Aquatic Plant Management Plan

Rooney Lake Association

Burnett County, WI

May 24, 2013

Sponsored By
Rooney Lake Association

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Tables

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Introduction

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

Knowing that Eurasian water milfoil (*Myriophyllum spicatum*) is found in several lakes in Burnett and Washburn County, concerned members of the Rooney Lake Association authorized an extensive assessment of Rooney 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 Rooney 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 Rooney Lake are presented. This plan will guide the Rooney Lake Association, Burnett County, and the Wisconsin Department of Natural Resources in aquatic plant management for Rooney Lake over the next five years (from 2014 through 2019).

Public Input for Plan Development

On August 28, 2013, a public meeting was held to discuss the concerns of Rooney Lake and to establish those concerns as the primary focus of writing the Aquatic Plant Management Plan for the lake. Prior to the meeting date, a Public Notice was advertised for two weeks in the local newspaper. A total of 31 people were present for the meeting. Minutes of the meeting were recorded. A summary of the concerns are listed below:

- Water clarity and algal blooms tied in with the fact that many felt like they could not use the lake for swimming
- Control and prevent nutrient run-off/shoreland preservation/restoration
- Issues concerning the introduction of aquatic invasive species
- Encouraging the growth of native plants
- Mass education on various subjects related to protecting and preserving this natural resource, including wildlife and fish species enhancement
- Boat landing inspections
- Issues concerning the amount of Eurasian water milfoil in Burnett County

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 80 surveys were sent out and a total of 45 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 Rooney Lake Association announced the availability of the draft Aquatic Plant Management Plan for review by April 21, 2014. 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 Rooney Lake Aquatic Plant Management committee members. Comments and suggestions can be mailed or emailed to the address/addresses below.

Schedule for Plan Completion	April 21, 2014
Comments accepted on the plan through	May 12, 2013
Final draft for DNR and public review by	May 24, 2014

Send comments via mail or email to:

Brad Morris
Burnett County Land and Water Conservation Department
7410 County Road K, #109
Siren, WI 54872
bmorris@burnettcounty.org

Board meeting to review comments TBD

Lake Information

Rooney 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 on 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

Rooney Lake	**WBIC: 2493100**
Size (acres)	329
Mean depth (feet)	9.2
Maximum depth (feet)	30
Littoral zone depth (feet)	20

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

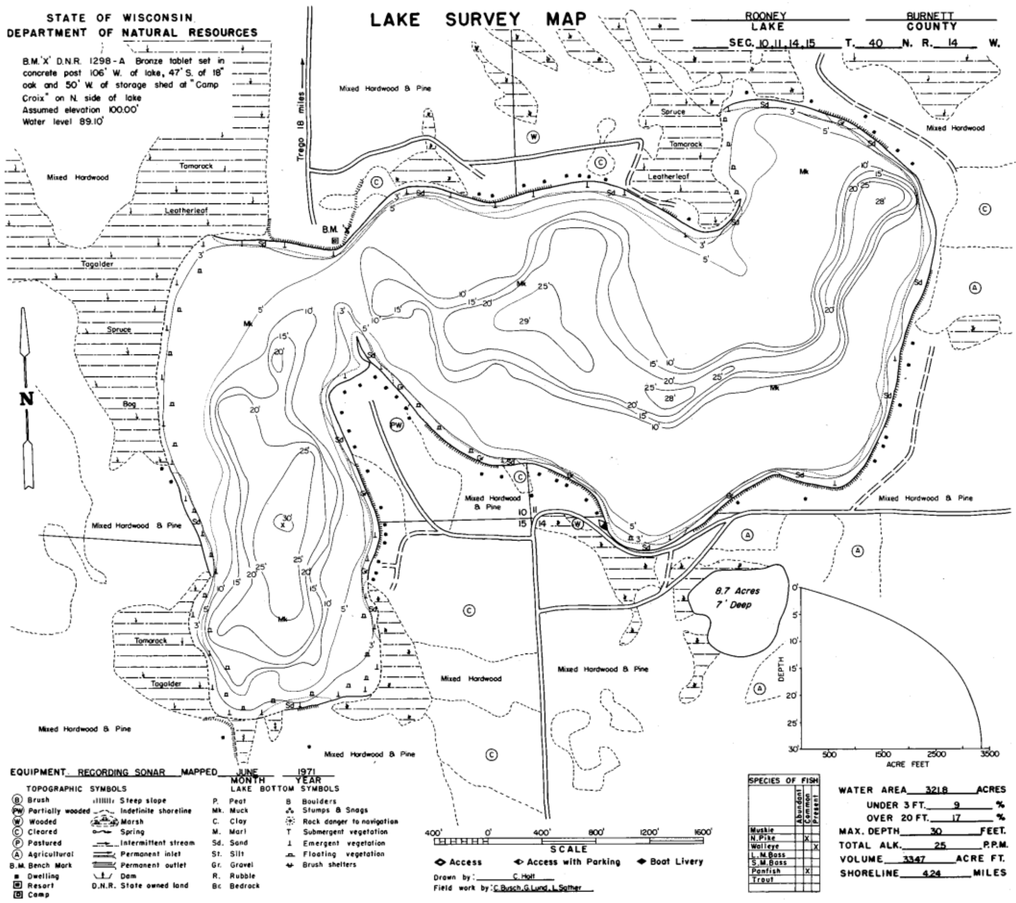


Figure 1: Rooney Lake Contour Map [1]

Water Quality

Water quality is frequently reported by the trophic state or nutrient level of the lake. 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 1988. The average summer (July-Aug) secchi disk reading for Rooney Lake - Deep Hole (Burnett

County, WBIC: 2649500) was 13.07 feet. The average for the Northwest Georegion was 8.5 feet.
Chemistry data was collected on Rooney Lake - East-Site A-Main Basin. The average summer Chlorophyll was 3.5 µg/l (compared to a Northwest Georegion summer average of 14.8 µg/l). The summer Total Phosphorus average was 14.3 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.
The overall Trophic State Index (based on chlorophyll) for Rooney Lake - East-Site A-Main Basin was 44. The TSI suggests that Rooney Lake - East-Site A-Main Basin 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. The average summer (July-Aug) secchi disk reading for Rooney Lake - East-Site A-Main Basin (Burnett County, WBIC: 2493100) was 13.07 feet. The average for the Northwest Georegion was 8.5 feet. Typically the summer (July-Aug) water was reported as* ***CLEAR*** *and* ***GREEN****.* [2]

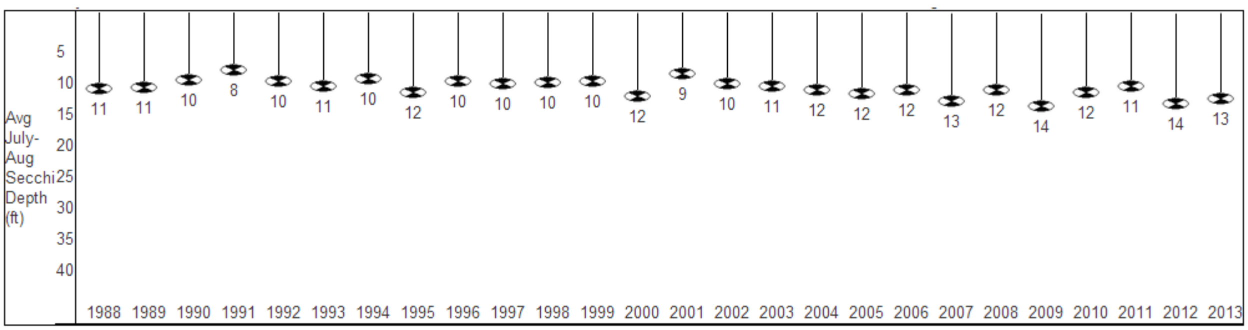


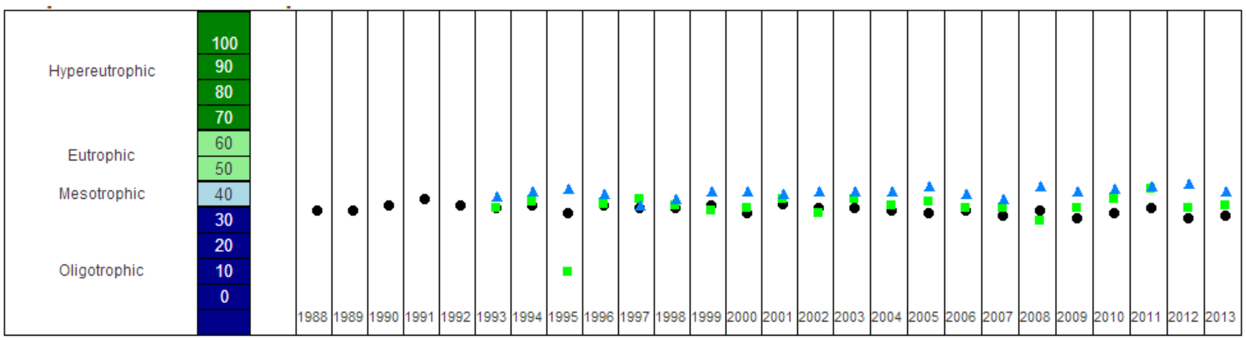
Figure 2: Past Secchi Readings of Rooney Lake (1)

Table 2: Secchi Readings on Rooney Lake from 1988-2013 [2]

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
1988	11.46	8.25	19	7
1989	11.25	11	11.5	2
1990	10	8	12	5
1991	8.33	8	10	6
1992	10.15	8.75	11	5
1993	11	9.5	13	3
1994	9.7	8.5	11	5
1995	12	11	13	2
1996	10.19	10	10.75	4
1997	10.58	7	12.5	6
1998	10.37	9	11.1	3
1999	10.25	7	12	4
2000	12.58	10.25	17	3

Continued 2001	9.06	7.25	11	4
2002	10.5	10	11	2
2003	11	10	12	3
2004	11.6	10	15	5
2005	12.21	10	14.5	6
2006	11.54	10	13	6
2007	13.37	9.6	16.5	6
2008	11.67	5	14	6
2009	14.25	14	14.5	3
2010	12	10	15	8
2011	11.05	9.5	12	5
2012	13.75	12	15.5	2
2013	13.07	11	15	7

Figure 3: Trophic State Index for Rooney Lake Deep Hole [1]



Monitoring Station: Rooney Lake - East-Site A-Main Basin, Burnett County

Past Summer (July-August) Trophic State Index (TSI) averages.

• = Secchi ■ = Chlorophyll ▲ = Total Phosphorus

TSI(Chl) = TSI(TP) = TSI(Sec)	It is likely that algae dominate light attenuation.
TSI(Chl) > TSI(Sec)	Large particulates, such as Aphanizomenon flakes dominate
TSI(TP) = TSI(Sec) > TSI(Chl)	Non-algal particulate or color dominate light attenuation
TSI(Sec) = TSI(Chl) >= TSI(TP)	The algae biomass in your lake is limited by phosphorus
TSI(TP) > TSI(Chl) = TSI(Sec)	Zooplankton grazing, nitrogen, or some factor other than phosphorus is limiting algae biomass

TSI	TSI Description
TSI < 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.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 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.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 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).
TSI > 80	Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

Watershed

The Lower Namekagon River Watershed includes the Namekagon River drainage from below the Trego Lake dam down to the confluence with the St. Croix River except for the Totagatic River drainage. Included in this area is a portion of west central Washburn County and a part of northeastern Burnett County. The watershed is approximately 153,176 acres in size and contains 172 miles of streams and rivers, 12,590 acress of lakes and 21,781 acres of wetlands. The watershed is dominated by forest (62%) and wetlands (14%) and is ranked low for nonpoint source issues affecting groundwater. [3]

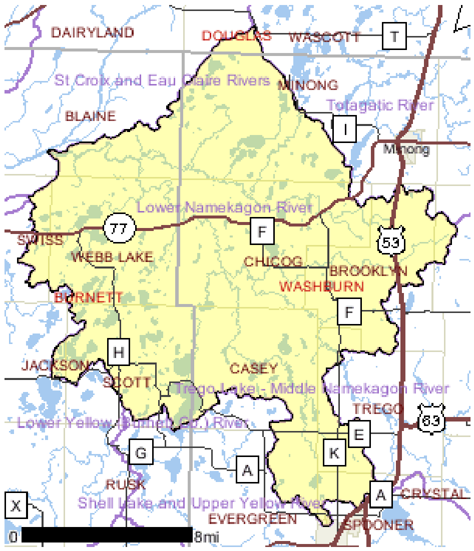


Figure 4: Lower Namekagon River Watershed [3]

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.[5] 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: [2]

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 found in the St. Croix Basin, followed by a short discussion of the major land cover types.

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

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.

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 Rooney 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 Rooney 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.[4] 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.[5]

Aquatic Invasive Species Status

During the spring and summer surveys of 2013, no purple loosestrife or curly-leaf pondweed were found on Rooney Lake. There was however reed canary grass found. No Eurasian water milfoil (Myriophyllum spicatum) was found on the lake, but it has been found in three nearby lakes in Burnett County: Ham Lake, Round Lake and Trade Lake. The EWM has also been found in Long Trade Lake, just across the border in Polk County. It is therefore of paramount importance that the Rooney Lake Association takes measures to avoid the introduction of EWM 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 Rooney Lake that are listed as being endangered, threatened or of special interest (Table 4).

Table 4: Natural Heritage Inventory (NHI) Species Found in Rooney Lake Area (T.40N. – R.14W.)[6]

Common Name	Scientific Name	WI State Status
Least Darter	*Etheostoma microperca*	SC/N
Blanding's Turtle	*Emydoidea blandingii*	SC/H
Trumpeter Swan	*Cygnus buccinator*	SC/M
Little Brown Bat	*Myotis lucifugus*	THR
Karner Blue Butterfly	*Lycaeides melissa samuelis*	NA
Bald Eagle	*Haliaeetus leucocephalus*	SC/P
Northeastern Bladderwort	*Utricularia resupinata*	SC
Slender Bulrush	*Schoenoplectus heterochaetus*	SC

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

Rooney Lake Fishery

Fish Stocking Data

Table 5: Fish Stocking Data[7]

Year	Stocked Waterbody Name	Local Waterbody Name	Location	Species	Strain (Stock)	Age Class	Number Fish Stocked	Avg Fish Length (IN)
1990	ROONEY LAKE		40N-14W-11	WALLEYE	UNSPECIFIED	YEARLING	558	9.00
1989	ROONEY LAKE		40N-14W-11	WALLEYE	UNSPECIFIED	FINGERLING	16,340	3.00
1986	ROONEY LAKE		40N-14W-11	WALLEYE	UNSPECIFIED	FINGERLING	16,000	3.00
1984	ROONEY LAKE		40N-14W-11	WALLEYE	UNSPECIFIED	FINGERLING	16,017	3.00
1982	ROONEY LAKE		40N-14W-11	WALLEYE	UNSPECIFIED	FINGERLING	6,480	3.00

Table 6: Rooney Lake Species List[7]

Common Name	Scientific Name	Relative Abundance
Gamefish		
Northern pike	Esox lucius	Abundant
Largemouth Bass	Micropterus salmoides	Abundant
Walleye	Sander vitreum	Present
Panfish		
Bluegill	Lepomis macrochirus	Abundant
Black crappie	Pomoxis nigromaculatus	Abundant
Pumpkinseed	Lepomis gibbosus	Common
Rock bass	Amblopites rupestris	Common
Yellow perch	Perca flavecens	Common
Black bullhead	Ameiurus melas	Present
Brown bullhead	Ictalurus nebulosus	Present
Yellow bullhead	Ictalurus natalis	Present
Forage and other species		
Bowfin		Common
White sucker	Catostomus commersoni	Common
Golden shiner	Notemigonus crysoleucas	Present
Common shiner	Notropis cornutus	Present
Spottail shiner	Notropis hudsonius	Common
Blacknose shiner	Notropis heterolepis	Present
Blackchin shiner	Notropis heterodon	Present
Johnny darter	Etheostoma nigrum	Present
Bluntnose minnow	Pimephales notatus	Present

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 Rooney Lake (Figure 7). In June, 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 537 points on Rooney 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, no sites in the littoral zone were discovered. (See Figure 5)

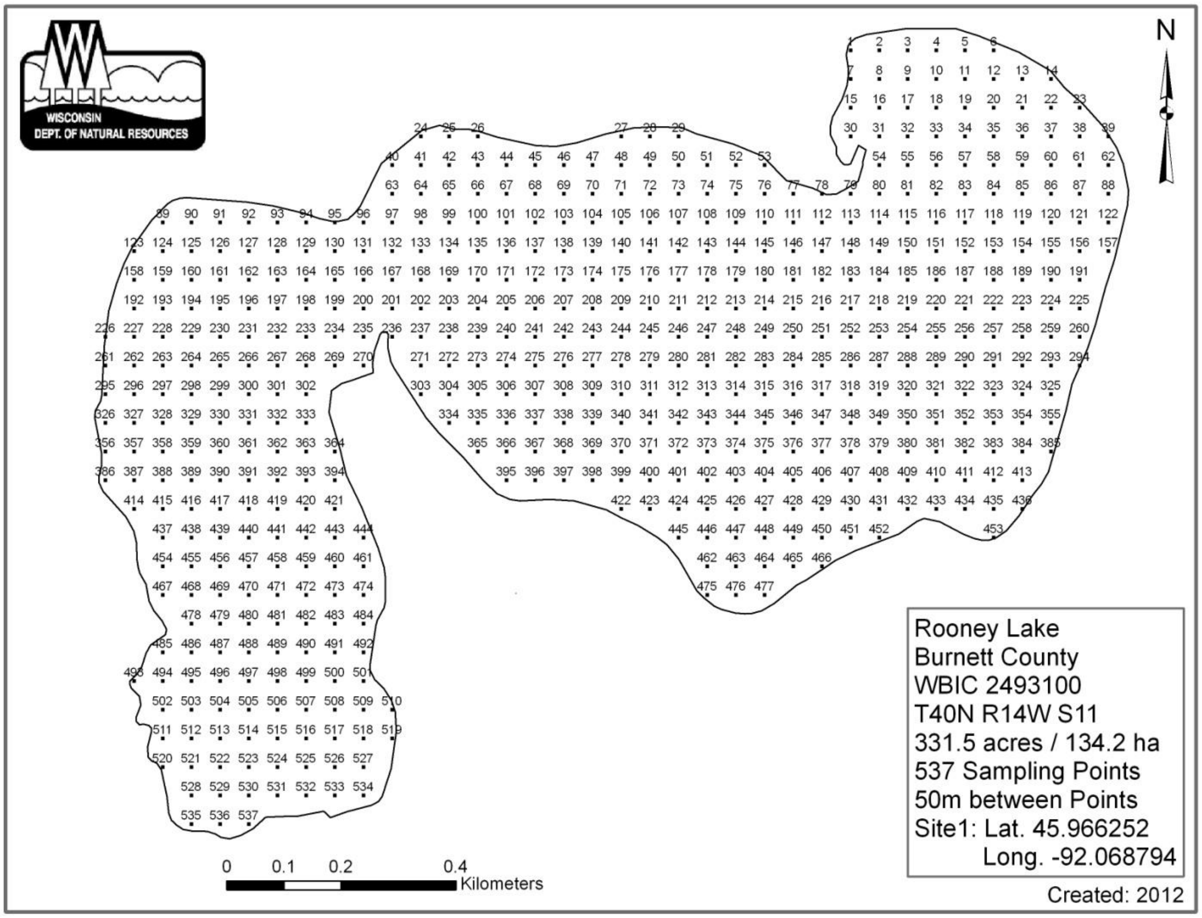


Figure 5: Rooney Lake Sample Grid

During the May survey, a general idea for the lake and plant communities was established and more detailed summary 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 Rooney 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 establishment the littoral zone at a maximum of 9 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.

Figure 6: Rake Fullness Ratings (UWEX, 2006)

DATA ANALYSIS:

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

<u>Total number of points sampled:</u> 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.

<u>Total number of sites with vegetation:</u> 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.

<u>Total number of sites shallower than the maximum depth of plants:</u> 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.

<u>Frequency of occurrence:</u> 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 1-10. 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. Rooney Lake is in the Northern Lakes and Forests Ecoregion.

RESULTS:

Aquatic Plant Survey Results for Rooney Lake

An aquatic plant survey was completed for Rooney Lake in 2013. 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. A general boat survey was also conducted prior to the point intercept survey to gain familiarity with the lake and the plant species found on the lake. The results discussed below are taken from these two surveys.

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 Rooney Lake. Figure 5 above shows the locations of these sampling points.

As mentioned before, Rooney Lake survey grid is comprised of 537 points of which, 526 sites were sampled. Of these points, we found plants at 397 sites 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 Rooney Lake. Plants were found growing on approximately 76% of the entire lake bottom, and in 87% of the littoral zone. Diversity was very high with a Simpson Diversity Index value of 0.88. Species richness was also high with 52 total species found growing in and immediately adjacent to the lake. The majority of aquatic macrophytes were found growing in shallow water with a mean depth of 5.82ft, and a median depth of 5.0ft. 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 7, 8 and 9 summarize data from the completed survey.

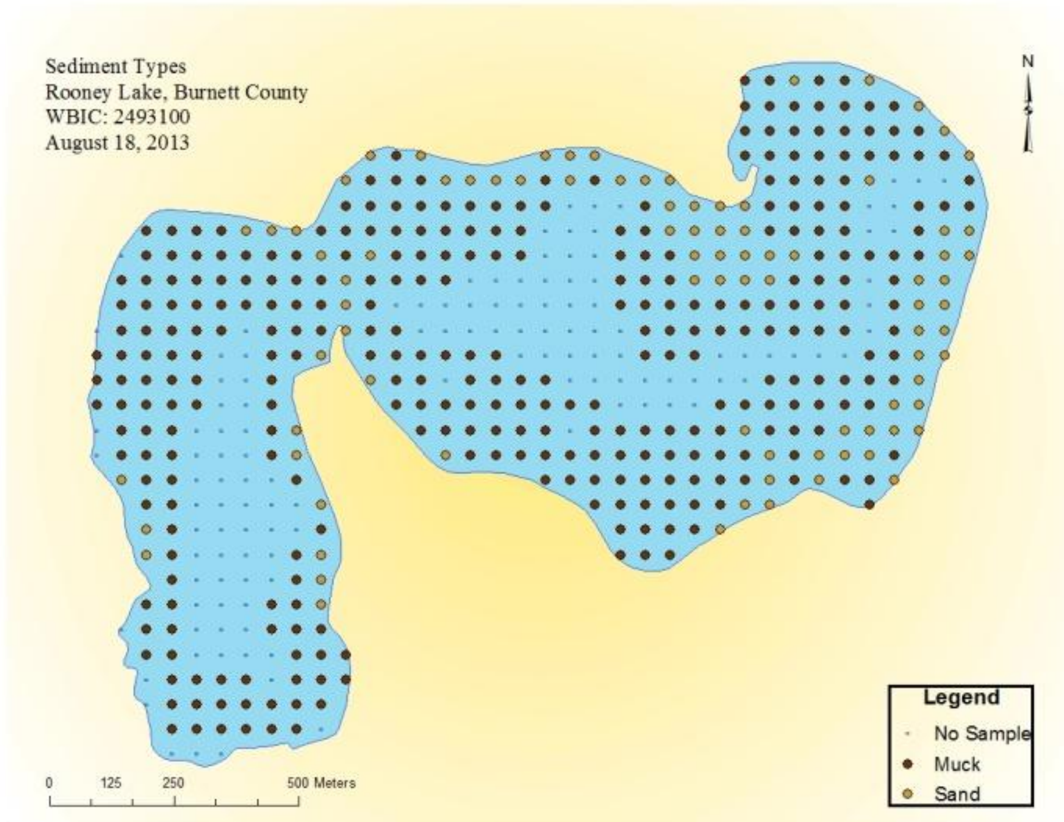


Figure 7: Rooney Lake Sediment Types

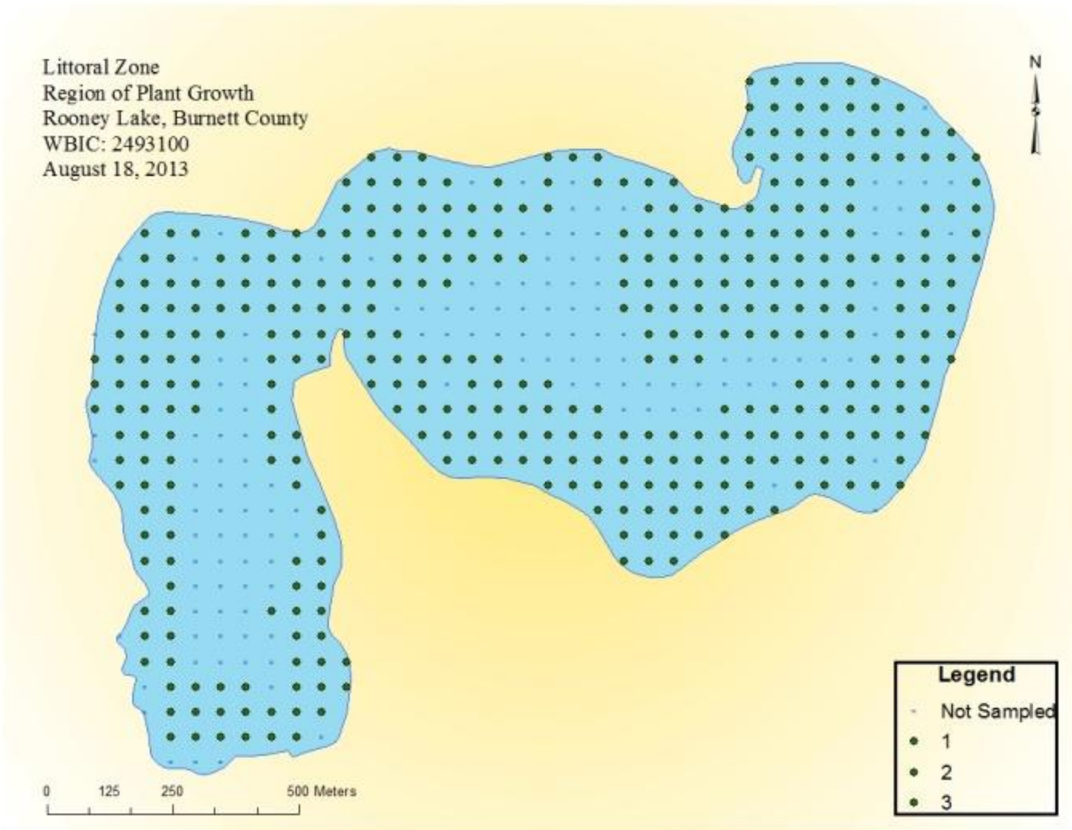


Figure 8: Rooney Lake Littoral Zone: Region of Plant Growth

The following plant species where the most frequently observed on the lake: Fern pondweed (*Potamogeton robbinsii*), Needle spikerush (*Eleocharis acicularis*), Large-leaf pondweed (*Potamogeton amplifolius*), and both Variable pondweed (*Potamogeton gramineus*) and Wild celery (*Vallisneria americana*) (Table 7). The five species were found at 64.99%, 13.10%, 11.59%, and 11.34% of the survey points with vegetation respectively (Figure 9). All five 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 11.34%.

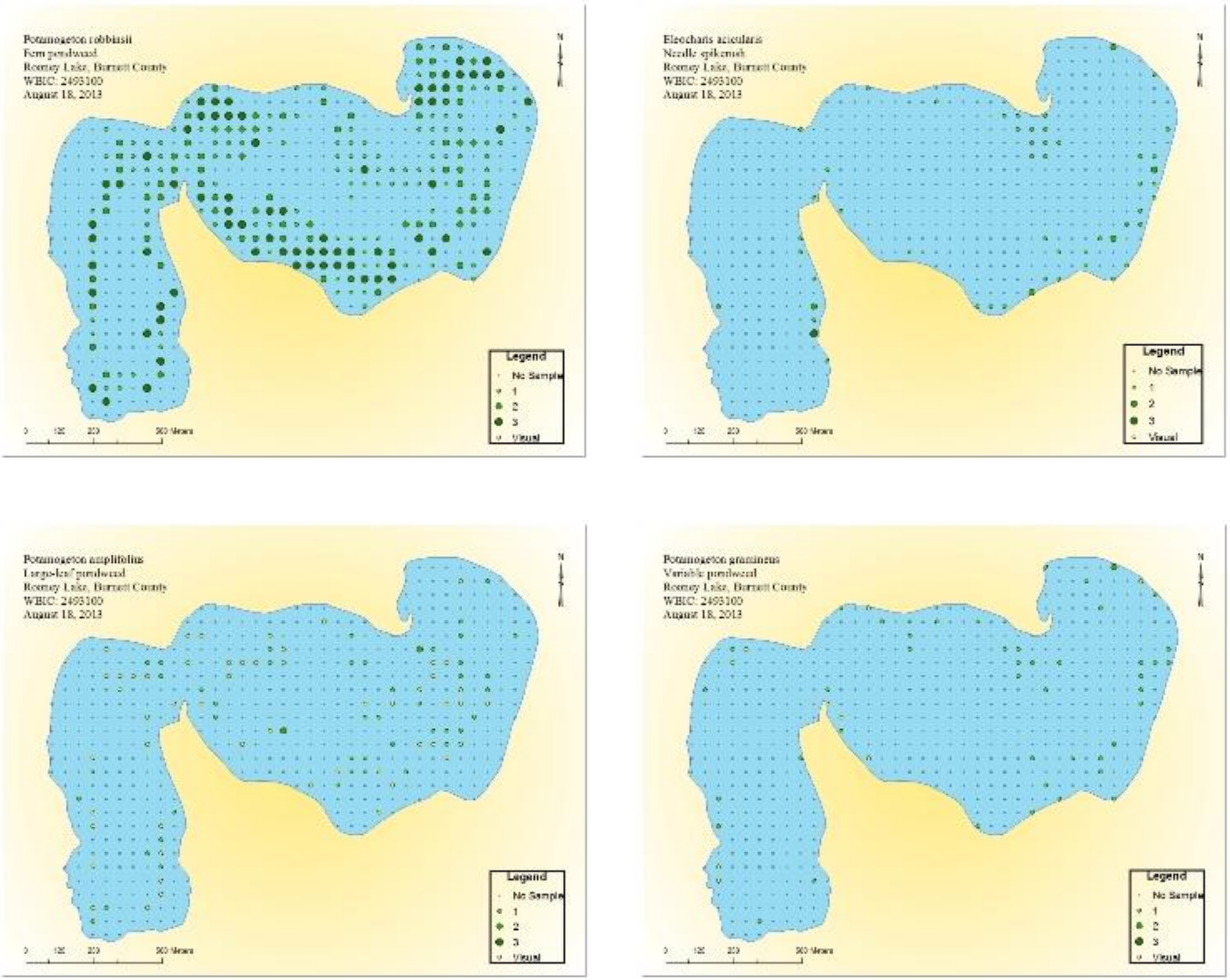


Figure 9: Most Common Aquatic Plant Species Found on Rooney Lake

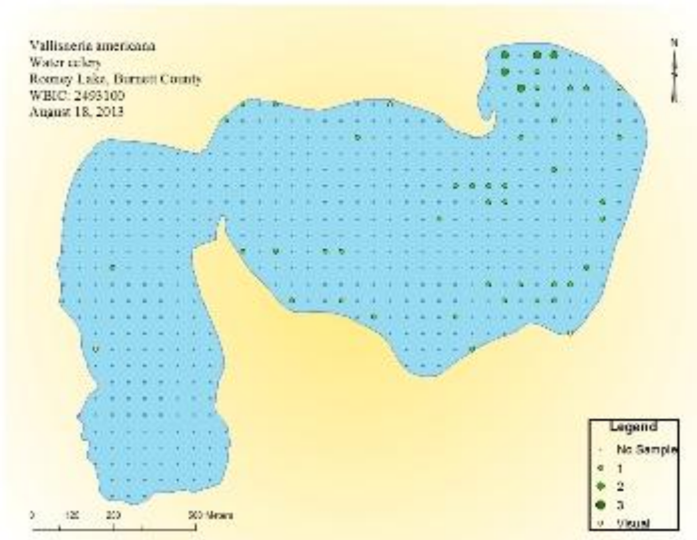


Figure 9 (Continued): Most Common Aquatic Plant Species Found on Rooney Lake

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.

Summary of Recommendations:

- Preserve and maintain Rooney Lake’s diverse native plant community.
- Continue to educate lakeshore 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/rice beds and the lake’s sensitive habitat areas.
- 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 Purple loosestrife plants where beetles are not present.
- Establish a Clean Boats/Clean Water and Aquatic Invasive Species program.
- Conduct Citizen Lake Monitoring for aquatic invasive species from May through October.

Table 7: Rooney Lake Aquatic Macrophytes Survey Summary Statistics

SUMMARY STATS:	
Total number of sites visited	**526**
Total number of sites with vegetation	**397**
Total number of sites shallower than maximum depth of plants	**456**
Frequency of occurrence at sites shallower than maximum depth of plants	**87.06**
Simpson Diversity Index	**0.88**
Maximum depth of plants (ft)**	**20.00**
Number of sites sampled using rake on Rope (R)	**414**
Number of sites sampled using rake on Pole (P)	**1**
Average number of all species per site (shallower than max depth)	**1.85**
Average number of all species per site (veg. sites only)	**2.12**
Average number of native species per site (shallower than max depth)	**1.85**
Average number of native species per site (veg. sites only)	**2.12**
Species Richness	**46**
Species Richness (including visuals)	**52**
Mean Depth of Plants (ft)	**4.4**
Median Depth of Plants (ft)	**3**

Table 8: Rooney Lake FQI Species and Conservatism Values

Species	Common Name	C
Acorus americanus	Sweet-flag	7
Alisma triviale	Northern water-plantain	4
Bidens beckii	Water marigold	8
Bolboschoenus fluviatilis	River bulrush	6
Brasenia schreberi	Watershield	6
Calla palustris	Wild calla	9
Callitriche hermaphroditica	Autumnal water-starwort	9
Callitriche heterophylla	Large water-starwort	9
Callitriche palustris	Common water-starwort	8
Carex comosa	Bottle brush sedge	5
Catabrosa aquatica	Brook grass	10
Ceratophyllum demersum	Coontail	3
Ceratophyllum echinatum	Spiny hornwort	10
Chara	Muskgrasses	7
Dulichium arundinaceum	Three-way sedge	9
Elatine minima	Waterwort	9
Elatine triandra	Greater waterwort	9
Eleocharis acicularis	Needle spikerush	5
Eleocharis erythropoda	Bald spikerush	3
Eleocharis palustris	Creeping spikerush	6
Elodea canadensis	Common waterweed	3
Elodea nuttallii	Slender waterweed	7
Equisetum fluviatile	Water horsetail	7
Eriocaulon aquaticum	Pipewort	9
Glyceria borealis	Northern manna grass	8
Gratiola aurea	Golden hedge-hyssop	10
Heteranthera dubia	Water star-grass	6
Isoetes echinospora	Spiny-spored quillwort	8
Isoetes lacustris	Lake quillwort	8
***Isoetes* sp.**	Quillwort	8
Juncus pelocarpus f. submersus	Brown-fruited rush	8
Juncus torreyi	Torrey's rush	4
Lemna minor	Small duckweed	4
Lemna perpusilla	Least duckweed	10
Lemna trisulca	Forked duckweed	6
Littorella uniflora	Littorella	10
Lobelia dortmanna	Water lobelia	10
Ludwigia palustris	Marsh purslane	4
Myriophyllum alterniflorum	Alternate-flowered water-milfoil	10
Myriophyllum farwellii	Farwell's water-milfoil	8
Myriophyllum heterophyllum	Various-leaved water-milfoil	7

Myriophyllum sibiricum	Northern water-milfoil	6
Myriophyllum tenellum	Dwarf water-milfoil	10
Myriophyllum verticillatum	Whorled water-milfoil	8
Najas flexilis	Slender naiad	6
Najas gracillima	Northern naiad	7
Najas guadalupensis	Southern naiad	8
Nelumbo lutea	American lotus	7
Nitella	Nitella	7
Nuphar advena	Yellow pond lily	8
Nuphar microphylla	Small pond lily	9
Nuphar X rubrodisca	Intermediate pond lily	9
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Phragmites australis	Common reed	1
Polygonum amphibium	Water smartweed	5
Polygonum punctatum	Dotted smartweed	5
Pontederia cordata	Pickerelweed	8
Potamogeton alpinus	Alpine pondweed	9
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton bicupulatus	Snail-seed pondwwed	9
Potamogeton confervoides	Algal-leaved pondweed	10
Potamogeton diversifolius	Water-thread pondweed	8
Potamogeton epihydrus	Ribbon-leaf pondweed	8
Potamogeton foliosus	Leafy pondweed	6
Potamogeton friesii	Fries' pondweed	8
Potamogeton gramineus	Variable pondweed	7
Potamogeton hillii	Hill's pondweed	9
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton nodosus	Long-leaf pondweed	7
Potamogeton oakesianus	Oakes' pondweed	10
Potamogeton obtusifolius	Blunt-leaf pondweed	9
Potamogeton praelongus	White-stem pondweed	8
Potamogeton pulcher	Spotted pondweed	10
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Fern pondweed	8
Potamogeton spirillus	Spiral-fruited pondweed	8
Potamogeton strictifolius	Stiff pondweed	8
Potamogeton vaseyi	Vasey's pondweed	10
Potamogeton zosteriformis	Flat-stem pondweed	6
Ranunculus aquatilis	White water crowfoot	8
Ranunculus flabellaris	Yellow water crowfoot	8
Ranunculus flammula	Creeping spearwort	9
Riccia fluitans	Slender riccia	7

Ruppia cirrhosa	Ditch grass	8
Sagittaria brevirostra	Midwestern arrowhead	9
Sagittaria cuneata	Arum-leaved arrowhead	7
Sagittaria graminea	Grass-leaved arrowhead	9
Sagittaria latifolia	Common arrowhead	3
Sagittaria rigida	Sessile-fruited arrowhead	8
Schoenoplectus acutus	Hardstem bulrush	6
Schoenoplectus heterochaetus	Slender bulrush	10
Schoenoplectus pungens	Three-square bulrush	5
Schoenoplectus subterminalis	Water bulrush	9
Schoenoplectus tabernaemontani	Softstem bulrush	4
Sparganium americanum	American bur-reed	8
Sparganium androcladum	Branched bur-reed	8
Sparganium angustifolium	Narrow-leaved bur-reed	9
Sparganium emersum	Short-stemmed bur-reed	8
Sparganium eurycarpum	Common bur-reed	5
Sparganium fluctuans	Floating-leaf bur-reed	10
Sparganium natans	Small bur-reed	9
Spirodela polyrhiza	Large duckweed	5
Stuckenia filiformis	Fine-leaved pondweed	8
Stuckenia pectinata	Sago pondweed	3
Stuckenia vaginata	Sheathed pondweed	9
Typha angustifolium	Narrow-leaved cattail	1
Typha latifolia	Broad-leaved cattail	1
***Typha* sp.**	Cattail	1
Utricularia cornuta	Horned bladderwort	10
Utricularia geminiscapa	Twin-stemmed bladderwort	9
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia minor	Small bladderwort	10
Utricularia purpurea	Large purple bladderwort	9
Utricularia resupinata	Small purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
Wolffia borealis	Northern watermeal	6
Wolffia columbiana	Common watermeal	5
Zannichellia palustris	Horned pondweed	7
Zizania aquatica	Southern wild rice	8
Zizania palustris	Northern wild rice	8
***Zizania* sp.**	Wild rice	8
N		43
mean C		7.14
FQI		46.82

Table 9: Frequencies and Mean Rake Sample of Aquatic Macrophytes Rooney Lake, Burnett County August 2013

Scientific Name	Common Name	Total Sites	Relative Frequency (%)	Frequency of occurrence Vegetated (%)	Frequency of occurrence Littoral	Mean Rake Fullness
Potamogeton robbinsii	**Fern pondweed**	**258**	**30.64**	**64.99**	**56.58**	**1.85**
Eleocharis acicularis	**Needle spikerush**	**52**	**6.18**	**13.10**	**11.40**	**1.13**
Potamogeton amplifolius	**Large-leaf pondweed**	**46**	**5.46**	**11.59**	**10.09**	**1.04**
Potamogeton gramineus	**Variable pondweed**	**45**	**5.34**	**11.34**	**9.87**	**1.02**
Vallisneria americana	**Wild celery**	**45**	**5.34**	**11.34**	**9.87**	**1.11**
Elodea canadensis	**Common waterweed**	**39**	**4.63**	**9.82**	**8.55**	**1.10**
Utricularia purpurea	**Large purple bladderwort**	**35**	**4.16**	**8.82**	**7.68**	**1.26**
Brasenia schreberi	**Watershield**	**34**	**4.04**	**8.56**	**7.46**	**1.35**
Chara sp.	**Muskgrasses**	**31**	**3.68**	**7.81**	**6.80**	**1.00**
Myriophyllum tenellum	**Dwarf water-milfoil**	**25**	**2.97**	**6.30**	**5.48**	**1.16**
Schoenoplectus subterminalis	**Water bulrush**	**25**	**2.97**	**6.30**	**5.48**	**1.12**
Nitella sp.	**Nitella**	**24**	**2.85**	**6.05**	**5.26**	**1.13**
Nuphar variegata	**Spatterdock**	**18**	**2.14**	**4.53**	**3.95**	**1.22**
Nymphaea odorata	**White water lily**	**17**	**2.02**	**4.28**	**3.73**	**1.29**
Potamogeton natans	**Floating-leaf pondweed**	**16**	**1.90**	**4.03**	**3.51**	**1.56**
Juncus pelocarpus f. submersus	**Brown-fruited rush**	**14**	**1.66**	**3.53**	**3.07**	**1.00**
Utricularia intermedia	**Flat-leaf bladderwort**	**14**	**1.66**	**3.53**	**3.07**	**1.00**
Utricularia gibba	**Creeping bladderwort**	**13**	**1.54**	**3.27**	**2.85**	**1.00**
Potamogeton pusillus	**Small pondweed**	**11**	**1.31**	**2.77**	**2.41**	**1.00**
Bidens beckii	**Water marigold**	**10**	**1.19**	**2.52**	**2.19**	**1.00**
Sagittaria sp.	**Arrowhead**	**9**	**1.07**	**2.27**	**1.97**	**1.33**
Drepanocladus sp.	**Aquatic moss**	**9**		**2.27**	**1.97**	**1.00**
Potamogeton obtusifolius	**Blunt-leaf pondweed**	**7**	**0.83**	**1.76**	**1.54**	**1.00**
Utricularia vulgaris	**Common bladderwort**	**6**	**0.71**	**1.51**	**1.32**	**1.00**
Eleocharis palustris	**Creeping spikerush**	**5**	**0.59**	**1.26**	**1.10**	**1.00**
Myriophyllum sibiricum	**Northern water-milfoil**	**4**	**0.48**	**1.01**	**0.88**	**1.00**
Najas flexilis	**Slender naiad**	**4**	**0.48**	**1.01**	**0.88**	**1.00**

Pontederia cordata	Pickerelweed	4	0.48	1.01	0.88	1.00
Eriocaulon aquaticum	Pipewort	3	0.36	0.76	0.66	1.00
Isoetes sp.	Quillwort	3	0.36	0.76	0.66	1.00
Schoenoplectus pungens	Three-square bulrush	3	0.36	0.76	0.66	1.00
Sparganium angustifolium	Narrow-leaved bur-reed	3	0.36	0.76	0.66	1.00
Heteranthera dubia	Water star-grass	2	0.24	0.50	0.44	1.00
Potamogeton foliosus	Leafy pondweed	2	0.24	0.50	0.44	1.00
Potamogeton richardsonii	Clasping-leaf pondweed	2	0.24	0.50	0.44	1.50
Utricularia geminiscapa	Twin-stemmed bladderwort	2	0.24	0.50	0.44	1.00
Dulichium arundinaceum	Three-way sedge	1	0.12	0.25	0.22	2.00
Elatine minima	Waterwort	1	0.12	0.25	0.22	1.00
Eleocharis erythropoda	Bald spikerush	1	0.12	0.25	0.22	1.00
Eleocharis robbinsii	Robbins' spikerush	1	0.12	0.25	0.22	1.00
Elodea nuttallii	Slender waterweed	1	0.12	0.25	0.22	1.00
Lemna minor	Small duckweed	1	0.12	0.25	0.22	1.00
Nuphar advena	Yellow pond lily	1	0.12	0.25	0.22	1.00
Potamogeton praelongus	White-stem pondweed	1	0.12	0.25	0.22	1.00
Ranunculus flammula	Creeping spearwort	1	0.12	0.25	0.22	1.00
Utricularia resupinata	Small purple bladderwort	1	0.12	0.25	0.22	1.00
St. Johns Wort	St. Johns Wort	1	0.12	0.25	0.22	1.00
Carex comosa	Bottle brush sedge	v				
Potamogeton spirillus	Spiral-fruited pondweed	v				
Potamogeton vaseyi	Vasey's pondweed	v				
Sagittaria latifolia	Common arrowhead	v				
Schoenoplectus tabernaemontani	Softstem bulrush	v				
Typha latifolia	Broad-leaved cattail	v				

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, in the case of Rooney Lake, 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[14]

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[14]

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[15]

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 Rooney 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 Rooney Lakes because a healthy, diverse native plant population is present.

Physical Control[14]

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 Rooney 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 Rooney 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.[16]

Contact herbicides[17]

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 discreet 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.[17] 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.[5]

Burnett County Land and Water Conservation (LWCD)[5]

Burnett County assists the Rooney 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.

Rooney Lake Aquatic Plant Management Plan Goals & Strategies

Introduction: Written by Jeanne Joyce – APM Committee member

Rooney Lake has one of the most diverse and extensive plant communities of all the lakes in Burnett County. Our recent Aquatic Plant Management (APM) Survey identified 54 different native species. This is an astounding number compared to some of the neighboring lakes.

The other amazing finding is that Rooney is still free of any aquatic plant invasive species. While surrounding lakes are dealing with purple loosestrife, curly pondweed, and even Eurasian water milfoil, we have been spared so far. The only invasive in the lake at this time is of the animal variety—the Chinese Snail. The good news here is that studies have yet to find any damaging effects to lake ecosystems from this snail.To be the only lake in the area with such an incredible diversity of plants and NO plant invasive species is a stroke of good fortune we must do whatever we can to preserve.

The APM Plan that the Rooney Lake Association commissioned the Burnett County Land and Conservation Department to do is one way we are trying to protect this gem called Rooney Lake. But we have always had a history of being proactive. We formed a Lake Association in 1987. We have participated in monitoring water quality and doing secchi readings through WDNR Citizens Lake Monitoring Network for 25 years—all done with volunteers. We have good neighbors who are good stewards of lake and land. But keeping Rooney as pristine as it is today is getting harder as invasive plant species come closer.Protecting our lake and property values will take planning, education and action, some of which is outlined in this plan.

Goals

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 Rooney 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. Rooney Lake is monitored regularly for AIS introduction.

D. Rooney Lake Association is ready to rapidly respond to identified AIS in the lake.

E. Determine if boat landing gate is a viable option for Rooney Lake.

Actions

1. Conduct Clean Boats Clean Waters monitoring and education at the boat landing using paid and/or volunteer staff and pursue grants from the DNR for this purpose???

2. Work with the Burnett County Sheriff's Department to encourage increased enforcement and potentially increased fines for the Do Not Transport Ordinance.

3. Monitor boat landings and other areas with high potential for introduction of AIS.

4. Continue to meet with other township lake associations regarding the feasibility of boat landing gates.

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

Objectives

A. Increase Rooney Lake community's understanding of the role and importance of aquatic plants and the impact of human activity on them.

B. Prevent removal of native plants using herbicides.

C. Implement strict adherence with treatment standards and monitoring methods prior to and following herbicide treatment.

Actions

1. Highlight how aquatic plants provide habitat for a diverse fish population, protect against shoreline erosion, and prevent colonization by invasive plants. Show the negative effects erosion, runoff, and boating disturbances near shore can have on the lake ecosystem and, ultimately, property values.

2. Consider alternative methods for removing native plants, other than using herbicide treatment, for individual access corridors.

3. Conduct a point intercept survey of the lake every five to ten years, or as needed.

4. Update the aquatic plant management plan every five to ten years, or as needed.

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.

C. Reduce phosphorus and sediment loads from immediate watershed.

D. Encourage riparian landowners to adopt and implement storm water runoff controls for existing structures and all new constructions utilizing the Adaptive Management Approach.

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.

2. Incorporate the Adaptive Management Approach to reduce phosphorus and sediment loads from immediate watershed. This includes addressing sources such as faulty septic systems, the use of phosphorus-containing fertilizers, shoreland areas that are maintained in an unnatural manner, and impervious surfaces.

3. Educate Rooney Lake community members in the restoration and preservation of shoreland buffers and vegetation (natural recovery, stop mowing, and plant natives). Review Burnett

County’s requirements and cost-sharing program for restoration of shoreline buffers and highlight good examples of Rooney neighbors who have participated in the program.

Goal 4: Educate the Rooney Lake community regarding aquatic plant management, management strategies found in the plan, erosion control and appropriate plant management.

Objectives

A. Communicate to audiences that make up the Rooney Lake community including lakes residents, business owners, lake users.

B. Provide education and appropriate avenues of communication to reach these audiences, including electronic, written, and live speaker presentations.

C. 100% of Rooney Lake landowners are aware of, understand, and support the APM plan.

Actions

1. Identify who makes up our audience and how to reach them.
2. Present summary of APM plan at a public meeting in the spring.
3. Conduct CLMN AIS education workshop for all lake users at our Lake Association spring meeting.
4. Improve signage at boat landings.
5. Obtain current and (if necessary) create Rooney-specific AIS handouts and distribute.
6. Write newsletter articles.
7. Send mailings to lake residents.
8. Include ongoing information, materials and APM plan on website.
9. Initiate Clean Boats, Clean Waters monitoring/education.
10. Recruit volunteers for CBCW and lake monitoring.
11. Underscore how a robust native aquatic plant population and AIS threats correlate to lake health and, consequently, property values.
12. Emphasize the importance and value of native aquatic plants and how to identify native and non-natives alike.

Implementation Plan

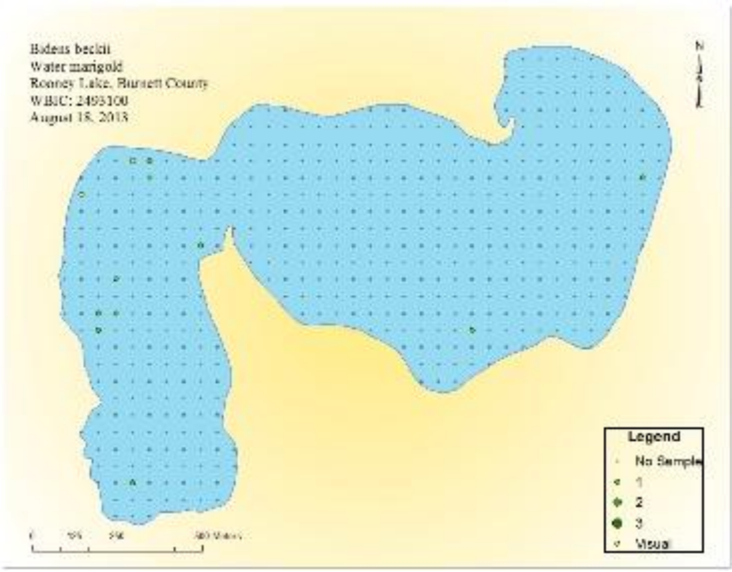
Action Items	Timeline	Cost 2014	Cost 2015	Cost 2016	Responsible Parties
Prevent AIS Introduction					
Identify and organize volunteer workers/employers for CBCW program	ongoing	15 hours	10 hours	10 hours	RLA President
Conduct CBCW program	ongoing	20 hours	20 hours	20 hours	RLA President
Increase enforcement of BC Do Not Transport Ordinance	Ongoing	4 hours	4 hours	4 hours	RLA, BC Sheriff Dept. and LWCD
Monitor boat landings	Annually	200 hours	200 hours	200 hours	RLA, Burnett County LWCD
Train Volunteer monitors in CLMN	As needed	10 hours	10 hours	10 hours	Burnett County LWCD/RLA
Rapid Response plan review	Ongoing	3 hours	3 hours	3 hours	RLA, Burnett County LWCD
Boat Landing Gate Research	Ongoing	6 hours	6 hours	TBD	
Provide Identification information and encourage volunteer monitoring	May - August	20 hours	20 hours	20 hours	RLA AIS Committee, BC LWCD
Preserve Native Plants					
Conduct a point intercept survey of the lake	2017-2022	$3000			RLA
Update APM plan	2018-2023	$3000			RLA

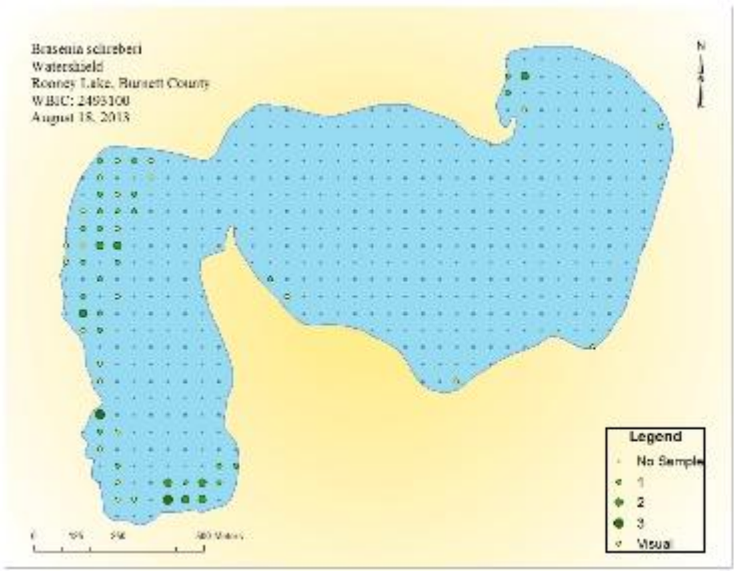
Implementation Plan Continued

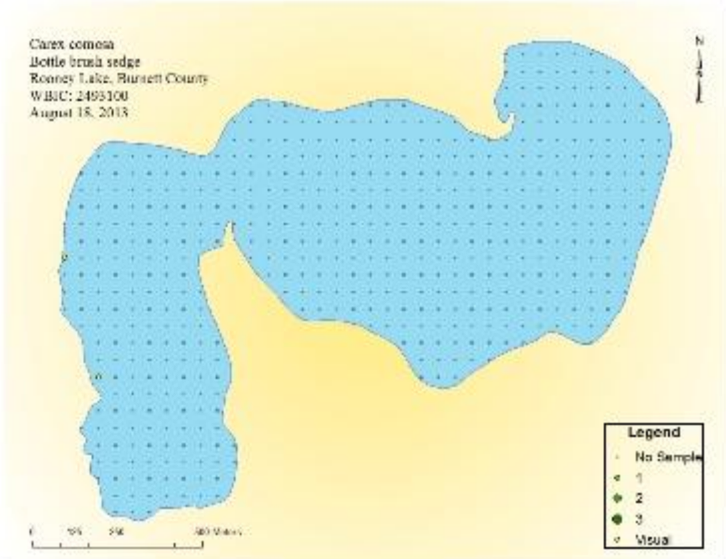
Action Items	Timeline	Cost 2014	Cost 2015	Cost 2016	Responsible Parties
Water Quality					
Water chemistry and Secchi sampling	ongoing	15 hours	15 hours	15 hours	RLA
Reduce phosphorus and sediment loads from immediate watershed	Ongoing	TBD			RLA, BC LWCD
Educate and assist Rooney Lake community members in the restoration and preservation of shoreland buffers and shoreland vegetation	Ongoing	TBD			RLA, BC LWCD
Continue implementation of shoreline owners' education program	Ongoing	TBD			RLA, BC LWCD
Educate Rooney Lake Community					
Recruit volunteers to conduct CBCW and CLMN	May	10 hours	10 hours	10 hours	RLA, BC LWCD
AIS workshops CBCW & CLMN	Ongoing	$0	$0	$0	BC LWCD
AIS signage	As needed	$0	$0	$0	BC LWCD
Handouts, mailings, door-to door distribution	Ongoing	5 hrs/$150	5 hrs/$150	5 hrs/$150	RLA
RLA newsletter articles	Ongoing	$500	$500	$500	RLA
RLA Website updates	Ongoing	20 hours/Vol	20 hours/Vol	20 hours/Vol	RLA
Annual meeting	Ongoing	$200	$200	$200	RLA

Appendix A

Aquatic Plant Maps






Carex comosa
Bottle brush sedge
Ronney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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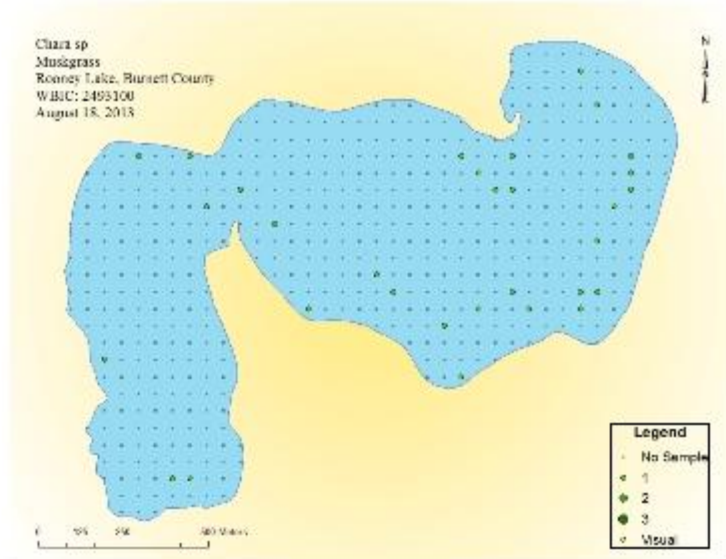
Visual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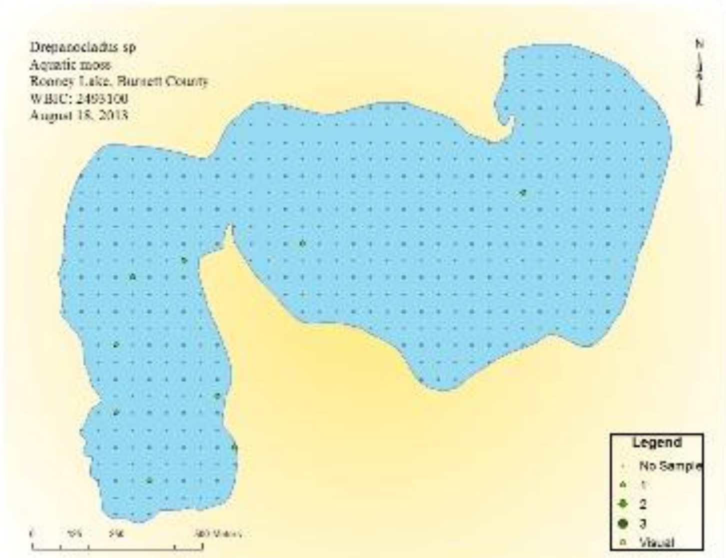
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Aquatic moss
Ronney Lake, Burnett County
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August 18, 2013
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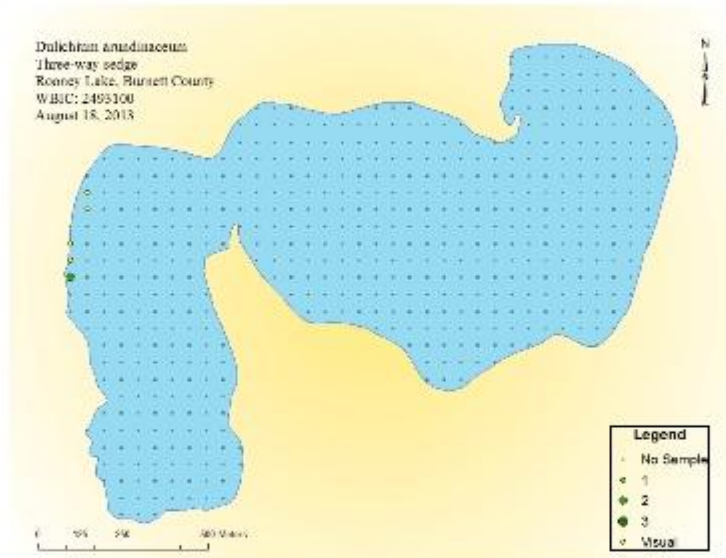
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Three-way sedge
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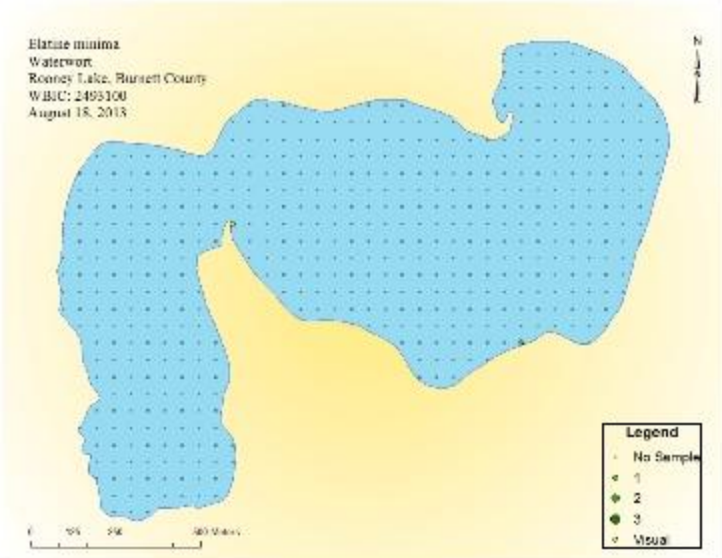
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Waterwort
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August 18, 2013
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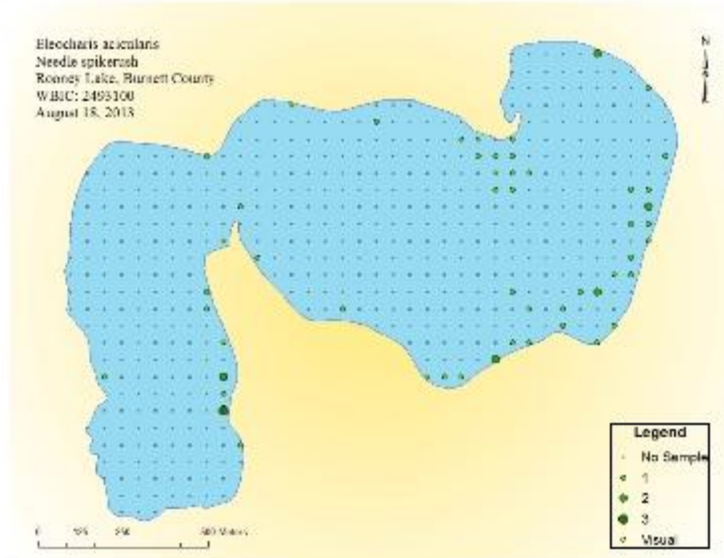
Eleocharis acicularis
Needle spikerush
Rooney Lake, Burnett County
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August 18, 2013
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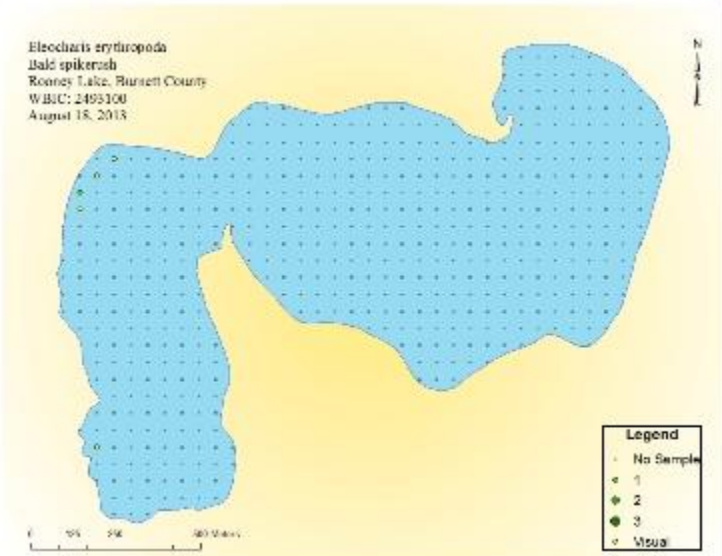
Visual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Bald spikerush
Rooney Lake, Burnett County
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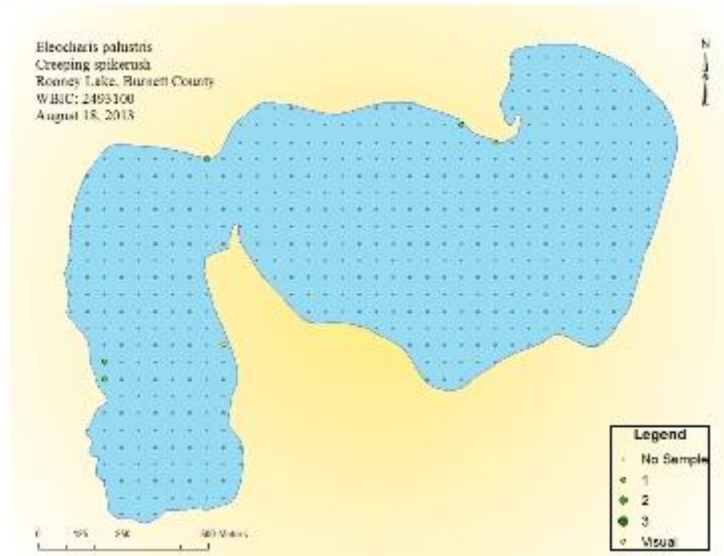
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Creeping spikerush
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August 18, 2013
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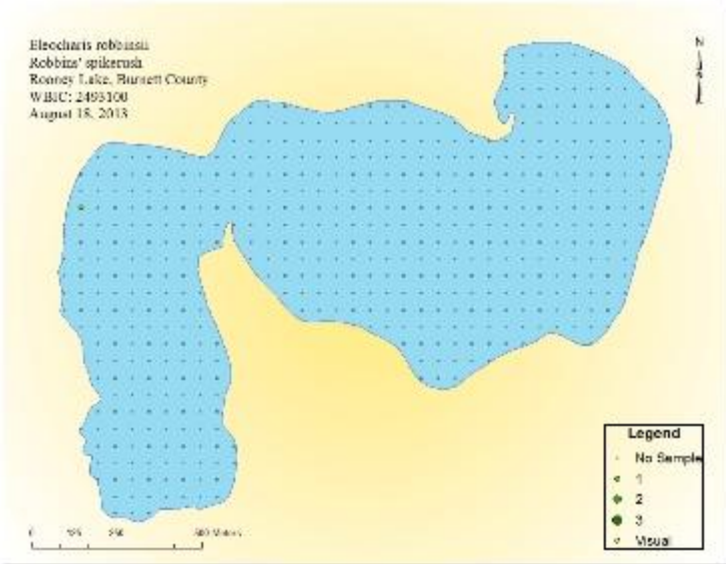
Visual


Eleocharis robbinsii
Robbins' spikerush
Rooney Lake, Burnett County
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August 18, 2013
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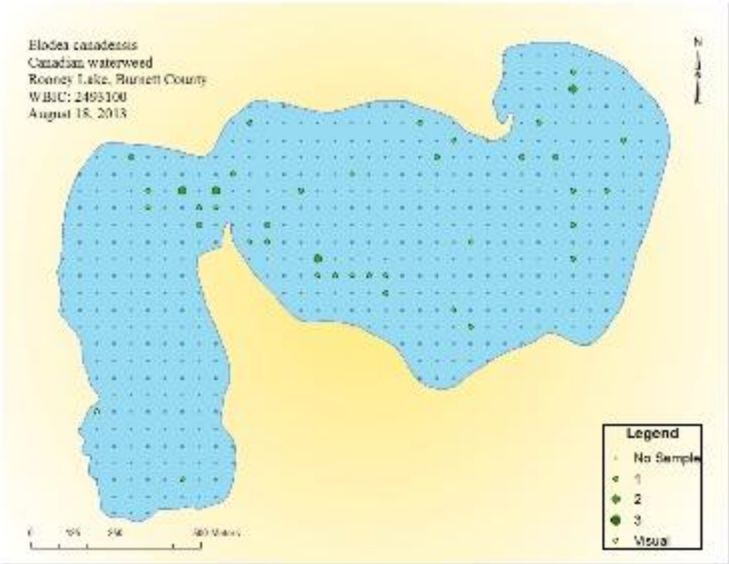
Visual


Elodea canadensis
Canadian waterweed
Rooney Lake, Burnett County
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August 18, 2013
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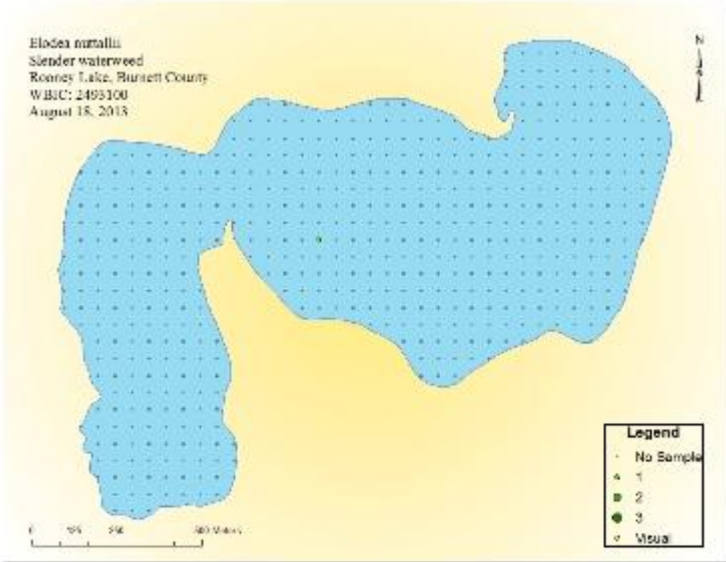
Elodea nuttallii
Slender waterweed
Rooney Lake, Burnett County
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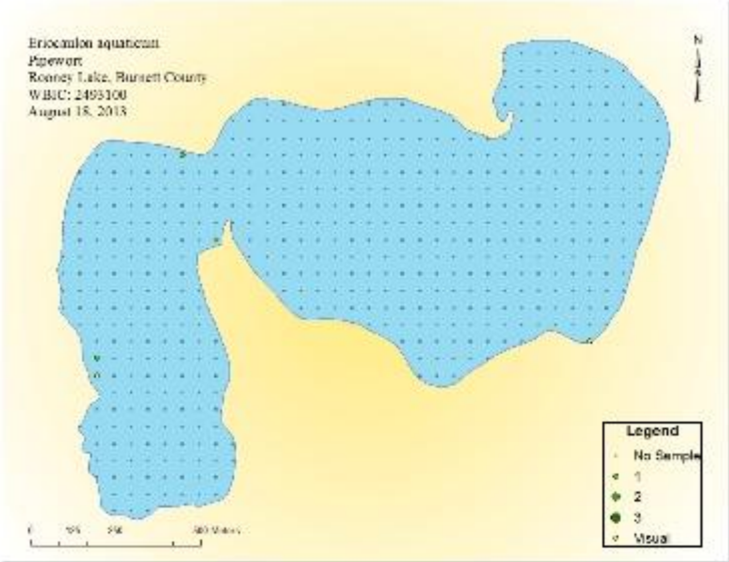
Eriocaulon aquaticum
Pipewort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
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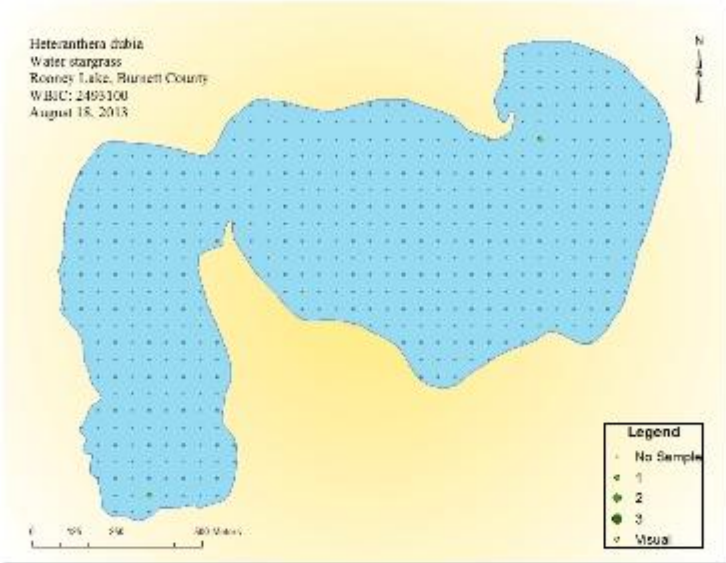
Visual


Heteranthera dubia
Water stargrass
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
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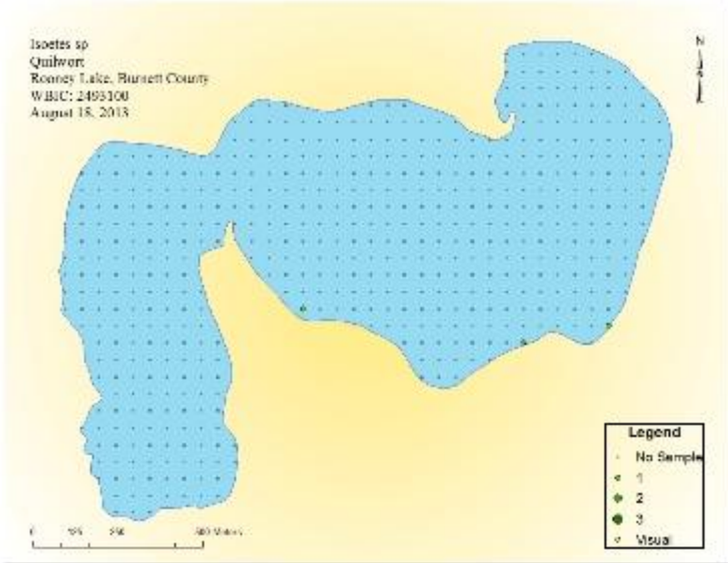
Visual


Isoetes sp
Quillwort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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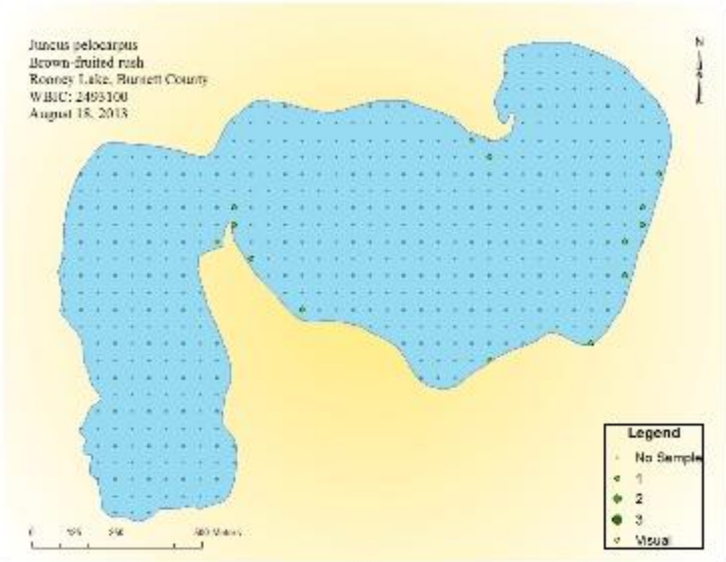
Juncus pelocarpus
Brown-fruited rush
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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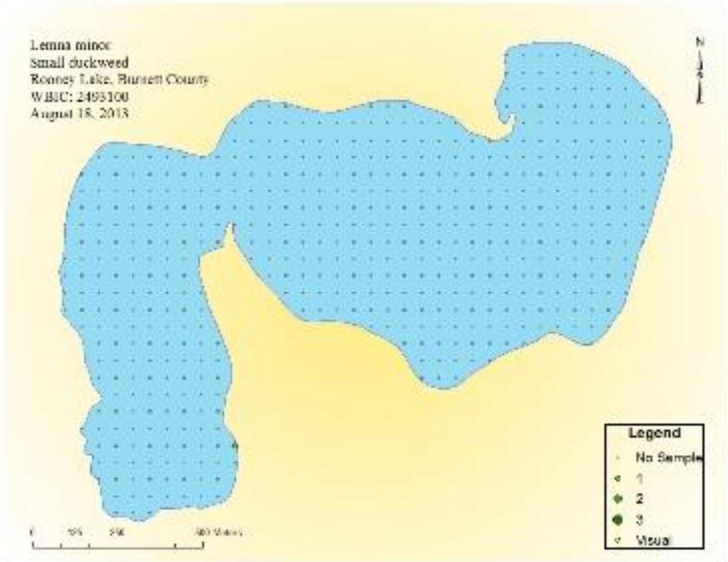
Lemna minor
Small duckweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
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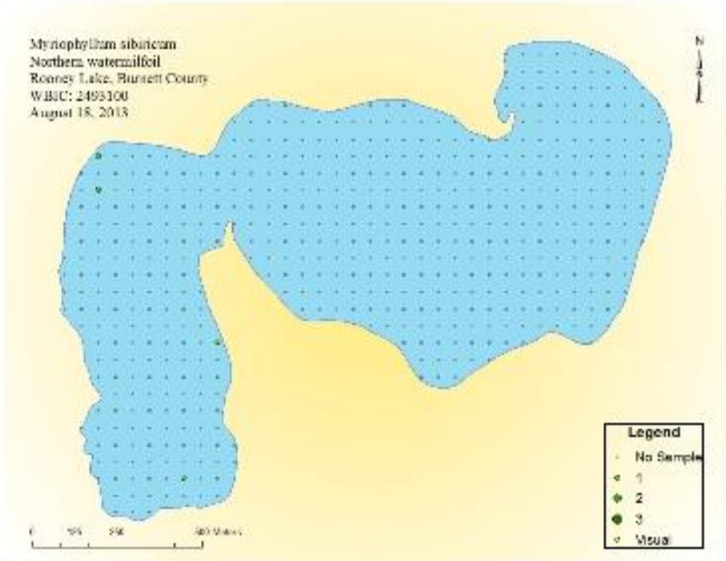
Visual


Myriophyllum sibiricum
Northern watermilfoil
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WBIC: 2493100
August 18, 2013
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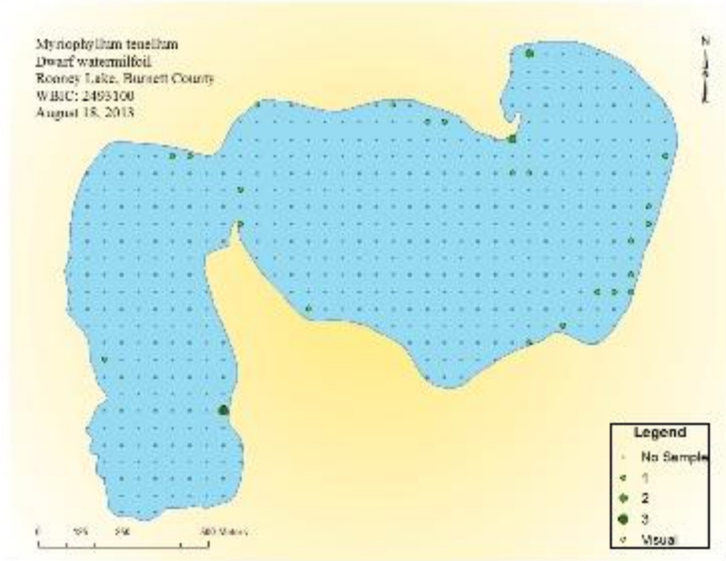
Myriophyllum tenellum
Dwarf watermilfoil
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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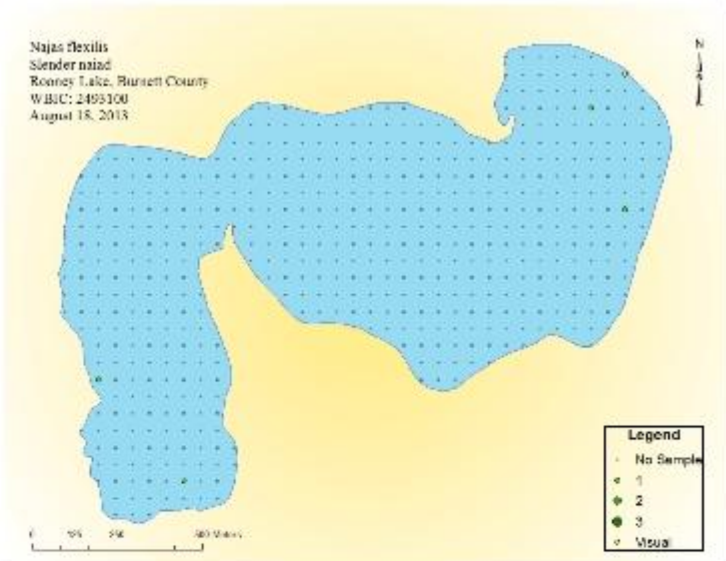
Visual


Najas flexilis
Slender naiad
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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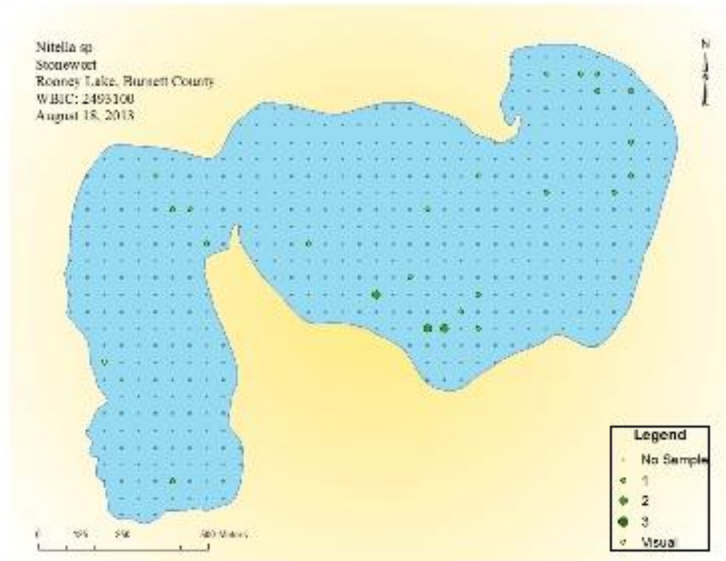
Visual


Nitella sp
Stonewort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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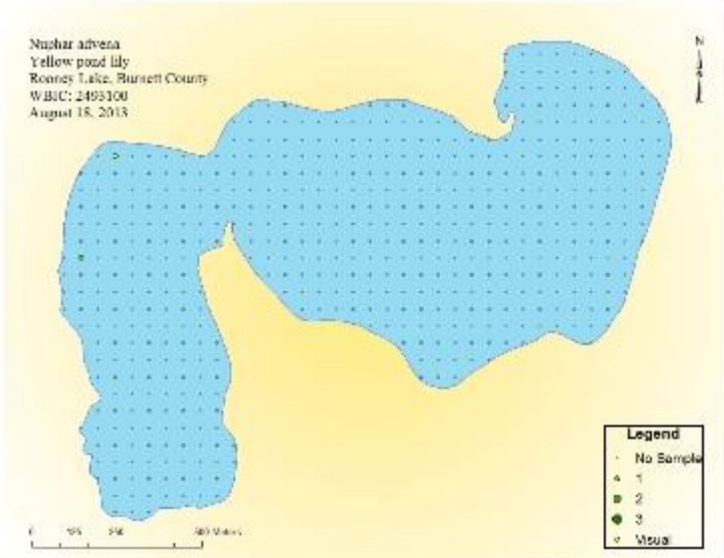
Visual


Nuphar advena
Yellow pond lily
Ronney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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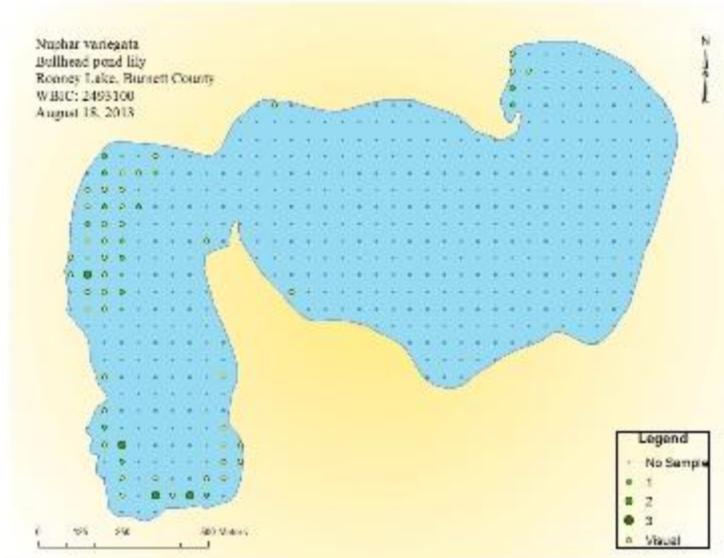
Visual


Nuphar variegata
Bullhead pond lily
Ronney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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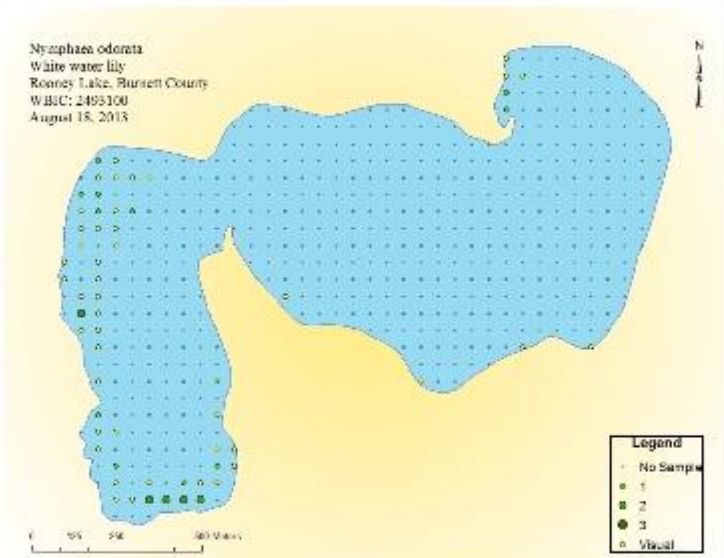
Visual


Nymphaea odorata
White water lily
Ronney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
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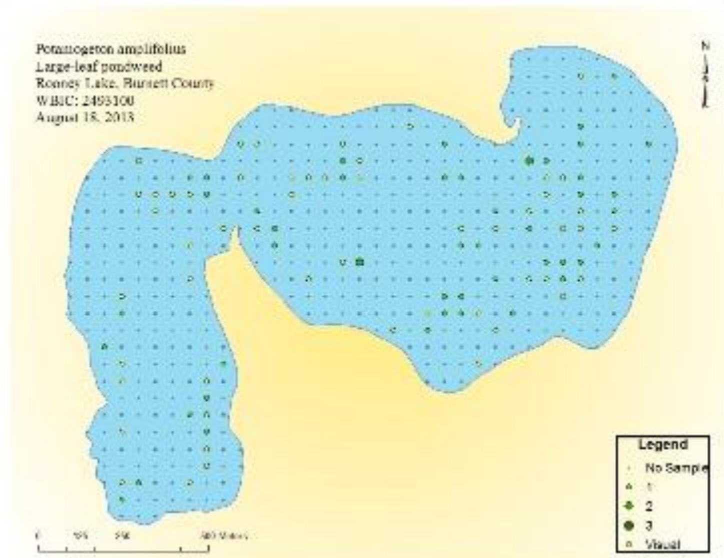
Potamogeton amplifolius
Large-leaf pondweed
Ronney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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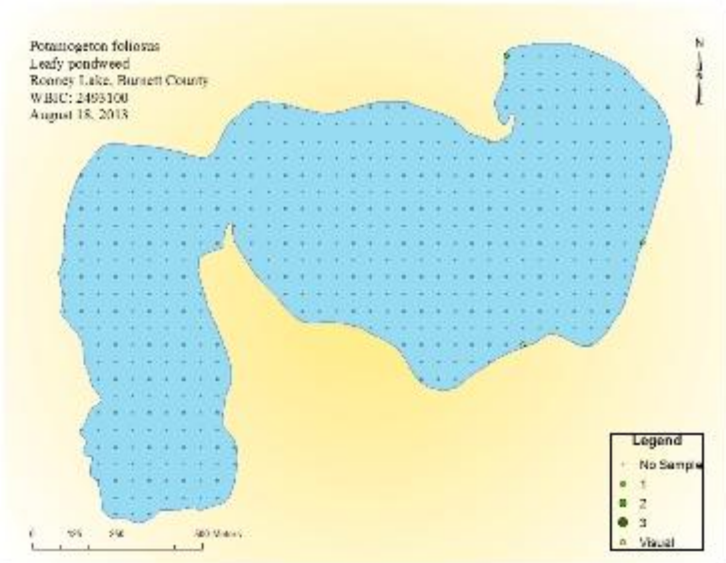
Potamogeton foliosus
Leafy pondweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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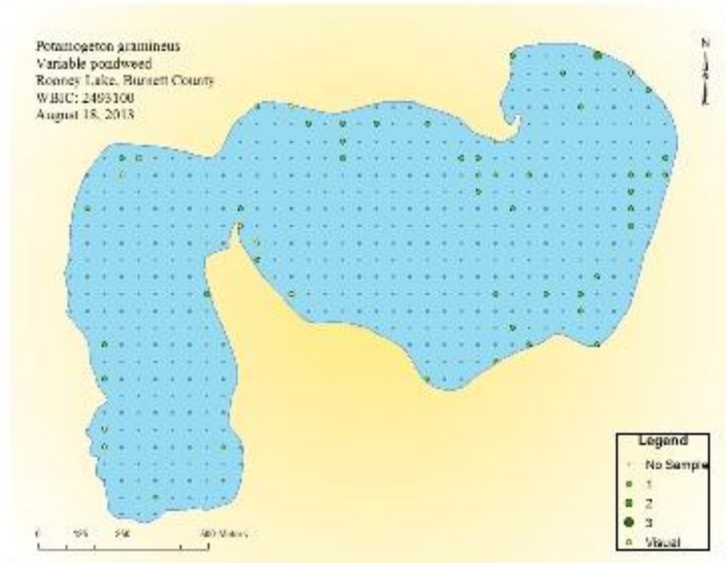
Visual


Potamogeton gramineus
Variable pondweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
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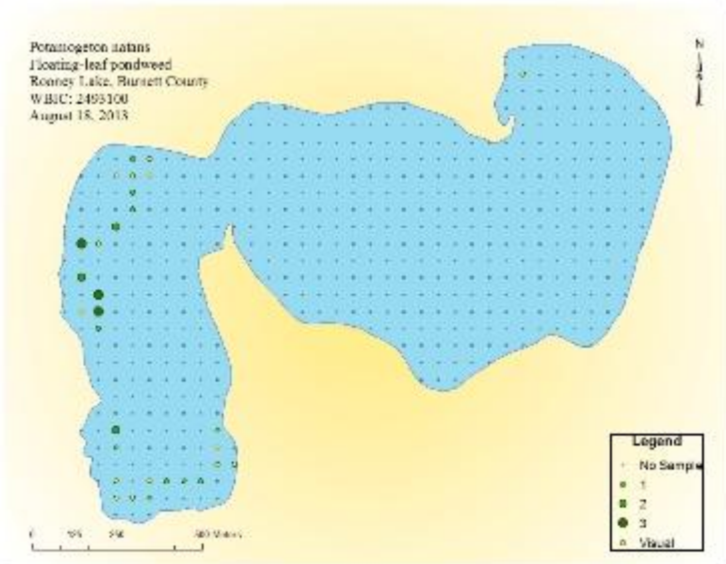
Visual


Potamogeton natans
Floating-leaf pondweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
Legend
No Sample
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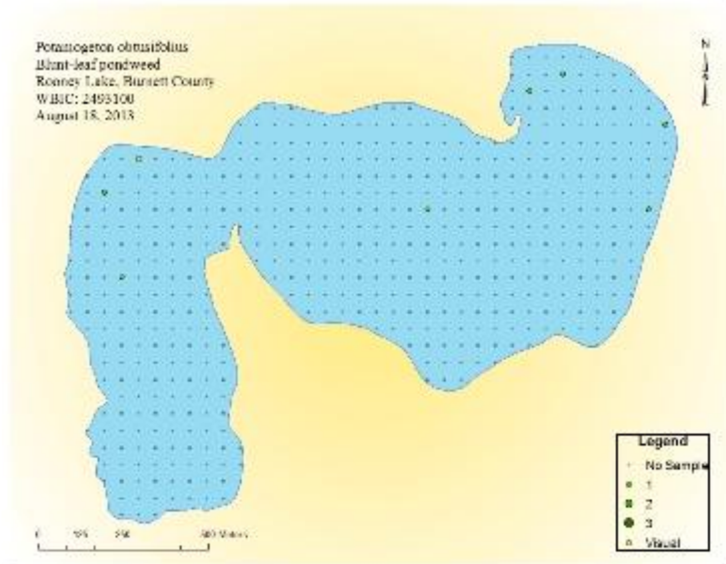
Visual


Potamogeton obtusifolius
Blunt-leaf pondweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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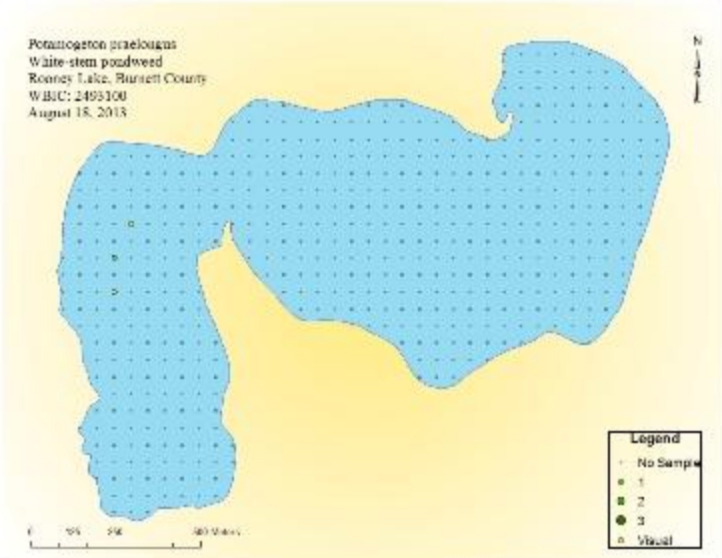
Visual


Potamogeton praelongus
White-stem pondweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
Legend
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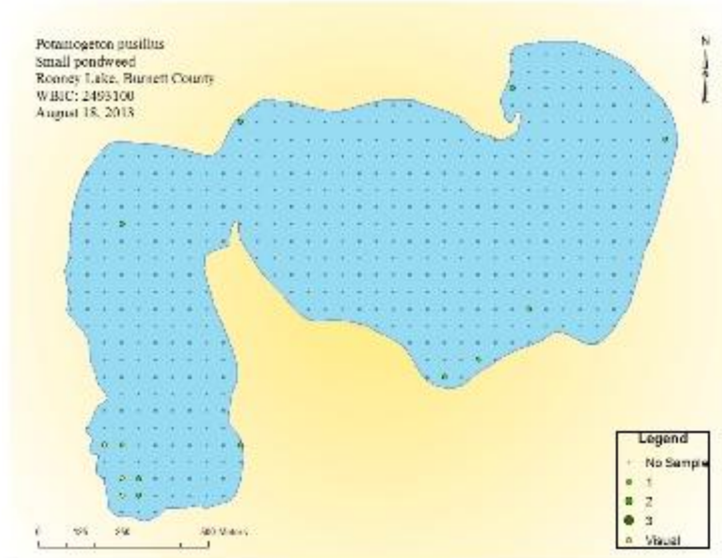
Visual


Potamogeton pusillus
Small pondweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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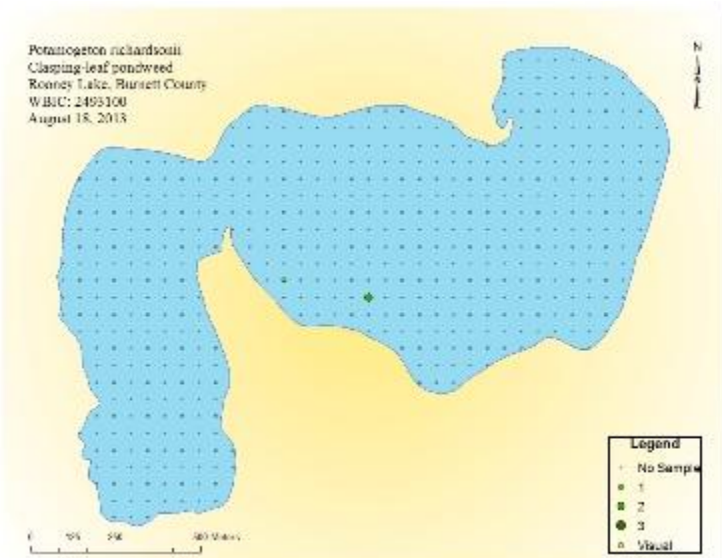
Visual


Potamogeton richardsonii
Clasping-leaf pondweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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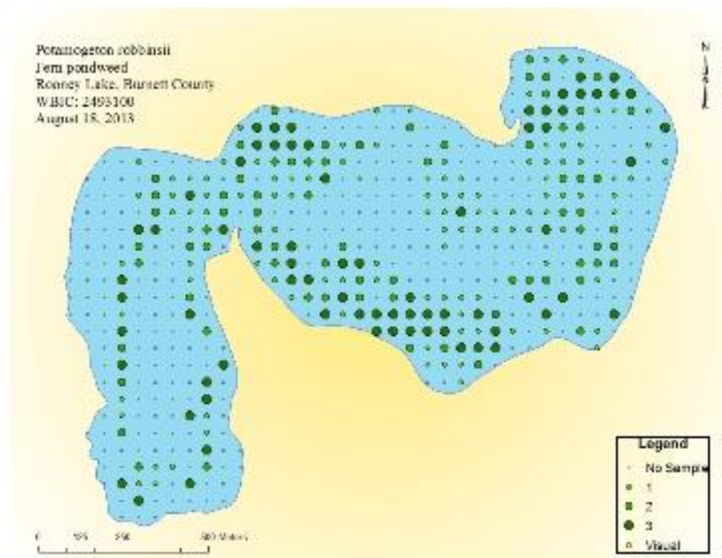
Visual


Potamogeton robbinsii
Fern pondweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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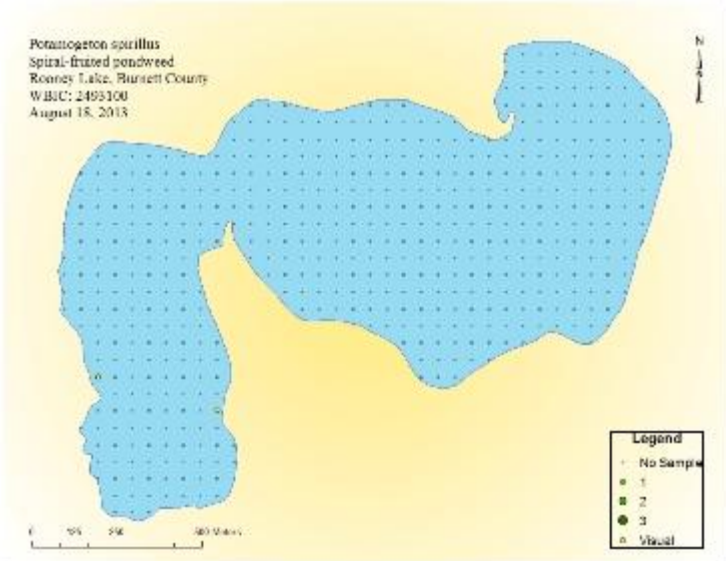
Visual


Potamogeton spirillus
Spiral-fruited pondweed
Rooney Lake, Burnett County
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August 18, 2013
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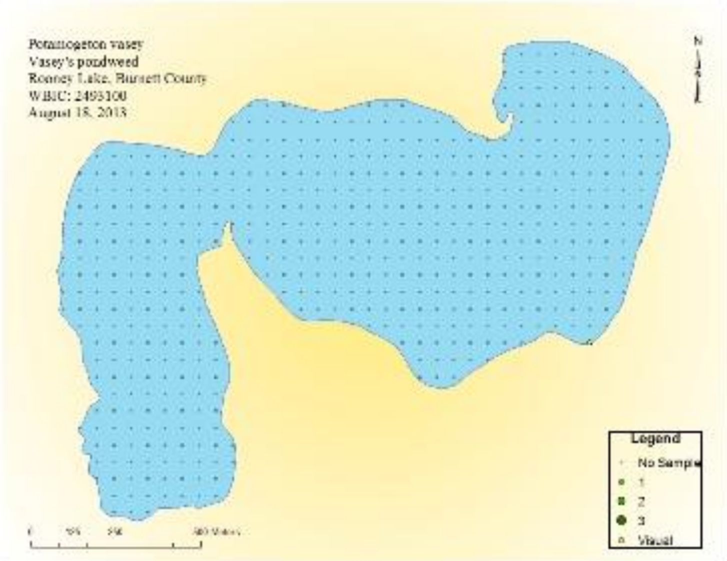
Potamogeton vasey
Vasey's pondweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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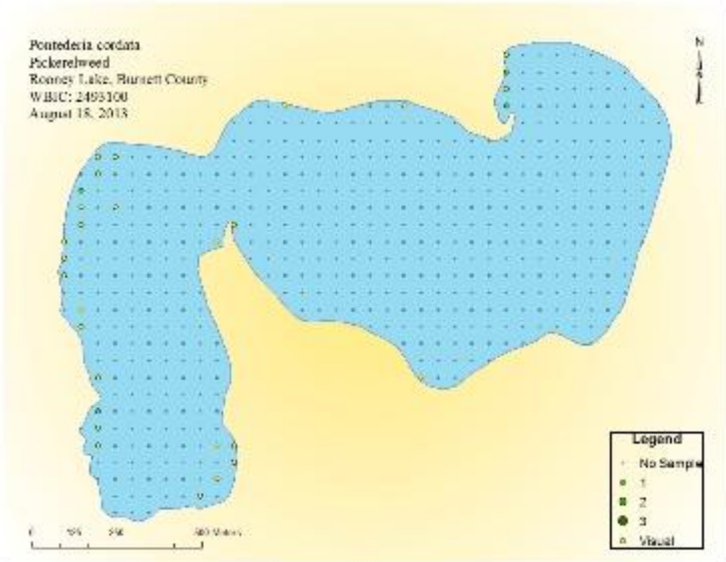
Pontederia cordata
Pickerelweed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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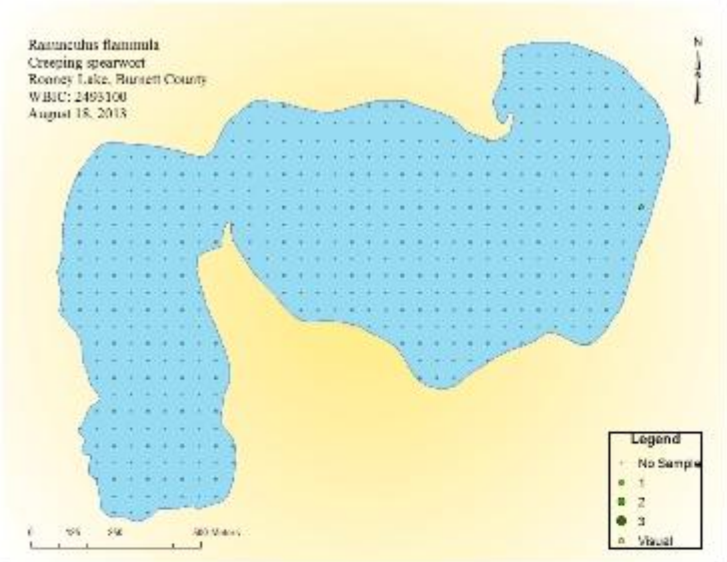
Ranunculus flammula
Creeping spearwort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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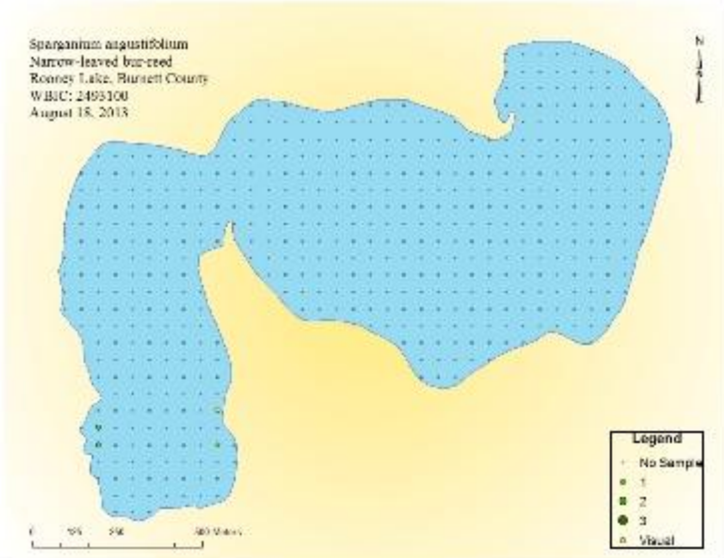
Visual


Sparganium angustifolium
Narrow-leaved bur-reed
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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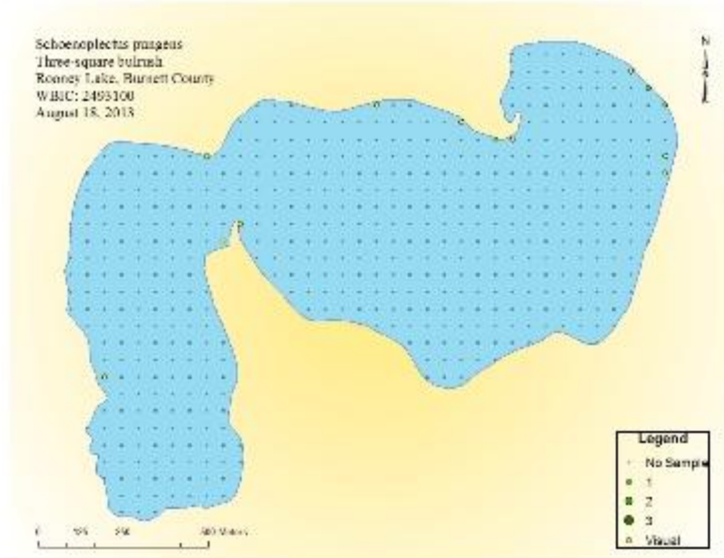
Visual


Schoenoplectus pungens
Three-square bulrush
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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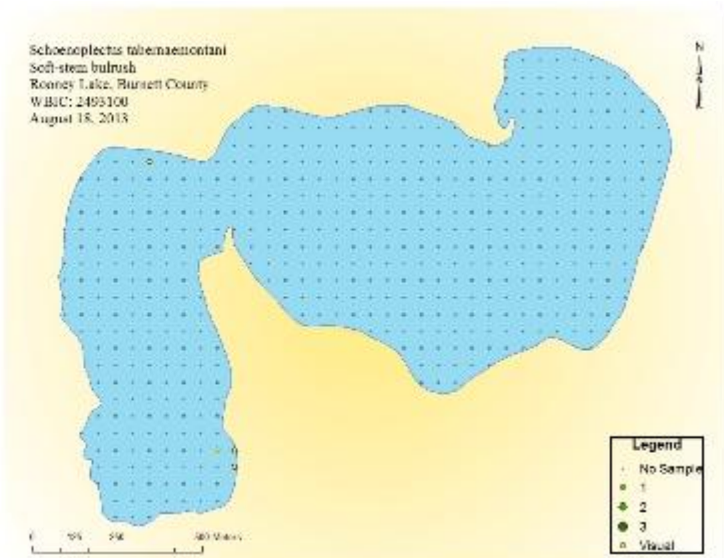
Visual


Schoenoplectus tabernaemontani
Soft-stem bulrush
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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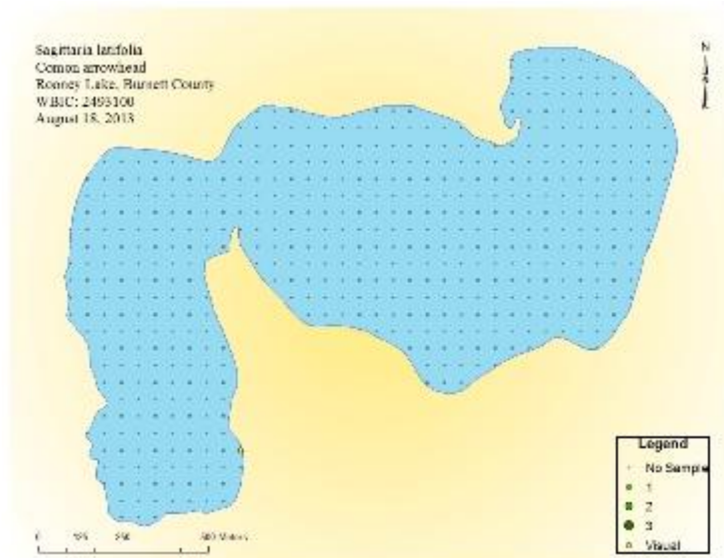
Visual


Sagittaria latifolia
Comon arrowhead
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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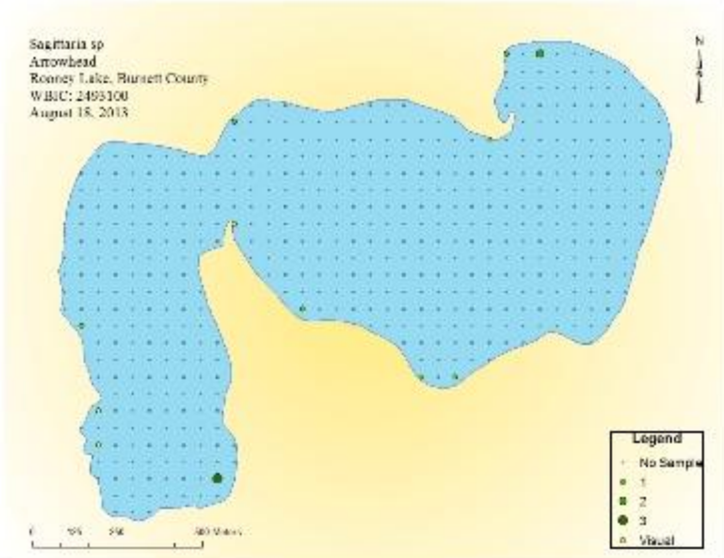
Sagittaria sp
Arrowhead
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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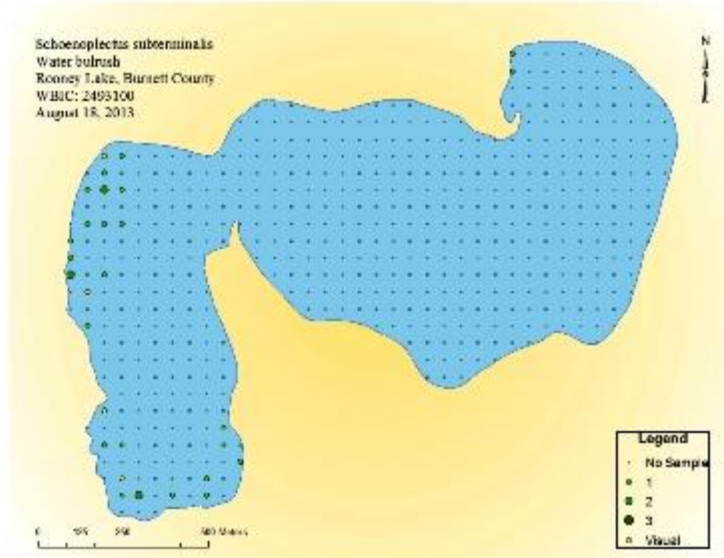
Visual


Schoenoplectus subterminalis
Water bulrush
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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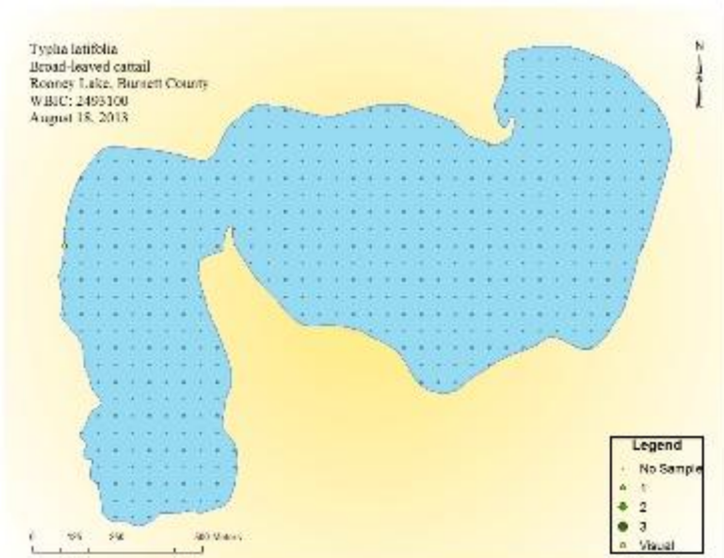
Typha latifolia
Broad-leaved cattail
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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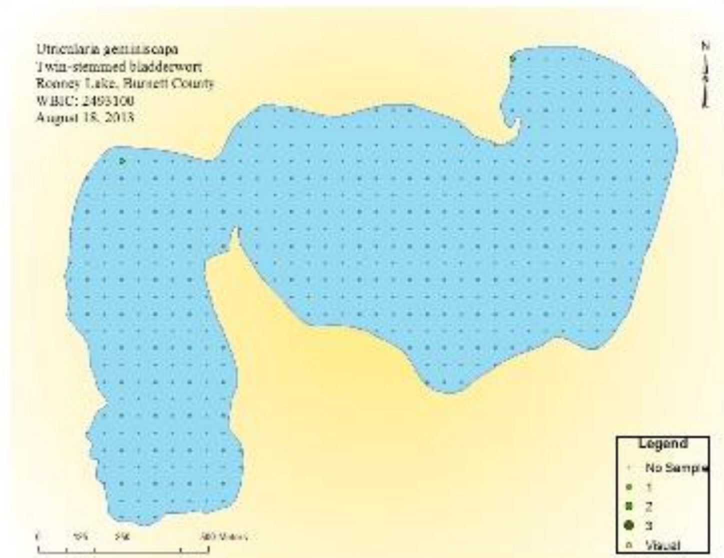
Utricularia geminiscapa
Twin-stemmed bladderwort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
Legend
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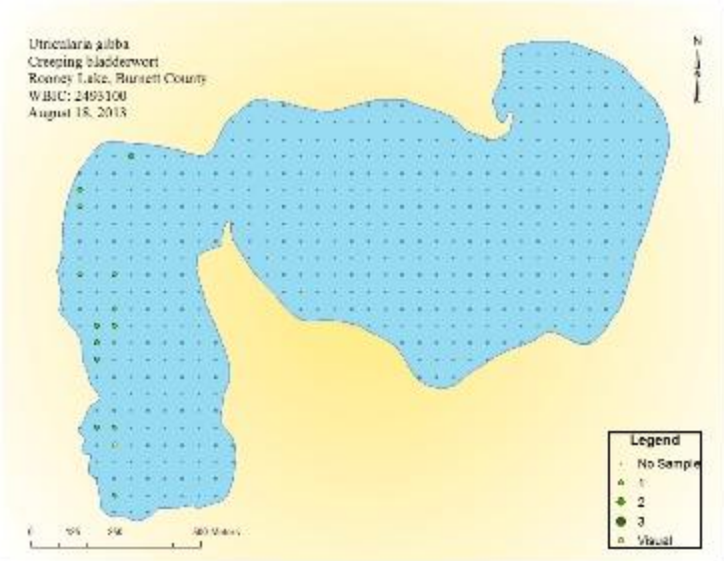
Visual


Utricularia gibba
Creeping bladderwort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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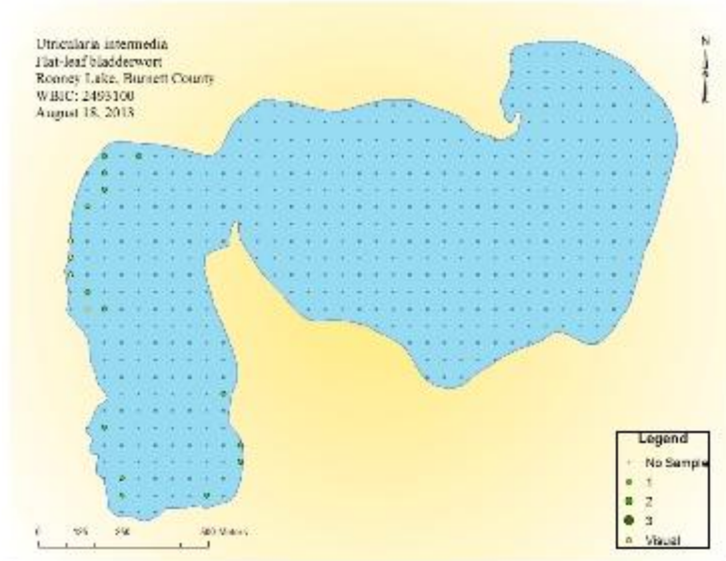
Visual


Utricularia intermedia
Flat-leaf bladderwort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
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Legend
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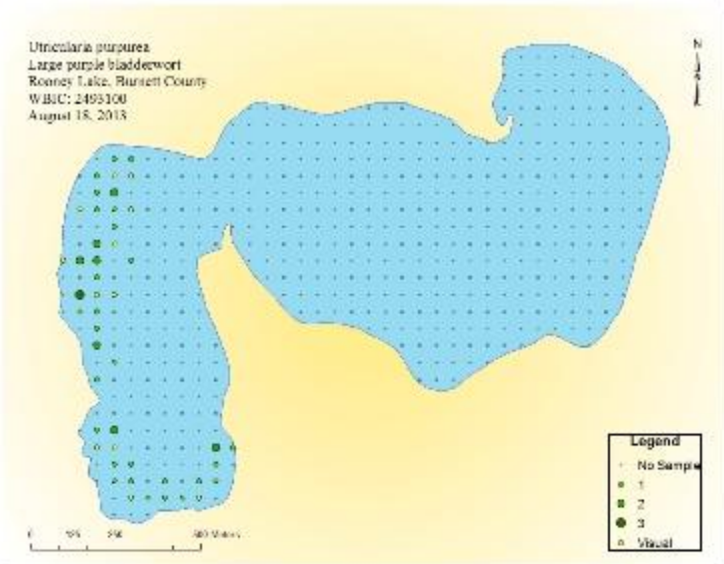
Visual


Utricularia purpurea
Large purple bladderwort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
Legend
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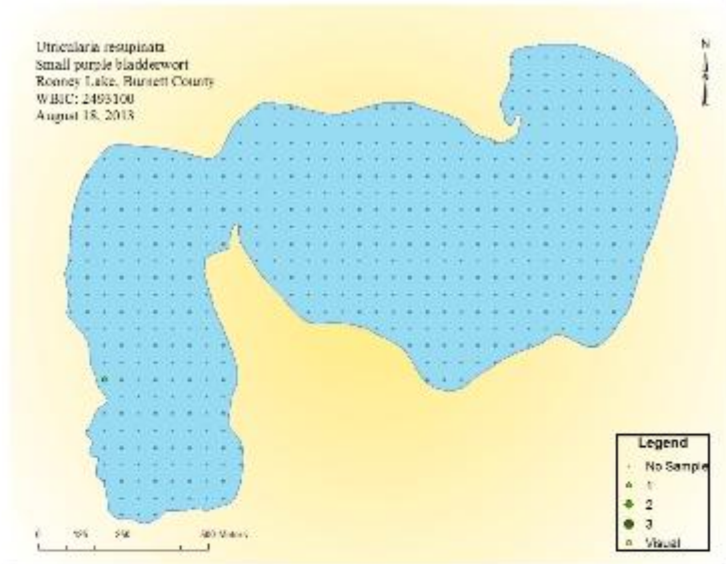
Visual


Utricularia resupinata
Small purple bladderwort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
Legend
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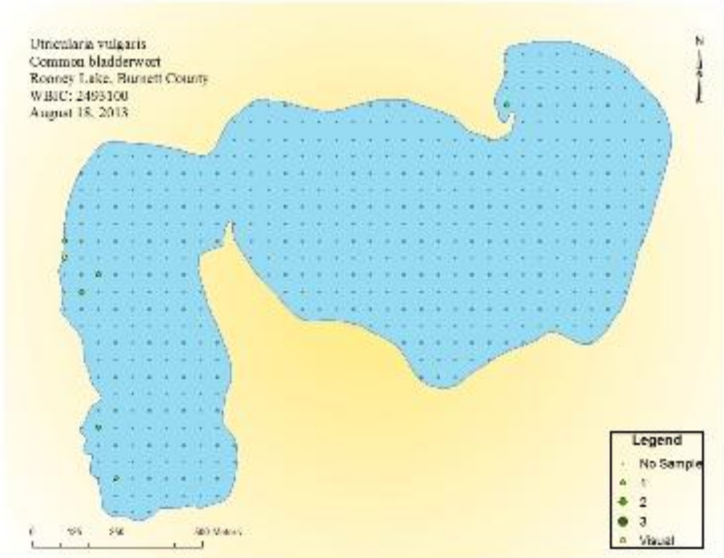
Visual


Utricularia vulgaris
Common bladderwort
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
Legend
No Sample
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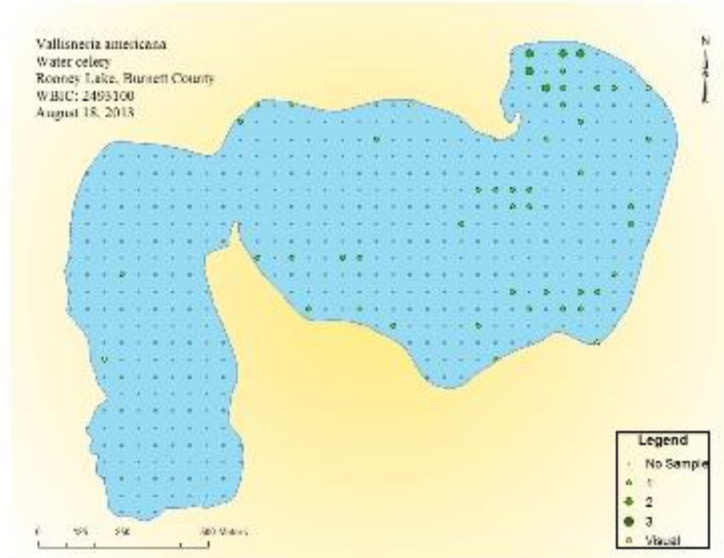
Visual


Vallisneria americana
Water celery
Rooney Lake, Burnett County
WBIC: 2493100
August 18, 2013
N
Legend
No Sample
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Visual

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

1. The Rooney Lake (RLA) community will be directed to contact the EWM identification (ID) lead Phyllis Meyers, if they see a plant in the lakes 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.

2. If the plant is likely to be EWM, the AIS ID lead will confirm identification with WDNR and inform the rest of the RLA board.

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

4. Confirm identification of EWM (or other AIS) with the WDNR (within 72 hours) (AIS ID Lead). 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.

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

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

7. If identification is positive, post a notice at the public landing and include a notice in the next newsletter. These notices will inform residents and visitors of the approximate location of EWM and provide appropriate means to avoid spread. (RLA board)

8. Contact Burnett County LWCD to seek assistance in EWM control efforts. The county has a rapid response plan in place that includes assisting lakes 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.

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.

10. Select a control plan in cooperation with Burnett County AIS Coordinator and WDNR (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.

11. 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.

12. RLA 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.

13. The President of the RLA 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 RLA shall formally apply for the grant.

14. RLA shall have the authority to accept donations or borrow money for the purpose of paying for control of EWM.

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

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

EXHIBIT A[1]

Rooney Lake Association

President	Jolene Mau
EWM ID Lead	Phyllis Meyers – 715-416-0704

Burnett County Land and Water Conservation Department – 715-349-2186

Brad Morris, AIS Coordinator

Dave Ferris, County Conservationist

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Grants	Pamela Toshner: 715-635-4073
Permits	Mark Sundeen: 715-635-4074
EWM Notice	Kathy Bartilson: 715-635-4053

LAKE MANAGEMENT CONSULTANT

Burnett County Land and Water Conservation Department: 715-483-2847

DIVERS

Endangered Resource Services   Matt Berg: 715-483-2847

[1] This list will be reviewed and updated each year.

Appendix D: Management Options

Management Options for Aquatic Plants

Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
No Management	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	May allow small population of invasive plants to become larger, more difficult to control later
			No immediate financial cost	Excessive plant growth can hamper navigation and recreational lake use
			No system disturbance	May require modification of lake users' behavior and perception
			No unintended effects of chemicals	
			Permit not required	
Mechanical Control	May be required under NR 109	Plants reduced by mechanical means	Flexible control	Must be repeated, often more than once per season
		Wide range of techniques, from manual to highly mechanized	Can balance habitat and recreational needs	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	Little to no damage done to lake or to native plant species	Very labor intensive
		Works best in soft sediments	Can be highly selective	Needs to be carefully monitored
			Can be done by shoreline property owners without permits within an area <30 ft wide OR where selectively removing exotics	Roots, runners, and even fragments of some species, particularly Eurasian watermilfoil (EWM) will start new plants, so all of plant must be removed
			Can be very effective at removing problem plants, particularly following early detection of an invasive exotic species	Small-scale control only

Management Options for Aquatic Plants

Draft updated Oct 2006

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

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

Management Options for Aquatic Plants

Draft updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
Physical Control	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	Eliminates all plants, including native plants important for a healthy lake ecosystem
			Useful for small areas	May inhibit spawning by some fish
				Need maintenance or will become covered in sediment and ineffective
				Gas accumulation under blankets can cause them to dislodge from the bottom
				Affects benthic invertebrates
				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	Winter drawdown can be effective at restoration, provided drying and freezing occur. Sediment compaction is possible over winter	Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling
		Season or duration of drawdown can change effects	Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction	May impact attached wetlands and shallow wells near shore
			Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization, and increased water quality	Species growing in deep water (e.g. EWM) that survive may increase, particularly if desirable native species are reduced
			Success demonstrated for reducing EWM, variable success for curly-leaf pondweed (CLP)	Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning
			Restores natural water fluctuation important for all aquatic ecosystems	Winter drawdawn must start in early fall or will kill hibernating reptiles and amphibians
				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	Plants are removed along with sediment	Increases water depth	Severe impact on lake ecosystem
			Most effective when soft sediments overlay harder substrate	Removes nutrient rich sediments	Increases turbidity and releases nutrients
			For extremely impacted systems	Removes soft bottom sediments that may have high oxygen demand	Exposed sediments may be recolonized by invasive species
			Extensive planning required		Sediment testing may be necessary
					Removes benthic organisms
					Dredged materials must be disposed of
d.	Dyes	Y	Colors water, reducing light and reducing plant and algal growth	Impairs plant growth without increasing turbidity	Appropriate for very small water bodies
				Usually non-toxic, degrades naturally over a few weeks	Should not be used in pond or lake with outflow
					Impairs aesthetics
					Effects to microscopic organisms unknown
e.	Non-point source nutrient control	N	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	Attempts to correct source of problem, not treat symptoms	Results can take years to be evident due to internal recycling of already-present lake nutrients
				Could improve water clarity and reduce occurrences of algal blooms	Requires landowner cooperation and regulation
				Native plants may be able to better compete with invasive species in low-nutrient conditions	Improved water clarity may increase plant growth

Management Options for Aquatic Plants

Draft updated Oct 2006

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

Management Options for Aquatic Plants

Draft updated Oct 2006

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

Appendix E

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