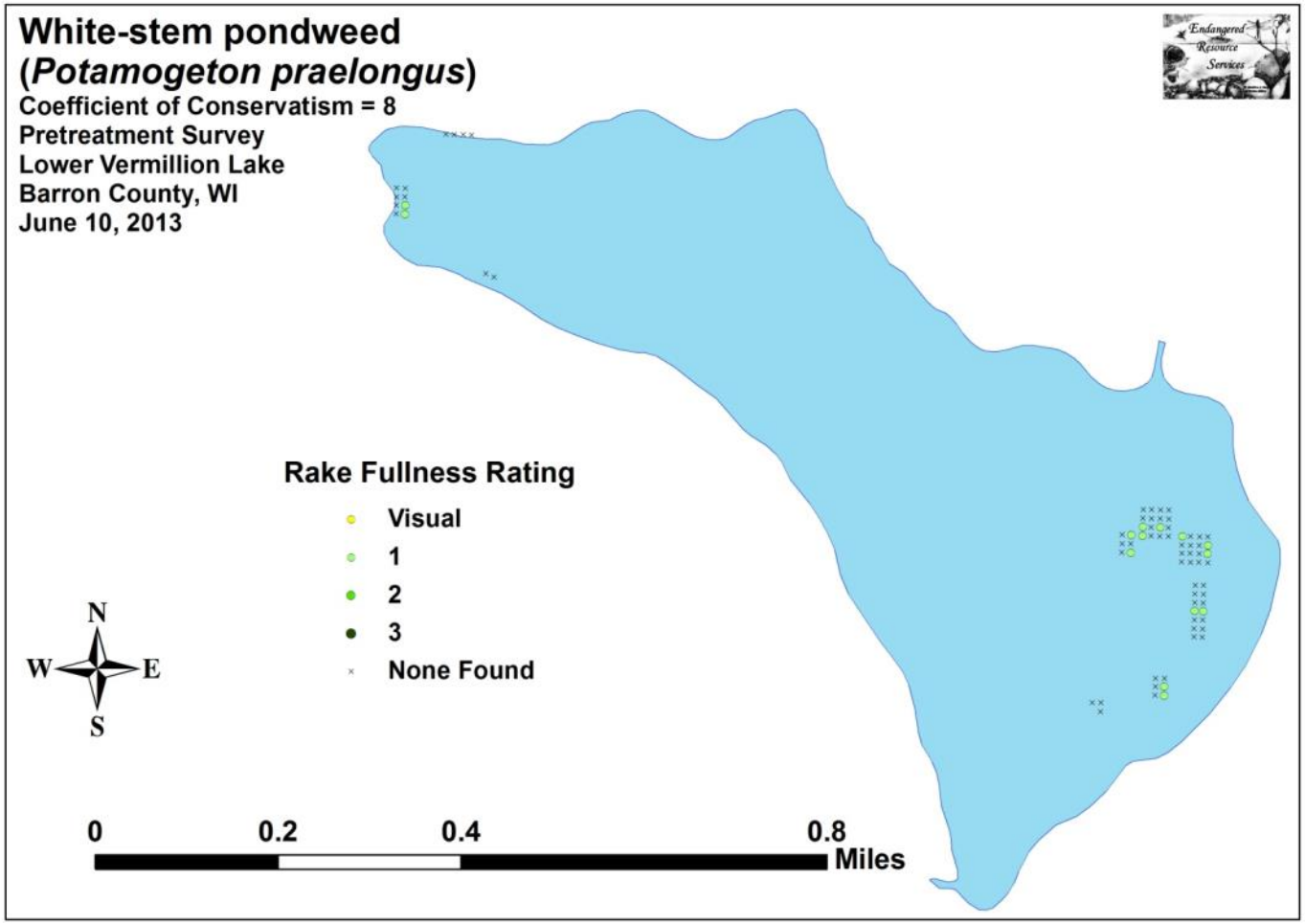

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

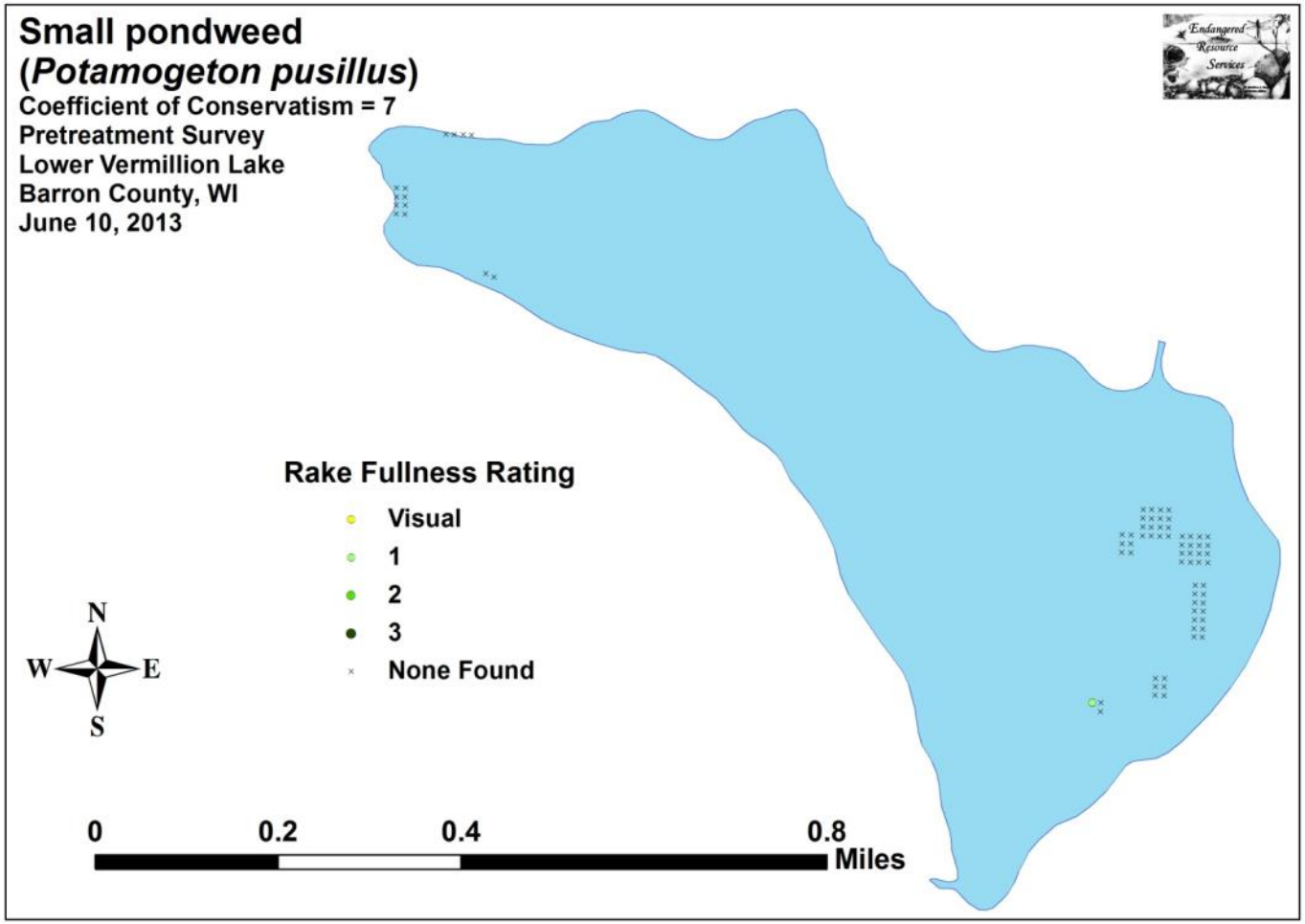

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

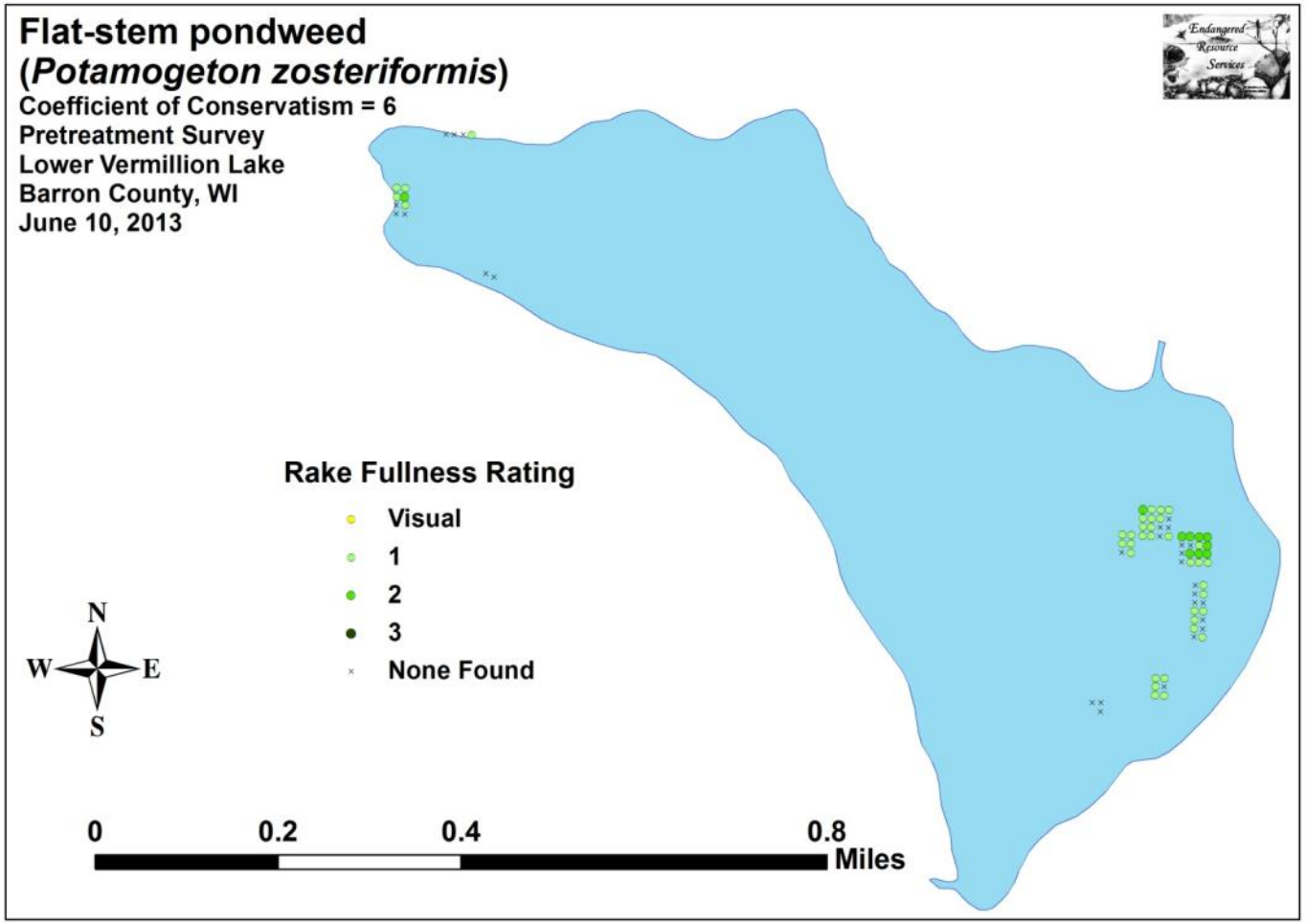

Northern water milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

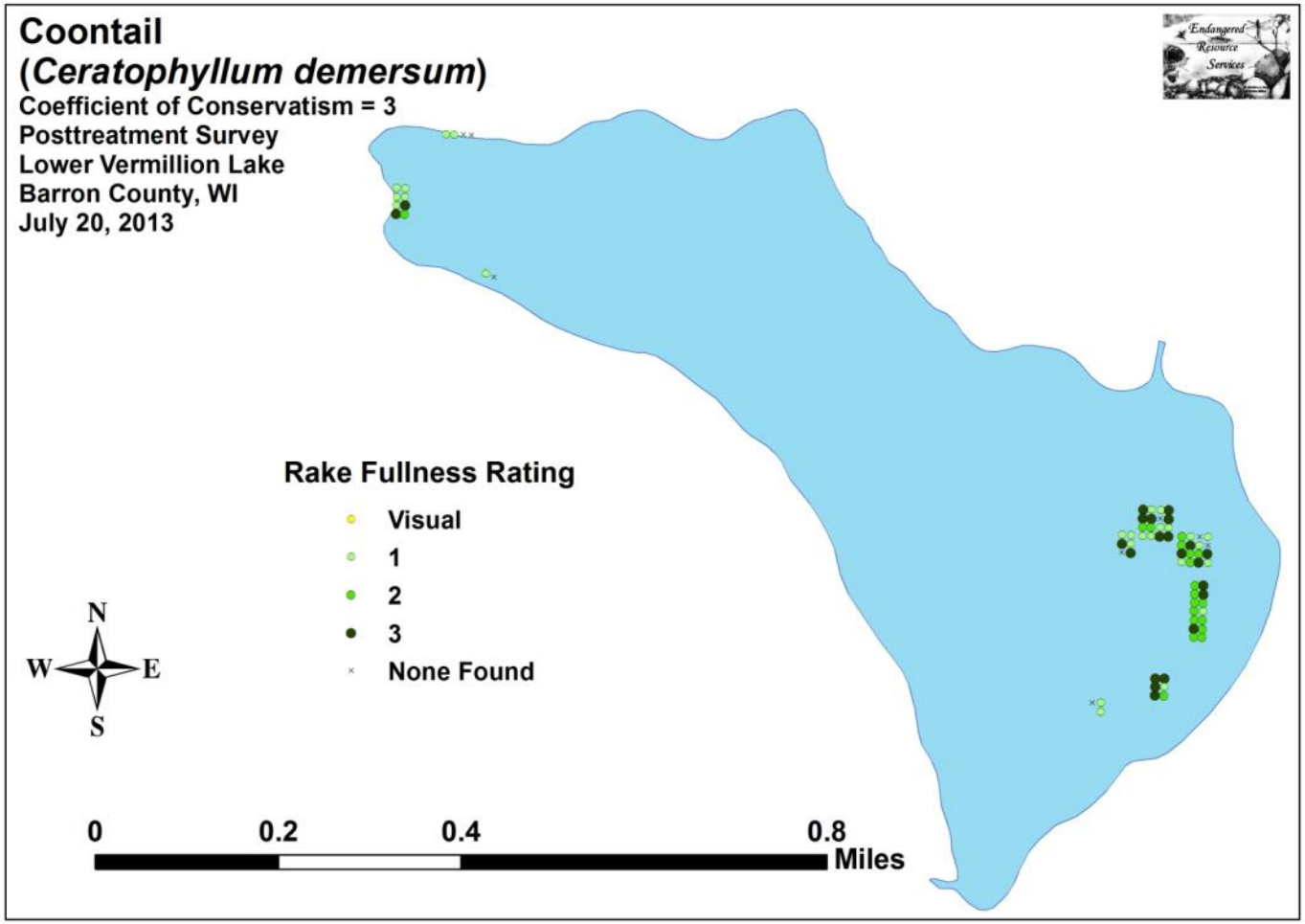

Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

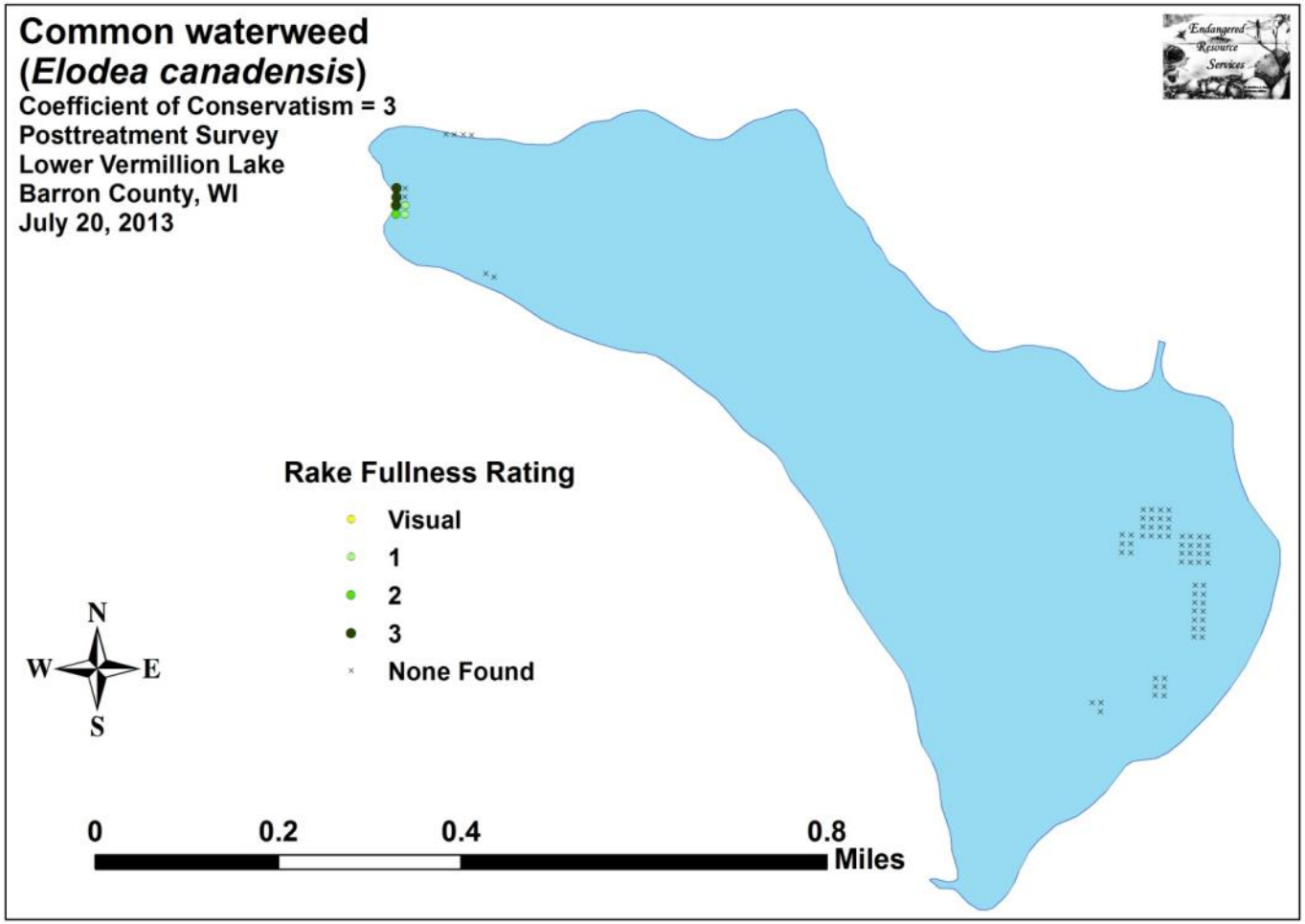

White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

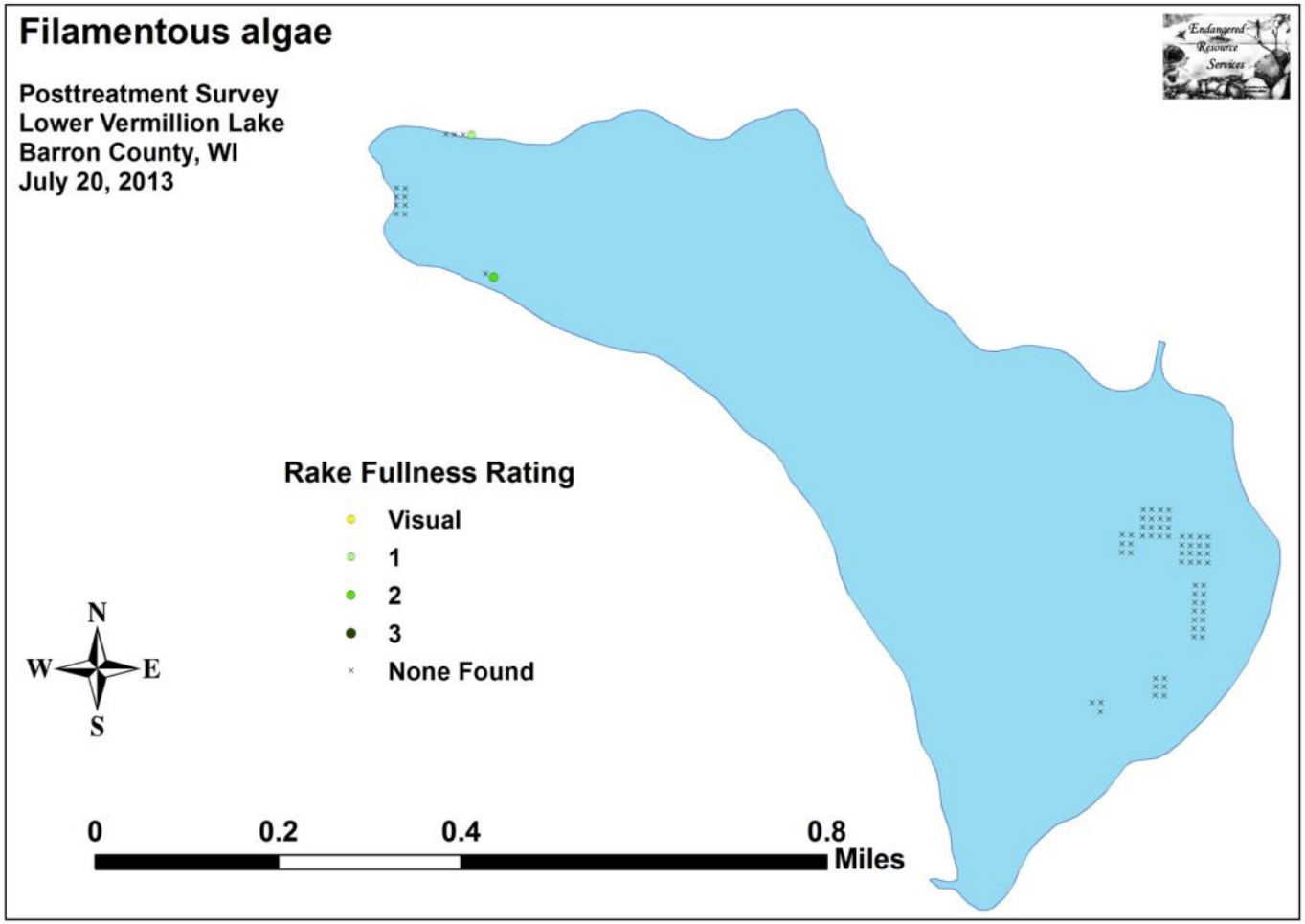

Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

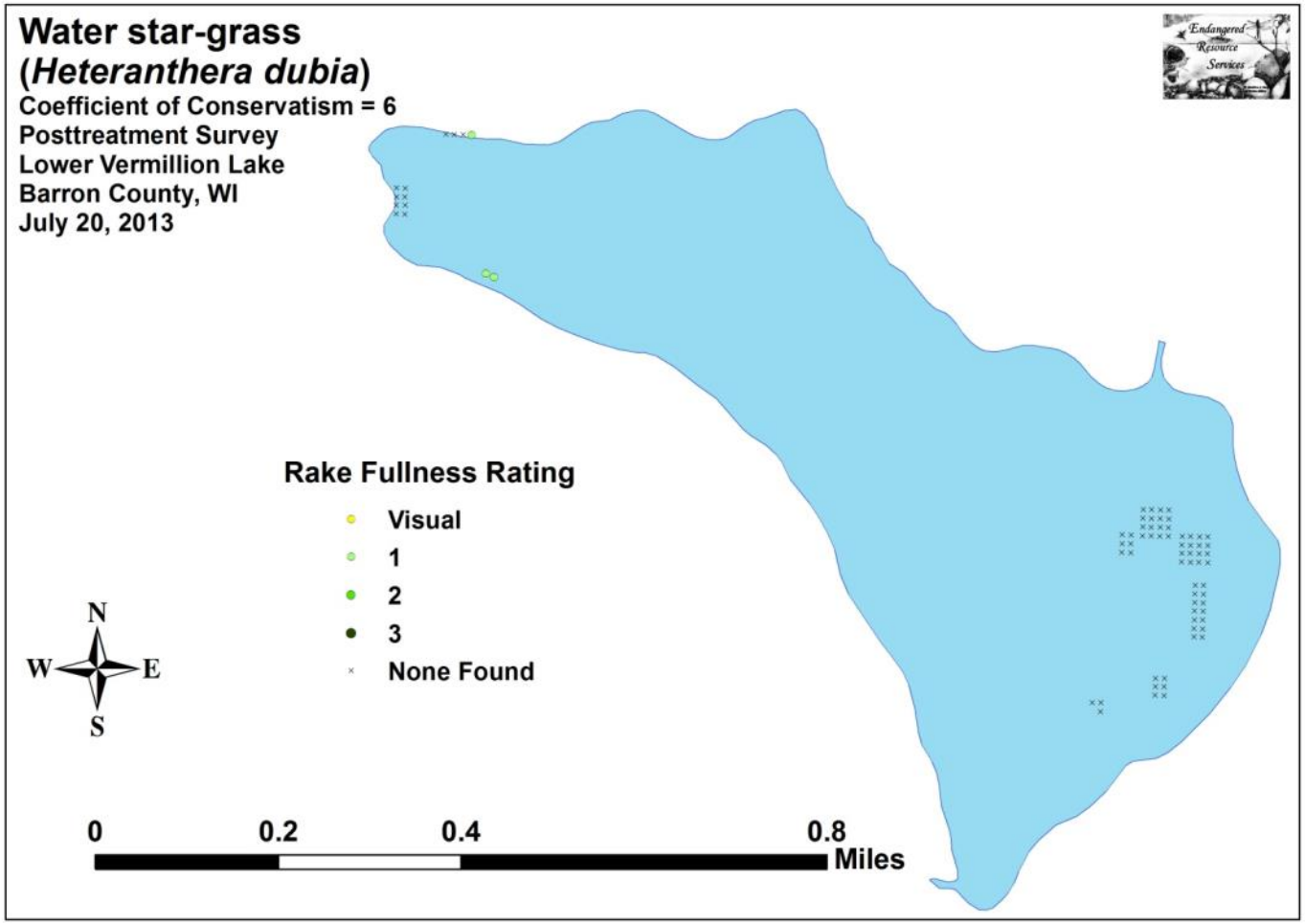

Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 10, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

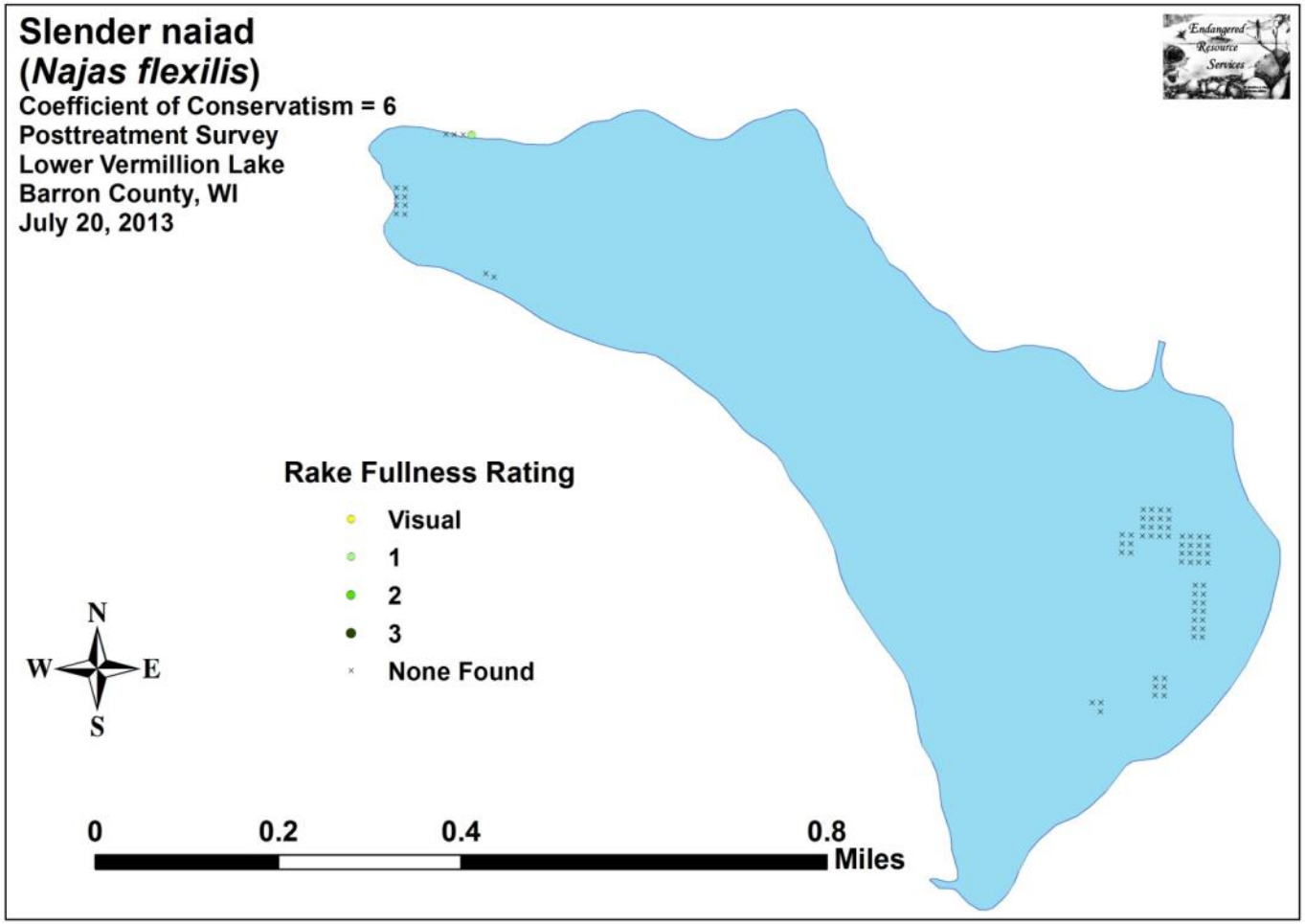
Appendix VII: Posttreatment Native Species Density and Distribution

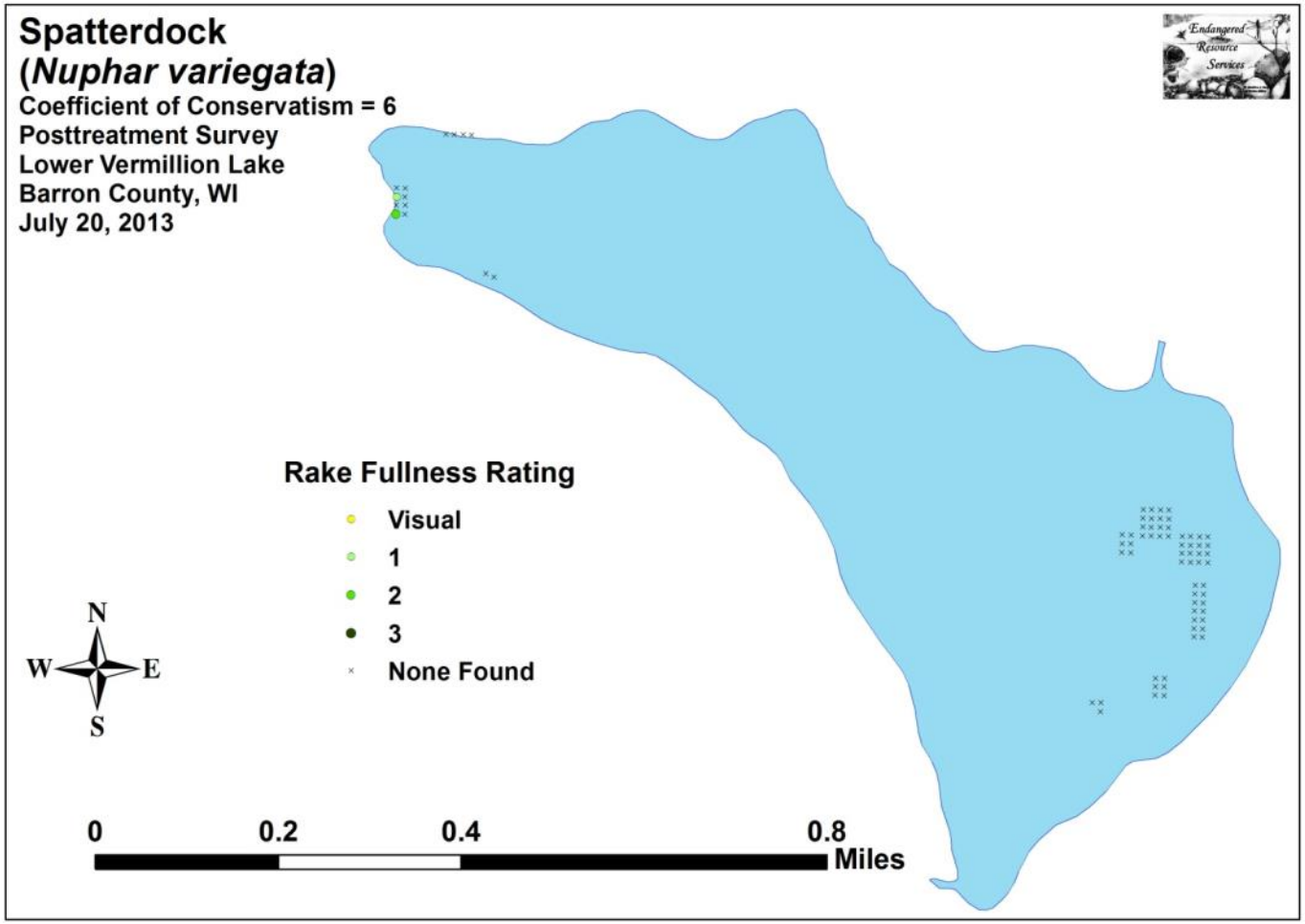

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

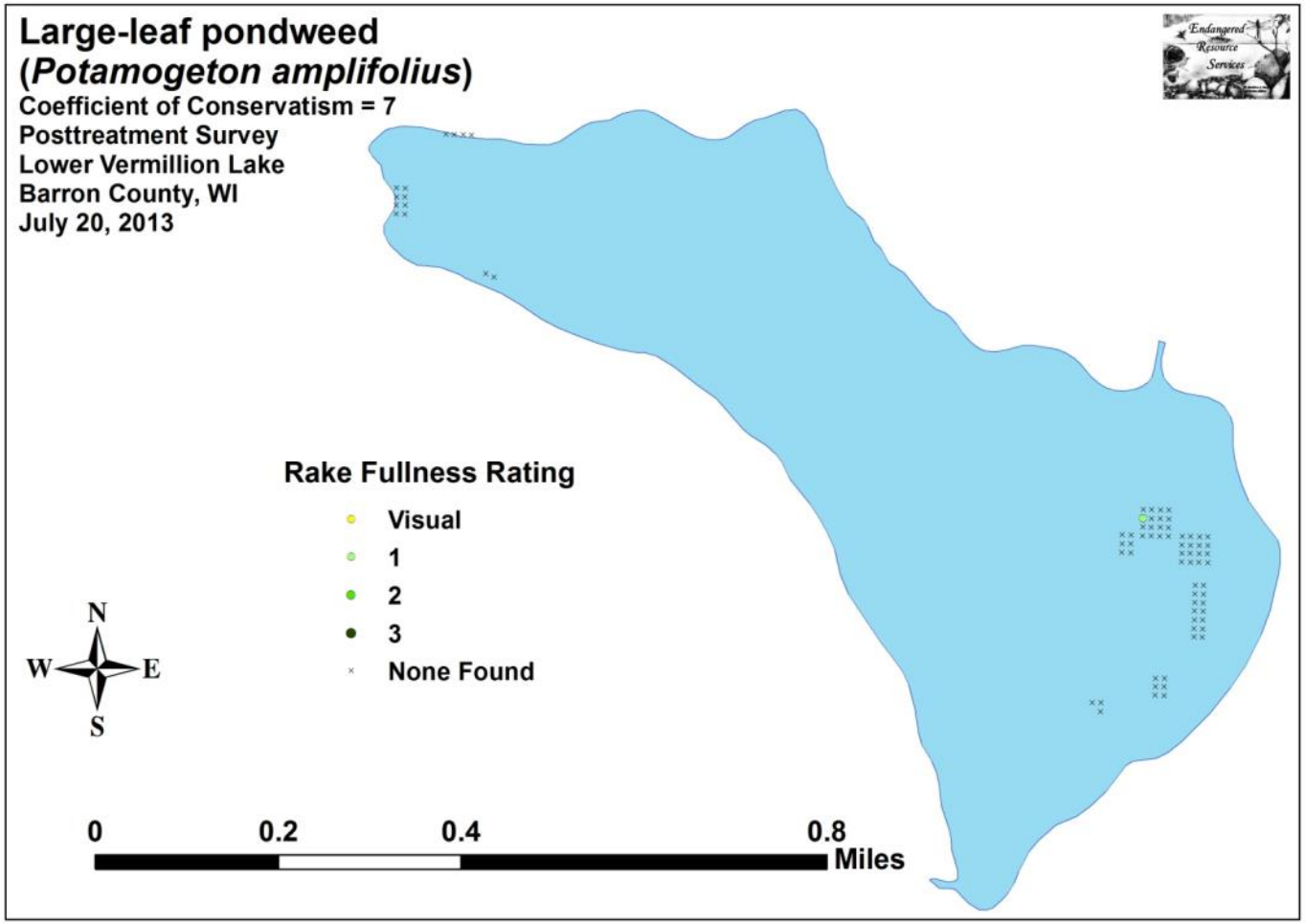

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

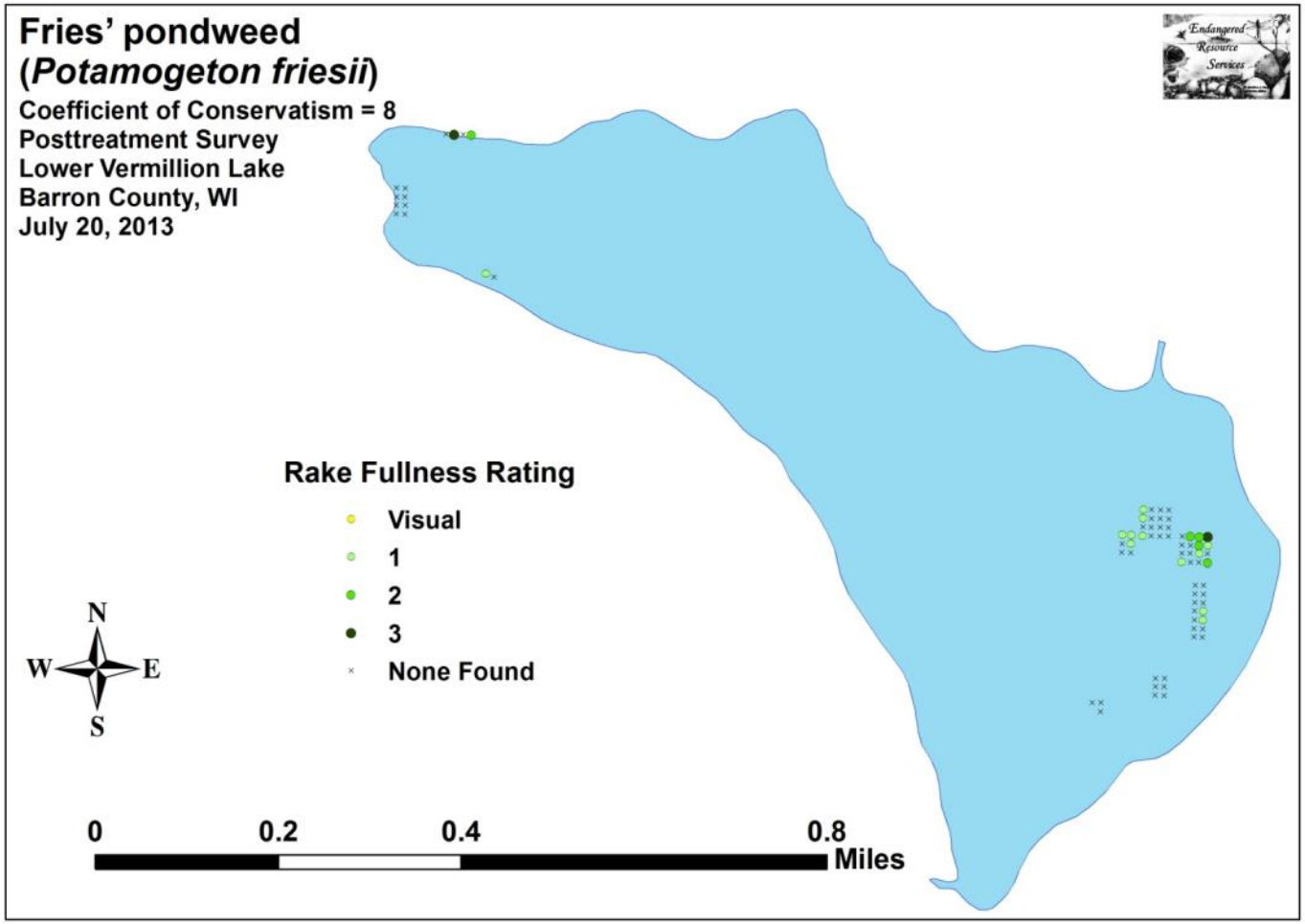

Filamentous algae
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

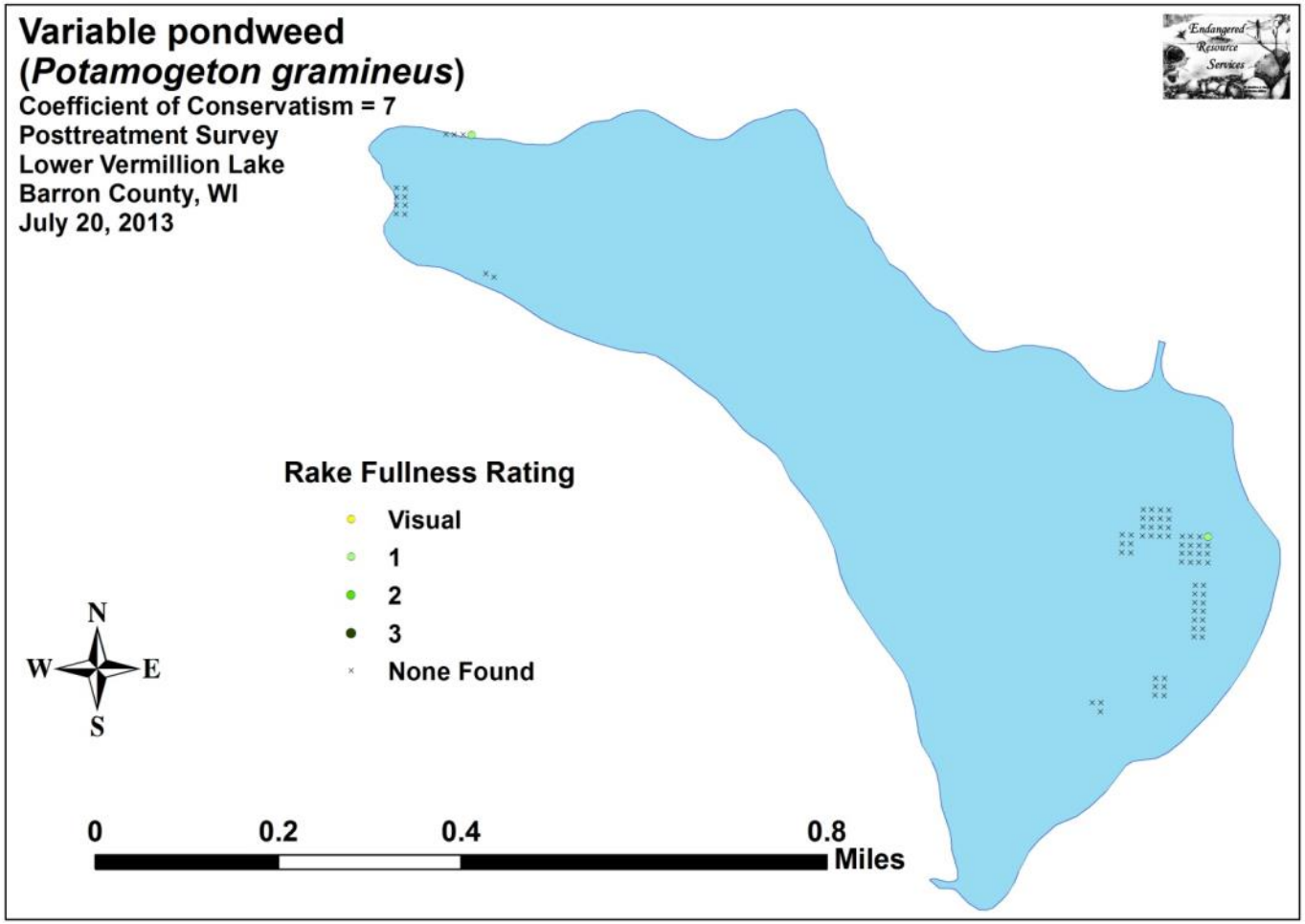

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

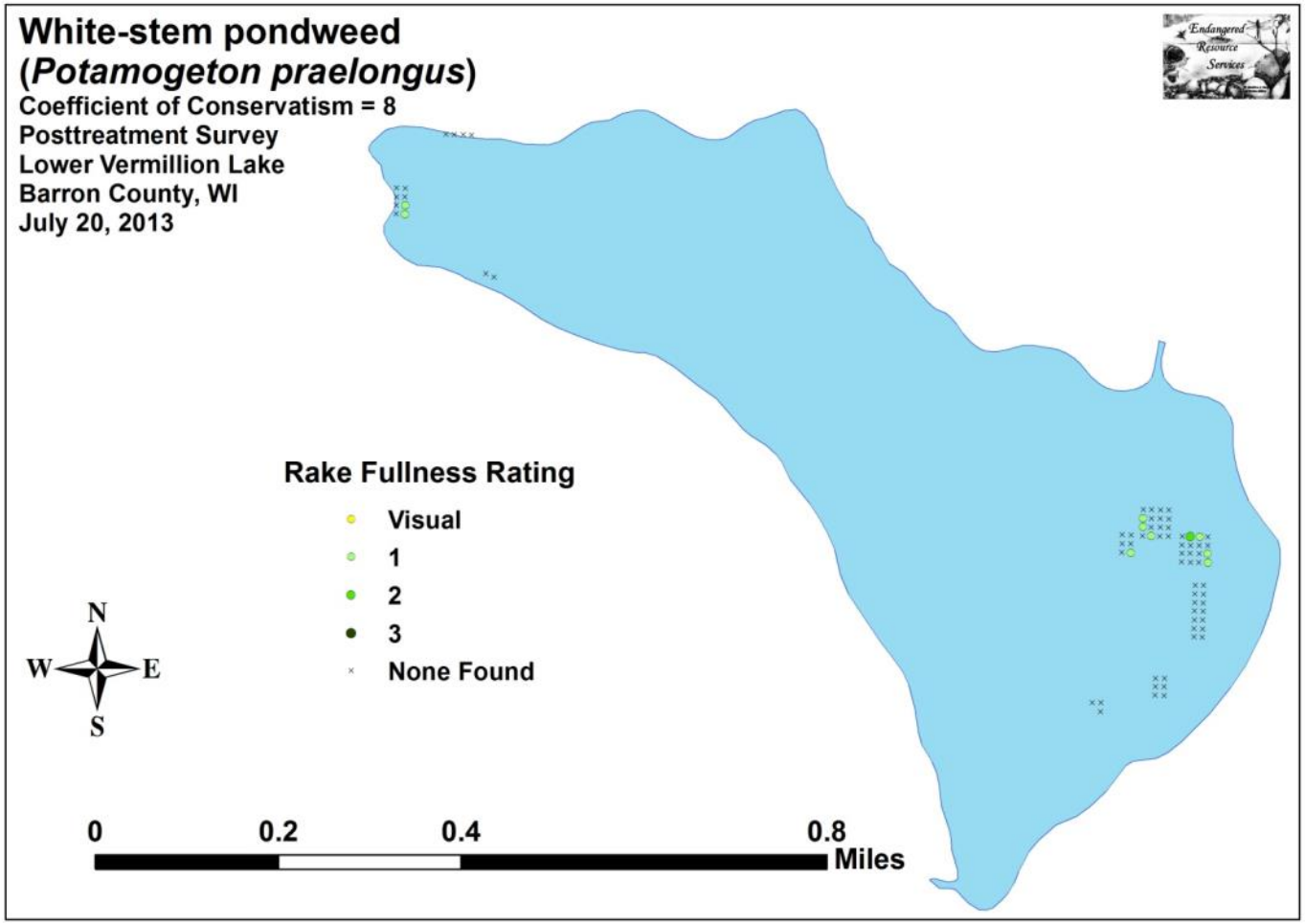

Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

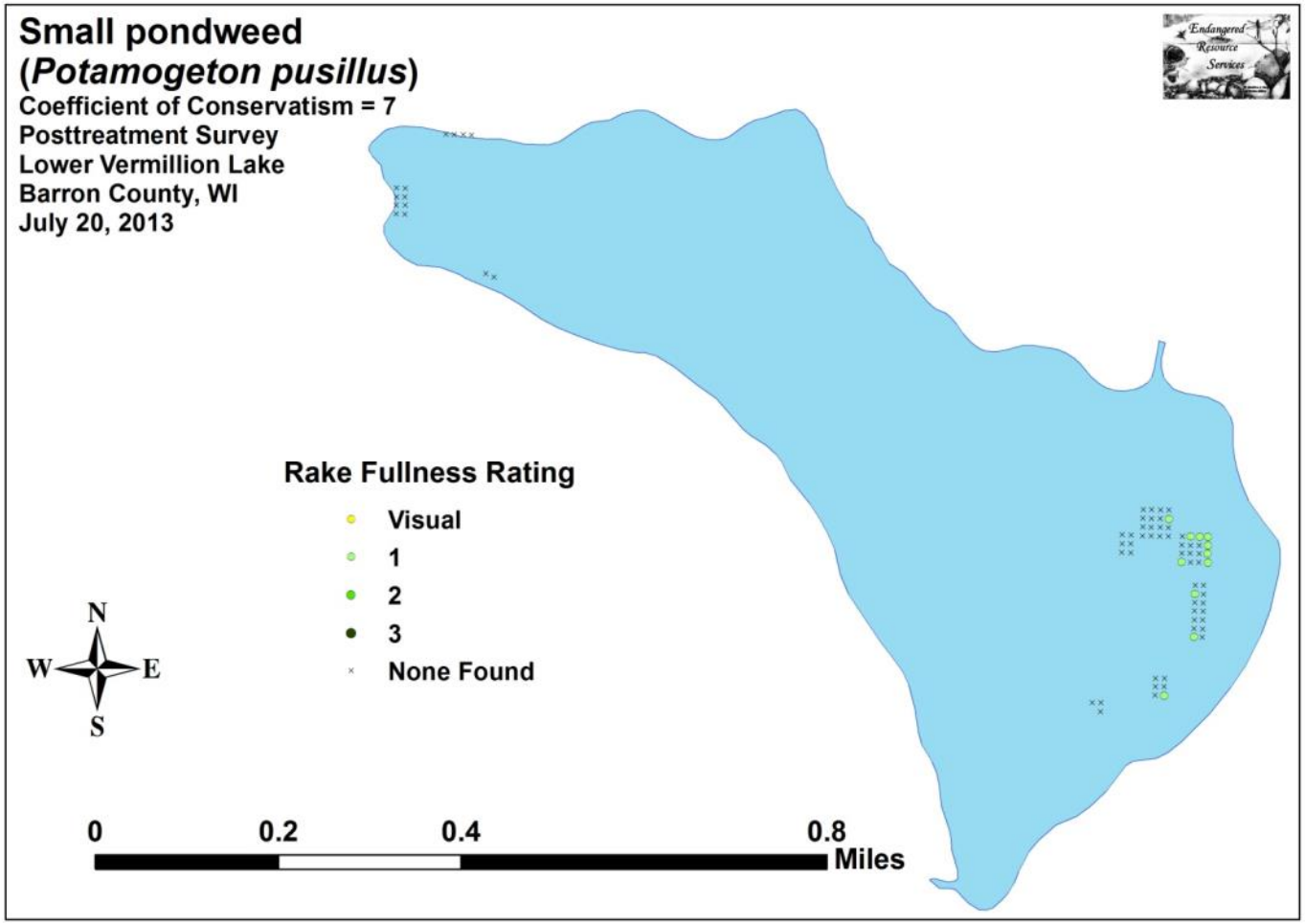

Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

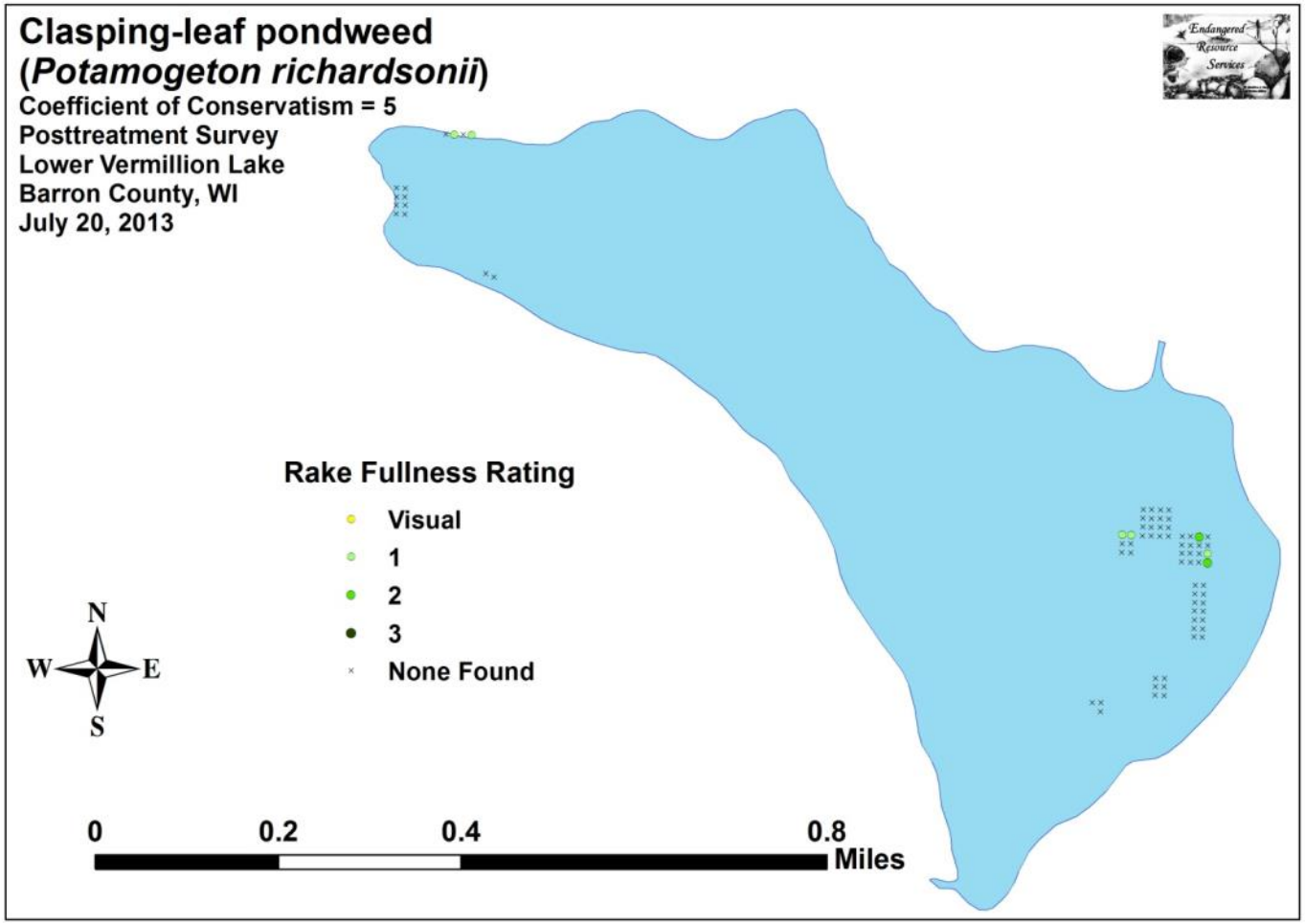

Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

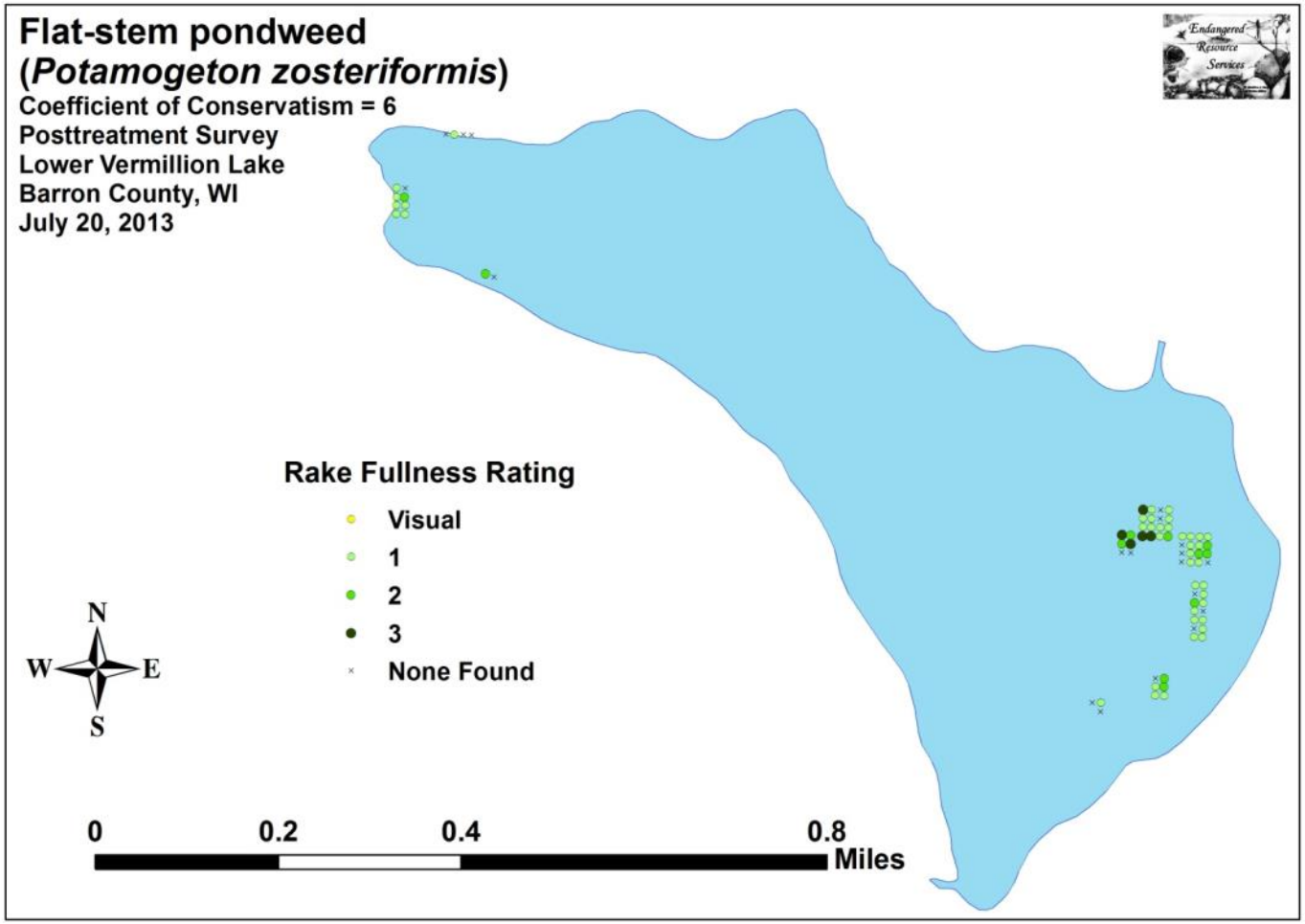

Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

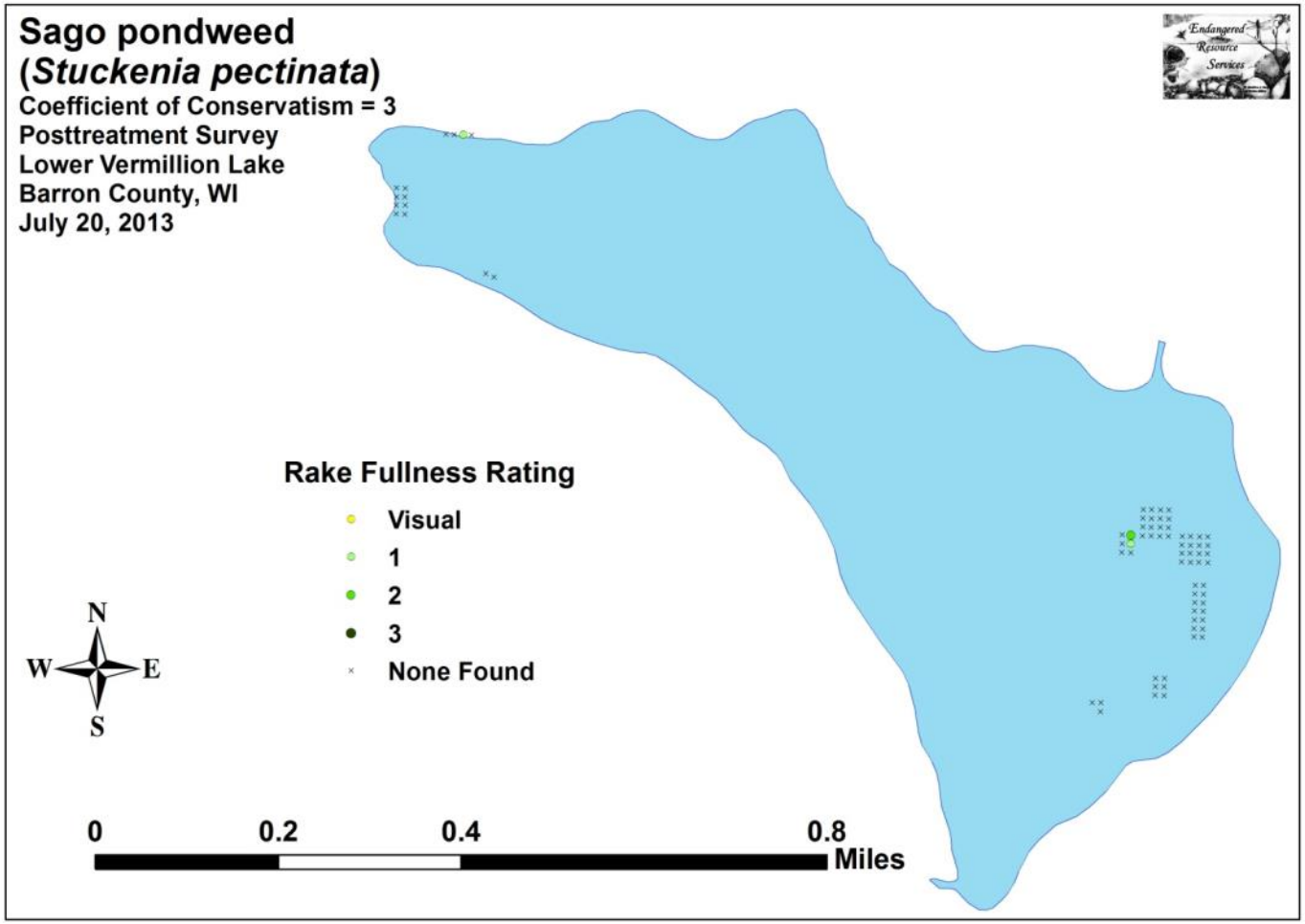

Variable pondweed
(Potamogeton gramineus)
Coefficient of Conservatism = 7
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

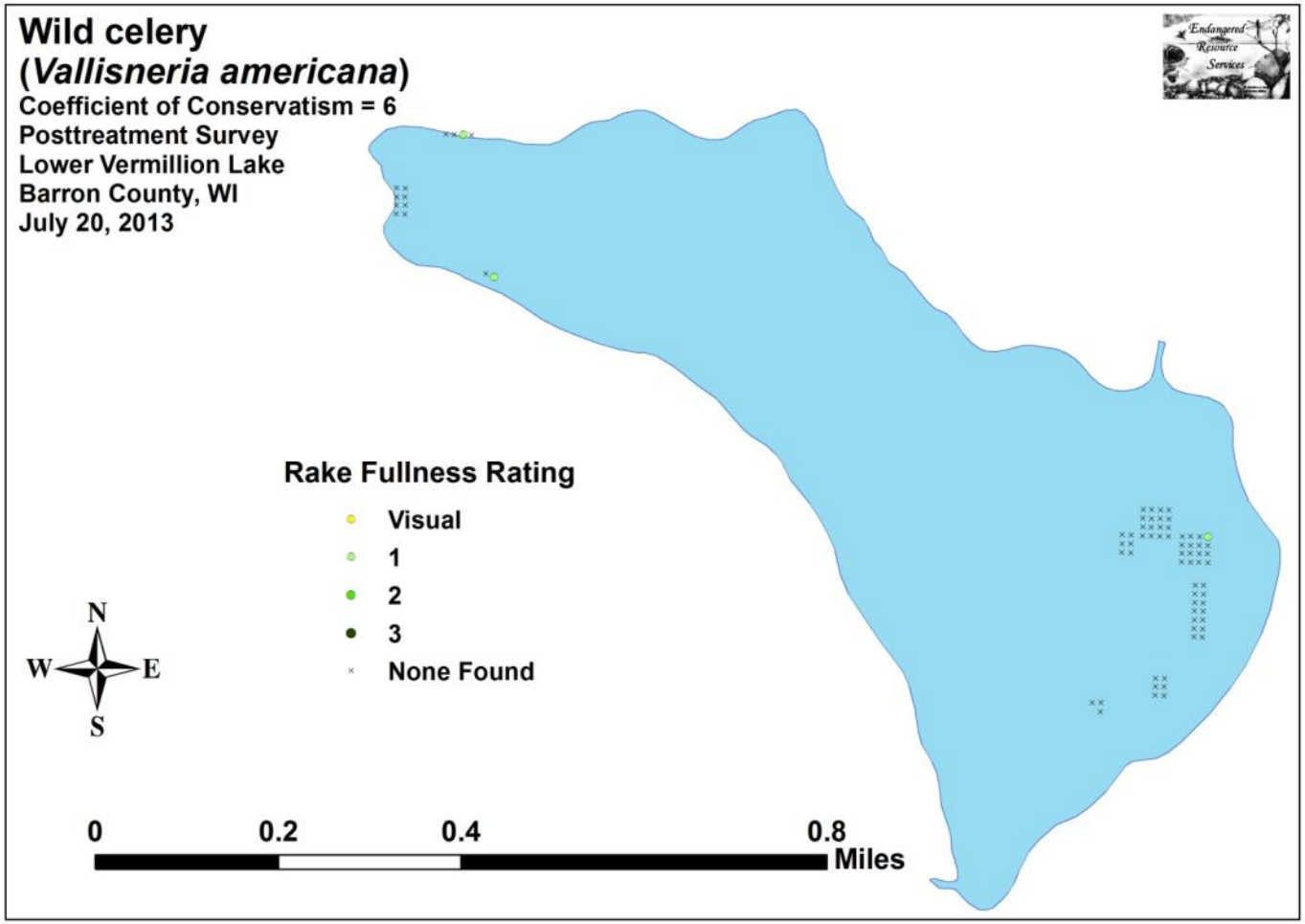

White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

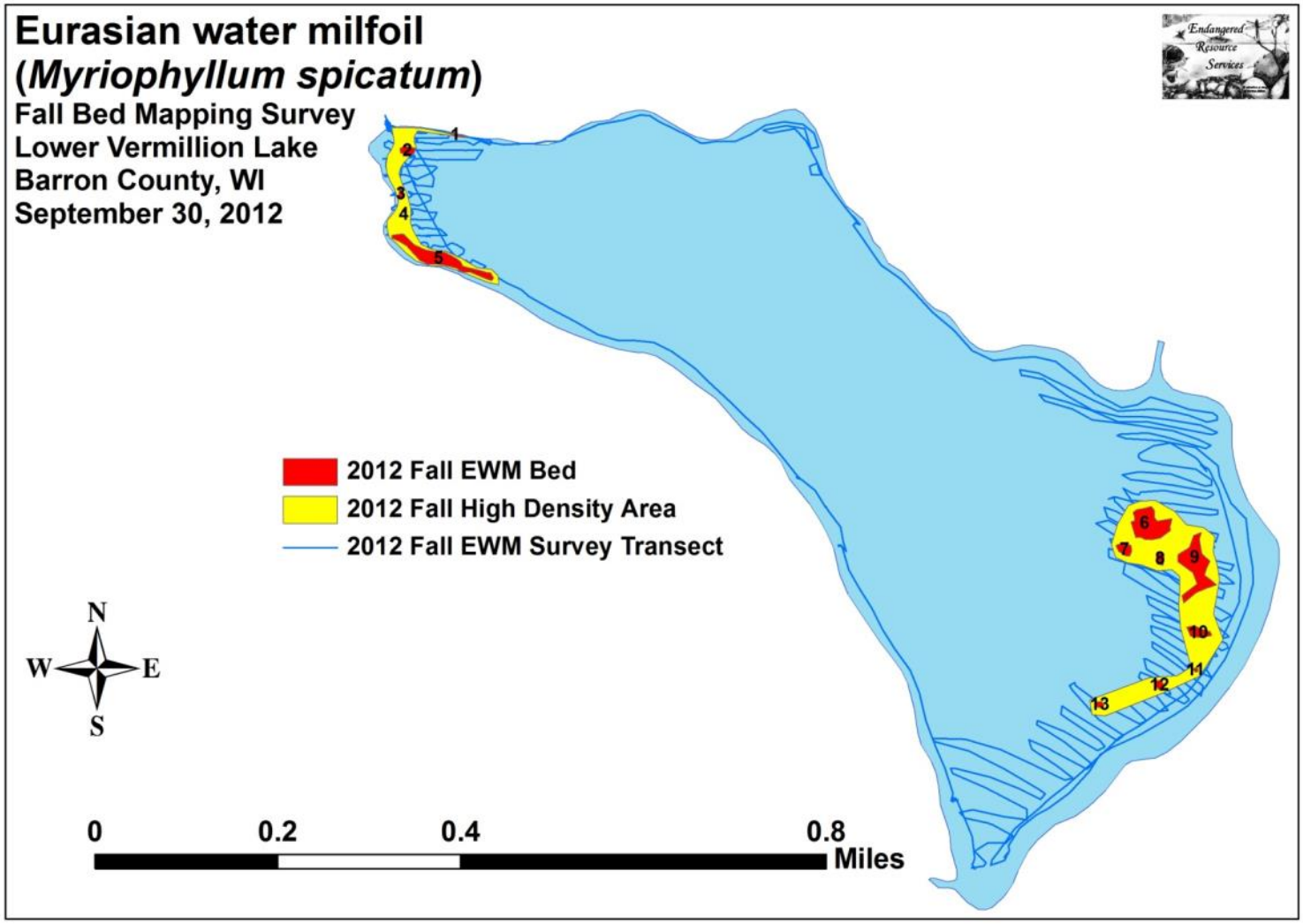

Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

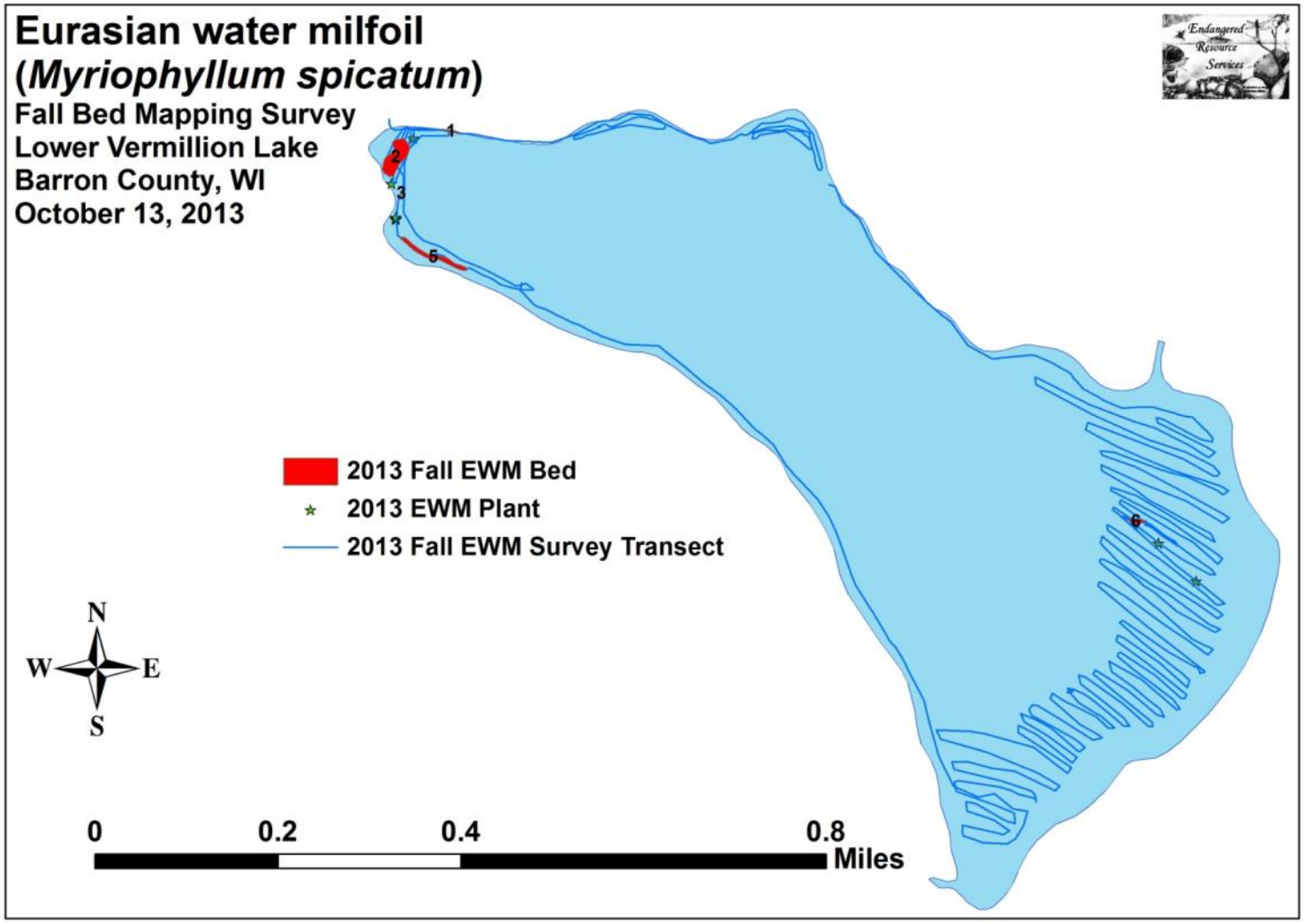

Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Sago pondweed
(Stuckenia pectinata)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
July 20, 2013
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

Appendix VIII: Lower Vermillion Lake Fall 2012 and 2013 EWM Bed Maps


Eurasian water milfoil
(Myriophyllum spicatum)
Fall Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
September 30, 2012
Endangered Resource Services
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
1
2
3
4
5
6
7
8
9
10
11
12
13


Eurasian water milfoil
(Myriophyllum spicatum)
Fall Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
October 13, 2013
Endangered Resource Services
1
2
3
5
6
2013 Fall EWM Bed
2013 EWM Plant
2013 Fall EWM Survey Transect
N
W
E
S
0
0.2
0.4
0.8
Miles