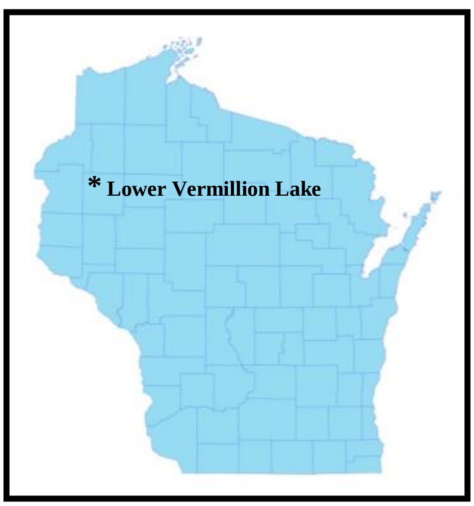
# Eurasian water milfoil (*Myriophyllum spicatum*) Pretreatment and Fall Bed Mapping Surveys Lower Vermillion Lake – WBIC: 2098200 Barron County, Wisconsin

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




Survey Conducted by and Report Prepared by:
Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
May 15 and September 24, 2011

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# INTRODUCTION:

Lower Vermillion Lake (WBIC 2098200) is a 208 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). Lower Vermillion is mesotrophic and water clarity is fair to good with Secchi readings from 7-12ft and a littoral zone the reaches approximately 16ft. 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.

Eurasian water milfoil (*Myriophyllum sibiricum*) (EWM), was discovered in the lake in 2008, and the Vermillion Lakes Association (ELA) has been actively managing to control this invasive exotic species ever since. Prior to herbicide treatment in 2011, the VLA, Short, Elliot and Hendrickson, Inc (SEHI), and the Wisconsin Department of Natural Resources (WDNR) authorized a series of surveys in accordance with the Vermillion Lakes Aquatic Plant Management Plan (APMP). An initial spring EWM pretreatment survey was conducted on May 15th, and a fall bed mapping survey was conducted on September 24th. This report is the summary analysis of these field surveys.

# METHODS:

## Pretreatment Survey:

Using the results of the 2010 fall bed mapping survey, SEHI biologists decided to treat two small areas totaling 1.00 acre in the far northwest end of the lake (Figure 1). In total, a sample grid of 17 points was generated (Appendix I).

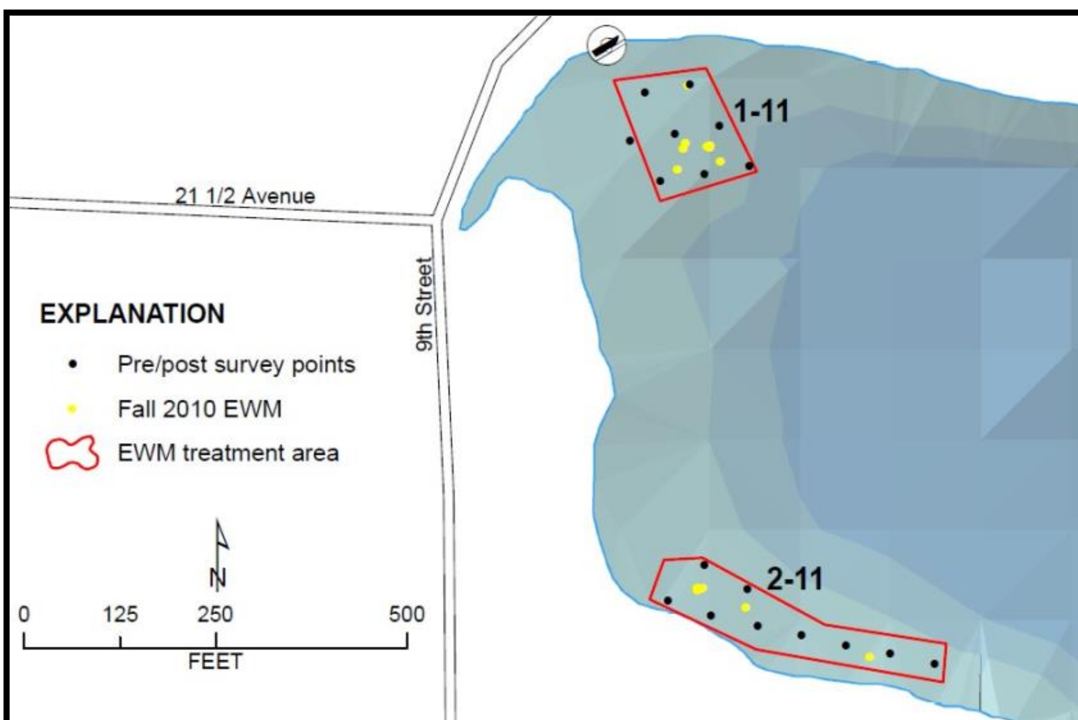


**Figure 1: 2011 Lower Vermillion Lake EWM Treatment Areas** (courtesy SEHI, 2011)

Following the establishment of the survey grid by SEHI, we uploaded them to a handheld mapping GPS unit (Garmin 76CSx), located the point on the lake, and used a rake to sample an approximately 2.5ft section of the bottom. At each point, we recorded the depth and bottom substrate. EWM was assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 2). We also recorded visual sightings of EWM within six feet of the sample point. Because visual sightings are not calculated into the pre/post statistical formulas, we only assigned a rake fullness value for non-EWM plants. A cumulative rake fullness value was also recorded.

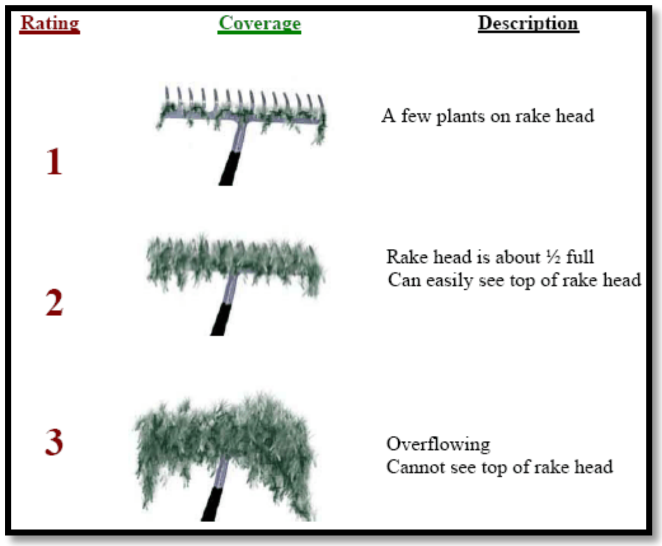


**Figure 2: Rake Fullness Ratings (UWEX, 2010)**

We entered all data collected into the standard APM spreadsheet (Appendix II) (UWEX, 2010). Data was analyzed using the linked statistical summary sheet.

## Fall EWM Bed Mapping Survey:

We conducted the fall bed mapping survey by motoring in transects parallel to shore. We expanded the search away from shore at intervals of 10-20m depending on search condition visibility until we could no longer see plants. We also rake sampled in transects through the spring bed areas to assess if EWM was still present and regrowing in areas where the bottom was not easily visible. The resulting data will be used to determine if, where, and how to treat EWM in 2012.

# RESULTS AND DISCUSSION:

## EWM Pre-Herbicide Survey:

Survey points were scattered throughout the littoral zone from 1.0 to 12.0ft of water with a mean depth of 4.0ft and a median depth of 3.0ft (Table 1). Most of the study area was located over organic muck with the exception of a few sandy areas on the south side of Bed 2 (Figure 3) (Appendix III). Diversity within the study area was very low with a Simpson's Index of only 0.71. Mean native species richness was also very low at 1.18/site within the littoral zone and 1.67 for sites with vegetation. Mean total rake fullness was a low/ moderate 1.65 (Figure 4) (Appendix IV).

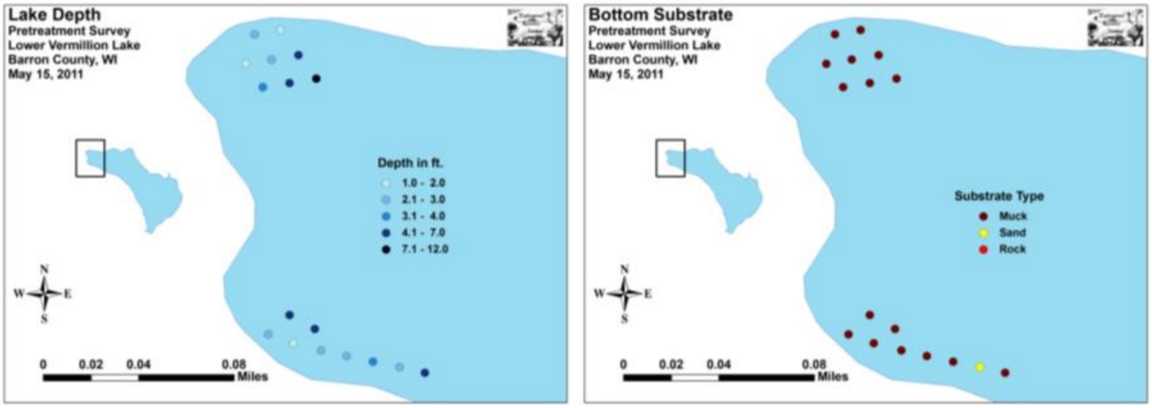


**Figure 3: Depth and Bottom Substrate**

## Table 1: Pretreatment Survey Summary Statistics
## Lower Vermillion Lake, Barron County
## May 15, 2011

| Summary Statistics: | Pre |
|---|---|
| Total number of points sampled | 17 |
| Total number of sites with vegetation | 13 |
| Total number of sites shallower than the maximum depth of plants | 17 |
| Frequency of occurrence at sites shallower than maximum depth of plants | 76.47 |
| Simpson Diversity Index | 0.71 |
| Maximum depth of plants (ft) | 12.00 |
| Number of sites sampled using rope rake (R) | 0 |
| Number of sites sampled using pole rake (P) | 17 |
| Average number of all species per site (shallower than max depth) | 1.71 |
| Average number of all species per site (veg. sites only) | 2.23 |
| Average number of native species per site (shallower than max depth) | 1.18 |
| Average number of native species per site (veg. sites only) | 1.67 |
| Species Richness | 5 |
| Mean depth of plants (ft) | 4.00 |
| Median depth of plants (ft) | 3.00 |
| Mean Rake Fullness | 1.65 |

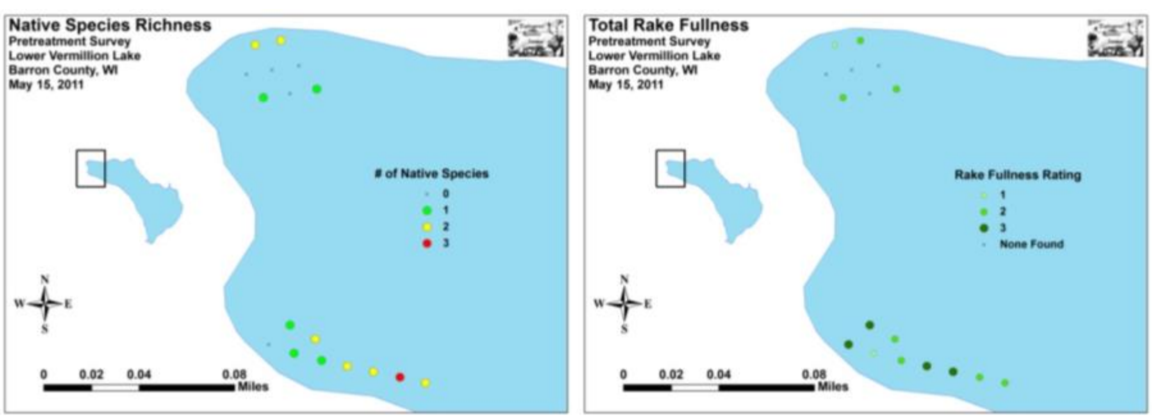


**Figure 4: Pre Native Species Richness/Total Rake Fullness**

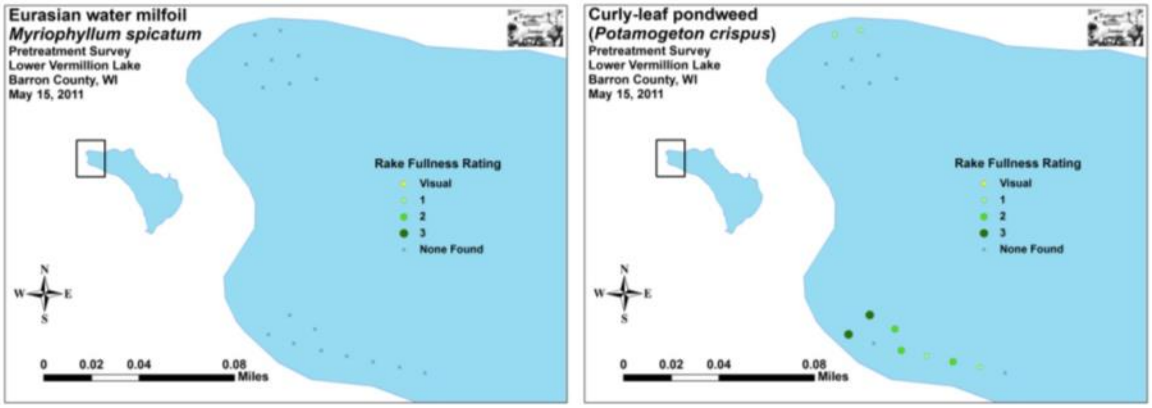


**Figure 5: Pretreatment EWM/CLP Density**

We did not found EWM at any of the pretreatment survey points or interpoint. However, Curly-leaf pondweed (*Potamogeton crispus*), another invasive exotic species, was abundant in Bed 2 (Figure 5) (Appendix V). Because of our findings, herbicide treatment in Bed 1 was cancelled, and the planned posttreatment survey was deemed unnecessary.

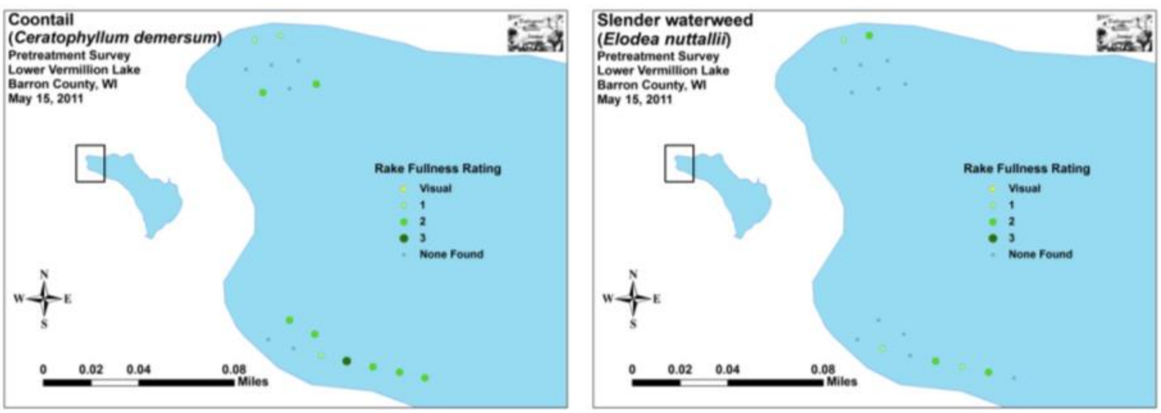


**Figure 6: Pretreatment Coontail/Slender Waterweed**

Besides EWM and CLP, only four other species were growing in the study areas (Table 2) (Appendix VI). Of these, Coontail (*Ceratophyllum demersum*) and Slender waterweed (*Elodea nuttallii*) made up almost 69% of the relative frequency (Figure 6).

**Table 2: Frequencies and Mean Rake Sample of Aquatic Macrophytes**
**Pretreatment Survey - Lower Vermillion Lake, Barron County**
**May 15, 2011**

| Species | Common Name | Total Sites | Relative Freq. | Freq. in Veg. | Freq. in Lit. | Mean Rake |
|---|---|---|---|---|---|---|
| *Ceratophyllum demersum* | Coontail | 11 | 37.93 | 84.62 | 64.71 | 1.82 |
| *Potamogeton crispus* | Curly-leaf pondweed | 9 | 31.03 | 69.23 | 52.94 | 1.78 |
| | Filamentous algae | 8 | | 61.54 | 47.06 | 1.50 |
| *Elodea nuttallii* | Slender waterweed | 6 | 20.69 | 46.15 | 35.29 | 1.50 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 2 | 6.90 | 15.38 | 11.76 | 1.50 |
| *Myriophyllum sibiricum* | Northern water-milfoil | 1 | 3.45 | 7.69 | 5.88 | 1.00 |

## Fall EWM Bed Mapping Survey:

On September 24th, we again surveyed Lower Vermillion Lake to identify any remaining beds or high density EWM areas that may need control in 2012. Water clarity was fair, and we could see down approximately four-five feet. Despite an exhaustive transect search of the lake's visible littoral zone under ideal conditions (high sun/no wind), we did not find any EWM plants in the eastern half of the lake (Figure 7). We also did not observe any expansion beyond the original infestation area with the exception of a single plant found in the first bay approximately 300m east of the landing. Unfortunately, in the Bed 1 area directly out from the landing, EWM was again common to abundant as we rake removed no less than 80 individual plants and clusters. We also found and removed eight sizable clusters in Bed 2 (Figure 8) (Appendix VII).

Technically, neither of these areas met the "bed" criteria of >50% of the area's plants or continuously canopied. However, if we reduced the criteria to >25% of plants, the two areas originally slated for treatment in spring 2011 would have both qualified. Collectively, the two "beds" added up to 0.84 acres (Table 3). Based on past experience, we expect that plants will again be present throughout much of the littoral zone by the landing again next year. It seems that EWM is slow to grow in the lake in the spring, but really takes off by August. This may necessitate delaying future pretreatment surveys until at least June to increase the chances of locating and then eliminating these early season EWM plants before they can spread.

In areas adjacent to the beds where we could not see the bottom, we randomly raked along transects. These surveys turned up plants in water as deep as 10-13ft of water, and some rakes were a three. These unseen deep water plants may be serving as a continuous source for the new plants that keep popping up in shallower water.

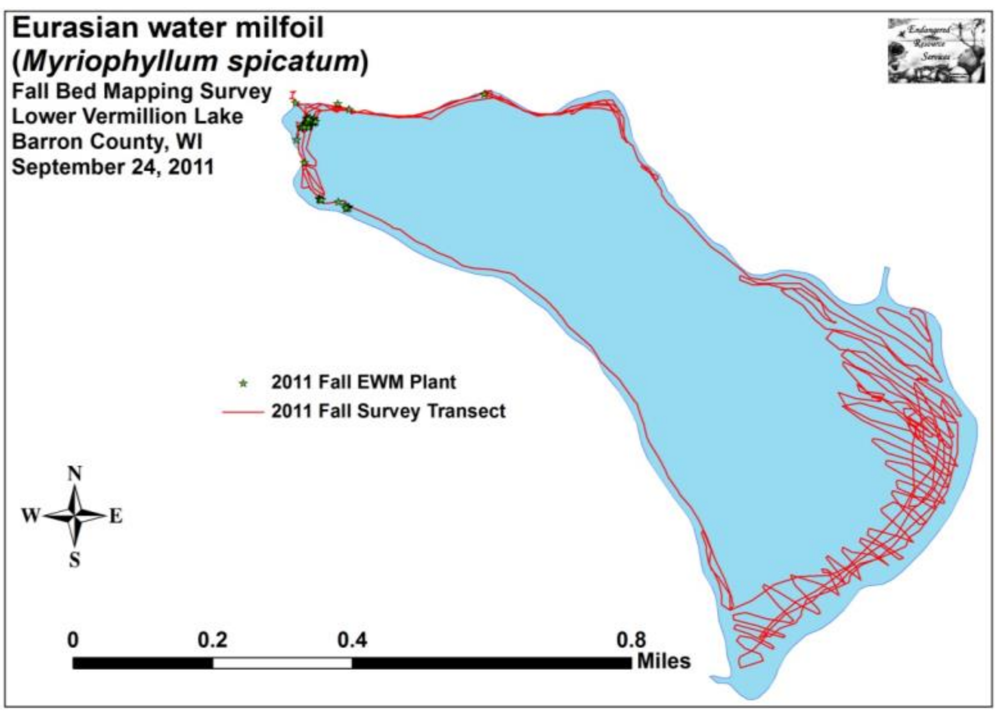


**Figure 7: Lower Vermillion Lake Fall 2011 EWM Survey Map**

## Description of EWM Beds:

Bed 1 – EWM plants were common throughout and many were prop clipped as there was no way to leave the area from the landing without driving right through the heart of the bed. Despite our raking everything we found that we could see, deep plants kept turning up during the transect survey, and there was no way to know if we were getting them all. Expanding the treatment area out to 15ft of water may be a prudent measure in the future.

Bed 2 – EWM plants were patchy throughout the treatment area. As opposed to the spring survey when dense CLP made searching for EWM difficult, we had a much easier time locating plants in the post treated area where total plant densities of all species were noticeably lower.

**Table 3: Fall EWM Bed Summary**
**Lower Vermillion Lake, Barron Co. September 24, 2011**

| Bed Number | 2011 Fall Bed Acreage | 2011 Spring Bed Acreage | Difference +/- |
|---|---|---|---|
| 1 | 0.49 | 0.45 | 0.04 |
| 2 | 0.35 | 0. 55 | -0.20 |
| **Total Acres** | 0.84 | 1.00 | -0.16 |

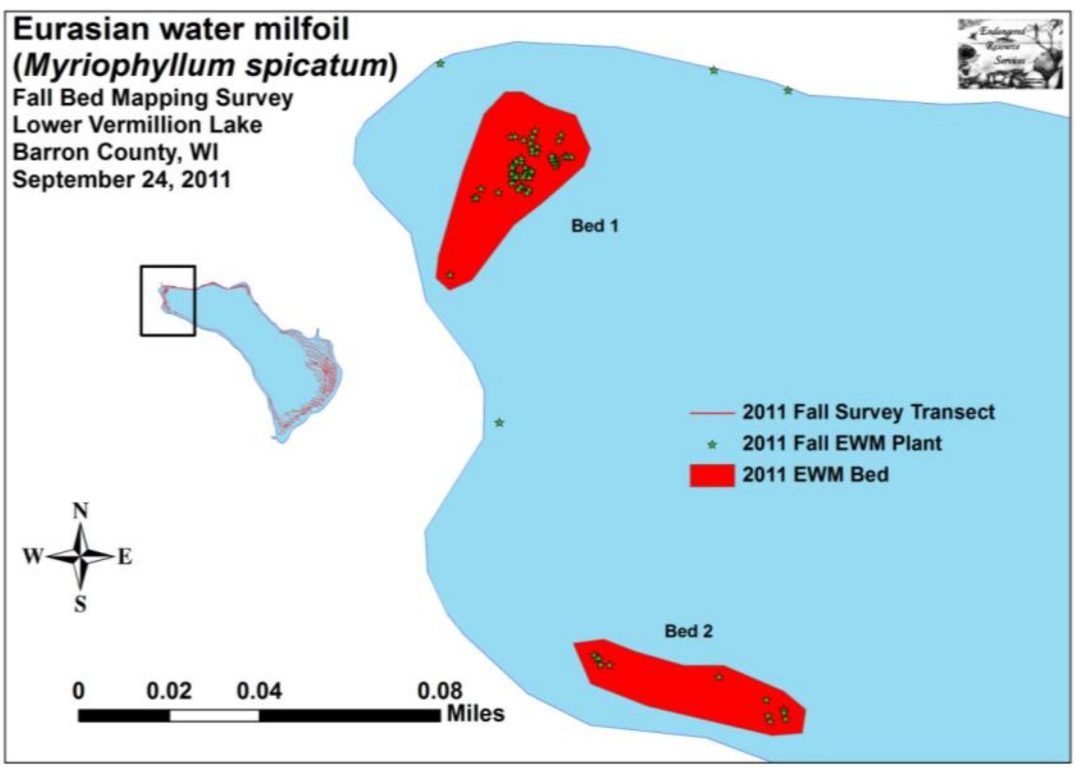


**Figure 8: Lower Vermillion Lake Fall 2011 EWM Beds**

# LITERATURE CITED

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 (2011,Sept.).

UWEX Lakes Program. [online]. 2010. Aquatic Plant Management in Wisconsin. Available from http://www.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp (2010, June).

UWEX Lakes Program. [online]. 2010. Pre/Post Herbicide Comparison. Available from http://dnr.wi.gov/org/water/fhp/lakes/PrePostEvaluation.pdf (2010, June).

WDNR. [online]. 2009. Citizen Monitoring Lake Water Quality Database. Available from http://dnr.wi.gov/lakes/clmn/reportsanddata/index.asp?folder=CLMN (2009, June).

## Appendix I: EWM Pretreatment Survey Areas with Survey Sample Points


**Treatment Options**

| Bed | Acreage | Mean Depth (ft) | Substrate | Pre/Post Points | Treatement Rate (lbs/acre) Control EWM | Control EWM and CLP | EWM Density | CLP Density |
|---|---|---|---|---|---|---|---|---|
| 1-11 | 0.45 | 4.1 | Muck | 8 | 27 | 54 | High | Unknown |
| 2-11 | .55 | 3.3 | Muck | 9 | 22 | 44 | Medium | Medium |
| **TOTAL** | **1.00** | | | **17** | | | | |

Note: Both beds are within WDNR Sensitive Area "A" which covers 7.8 acres.

Curly-leaf pondweed is present in Bed 2-11 and likely in both treatment areas.

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www.sehinc.com

Project: VERLA
Print Date: 01/13/2011

Map by: JAM
Projection: NAD 83 Wisconsin TM
Source: M. Berg, WDNR GIS Repository

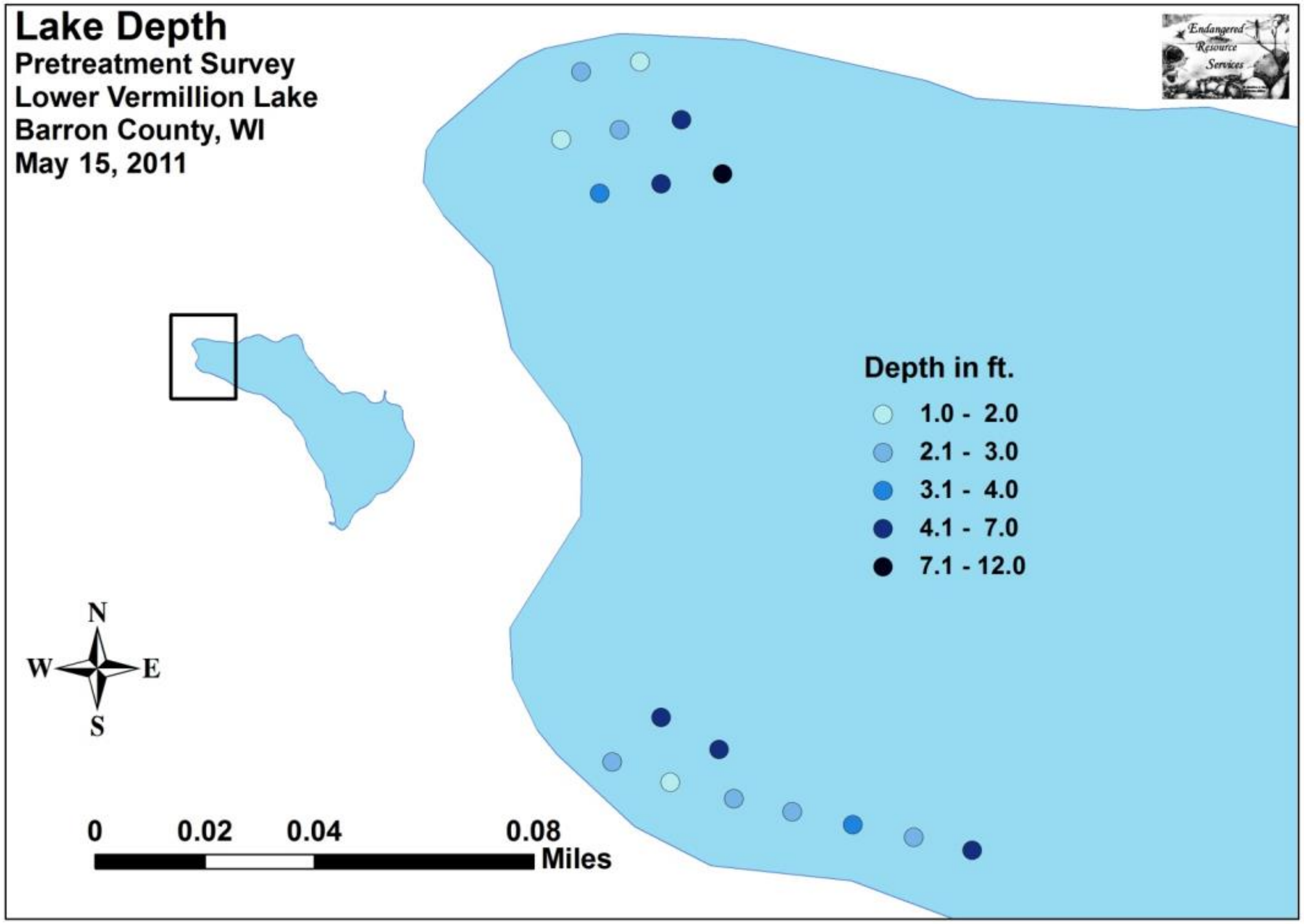
***Lower Vermillion Lake***
2011 Proposed Eurasian Watermilfoil Treatment Areas
Barron County, Wisconsin

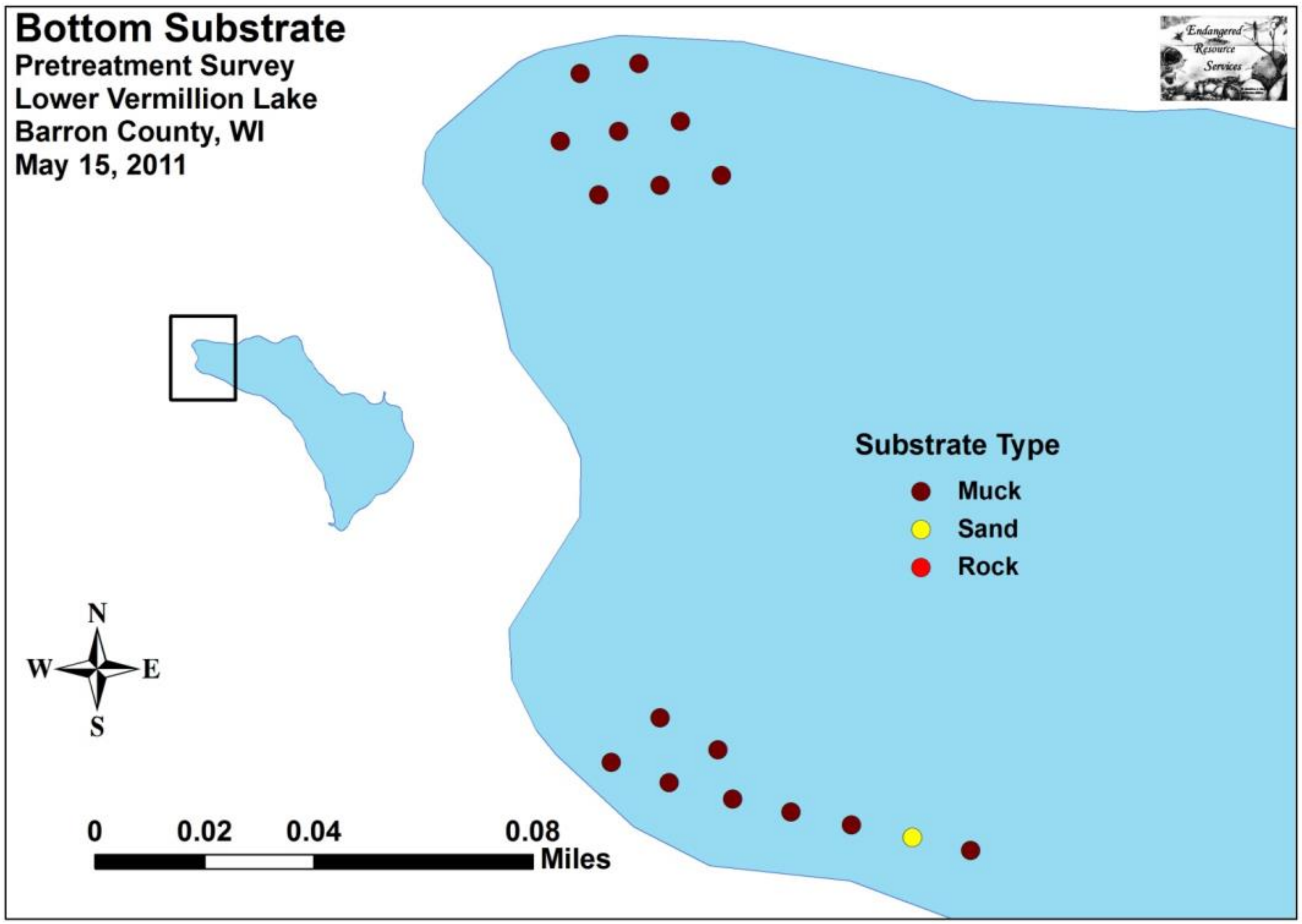
Area Enlarged

# 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 | EWM | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | | | | | |

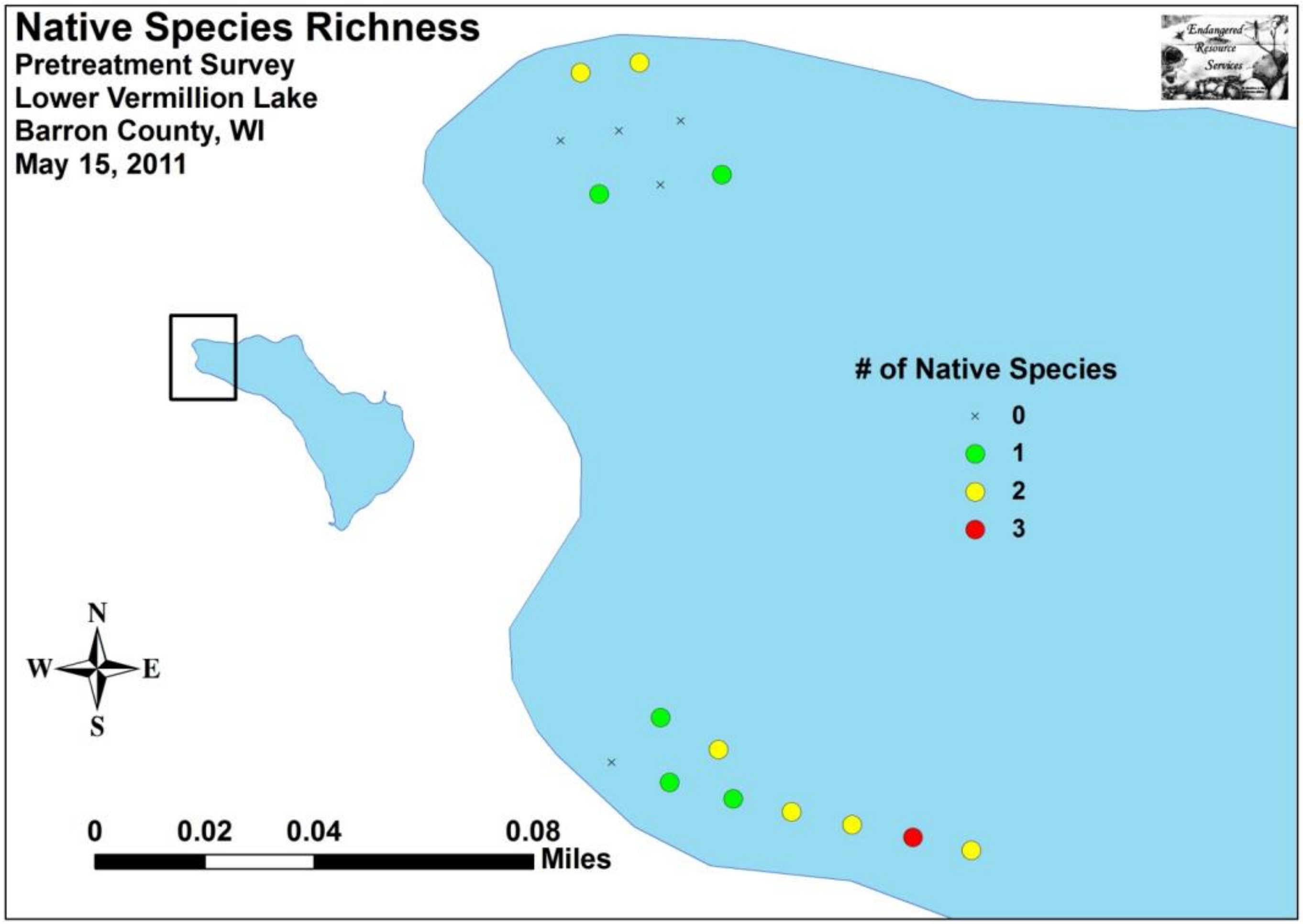
# Appendix III:  Lower Vermillion Lake Pretreatment Habitat Variables

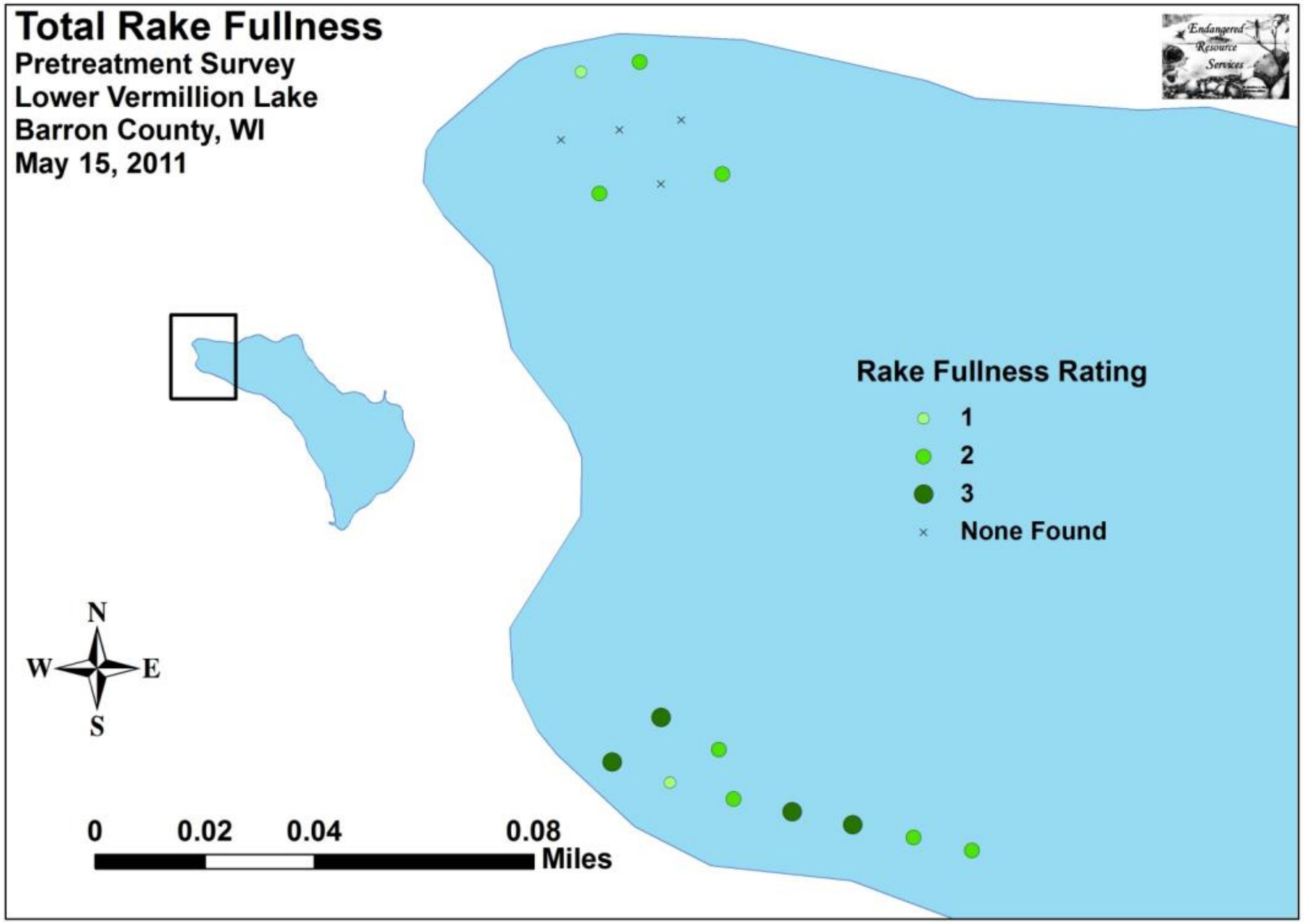

Lake Depth
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Endangered Resource Services
Depth in ft.
1.0 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 7.0
7.1 - 12.0
N
W
E
S
0
0.02
0.04
0.08
Miles



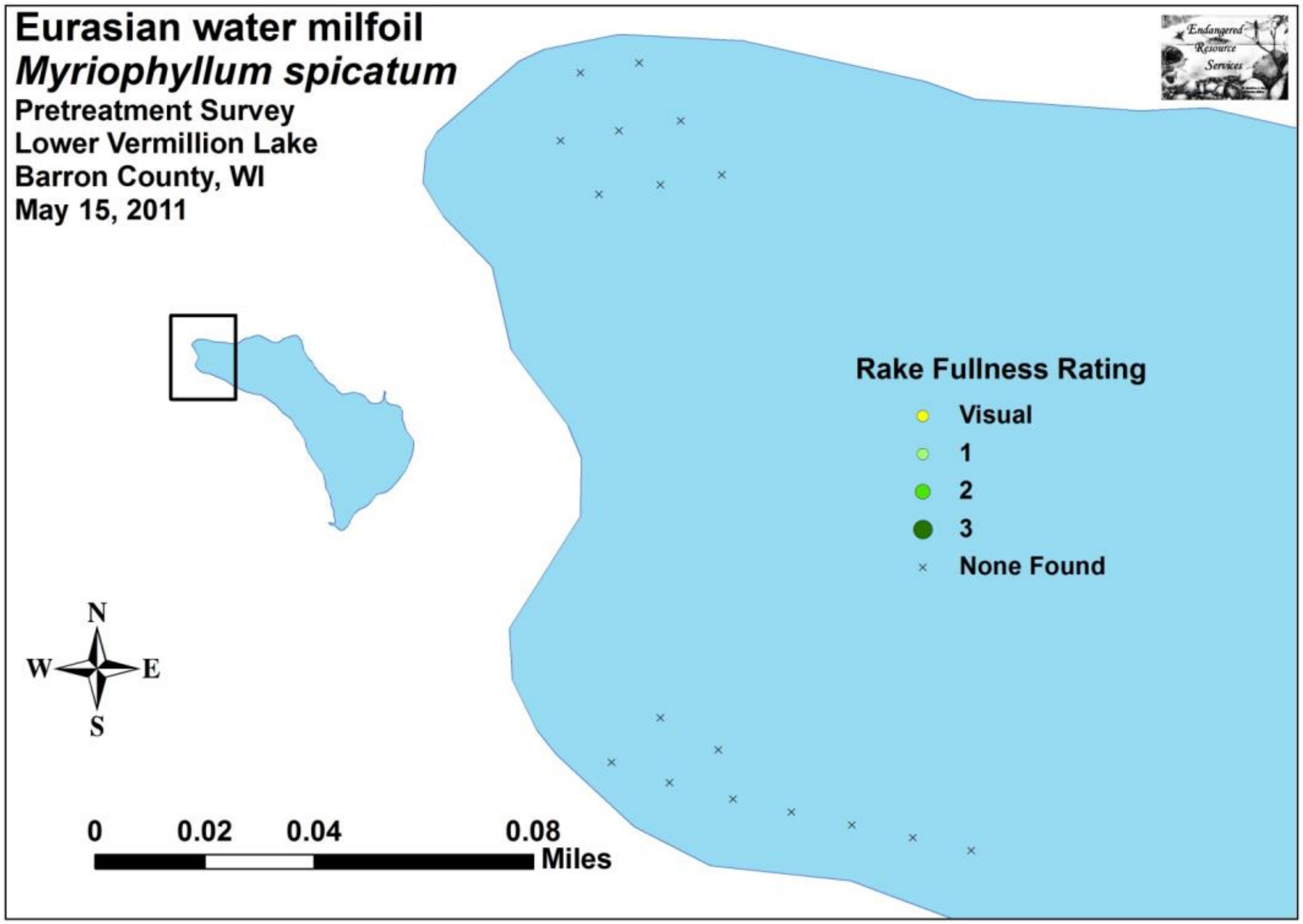
Bottom Substrate
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Endangered Resource Services
Substrate Type
Muck
Sand
Rock
N
W
E
S
0
0.02
0.04
0.08
Miles

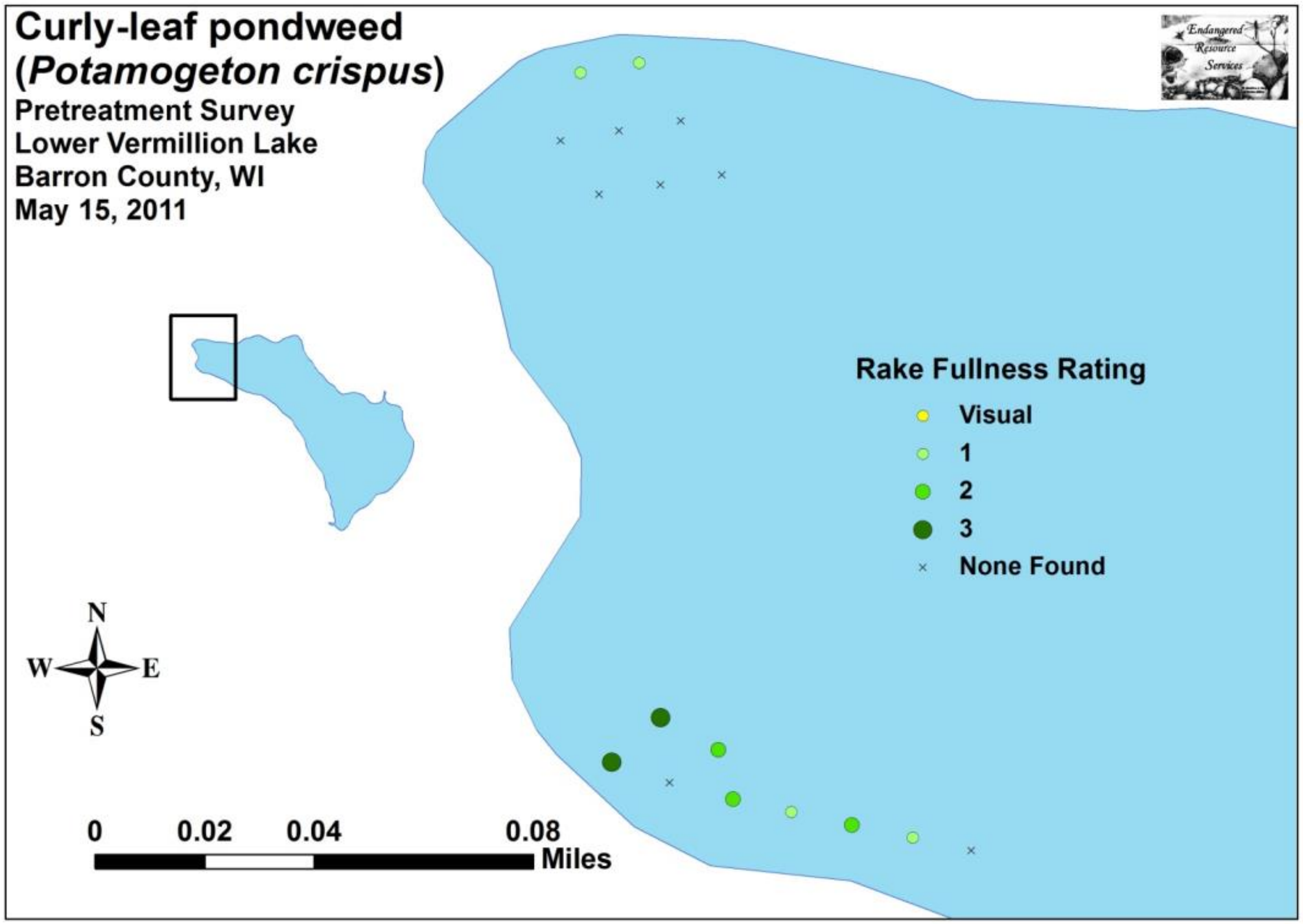
# Appendix IV: Pretreatment Native Species Richness and Total Rake Fullness


Native Species Richness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Endangered Resource Services
# of Native Species
0
1
2
3
N
W
E
S
0
0.02
0.04
0.08
Miles

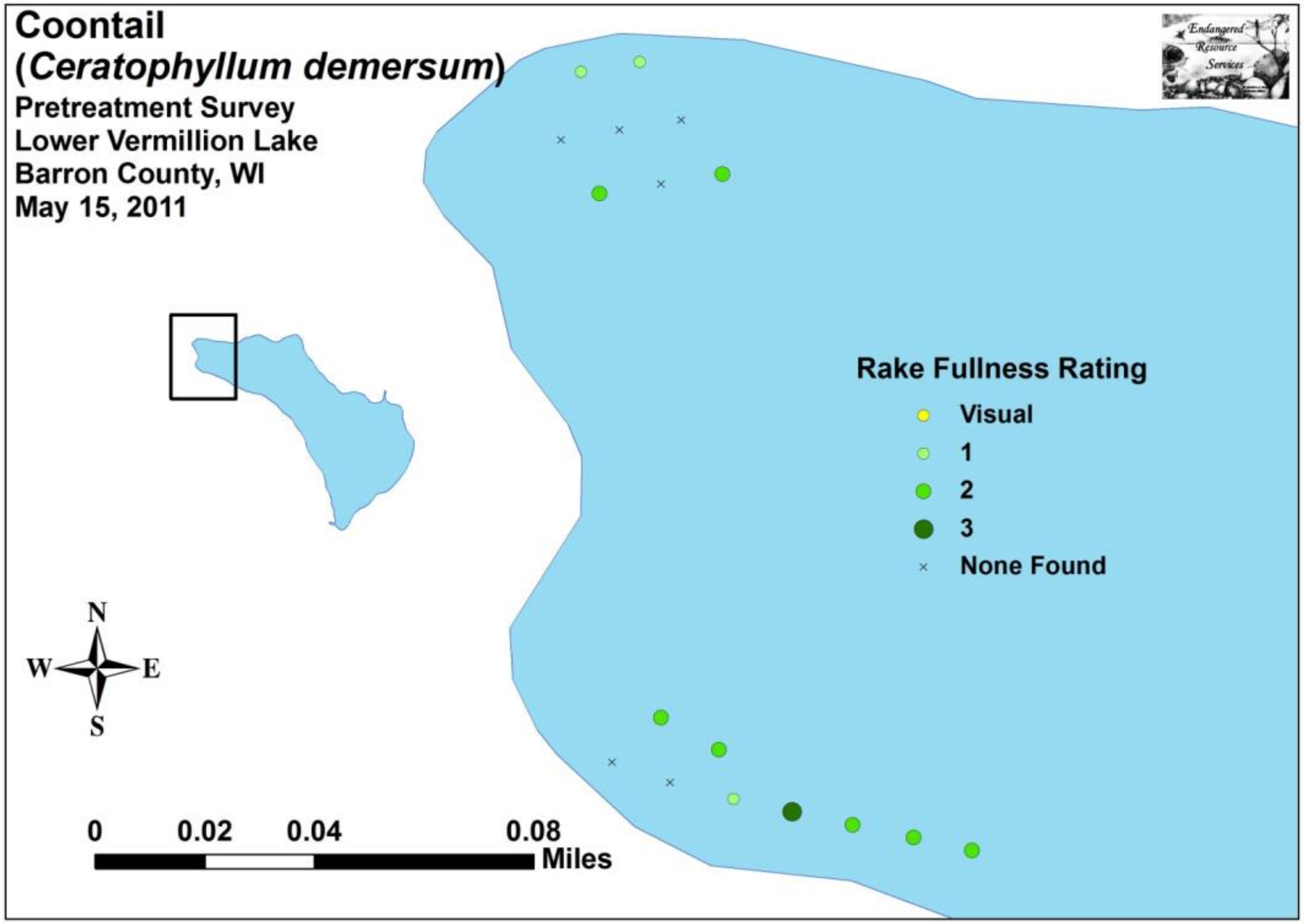

Total Rake Fullness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.02
0.04
0.08
Miles

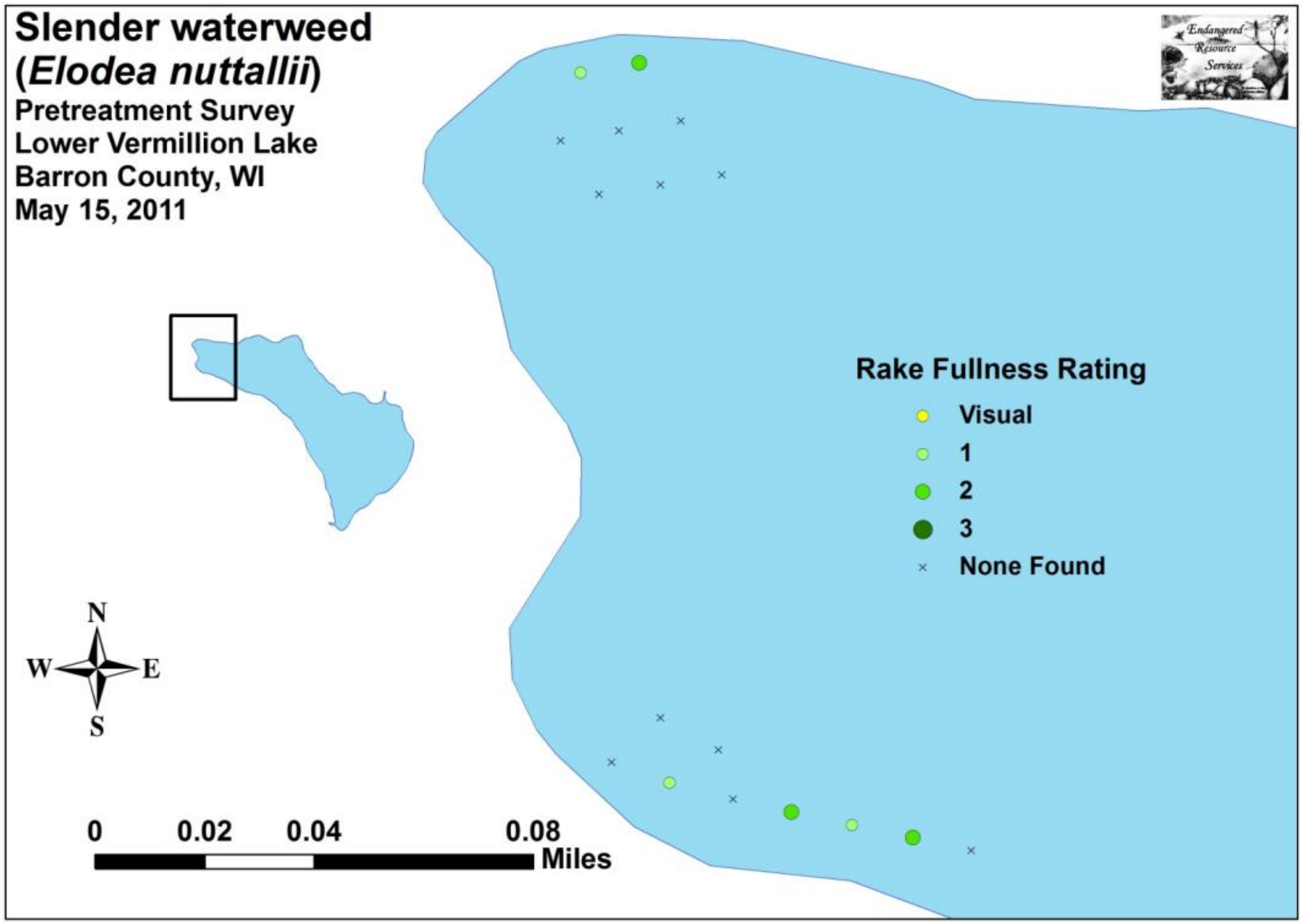
## Appendix V: Lower Vermillion Lake EWM/CLP Pretreatment Distribution

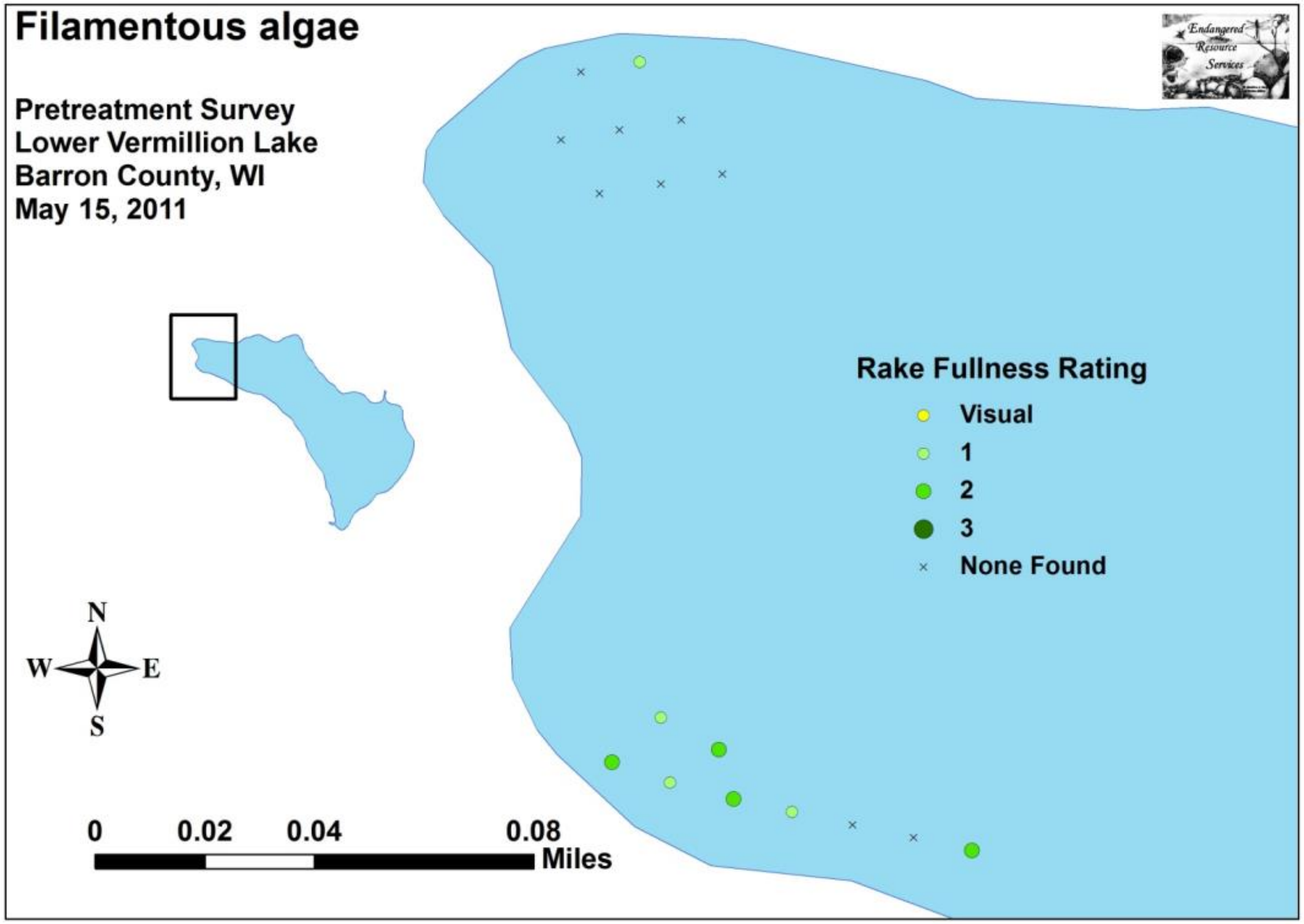

Eurasian water milfoil
Myriophyllum spicatum
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.02
0.04
0.08
Miles

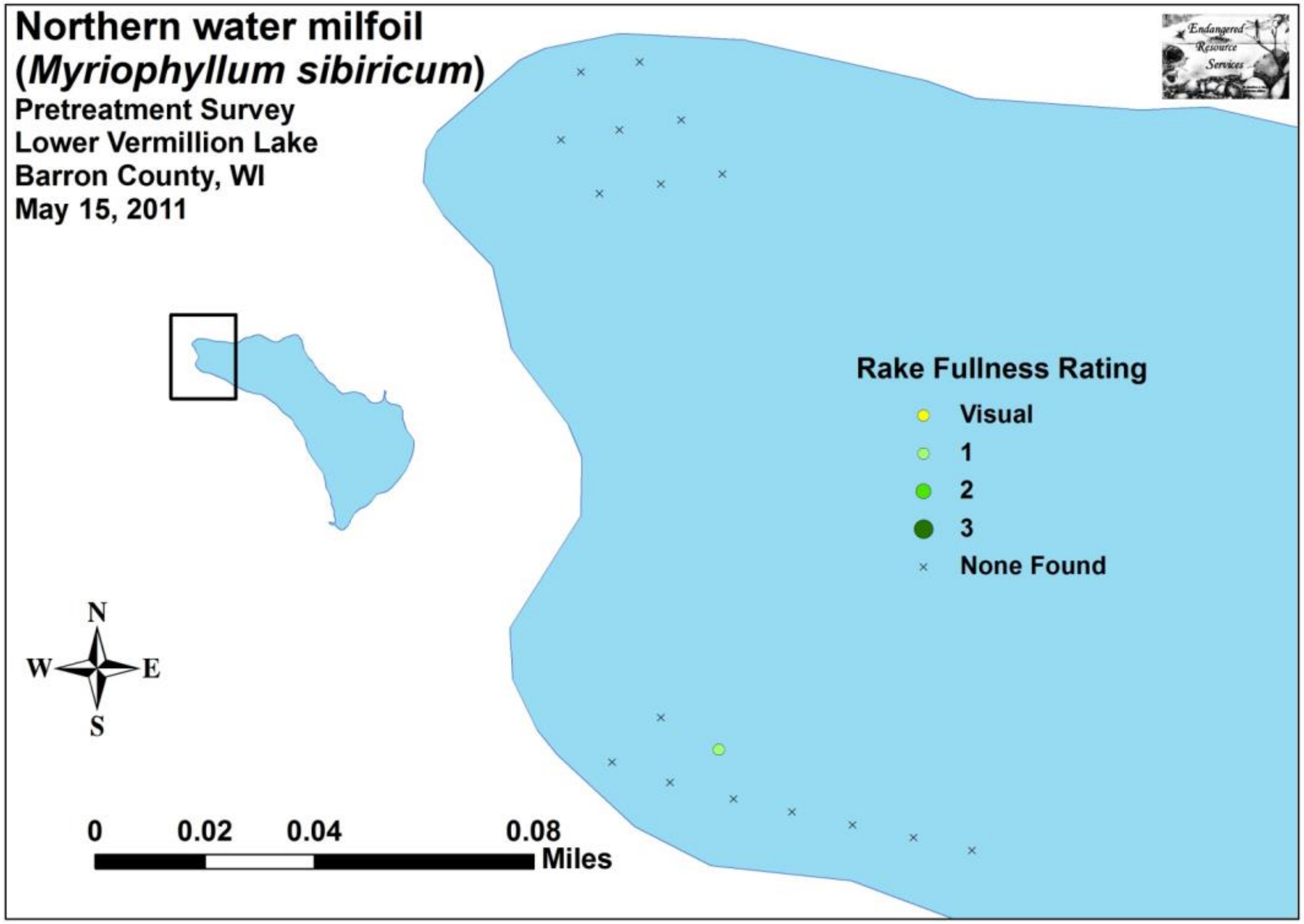

Curly-leaf pondweed
(*Potamogeton crispus*)
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.02
0.04
0.08
Miles

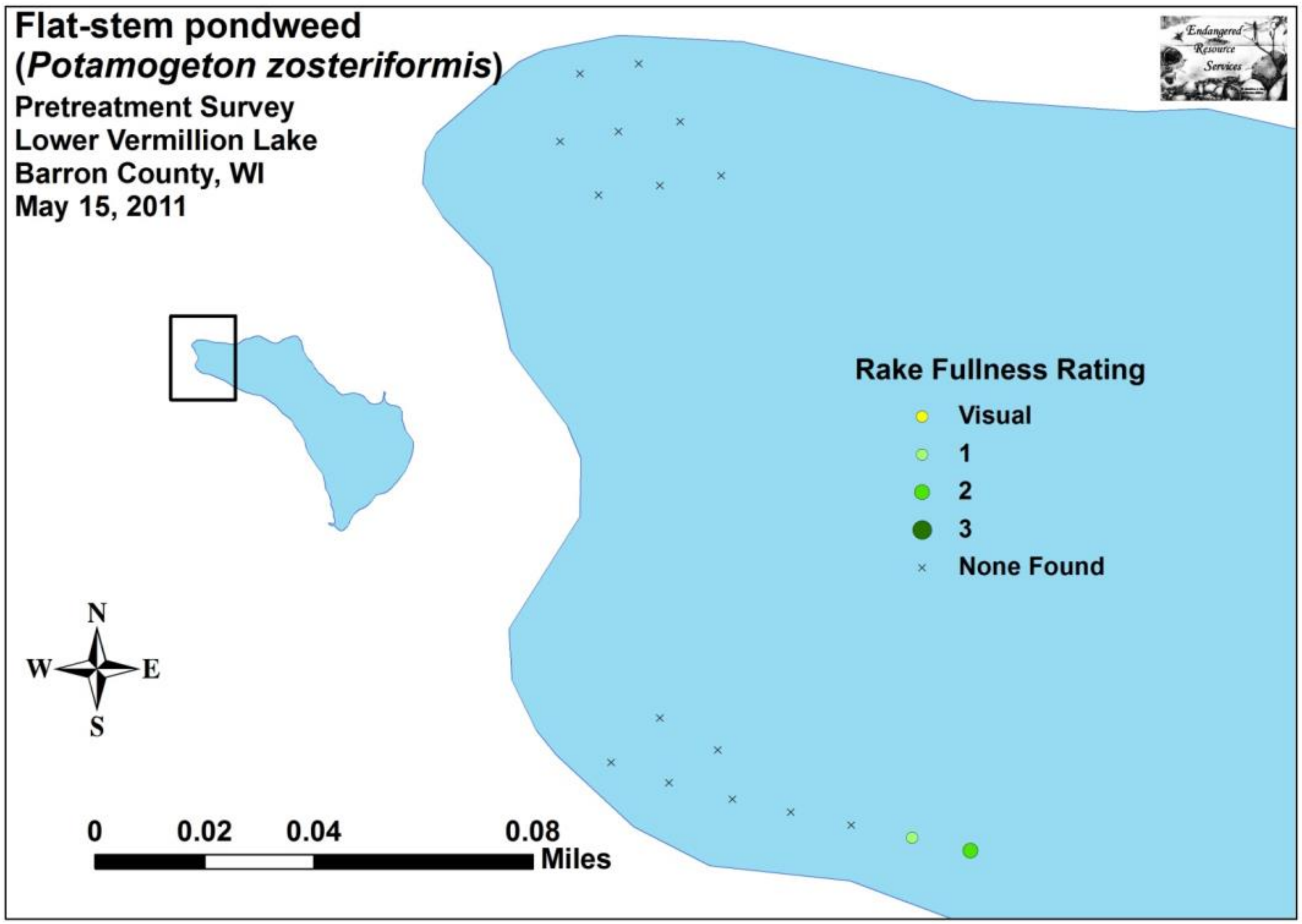
# Appendix VI: Lower Vermillion Lake Pretreatment Species Distribution


Coontail
(*Ceratophyllum demersum*)
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.02
0.04
0.08
Miles

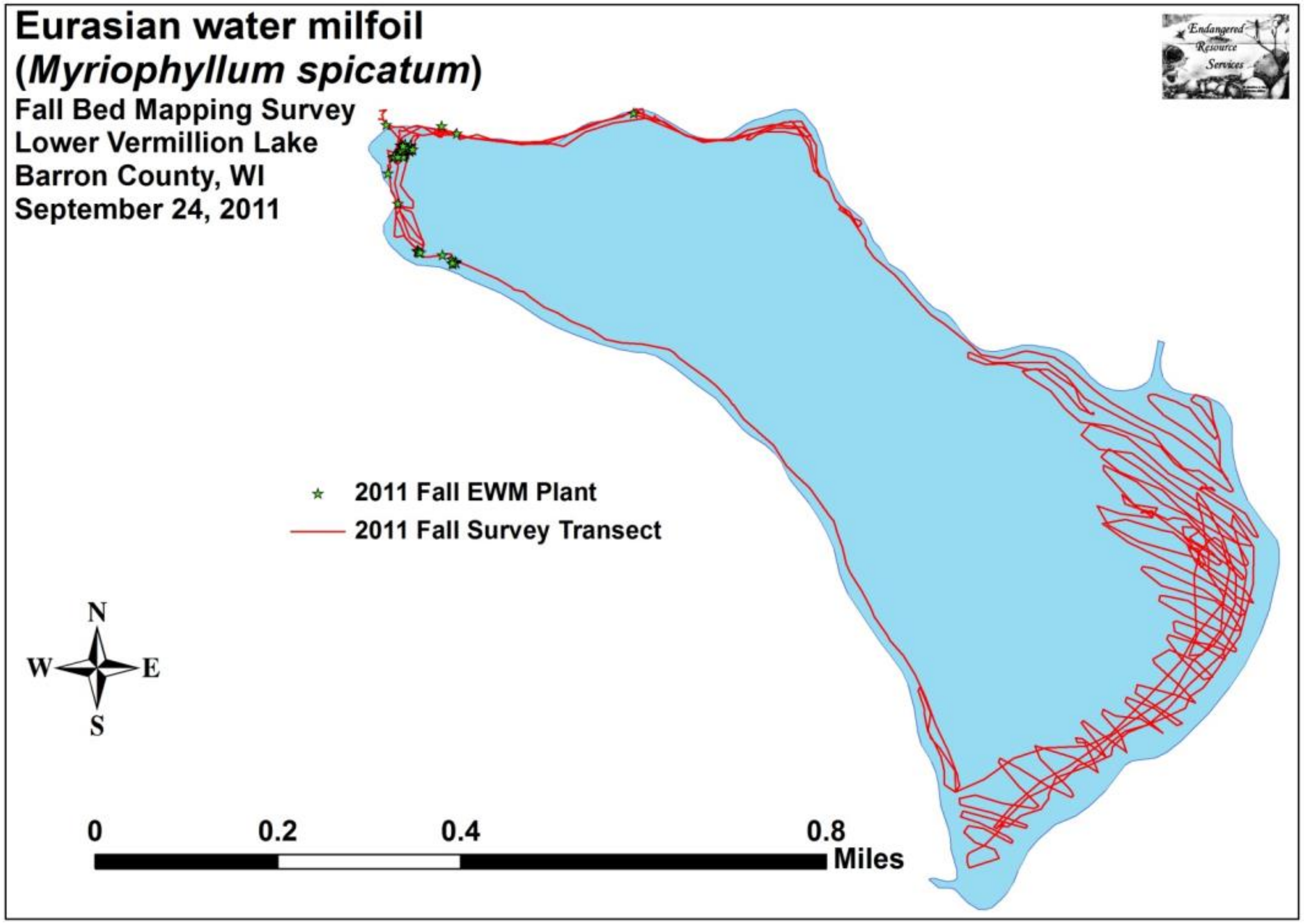

Slender waterweed
(*Elodea nuttallii*)
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.02
0.04
0.08
Miles


Filamentous algae
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.02
0.04
0.08
Miles

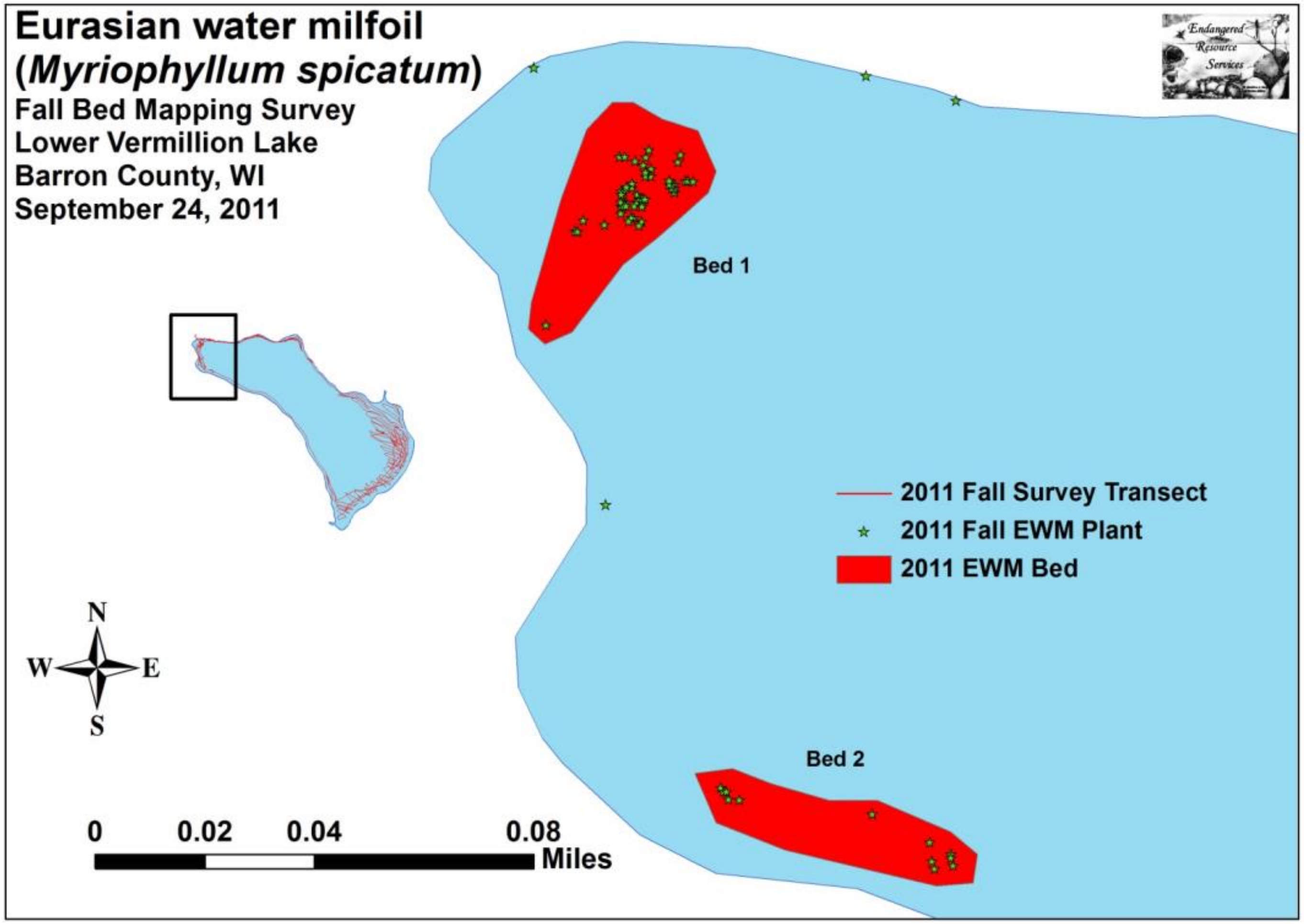

Northern water milfoil
(Myriophyllum sibiricum)
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.02
0.04
0.08
Miles


Flat-stem pondweed
(*Potamogeton zosteriformis*)
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
May 15, 2011
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.02
0.04
0.08
Miles
Endangered Resource Services

## Appendix VII:  Lower Vermillion Lake Fall EWM Survey Map



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 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 24, 2011
Endangered Resource Services
Bed 1
Bed 2
2011 Fall Survey Transect
2011 Fall EWM Plant
2011 EWM Bed
N
W
E
S
0
0.02
0.04
0.08
Miles