

# Aquatic Plant Management Plan

**Devils Lake Association**

**Burnett County, WI  
August 24, 2015**

**Sponsored By  
Devils Lake Association and Burnett County Land  
and Water Conservation Department**



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## **Introduction**

The Aquatic Plant Management Plan for Devils Lake is sponsored by the Devils Lake Association (DLA). The planning phase of the project is funded, in part, by the Burnett County Land and Water Conservation Department and the Devils Lake Association.

Knowing that Eurasian water milfoil (*Myriophyllum spicatum*) is found in several lakes in Burnett and Washburn County, concerned members of the Devils Lake Association authorized an extensive assessment of Devils Lake aquatic macrophytes using the Wisconsin Department of Natural Resources statewide guidelines for conducting systematic point intercept macrophyte sampling. This Aquatic Plant Management Plan for Devils Lake presents a strategy for managing aquatic plants by protecting native plant populations and preventing the establishment of invasive species. The plan includes data about the plant community, watershed, and water quality, as well as other non plant species. Based on this data and public input, goals and strategies for the sound management of aquatic plants in Devils Lake are presented. This plan will guide the Devils Lake Association, Burnett County, and the Wisconsin Department of Natural Resources in aquatic plant management for Devils Lake over the next five years (from 2014 through 2019).

## **Public Input for Plan Development**

On June 6, 2015, a public meeting was held to discuss the concerns of Devils Lake and to establish those concerns as the primary focus of writing the Aquatic Plant Management Plan for the lake. A total of 32 people were present for the meeting. Minutes of the meeting were recorded. A summary of the concerns are listed below:

- Control and prevent nutrient run-off/shoreland preservation/restoration
- Issues concerning the introduction of aquatic invasive species
- Encouraging the growth of native plants
- Boat landing inspections/sign-up sheets and DNR issued grant
- Membership dues
- Poor quality fishing
- Over usage of the lake
- Water levels
- Introduction of zebra mussels
- Chinese and banded mystery snail populations.

A brief meeting was held immediately after the kick-off meeting to establish a committee. In addition to a public kick-off meeting, a survey was sent out to all riparian land owners. A total of 185 surveys were sent out and a total of 94 were returned. Survey results were discussed during the kick-off meeting and were used to help guide decisions made by the Aquatic Plant Management Committee members. The Devils Lake Association announced the availability of the draft Aquatic Plant Management Plan for review by August 24, 2015. Copies will be available at the following locations: Burnett County Government Center Land and Water Conservation Department, Room 21; online at the Burnett County website, and from Devils Lake Aquatic Plant Management committee members. Comments and suggestions can be mailed or emailed to the address/addresses below.

|  |                    |
|--|--------------------|
| Schedule for Plan Completion             | September 19, 2015 |
| Comments accepted on the plan through    | September 14, 2015 |
| Final draft for DNR and public review by | September 19, 2015 |

Send comments via mail or email to:

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### Lake Information

Devils Lake (WBIC 2493100) is a 329 acre seepage lake located in Burnett County. It has a maximum depth of 30 feet. The lake is comprised of 80% sand, 5% gravel, and 15% muck. Visitors have access to the lake from a public boat landing. Fish include Panfish, Largemouth Bass, Northern Pike and Walleye. The lake's water is moderately clear with an average Seechi reading of 13.07 feet in 2013. The moderately clear water created a littoral zone of 20 feet which classifies this lake as Mesotrophic. (1)

**Table 1: Lake Information**

| Devils Lake                | <b>WBIC: 2461100</b> |
|----------------------------|----------------------|
| Size (acres)               | 975                  |
| Mean depth (feet)          | 14                   |
| Maximum depth (feet)       | 24                   |
| Littoral zone depth (feet) | 20                   |

A Map of Devils Lake can be found below in Figure 1.

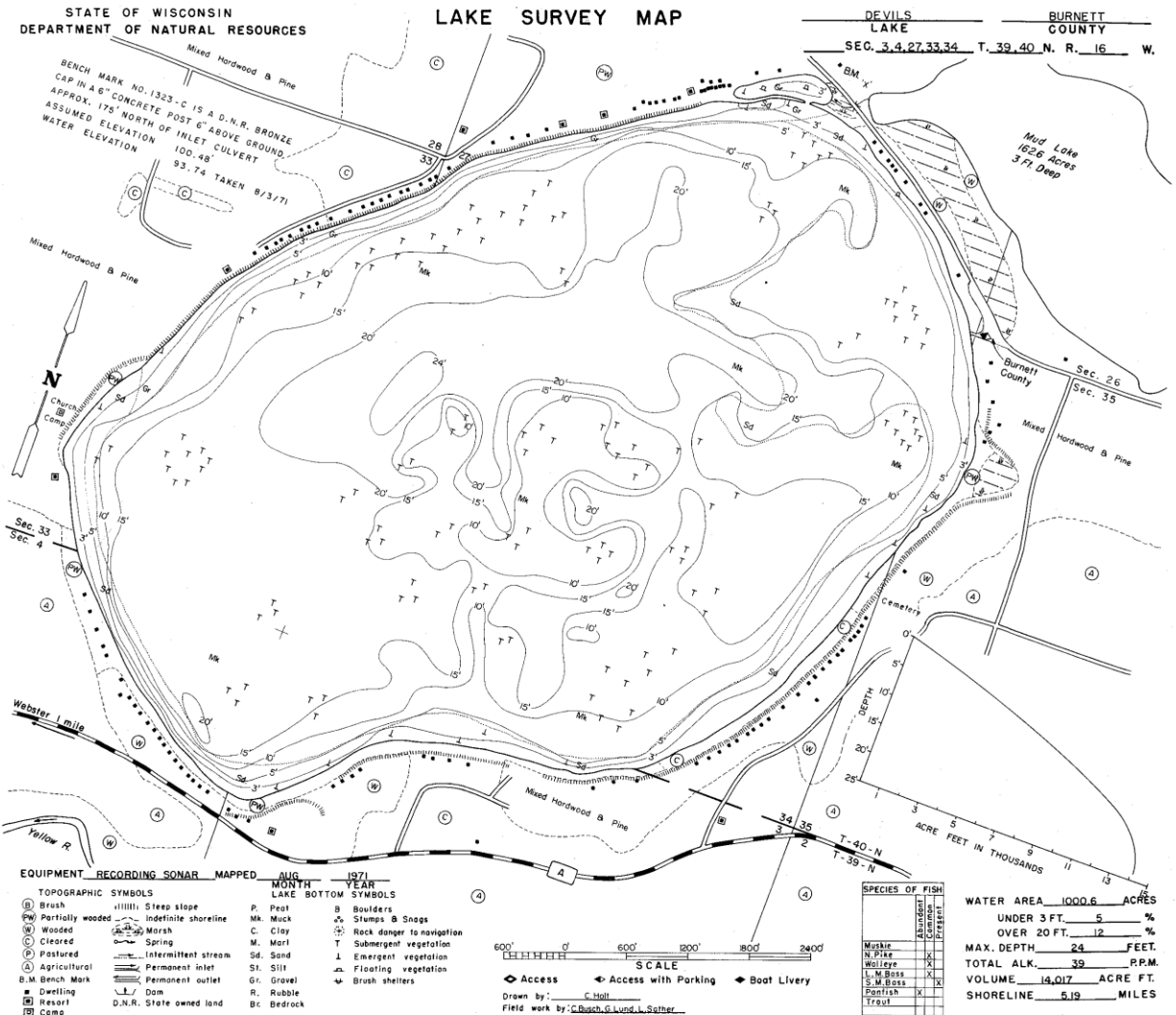


Figure 1: Devils Lake Contour Map <sup>1</sup>

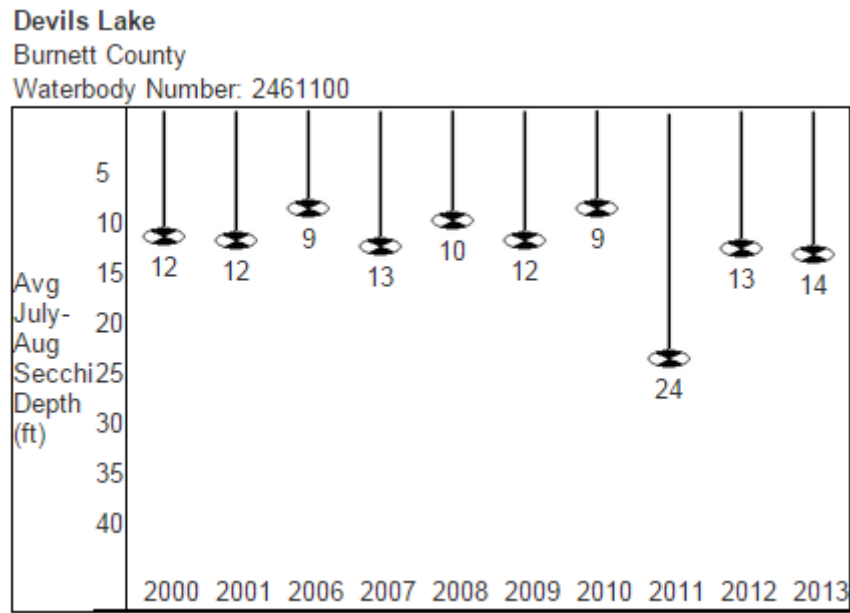
## Water Quality

Water quality is frequently reported by the trophic state or nutrient level of the lake, which relates to the amount of algae in the water. Nutrient-rich lakes are classified as eutrophic. These lakes tend to have abundant aquatic plant growth and low water clarity due to algae blooms. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms. Oligotrophic lakes are nutrient-poor with little growth of plants and algae.

Secchi depth readings are one way to assess the trophic state of a lake. The Secchi depth is the depth at which the black and white Secchi disk is no longer visible when it is lowered into the water. Greater Secchi depths occur with greater water clarity. Secchi depth readings, phosphorus concentrations, and chlorophyll measurements can each be used to calculate a Trophic State Index (TSI) for lakes. TSI values range from 0 – 110. Lakes with TSI values greater than 50 are considered eutrophic. Those with values in the 40 to 50 range are mesotrophic. Lakes with TSI values below 40 are considered oligotrophic.

Citizen lake monitoring volunteers have collected lake data annually since 2000 with the exception of not collecting in 2014. The average summer (July-Aug) secchi disk reading for Devils Lake – nr Deep Hole (Burnett County, WBIC: 2461100) was 13.5 feet (see Figure 2 and Table 1). *The average for the Northwest Georegion was 8.5 feet. The TSI suggests that Devils Lake was mesotrophic. Mesotrophic lakes are characterized by moderately clear water, but have an increasing chance of low dissolved oxygen in deep water during the summer.*<sup>2</sup>

Chemistry data was collected on Devils Lake – nr deep hole (see Figure 3). The average summer Chlorophyll was 3.15 µg/l (compared to a Northwest Georegion summer average of 14.8 µg/l).<sup>2</sup> *The summer Total Phosphorus average was 7.85 µg/l. Lakes that have more than 20 µg/l and impoundments that have more than 30 µg/l of total phosphorus may experience noticeable algae blooms.*<sup>2</sup> In 2013, the summer water was described in June as being blue. In July and August, the color of the water was reported as being green and brown respectively.



**Figure 2: Past Secchi Readings on Devils Lake**

**Table 2: Secchi Reading on Devils Lake from 2000 – 2013<sup>(1)</sup>**

| Year | Secchi Mean | Secchi Min | Secchi Max | Secchi Count |
|------|-------------|------------|------------|--------------|
| 2000 | 11.75       | 8.75       | 14.5       | 3            |
| 2001 | 12.1        | 8.5        | 15.5       | 5            |
| 2006 | 9.09        | 8          | 10         | 4            |
| 2007 | 12.87       | 10.6       | 16         | 3            |
| 2008 | 10.25       | 9          | 12         | 4            |
| 2009 | 12.25       | 10         | 15         | 6            |
| 2010 | 9           | 9          | 9          | 1            |
| 2011 | 24          | 24         | 24         | 2            |
| 2012 | 13          | 9          | 17         | 4            |
| 2013 | 13.5        | 11         | 16         | 2            |



## Trophic State Index Graph

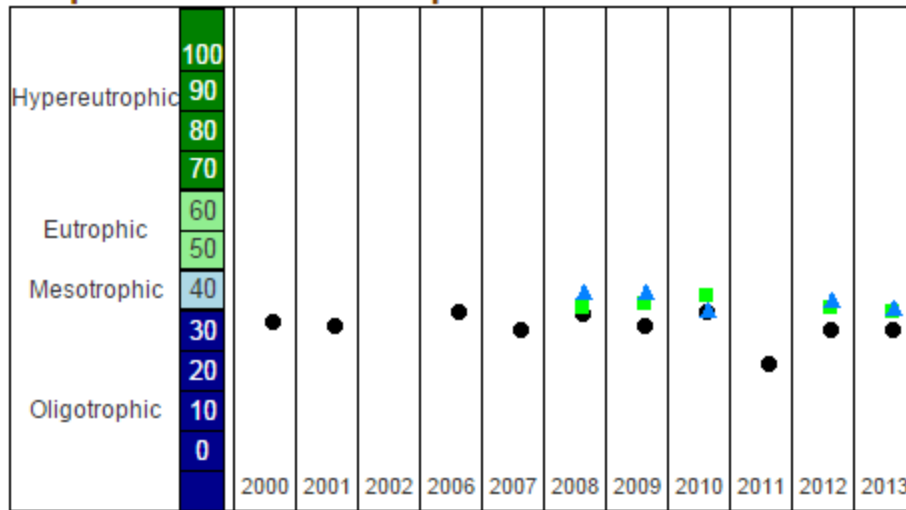
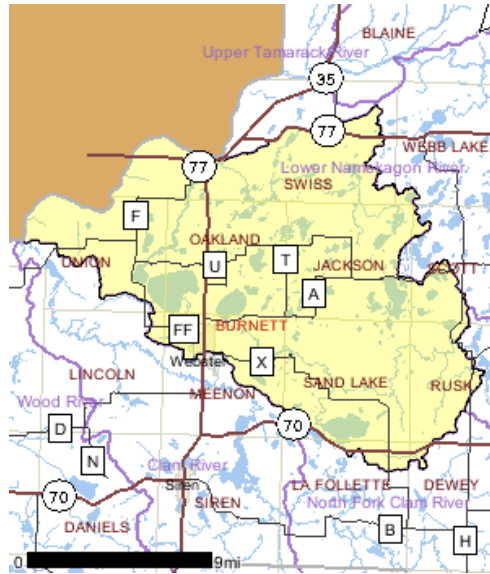


Figure 3: Historical Trophic State Index for Devils Lake Deep Hole<sup>1</sup>

| TSI     | Description of Associated Conditions  |
|---------|---|
| < 30    | Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.             |
| 30 - 40 | Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.  |
| 40 - 50 | Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.  |
| 50 - 60 | Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only. |
| 60 - 70 | Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.  |
| 70 - 80 | Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).                              |
| > 80    | Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.  |

## Watershed

*The Lower Yellow River Watershed encompasses a large portion of central Burnett County and is blessed with a large number of lakes. The watershed is approximately 133,725 acres in size and contains 99 miles of streams and rivers, 13,740 acres of lakes and 23,442 acres of wetlands. The watershed is dominated by forest (55%) and wetland (17%), and is ranked low for nonpoint source issues affecting groundwater.<sup>3</sup>*



**Figure 4: Lower Yellow River Watershed**

### **Watershed Runoff**

Land cover plays a critical role in a watershed. The type of land cover that exists in the watershed determines the amount of phosphorus (and sediment) that runs off the land and eventually makes its way to the lake. The actual amount of pollutants (nutrients, sediment, toxins, etc.) depends greatly on how the land within the watershed is used. Vegetated areas, such as forests, grasslands, and meadows, allow the water to permeate the ground and do not produce much surface runoff. On the other hand, agricultural areas, particularly row crops, along with residential/urban areas, minimize infiltration and increase surface runoff. The increased surface runoff associated with these land cover types leads to increased phosphorus and pollutant loading; which, in turn, can lead to nuisance algal blooms, increased sedimentation, overabundant macrophyte populations, and decreased dissolved oxygen levels.<sup>5</sup> Land that is maintained in a natural, vegetated state is beneficial to soil and water quality.

A 2002 State of the St. Croix River Basin report, identified four key priorities for the basin, all of which are directly associated with water quality:<sup>2</sup>

1. Protection and restoration of shoreland habitat
2. Control of nonpoint source runoff contamination of surface waters
3. Restoration of grasslands, prairies, and wetlands to protect soil and water quality, and to enhance wildlife habitat
4. Implementation of a Northwest Sands Integrated Ecosystem Management Plan

Below is a list of Land Cover Classifications and percentages for each type found in the St. Croix Basin.

**Table 3: Land Cover Classification found in the St. Croix Basin (4)**

|                 |        |
|-----------------|--------|
| Forest          | 48.01% |
| Grassland       | 16.64% |
| Wetland         | 14.02% |
| Agriculture     | 12.85% |
| Water           | 4.55%  |
| Shrubland       | 3.18%  |
| Urban/Developed | 0.43%  |
| Barrens         | 0.32%  |

## **Aquatic Habitats**

### **Functions and Values of Native Aquatic Plants**

Naturally occurring native plants are extremely beneficial to the lake. They provide a diversity of habitats, help maintain water quality, sustain fish populations, and support common lakeshore wildlife such as loons and frogs. They are the primary producers in the aquatic food chain, converting energy from the sun into nutrients for all other organisms. Many submerged plants produce seeds and tubers which are eaten by various waterfowl and other species of animals. Submerged plants also provide excellent habitat for numerous fish species, as well as other species like snails and other aquatic macrophytes.

### **Water Quality**

Aquatic plants can improve water quality by absorbing phosphorus, nitrogen, and other nutrients from the water that could otherwise fuel nuisance algal growth. Some plants can even filter and break down pollutants. Plant roots and underground stems help to prevent re-suspension of sediments from the lake bottom. Stands of emergent plants (whose stems protrude above the water surface) and floating plants help to blunt wave action and prevent erosion of the shoreline. The shoreline plant populations around Devils Lake are particularly important to reducing erosion along the shoreline, but these populations are also vulnerable to the nutrient loading and the resultant algae growth in the lakes.

### **Fishing**

Habitat created by aquatic plants provides food and shelter for both young and adult fish. Invertebrates living on or beneath plants are a primary food source for many species of fish. Other fish such as bluegills graze directly on the plants themselves. Plant beds, such as bulrush present on Devils Lake, provide important spawning habitat for many fish species.

### **Waterfowl**

Plants offer food, shelter, and nesting material. Birds eat both the invertebrates that live on plants and the plants themselves.<sup>5</sup> During both the late May and July plant surveys, a very diverse population of bird species was observed on and around the lake.

## **Protection against Invasive Species**

Non-native invasive species threaten native plants in Northern Wisconsin. The most common are Eurasian water milfoil (EWM) and curly leaf pondweed (CLP). These species are described as opportunistic invaders. This means that they take over openings in the lake bottom where native plants have been removed. Without competition from other plants, these invasive species may successfully become established in the lake. This concept of opportunistic invasion can also be observed on land, in areas where bare soil is quickly taken over by weeds.

Removal of native vegetation not only diminishes the natural qualities of a lake, but it increases the risk of non-native species invasion and establishment. Invasive species can change many of the natural features of a lake and often lead to expensive annual control plans. Allowing native plants to grow may not guarantee protection against invasive plants, but it can discourage their establishment. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.<sup>6</sup>

## **Aquatic Invasive Species Status**

During the spring and summer surveys of 2014, no purple loosestrife or curly-leaf pondweed were found on Devils Lake. However, purple loosestrife was found in August of 2015, in the culvert between Devils Lake and Mud Lake. A significant amount of PLS was found on Mud Lake and bio-control efforts will be coordinated with Burnett County Land & Water Conservation Department, to control and prohibit the spreading. Also, reed canary grass was found at several locations around the lake. No Eurasian water milfoil (*Myriophyllum spicatum*) was found on the lake, but it has been found in four nearby lakes in Burnett County: Ham Lake, Round Lake Trade and Little Trade Lake. The EWM has also been found in Long Trade Lake, just across the border in Polk County; as well as Shallow Lake in Barron County. It is therefore of paramount importance that the Devils Lake Association takes measures to avoid the introduction of EWM and other invasive species, into the lake.

## **Rare and Endangered Species Habitat**

In addition to sensitive areas designated to aquatic plants, the Natural Heritage Inventory has developed a list of species on and around Devils Lake that are listed as being endangered, threatened or of special interest (Table 4 & 5).

**Table 4: Natural Heritage Inventory (NHI) Species Found in Devils Lake Area (T.39N. – R.16W.)<sup>7</sup>**

| <u>Scientific Name</u>                          | <u>Common Name</u>                       | <u>WI Status</u> | <u>Federal Status</u> | <u>Group</u> |
|---|--|------------------|-----------------------|--------------|
| <u>Acipenser fulvescens</u>                     | Lake Sturgeon                            | SC/H             |                       | Fish~        |
| <u>Emydoidea blandingii</u>                     | Blanding's Turtle                        | SC/H             |                       | Turtle~      |
| <u>Karner Blue Federal High Potential Range</u> | Karner Blue Federal High Potential Range | NA               | HPR                   | Other        |
| <u>Lycaeides melissa samuelis</u>               | Karner Blue                              | SC/FL            | LE                    | Butterfly    |
| <u>Northern sedge meadow</u>                    | Northern Sedge Meadow                    | NA               |                       | Community~   |
| <u>Notropis anogenus</u>                        | Pugnose Shiner                           | THR              |                       | Fish~        |
| <u>Potamogeton vaseyi</u>                       | Vasey's Pondweed                         | SC               |                       | Plant~       |
| <u>Schoenoplectus torreyi</u>                   | Torrey's Bulrush                         | SC               |                       | Plant~       |
| <u>Stenelmis antennalis</u>                     | A Riffle Beetle                          | SC/N             |                       | Beetle~      |

**Table 5: Natural Heritage Inventory (NHI) Species Found in Devils Lake Area (T.40N. – R.16W.)<sup>7</sup>**

| <u>Scientific Name</u>                          | <u>Common Name</u>                       | <u>WI Status</u> | <u>Federal Status</u> | <u>Group</u> |
|---|--|------------------|-----------------------|--------------|
| <u>Acipenser fulvescens</u>                     | Lake Sturgeon                            | SC/H             |                       | Fish~        |
| <u>Asclepias ovalifolia</u>                     | Dwarf Milkweed                           | THR              |                       | Plant        |
| <u>Ixobrychus exilis</u>                        | Least Bittern                            | SC/M             |                       | Bird~        |
| <u>Karner Blue Federal High Potential Range</u> | Karner Blue Federal High Potential Range | NA               | HPR                   | Other        |
| <u>Lake--shallow, hard, drainage</u>            | Lake--Shallow, Hard, Drainage            | NA               |                       | Community~   |
| <u>Lycaeides melissa samuelis</u>               | Karner Blue                              | SC/FL            | LE                    | Butterfly    |
| <u>Notropis anogenus</u>                        | Pugnose Shiner                           | THR              |                       | Fish~        |
| <u>Open bog</u>                                 | Open Bog                                 | NA               |                       | Community~   |
| <u>Platanthera flava var. herbiola</u>          | Pale Green Orchid                        | THR              |                       | Plant~       |
| <u>Potamogeton vaseyi</u>                       | Vasey's Pondweed                         | SC               |                       | Plant~       |
| <u>Schoenoplectus torreyi</u>                   | Torrey's Bulrush                         | SC               |                       | Plant~       |

WDNR and federal regulations regarding Special Concern species range from full protection to no protection. The current categories and their respective level of protection are as follows:

Key:    **END** = Endangered            **SC/P** = Fully protected  
           **THR** = Threatened            **SC/N** = No laws regulating use, possession, or harvesting  
           **SC** = Special Concern        **SC/H** = Take regulated by establishment of open /closed seasons  
           **SC/FL** = Federally protected as endangered or threatened, but not so designated by state  
           **SC/M** = Fully protected by federal and state laws under the Migratory Bird Act

## Devils Lake Fishery

### Fish Stocking Data

Devils Lake has a variety of fish species with walleye being a primary focus of the lake association. Efforts have been made over several years to help increase and maintain the walleye population (See Table 6). Several stockings of walleye have taken place over the years. Another focus is on stocking Yellow Perch. This past spring, the Lake Association voted on stocking perch and money was set aside to fund this project. Table 7 list other known species of fish found in Devils Lake.

**Table 6: Fish Stocking Data<sup>8</sup>**

| Year | Stocked Waterbody Name ▲ | Local Waterbody Name | Location   | Species | Strain (Stock)         | Age Class        | Number Fish Stocked | Avg Fish Length (IN) |
|------|--------------------------|----------------------|------------|---------|------------------------|------------------|---------------------|----------------------|
| 2014 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | MISSISSIPPI HEADWATERS | LARGE FINGERLING | 9,749               | 6.30                 |
| 2005 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | MISSISSIPPI HEADWATERS | SMALL FINGERLING | 50,030              | 1.40                 |
| 2003 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | MISSISSIPPI HEADWATERS | SMALL FINGERLING | 50,529              | 1.70                 |
| 2001 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | UNSPECIFIED            | SMALL FINGERLING | 50,000              | 1.55                 |
| 1999 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | UNSPECIFIED            | SMALL FINGERLING | 50,000              | 1.30                 |
| 1997 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | UNSPECIFIED            | SMALL FINGERLING | 51,240              | 1.75                 |
| 1995 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | UNSPECIFIED            | FINGERLING       | 25,651              | 2.60                 |
| 1993 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | UNSPECIFIED            | FINGERLING       | 22,085              | 3.60                 |
| 1993 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | UNSPECIFIED            | FRY              | 2,940               | 2.60                 |
| 1992 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | UNSPECIFIED            | FINGERLING       | 20,000              | 2.00                 |
| 1991 | DEVILS LAKE              |                      | 40N-16W-34 | WALLEYE | UNSPECIFIED            | FINGERLING       | 12,500              | 3.00                 |

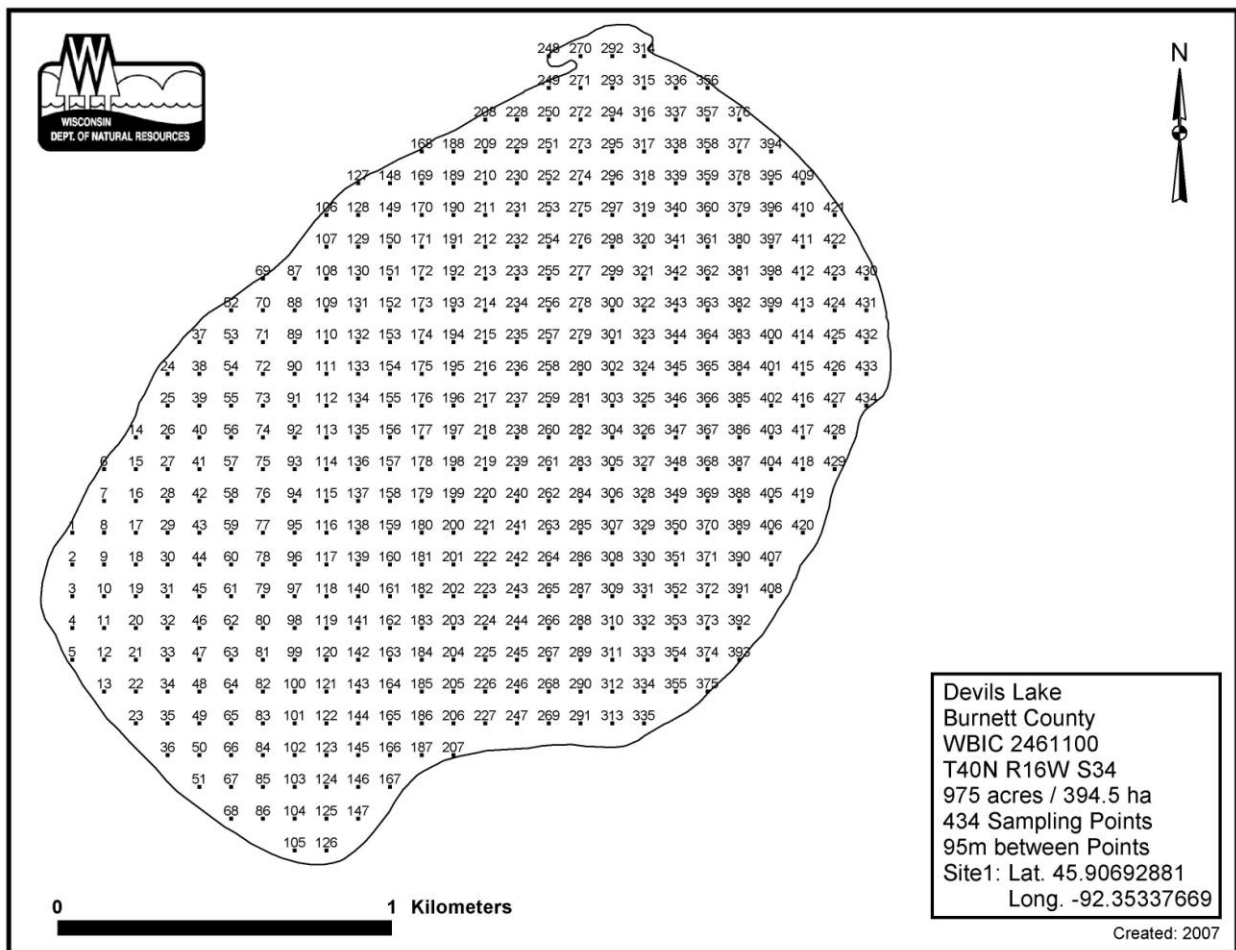
**Table 7: Devils Lake Fish Species List<sup>8</sup>**

| Common Name      | Scientific Name        |
|------------------|------------------------|
| Black Crappie    | Pomoxis nigromaculatus |
| Blacknose Shiner | Notropis heterolepis   |
| Bluegill         | Lepomis macrochirus    |
| Bluntnose Minnow | Pimephales notatus     |
| Johnny Darter    | Etheostoma nigrum      |
| Largemouth Bass  | Micropterus salmoides  |
| Mimic Shiner     | Notropis volucellus    |
| Northern Pike    | Esox lucius            |
| Pumpkinseed      | Lepomis gibbosus       |
| Rock Bass        | Amplopites rupestris   |
| Spotfin Shiner   | Cyprinella spilopetera |
| Spottail Shiner  | Notropis hudsonius     |
| Walleye          | Zander vitreum         |
| White Sucker     | Catostomus commersoni  |
| Yellow Bullhead  | Ictalurus natalis      |
| Yellow Perch     | Perca flavescens       |

## Plant Community

### METHODS:

Using a standard formula that takes into account the shoreline shape and distance, islands, water clarity, depth and total lake acres, Michelle Nault (WDNR) generated a sampling grid for Devils Lake (Figure 5). On June 27, 2014, we conducted a Curly-leaf pondweed survey to check for the presence of this invasive species. During this survey, we went to each of the 434 points on Devils Lake. We sampled just for Curly-leaf pondweed at each site. This type of survey should result in both detection and approximate mapping of any infestation that may have occurred. During the June survey, we did not discover any Curly-leaf pondweed within the littoral zone. Littoral zone map can be seen below. (See Figure 8)



**Figure 5: Devils Lake Sample Grid**

During the June survey, a general idea for the lake and plant communities was established in preparation for the July survey. During the July survey, all plants found were identified (Boreman et al. 1997; Chadde 2002; Crow and Hellquist 2006), and two vouchers were pressed and retained for herbarium specimens – one to be retained by the Devils Lake Association, and

one to be sent to the state for identification confirmation. During the point intercept survey, we located each survey point using a handheld mapping GPS unit (Garmin 76CSx). At each point, we recorded a depth reading with a Hummingbird depth finder unit. After sampling numerous depths at numerous sites, we were able to establish the littoral zone at a maximum of 24 feet. We sampled for plants within the depth range of plant growth. At each of these points, we used a rake (either on a pole or a throw line depending on depth) to sample an approximately 2.5ft. section of the bottom. All plants on the rake, as well as any that were dislodged by the rake were identified, and assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 6). We also recorded visual sightings of plants within six feet of the sample point. Substrate (lake bottom) type was assigned at each site where the bottom was visible or it could be reliably determined using the rake. The substrate is defined as either being sand, muck or rock.




| Fullness Rating | Coverage  | Description  |
|-----------------|---|--|
| 1               |    | Only few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.            |
| 2               |   | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover the tines. |
| 3               |  | The rake is completely covered and tines are not visible.  |

Figure 6: Rake Fullness Ratings<sup>11</sup>

#### DATA ANALYSIS:

We entered all data collected into the standard APM spreadsheet (UWEX, 2007). From this, we calculated the following:

Total number of points sampled: This included the total number of points on the lake coverage that were within the littoral zone (0-maximum depth where plants are found) Initially, we continued to sample points whose depth were several feet beyond the littoral zone, but once we established this maximum depth with confidence, most points beyond this depth were not rake sampled.



Total number of sites with vegetation: These included all sites where we found vegetation after doing a rake sample. For example, if 20% of all sample sites have vegetation, it suggests that 20% of the lake has plant coverage.

Total number of sites shallower than the maximum depth of plants: This is the number of sites that are in the littoral zone. Because not all sites that are within the littoral zone actually have vegetation, we use this value to estimate how prevalent vegetation is throughout the littoral zone. For example, if 60% of the sites shallower than the maximum depth of plants have vegetation, then we estimate that 60% of the lake's littoral zone has plants.

Frequency of occurrence: The frequency of all plants (or individual species) is generally reported as a percentage of occurrences at all sample points. It can also be reported as a percentage of occurrences at sample points within the littoral zone.

Frequency of occurrence example:

Plant A is sampled at 70 out of 700 total points =  $70/700 = .10 = 10\%$

This means that Plant A's frequency of occurrence = 10% considering the entire lake sample.

Plant A is sampled at 70 out of 350 total points in the littoral zone =  $70/350 = .20 = 20\%$

This means that Plant A's frequency of occurrence = 20% when only considering the littoral zone.

From these frequencies, we can estimate how common each species was throughout the lake, and how common the species was at depths where plants were able to grow. Note the second value will be greater as not all the points (in this example, only ½) occur at depths shallow enough for plant growth.

Simpson's diversity index: A diversity index allows the entire plant community at one location to be compared to the entire plant community at another location. It also allows the plant community at a single location to be compared over time thus allowing a measure of community degradation or restoration at that site. With Simpson's diversity index, the index value represents the probability that two individuals (randomly selected) will be different species. The index values range from 0 -1 where 0 indicates that all the plants sampled are the same species to 1 where none of the plants sampled are the same species. The greater the index value, the higher the diversity in a given location. Although many natural variables like lake size, depth, dissolved minerals, water clarity, mean temperature, etc. can affect diversity, in general, a more diverse lake indicates a healthier ecosystem. Perhaps most importantly, plant communities with high diversity also tend to be **more resistant** to invasion by exotic species.

Maximum depth of plants: This indicates the deepest point that vegetation was sampled. In clear lakes, plants may be found at depths of over 20ft, while in stained or turbid locations, they may only be found in a few feet of water. While some species can tolerate very low light conditions, others are only found near the surface. In general, the diversity of the plant community decreases with increased depth.

Number of sites sampled using rope/pole rake: This indicates which rake type was used to take a sample. Protocol suggests a 15ft pole rake, and a 25ft rope rake for sampling (Wagoner personal communication).

Average number of species per site: This value is reported using four different considerations.

- 1) **shallower than maximum depth of plants** indicates the average number of plant species at all sites in the littoral zone.
- 2) **vegetative sites only** indicate the average number of plants at all sites where plants were found.
- 3) **native species shallower than maximum depth of plants** and
- 4) **native species at vegetative sites only** excludes exotic species from consideration.

Species richness: This value indicates the number of different plant species found in and directly adjacent to (on the waterline) the lake. Species richness alone only counts those plants found in the rake survey. The other two values include those seen during the point intercept survey and the initial boat survey.

Mean and median depth of plants: The mean depth of plants indicates the average depth in the water column where plants were sampled. Because a few samples in deep water can skew this data, median depth is also calculated. This tells us that half of the plants sampled were in water shallower than this value, and half were in water deeper than this value.

Relative frequency: This value shows a species' frequency relative to all other species. It is expressed as a percentage, and the total of all species' relative frequency will add up to 100%. Organizing species from highest to lowest relative frequency value gives us an idea of which species are most important within the macrophyte community.

Relative frequency example:

Suppose that we sample 100 points and found 5 species of plants with the following results:

Plant A was located at 70 sites. Its frequency of occurrence is thus  $70/100 = 70\%$

Plant B was located at 50 sites. Its frequency of occurrence is thus  $50/100 = 50\%$

Plant C was located at 20 sites. Its frequency of occurrence is thus  $20/100 = 20\%$

Plant D was located at 10 sites. Its frequency of occurrence is thus  $10/100 = 10\%$

To calculate an individual species' relative frequency, we divide the number of sites a plant is sampled at by the total number of times all plants were sampled. In our example that would be 150 samples ( $70+50+20+10$ ).

Plant A =  $70/150 = .4667$  or 46.67%

Plant B =  $50/150 = .3333$  or 33.33%

Plant C =  $20/150 = .1333$  or 13.33%

Plant D =  $10/150 = .0667$  or 6.67%

This value tells us that 46.67% of all plants sampled were Plant A.

Floristic Quality Index (FQI): This index measures the impact of human development on a lake's aquatic plants. Species in the index are assigned a Coefficient of Conservatism (C) which ranges from 0-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each species found in the lake. Consequently, a higher index value indicates a healthier macrophyte community. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Devils Lake is in the Northern Lakes and Forests Ecoregion. Within this region, the mean FQI ranges from 20-28, depending on several factors, such as size of the lake and canopy cover. A total of 51 species were identified on the lake, of those identified, 45 have been assigned Floristic Qualities. The FQI for Devils Lake is 44.27 and the Mean C value is 6.6 (See Table 9 below). This data suggests that plants found in Devils Lake are less tolerant to disturbances.

## **RESULTS:**

### **Aquatic Plant Survey Results for Devils Lake**

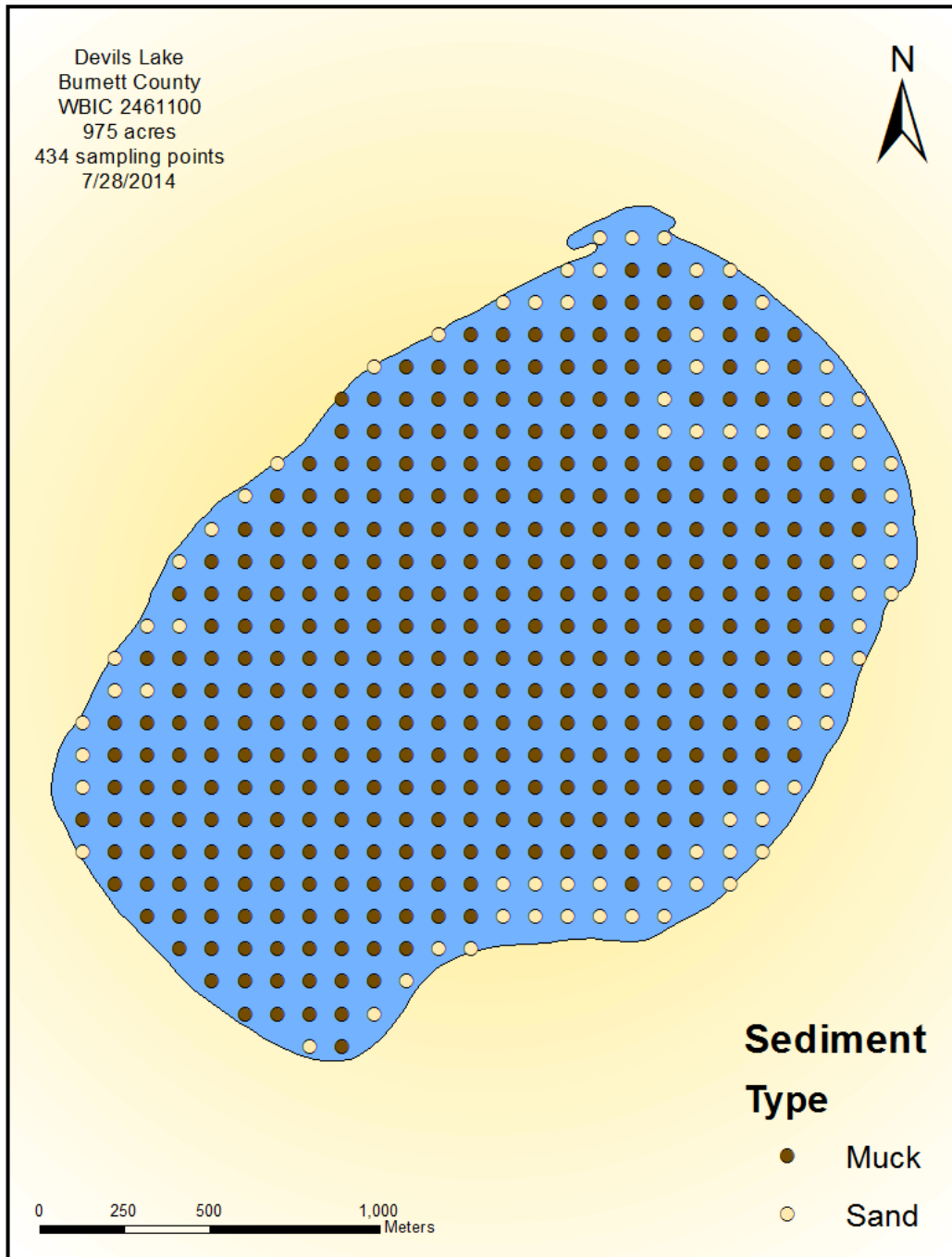
An aquatic plant survey was completed for Devils Lake in 2014. Prior to the whole lake monitoring, a curly leaf pondweed (CLP) survey was conducted to confirm the presence of this aquatic invasive species. Since CLP grows earlier than native species, it typically dies in early July; therefore, the CLP survey is done in May or early June while the plant is still robust. In 2013, while working in conjunction with WI DNR, an invasive species survey was also conducted to determine the presence of various invasive species, such as snails, spiny water flea, zebra mussels, CLP, Purple Loosestrife and Eurasian Water Milfoil. Chinese Mystery Snails were discovered during this survey however, no other invasive species was detected. The results of the CLP survey and the point intercept whole lake survey are discussed below.

Using a standard formula based on a lake's shoreline shape and distance, islands, water clarity, depth, and size in acres, the Wisconsin Department of Natural Resources (WDNR) generated the sampling point grid of 468 points for Devils Lake. Figure 5 above shows the locations of these sampling points.

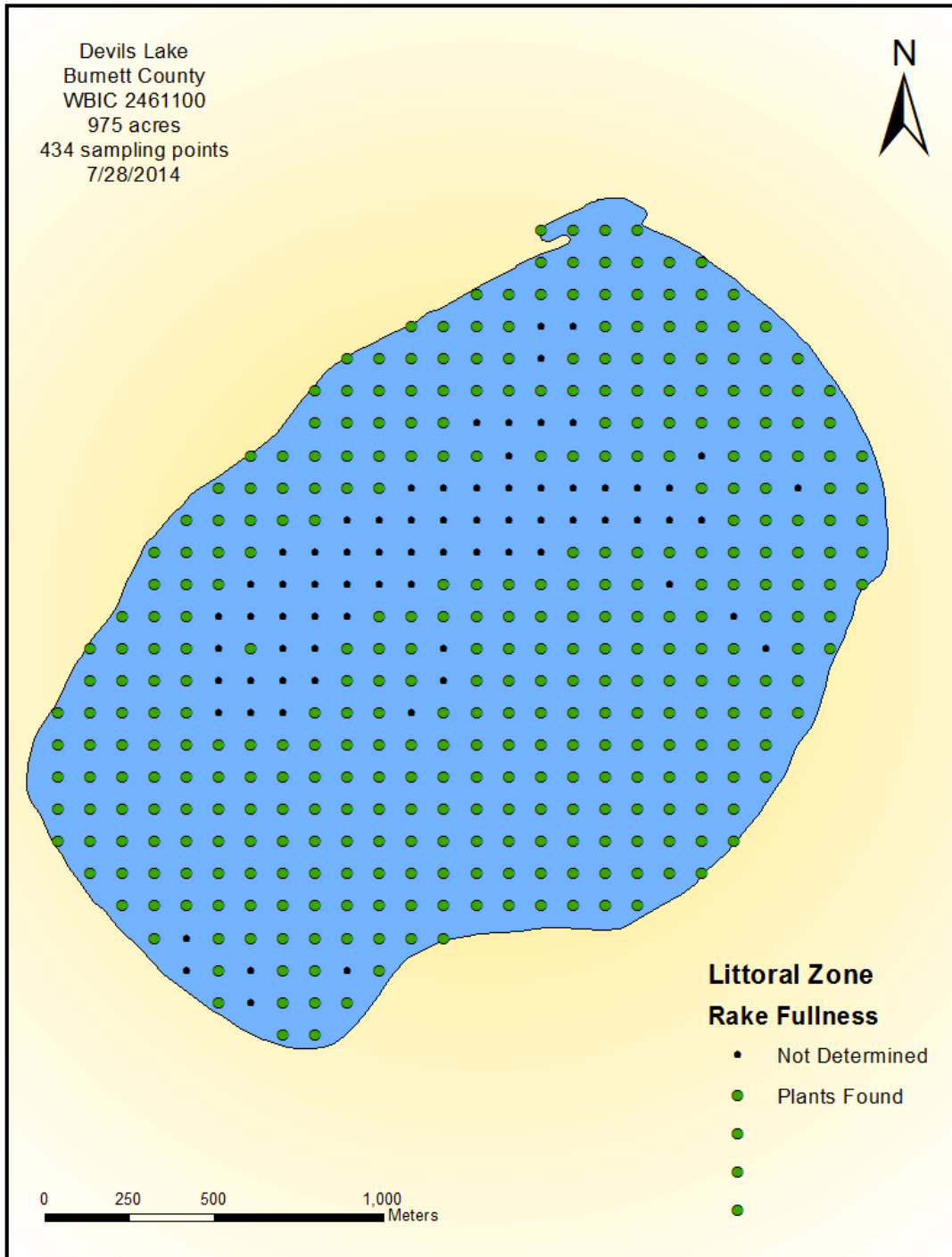
As mentioned before, Devils Lake survey grid is comprised of 434 points of which, all 434 sites were sampled. Of these points, we found plants at 350 sites, typically, in less than 20 feet of

water (Figure 8: littoral zone). Areas that were shallow and had a mucky substrate supported more plants than those with sandy or rocky bottoms. Figure 7 below illustrates the substrate of Devils Lake. Plants were found growing on approximately 81% of the entire lake bottom, and in 97% of the littoral zone. Diversity was very high with a Simpson Diversity Index value of 0.87. Species richness was also high with 51 total species found growing in and immediately adjacent to the lake. Even though there were 51 species of aquatic macrophytes located on the lake, 28 of the 51 plants were found at site #270. The diversity of plants at this one location was extraordinary. In the future, if this location of the lake were to be developed, several of these plants could potentially no longer exist. The majority of aquatic macrophytes were found growing in shallow water with a mean depth of 13.8ft, and a median depth of 16ft. These zones of plant growth are extremely important in helping to control algal growth and they support diverse plant beds that provide important underwater habitat. Tables 8, 9 and 10 summarize the data from the completed survey.

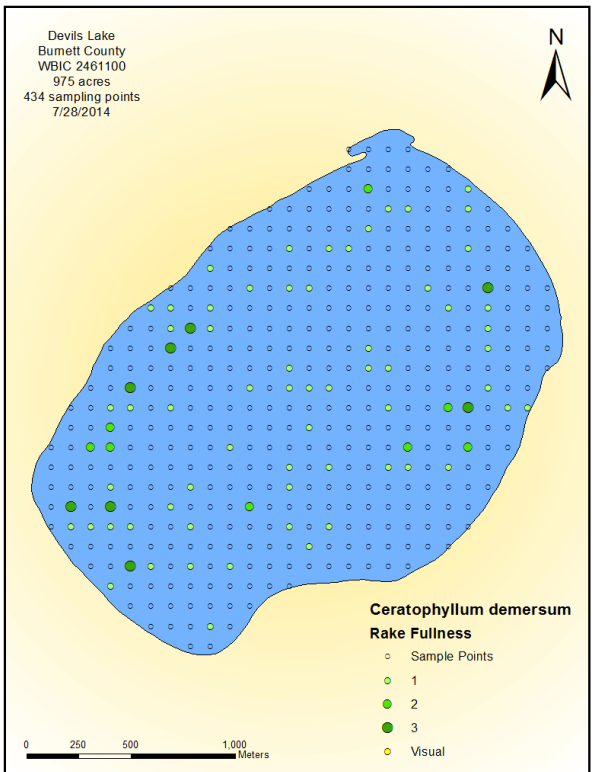
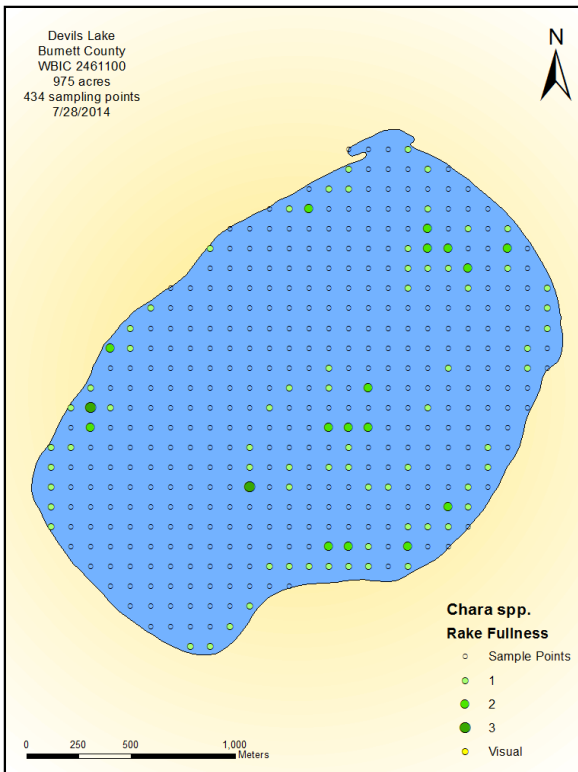
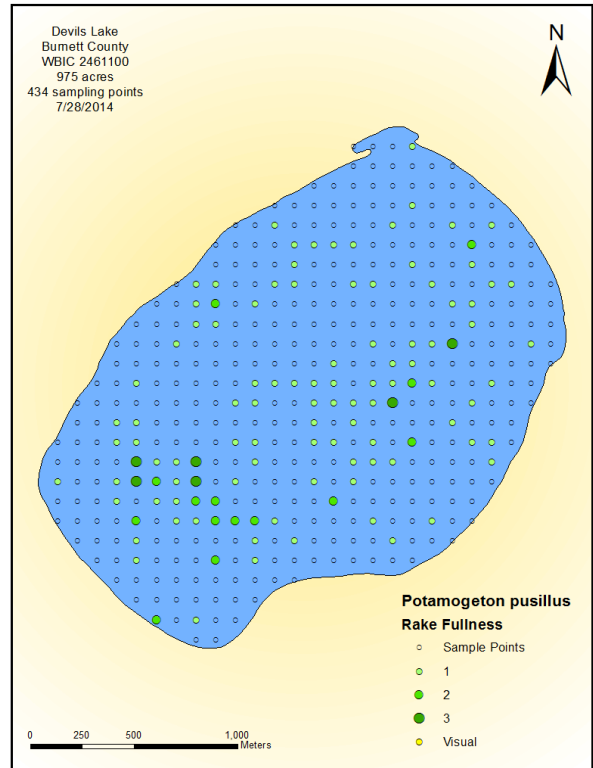
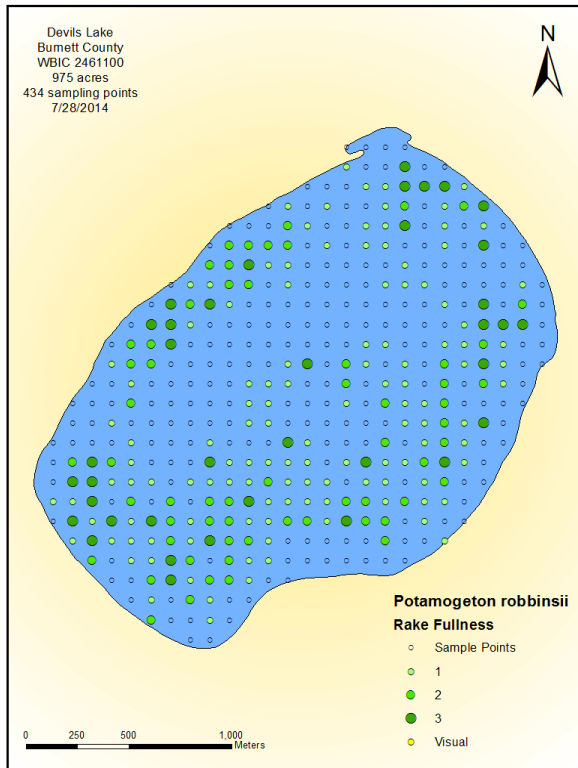
The following plant species were the most frequently observed on the lake: Fern pondweed (*Potamogeton robbinsii*), Small pondweed (*Potamogeton pusillus*), Muskgrasses (*Chara sp.*) and Coontail (*Ceratophyllum demersum*) (Table 7). The four species were found at 62.00%, 33.14%, 24.86%, and 22.29% of the survey points with vegetation respectively (Figure 9). Each of the four species were widely distributed throughout the lake over muck and sandy bottoms (Figure 7). Although many other species were widely distributed, none were found with a relative frequency over 9.52%.



**Figure 7: Devils Lake Sediment Types**



**Figure 8: Devils Lake Littoral Zone: Region of Plant Growth**



**Figure 9: Most Common Aquatic Plant Species Found on Devils Lake**

During the May and July survey, no Eurasian water-milfoil (*Myriophyllum sibiricum*) was detected. Several sites adjacent to the littoral zone had Reed canary grass, a common invasive species. Although we did not find any Purple loosestrife (PLS) in the littoral zone or adjacent to littoral zone, PLS had been spotted on several nearby lakes. Members of the lake association have been trained in Citizen Lake Monitoring Network aquatic invasive species and have been monitoring the lake. More members will be trained in the future to monitor aquatic invasive species and will continue to survey the lake for Purple loosestrife. Below is a list of recommendations that should be considered to ensure the well being of Devils Lake:

- Preserve and maintain the native plant community in Devils Lake
- Continue to educate lakesore owners and boaters about the importance of aquatic plants and the negative impacts AIS can have on the entire lake ecosystem
- Preserve the lake’s many rush/reed beds
- Whenever possible, refrain from removing native plants from the lake
- Reduce and, wherever possible, eliminate fertilizer and pesticide applications near the lakeshore
- Encourage shoreline restoration
- Establish native vegetation buffer strips along the lakeshore
- Consider transect monitoring for aquatic invasive species at and near the boat landing at least once a month during the summer months
- Complete a full shoreline inspection in mid-August to locate and eliminate any beds of newly-developed Purple loosestrife
- Continue conducting Clean Boats/Clean Water inspections and develop an Aquatic Invasive Species program
- Conduct Citizen Lake Monitoring for aquatic invasive species from May through October

**Table 8: Devils Lake Aquatic Macrophytes Survey Summary Statistics**

| SUMMARY STATS:  |          |
|---|----------|
| Total number of sites visited   | 434      |
| Total number of sites with vegetation                                   | 350      |
| Total number of sites shallower than maximum depth of plants            | 419      |
| Frequency of occurrence at sites shallower than maximum depth of plants | 83.53222 |
| Simpson Diversity Index   | 0.874508 |
| Maximum depth of plants (ft)**  | 24       |
| Number of sites sampled using rake on Rope (R)                          | 414      |
| Number of sites sampled using rake on Pole (P)                          | 0        |



|  |          |
|--|----------|
| Average number of all species per site (shallower than max depth)    | 1.954654 |
| Average number of all species per site (veg. sites only)             | 2.34     |
| Average number of native species per site (shallower than max depth) | 1.954654 |
| Average number of native species per site (veg. sites only)          | 2.34     |
| Species Richness   | 25       |
| Species Richness (including visuals)                                 | 51       |
| Mean Depth of Plants (ft)  | 13.8     |
| Median Depth of Plants   | 16       |

**Table 9: Devils Lake FQI Species and Conservatism Values**

| Species                                      | Common Name            | C  |
|--|------------------------|----|
| <i>Bidens beckii</i>                         | Water marigold         | 8  |
| <i>Brasenia schreberi</i>                    | Watershield            | 6  |
| <i>Ceratophyllum demersum</i>                | Coontail               | 3  |
| <i>Chara</i>                                 | Muskgrasses            | 7  |
| <i>Dulichium arundinaceum</i>                | Three-way sedge        | 9  |
| <i>Elatine minima</i>                        | Waterwort              | 9  |
| <i>Eleocharis acicularis</i>                 | Needle spikerush       | 5  |
| <i>Eleocharis erythropoda</i>                | Bald spikerush         | 3  |
| <i>Eleocharis palustris</i>                  | Creeping spikerush     | 6  |
| <i>Elodea canadensis</i>                     | Common waterweed       | 3  |
| <i>Elodea nuttallii</i>                      | Slender waterweed      | 7  |
| <i>Isoetes</i> sp.                           | Quillwort              | 8  |
| <i>Juncus pelocarpus</i> f. <i>submersus</i> | Brown-fruited rush     | 8  |
| <i>Lemna minor</i>                           | Small duckweed         | 4  |
| <i>Myriophyllum sibiricum</i>                | Northern water-milfoil | 6  |
| <i>Myriophyllum tenellum</i>                 | Dwarf water-milfoil    | 10 |
| <i>Najas flexilis</i>                        | Slender naiad          | 6  |
| <i>Najas guadalupensis</i>                   | Southern naiad         | 8  |
| <i>Nitella</i>                               | Nitella                | 7  |
| <i>Nuphar variegata</i>                      | Spatterdock            | 6  |
| <i>Nymphaea odorata</i>                      | White water lily       | 6  |
| <i>Potamogeton amplifolius</i>               | Large-leaf pondweed    | 7  |
| <i>Potamogeton gramineus</i>                 | Variable pondweed      | 7  |
| <i>Potamogeton praelongus</i>                | White-stem pondweed    | 8  |
| <i>Potamogeton pusillus</i>                  | Small pondweed         | 7  |
| <i>Potamogeton richardsonii</i>              | Clasping-leaf pondweed | 5  |
| <i>Potamogeton robbinsii</i>                 | Fern pondweed          | 8  |
| <i>Potamogeton zosteriformis</i>             | Flat-stem pondweed     | 6  |
| <i>Ranunculus flammula</i>                   | Creeping spearwort     | 9  |
| <i>Riccia fluitans</i>                       | Slender riccia         | 7  |
| <i>Sagittaria cuneata</i>                    | Arum-leaved arrowhead  | 7  |

|                               |                           |       |
|-------------------------------|---------------------------|-------|
| <i>Sagittaria graminea</i>    | Grass-leaved arrowhead    | 9     |
| <i>Sagittaria latifolia</i>   | Common arrowhead          | 3     |
| <i>Sagittaria rigida</i>      | Sessile-fruited arrowhead | 8     |
| <i>Schoenoplectus acutus</i>  | Hardstem bulrush          | 6     |
| <i>Schoenoplectus pungens</i> | Three-square bulrush      | 5     |
| <i>Sparganium eurycarpum</i>  | Common bur-reed           | 5     |
| <i>Sparganium fluctuans</i>   | Floating-leaf bur-reed    | 10    |
| <i>Stuckenia pectinata</i>    | Sago pondweed             | 3     |
| <i>Typha angustifolium</i>    | Narrow-leaved cattail     | 1     |
| <i>Utricularia gibba</i>      | Creeping bladderwort      | 9     |
| <i>Utricularia intermedia</i> | Flat-leaf bladderwort     | 9     |
| <i>Utricularia minor</i>      | Small bladderwort         | 10    |
| <i>Utricularia vulgaris</i>   | Common bladderwort        | 7     |
| <i>Vallisneria americana</i>  | Wild celery               | 6     |
| <b>N</b>                      |                           | 45    |
| <b>mean C</b>                 |                           | 6.6   |
| <b>FQI</b>                    |                           | 44.27 |

**Table 10: Frequencies and Mean Rake Sample of Aquatic Macrophytes Devils Lake, Burnett County July 2014**

| Scientific Name                       | Common Name            | Total Sites | Relative Frequency (%) | Frequency of occurrence within vegetated areas (%) | Frequency of occurrence within Littoral Zone | Mean Rake Fullness |
|---------------------------------------|------------------------|-------------|------------------------|--|--|--------------------|
| <i>Potamogeton robbinsii</i>          | Fern pondweed          | 217         | 26.50                  | 62.00  | 51.79  | 1.617512           |
| <i>Potamogeton pusillus</i>           | Small pondweed         | 116         | 14.16                  | 33.14  | 27.68  | 1.224138           |
| <i>Chara sp.</i>                      | Muskgrasses            | 87          | 10.62                  | 24.86  | 20.76  | 1.229885           |
| <i>Ceratophyllum demersum</i>         | Coontail               | 78          | 9.52                   | 22.29  | 18.62  | 1.307692           |
| <i>Potamogeton gramineus</i>          | Variable pondweed      | 50          | 6.11                   | 14.29  | 11.93  | 1                  |
| <i>Elodea canadensis</i>              | Common waterweed       | 47          | 5.74                   | 13.43  | 11.22  | 1.319149           |
| <i>Najas guadalupensis</i>            | Southern naiad         | 46          | 5.62                   | 13.14  | 10.98  | 1.043478           |
| <i>Nitella sp.</i>                    | Nitella                | 27          | 3.30                   | 7.71   | 6.44   | 1                  |
| <i>Potamogeton praelongus</i>         | White-stem pondweed    | 22          | 2.69                   | 6.29   | 5.25   | 1.045455           |
| <i>Eleocharis acicularis</i>          | Needle spikerush       | 21          | 2.56                   | 6.00   | 5.01   | 1.047619           |
| <i>Potamogeton amplifolius</i>        | Large-leaf pondweed    | 19          | 2.32                   | 5.43   | 4.53   | 1                  |
| <i>Myriophyllum tenellum</i>          | Dwarf water-milfoil    | 19          | 2.32                   | 5.43   | 4.53   | 1                  |
| <i>Najas flexilis</i>                 | Slender naiad          | 16          | 1.95                   | 4.57   | 3.82   | 1                  |
| <i>Vallisneria americana</i>          | Wild celery            | 14          | 1.71                   | 4.00   | 3.34   | 1                  |
| <i>Juncus pelocarpus f. submersus</i> | Brown-fruited rush     | 14          | 1.71                   | 4.00   | 3.34   | 1                  |
| <i>Bidens beckii</i>                  | Water marigold         | 9           | 1.10                   | 2.57   | 2.15   | 1                  |
| <i>Potamogeton zosteriformis</i>      | Flat-stem pondweed     | 5           | 0.61                   | 1.43   | 1.19   | 1.8                |
| <i>Elodea nuttallii</i>               | Slender waterweed      | 3           | 0.37                   | 0.86   | 0.72   | 1                  |
| <i>Potamogeton richardsonii</i>       | Clasping-leaf pondweed | 2           | 0.24                   | 0.57   | 0.48   | 1                  |
| <i>Elatine minima</i>                 | Waterwort              | 2           | 0.24                   | 0.57   | 0.48   | 1                  |
| <i>Schoenoplectus pungens</i>         | Three-square bulrush   | 1           | 0.12                   | 0.29   | 0.24   | 1                  |
| <i>Schoenoplectus acutus</i>          | Hardstem bulrush       | 1           | 0.12                   | 0.29   | 0.24   | 1                  |
| <i>Sagittaria sp.</i>                 | Arrowhead              | 1           | 0.12                   | 0.29   | 0.24   | 1                  |

|                                |                           |        |      |      |      |        |
|--------------------------------|---------------------------|--------|------|------|------|--------|
| <i>Myriophyllum sibiricum</i>  | Northern water-milfoil    | 1      | 0.12 | 0.29 | 0.24 | 1      |
| <i>Isoetes sp.</i>             | Quillwort                 | 1      | 0.12 | 0.29 | 0.24 | 1      |
| <i>Drepanocladus sp.</i>       | Aquatic moss              | 1      |      | 0.29 | 0.24 | 1      |
| <i>Brasenia schreberi</i>      | Watershield               | visual |      |      |      | visual |
| <i>Dulichium arundinaceum</i>  | Three-way sedge           | visual |      |      |      | visual |
| <i>Eleocharis erythropoda</i>  | Bald spikerush            | visual |      |      |      | visual |
| <i>Eleocharis palustris</i>    | Creeping spikerush        | visual |      |      |      | visual |
| <i>Lemna minor</i>             | Small duckweed            | visual |      |      |      | visual |
| <i>Nuphar variegata</i>        | Spatterdock               | visual |      |      |      | visual |
| <i>Nymphaea odorata</i>        | White water lily          | visual |      |      |      | visual |
| <i>Pontederia cordata</i>      | Pickerelweed              | visual |      |      |      | visual |
| <i>Potamogeton spirillus</i>   | Spiral-fruited pondweed   | visual |      |      |      | visual |
| <i>Ranunculus flammula</i>     | Creeping spearwort        | visual |      |      |      | visual |
| <i>Riccia fluitans</i>         | Slender riccia            | visual |      |      |      | visual |
| <i>Sagittaria cristata</i>     | Crested arrowhead         | visual |      |      |      | visual |
| <i>Sagittaria cuneata</i>      | Arum-leaved arrowhead     | visual |      |      |      | visual |
| <i>Sagittaria graminea</i>     | Grass-leaved arrowhead    | visual |      |      |      | visual |
| <i>Sagittaria latifolia</i>    | Common arrowhead          | visual |      |      |      | visual |
| <i>Sagittaria rigida</i>       | Sessile-fruited arrowhead | visual |      |      |      | visual |
| <i>Scirpus atrovirens</i>      | Dark-green bulrush        | visual |      |      |      | visual |
| <i>Sparganium chlorocarpum</i> | European bur-reed         | visual |      |      |      | visual |
| <i>Sparganium eurycarpum</i>   | Common bur-reed           | visual |      |      |      | visual |
| <i>Sparganium fluctuans</i>    | Floating-leaf bur-reed    | visual |      |      |      | visual |
| <i>Sparganium sp.</i>          | Bur-reed                  | visual |      |      |      | visual |
| <i>Stuckenia pectinata</i>     | Sago pondweed             | visual |      |      |      | visual |
| <i>Typha angustifolia</i>      | Narrow-leaved cattail     | visual |      |      |      | visual |
| <i>Utricularia gibba</i>       | Creeping bladderwort      | visual |      |      |      | visual |
| <i>Utricularia intermedia</i>  | Flat-leaf bladderwort     | visual |      |      |      | visual |

|                             |                    |        |        |
|-----------------------------|--------------------|--------|--------|
| <i>Utricularia minor</i>    | Small bladderwort  | visual | visual |
| <i>Utricularia vulgaris</i> | Common bladderwort | visual | visual |

## ***Aquatic Plant Management***

This section reviews the potential management methods available, and reports recent management activities on the lakes. The application, location, timing, and combination of techniques must be considered carefully.

### **Discussion of Management Methods**

#### **Permitting Requirements**

The Department of Natural Resources regulates the removal of aquatic plants when chemicals are used, when plants are removed mechanically, and when plants are removed manually from an area greater than thirty feet in width along the shore. The requirements for chemical plant removal are described in Administrative Rule NR 107 – Aquatic Plant Management. A permit is required for any aquatic chemical application in Wisconsin. Additional requirements exist when a lake is considered an ASNRI (Area of Special Natural Resource Interest) due to the presence of wild rice.

The requirements for manual and mechanical plant removal are described in NR 109 – Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations. A permit is required for manual and mechanical removal except for when a riparian (waterfront) landowner manually removes or gives permission to someone to manually remove plants, (with the exception of wild rice) from his/her shoreline up to a 30-foot corridor. A riparian landowner may also manually remove the invasive plants Eurasian water milfoil, Curly leaf pondweed, and Purple loosestrife along his or her shoreline without a permit. Manual removal refers to the control of aquatic plants by hand or hand-held devices without the use or aid of external or auxiliary power (WDNR).

#### **Manual Removal<sup>14</sup>**

Manual removal—hand pulling, cutting, or raking—will effectively remove plants from small areas. It is likely that plant removal will need to be repeated more than once during the growing season. The best timing for hand removal of herbaceous plant species is after flowering but before seed head production. For plants with rhizomatous (underground stem) growth, pulling roots is not generally recommended since it may stimulate new shoot production. Hand pulling is a strategy recommended for rapid response to a Eurasian water milfoil establishment and for private landowners who wish to remove small areas of curly leaf pondweed growth. Raking is recommended to clear nuisance growth in riparian area corridors up to twenty feet wide.

SCUBA divers may engage in manual removal for invasive species like Eurasian water milfoil. Care must be taken to ensure that all plant fragments are removed from the lake. Manual removal with divers is recommended for shallow areas with sporadic EWM growth.

## **Mechanical Control**

Larger-scale control efforts require more mechanization. Mechanical cutting, mechanical harvesting, diver-operated suction harvesting, and rotovating (tilling) are the most common forms of mechanical control available. WDNR permits under Chapter NR 109 are required for mechanical plant removal. (APIS, Army Corps of Engineers)

**Aquatic plant harvesters** are floating machines that cut and remove vegetation from the water. The cutter head uses sickles similar to those found on farm equipment, and generally cut to depths from one to six feet. A conveyor belt on the cutter head brings the clippings onboard the machine for storage. Once full, the harvester travels to shore to discharge the load of weeds off of the vessel.

The size, and consequently the harvesting capabilities, of these machines vary greatly. As they move, harvesters cut a swath of aquatic plants that is between 4 and 20 feet wide, and can be up to 10 feet deep. The on-board storage capacity of a harvester ranges from 100 to 1000 cubic feet (by volume) or 1 to 8 tons (by weight).

In some cases the plants are transported to shore by the harvester itself for disposal, while in other cases a barge is used to store and transport the plants in order to increase the efficiency of the cutting process. The plants are deposited on shore, where they can be transported to a local farm (the nutrient content of composted aquatic plants is comparable to that of cow manure) or to an upland landfill for proper disposal. Most harvesters can cut between 2 and 8 acres of aquatic vegetation per day, and the average lifetime of a mechanical harvester is 10 years.

Mechanical harvesting of aquatic plants presents both positive and negative consequences to any lake. Its results—open water and accessible boat lanes—are immediate, and can be enjoyed without the restrictions on lake use which follow herbicide treatments. In addition to the human use benefits, the clearing of thick aquatic plant beds may also increase the growth and survival of some fish. By eliminating the upper canopy, harvesting reduces the shading caused by aquatic plants. The nutrients stored in the plants are also removed from the lake, and the sedimentation that would normally occur as a result of the decaying of this plant matter is prevented. Additionally, repeated treatments may result in thinner, more scattered growth.

Aside from the obvious effort and expense of harvesting aquatic plants, there are many environmentally-detrimental consequences to consider. The removal of aquatic species during harvesting is non-selective. Native and invasive species alike are removed from the target area. This loss of plants results in a subsequent loss of the functions they perform, including sediment stabilization and wave absorption. Shoreline erosion may therefore increase. Other organisms such as fish, reptiles, and insects are often displaced or removed from the lake in the harvesting process. This may have adverse effects on these organisms' populations as well as the lake ecosystem as a whole.

While the enjoyed results of harvesting aquatic plants may be short term, the negative consequences are not so short lived. Much like mowing a lawn, harvesting must be conducted numerous times throughout the growing season. Although the harvester collects most of the plants that it cuts, some plant fragments

inevitably persist in the water. This may allow the invasive plant species to propagate and colonize in new, previously unaffected areas of the lake. Harvesting may also result in re-suspension of contaminated sediments and the excess nutrients they contain.

Disposal sites are a key component when considering the mechanical harvesting of aquatic plants. The sites must be on shore and upland to make sure the plants and their reproductive structures don't make their way back into the lake or to other lakes. The number of available disposal sites and their distance from the targeted harvesting areas will determine the efficiency of the operation, in terms of time as well as cost.

Timing is also important. The ideal time to harvest, in order to maximize the efficiency of the harvester, is just before the aquatic plants break the surface of the lake. For curly leaf pondweed, it should also be before the plants form turions to avoid spreading of the turions within the lake. If the harvesting is conducted too early, the plants will not be close enough to the surface, and the cutting will not do much damage to them. If too late, there may be too much plant matter on the surface of the lake for the harvester to cut effectively.

If the harvesting work is contracted, be sure to inspect the equipment before and after it enters the lake. Since these machines travel from lake to lake, they may carry plant fragments with them, and facilitate the spread of aquatic invasive species from one body of water to another. One must also consider prevailing winds, since cut vegetation can be blown into open areas of the lake or along shorelines.

**Diver dredging** operations use pump systems to collect plant and root biomass. The pumps are mounted on a barge or pontoon boat. The dredge hoses are from 3 to 5 inches in diameter and are handled by one diver. The hoses normally extend about 50 feet in front of the vessel. Diver dredging is especially effective against the pioneering establishment of submersed invasive plant species. When a weed is discovered in a pioneering state, this methodology can be considered. To be effective, the entire plant, including the subsurface portions, should be removed.

Plant fragments can result from this type of operation, but fragmentation is not as great a problem when infestations are small. Diver dredging operations may need to be repeated more than once to be effective. When applied to a pioneering infestation, control can be complete. However, periodic inspections of the lake should be performed to ensure that all the plants have been found and collected.

Lake substrates play an important part in the effectiveness of a diver dredging operation. Soft substrates are very easy to work in. Divers can remove the plant and root crowns with little difficulty. Hard substrates, however, pose more of a problem. Divers may need hand tools to help dig the root crowns out of hardened sediment.

**Rotovation** involves using large underwater rototillers to remove plant roots and other plant tissue. Rotovators can reach bottom sediments to depths of 20 feet. Rotovating may significantly affect non-target organisms and water quality as bottom sediments are disturbed. However, the suspended sediments and resulting turbidity produced by rotovation settles fairly rapidly once the tiller has passed.



Tilling contaminated sediments could possibly release toxins into the water column. If there is any potential of contaminated sediments in the area, further investigation should be performed to determine the potential impacts from this type of treatment. Tillers do not operate effectively in areas with many underwater obstructions such as trees and stumps. If operations are releasing large amounts of plant material, harvesting equipment should be on hand to collect this material and transport it to shore for disposal.

### **Biological Control<sup>14</sup>**

Biological control is the purposeful introduction of parasites, predators, and/or pathogenic microorganisms to reduce or suppress populations of plant or animal pests. Biological control counteracts the problems that occur when a species is introduced into a new region of the world without a complex or assemblage of organisms that feed directly upon it, attack its seeds or progeny through predation or parasitism, or cause severe or debilitating diseases. With the introduction of native pests to the target invasive organism, the exotic invasive species may be maintained at lower densities.

#### ***Weevils<sup>15</sup>***

*Weevils have potential for use as a biological control agent against Eurasian water milfoil. There are several documented “natural” declines of EWM infestations. In these cases, EWM was not eliminated but its abundance was reduced enough so that it did not achieve dominance. These declines are attributed to an ample population of native milfoil weevils (Euhrychiopsis lecontei). Weevils feed on native milfoils but will shift preference over to EWM when it is present. Lakes where weevils can become an effective control have an abundance of native Northern water milfoil and fairly extensive natural shoreline where the weevils can over winter. Because native milfoils are susceptible to higher doses of herbicides, any control strategy for EWM that would also harm native milfoil may hinder the ability of this natural bio-control agent. Lakes with large bluegill populations are not good candidates for weevils because bluegills feed on the weevils. The presence and efficacy of stocking weevils in EWM lakes is being evaluated in Wisconsin lakes. So far, stocking does not appear to be effective.*

The effectiveness of biocontrol efforts varies widely (Madsen, 2000). Beetles are commonly used to control Purple loosestrife populations in Wisconsin with good success. As mentioned above, weevils are used as an experimental control for Eurasian water milfoil once the plant is established. Tilapia and carp are used to control the growth of filamentous algae in ponds. Grass carp, an herbivorous fish, is sometimes used to feed on pest plant populations, but grass carp introduction is not allowed in Wisconsin.

There are advantages and disadvantages to the use of biological control as part of an overall aquatic plant management program. Advantages include longer-term control relative to other technologies, lower overall costs, and plant-specific control. On the other hand there are several disadvantages to consider, including very long control times (years instead of weeks), a lack of available agents for particular target species, and relatively specific environmental conditions necessary for success.

Biological control is not without risks; new non-native species introduced to control a pest population may cause problems of its own. Biological control is not currently proposed for management of aquatic plants in Devils Lake, although it will be considered for Purple loosestrife control.

### **Re-vegetation with Native Plants**

Another aspect to biological control is native aquatic plant restoration. The rationale for re-vegetation is that restoring a native plant community should be the end goal of most aquatic plant management programs (Nichols 1991; Smart and Doyle 1995). However, in communities that have only recently been invaded by nonnative species, a propagule (seed) bank probably exists that will restore the community after nonnative plants are controlled (Madsen, Getsinger, and Turner, 1994). Re-vegetation following plant removal is probably not necessary on Devils Lakes because a healthy, diverse native plant population is present.

### **Physical Control<sup>14</sup>**

In physical management, the environment of the plants is manipulated, which in turn acts upon the plants. Several physical techniques are commonly used: dredging, drawdown, benthic (lake bottom) barriers, and shading or light attenuation. Because they involve placing a structure on the bed of a lake and/or affect lake water level, a Chapter 30 or 31 DNR permit would be required.

**Dredging** removes accumulated bottom sediments that support plant growth. Dredging is usually not performed solely for aquatic plant management but to restore lakes that have been filled in with sediments, have excess nutrients, need deepening, or require removal of toxic substances (Peterson 1982). Lakes that are very shallow due to sedimentation tend to have excess plant growth. Dredging can form an area of the lake too deep for plants to grow, thus creating an area for open water use (Nichols 1984). By opening more diverse habitats and creating depth gradients, dredging may also create more diversity in the plant community (Nichols 1984). Results of dredging can be very long term. However, due to the cost, environmental impacts, and the problem of disposal, dredging should not be performed for aquatic plant management alone. It is best used as a lake remediation technique. Dredging is not suggested for the Devils Lake as part of the aquatic plant management plan.

**Benthic barriers** or other bottom-covering approaches are another physical management technique. The basic idea is to cover the plants with a layer of a growth-inhibiting substance. Many materials have been used, including sheets or screens of organic, inorganic, and synthetic materials; sediments such as dredge sediment, sand, silt or clay; fly ash; and various combinations of the above materials (Cooke 1980b; Nichols 1974; Perkins 1984; Truelson 1984). The problem with using sediments is that new plants establish on top of the added layer (Engel and Nichols 1984). The problem with synthetic sheeting is that the gasses evolved from plant and sediment decomposition collect underneath and lift the barrier (Gunnison and Barko 1992). Benthic barriers will typically kill the plants under them within 1 to 2 months, after which time they may be removed (Engel 1984). Sheet color is relatively unimportant; opaque (particularly black) barriers work best, but even clear plastic barriers will work effectively (Carter et al. 1994). Sites from which barriers are removed will be rapidly re-colonized (Eichler et al. 1995). Synthetic barriers, if left in place for multi-year control, will eventually become

sediment-covered and will allow colonization by plants. Benthic barriers may be best suited to small, high-intensity use areas such as docks, boat launch areas, and swimming areas. However, they are too expensive to use over widespread areas, and heavily affect benthic communities by removing fish and invertebrate habitat. A WDNR permit would be required for a benthic barrier.

**Shading or light attenuation** reduces the light plants need to grow. Shading has been achieved by fertilization to produce algal growth, by application of natural or synthetic dyes, shading fabric, or covers, and by establishing shade trees (Dawson 1981, 1986; Dawson and Hallows 1983; Dawson and Kern-Hansen 1978; Jorga et al. 1982; Martin and Martin 1992; Nichols 1974). During natural or cultural eutrophication, algae growth alone can shade aquatic plants (Jones et al. 1983). Although light manipulation techniques may be useful for narrow streams or small ponds, in general these techniques are of only limited applicability. Physical control is not currently proposed for management of aquatic plants in Devils Lake.

#### Herbicide and Algaecide Treatments

Herbicides are chemicals used to kill plant tissue. Currently, no product can be labeled for aquatic use if it poses more than a one in a million chance of causing significant damage to human health, the environment, or wildlife resources. In addition, it may not show evidence of biomagnification, bioavailability, or persistence in the environment (Joyce, 1991). Thus, there are a limited number of active ingredients that are assured to be safe for aquatic use (Madsen, 2000).

An important caveat is that these products are considered safe when used according to the label. The U.S. Environmental Protection Agency (EPA)-approved label gives guidelines protecting the health of the environment, the humans using that environment, and the applicators of the herbicide. WDNR permits under Chapter NR 107 are required for herbicide application.

General descriptions of herbicide classes are included below.<sup>16</sup>

#### *Contact herbicides*<sup>17</sup>

Contact herbicides act quickly and are generally lethal to all plant cells that they contact. Because of this rapid action, or other physiological reasons, they do not move extensively within the plant and are effective only where they contact plants directly. They are generally more effective on annuals (plants that complete their life cycle in a single year). Perennial plants (plants that persist from year to year) can be defoliated by contact herbicides, but they quickly resprout from unaffected plant parts. Submersed aquatic plants that are in contact with sufficient concentrations of the herbicide in the water for long enough periods of time are affected, but regrowth occurs from unaffected plant parts, especially plant parts that are protected beneath the sediment. Because the entire plant is not killed by contact herbicides, retreatment is necessary, sometimes two or three times per year. **Endothall, diquat, and copper** are contact aquatic herbicides.

### *Systemic herbicides*

Systemic herbicides are absorbed into the living portion of the plant and move within the plant. Different systemic herbicides are absorbed to varying degrees by different plant parts. Systemic herbicides that are absorbed by plant roots are referred to as soil active herbicides and those that are absorbed by leaves are referred to as foliar active herbicides. **2,4-D, dichlobenil, fluridone, and glyphosate** are systemic aquatic herbicides. When applied correctly, systemic herbicides act slowly in comparison to contact herbicides. They must move to the part of the plant where their site of action is. Systemic herbicides are generally more effective for controlling perennial and woody plants than contact herbicides. Systemic herbicides also generally have more selectivity than contact herbicides.

### *Broad spectrum herbicides*

Broad spectrum (sometimes referred to as nonselective) herbicides are those that are used to control all or most species of vegetation. This type of herbicide is often used for total vegetation control in areas such as equipment yards and substations where bare ground is preferred. **Glyphosate** is an example of a broad spectrum aquatic herbicide. **Diquat, endothall, and fluridone** are used as broad spectrum aquatic herbicides, but can also be used selectively under certain circumstances.

### *Selective herbicides*

Selective herbicides are those that are used to control certain plants but not others. Herbicide selectivity is based upon the relative susceptibility or response of a plant to an herbicide. Many related physical and biological factors can contribute to a plant's susceptibility to an herbicide. Physical factors that contribute to selectivity include herbicide placement, formulation, timing, and rate of application. Biological factors that affect herbicide selectivity include physiological factors, morphological factors, and stage of plant growth.

### *Environmental considerations*

Aquatic communities consist of aquatic plants including macrophytes (large plants) and phytoplankton (free floating algae), invertebrate animals (such as insects and clams), fish, birds, and mammals (such as muskrats and otters). All of these organisms are interrelated in the community. Organisms in the community require a certain set of physical and chemical conditions to exist such as nutrient requirements, oxygen, light, and space. Aquatic weed control operations can affect one or more of the organisms in the community, and in turn affect other organisms or weed control operations. These operations can also impact water chemistry which may result in further implications for aquatic organisms.

### *Copper*

Copper is a naturally occurring element that is essential at low concentrations for plant growth. It does not break down in the environment, but it forms insoluble compounds with other elements and is bound to charged particles in the water. It rapidly disappears from water after application as an herbicide. Because it is not broken down, it can accumulate in bottom sediments after repeated or high rates of application. Accumulation rarely reaches levels that are toxic to organisms or significantly above background concentrations in the sediment.

### *2,4-D*

2,4-D photodegrades on leaf surfaces after being applied to leaves, and is broken down by microbial degradation in water and in sediments. Complete decomposition usually takes about 3 weeks in water but can be as short as 1 week. 2,4-D breaks down into naturally occurring compounds.

### *Diquat*

When applied to enclosed ponds for submersed weed control, diquat is rarely found longer than 10 days after application and is often below detection levels 3 days after application. The most important reason for the rapid disappearance of diquat from water is that it is rapidly taken up by aquatic vegetation and bound tightly to particles in the water and bottom sediments. When bound to certain types of clay particles, diquat is not biologically available. When diquat is bound to organic matter, it can be slowly degraded by microorganisms. When diquat is applied foliarly, it is degraded to some extent on the leaf surfaces by photodegradation. Because it is bound in the plant tissue, a proportion is probably degraded by microorganisms as the plant tissue decays.

### *Endothall*

Like 2,4-D, endothall is rapidly and completely broken down into naturally occurring compounds by microorganisms. The by-products of endothall dissipation are carbon dioxide and water. Complete breakdown usually occurs in about 2 weeks in water and 1 week in bottom sediments.

### *Fluridone*

Dissipation of fluridone from water occurs mainly by photodegradation. Metabolism by tolerant organisms and microbial breakdown also occurs, and microbial breakdown is probably the most important method of breakdown in bottom sediments. The rate of breakdown of fluridone is variable and may be related to time of application. Applications made in the fall or winter, when the sun's rays are less direct and days are shorter, result in longer half-lives. Fluridone usually disappears from pondwater after about 3 months but can remain up to 9 months. It may remain in bottom sediment between 4 months and 1 year.

### *Glyphosate*

Glyphosate is not applied directly to water for weed control, but when it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive. Glyphosate is broken down into carbon dioxide, water, nitrogen, and phosphorus over a period of several months.

### *Copper Compounds*

Copper-based compounds are generally used to treat filamentous algae. Common chemicals used are copper sulfate and Cutrine Plus, a chelated copper algaecide.

## Herbicide Use to Manage Invasive Species

### *Eurasian water milfoil*

The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies the following herbicides for control of Eurasian water milfoil: 2,4-D, diquat, endothall, All of these herbicides with the

exception of diquat are available in both granular and liquid formulations. It is possible to target invasive species by using the appropriate herbicide and timing. The herbicide 2,4-D is most commonly used to treat EWM in Wisconsin. This herbicide kills dicots including native aquatic species such as northern water milfoil, coontail, water lilies, spatterdock, and watershield. Early season (April to May) treatment of Eurasian water milfoil is recommended to limit the impact on native aquatic plant populations because EWM tends to grow before native aquatic plants.

Granular herbicide formulations are more expensive than liquid formulations (per active ingredient). However, granular formulations release the active ingredient over a longer period of time. Granular formulations, therefore, may be more suited to situations where herbicide exposure time will likely be limited, as is the case in small bands or blocks. In large, shallow lakes with widespread EWM, a whole lake treatment with a low rate of liquid herbicide may be most cost effective because exposure time is greater. Factors that affect exposure time are size and configuration of treatment area, water flow, and wind.

Application rates for liquid and granular formulations are not interchangeable. A rate of 1 to 1.5 mg/L 2,4-D applied as a liquid is a middle rate that will require a contact time of 36 to 48 hours. Application rates recommended for Navigate (granular 2,4-D) are 100 pounds per acre for depths of 0 to 5 feet, 150 pounds per acre for 5 to 10 feet, and 200 pounds per acre for depths greater than 10 feet.

#### *Curly leaf pondweed*

The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies three herbicides for control of curly leaf pondweed: diquat, endothall, and fluridone. Fluridone requires exposure of 30 to 60 days making it infeasible to target a discrete area in a lake system. The other herbicides act more rapidly. Herbicide labels provide water use restriction following treatment. Diquat (Reward) has the following use restrictions: drinking water 1-3 days, swimming and fish consumption 0 days. Endothall (Aquathol K) has the following use restrictions: drinking water 7 – 25 days, swimming 0 days, fish consumption 3 days.

Studies have demonstrated that curly leaf pondweed can be controlled with Aquathol K (a formulation of endothall) in 50 to 60 degree F water, and that treatments of CLP this early in its life cycle can prevent turion formation.<sup>17</sup> Since curly leaf pondweed is actively growing at these low water temperatures and many native aquatic plants are still dormant, early season treatment selectively targets curly leaf pondweed. Staff from the Minnesota Department of Natural Resources and the U.S Army Engineer Research and Development Center is conducting trials of this method.

Because the dosage is at lower rates than the dosage recommended on the label, a greater herbicide residence time is necessary. To prevent drift of herbicide and allow greater contact time, application in shallow bays is likely to be most effective. Herbicide applied to a narrow band of vegetation along the shoreline is likely to drift, rapidly decrease in concentration, and be rendered ineffective.<sup>5</sup>

**Burnett County Land and Water Conservation (LWCD)<sup>5</sup>**

Burnett County assists the Devils Lake Association in management of aquatic invasive species. They have individuals available to assist with the following tasks:

- Conduct watercraft inspection at public access points.
- Complete in-lake monitoring for EWM and other invasive species.
- Carry out public outreach and education events related to invasive species including lake meetings, fishing tournaments, county fairs, and local festivals.
- Post signs at boat landings and other public lake access points to inform residents of the new Burnett County “do not transport” ordinance.
- Train local lake residents and others to monitor their own boat landings as part of the WDNR “Clean Boats, Clean Waters” (CBCW) program.
- Train lake residents and others in Citizen Lake Monitoring, which includes CBCW, Secchi, Water Chemistry, and Aquatic Invasive Species identification.
- Assist in “rapid response” actions to identify and respond to new invasive species infestations reported by the public.
- Conduct integrated pest management for purple loosestrife control including beetle rearing and release, and offer assistance with clipping and herbicide application for individual infestations.

**In-lake monitoring** focuses on searching for potential establishment of Eurasian water milfoil and other aquatic invasive species at boat landings and other areas with high public use. Grab samples are taken at regular intervals at these high public use areas and at random locations around the littoral zone. All Burnett County boat landings are monitored each year.

**Workshops and trainings** include Clean Boats, Clean Waters training, plant identification, and whole lake monitoring workshops. Staff generally travels to local lakes to encourage participation and provide more focused training.

**The Rapid Response Plans** will involve a team of resource professionals from various agencies who can directly assist the lake organization in managing newly discovered invasive species and develop a plan to restore the native plant community. This Rapid Response SWAT team will assist with identifying appropriate management methods, coordinating and, in some instances, carrying out control measures, grant writing, and completing or hiring consultants to complete aquatic plant surveys and management plans.

## **Aquatic Plant Management Plan Goals & Strategies**

### **Overall Purpose**

This section of the plan lists goals for aquatic plant management for Devils Lake. It also presents a detailed strategy of actions that will be used to reach Aquatic Plant Management Plan goals. Educational strategies that outline audience, messages, and methods are included under each goal.

### Plan Goals and Strategies

### **Overall Purpose**

This section of the plan lists goals for aquatic plant management for Devils Lake. It also presents a detailed strategy of actions that will be used to reach Aquatic Plant Management Plan goals. Educational strategies that outline audience, messages, and methods are included under each goal.<sup>37</sup>

### **Plan Goals**

The APM committee established five equally important goals and has listed them below:

1. Prevent the introduction and spread of aquatic invasive species.
2. Enhance and maintain the diverse populations of native aquatic plants.
3. Maintain and improve water quality conditions.
4. Educate the Devils Lake community regarding aquatic plant management, management strategies found in the plan, erosion control and appropriate plant management actions.

**Goal 1:** Prevent the introduction and spread of aquatic invasive species

### ***Objectives***

- A. 100% of boaters inspect, clean, and drain boats, trailers and equipment.
- B. 100% enforcement of Burnett County's Do Not Transport Ordinance.
- C. Devils Lake is monitored regularly for AIS introduction.
- D. Devils Lake Association is ready to rapidly respond to identified AIS in the lake.

### ***Actions***

1. Install and Maintain I-Lids cameras at each landing. (OBJ A,B,C)

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Templates taken from Harmony Environmental. *Aquatic Plant Management Plan. Yellow and Little Yellow Lakes, Burnett County, Wisconsin.* June 2009.



**Table 11: Estimated Cost of Installation and Maintenance of I-LIDS Camera.**

| Description  | Unit Cost | Units | 2015 | 2016 | 2017 |
|--|-----------|-------|------|------|------|
| <b>Initial Costs</b>   |           |       |      |      |      |
| I-LIDS (housing, electronics, mast, sign, solar panel/controller, batteries)   | 6500      | 1     | 6500 | 0    | 0    |
| Audio message option   | 400       | 1     | 400  |      |      |
| Per site plan design and permit application  | 200       | 1     | 200  |      |      |
| Installation of base I-LIDS (est 4 hours). Includes one trip to install and train association personnel.                                   | 480       | 1     | 480  |      |      |
| <b>Subtotal</b>  |           |       | 7580 |      |      |
| <b>Annual Costs (6 month season)</b>   |           |       |      |      |      |
| Monthly I-LIDS Operation (Video storage, Website access, remote maintenance, network monitoring, 200 video/ month review, monthly reports) | 200       | 6     | 1200 | 1200 | 1200 |
| Monthly Networking Cost for Verizon 4G (limited to 5GB per month/ 6 month season)  | 50        | 6     | 300  | 300  | 300  |
| Removal, storage, reinstall  |           |       | 400  | 400  | 400  |
| <b>Subtotal</b>  |           |       | 1900 | 1900 | 1900 |
| <b>Options</b>   |           |       |      |      |      |
| Additional Video Review (per 5,000 videos)   | 425       | 1     | 425  | 425  | 425  |
| LED light  | 400       | 0     | 0    |      |      |
| Extra Footing  | 500       | 0     | 0    |      |      |
| <b>Total</b>   |           |       | 9905 | 2325 | 2325 |

2. Conduct Clean Boats Clean Waters monitoring and education at the boat landing using paid and/or volunteer staff. (OBJ A,C)
3. Work with the Burnett County Sheriff’s Department to encourage increased enforcement and potentially increased fines for the Do Not Transport Ordinance. (OBJ B)
4. Monitor boat landings and other areas with high potential for introduction of AIS. (OBJ A)
5. Train volunteer monitors to identify and monitor for aquatic invasive species. (Burnett County Land and Water Conservation Department will train volunteers with support from DLA.) (OBJ C)
6. Review and update the existing rapid response plan for Eurasian water milfoil found in Appendix D. (OBJ D)
7. Provide information to the Devils Lake community so they can identify purple loosestrife (PL), Curly leaf pondweed (CLP) and Eurasian water milfoil (EWM) and they know who to contact if they have a suspected plant. (Burnett County LWCD will provide volunteer training for plant identification. Burnett County AIS coordinator and lake association AIS representative will provide identification assistance.) (OBJ B)

8. Monitor Devils Lake for PL growth each year. (Volunteers) (OBJ B)
9. Cut and spray individual PL plants where identification is confirmed. (Volunteers) (OBJ A and B)
10. Note each area where PL is sprayed and monitor subsequent years. (Volunteers) (OBJ A)
11. Conduct a Point Intercept survey every two years to monitor for CLP, EWM and other aquatic invasive species. (OBJ C)
12. Consider viable control efforts for any invasive species detected. (OBJ C)

**Goal 2:** Enhance and maintain the diverse populations of native aquatic plants.

***Objectives***

- A. Implement strict adherence with treatment standards and monitoring methods prior to and following herbicide treatment.
- B. Prevent removal of native plants using herbicides, with special consideration to wild rice beds.
- C. Increase Devils Lake community's understanding of the role and importance of aquatic plants and their impacts on them.

**Discussion**

The plant community in Devils Lake is very diverse and extensive. It is important to understand that these plants play a very important role in the lake ecosystem. Aquatic plants in the lake provide habitat for a diverse fish population. They also provide protection from shoreline erosion. Removing native plants could lead to adverse effects in the lakes. Healthy native plant populations prevent colonization by invasive plants. Erosion and runoff from waterfront property may alter sediment characteristics encouraging spread of invasive plants. Boating disturbance near the shoreline can remove aquatic plants and the valuable functions they provide. Boating disturbance near shore also creates sediment disturbance and the release of excess phosphorus, which can lead to excess algal blooms.

***Actions***

1. Consider alternative methods for removing native plants, other than using herbicide treatment, for individual access corridors. (OBJ B)
2. Conduct a point intercept survey of the lake every five to ten years, or as needed. (OBJ C)
3. Update the aquatic plant management plan every five to ten years, or as needed. (OBJ A, B and C)
4. Educational activities are detailed in the discussion for Goal 5.

**Goal 3:** Maintain and improve water quality conditions.

***Objectives***

- A. Continue to sample and record both water samples and Secchi readings to ensure water quality.
- B.** Encourage lake residents to restore and preserve shoreline buffers of native vegetation.

**Messages**

- 1. Shoreline buffers protect water quality and provide fish and wildlife habitat.
  - 2. Describe ways to restore shoreline buffers (natural recovery, stop mowing, plant natives).
  - 3. Cost sharing for restoration shoreline buffers is available from Burnett County.
  - 4. Describe the Burnett County shoreline buffer requirements and how to report violations of these requirements.
  - 5. Highlight good examples of shoreline buffers on private waterfront property.
- C. Reduce phosphorus and sediment loads from immediate watershed<sup>19</sup>.
- a. Maintaining native vegetation along shorelines as buffer areas
  - b. Minimizing activities that result in erosion
  - c. Reducing the amount of fertilizer used on lawns
  - d. Using only phosphorus-free fertilizer when possible
  - e. Fixing leaking septic systems
  - f. Using only phosphorus-free detergents in dishwashing machines
- D. Encourage Riparian land owners to adopt and implement storm water runoff controls for existing structures and all new constructions.

**Adaptive Management Approach**

Devils Lake has a relatively small watershed draining to it and as a result, the impacts that are most controllable at this time originate along the lake’s immediate shoreline. These sources include faulty septic systems, the use of phosphorus-containing fertilizers, shoreland areas that are maintained in an unnatural manner, and impervious surfaces. To reduce these impacts, the Devils Lake Association will conduct an educational initiative aimed at raising awareness among shoreland property owners concerning their impacts on the lake. This will include news letter articles and guest speakers at Association meetings. This Management Action will be completed in conjunction with the Shoreland Restoration Action listed below.

**Action Steps:**

- 1. Recruit facilitators
- 2. Facilitators summarize educational material collected from WDNR, UW-Extension, and County Land and Water Conservation sources for the creation of informative materials
- 3. Facilitators disperse materials to stakeholders

**Actions:**

1. Continue to monitor water quality through WDNR Citizens Lake Monitoring Network advanced water chemistry program and Secchi disk sampling and record data in the Surface Water Integrated Monitoring System (SWIMS) system. (OBJ A)
2. Incorporate the Adaptive Management Approach to reduce phosphorus and sediment loads from immediate watershed. (OBJ B, C)
3. Educate and assist Devils Lake community members in the restoration and preservation of shoreland buffers and shoreland vegetation. Continue implementation of shoreline owners' education program. (OBJ B, C, D)
4. Implement a yearly clean-up and encourage each Riparian Landowner to participate in this activity on a designated date and time. (OBJ A)

**Goal 4:** Educate the Devils Lake community regarding aquatic plant management, management strategies found in the plan and appropriate plant management actions.

**Audience: Devils Lake Community**

- A. All lake residents
- B. Business owners
- C. Lake users
- D. Residents who treated waterfront with herbicides in the past

**Messages**

1. Summary of APM plan, notice of public meeting, and how to get full APM plan
2. List of APM dos and don'ts
3. Contact list for APM include web resources
4. Native aquatic plant values
5. Limit impacts to native aquatic plants by traveling with no wake in shallow areas, using hand removal methods near docks and swimming areas, etc.
6. Explain procedure for individual corridor herbicide applications and describe conditions where herbicide treatment may be allowed.
7. Explain location and procedures for curly leaf pondweed herbicide treatment
8. Identification of CLP and methods for removal (include illustrations)
9. Identification of PL and methods for removal (include illustrations)
10. Identification of EWM and contact if suspected (include illustrations)
11. Locations of nearby lakes with EWM
12. Describe new potential invasive species and why they are a threat
13. Native plant identification

14. Inspect, clean, and drain boats and equipment.

15. Burnett County has a new ordinance that makes it illegal to transport aquatic plants on public roads.

**Methods**

- Summary of APM plan
- AIS education workshops for all lake users
- Improvements to signage at boat landings
- Updates to AIS handouts
- Newsletter articles
- Mailings to lake residents
- Develop and update Web site
- Clean Boats, clean Waters monitoring/education
- Annual meeting/special meetings
- Door-to-door distribution of information
- Plastic peel-off stickers for boats

| <b>Method</b>               | <b>Audience</b> | <b>Message</b> |
|-----------------------------|-----------------|----------------|
| APM plan summary            | A - D           | 1              |
| AIS workshops               | A – C           | 4, 8-15        |
| Signage                     | A – C           | 14, 15         |
| AIS handouts                | A – D           | 4, 6-15        |
| Newsletter articles         | A – B           | 1–15           |
| Mailings                    | A – B           | 1 –15          |
| Web site updates            | A – D           | 1 -15          |
| Clean Boats, Clean Waters   | C               | 8-11, 14, 15   |
| Annual and special meetings | A – B           | 1-15           |
| Door-to-door distribution   | A               | 4-15           |
| Plastic peel-off stickers   | A – C           | 14, 15         |

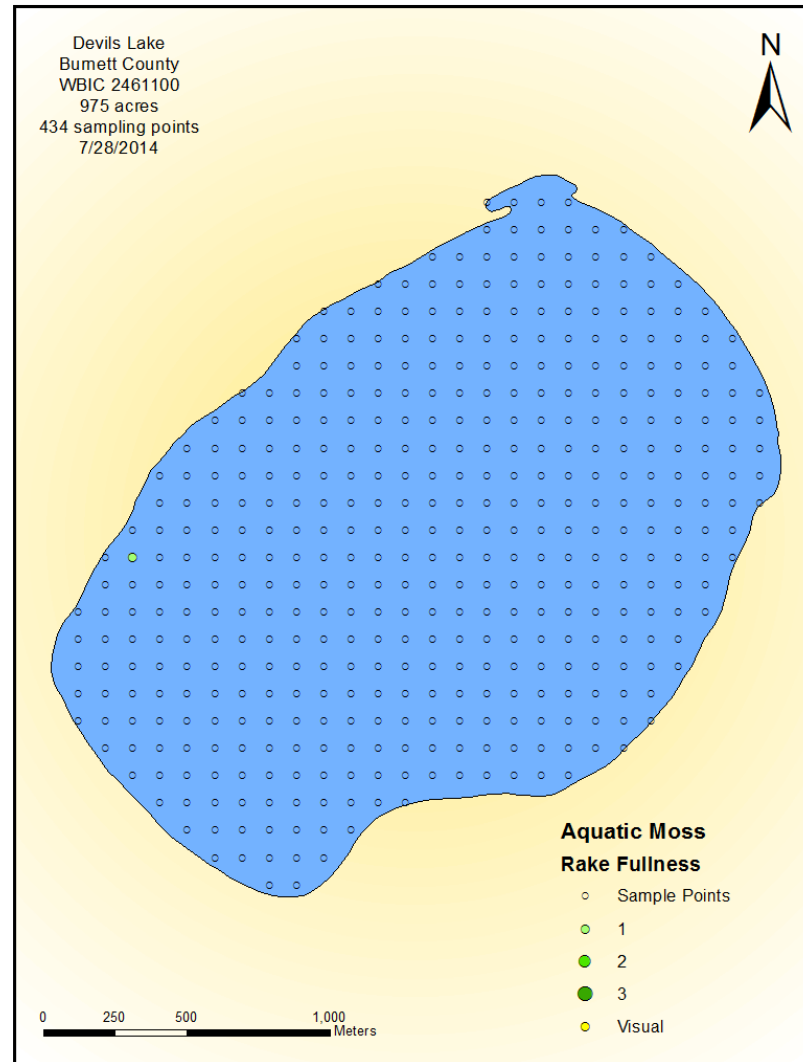
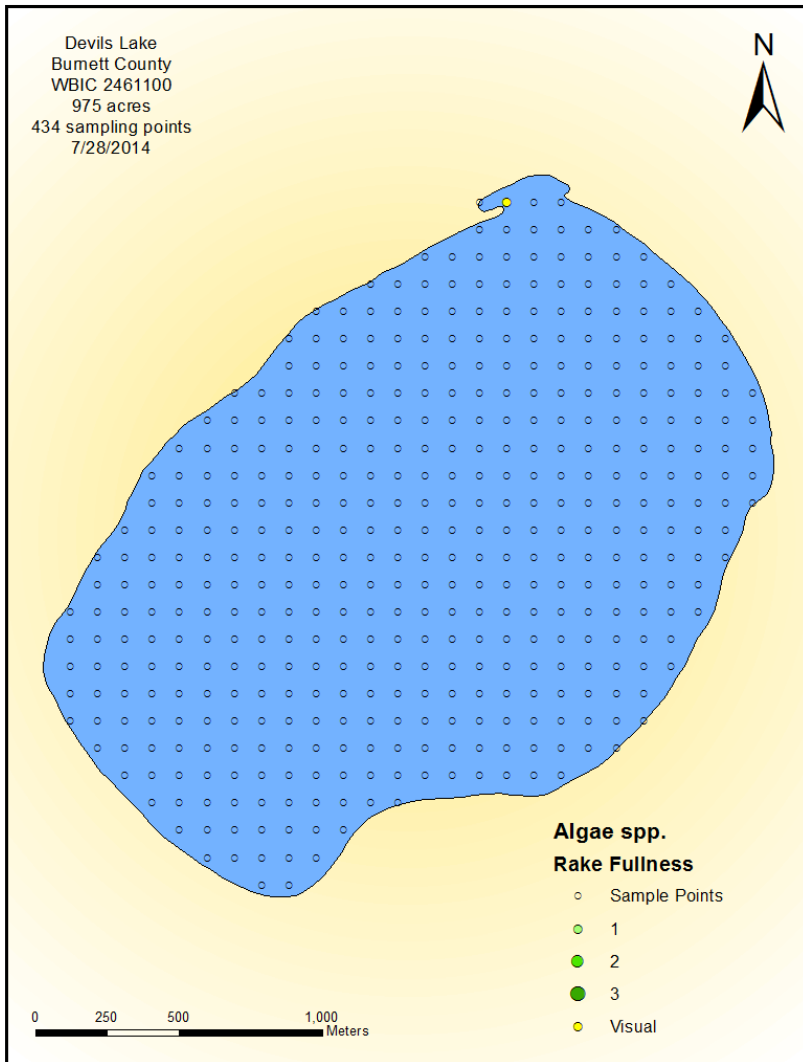
**Table 12: Implementation Plan**

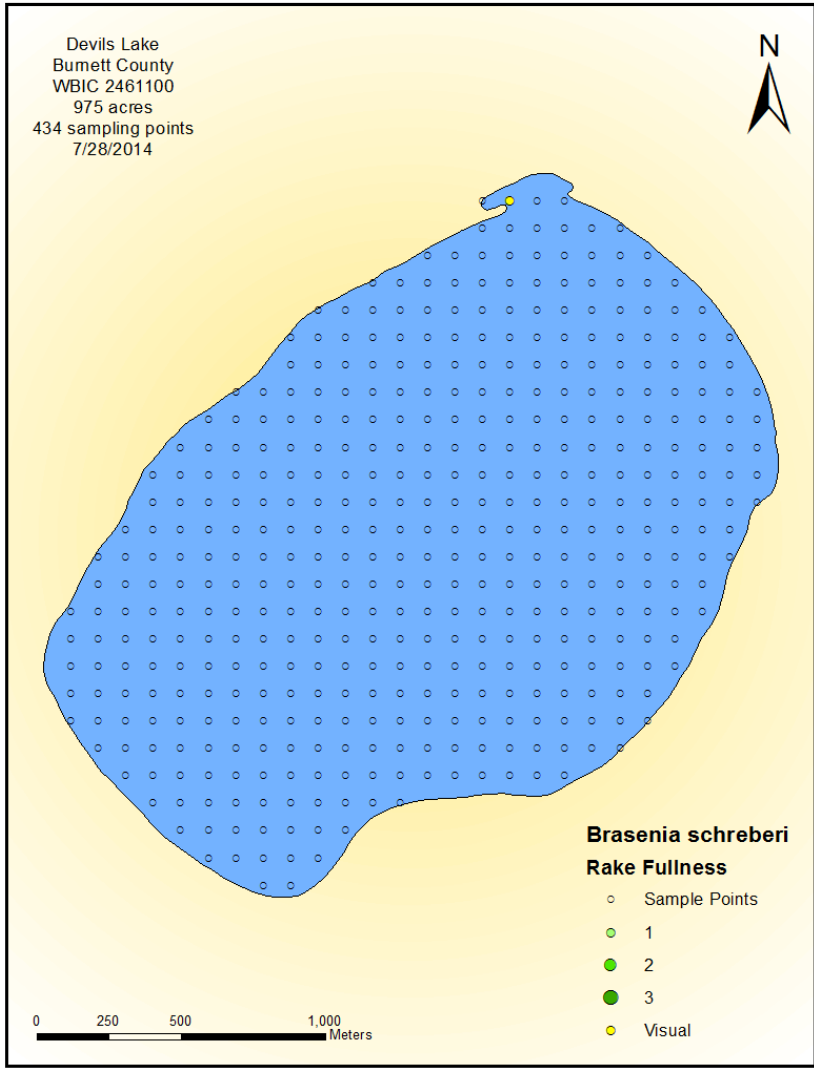
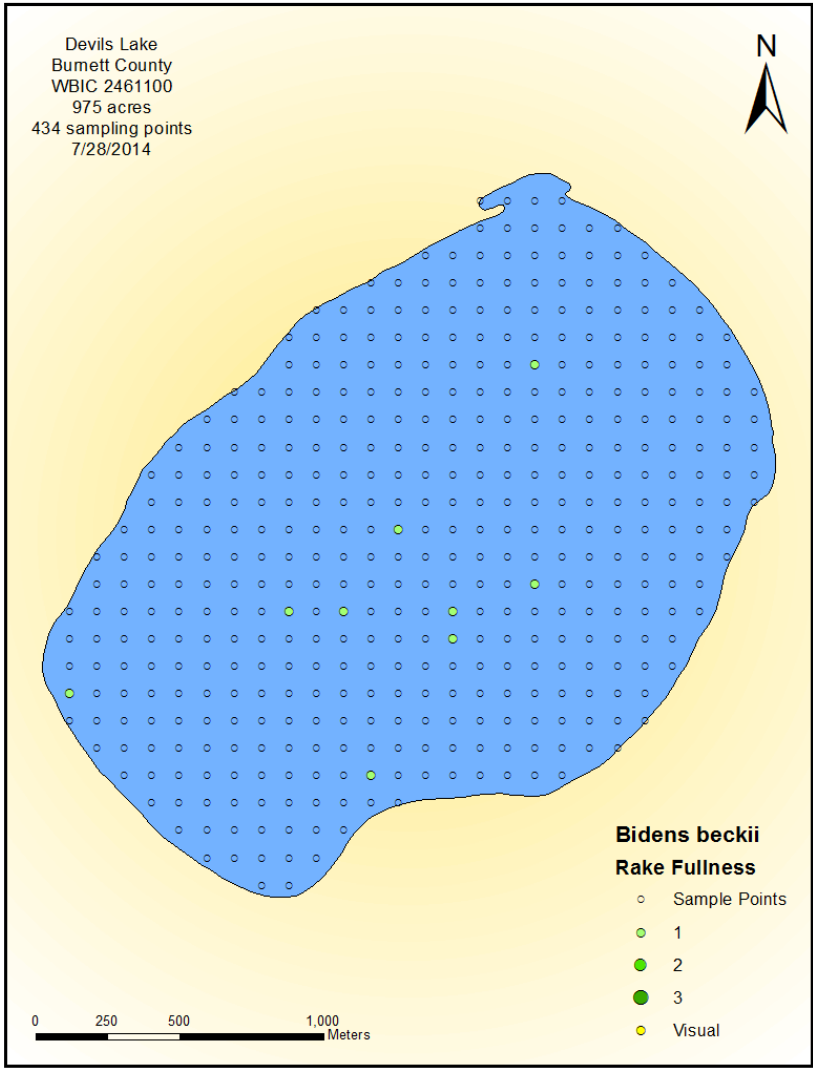
| Action Items   | Timeline     | Cost 2016 | Cost 2017 | Cost 2018 | Responsible Parties            |
|--|--------------|-----------|-----------|-----------|--------------------------------|
| <b>Prevent AIS Introduction</b>  |              |           |           |           |                                |
| Install I-LIDS (Environmental Sentry Protection, LLC)                                  | 2016         | \$9,905   |           |           | ESP LLC                        |
| Maintain I-Lids cameras at each landing  | 2016         | \$2,325   | \$2,325   | \$2,325   | DLA, ESP LLC                   |
| Identify and organize volunteer workers/employers for CBCW program                     | ongoing      | 10 hours  | 10 hours  | 10 hours  | DLA President                  |
| CBCW SWIMS Data Entry  | ongoing      | 15 hours  | 15 hours  | 15 hours  | DLA President                  |
| Increase enforcement of BC Do Not Transport Ordinance                                  | Ongoing      | 4 hours   | 4 hours   | 4 hours   | DLA, BC Sheriff Dept. and LWCD |
| Monitor boat landings CBCW   | Annually     | 180 hours | 180 hours | 180 hours | DLA, Burnett County LWCD       |
| Train Volunteer monitors in CLMN Clean Boats Clean Waters and Aquatic Invasive Species | As needed    | 10 hours  | 10 hours  | 10 hours  | Burnett County LWCD, DLA       |
| Rapid Response plan review   | Ongoing      | 3 hours   | 3 hours   | 3 hours   | DLA, Burnett County LWCD       |
| <b>AIS Reduction and Prevention</b>  |              |           |           |           |                                |
| Provide Identification information and encourage volunteer monitoring                  | May - August | 20 hours  | 20 hours  | 20 hours  | DLA AIS Committee, BC LWCD     |
| Monitor Lake for PL growth   | July/August  | 20 hours  | 20 hours  | 20 hours  | DLA/community                  |
| Cut and Spray plants as needed   | July/August  | \$100     | \$100     | \$100     | DLA/community                  |
| Track and monitor previously sprayed areas in previous years                           | Ongoing      | 20 hours  | 20 hours  | 20 hours  | DLA/community                  |

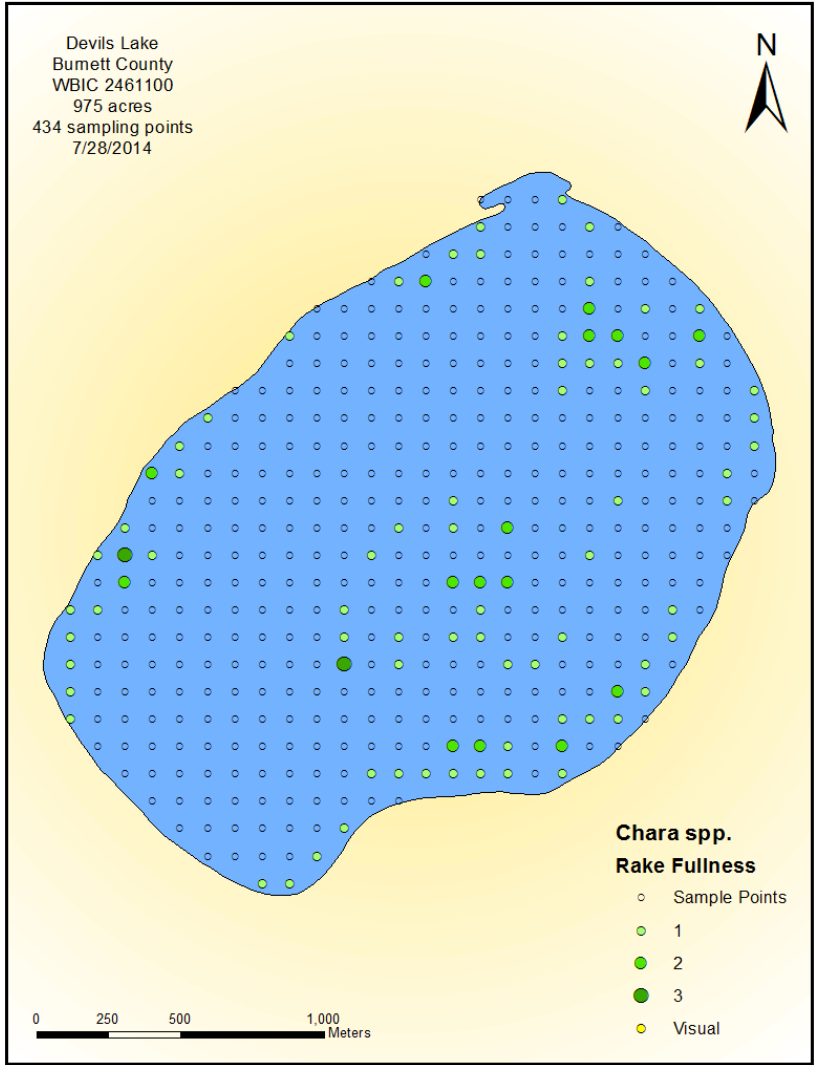
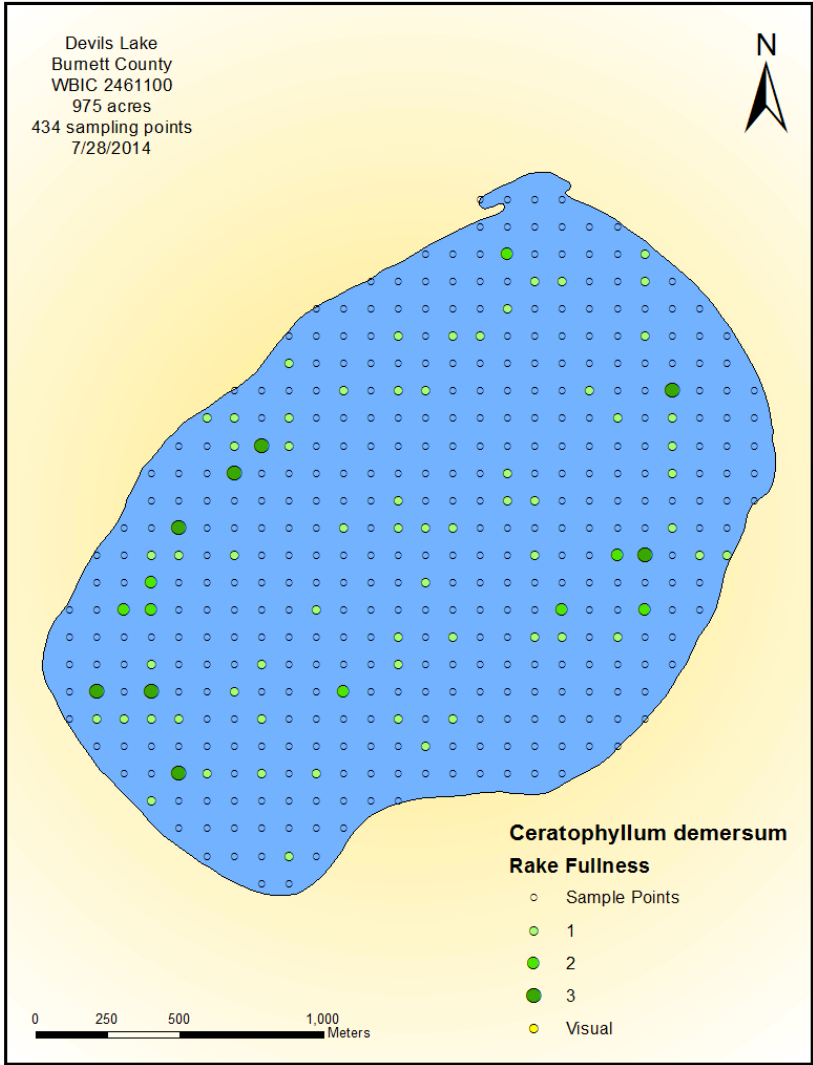
| Action Items   | Timeline  | Cost 2016    | Cost 2017    | Cost 2018    | Responsible Parties |
|--|-----------|--------------|--------------|--------------|---------------------|
| Conduct a Point Intercept survey every 2-3 years to monitor for Invasive Species   | Mid June  | TBD          |              |              | Burnett County LWCD |
| Consider if CLP control is warranted   | September | TBD          |              |              | DLA                 |
|  |           |              |              |              |                     |
| <b>Preserve Native Plants</b>  |           |              |              |              |                     |
| Conduct a point intercept survey of the lake   | 2019-2024 |              | \$8000       |              | DLA                 |
| Update APM plan  | 2019-2024 |              | \$8000       |              | DLA                 |
|  |           |              |              |              |                     |
| <b>Water Quality</b>   |           |              |              |              |                     |
| Water chemistry and Secchi sampling  | ongoing   | 25 hours     | 25 hours     | 25 hours     | DLA                 |
| Reduce phosphorus and sediment loads from immediate watershed  | Ongoing   | TBD          |              |              | DLA, BC LWCD        |
| Educate and assist Devils Lake community members in the restoration and preservation of shoreland buffers and shoreland vegetation | Ongoing   | TBD          |              |              | DLA, BC LWCD        |
| Continue implementation of shoreline owners' education program   | Ongoing   | TBD          |              |              | DLA, BC LWCD        |
|  |           |              |              |              |                     |
| <b>Educate Devils Lake Community</b>   |           |              |              |              |                     |
| AIS workshops  | Ongoing   | \$0          | \$0          | \$0          | BC LWCD             |
| AIS signage  | As needed | \$0          | \$0          | \$0          | BC LWCD             |
| Handouts, mailings, door-to door distribution  | Ongoing   | \$1000       | \$1000       | \$1000       | DLA                 |
| DLA newsletter articles  | Ongoing   | \$1000       | \$1000       | \$1000       | DLA                 |
| DLA Website updates  | Ongoing   | 30 hours/Vol | 30 hours/Vol | 30 hours/Vol | DLA                 |
| Annual and special meetings  | Ongoing   | \$200        | \$200        | \$200        | DLA                 |

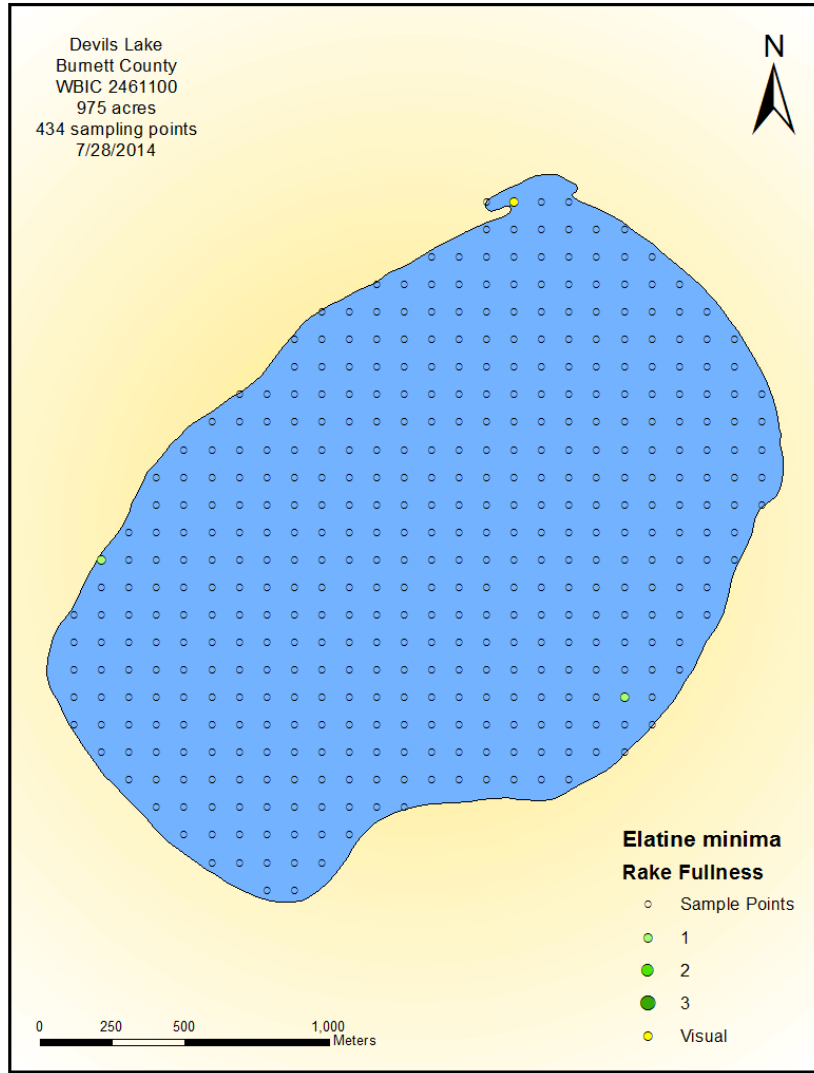
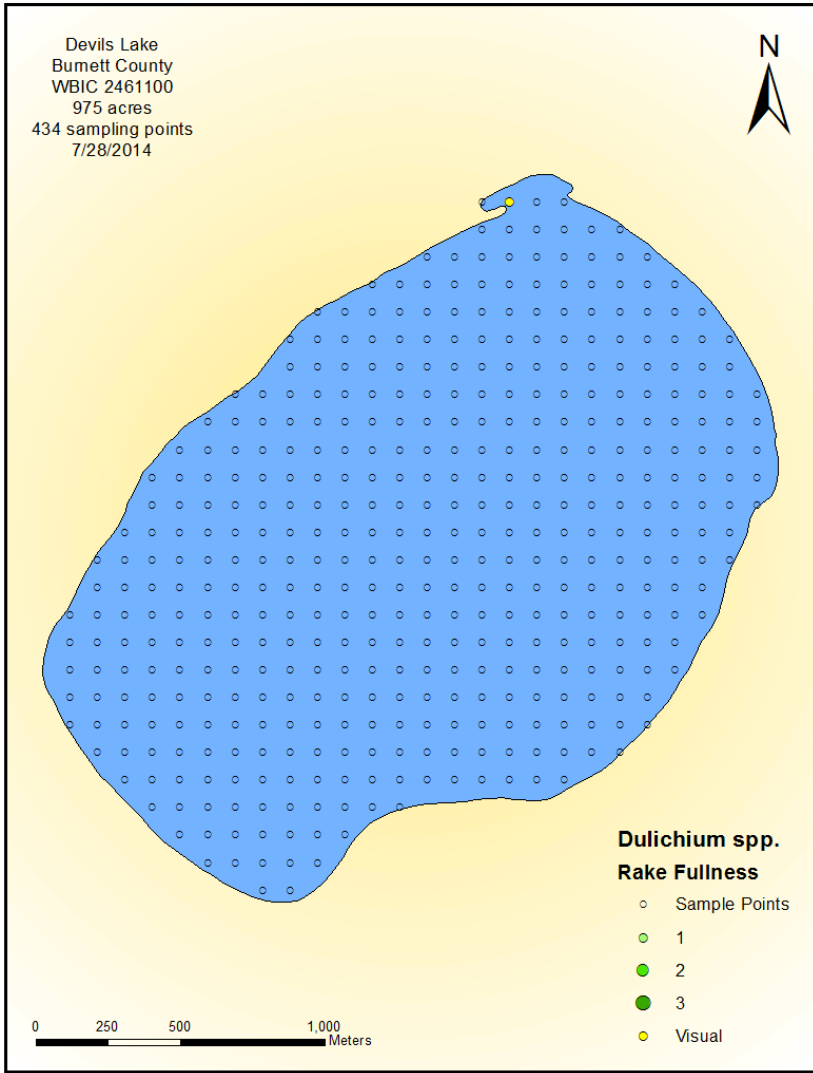
**Appendix A**  
**Aquatic Plants Maps**

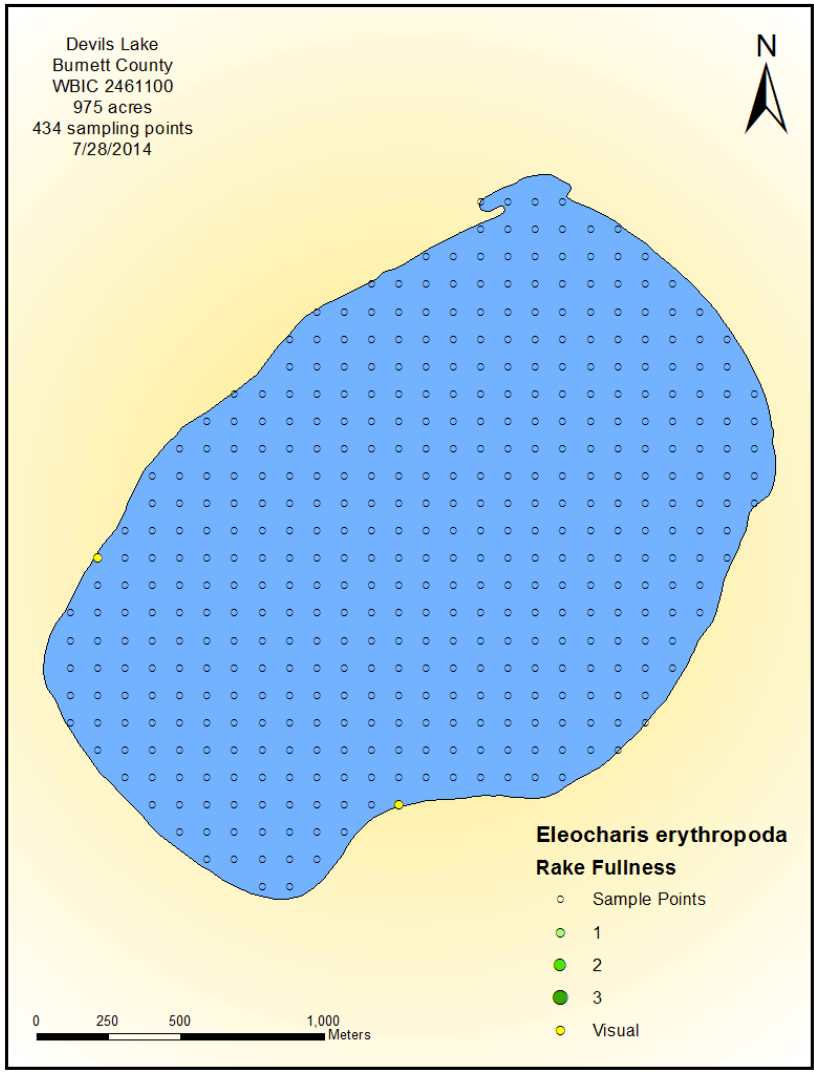
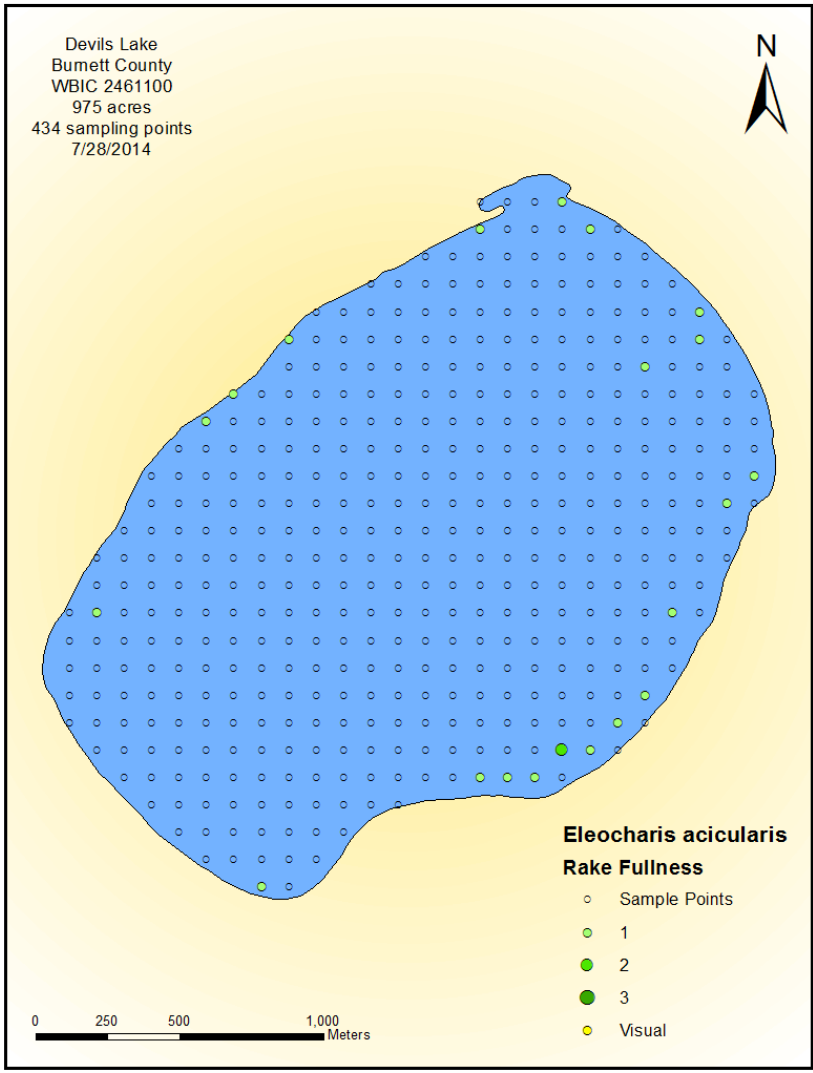


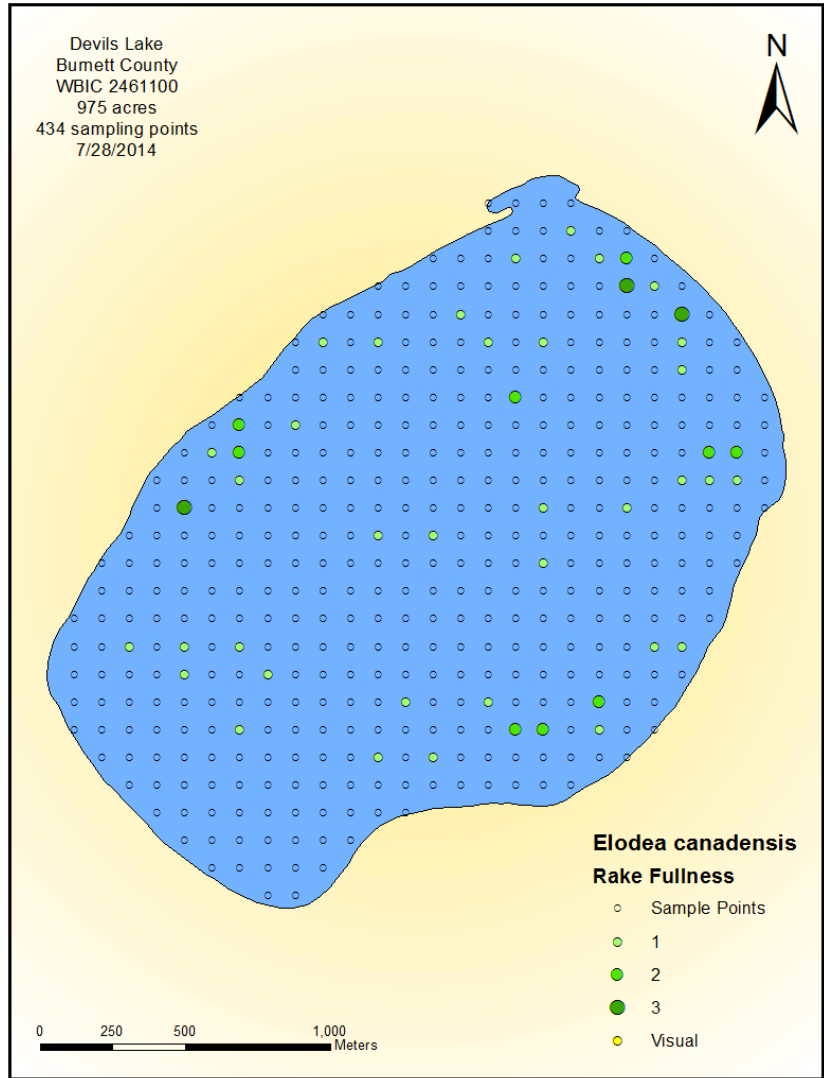
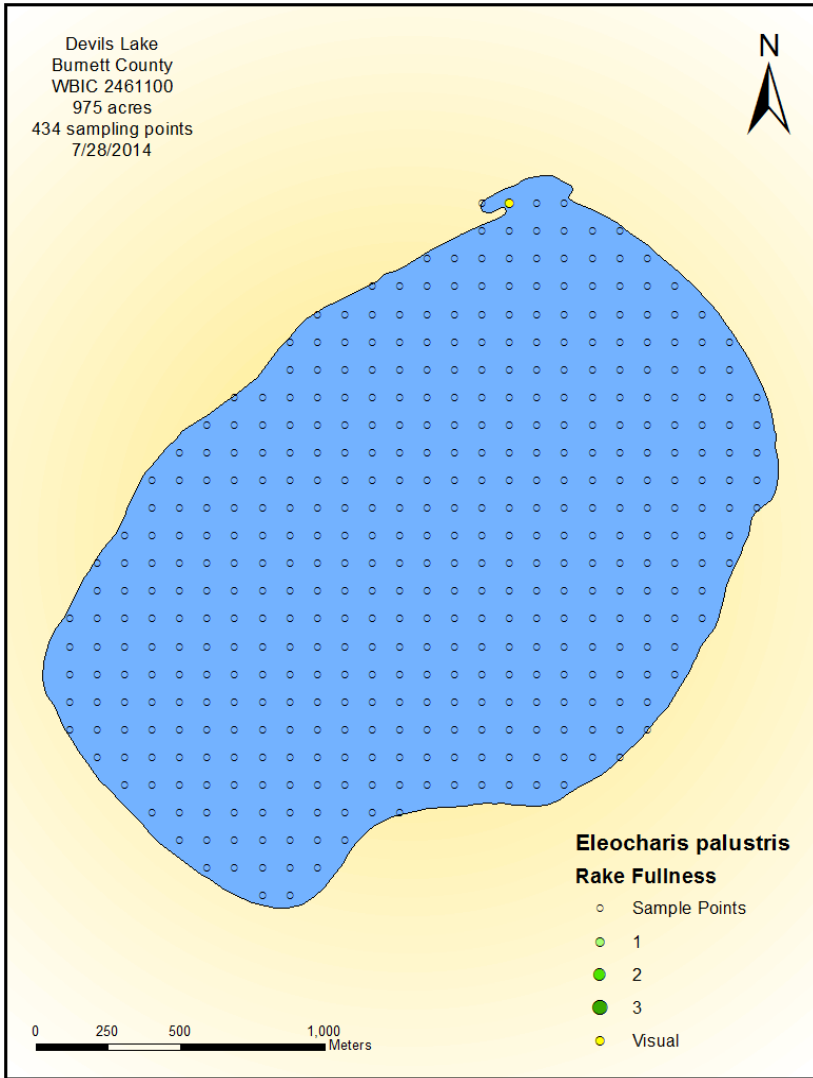


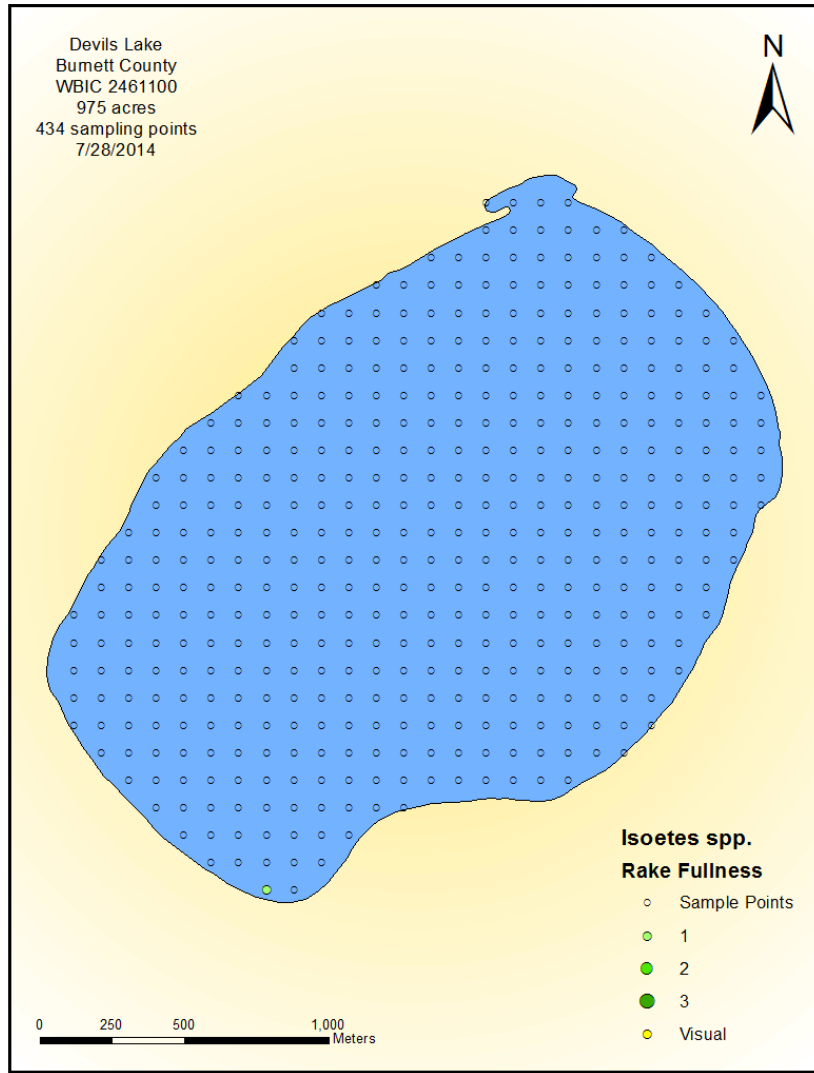
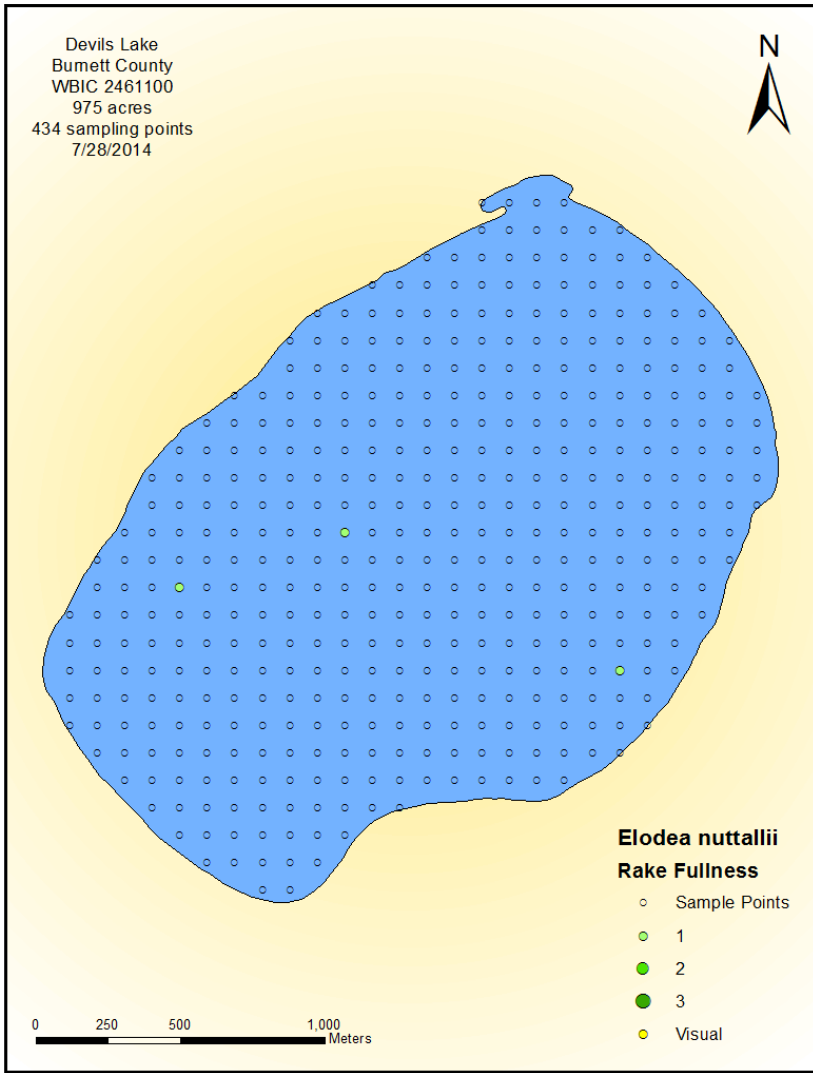


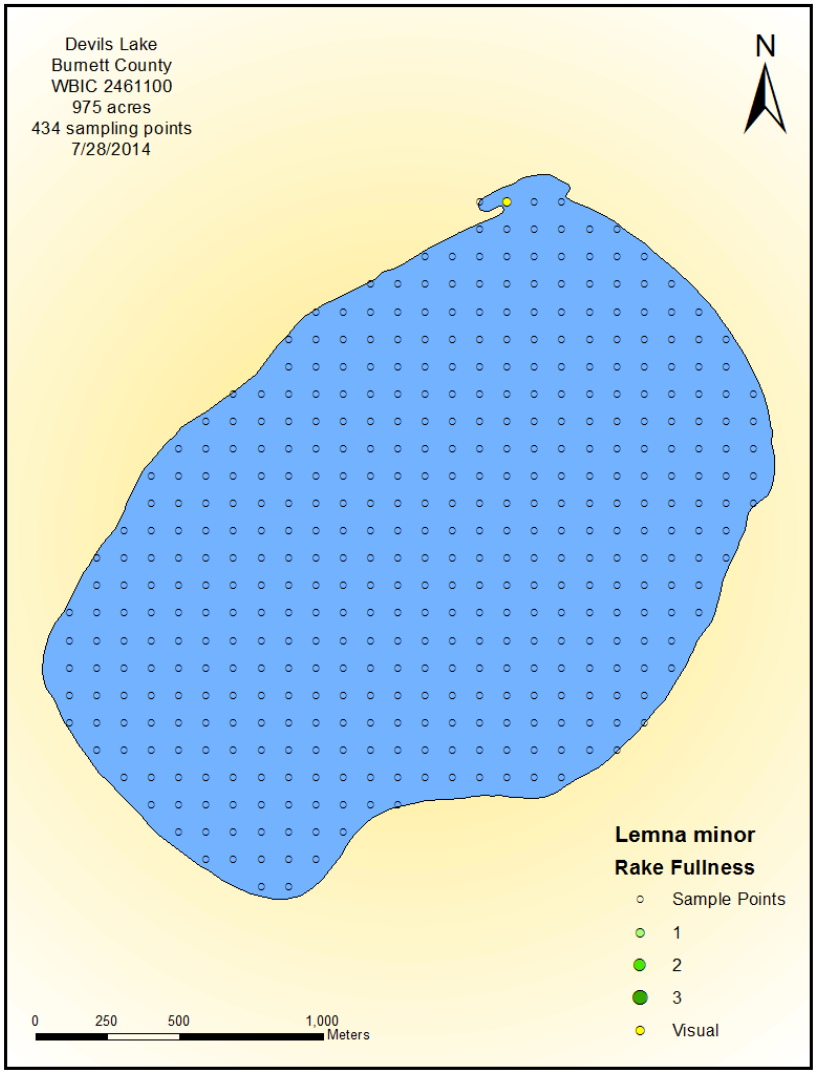
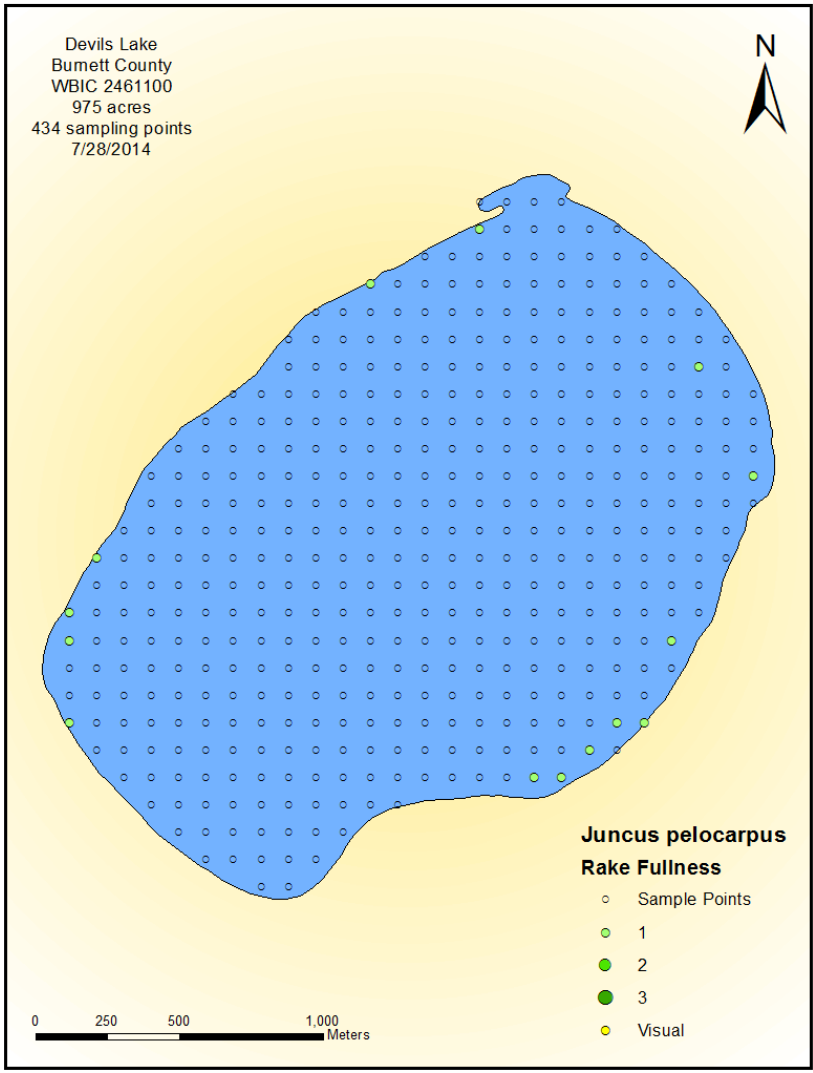




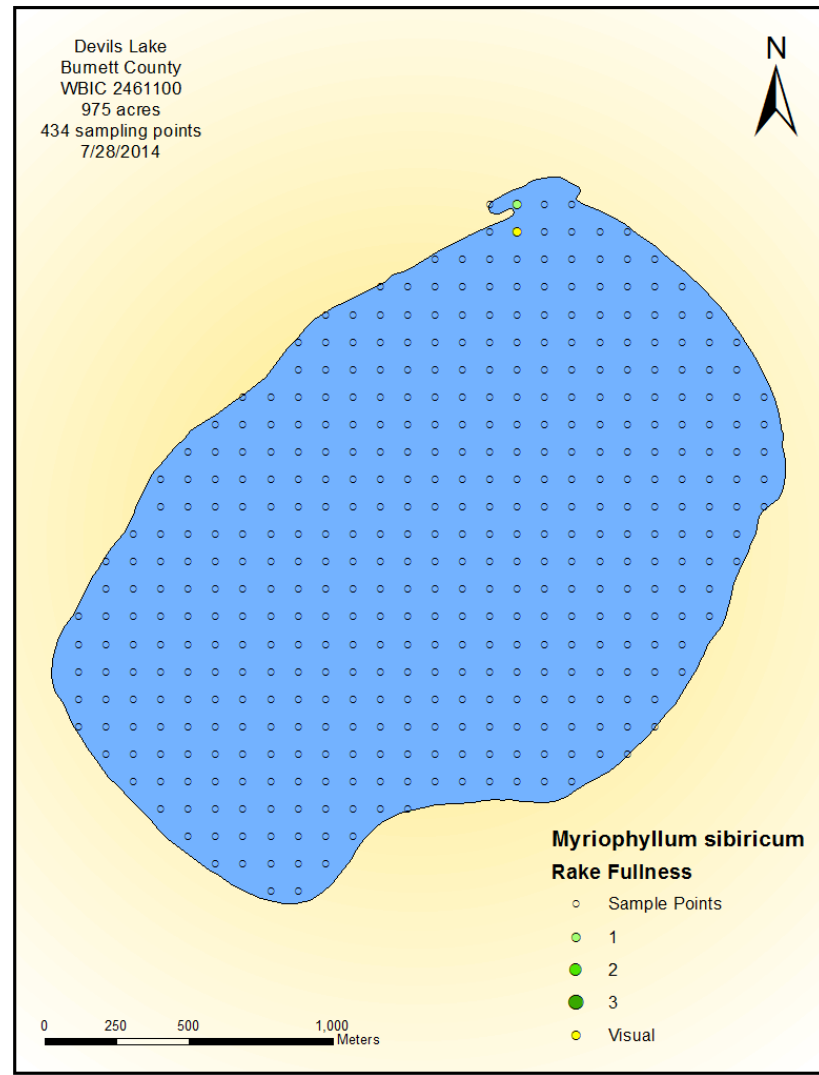
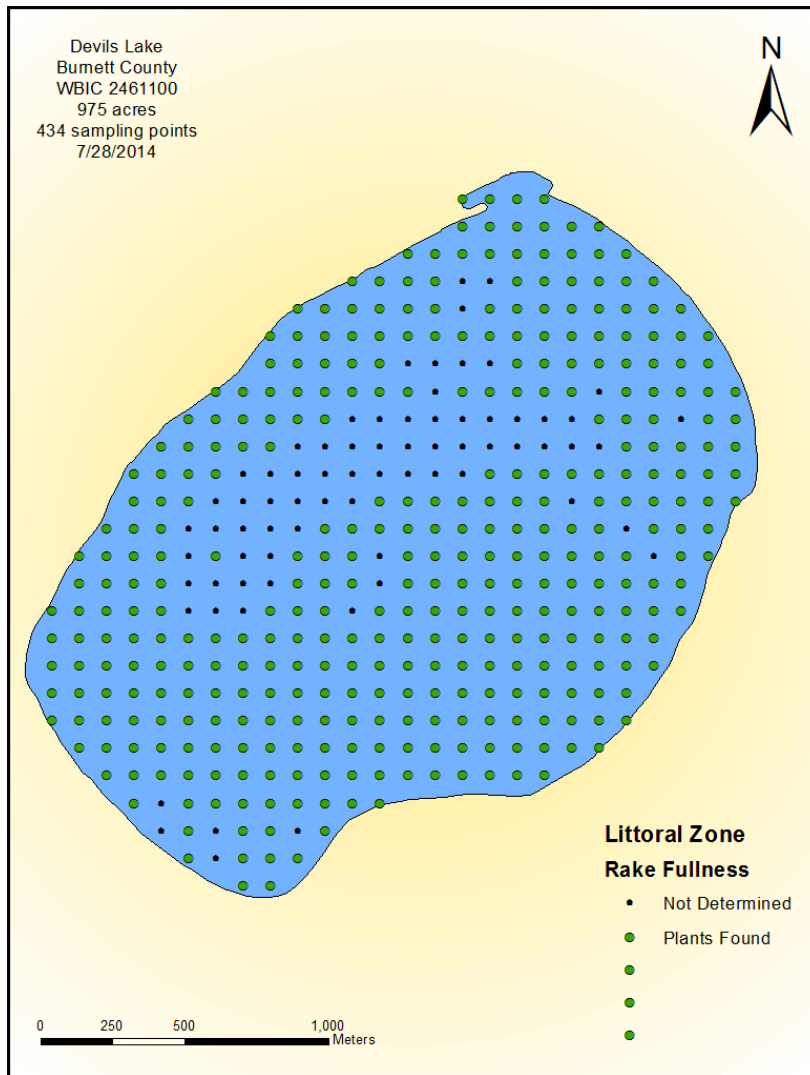


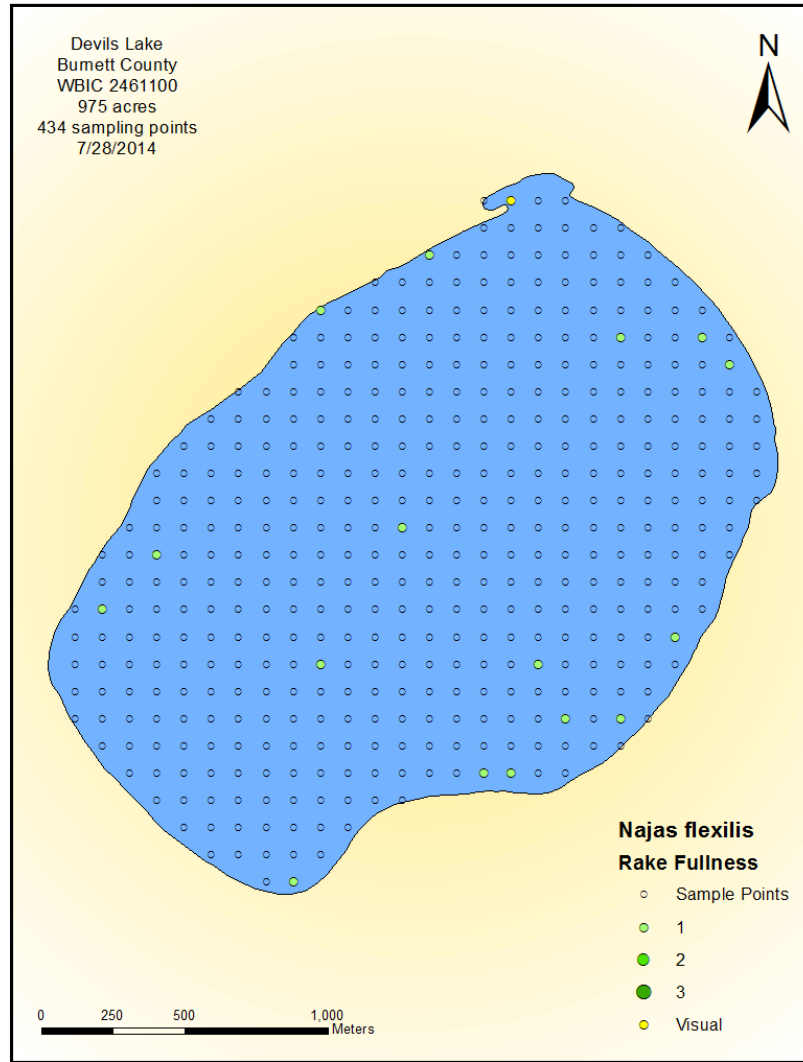
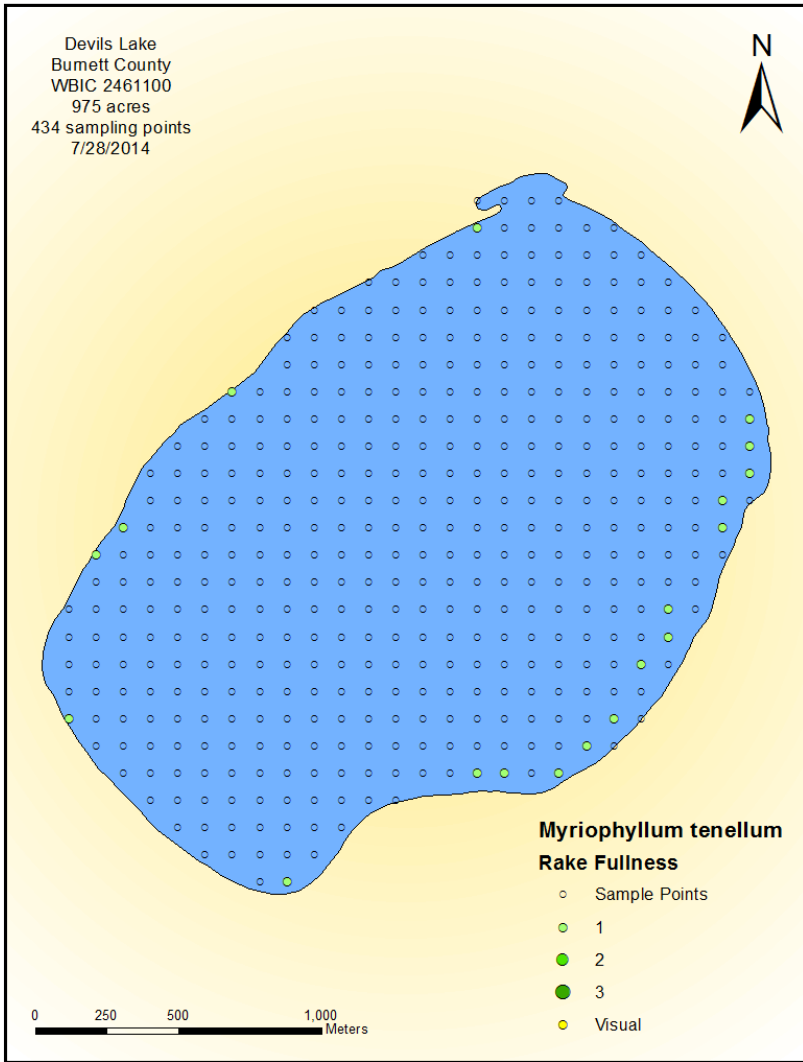


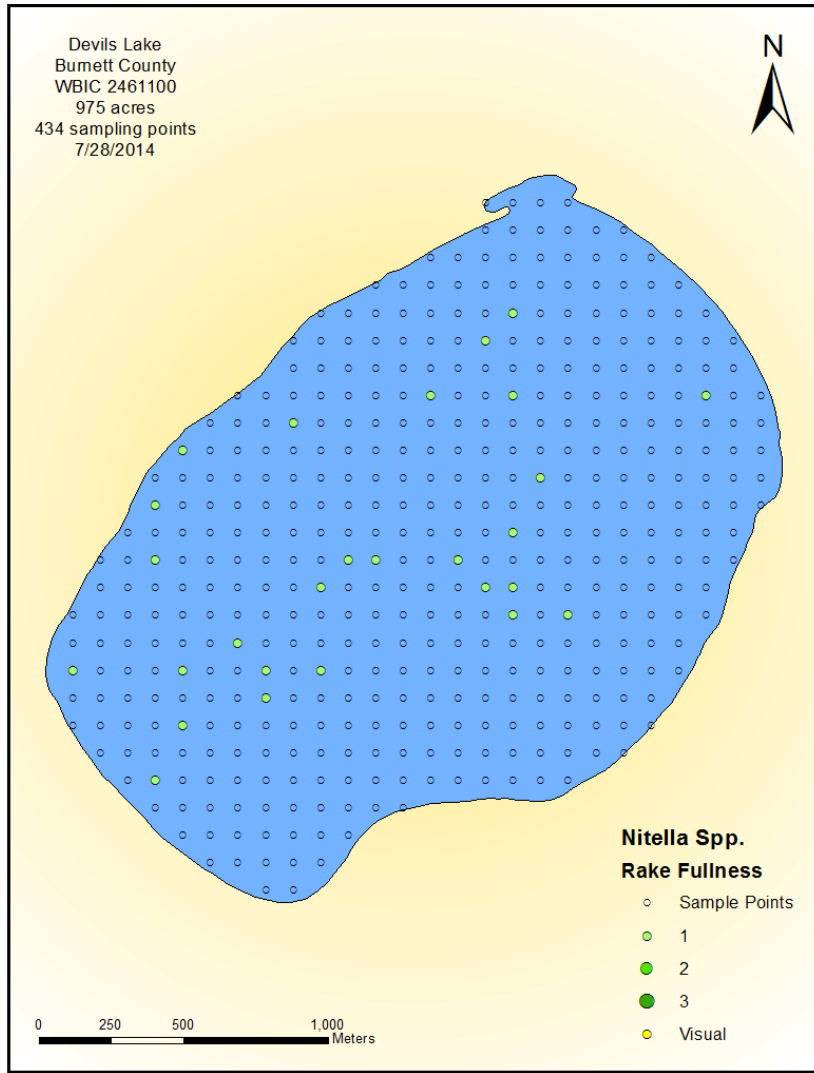
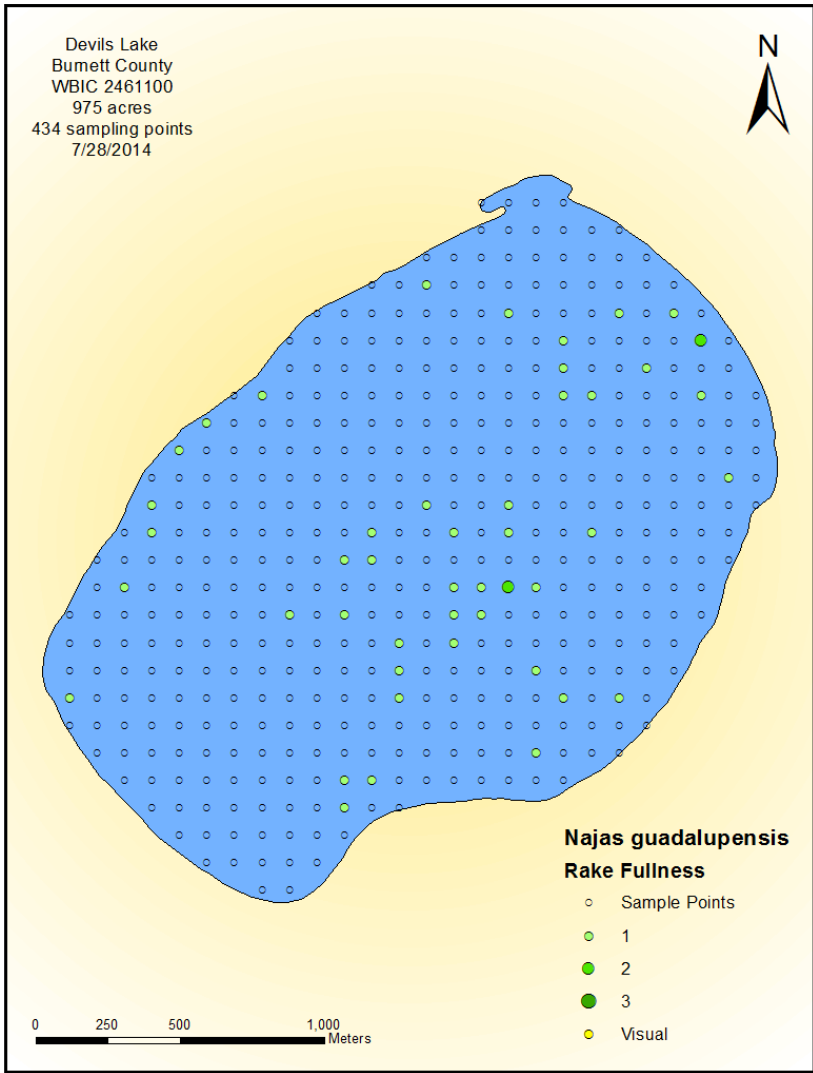


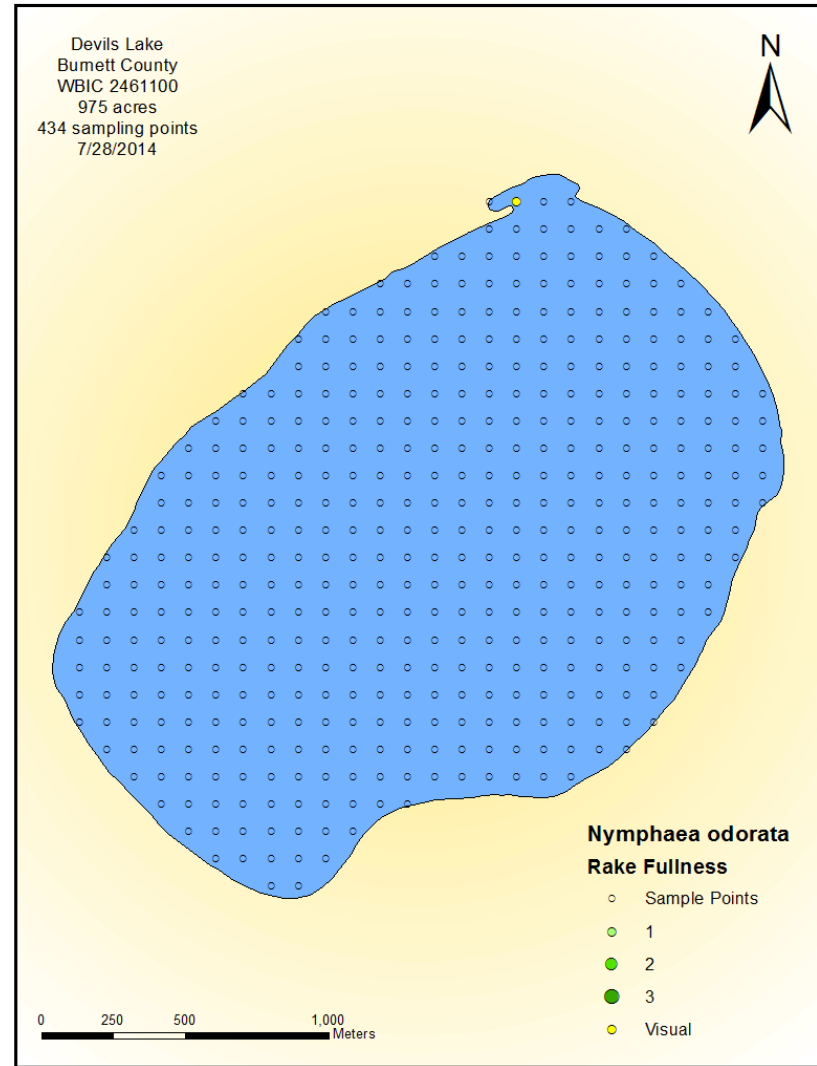
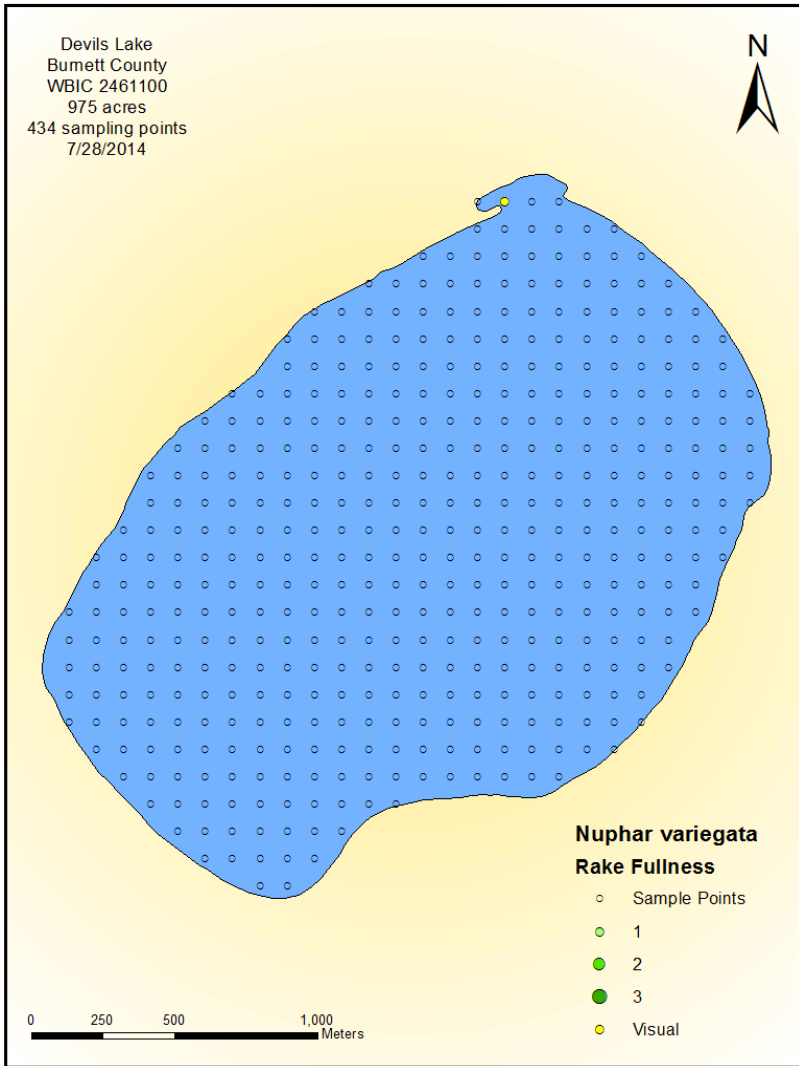


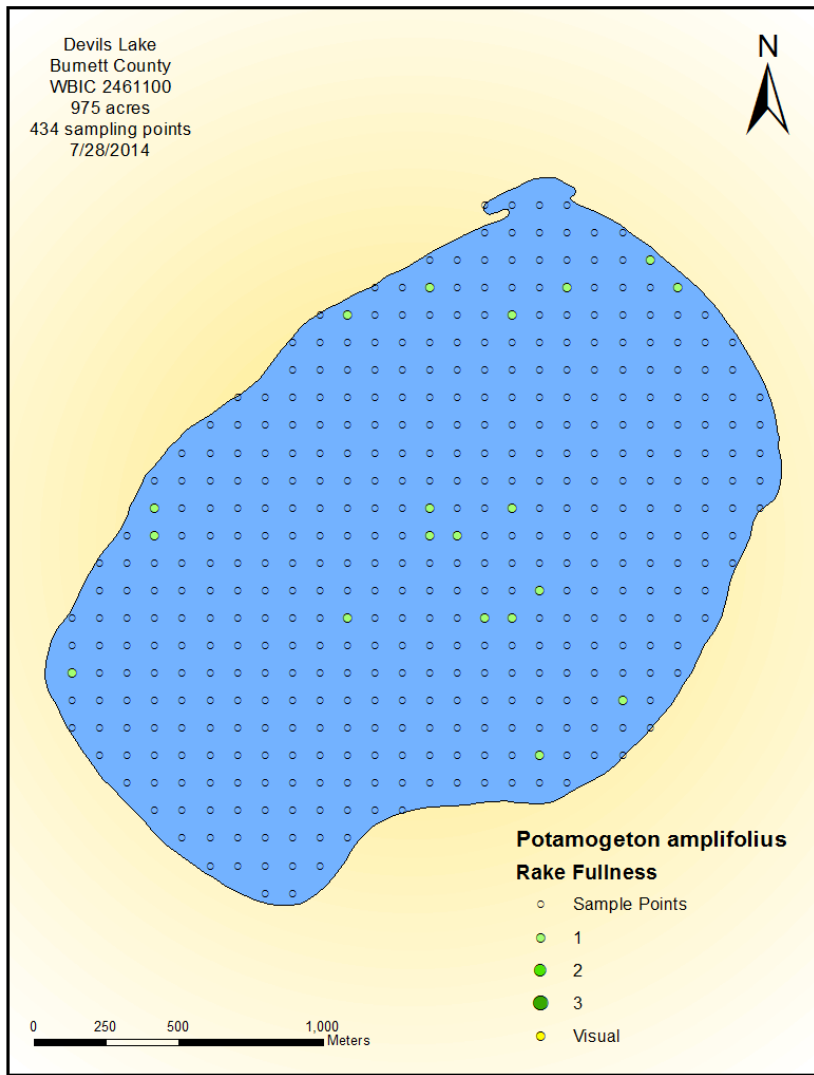
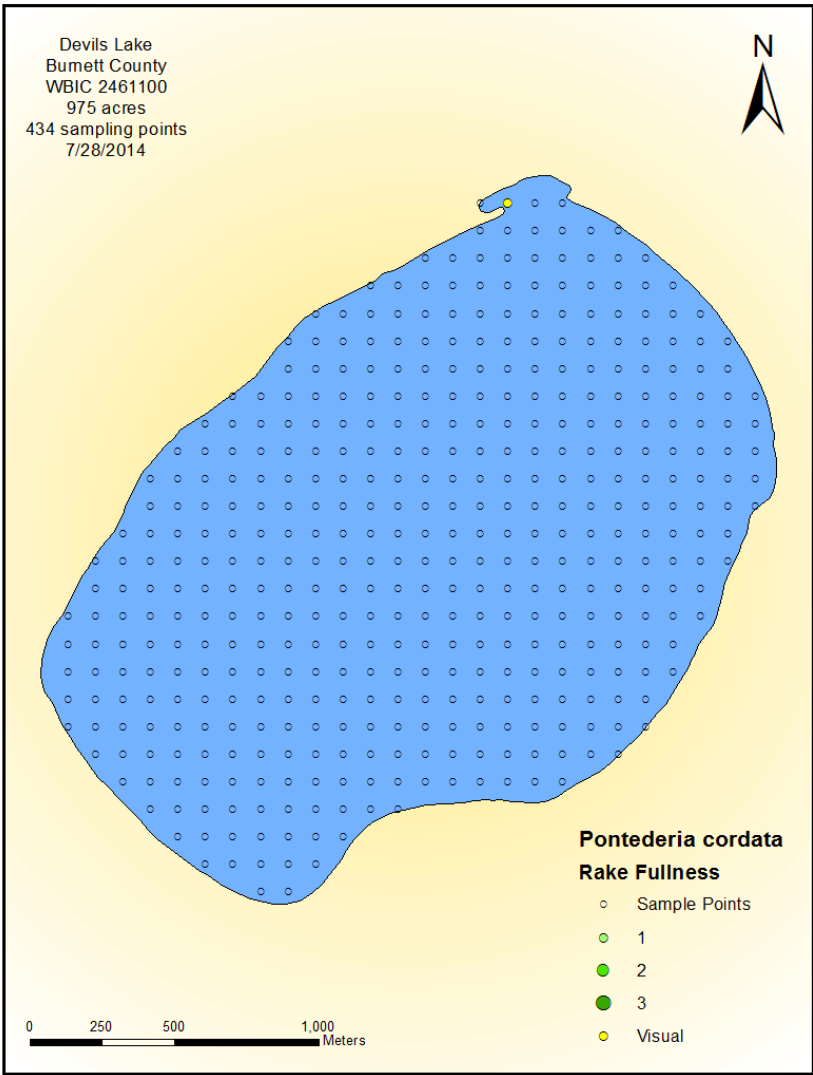


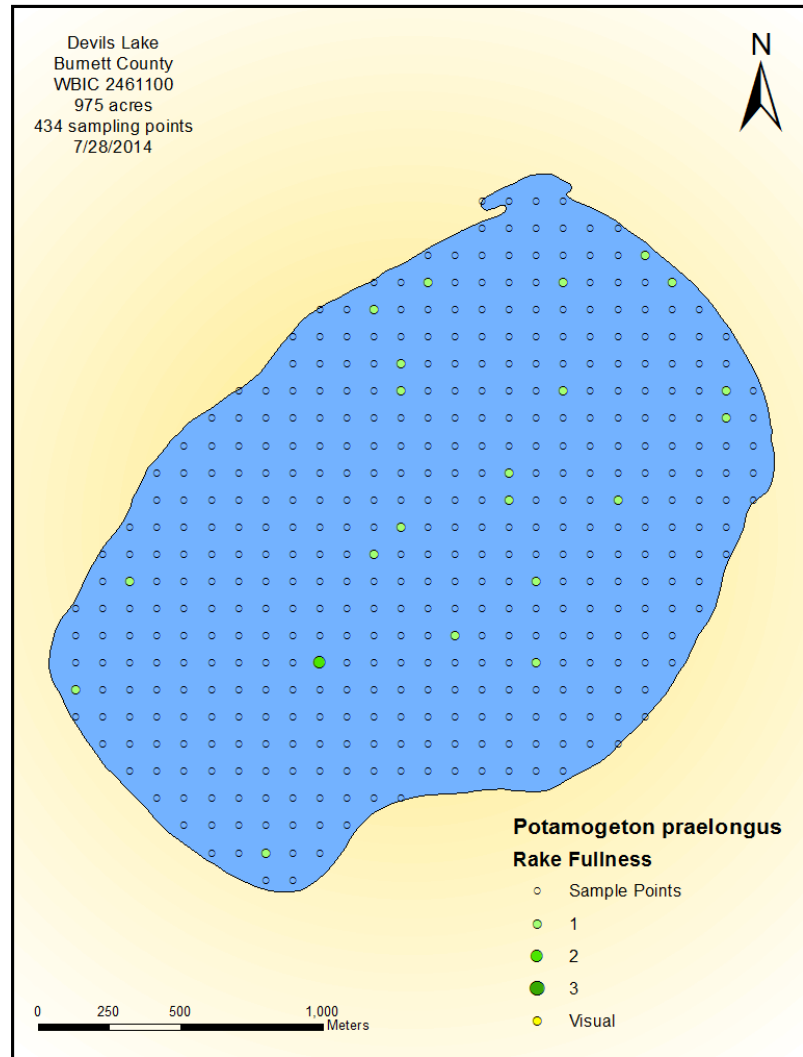
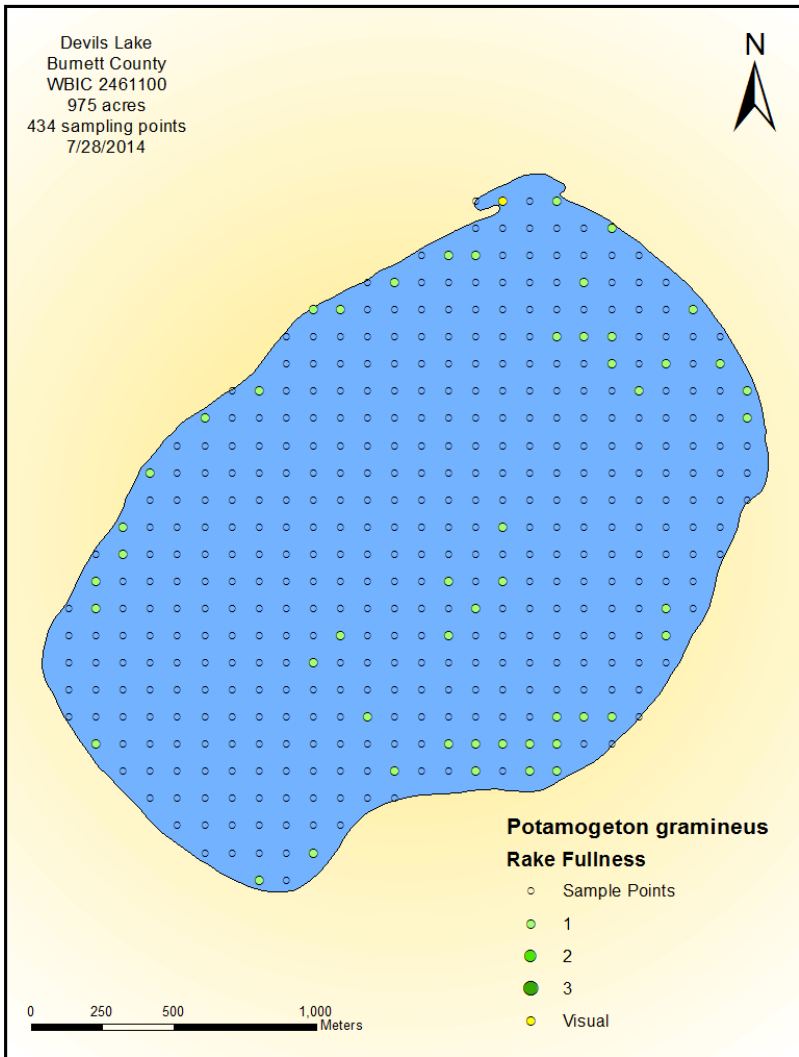


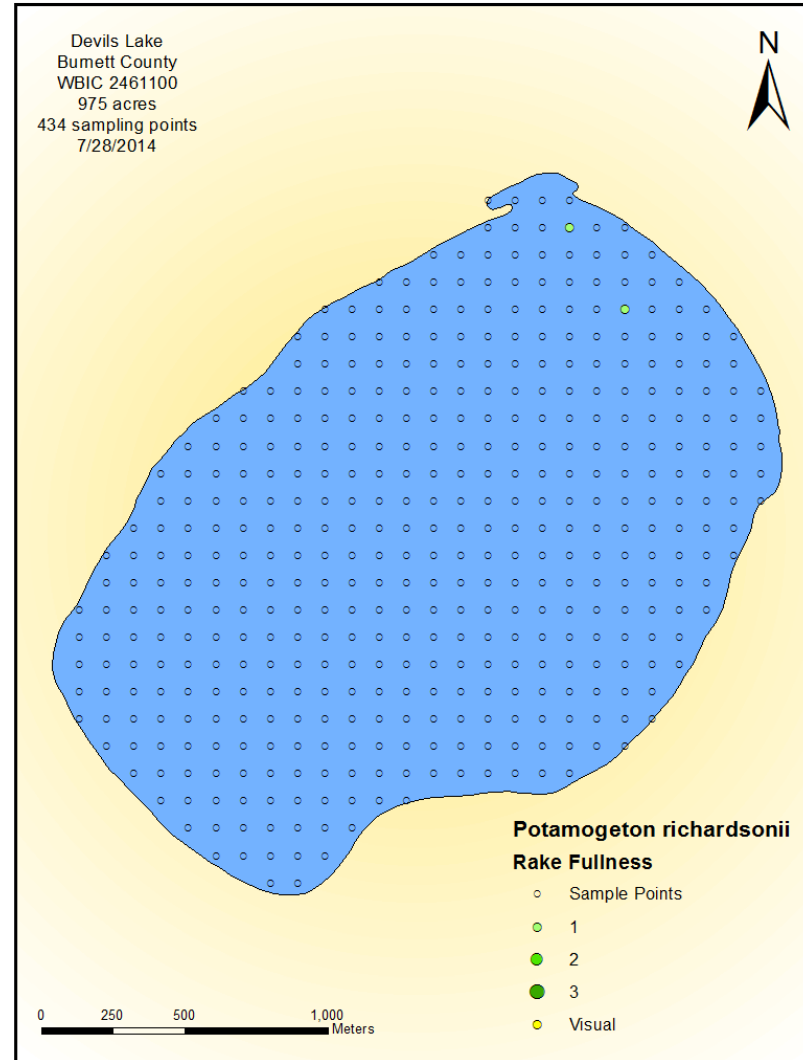
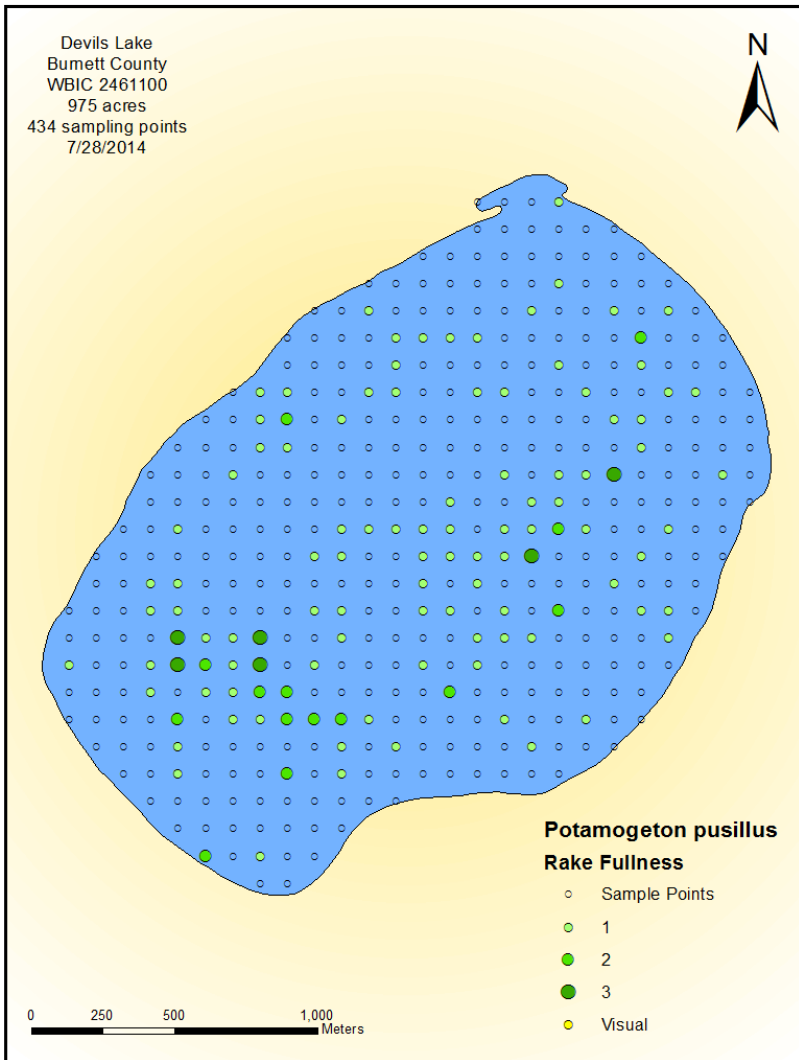


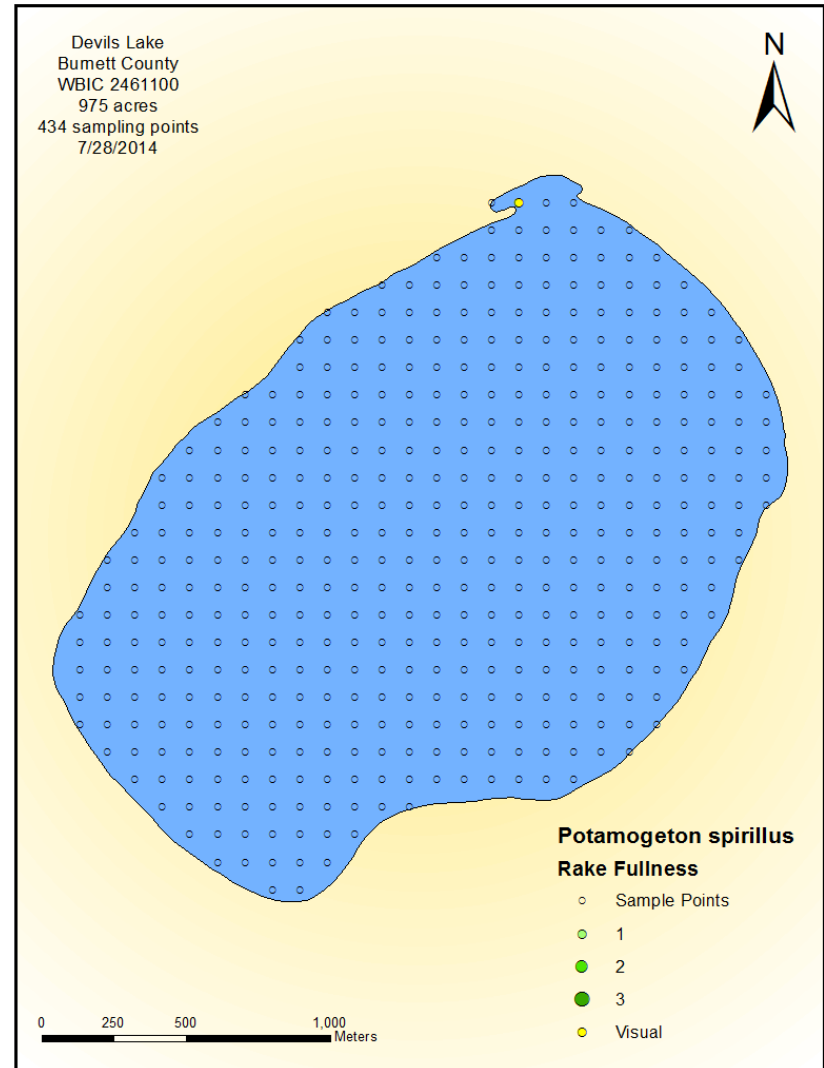
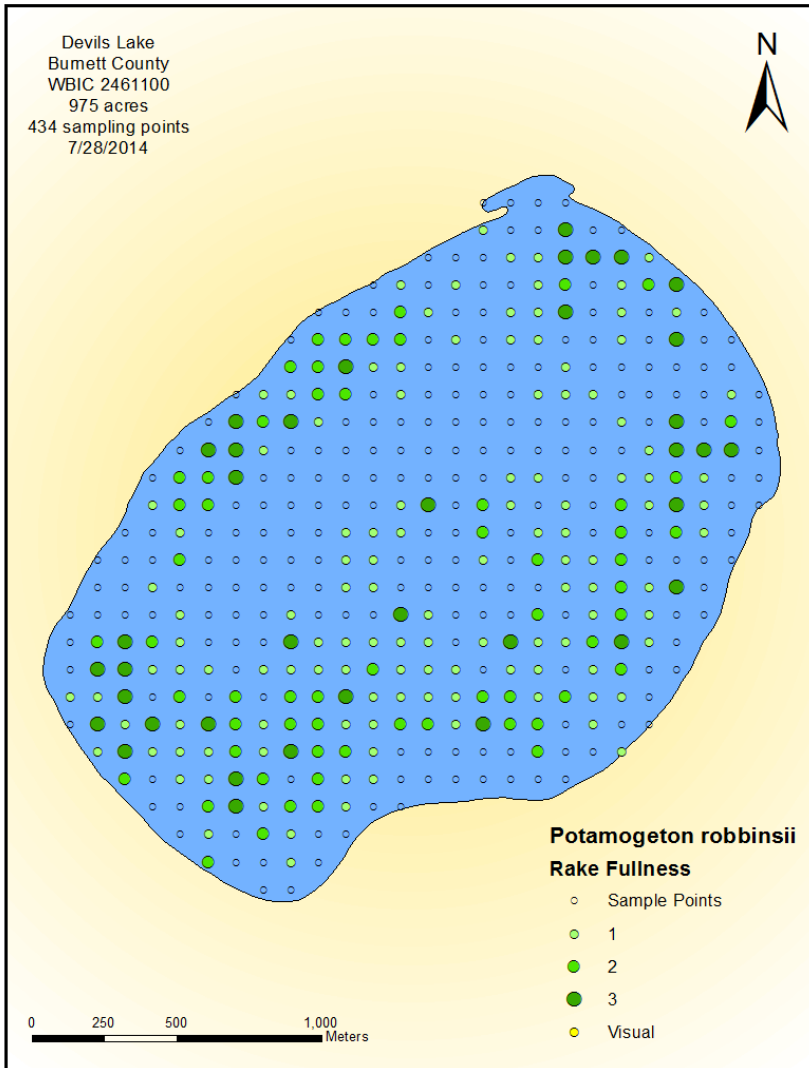




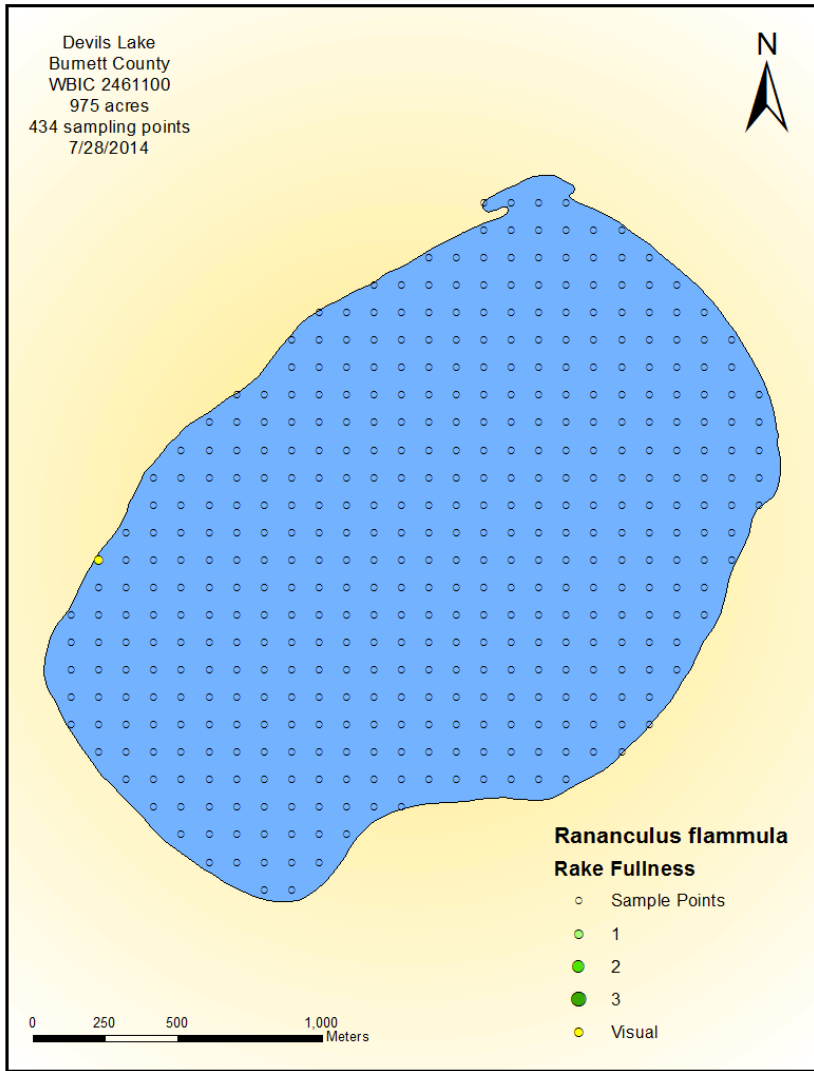
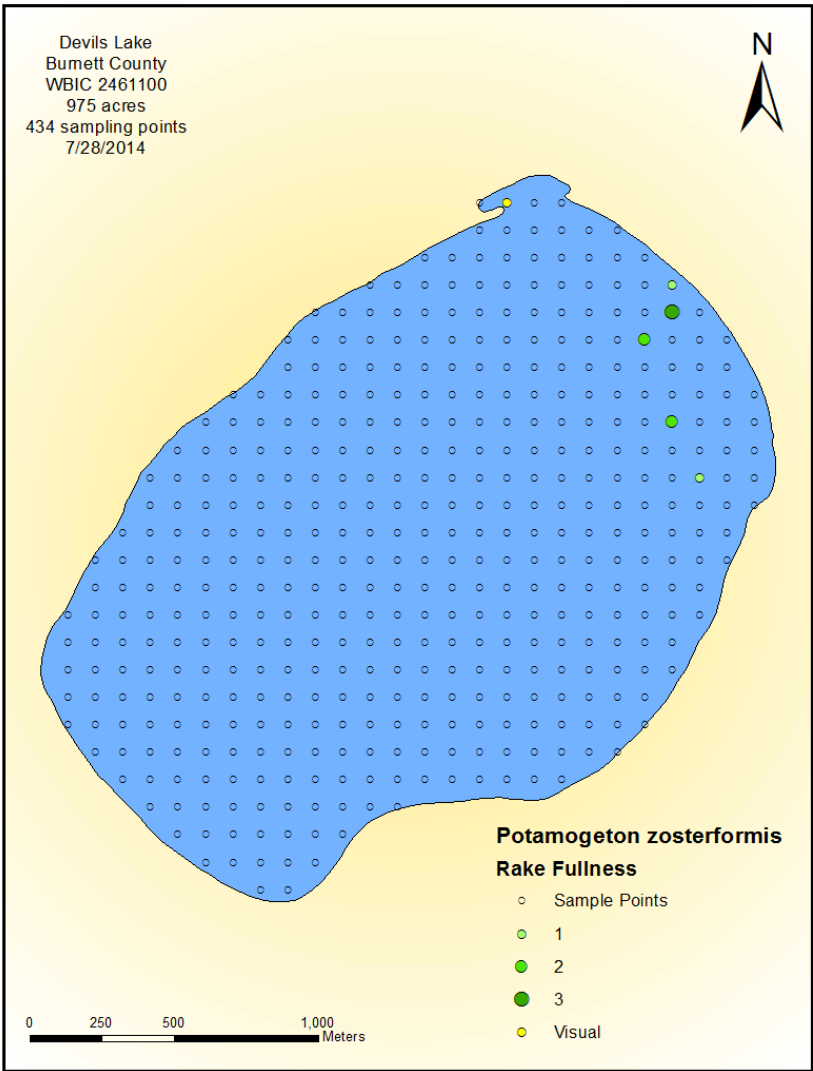


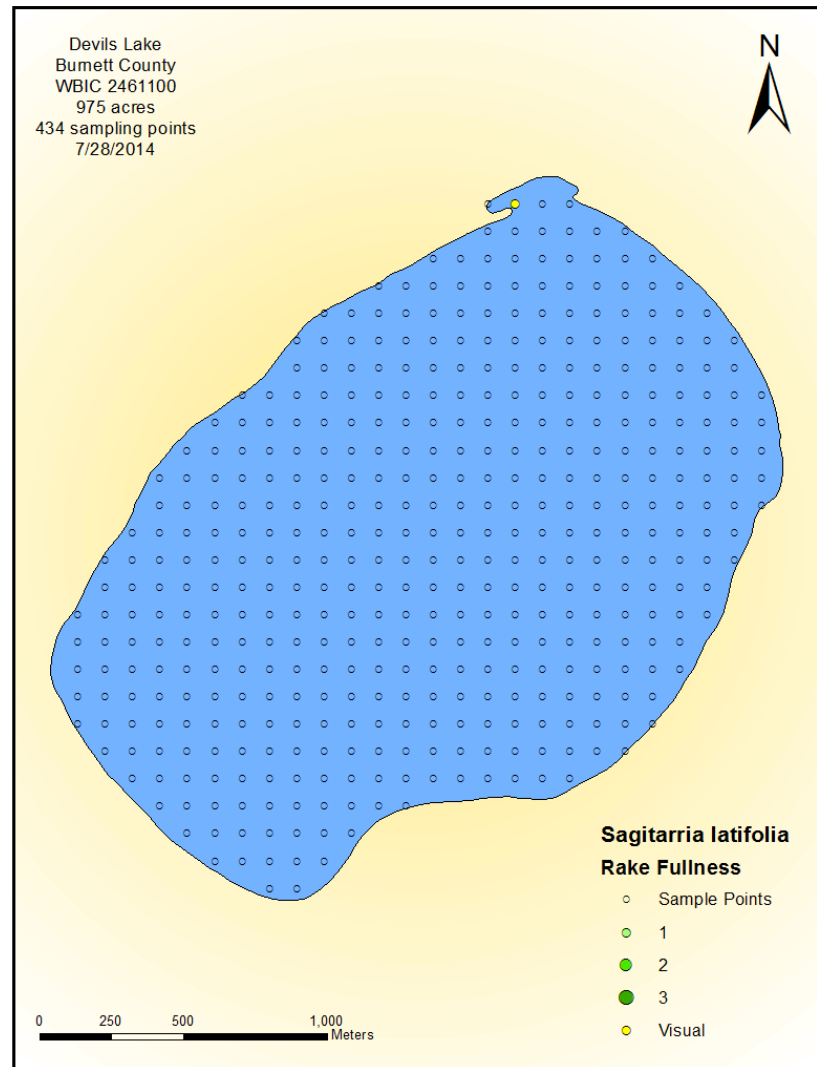
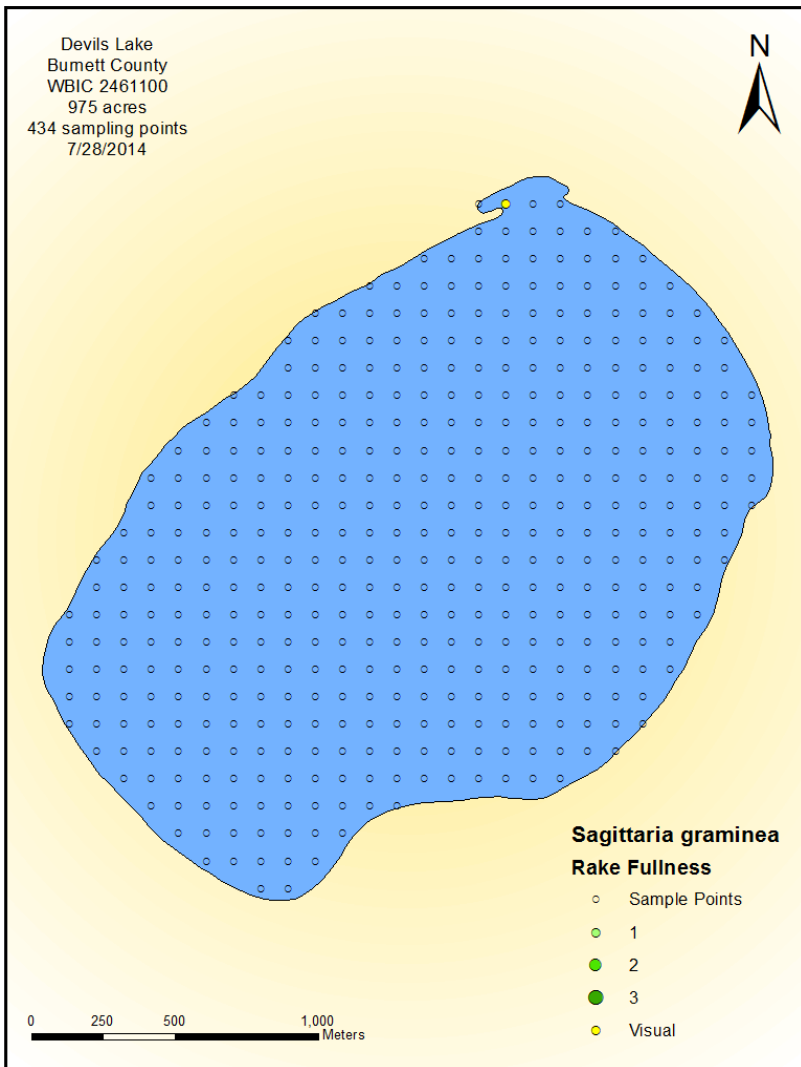


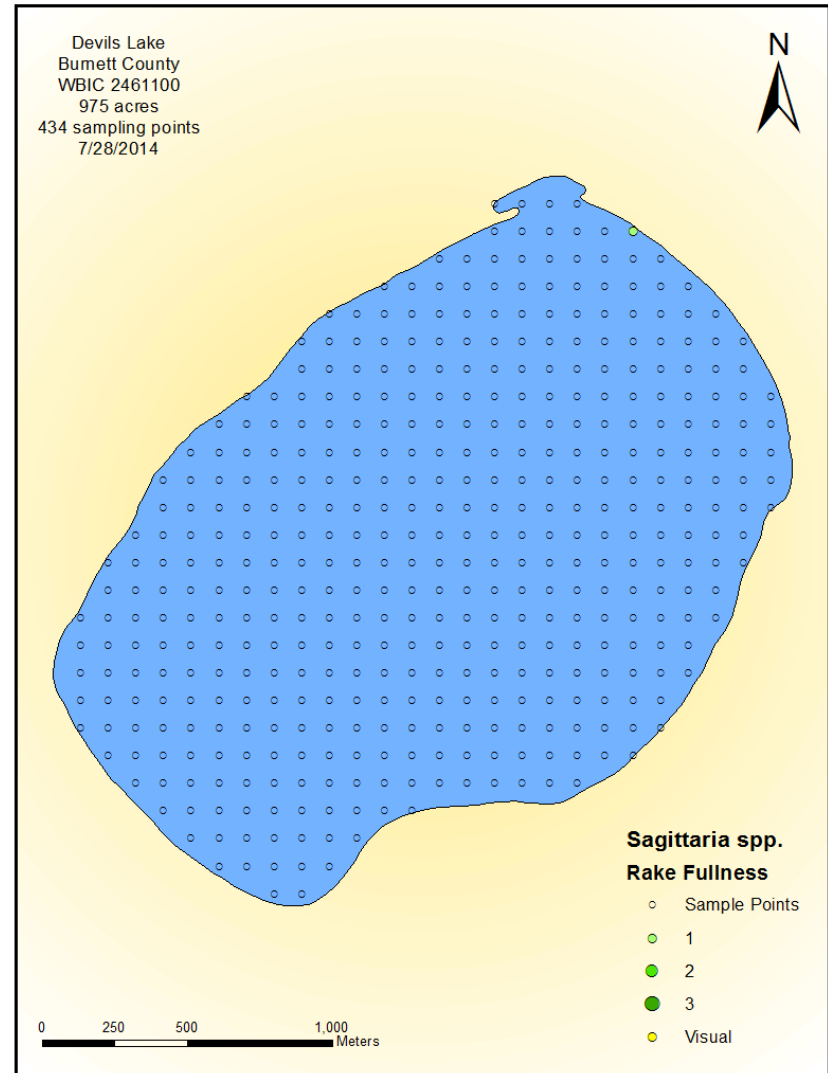
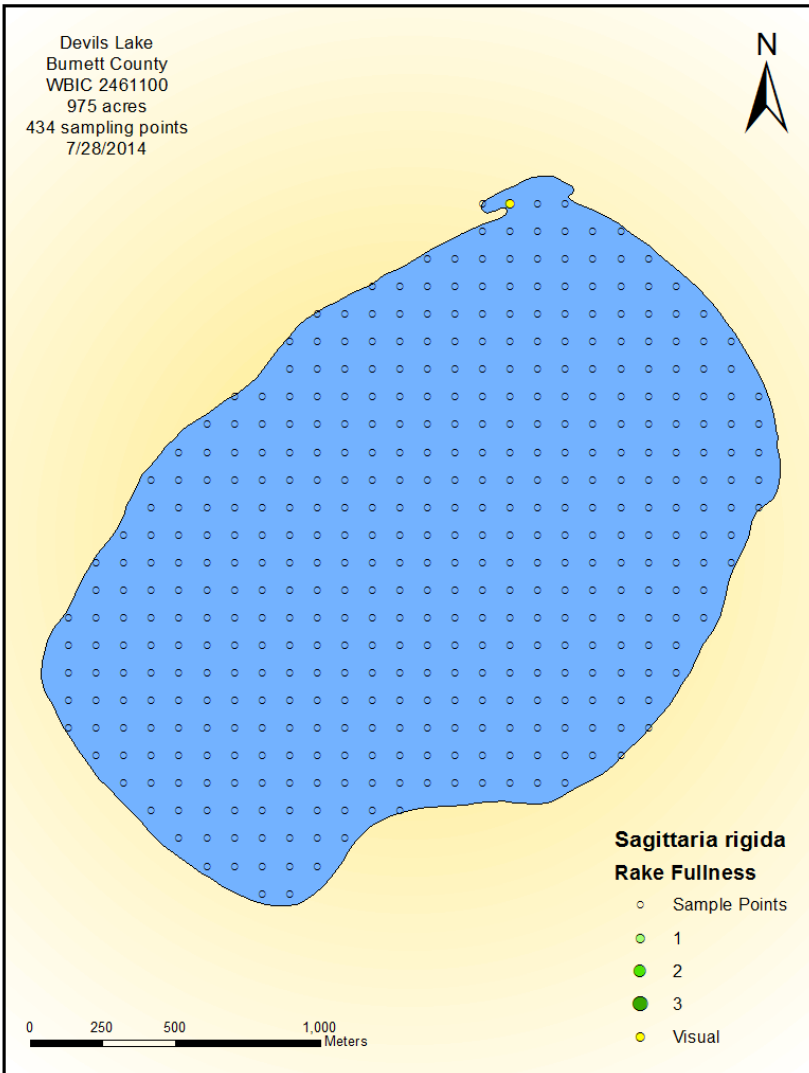


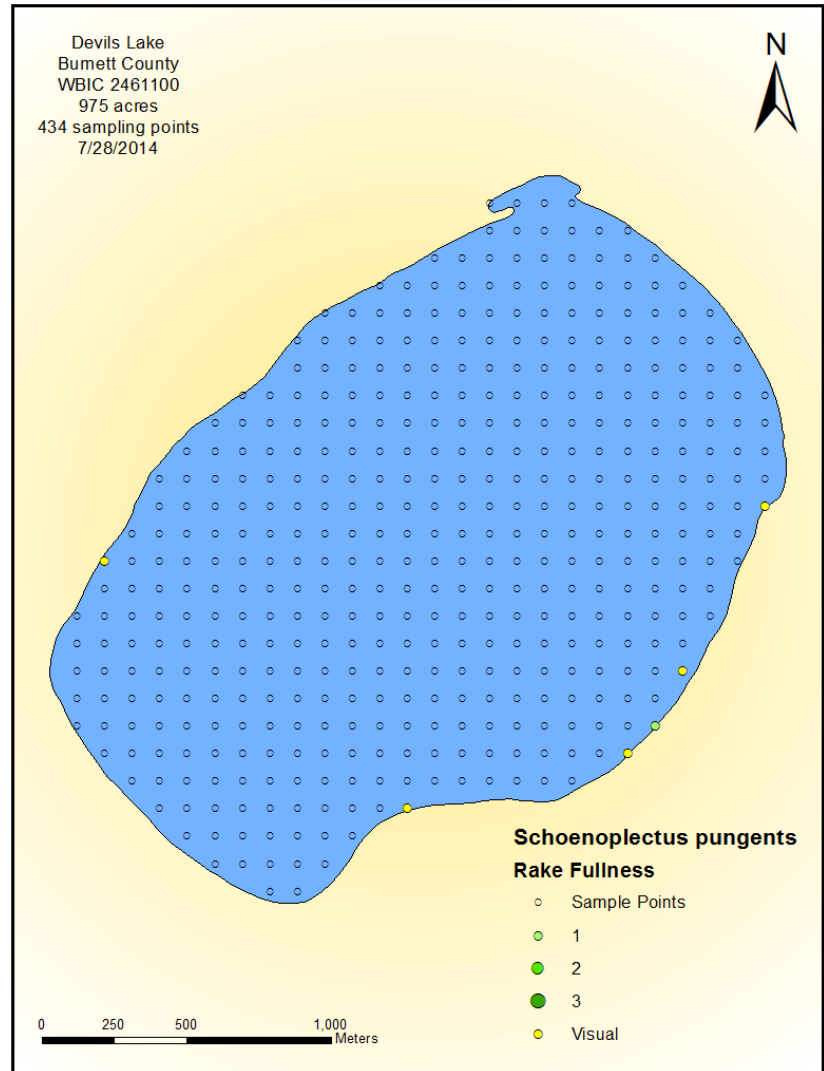
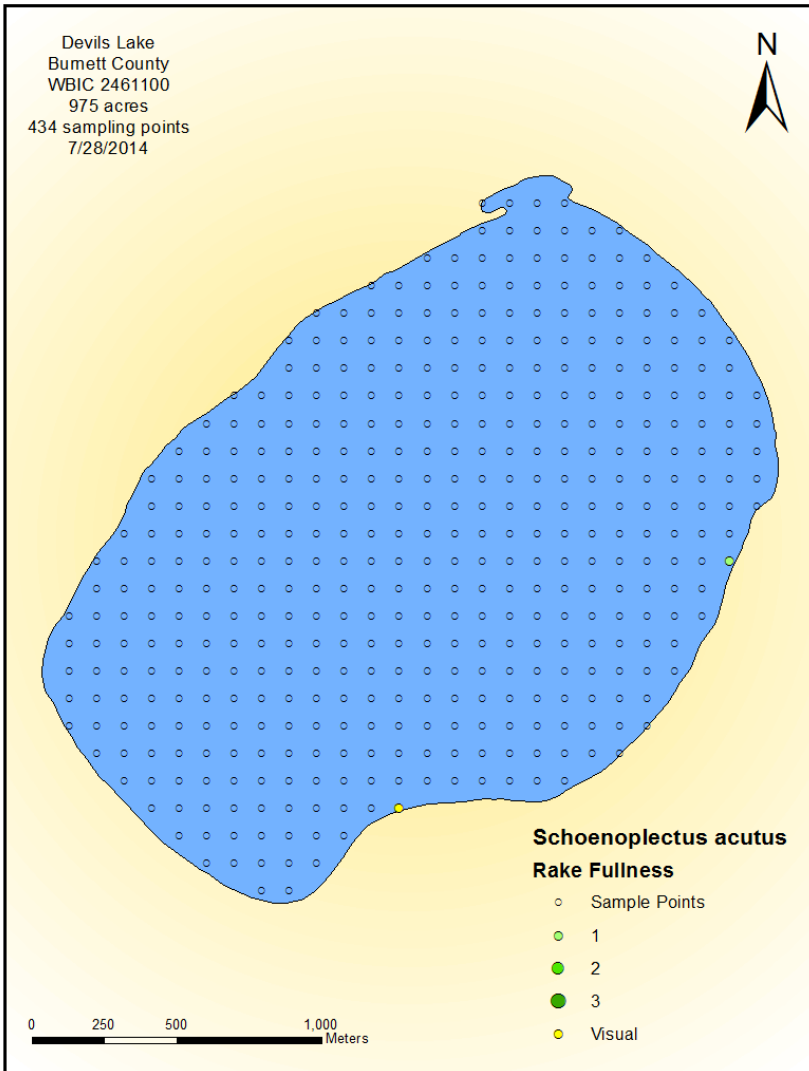


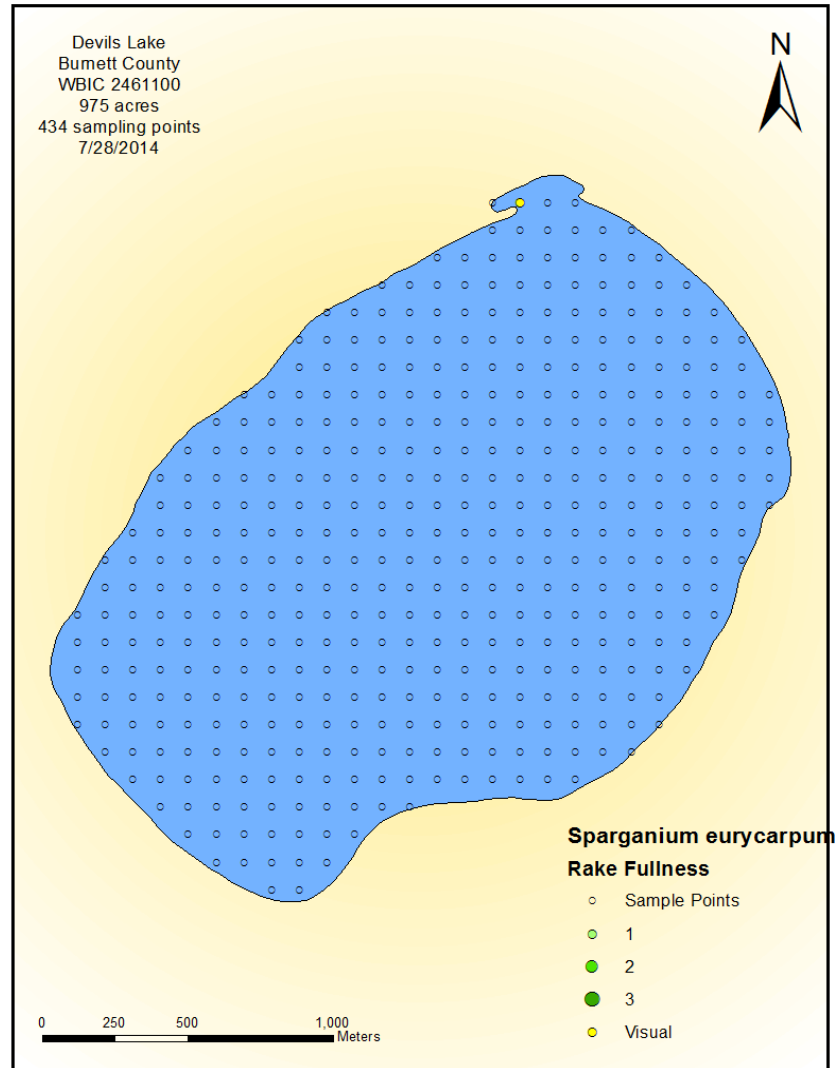
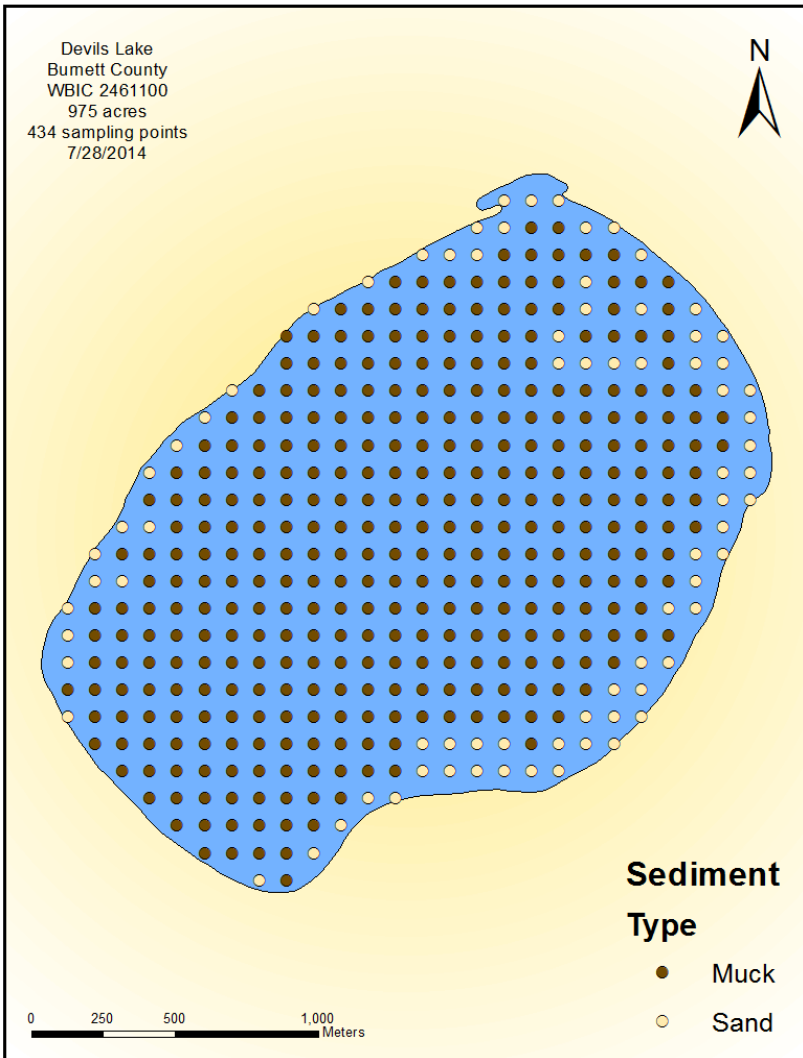


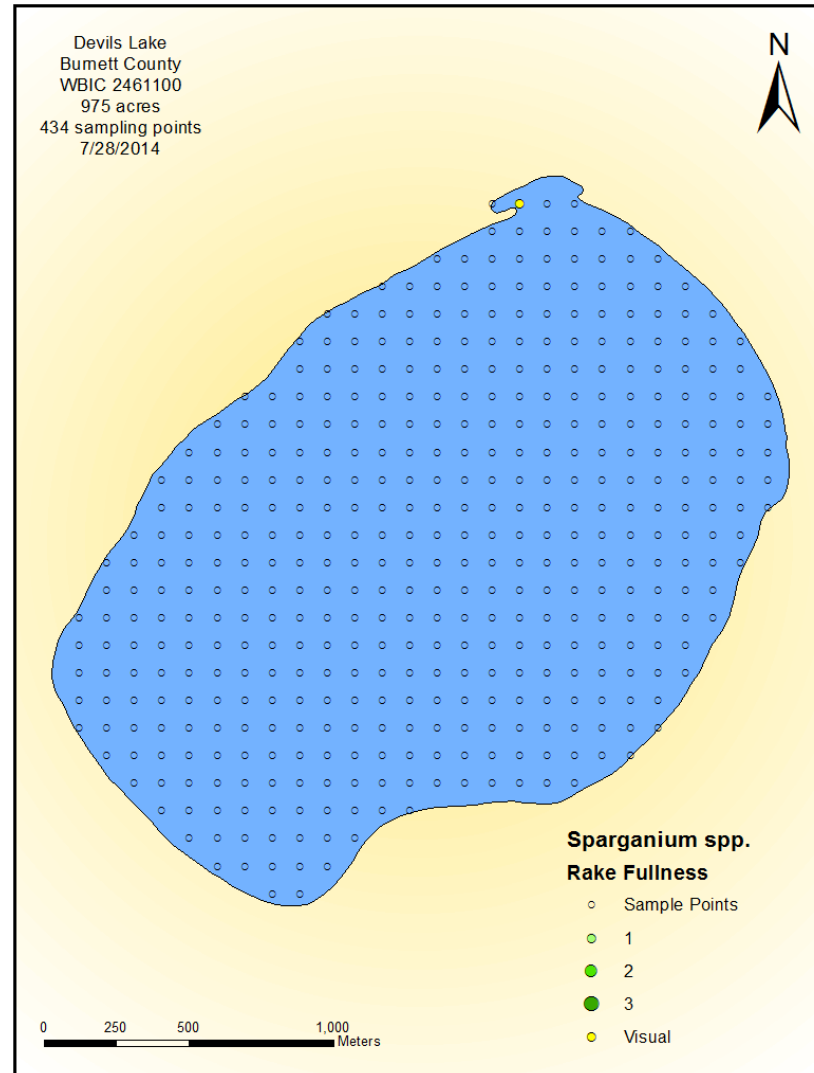
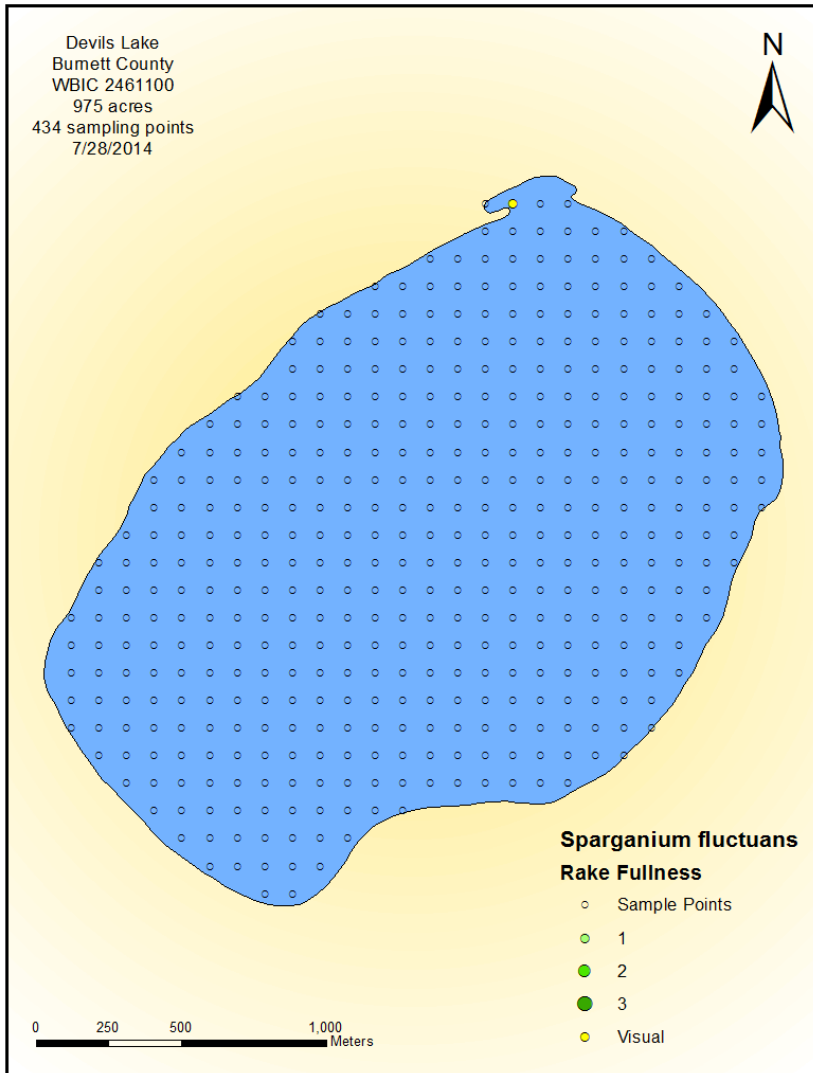


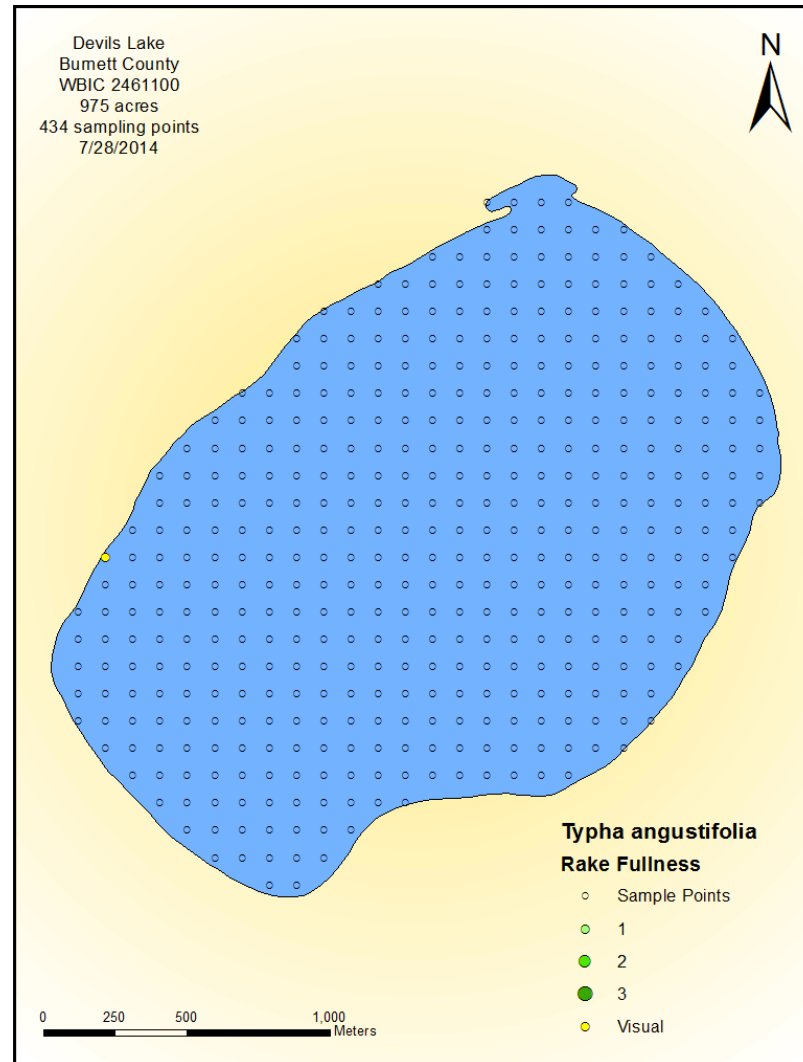
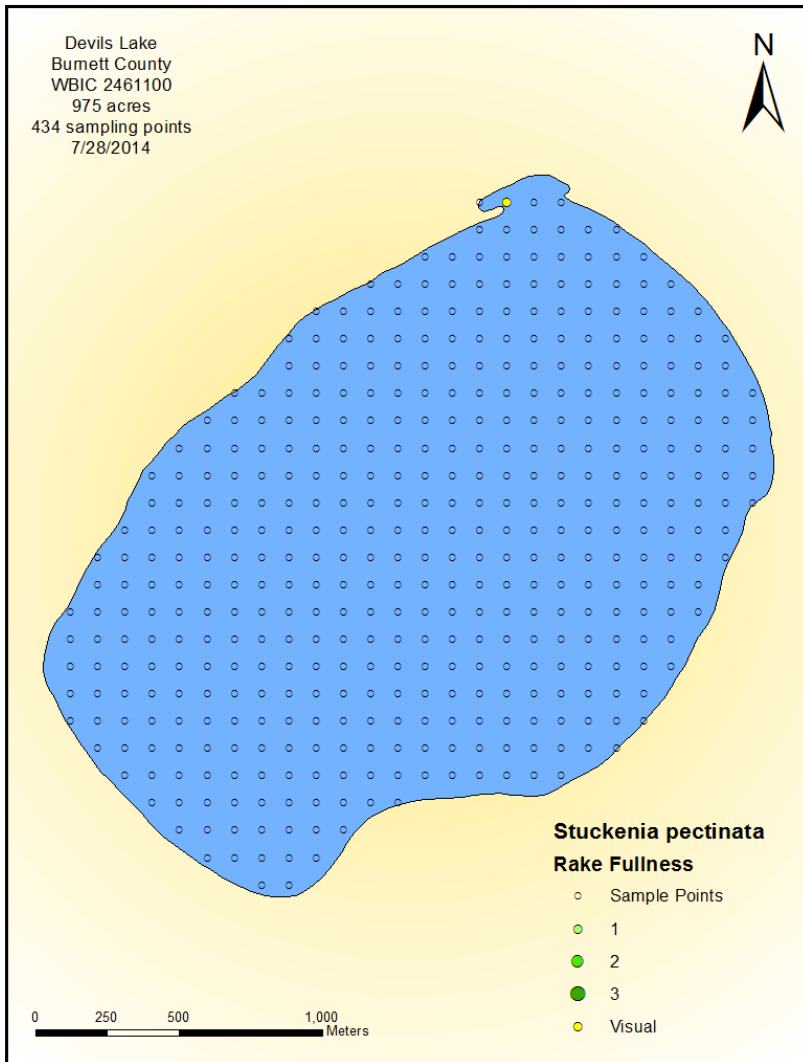


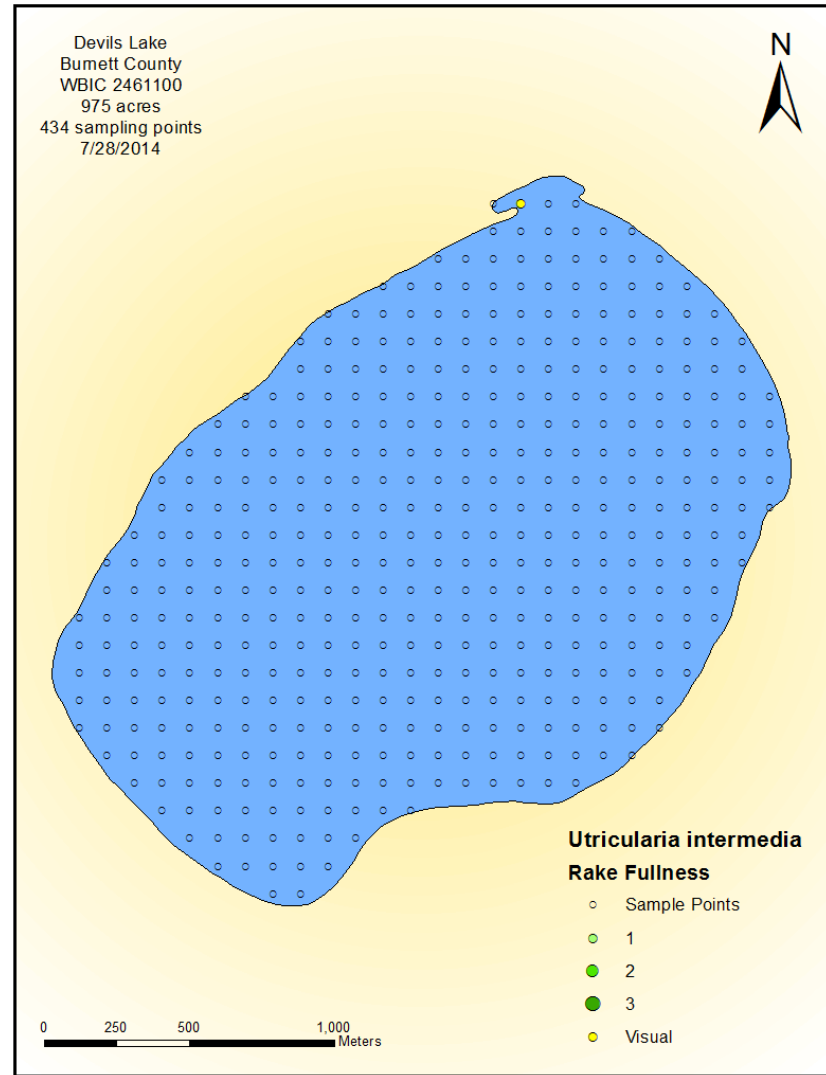
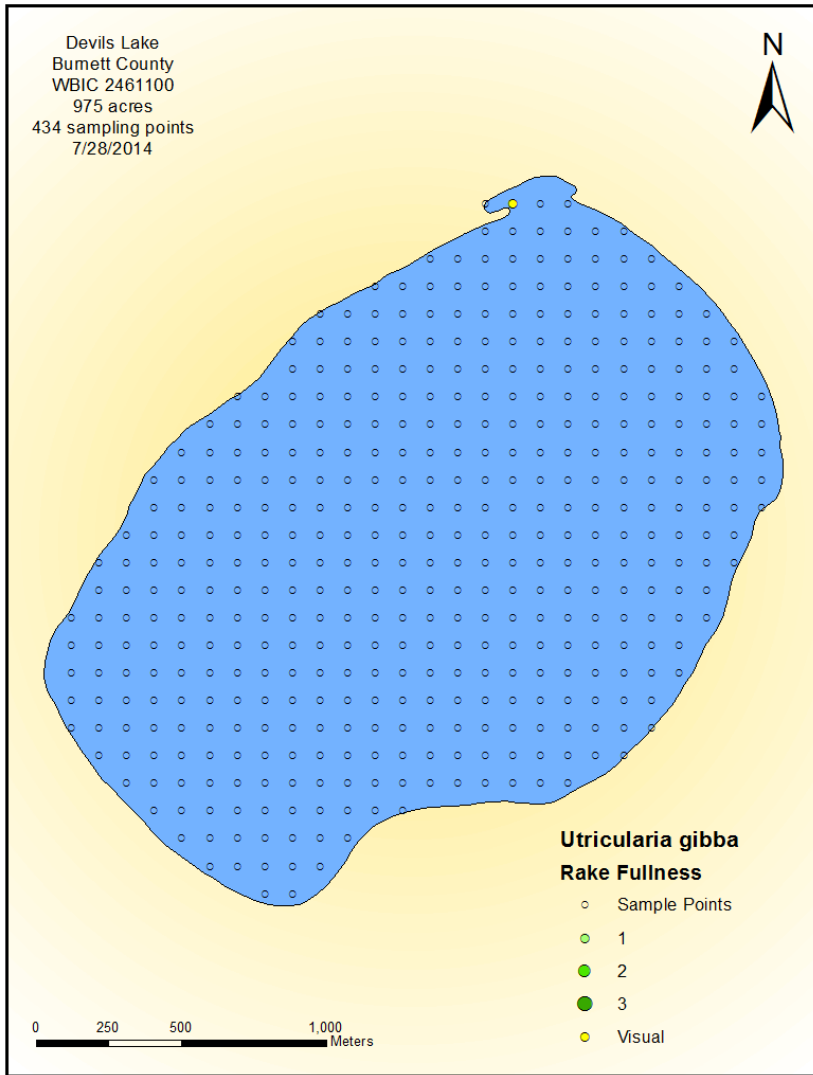




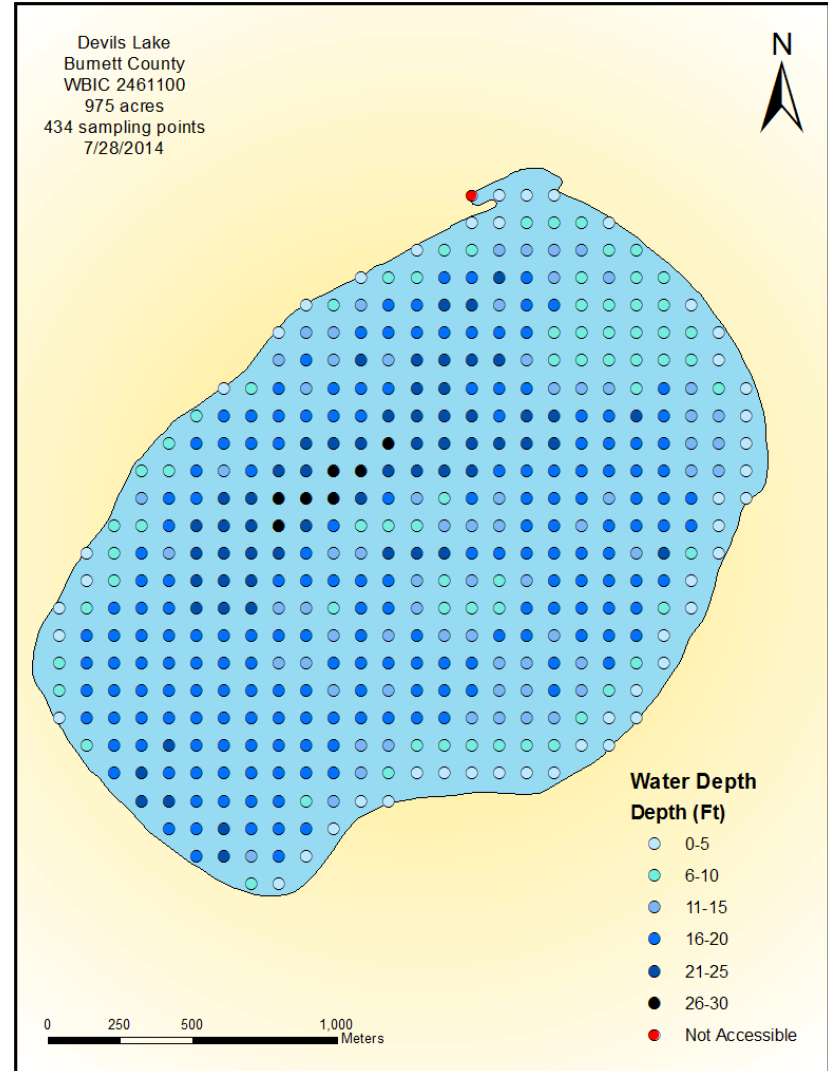
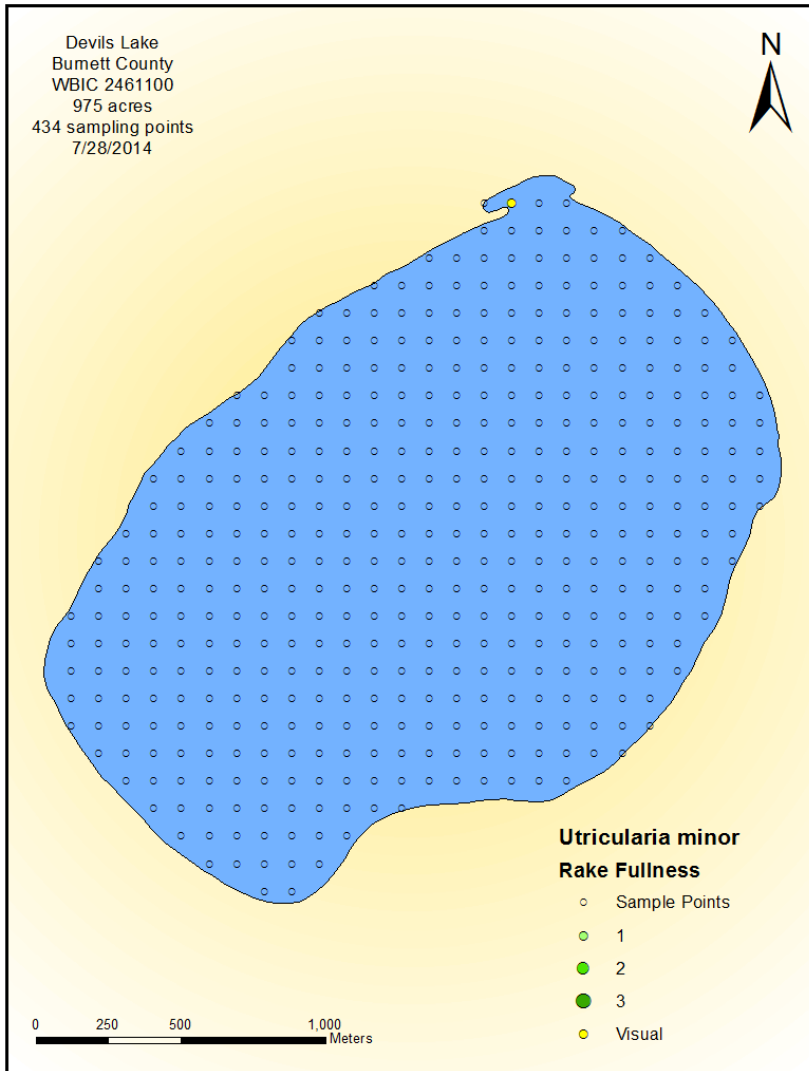












**Appendix B**

**AQUATIC PLANT MANAGEMENT  
STRATEGY**

**Northern Region WDNR  
Summer, 2007**

# AQUATIC PLANT MANAGEMENT STRATEGY

## Northern Region WDNR

### ISSUES

- Protect desirable native aquatic plants.
- Reduce the risk that invasive species replace desirable native aquatic plants.
- Promote “whole lake” management plans
- Limit the number of permits to control native aquatic plants.

### BACKGROUND

As a general rule, the Northern Region has historically taken a protective approach to allow removal of native aquatic plants by harvesting or by chemical herbicide treatment. This approach has prevented lakes in the Northern Wisconsin from large-scale loss of native aquatic plants that represent naturally occurring high quality vegetation. Naturally occurring native plants provide a *diversity of habitat* that *helps maintain water quality*, helps *sustain the fishing* quality known for Northern Wisconsin, supports common lakeshore wildlife from loons to frogs, and helps to provide the *aesthetics* that collectively create the “up-north” appeal of the northwoods lake resources.

In Northern Wisconsin lakes, an inventory of aquatic plants may often find 30 different species or more, whereas a similar survey of a Southern Wisconsin lake may often discover less than half that many species. Historically, similar species diversity was present in Southern Wisconsin, but has been lost gradually over time from stresses brought on by cultural land use changes (such as increased development, and intensive agriculture). Another point to note is that while there may be a greater variety of aquatic vegetation in Northern Wisconsin lakes, the vegetation itself is often *less dense*. This is because northern lakes have not suffered as greatly from nutrients and runoff as have many waters in Southern Wisconsin.

The newest threat to native plants in Northern Wisconsin is from invasive species of aquatic plants. The most common include Eurasian Water Milfoil (EWM) and CurlyLeaf Pondweed (CLP). These species are described as *opportunistic invaders*. This means that these “invaders” benefit where an opening occurs from removal of plants, and without competition from other plants may successfully become established in a lake. Removal of native vegetation not only diminishes the natural qualities of a lake, it *may increase the risk that an invasive species can successfully invade onto the site where native plants have been removed*. There it may more easily establish itself without the native plants to compete against. This concept is easily observed on land where bared soil is quickly taken over by replacement species (often weeds) that crowd in and establish themselves as new occupants of the site. While not a providing a certain guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of an invasive species becoming established on a lake. Once established, the invasive species cause far more inconvenience for all lake users, riparian and others included; can change many of the natural features of a lake; and often lead to *expensive annual control plans*. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.

2 To the extent we can maintain the normal growth of native vegetation, Northern Wisconsin lakes can continue to offer the water resource appeal and benefits they’ve historically provided. A regional position on removal of aquatic plants that carefully recognizes how native aquatic plants benefit lakes in Northern Region can help prevent a gradual decline in the overall quality and recreational benefits that make these lakes attractive to people and still provide abundant fish, wildlife, and northwoods appeal.

### GOALS OF STRATEGY:

1. Preserve native species diversity which, in turn, fosters natural habitat for fish and other aquatic species, from frogs to birds.
2. Prevent openings for invasive species to become established in the absence of the native species.
3. Concentrate on a” whole-lake approach” for control of aquatic plants, thereby fostering systematic documentation of conditions and specific targeting of invasive species as they exist.

4. Prohibit removal of wild rice. WDNR – Northern Region will not issue permits to remove wild rice unless a request is subjected to the full consultation process via the Voigt Tribal Task Force. We intend to discourage applications for removal of this ecologically and culturally important native plant.
5. To be consistent with our WDNR Water Division Goals (work reduction/disinvestment), established in 2005, to “not issue permits for chemical or large scale mechanical control of native aquatic plants – develop general permits as appropriate or inform applicants of exempted activities.” This process is similar to work done in other WDNR Regions, although not formalized as such.

#### **BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE**

**State Statute 23.24 (2)(c)** states:

“The requirements promulgated under par. (a) 4. may specify any of the following:

1. The **quantity** of aquatic plants that may be managed under an aquatic plant management permit.
2. The **species** of aquatic plants that may be managed under an aquatic plant management permit.
3. The **areas** in which aquatic plants may be managed under an aquatic plant management permit.
4. The **methods** that may be used to manage aquatic plants under an aquatic plant management permit.
5. The **times** during which aquatic plants may be managed under an aquatic plant management permit.
6. The **allowable methods** for disposing or using aquatic plants that are removed or controlled under an aquatic plant management permit.
7. The requirements for plans that the department may require under sub. (3) (b). “

**State Statute 23.24(3)(b)** states:

“The department may require that an application for an aquatic plant management permit contain a plan for the department’s approval as to how the aquatic plants will be introduced, removed, or controlled.”

**Wisconsin Administrative Code NR 109.04(3)(a)** states:

“The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long-term sustainability of beneficial water use activities.”

# AQUATIC PLANT MANAGEMENT STRATEGY

## Northern Region WDNR

### APPROACH

1. After January 1, 2009\* no individual permits for control of native aquatic plants will be issued. Treatment of native species may be allowed under the auspices of an approved lake management plan, and only if the plan clearly documents “impairment of navigation” and/or “nuisance conditions”. Until January 1, 2009, individual permits will be issued to previous permit holders, only with adequate documentation of “impairment of navigation” and/or “nuisance conditions”. No new individual permits will be issued during the interim.
2. Control of aquatic plants (if allowed) in documented sensitive areas will follow the conditions specified in the report.
3. Invasive species must be controlled under an approved lake management plan, with two exceptions (these exceptions are designed to allow sufficient time for lake associations to form and subsequently submit an approved lake management plan):
  - a. Newly-discovered infestations. If found on a lake with an approved lake management plan, the invasive species can be controlled via an amendment to the approved plan. If found on a lake without an approved management plan, the invasive species can be controlled under the WDNR’s Rapid Response protocol (see definition), and the lake owners will be encouraged to form a lake association and subsequently submit a lake management plan for WNDR review and approval.
  - b. Individuals holding past permits for control of *invasive* aquatic plants and/or “mixed stands” of native and invasive species will be allowed to treat via individual permit until January 1, 2009 if “impairment of navigation” and/or “nuisance conditions” is adequately documented, unless there is an approved lake management plan for the lake in question.
4. Control of invasive species or “mixed stands” of invasive and native plants will follow current best management practices approved by the Department and contain an explanation of the strategy to be used. Established stands of invasive plants will generally use a control strategy based on Spring treatment. (typically, a water temperature of less than 60 degrees Fahrenheit, or approximately May 31st, annually).
5. Manual removal (see attached definition) is allowed (Admin. Code NR 109.06).

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\* *Exceptions to the Jan. 1, 2009 deadline will be considered only on a very limited basis and will be intended to address unique situations that do not fall within the intent of this approach.*

# AQUATIC PLANT MANAGEMENT STRATEGY

## Northern Region WDNR

### DOCUMENTATION OF IMPAIRED NAVIGATION AND/OR NUISANCE CONDITIONS

Navigation channels can be of two types:

- Common use navigation channel. This is a common navigation route for the general lake user. It often is off shore and connects areas that boaters commonly would navigate to or across, and should be of public benefit.
  
- Individual riparian access lane. This is an access lane to shore that normally is used by an individual riparian shore owner.

Severe impairment or nuisance will generally mean vegetation grows thickly and forms mats on the water surface. Before issuance of a permit to use a regulated control method, a riparian will be asked to document the problem and show what efforts or adaptations have been made to use the site. (This is currently required in NR 107 and on the application form, but the following helps provide a specific description of what impairments exist from native plants).

**Documentation of *impairment of navigation*** by native plants must include:

- a. Specific locations of navigation routes (preferably with GPS coordinates)
- b. Specific dimensions in length, width, and depth
- c. Specific times when plants cause the problem and how long the problem persists
- d. Adaptations or alternatives that have been considered by the lake shore user to avoid or lessen the problem
- e. The species of plant or plants creating the nuisance (documented with samples or a from a Site inspection)

**Documentation of the *nuisance*** must include:

- a. Specific periods of time when plants cause the problem, e.g. when does the problem start and when does it go away.
- b. Photos of the nuisance are encouraged to help show what uses are limited and to show the severity of the problem.
- c. Examples of specific activities that would normally be done where native plants occur naturally on a site but cannot occur because native plants have become a nuisance.

# **AQUATIC PLANT MANAGEMENT STRATEGY**

## **Northern Region WDNR**

### **DEFINITIONS**

Manual removal:

Removal by hand or hand-held devices without the use or aid of external or auxiliary power. Manual removal cannot exceed 30 ft. in width and can only be done where the shore is being used for a dock or swim raft. The 30 ft. wide removal zone cannot be moved, relocated, or expanded with the intent to gradually increase the area of plants removed. Wild rice may not be removed under this waiver.

Native aquatic plants:

Aquatic plants that are indigenous to the waters of this state.

Invasive aquatic plants:

Non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Sensitive area:

Defined under s. NR 107.05(3)(i) (sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water).

Rapid Response protocol: This is an internal WDNR document designed to provide guidance for grants awarded under NR 198.30 (Early Detection and Rapid Response Projects). These projects are intended to control pioneer infestations of aquatic invasive species before they become established.

## Appendix C

### Rapid Response for Early Detection of Eurasian Water Milfoil

The Devils Lake community will be directed to contact the EWM identification (ID) leads (currently Frank Alabarado and John Fink) or the Burnett County AIS Coordinator if they see a plant in the lake they suspect might be Eurasian water milfoil (EWM). Signs at the public boat landings, web pages, and newsletter articles will provide contact information and instructions.

If the plant is likely EWM, the AIS ID lead will confirm identification with Burnett County LWCD and the WDNR and inform the rest of the Devils Lake Association Board (DLA). Two entire intact rooted adult specimens of the suspect plants will be collected and bagged and delivered to the WDNR. WDNR may confirm identification with the herbarium at the University of Wisconsin – Stevens Point or the University of Wisconsin – Madison.

Mark the location of suspected EWM (AIS ID Lead). Use GPS points, if available, or mark the location with a small float.

If the suspect plants are determined to be EWM, the location of EWM will be marked with a more permanent marker. Special EWM buoys are available. (AIS ID Lead).

If identification is positive, inform the board, Burnett County LWCD, herbicide applicator, the person who reported the EWM, lake management consultant, all lake residents and any other significant entities. (AIS ID Lead).

If identification is positive, post a notice at the public landing and include a notice in the next newsletter. (DNR has these signs available.) Notices will inform residents and visitors of the approximate location of EWM and provide appropriate means to avoid spread. (DLA board)

Contact Burnett County LWCD to seek assistance in EWM control efforts. The county has a rapid response plan in place that includes assisting lake where EWM is discovered. Request that the county determine the extent of the EWM introduction and conduct initial removal efforts. If unavailable to assist within two weeks, proceed to step 9.

Hire a consultant to determine the extent of the EWM introduction. A diver may be used. If small amounts of EWM are found during this assessment, the consultant will be directed to identify locations with GPS points and hand pull plants found. All plant fragments will be removed from the lake when hand pulling.

Select a control plan in cooperation with Burnett County AIS Coordinator and WDNR (DLA board of directors). Additional guidance regarding EWM treatment is found in DNR's *Response for Early Detection of Eurasian Water Milfoil Field Protocol*.

Control methods may include hand pulling, use of divers to manually or mechanically remove the EWM from the lake bottom, application of herbicides, and/or other effective and approved control methods.



The goal of the control plan will be eradication of the EWM.

Implement the selected control plan including applying for the necessary permits. Regardless of the control plan selected, it will be implemented by persons who are qualified and experienced in the technique(s) selected.

DLA funds may be used to pay for any reasonable expense incurred in implementing the selected control plan, and implementation will not be delayed by waiting for WDNR to approve or fund a grant application.

The President of the DLA will work with the WDNR to confirm, as soon as possible, a start date for an Early Detection and Rapid Response AIS Control Grant. Thereafter, the DLA shall formally apply for the grant.


DLA board has the responsibility to raise funds to match the grant. The DLA may develop a rapid response contingency fund with special donations.

Frequently inspect the area of the EWM to determine the effectiveness of the treatment and whether additional treatment is necessary.

Contract for professional monitoring to supplement volunteer monitoring in years following EWM discovery.



## Appendix D: Management Options

| <b>Management Options for Aquatic Plants</b>  |                              |  |   |  |
|---|------------------------------|--|---|--|
|  |                              |  |   |  |
| Draft updated Oct 2006  |                              |  |   |  |
| Option  | Permit Needed?               | How it Works   | PROS  | CONS   |
| <b>No Management</b>  | N                            | Do not actively manage plants  | Minimizing disturbance can protect native species that provide habitat for aquatic fauna; protecting natives may limit spread of invasive species; aquatic plants reduce shoreline erosion and may improve water clarity<br><br>No immediate financial cost<br><br>No system disturbance<br><br>No unintended effects of chemicals<br><br>Permit not required | May allow small population of invasive plants to become larger, more difficult to control later<br><br>Excessive plant growth can hamper navigation and recreational lake use<br><br>May require modification of lake users' behavior and perception   |
| <b>Mechanical Control</b>   | May be required under NR 109 | Plants reduced by mechanical means<br><br>Wide range of techniques, from manual to highly mechanized                   | Flexible control<br><br>Can balance habitat and recreational needs  | Must be repeated, often more than once per season<br><br>Can suspend sediments and increase turbidity and nutrient release   |
| a. Handpulling/Manual raking  | Y/N                          | SCUBA divers or snorkelers remove plants by hand or plants are removed with a rake<br><br>Works best in soft sediments | Little to no damage done to lake or to native plant species<br><br>Can be highly selective<br><br>Can be done by shoreline property owners without permits within an area <30 ft wide OR where selectively removing exotics<br><br>Can be very effective at removing problem plants, particularly following early detection of an invasive exotic species     | Very labor intensive<br><br>Needs to be carefully monitored<br><br>Roots, runners, and even fragments of some species, particularly Eurasian watermilfoil (EWM) will start new plants, so all of plant must be removed<br><br>Small-scale control only |

## Management Options for Aquatic Plants



Draft updated Oct 2006

| Option                    | Permit Needed? | How it Works  | PROS  | CONS   |
|---------------------------|----------------|---|---|--|
| b. Harvesting             | Y              | <p>Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto shore</p> <p>Harvest invasives only if invasive is already present throughout the lake</p> | <p>Immediate results</p> <p>EWM removed before it has the opportunity to autofragment, which may create more fragments than created by harvesting</p> <p>Minimal impact to lake ecology</p> <p>Harvested lanes through dense weed beds can increase growth and survival of some fish</p> <p>Can remove some nutrients from lake</p> | <p>Not selective in species removed</p> <p>Fragments of vegetation can re-root</p> <p>Can remove some small fish and reptiles from lake</p> <p>Initial cost of harvester expensive</p>   |
| <b>Biological Control</b> | Y              | Living organisms (e.g. insects or fungi) eat or infect plants   | <p>Self-sustaining; organism will over-winter, resume eating its host the next year</p> <p>Lowers density of problem plant to allow growth of natives</p>   | <p>Effectiveness will vary as control agent's population fluctuates</p> <p>Provides moderate control - complete control unlikely</p> <p>Control response may be slow</p> <p>Must have enough control agent to be effective</p>             |
| a. Weevils on EWM         | Y              | Native weevil prefers EWM to other native water-milfoil   | <p>Native to Wisconsin; weevil cannot "escape" and become a problem</p> <p>Selective control of target species</p> <p>Longer-term control with limited management</p>   | <p>Need to stock large numbers, even if some already present</p> <p>Need good habitat for overwintering on shore (leaf litter) associated with undeveloped shorelines</p> <p>Bluegill populations decrease densities through predation</p> |

## Management Options for Aquatic Plants



Draft updated Oct 2006

| Option                    | Permit Needed? | How it Works   | PROS   | CONS  |
|---------------------------|----------------|--|--|---|
| b. Pathogens              | Y              | Fungal/bacterial/viral pathogen introduced to target species to induce mortality | <p>May be species specific</p> <p>May provide long-term control</p> <p>Few dangers to humans or animals</p>  | <p>Largely experimental; effectiveness and longevity unknown</p> <p>Possible side effects not understood</p>  |
| c. Allelopathy            | Y              | Aquatic plants release chemical compounds that inhibit other plants from growing | <p>May provide long-term, maintenance-free control</p> <p>Spikerushes (<i>Eleocharis</i> spp.) appear to inhibit Eurasian watermilfoil growth</p>                            | <p>Initial transplanting slow and labor-intensive</p> <p>Spikerushes native to WI, and have not effectively limited EWM growth</p> <p>Wave action along shore makes it difficult to establish plants; plants will not grow in deep or turbid water</p>  |
| d. Planting native plants | Y              | Diverse native plant community established to repel invasive species             | <p>Native plants provide food and habitat for aquatic fauna</p> <p>Diverse native community may be "resistant" to invasive species</p> <p>Supplements removal techniques</p> | <p>Initial transplanting slow and labor-intensive</p> <p>Nuisance invasive plants may outcompete plantings</p> <p>Largely experimental; few well-documented cases</p> <p>If transplants from external sources (another lake or nursery), may include additional invasive species or "hitchhikers"</p> |

## Management Options for Aquatic Plants



Draft updated Oct 2006

| Option                      | Permit Needed?                          | How it Works  | PROS   | CONS  |
|-----------------------------|---|---|--|---|
| <b>Physical Control</b>     | Required under Ch. 30 / NR 107          | Plants are reduced by altering variables that affect growth, such as water depth or light levels  |  |   |
| a. Fabrics/ Bottom Barriers | Y                                       | Prevents light from getting to lake bottom  | Reduces turbidity in soft-substrate areas<br><br>Useful for small areas  | Eliminates all plants, including native plants important for a healthy lake ecosystem<br><br>May inhibit spawning by some fish<br><br>Need maintenance or will become covered in sediment and ineffective<br><br>Gas accumulation under blankets can cause them to dislodge from the bottom<br><br>Affects benthic invertebrates<br><br>Anaerobic environment forms that can release excessive nutrients from sediment  |
| b. Drawdown                 | Y, May require Environmental Assessment | Lake water lowered with siphon or water level control device; plants killed when sediment dries, compacts or freezes<br><br>Season or duration of drawdown can change effects | Winter drawdown can be effective at restoration, provided drying and freezing occur. Sediment compaction is possible over winter<br><br>Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction<br><br>Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization, and increased water quality<br><br>Success demonstrated for reducing EWM, variable success for curly-leaf pondweed (CLP)<br><br>Restores natural water fluctuation important for all aquatic ecosystems | Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling<br><br>May impact attached wetlands and shallow wells near shore<br><br>Species growing in deep water (e.g. EWM) that survive may increase, particularly if desirable native species are reduced<br><br>Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning<br><br>Winter drawdown must start in early fall or will kill hibernating reptiles and amphibians<br><br>Navigation and use of lake is limited during drawdown |

## Management Options for Aquatic Plants



Draft updated Oct 2006

| Option                               | Permit Needed? | How it Works   | PROS   | CONS  |
|--------------------------------------|----------------|--|--|---|
| c. Dredging                          | Y              | <p>Plants are removed along with sediment</p> <p>Most effective when soft sediments overlay harder substrate</p> <p>For extremely impacted systems</p> <p>Extensive planning required</p>    | <p>Increases water depth</p> <p>Removes nutrient rich sediments</p> <p>Removes soft bottom sediments that may have high oxygen demand</p>  | <p>Severe impact on lake ecosystem</p> <p>Increases turbidity and releases nutrients</p> <p>Exposed sediments may be recolonized by invasive species</p> <p>Sediment testing may be necessary</p> <p>Removes benthic organisms</p> <p>Dredged materials must be disposed of</p> |
| d. Dyes                              | Y              | <p>Colors water, reducing light and reducing plant and algal growth</p>  | <p>Impairs plant growth without increasing turbidity</p> <p>Usually non-toxic, degrades naturally over a few weeks</p>   | <p>Appropriate for very small water bodies</p> <p>Should not be used in pond or lake with outflow</p> <p>Impairs aesthetics</p> <p>Effects to microscopic organisms unknown</p>   |
| e. Non-point source nutrient control | N              | <p>Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use) thereby providing fewer nutrients available for plant growth</p> | <p>Attempts to correct source of problem, not treat symptoms</p> <p>Could improve water clarity and reduce occurrences of algal blooms</p> <p>Native plants may be able to better compete with invasive species in low-nutrient conditions</p> | <p>Results can take years to be evident due to internal recycling of already-present lake nutrients</p> <p>Requires landowner cooperation and regulation</p> <p>Improved water clarity may increase plant growth</p>  |

## Management Options for Aquatic Plants



Draft updated Oct 2006

| Option                  | Permit Needed?           | How it Works   | PROS   | CONS  |
|-------------------------|--------------------------|--|--|---|
| <b>Chemical Control</b> | Y, Required under NR 107 | <p>Granules or liquid chemicals kill plants or cease plant growth; some chemicals used primarily for algae</p> <p>Results usually within 10 days of treatment, but repeat treatments usually needed</p> <p>Chemicals must be used in accordance with label guidelines and restrictions</p> | <p>Some flexibility for different situations</p> <p>Some can be selective if applied correctly</p> <p>Can be used for restoration activities</p>   | <p>Possible toxicity to aquatic animals or humans, especially applicators</p> <p>May kill desirable plant species, e.g. native water-milfoil or native pondweeds; maintaining healthy native plants important for lake ecology and minimizing spread of invasives</p> <p>Treatment set-back requirements from potable water sources and/or drinking water use restrictions after application, usually based on concentration</p> <p>May cause severe drop in dissolved oxygen causing fish kill, depends on plant biomass killed, temperatures and lake size and shape</p> <p>Often controversial</p> |
| a. 2,4-D                | Y                        | <p>Systemic<sup>1</sup> herbicide selective to broadleaf<sup>2</sup> plants that inhibits cell division in new tissue</p> <p>Applied as liquid or granules during early growth phase</p>   | <p>Moderately to highly effective, especially on EWM</p> <p>Monocots, such as pondweeds (e.g. CLP) and many other native species not affected</p> <p>Can be selective depending on concentration and seasonal timing</p> <p>Can be used in synergy with endothall for early season CLP and EWM treatments</p> <p>Widely used aquatic herbicide</p> | <p>May cause oxygen depletion after plants die and decompose</p> <p>May kill native dicots such as pond lilies and other submerged species (e.g. coontail)</p> <p>Cannot be used in combination with copper herbicides (used for algae)</p> <p>Toxic to fish</p>  |



## Management Options for Aquatic Plants



Draft updated Oct 2006

| Option       | Permit Needed?   | How it Works  | PROS   | CONS  |
|--------------|--|---|--|---|
| b. Endothall | Y  | <p>Broad-spectrum<sup>3</sup>, contact<sup>4</sup> herbicide that inhibits protein synthesis</p> <p>Applied as liquid or granules</p>   | <p>Especially effective on CLP and also effective on EWM</p> <p>May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring</p> <p>Can be selective depending on concentration and seasonal timing</p> <p>Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds</p> <p>Limited off-site drift</p> | <p>Kills many native pondweeds</p> <p>Not as effective in dense plant beds; heavy vegetation requires multiple treatments</p> <p>Not to be used in water supplies; post-treatment restriction on irrigation</p> <p>Toxic to aquatic fauna (to varying degrees)</p>  |
| c. Diquat    | Y  | <p>Broad-spectrum, contact herbicide that disrupts cellular functioning</p> <p>Applied as liquid, can be combined with copper treatment</p>   | <p>Mostly used for water-milfoil and duckweed</p> <p>Rapid action</p> <p>Limited direct toxicity on fish and other animals</p>   | <p>May impact non-target plants, especially native pondweeds, coontail, elodea, naiads</p> <p>Toxic to aquatic invertebrates</p> <p>Must be reapplied several years in a row</p> <p>Ineffective in muddy or cold water (&lt;50°F)</p>   |
| d. Fluridone | Y; special permit and Environmental Assessment may be required | <p>Broad-spectrum, systemic herbicide that inhibits photosynthesis</p> <p>Must be applied during early growth stage</p> <p>Available with a special permit only; chemical applications beyond 150 ft from shore not allowed under NR 107</p> <p>Applied at very low concentration at whole lake scale</p> | <p>Effective on EWM for 1 to 4 years with aggressive follow-up treatments</p> <p>Some reduction in non-target effects can be achieved by lowering dosage</p> <p>Slow decomposition of plants may limit decreases in dissolved oxygen</p> <p>Low toxicity to aquatic animals</p>  | <p>Affects non-target plants, particularly native milfoils, coontails, elodea, and naiads, even at low concentrations</p> <p>Requires long contact time at low doses: 60-90 days</p> <p>Demonstrated herbicide resistance in hydrilla subjected to repeat treatments</p> <p>In shallow eutrophic systems, may result in decreased water clarity</p> <p>Unknown effect of repeat whole-lake treatments on lake ecology</p> |

**Appendix E**  
**Survey Results**

## Devils LAKE USER SURVEY

### SECTION 1 – Residency

These first few questions will help to determine who is responding to this. If you have more one property on the lake, please comment on the one property that you have had the longest.

1. What type of property do you have on Devils Lake? If you have more than one type of property, please report on only the property you have had the Devilsest. (please select one)

|   |                           |
|---|---------------------------|
| <u>23</u> permanent residence                                 | <u>2</u> business         |
| <u>37</u> seasonal residence<br>weekend visits throughout the | <u>1</u> undeveloped land |
| <u>31</u> year  | <u>0</u> other _____      |

2. How long have you owned your property on Devils Lake? (If less than 1 year, please write '1' in the space provided. If you own multiple properties, please comment on the one you have owned for the Devilsest period of time.)

I have owned the property for 20.698925 years.

3. During a 12-month period (Jan. 1 – Dec. 31) how many days are you, members of your family, or guests at the property indicated in Question 1? (please provide your best estimate in the space below)

There are people at the property approximately 134.52174 days a year.

4. On average, about how many people are at the property each time it is being used? 3.622340426

### SECTION 2 – Lake Use

The purpose of this section is to gather information on how Devils Lake is used by its residents.

1. From the list below, check all activities on Devils Lake that you, your family, or guests participate in.

|                                     |                               |                                  |
|-------------------------------------|-------------------------------|----------------------------------|
| <u>67</u> A. fishing from the shore | <u>29</u> F. ice fishing      | <u>54</u> K. wildlife viewing    |
| <u>73</u> B. fishing from a boat    | <u>30</u> G. speed boating    | L. canoe/kayak/paddle<br>boat    |
| <u>66</u> C. pontoon boating        | <u>21</u> H. jet skiing       | <u>61</u> M. water skiing/tubing |
| <u>85</u> D. rest/relaxation        | <u>0</u> I. wild rice harvest |                                  |
| <u>86</u> E. swimming/wading        | <u>8</u> J. sailing           |                                  |

2. Which 3 activities from the above list do you or members of your family or guests participate in most often? (write the letters of the corresponding activities in the spaces below)

I (We) participate in \_ ice fishing  
rest/relaxation  
fishing from the shore

3. During the open-water (no ice) season, how frequently do you use the lake for the activities listed in Question 1, this section?

|           |                        |          |                                     |
|-----------|------------------------|----------|-------------------------------------|
| <u>14</u> | daily                  | <u>9</u> | once or twice per month             |
| <u>35</u> | several times per week | <u>2</u> | once or twice per open-water season |
| <u>34</u> | 3 or 4 times per month |          |                                     |

4. What type(s) of watercraft do you own, rent, or use on Devils Lake? (Check all that apply. If you do *not use any watercraft on Devils Lake, please check the last box.*)

|           |                                     |           |  |
|-----------|-------------------------------------|-----------|--|
| <u>35</u> | motorized boat (less than 50hp)     | <u>56</u> | canoe or kayak   |
| <u>39</u> | motorized boat (50hp or greater)    | <u>0</u>  | sailboat   |
| <u>40</u> | paddle boat                         | <u>0</u>  | other (please specify) _____   |
| <u>55</u> | pontoon boat                        | <u>0</u>  | I do not own, rent, or use a boat or other watercraft on Devils Lake |
| <u>19</u> | personal watercraft – PWC (jet-ski) |           |  |

### SECTION 3 – Lake Stewardship

This section of the survey will provide information about the lake stewardship practices of lake property owners.

1. Which of the following do you consider the most desirable landscaping for your property? (*please check one*)

|           |  |          |  |
|-----------|--|----------|--|
| <u>3</u>  | mowed/manicured lawn to shoreline          | <u>9</u> | unmanaged natural vegetation aDevils shoreline |
| <u>6</u>  | mowed lawn with landscaped shoreline       | <u>0</u> | other  |
| <u>36</u> | mowed lawn to sand beach                   |          |  |
| <u>38</u> | managed natural vegetation along shoreline |          |  |

2. Which of the following water quality/landscaping practices are you familiar with? (*check all that apply*)

|           |  |           |  |
|-----------|--|-----------|--|
| <u>24</u> | rain garden                                      | <u>48</u> | natural shoreline restoration                                |
| <u>46</u> | shoreline buffers                                | <u>39</u> | septic system upgrade  |
| <u>35</u> | native prairie restoration                       | <u>27</u> | runoff reduction practices                                   |
| <u>68</u> | not fertilizing                                  | <u>43</u> | native flower/tree planting                                  |
| <u>58</u> | using zero phosphorus fertilizers                | <u>0</u>  | other (please describe) _____                                |
| <u>25</u> | diversion of surface water runoff away from lake | <u>3</u>  | not familiar with any of these ( <i>skip to question 6</i> ) |

3. Which, if any, of the following water quality/landscaping “practices” have you installed or do you practice on your property on Devils Lake? (check all that apply)

|           |  |           |                                       |
|-----------|--|-----------|---------------------------------------|
| <u>4</u>  | rain garden                                      | <u>20</u> | natural shoreline restoration         |
| <u>22</u> | shoreline buffers                                | <u>25</u> | septic system upgrade                 |
| <u>5</u>  | native prairie restoration                       | <u>12</u> | runoff reduction practices            |
| <u>60</u> | not fertilizing                                  | <u>23</u> | native flower/tree planting           |
| <u>31</u> | using zero phosphorus fertilizers                | <u>0</u>  | other (please describe) _____         |
| <u>9</u>  | diversion of surface water runoff away from lake | <u>3</u>  | I have not installed any of the above |

4. Which, if any, of the following outcomes might motivate you to install a water quality/landscaping practice on your property? (*check all that apply*)

- 52 increasing the natural beauty of your property
- 65 improving the water quality of Devils Lake
- 49 improving the water quality around your property's shoreline
- 53 providing better habitat for fish
- 51 providing better habitat for birds and wildlife
- 27 setting an example for other lake residents
- 20 less lawn mowing time
- 32 a property tax rebate
- 21 financial assistance that pays a portion of the cost/installation
- 17 technical assistance that would evaluate my property for water quality concerns
- 17 technical assistance that would identify appropriate practices to install
- 0 other (*please describe*) \_\_\_\_\_
- 19 I have no interest in installing a water quality/landscaping practice on my property

5. From the list above, select your first and second strongest motivators. (*write the letters of the corresponding activities in the spaces below*)

- |   |                            |
|---|----------------------------|
| <u>improving the water quality of Devils Lake</u>     | Strongest motivator        |
| <u>increasing the natural beauty of your property</u> | Second strongest motivator |

6. What type of septic system do you have on your property? (*select all that apply*)

- |                               |                                    |
|-------------------------------|------------------------------------|
| <u>16</u> mound system        | <u>19</u> holding tank             |
| <u>9</u> at-grade system      | <u>5</u> lift pump system          |
| <u>44</u> conventional system | <u>3</u> none (skip to Section 4)  |
|                               | <u>0</u> other (please list) _____ |

7. How many years ago was your septic system last inspected? (*please provide your best recall*)

- |                     |                     |                    |
|---------------------|---------------------|--------------------|
| <u>77</u> 1-5 years | <u>5</u> 6-10 years | <u>2</u> 11+ years |
| <u>1</u> Never      | <u>7</u> Not Sure   |                    |

8. When was your septic system last 'pumped' or 'sewered'? (*please provide your best recall*)

- |                     |                     |                    |
|---------------------|---------------------|--------------------|
| <u>83</u> 1-5 years | <u>3</u> 6-10 years | <u>0</u> 11+ years |
| <u>0</u> Never      | <u>0</u> Not Sure   |                    |

## SECTION 4 – Lake Issues

The questions in this section pertain to various issues in Devils Lake including water quality, lake level, and aquatic plant growth.

1. Below is a list of possible impacts to Wisconsin lakes. To what level do you believe each of the following factors may currently be negatively impacting Devils Lake? Please enter one number for each impact description. Not present means that you believe the issue does not exist on Devils Lake. No Impact means that the issue may exist but is NOT negatively impacting the lake.

0. = Not Present

1. = No Impact

2. = Low negative impact

3. = Moderately negative impact

4. = Great negative impact

5. = Unsure or Need more information

|           |                                     |           |   |
|-----------|-------------------------------------|-----------|---|
| <u>44</u> | A. poor quality fishing             | <u>9</u>  | K. high water level in the lake                                 |
| <u>33</u> | B. too much public use              | <u>1</u>  | L. too much wild rice   |
| <u>6</u>  | C. not enough weed growth           | <u>2</u>  | M. not enough wild rice   |
| <u>25</u> | D. poorly maintained boat access    | <u>57</u> | N. introduction of undesirable aquatic plants and animals       |
| <u>35</u> | E. low water level in the lake      | <u>9</u>  | O. nuisance wildlife (please specify) _____                     |
| <u>18</u> | F. foul or offensive odor           | <u>7</u>  | P. other (please specify) _____                                 |
| <u>22</u> | G. too much weed growth             | <u>10</u> | Q. not concerned about any of these issues (skip to Question 3) |
| <u>27</u> | H. overdevelopment of the shoreline |           |   |
| <u>22</u> | I. "icky" or "green" water          |           |   |
| <u>22</u> | J. too much shoreline lighting      |           |   |

2. Which **three** issues from the above list are of the most concern to you? (*write the letters of the corresponding issues in the spaces below*)

I am most concerned about issues introduction of undesirable aquatic plants and animals  
poor quality fishing  
low water level in the lake

3. In this survey, clean and clear water is considered *good* water quality while green (algae) water is considered *poor* water quality. In your opinion, the water quality in the summer (June – September) in Devils Lake is:

43 excellent    48 good    2 fair    0 poor  
0 very poor    0 I don't know

4. Please check the answer that best completes the following sentence: "In my opinion, the overall level of the lake, given fluctuation with rainfall, seems to be ...."

9 too high    58 just right    9 too low    9 I don't know

5. How often, if ever has low water level prevented you from using Devils Lake?

54 never    21 rarely    15 sometimes  
1 often    0 I do not use the lake

6. Aquatic plants (rooted and floating) are an important part of any healthy lake system. In the time that you have owned the property indicated in Section 1, Question 1, would you say the amount of visible aquatic plant growth in the lake, **excluding algae**, has:

16 increased    57 stayed the same  
8 decreased    11 unsure

7. Aquatic plant growth varies throughout the open water season. Which month(s) of the season do you consider aquatic plant growth, excluding algae, to be problematic in Devils Lake? (check all that apply)

1 May    1 June    3 July    21 August  
4 September    0 October    41 Never a problem    26 I don't know

### **SECTION 5 – Aquatic Invasive Species in Devils Lake**

**This section of the survey seeks to determine how much lake residents know about aquatic invasive species. Aquatic invasive species are plants and animals that are foreign to Devils Lake and do not belong there.**

#### **Curly-leaf pondweed (CLP)**

Curly-leaf pondweed has not been documented in Devils Lake but could be a threat in the future. CLP can create nuisance levels of plant growth and negatively impact water quality in a lake.

1. How much do you know about CLP and the problems it can cause in a lake?

2 a lot    23 some    32 very little    36 just what I have read here

2. Do you think you would recognize CLP in the lake if you saw it?

3 definitely yes    14 probably yes    20 unsure  
34 probably not    23 definitely not

#### **Eurasian Watermilfoil (EWM)**

Eurasian watermilfoil has not been documented in Devils Lake but could be a threat in the future. EWM can form dense beds of vegetation that interfere with many lake uses.

3. How much do you know about EWM and the problems it can cause in a lake?

17 a lot    41 some    24 very little    11 just what I have read here

4. Do you think you would recognize EWM in the lake if you saw it?

8 definitely yes      30 probably yes      25 unsure  
21 probably not      9 definitely not

**Purple Loosestrife**

Purple loosestrife, an invasive shoreline/wetland plant species, has not been documented in Devils Lake but could be a threat in the future. Purple loosestrife can take over shorelines and wetlands displacing more beneficial native plants.

5. How much do you know about purple loosestrife and the problems it can cause in a lake?

7 a lot      18 some      41 very little      27 just what I have read here

6. Do you think you would recognize purple loosestrife in the lake if you saw it?

6 definitely yes      19 probably yes      19 unsure  
31 probably not      18 definitely not

**Other Aquatic Invasive Species**

7. Below is a list of additional aquatic invasive species. Please check all of those that you have heard of before.

|                                 |   |
|---------------------------------|---|
| <u>91</u> zebra mussels         | <u>5</u> freshwater jellyfish             |
| <u>28</u> Chinese mystery snail | <u>75</u> carp                            |
| <u>2</u> New Zealand mudsnail   | <u>12</u> spiny waterflea                 |
| <u>2</u> Japanese knotweed      | <u>8</u> hydrilla                         |
| <u>23</u> Rusty crayfish        | <u>1</u> phragmites                       |
| <u>9</u> Banded mystery snail   | <u>1</u> I have not heard of any of these |

8. In order to gauge potential interest, would you be willing to take part in a training session to help you identify aquatic invasive species in the lake?

8 definitely yes      45 probably yes      15 unsure  
19 probably not      6 definitely not

**SECTION 6 – Aquatic Plant Management**

**Currently aquatic plant growth in Devils Lake is not managed. Algae growth is also not managed. A benefit of aquatic plant management strategies is that they can also help reduce algae growth. Aquatic plants in a lake can be managed in many different ways. Sometimes no aquatic plant management may be the best option.**

1. During open water season how often, if at all, does aquatic plant growth (including algae) negatively impact your enjoyment of Devils Lake?



42 never                      43 rarely                      7 sometimes  
0 often                      0 always

2. Considering your answer to the question above, do you believe aquatic plant management (which would also help reduce algae growth) is needed on Devils Lake?

8 definitely yes                      24 probably yes                      38 unsure  
23 probably not                      0 definitely not

3. Which type(s) of aquatic plants do you think should be managed on Devils Lake? (*check all that apply*)

|  |   |
|--|---|
| <u>40</u> grow below the water's surface | <u>38</u> algae on the water's surface            |
| <u>34</u> stick out of the water         | <u>23</u> grow on the shoreline, out of the water |
| <u>28</u> float on the water's surface   | <u>0</u> other                                    |

**Common Aquatic Plant Management Methods**

If plant management is recommended for Devils Lake, what methods might you support? Please assume that the following management methods are safe and legal, and would only be performed by professionals and only be used if approved by the State of Wisconsin. Total removal or eradication of aquatic plants is not possible.

4. Please mark whether you would support, oppose, or need more information about the use of these aquatic plant management methods on Devils Lake.

Small-scale (less than 10 acres) mechanical harvesting:

|                   |                       |
|-------------------|-----------------------|
| <u>19</u> support | <u>12</u> oppose      |
| <u>50</u>         | need more information |

Large-scale (10 acres or greater) mechanical harvesting:

|                   |                       |
|-------------------|-----------------------|
| <u>15</u> support | <u>15</u> oppose      |
| <u>50</u>         | need more information |

Hand-pulling and raking in shallow waters:

|                   |                       |
|-------------------|-----------------------|
| <u>46</u> support | <u>9</u> oppose       |
| <u>28</u>         | need more information |

Small-scale (less than 10 acres) of chemical herbicide application:

|                   |                       |
|-------------------|-----------------------|
| <u>11</u> support | <u>33</u> oppose      |
| <u>36</u>         | need more information |

Large-scale (10 acres or greater) of chemical herbicide application:

|                  |                       |
|------------------|-----------------------|
| <u>5</u> support | <u>36</u> oppose      |
| <u>38</u>        | need more information |

Biological control (using one live species to control another):

|                   |                       |
|-------------------|-----------------------|
| <u>13</u> support | <u>16</u> oppose      |
| <u>49</u>         | need more information |

No Management:

|           |           |           |                       |
|-----------|-----------|-----------|-----------------------|
| <u>13</u> | support   | <u>18</u> | oppose                |
|           | <u>38</u> |           | need more information |

5. Have you made any attempts to remove or control aquatic plants in Devils Lake by your shore property?

(check one)

|           |                      |           |  |
|-----------|----------------------|-----------|--|
| <u>54</u> | no                   | <u>37</u> | yes, I did it myself                     |
| <u>0</u>  | yes, I hired someone | <u>0</u>  | yes, I did some myself and hired someone |

6. What have you done to remove aquatic plants from the lake by your property? (Check all that apply)

|          |   |           |  |
|----------|---|-----------|--|
| <u>0</u> | hire someone to hand-pull or rake                               | <u>39</u> | self hand pull or rake                 |
| <u>0</u> | hire someone to apply chemical herbicide                        | <u>2</u>  | self application of chemical herbicide |
| <u>0</u> | mechanical plant removal with boat and motor or other apparatus | <u>0</u>  | other                                  |

**SECTION 7 –Community Support**

Local, county, state, and federal resources will be sought in addition to Lake Association funds to implement management recommendations for Devils Lake. Donations of volunteer time, services, materials, and equipment can be used as match funding for many grant programs reducing the overall financial burden to the Lake Association. The following questions will help to determine your willingness to support future projects involving the implementation of aquatic plant and lake management recommendations.

1. Following are activities that lake residents could participate in. *Please check all those activities you might be willing to volunteer your time if additional assistance is needed. This is not a commitment but rather a measure of possible assistance if needed.*

|           |   |
|-----------|---|
| <u>46</u> | watercraft inspection at the boat landings such as Clean Boats Clean Waters       |
| <u>31</u> | on the water monitoring for aquatic invasive species                              |
| <u>33</u> | shore land monitoring for aquatic invasive species                                |
| <u>8</u>  | raising beetles for purple loosestrife control                                    |
| <u>20</u> | native aquatic plant monitoring and identification                                |
| <u>35</u> | water quality monitoring  |
| <u>31</u> | wildlife monitoring (ex. frogs, turtles, loons, other waterfowl, mussels & clams) |
| <u>1</u>  | Some other activity <u>pulling purple loosestrife</u>                             |
| <u>23</u> | I am not interested in volunteering any time (skip to question 3)                 |

2. How much time would you be willing to contribute to support any of the activities in Question 1 above?

|           |                    |           |                   |          |                        |
|-----------|--------------------|-----------|-------------------|----------|------------------------|
| <u>39</u> | a few hours a year | <u>21</u> | a few days a year | <u>2</u> | longer periods of time |
|-----------|--------------------|-----------|-------------------|----------|------------------------|

3. Donated service needs are varied and somewhat unknown, but could include any of the options listed below. Do you think you would be willing to provide any of the services that may be necessary? This is not a commitment but rather a measure of possible assistance if needed. (check all that apply)

|           |                   |          |                                    |
|-----------|-------------------|----------|------------------------------------|
| <u>13</u> | GPS use           | <u>8</u> | gardening/landscape design         |
| <u>4</u>  | grant writing     | <u>5</u> | gardening/landscape implementation |
| <u>2</u>  | printing services | <u>1</u> | web development                    |
| <u>34</u> | physical labor    | <u>3</u> | scuba diving                       |

1 sewing  
3 graphic design  
1 legal services  
5 construction service

7 outdoor sign design  
37 I am not interested or not able to provide assistance  
1 other

4. Have you ever attended a Devils Lake Association (DLA) meeting?

56 yes (*skip to question 6*)      34 no

5. What, if anything, has prevented you from attending a DLA meeting?

5 not interested      10 I don't have time      8 I never know when they are  
0 other (please explain) \_\_\_\_\_ occurring

6. The Devils Lake Association annual meeting is generally held in the morning on the Saturday of Memorial Day Weekend. *In the following list of meeting dates and times, please check up to three meeting dates that would work for you.*

41 The current date and time works for me  
7 Hold the meeting in the afternoon on the Saturday of Memorial Day  
5 Hold the meeting in the evening on the Saturday of Memorial Day  
14 Hold the meeting the Saturday before Memorial Weekend  
13 Hold the meeting the Saturday after Memorial Weekend  
9 Hold the meeting a different day (please indicate when) \_\_\_\_\_  
13 I am not interested in the Long Lake Association annual meeting

7. What is your affiliation with the Devils Lake Association?

67 current member (skip to Question 9)      8 former member  
10 I have never been a member

8. What, if anything has kept you from being a member of DLA?

2 not interested      1 I disagree with what they are doing  
2 dues are too high      2 I haven't been asked to be a member  
2 I did not know it existed      1 I feel there is no benefit for being a member  
4 I do not have enough time      5 Other \_\_\_\_\_

9. How satisfied are you with the following aspects of Lake Association activity? If you are unfamiliar with an activity, please check the last column.

|   | Very Satisfied | Somewhat Satisfied | Unsure    | Somewhat Dissatisfied | Very Dissatisfied | Unfamiliar with Activity |
|---|----------------|--------------------|-----------|-----------------------|-------------------|--------------------------|
| Communication with Community                          | <b>24</b>      | <b>24</b>          | <b>17</b> | <b>8</b>              | <b>2</b>          | <b>9</b>                 |
| Meeting Frequency                                     | <b>15</b>      | <b>25</b>          | <b>25</b> | <b>2</b>              | <b>3</b>          | <b>12</b>                |
| Meeting atmosphere (parliamentary procedure)          | <b>14</b>      | <b>18</b>          | <b>26</b> | <b>6</b>              | <b>0</b>          | <b>17</b>                |
| Executing Lake Association business                   | <b>29</b>      | <b>5</b>           | <b>10</b> | <b>1</b>              | <b>1</b>          | <b>11</b>                |
| Promoting cooperation to achieve goals and objectives | <b>19</b>      | <b>19</b>          | <b>24</b> | <b>3</b>              | <b>2</b>          | <b>14</b>                |
| Management of association and finances                | <b>19</b>      | <b>17</b>          | <b>28</b> | <b>3</b>              | <b>0</b>          | <b>16</b>                |
| Listening to property owners' needs and concerns      | <b>13</b>      | <b>19</b>          | <b>30</b> | <b>2</b>              | <b>4</b>          | <b>15</b>                |

10. When information from the Devils Lake Association is available, how would you most prefer to be contacted? (*please check one*)

53 mail      44 email      3 phone      0 in person  
2 I do not want to be contacted

11. If there are any additional issues you would like the Lake Association to address, please use the space

need more monitoring at boat landings

outlaw fertilizer on lake frontage and land sloping to lake. Outlaw power raking of sandy beaches

"Want people to leave the lake alone... This aint the suburbs"

Article in Loon Lingo about dogs not being on leashes

LONG RANT - See Survey #11

Stock Walleye

Wash station at landing and will to contribute

Put buoys back at the beach to protect swimmers

better boat inspections and expanded

Use of Jet skis causing erosion & underwater pathways

Grooming to waters edge - unnatural lake shore. Use power equip and disc the soil/sand. Why no enforcement? You can see straight edge where one property line ends and looks like a city beach.

---

Fishing regulations- general regulations for WI are poor need slot limits on Bass, Hybrid or Nothern pike policy/introduction/management to control pan fish size

---

I can't believe the county would allow a 5000sq' house to be built on a 100' lot. Most of the rain water is going to the lake at this time. We need to control new construction first.

---

The future of Devils Lake needs to be based on things other than tourism/public use and fishing

---

More info about cabin breakins and how to prevent

---

Fishing regulations, too many small northerns and largemouth gass. Needs to be addressed.

---

Stop the over fishing from people in the trailers by the bumps, in particular Terry \_\_\_\_? Large man in his 50's and his son Mitchel. He holds fish frys for the residents and brags about his abuse of fish limits.

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There is not enough empahsis on invasive species and boat monitoring by the DLA board. Many weekends have not been monitored this summer. Many members have been alienated by current board.

---

Control personal watercraft motorized on lake stay away from docks and shore

---

**Thank you for your time and your answers! Providing your contact information is *OPTIONAL* but if you wish to, please do! Contact information will be used for follow up if needed.**

Name: \_\_\_\_\_

Address: \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_ Zip \_\_\_\_\_

Phone number: \_\_\_\_\_ Email address \_\_\_\_\_

## Appendix F

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