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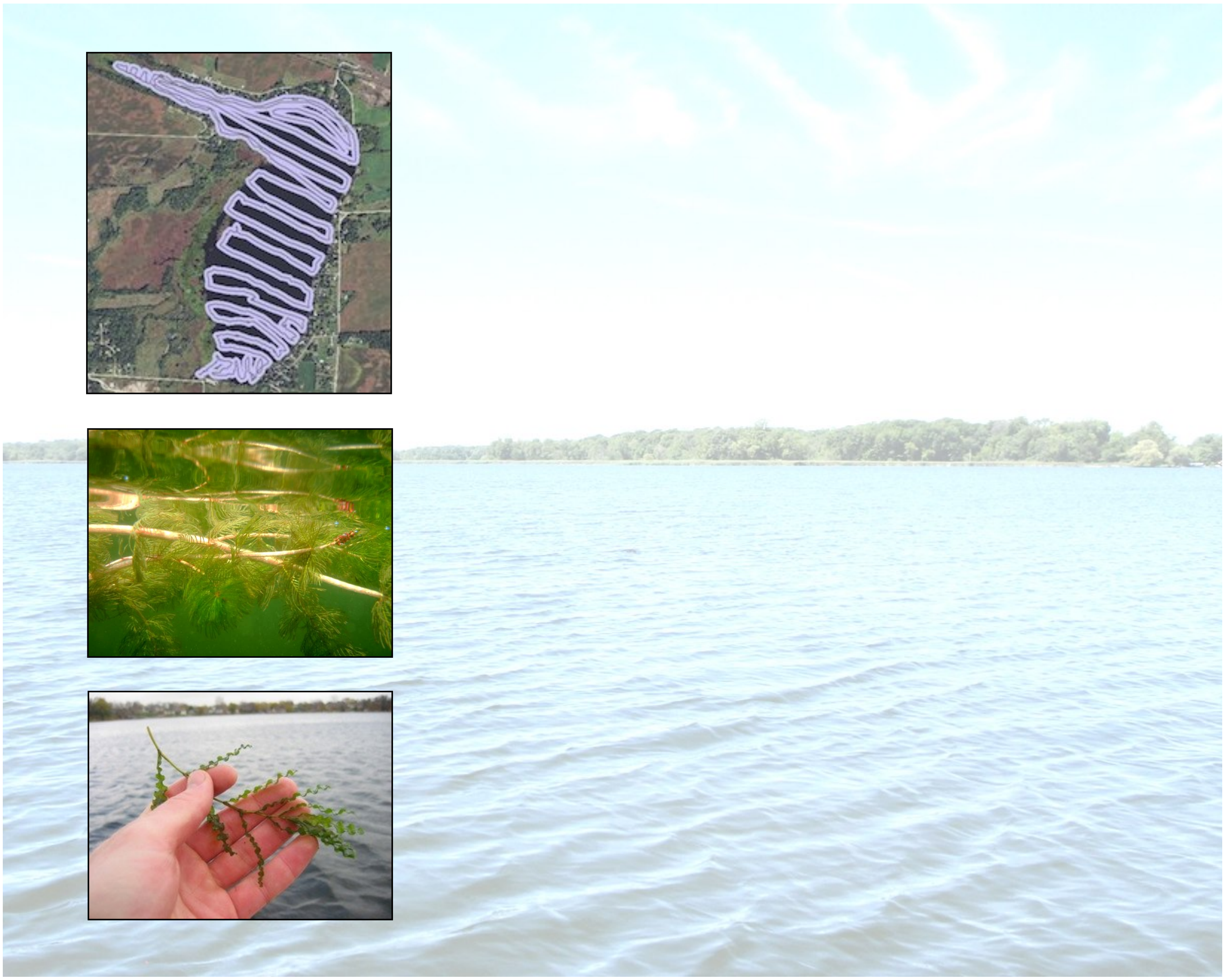
# Invasive Aquatic Plants in Lake John *(WBIC# 86-0288)*

## Wright County, MN

## Visual Survey – June 25, 2012



Prepared for the Lake John Association (Annandale, MN) – July 2012

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Wright County, MN
Visual Survey – June 25, 2012

## Survey, Analysis, and Reporting by:

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# Executive Summary

## Purpose of Survey

This visual survey of Lake John was conducted to locate and delineate areas of Eurasian watermilfoil (*Myriophyllum spicatum*, henceforth referred to as EWM) in Lake John (#86-0288). This results of this survey will help to guide vegetation management planning and provide a baseline condition for tracking any changes in the distribution and density of EWM in John Lake over the coming years.

## Summary of Findings

1) EWM growth was generally sparse but widespread in Lake John. Although EWM was first reported in Lake John in 2011 (one year prior to this survey), the widespread distribution and localized moderate-density beds of EWM that we observed suggest that this invasive plant has been in the lake for several years.

2) Although most of the EWM growth we found consisted of individual plants spaced widely apart, we did encounter several small beds of moderate-density EWM (each < 0.2 acres) in the far northwestern bay and in the southeastern one-third of the main lake basin (Figure 6). These denser beds were surrounded by areas of more sparse EWM growth.

3) Several moderate-density beds of EWM with some degree of surface-matting were found in areas that likely receive frequent boat traffic (in open water areas or in close proximity to existing water-ski course). This creates a high potential for fragmentation of EWM plants that could hasten its spread within the lake. The Lake John Association should prioritize management of these areas and consider a combination of restricting boat traffic in the areas immediately around these EWM beds (marker buoys), herbicide treatment of denser, more established beds, and manual removal of sparse EWM growth in shallow, near-shore areas.

4) We observed widespread and dense growth of native Northern watermilfoil (*Myriophyllum sibiricum*) in Lake John. This native plant is susceptible to the herbicides commonly used to control EWM. Any control strategies need to carefully consider the potential impacts to this native plant.

5) We found very little curlyleaf pondweed (*Potamogeton crispus*) during the visual survey. Curlyleaf appeared to have senesced several weeks prior to the survey. Consequently, this survey does not provide an accurate assessment of the distribution or density of curlyleaf in Lake John. The 2006 MDNR curlyleaf bed delineation (Figure 3) likely provides a much better estimate of curlyleaf in the lake.

# Introduction

## Value of Aquatic Plants

Aquatic plants play an important role in freshwater lakes. They anchor sediments, buffer wave action, oxygenate water, and provide valuable habitat for aquatic animals. As a result, the amount and type of plants in a lake can greatly affect nutrient cycling, water clarity, and food-web interactions (Jeppeson et al. 1998). Furthermore, plants are very important for fish reproduction, survival, and growth, and can greatly impact the type and size of fish in a lake. However, healthy aquatic plant communities are frequently degraded by poor water clarity, excessive plant control activities, and the invasion on non-native nuisance plants. These disruptive forces alter the diversity and abundance of aquatic plants in lakes and can lead to changes in many other aspects of a lake's ecology. Consequently, it is very important that lake managers find a balance between controlling nuisance plant growth and maintaining a healthy, diverse plant community.

## Purpose of Survey

This visual survey of Lake John was conducted to locate and delineate areas of Eurasian watermilfoil (*Myriophyllum spicatum*) in Lake John (#86-0288). This information will help to guide vegetation management planning and provide a baseline condition for tracking any changes in the extent and density of EWM over the coming years. The results presented here should be considered a supplement to the point-intercept vegetation survey conducted by the MDNR in 2006.

Although the primary focus of this survey was to map EWM in the lake, the Lake John Association requested that we also assess areas of curlyleaf pondweed (*Potamogeton crispus*) observed during the survey. The lake association did not approve funding for this survey until June 23, 2012. Although we conducted our assessment only 2 days after approval, curlyleaf appeared to have senesced several weeks prior to the survey. Consequently, our survey severely underestimated the extent of curlyleaf growth in Lake John. Previous assessments of curlyleaf conducted by the Minnesota Department of Natural Resources (MDNR) likely provide a much better assessment of the distribution of curlyleaf in the lake (Figure 3).

## Objectives of Survey

1) Locate and map areas of EWM growth throughout Lake John
2) Estimate the abundance (rake density) of EWM growth in delineated beds
3) Calculate the area, density, and mean depth of all delineated EWM beds
4) Provide basic management recommendations based upon findings

## Description of Lake & Watershed

Lake John is a 391-acre, relatively shallow lake (90% littoral; max depth 28 ft) in northwestern Wright County, MN (Figures 1 and 2; Table 1). The lake has a public access on the southern shore and is primarily used as a recreational lake, with waterskiing, boating, fishing, and swimming being the dominant lake uses. In addition, lake residents have installed a water-ski course in the open water portion of the northwestern bay (oriented NW to SE).

Lake John is a moderately-fertile (eutrophic) and typically experiences low to moderate total phosphorus (~25 µg/L), low to moderate algae levels (chlorophyll-a ~9 µg/L), and moderate water clarity (Secchi depth ~7 to 13 ft) during the summer months (MPCA 2012).

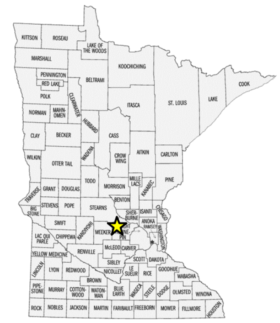


**Figure 1.** Location of Lake John

**Table 1.** Lake John characteristics

| | |
|---|---|
| Surface Area | 391 acres |
| Maximum Depth | 28 ft |
| % Littoral (<15 ft) | 90% |

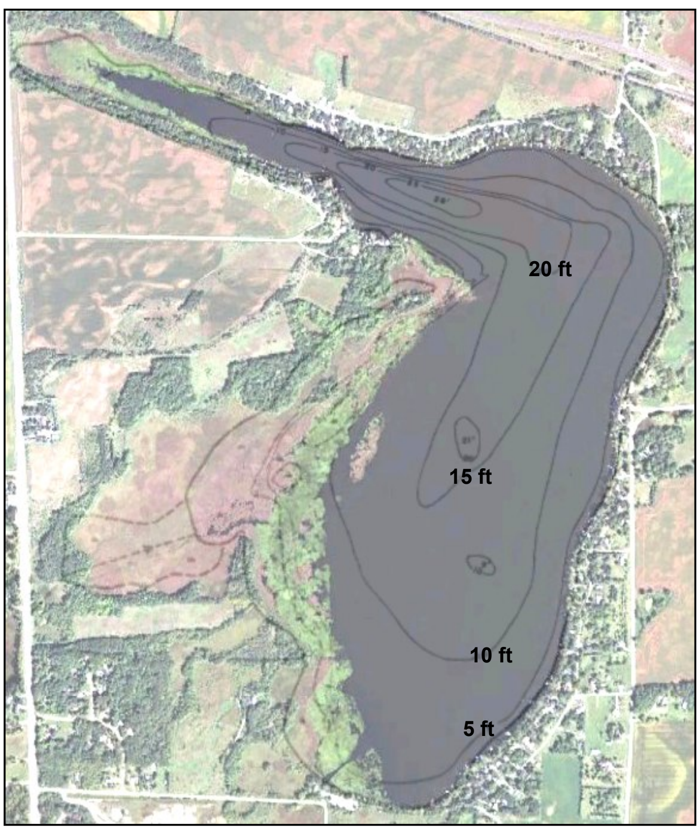



**Figure 2.** Aerial image of Lake John showing approximate location of depth contours (modified MDNR bathymetric map).

## History of Aquatic Plants in Lake John

Previous plant surveys conducted by the MNDNR indicated that Lake John has generally supported abundant and diverse aquatic plants, with most plant growth occurring in areas shallower than ~12 ft (MDNR 2006). Past surveys reported up to 35 species of aquatic and near-shore plants, with the most recent survey reporting 16 submersed native aquatic plants and one submersed invasive aquatic plant (curlyleaf pondweed). The presence of invasive curlyleaf pondweed in Lake John was first confirmed in 1980. Since that time, curlyleaf has become widespread in the lake, but the most recent spring survey (June 2006, MDNR) found that curlyleaf formed dense, surface-matted growth in only ~12 acres (3% of total lake area). In 2011, MDNR staff confirmed the presence of Eurasian watermilfoil in the lake. Previous surveys did not document the presence of EWM, so our assessment provides the first quantitative assessment of EWM distribution and density in Lake John.

**Table 2.** Summary of submersed aquatic plants found in Lake John during the most recent point-intercept survey (2006). Surveyed July 28, 2006 by MDNR staff. Table excerpt from the *Lake John Vegetation Management Plan* (MDNR 2006).

| Life Forms | Common Name | Scientific Name | Voucher | % Frequency |
|---|---|---|---|---|
| SUBMERGED -ANCHORED These plants grow primarily under the water surface. Upper leaves may float near the surface and flowers may extend above the surface. Plants are rooted or anchored to the lake bottom. | Coontail | *Ceratophyllum demersum* | | 63.8 |
| | Flatstem pondweed | *Potamogeton zosteriformis* | | 48.0 |
| | Milfoil group native | *Myriophyllum spp.* | | 26.3 |
| | Greater bladderwort | *Utricularia vulgaris* | | 23.0 |
| | Muskgrass | *Chara sp.* | | 18.4 |
| | Wild celery | *Vallisneria americana* | | 15.8 |
| | Illinois pondweed | *Potamogeton illinoensis* | | 9.2 |
| | Bushy pondweed | *Najas flexilis* | | 9.2 |
| | Canada Waterweed | *Elodea canadensis* | | 8.6 |
| | White water buttercup | *Ranunculus longirostris* | | 7.2 |
| | White-stem pondweed | *Potamogeton praelongus* | | 7.2 |
| | Sago pondweed | *Stuckenia pectinata* | | 5.3 |
| | Curly-leaf pondweed | *Potamogeton crispus* | | 3.9 |
| | Largeleaf pondweed | *Potamogeton amplifolius* | | 3.3 |
| | Small pondweed | *Potamogeton pusillus* | | 2.6 |
| | Stonewort group | *Nitella sp.* | | 2.0 |
| | Water stargrass | *Zosterella dubia* | | 2.0 |

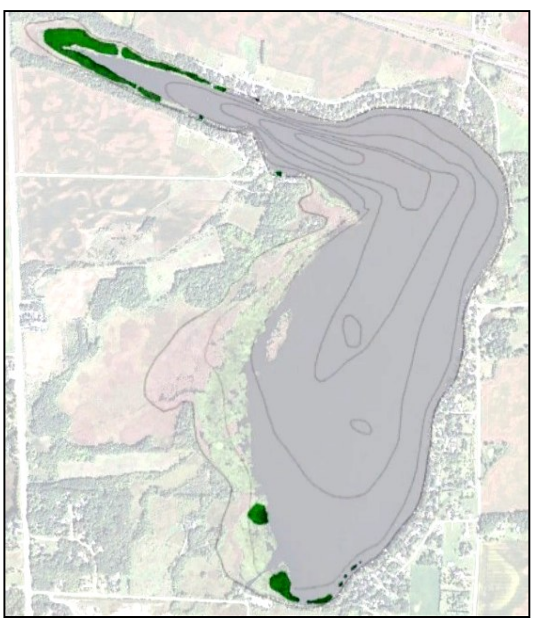


**Figure 3.** Map of curlyleaf pondweed beds (dark areas) found in Lake John by MDNR staff on June 9, 2006 (MDNR 2006).

# Survey & Analysis Methods

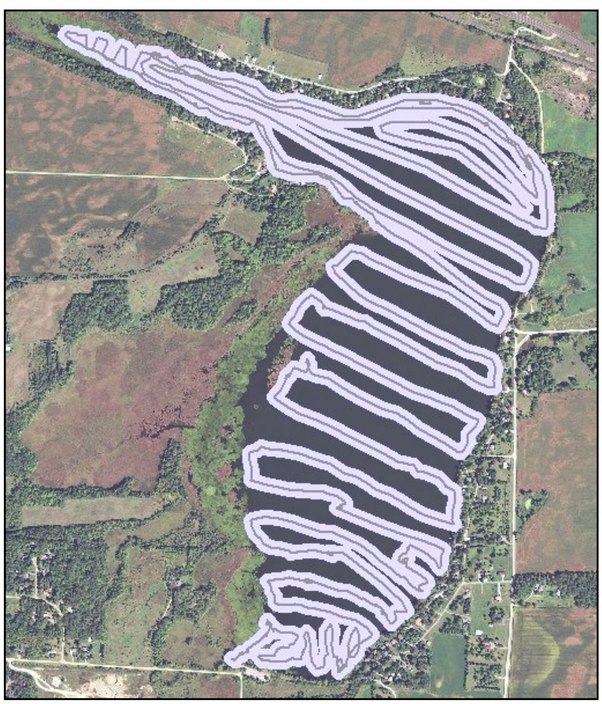
## 2012 Visual Survey

Freshwater Scientific Services, LLC completed a lake-wide visual survey for invasive aquatic plants in Lake John on June 25, 2012. During this survey, we navigated a 14-mile long, zig-zag transect in open-water areas of the lake (Figure 4). While navigating this transect path, we used a combination of surface observations (using polarized glasses), rake tosses, sonar readings, and an underwater video camera to locate and delineate areas of EWM growth. We marked all locations where EWM was found using a hand-held Garmin GPS unit (GPS-MAP78), and recorded water depth and EWM abundance (rake density rating; 1 to 4 scale as described below). To verify identification of EWM at the marked locations, we also collected and pressed voucher specimens from approximately 15% of the locations where EWM was found (Figure 6).

<u>Rake Density Rating</u>
1 = 1-25% rake head coverage
2 = 25-50%
3 = 50-75%
4 = 75-100%

The recorded EWM locations, rake densities, and water depths were loaded into desktop GIS software (ArcView 3.3) and projected onto aerial imagery of Lake John. We then delineated beds of EWM growth throughout the lake based upon the proximity and density of the recorded EWM locations, and calculated the area, maximum density, and mean water depth of each delineated bed.

**Figure 4.** Map showing the transect path used during the 2012 visual survey of Lake John (total path length = 14.2 miles). The dark line represents the recorded boat path; the lighter wide band approximates the width of visual assessment (30-ft on each side of boat).



# *Results & Discussion*

## Eurasian Watermilfoil in Lake John

We found EWM growing at 108 locations in Lake John (Figures 5 and 6). EWM growth at most of these locations consisted of very small clusters of only a few individual EWM plants. However, we did encounter several areas where EWM growth was substantially more uniform and dense (as indicated by clusters of marked EWM points in Figure 5). These denser beds consisted of many individual EWM plants in close proximity, growing to within 1 foot of the water surface in the open area of the lake, and to the surface in the northwestern bay. Overall, we found a total of 4.5 acres of EWM growth throughout the lake, with about 0.6 acres of that being of nuisance density (Figure 7; Table 2).

**Figure 5.** Map of locations where EWM was found during the visual survey of Lake John (June 25, 2012). A total of 108 sites were marked sequentially (#001 to #108) as we worked from south to north.

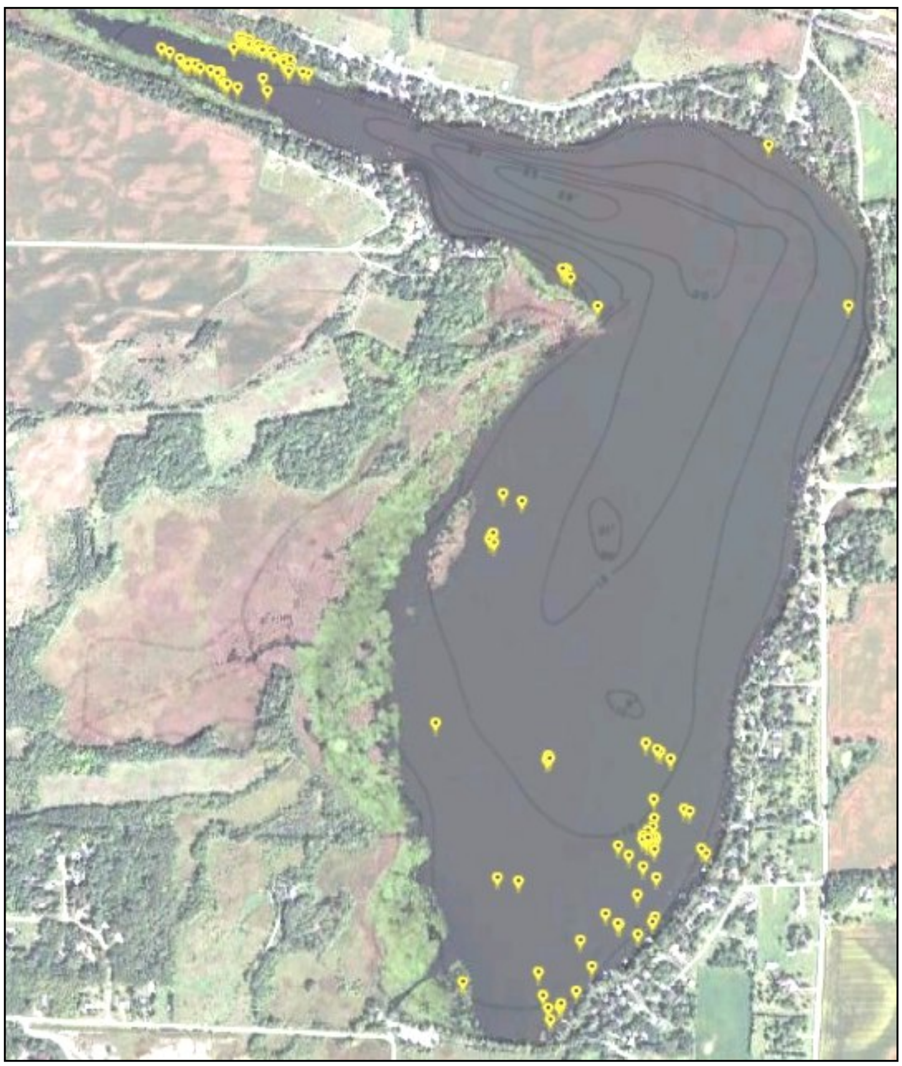


**Figure 6.** Pressed voucher specimens of Eurasian watermilfoil (EWM) collected from Lake John at roughly 15% of locations where EWM was found. Pressed vouchers are stored at *Freshwater Scientific Services, LLC* office; Maple Grove, MN.

**Figure 7.** Map showing delineated beds of Eurasian watermilfoil growth in Lake John (June 25, 2012). Areas of sparse or patchy EWM are shown in yellow and denser areas are shown in red. Beds are numbered sequentially from largest in area (#1) to smallest (#31), and bed #'s correspond with values given in Table 2. GPS locations for each of the identified beds are given in the Appendix.

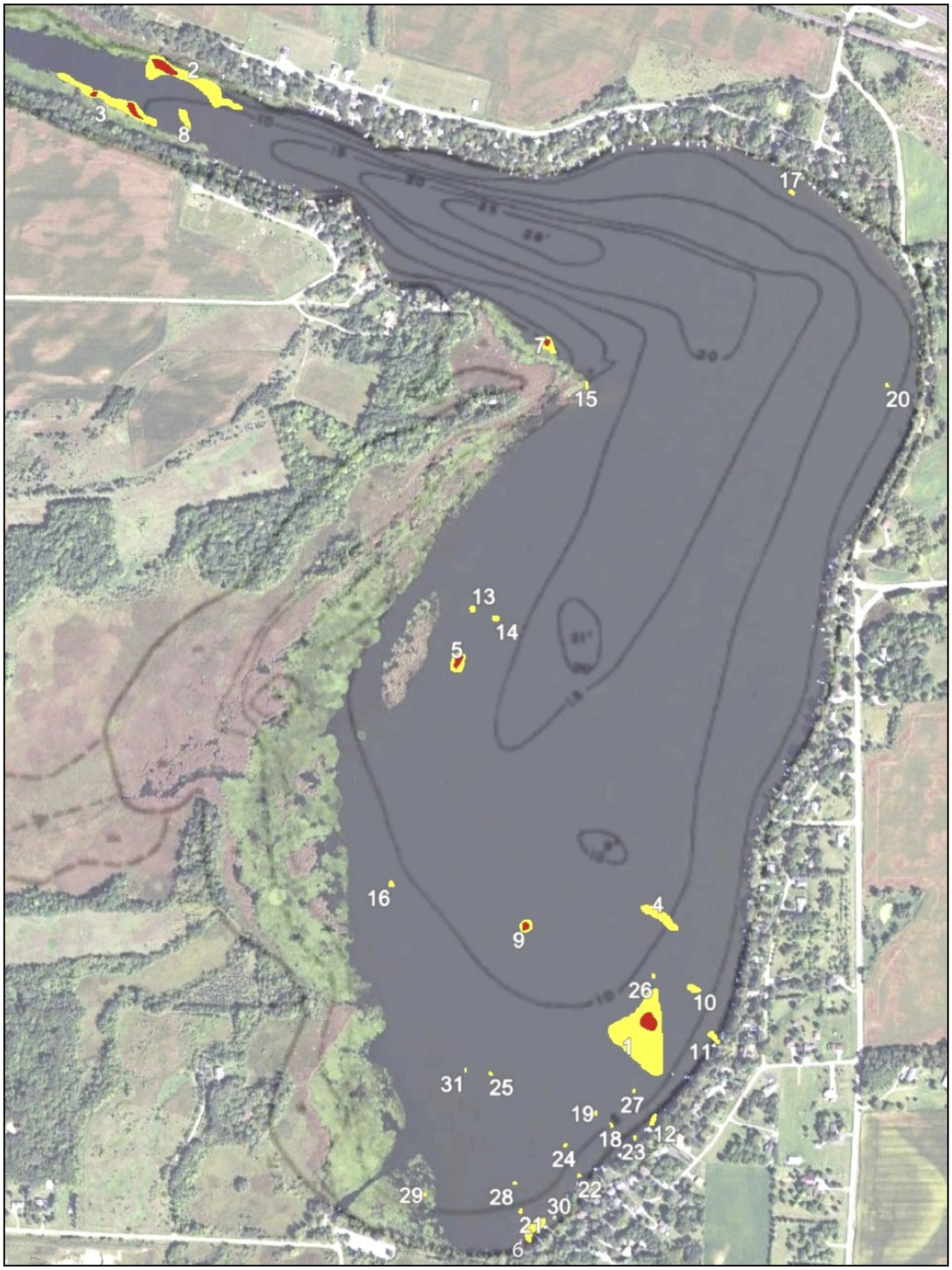


**Table 2.** Area, rake density, and mean water depth for delineated beds of Eurasian watermilfoil growth in Lake John (June 25, 2012). Beds are numbered sequentially from largest in area to smallest, and bed #'s correspond with values given in Figure 7. GPS locations for each of the identified beds are given in the Appendix.

| Bed # | Sparse Area *(acres)* | Dense Area *(acres)* | Mean Density *(1 to 4 scale)* | Max Density *(1 to 4 scale)* | Mean Depth *(ft)* |
|---|---|---|---|---|---|
| 1 | 1.88 | 0.18 | 2 | 4 | 7 |
| 2 | 0.81 | 0.16 | 2 | 4 | 7 |
| 3 | 0.57 | 0.11 | 2 | 4 | 5 |
| 4 | 0.26 | – | 1 | 2 | 8 |
| 5 | 0.12 | 0.06 | 1 | 2 | 7 |
| 6 | 0.17 | – | 1 | 1 | 6 |
| 7 | 0.12 | 0.03 | 1 | 2 | 6 |
| 8 | 0.11 | – | 1 | 1 | 9 |
| 9 | 0.06 | 0.04 | 2 | 3 | 9 |
| 10 | 0.07 | – | 1 | 1 | 7 |
| 11 | 0.06 | – | 1 | 1 | 3 |
| 12 | 0.04 | – | 1 | 1 | 3 |
| 13 | 0.03 | – | 1 | 1 | 5 |
| 14 | 0.03 | – | 1 | 1 | 6 |
| 15 | 0.02 | – | 1 | 1 | 4 |
| 16 | 0.02 | – | 1 | 1 | 6 |
| 17 | 0.02 | – | 1 | 1 | 7 |
| 18 | 0.01 | – | 1 | 1 | 6 |
| 19 | 0.01 | – | 1 | 1 | 6 |
| 20 | 0.01 | – | 1 | 1 | 4 |
| 21 | 0.01 | – | 1 | 1 | 5 |
| 22 | 0.01 | – | 1 | 1 | 3 |
| 23 | 0.01 | – | 1 | 1 | 3 |
| 24 | 0.01 | – | 1 | 1 | 5 |
| 25 | 0.01 | – | 1 | 1 | 6 |
| 26 | 0.01 | – | 1 | 1 | 7 |
| 27 | 0.01 | – | 1 | 1 | 7 |
| 28 | 0.01 | – | 1 | 1 | 5 |
| 29 | 0.01 | – | 1 | 1 | 3 |
| 30 | 0.01 | – | 1 | 1 | 3 |
| 31 | 0.01 | – | 1 | 1 | 6 |
| *Totals* | ***4.53*** | ***0.58*** | **–** | **–** | **–** |

## *Management Context*

Invasive aquatic plants, such as curlyleaf pondweed and Eurasian watermilfoil can dramatically alter the ecological and recreational quality of lakes. In Lake John, EWM appears to be spreading throughout areas between 3 and 10 feet deep; particularly in the northwestern bay and in the southeast one-third of the main lake basin. If EWM reaches nuisance density in these areas of the lake, many of the current lake uses could be severely impacted.

Based upon the observed widespread distribution of EWM in Lake John, it is likely that the plant has been in the lake for at least 3 to 5 years. Furthermore, this widespread distribution suggests that it will be very difficult to eradicate the plant from the lake. Accordingly, the Lake John Association will likely need to actively manage milfoil in the lake for years to come to reduce the rate of spread and to control areas of surface-matted growth. In the short-term, management strategies should focus on slowing the spread of EWM in the lake and preventing further establishment in near-shore areas (see table below).

Currently, EWM is very sparse in most areas of Lake John. This means that manual removal of individual EWM plants in shallow, near-shore areas may still be a viable option. Alternatively, herbicides can effectively control EWM. However, such treatments are typically only effective when each treated area is several acres in size (to reduce effects of dilution and drift). In addition, extensive use of herbicides for EWM control would likely kill native northern watermilfoil, which is currently one of the dominant native plants in the lake. Based upon these observations, we recommend the following management strategies for Lake John:

| Focus | Actions * |
|---|---|
| Slow spread of EWM by minimizing fragmentation of plants by boats | Place marker buoys in or around beds 1, 2, 3, 4, 5, and 9. Send out notices to lakeshore homeowners and place signage at the boat launch requesting that boaters stay out of these marked areas.<br>**May need permission from county water patrol and local government to place buoys** |
| Use herbicides to control EWM surface growth in boat-traffic areas<br>*(further prevention of fragmentation by boats and natural autofragmentation)* | Consider application of 2,4-D or Triclopyr herbicide to beds 1,2, 3, and possibly 9. Treated areas should include a "halo" around each bed to reduce effects of dilution and drift. Discuss treatment areas and pro's and con's of using liquid vs. granular formulations of herbicide with your contracted herbicide applicator.<br>**DNR permit required**: include MDNR in discussions. |
| Slow establishment of EWM in nearshore areas where it is currently sparse to prevent nuisance, surface-matted growth | Manually remove EWM plants in shallow, nearshore areas using rakes or divers (divers preferred; remove roots as well); particularly in the southeastern third of the lake. Given the very sparse EWM growth in most areas, manual removal is still a viable option. If EWM in these areas increases in density, this option will become much less feasible.<br>**DNR permit required** |

* Mechanical harvesting should be avoided, as it will spread EWM fragments in Lake John.

### Milfoil Weevils in Lake John

Although we did not conduct a systematic search for milfoil weevils (*Euhrychiopsis lecontei*) in EWM samples from Lake John, we did see a few plants with signs of stem damage typically caused by weevils (blackened stem in sample #044; Figure 6). Past studies have suggested that although milfoil weevils can effectively suppress EWM growth in some lakes, they are unpredictable as a management strategy (Sutter and Newman 1997; Newman and Biesboer 2000). Moreover, weevil populations may be suppressed in lakes with bluegills (eat weevils), and stocking of weevils can be very expensive ($1 to $2 per weevil; typically need several thousand). Given the abundance of native milfoil in Lake John and the observed EWM stem damage, the lake may already support some milfoil weevils. Despite the unpredictability and potential cost associated with milfoil weevils, your lake association members may wish to explore biological control as a supplemental strategy to control EWM in Lake John.

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Sutter, T. J., and R. M. Newman. 1997. Is predation by sunfish (*Lepomis* spp.) an important source of mortality for the Eurasian watermilfoil biocontrol agent Euhrychiopsis lecontei? Journal Freshwater Ecology. 12:225-234.

# *Online Resources & Contacts*

Minnesota Administrative Rules for Aquatic Plant Management
https://www.revisor.mn.gov/rules/?id=6280

Minnesota DNR – Aquatic Plant Management Regulations & Permit Application Forms
http://www.dnr.state.mn.us/shorelandmgmt/apg/regulations.html

Estimated Cost of Herbicides (MDNR)
http://files.dnr.state.mn.us/assistance/backyard/shorelandmgmt/apg/pests.pdf

List of Herbicide Retailers and Applicators in MN
http://files.dnr.state.mn.us/assistance/backyard/shorelandmgmt/apg/companies_selling_approved_aquatic_herbicides.pdf

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# *Appendix*

**Table A1.** GPS coordinates for centroid of each EWM bed identified during the June 2012 visual survey (coordinates given in decimal degrees and UTM). Bed #'s correspond to values presented in Table 2 and Figure 7.

| Bed # | Lat *(dec. deg)* | Long *(dec. deg)* | UTM_X *(15N)* | UTM_Y *(15N)* |
|---|---|---|---|---|
| 1 | 45.25321559 | -94.16182521 | 5011736 | 408835 |
| 2 | 45.26808190 | -94.17156284 | 5013398 | 408095 |
| 3 | 45.26781384 | -94.17347936 | 5013371 | 407944 |
| 4 | 45.25501817 | -94.16128423 | 5011935 | 408881 |
| 5 | 45.25900016 | -94.16573642 | 5012383 | 408538 |
| 6 | 45.25012023 | -94.16402673 | 5011394 | 408658 |
| 7 | 45.26397467 | -94.16375932 | 5012933 | 408701 |
| 8 | 45.26748993 | -94.17176422 | 5013333 | 408078 |
| 9 | 45.25488176 | -94.16422665 | 5011923 | 408650 |
| 10 | 45.25390814 | -94.16052689 | 5011811 | 408938 |
| 11 | 45.25313645 | -94.16008416 | 5011725 | 408972 |
| 12 | 45.25185309 | -94.16141440 | 5011584 | 408865 |
| 13 | 45.25983730 | -94.16541442 | 5012475 | 408564 |
| 14 | 45.25969622 | -94.16489655 | 5012459 | 408605 |
| 15 | 45.26334924 | -94.16289237 | 5012863 | 408768 |
| 16 | 45.25553892 | -94.16719787 | 5012000 | 408417 |
| 17 | 45.26635813 | -94.15836240 | 5013192 | 409128 |
| 18 | 45.25177070 | -94.16234974 | 5011576 | 408792 |
| 19 | 45.25195844 | -94.16269743 | 5011597 | 408765 |
| 20 | 45.26334575 | -94.15624735 | 5012855 | 409289 |
| 21 | 45.25042660 | -94.16435105 | 5011429 | 408633 |
| 22 | 45.25098325 | -94.16305577 | 5011489 | 408735 |
| 23 | 45.25156959 | -94.16182555 | 5011553 | 408833 |
| 24 | 45.25145978 | -94.16336638 | 5011542 | 408712 |
| 25 | 45.25257851 | -94.16500969 | 5011669 | 408584 |
| 26 | 45.25409982 | -94.16140862 | 5011833 | 408869 |
| 27 | 45.25230706 | -94.16185348 | 5011635 | 408832 |
| 28 | 45.25086555 | -94.16447607 | 5011478 | 408624 |
| 29 | 45.25068428 | -94.16647102 | 5011460 | 408467 |
| 30 | 45.25051450 | -94.16347172 | 5011437 | 408702 |
| 31 | 45.25263057 | -94.16556093 | 5011675 | 408541 |