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Montello Lake - Aquatic Plant Management Plan

Montello Lake Inland Protection & Rehabilitation District

Prepared by:
Wisconsin Lake & Pond Resource

James Scharl
Sydney Kanz

April 28, 2025

N7828 Town Hall Rd
Eldorado WI 54932

www.wisconsinlpr.com

Phone: (920) 872-2032
Fax: (920) 872-2036

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EXECUTIVE SUMMARY

At 327-acres, Montello Lake is the third largest lake in Marquette County and provides numerous recreational opportunities for a wide spectrum of users. Being a popular fishing destination and near Buffalo and Puckaway Lakes and the Fox and Montello Rivers, Montello Lake draws a wide array of users from throughout the area and statewide. Some use patterns may be detrimental to the overall health of the lake and bring a higher risk of the introduction of new aquatic invasive species (AIS) into or out of Montello Lake.

The aquatic plant community in Montello Lake is very diverse and can grow dense in large areas. Dense aquatic plant growth can impact lake users and hamper navigation, which can be made worse by the presence of AIS. There are two AIS present in the lake; Eurasian water-milfoil (*Myriophyllum spicatum*), which has since been genetically confirmed as a hybrid cross with native northern water-milfoil (*Myriophyllum sibiricum*) and curly-leaf pondweed (*Potamogeton crispus* – CLP). Curly-leaf pondweed has historically been present in low density background populations.

Periodically dense aquatic plant growth can impact lake users and hamper navigation. Hybrid water-milfoil (HWM) populations have been documented to be lake-wide, topped out, and extremely dense in Montello Lake. Past management focused on aquatic plant control through herbicide applications, mechanical aquatic plant harvesting, and periodic drawdowns. These techniques, though expensive, provided temporary relief to navigation with the most accepted practice on Montello Lake. Mechanical harvesting has continued for navigational relief coupled with targeted herbicide application for near-shore areas where harvesters cannot access. This technique provides only temporary relief to navigation but is the most accepted practice for plant control. Mechanical harvesting, however, does not reduce the presence or spread of aquatic invasive species.

As a moderately sized man-made impoundment, the water quality of Montello Lake is reflective of its watershed. The watershed draining into the Lake is large and predominantly agricultural and forested with above average nutrient loading, leading to high productivity and moderate water clarity. Dense aquatic plant growth from a mix of AIS and native species is the main issues of concern for lake users and can hamper the health of the lake, limit enjoyment, and cause increased expenditure on actions to alleviate them. An updated understanding and review of renewed data and current issues has caused the need for development of an updated aquatic plant management plan.

This management plan provides a multi-faceted approach to address issues and recommend management options based on best fit, cost, feasibility, and desires based on direct input from the lake user survey questions. Many management options are evaluated and, while there is not one silver bullet, it is likely a combination of techniques over a period of several years that will begin to yield positive results. The basic plan is based on exploration of new aquatic plant management techniques with expanded actions for AIS control, overall aquatic plant community improvement, and addresses water quality concerns and protection of the lake's value to all users. Some of these actions potentially include active management for AIS, such as herbicide applications, protection of ecologically sensitive areas, AIS and boat landing monitoring, and continued nuisance reduction through mechanical harvesting. It would be recommended the group start with a specific project component or area of the lake to gain early and immediate success and build off that for future projects.

INTRODUCTION

Montello Lake is manmade impoundment on the Montello River lake located in the City and Town of Montello in central Marquette County. Montello Lake encompasses 327-acres, has a maximum depth of 15 feet, mean depth of 5 feet, and 6.5 miles of shoreline. The watershed is primarily a mix of agricultural land, forest, wetlands, and various residential densities.

Primary concerns from residents relate to the health of the lake, maintaining open navigation, aquatic invasive species management, and maintaining water quality. Eurasian water-milfoil, now confirmed as hybrid water-milfoil, has been present in Montello Lake since 1975 and consistently grows at high frequency and density, but has not received direct management efforts. A diverse aquatic plant community with multiple, high quality pondweed species has consistently been present even with high populations of HWM. As a mix of native and invasive species, the aquatic plant community annually grows dense enough to impact navigation and require management with mechanical harvesting to alleviate issues.

Water quality of Montello Lake rates as eutrophic and very productive with generally moderate to good clarity. The lake provides numerous recreational opportunities, primarily fishing, boating, and swimming. The Montello Lake Inland Protection & Rehabilitation District (the District) is the main organization responsible for management activities on Montello Lake, with input and support from their consulting firms, residents, and the DNR. The District is a group who supports the restoration and management of the lake with a strong tradition in conservation and resource management to protect and enhance these opportunities. The District has been active in several lake management activities on Montello Lake including: aquatic plant management, water quality sampling and management, invasive species sampling, and protection of the lake. The District received a grant from WDNR and contracted Wisconsin Lake & Pond Resource (WLPR) to update their aquatic plant management (APM) plan for Montello Lake.

LAKE USER INPUT AND PRIMARY CONCERNS

Any management plan can only be successful if accepted by the lake users it impacts the most. If options are laid out that are not needed or feasible, a plan is set to fail due to lack of support and this management plan is no different. Prior to and throughout the drafting of this plan, multiple meetings and presentations were complete. These direct engagements give us a unique look at all lake users and a better understanding of issues to guide development of a plan that will not only strive to improve current lake conditions, but be successfully implemented and supported by lake users through direct response actions by the people the lake impacts the most.

Project meetings and discussions to present results further refine the plan and goals were held during annual Village meetings. The draft APM plan was submitted to the District and WDNR for comments prior to finalization. The APM plan that follows recommends specific management activities for Montello Lake based on the top management concerns indicated during the presentations and further discussions with lake users: preventing the spread of AIS into and out of Montello Lake, potential control of dense populations of HWM, and management of nuisance aquatic plant populations that can negatively impact recreation, access and navigation. This plan will focus on these main contributing factors to lake user frustrations and concerns. Many options were discussed and it was clear that no action was not acceptable to lake users.

The Montello Lake APM Plan includes a review of available lake information, an aquatic plant survey, and lake user input to determine the most appropriate management alternatives (physical, mechanical, biological, or chemical) for protection and health of the lake. Though not all activities desired for management by lake users may be viable or appropriate, their input above provides a strong base to form this plan.

LAKE HISTORY AND PAST MANAGEMENT

Located in central Marquette County, the lake has been an important fixture in the lives of residents and non-resident users. A public landing on the west shore provides excellent accessibility with a paved launch lane. Additional lake access is provided by two public Parks: Montello City Park and Wells Park. Montello City Park has a public swimming beach and picnic/recreation located on the shores and has been called the finest small-town park in Wisconsin. Additional access is provided by private businesses, including Sky Lodge Christian Camp.

Numerous accesses to Montello Lake and its proximity to popular nearby waterbodies have led to a history of heavy recreational use, primarily fishing. Montello Lake is a very biologically productive lake with the potential for significant areas of dense aquatic plant growth. Most areas of dense growth are in soft-sediment areas of water depths from 2-8 feet. Throughout the year, moderately clear water allows the sunlight to reach the bottom in much of the lake. Aquatic plants have created a nuisance to navigation in multiple locations which are exacerbated by AIS, primarily HWM. Dense aquatic plant growth has been a concern throughout the history of Montello Lake and has become the main issue for management. These have been dealt with various management plans, including the following:

- **Montello Lake Inland Protection & Rehabilitation District**: The District was officially founded to protect the lake, deal with management issues, and enhance the lake for future generations. All the activities below, including this plan, would not have been possible without them. The District has taken on mechanical harvesting and AIS control tasks including various herbicide applications ranging from small scale (<10 acres) to whole-lake dosed application and water level drawdowns. Over-winter drawdowns were completed in 2002-03, 2008-09, and 2013-14.
- **Aquatic Plant Management:** Earliest methods of control were completed by individual landowners contracting for chemical treatments.
- **Aquatic Plant Survey – 1993**: The first documented aquatic plant survey of the lake was conducted. Many of the species noted in the 1993 survey are still present today and included: Milfoil species, pondweed species, lotus, common waterweed, white water lily, and others. Dense locations of growth requiring management were noted. The point-intercept method was first used in 2013 and for all whole-lake surveys since.
- **The District purchases its first mechanical harvester - 1983:** The District acquired its first mechanical harvester to control excessive aquatic plant growth and improve navigation. Harvesting continues today, averaging up to 130 loads of material each year.
- **Aquatic Invasive Species identified:** The first AIS were found growing in Montello Lake – EWM (1975) and CLP (1993). Both species can grow extremely dense and hamper recreation al use of the Lake. Management of AIS has been primarily focused on EWM, which has since been verified as a hybrid water-milfoil in 1993. Since then, the following AIS has been identified in Montello Lake: Chinese mystery snail – 2007.
- **Aquatic Plant Management Plan - 1994:** A targeted management of Montello Lake's aquatic plants was created with assistance from the WDNR and the District. This plan laid the groundwork for aquatic plant management. Updates to the plan to reflect current conditions were completed in 2002, 2009, and 2021.

WATERSHED AND WATER QUALITY SUMMARY

Montello Lake is a man-made drainage lake, or impoundment, relying precipitation and incoming river flows to maintain water levels. With a reliance on precipitation as the main source, water levels can fluctuate over the years, though the dam largely regulates a near-static water level. Water quality within the Lake is reflective of the quality of the landuse within the watershed and annual precipitation. Watershed with higher disturbance land use practices, such as agriculture or commercial properties with large areas of impermeable surface area, lead to decreased water quality from increased nutrient and sediment inputs. On the other side, land use that remains more natural, such as forests and wetlands, can slow runoff, take up excess nutrients, and lead to better incoming water quality.

Watershed Summary

Water quality factors are impacted by the lake's watershed. To gauge the watershed's effect on the water quality of Montello Lake the Wisconsin Lake Modeling Suite (WiLMS), a WDNR computer program, was used to model lake water quality based on watershed land use and current water quality data. WiLMS can be used as a planning tool to assist in management recommendations or procedures within a watershed to ensure stable or increased water quality.

Montello Lake is the largest of 22 lakes in the watershed and, including the lake, the watershed encompasses 91,440 acres, or 142.88 square miles terminating at the lake's dam in the southern part of the lake. The Montello River begins as Tagatz Creek in the norther part of the watershed. Westfield Creek flows into Tagatz Creek form the Montello River just upstream of Harris Pond. Klawitter Creek then joins the Montello River downstream of Harris Pond before flowing into Montello Lake.

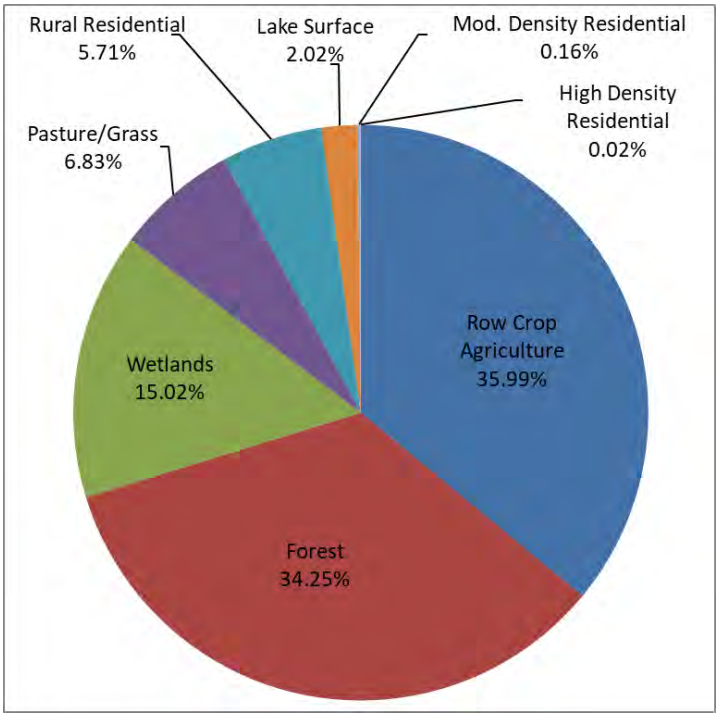
From the WiLMS landcover, there is approximately 1,847 acres of open water spread across 22 lakes. Montello Lake is the largest within the watershed at 327 acres, which gives a watershed-to-lake ratio of 279.6:1, meaning for every 279.6 acres of watershed there is one acre of open water on Lake Montello. This means the watershed has a huge potential to impact the water quality of the lake. A lake and its water quality are a representation of the watershed around it, specifically its land use, soils, topography, vegetation, and geology. All of these factors directly into the nutrient loading to the lake. The small watershed-to-lake ratio for Montello Lake can indicate potentially low nutrient loading relative to the lake size. The Lake has a mean depth of 5 feet and belongs in the central sand ridges sub-region of the North Central Hardwoods Forests ecoregion (Figure 1).

In order to complete WiLMS modeling, land use within the watershed first had to be calculated. Land use was calculated using aerial and satellite imagery to assess and assign land cover to areas within the watershed across eight types in WiLMS modeling. Land cover breakdown for the Montello Lake watershed is in Table 1.

Table 1: Land cover within Montello Lake Watershed.

WiLMS* Landcover	Acres
Row Crop Agriculture	32910.0
Forest	31319.0
Wetlands	13734.0
Pasture/Grass	6245.0
Rural Residential (>1 ac)	5221.0
Lake Surface	1847.0
Moderate Density Residential (1/4 ac)	146.0
High Density Residential (1/8 ac)	18.0
TOTAL	**91440.0**

* Wisconsin Lake Modeling Suite



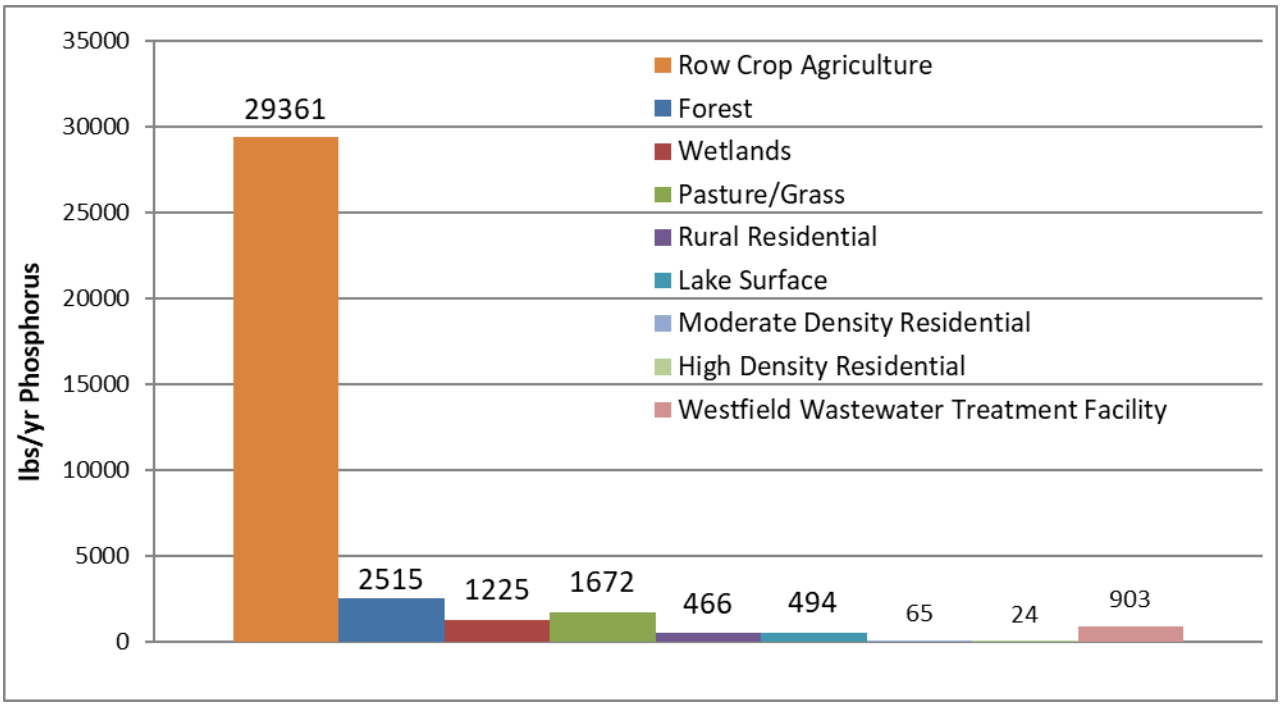
A majority of Montello Lake's watershed is developed into agricultural use with forest a close second. Agricultural landcover typically is not well protected against runoff and attributes moderate to high amounts of sediment and additional nutrients into the water. Forests and wetlands, however, are closer to natural conditions well protected from runoff. These landcovers add much smaller amounts of phosphorus from runoff.

Using WiLMS, a Lake Total Phosphorous Prediction (LTPP) model was used to predict the amount of phosphorus loading into the Lake within its watershed through point and non-point sources. This is important because in many lakes, phosphorus is the limiting nutrient for plant growth. An increase in phosphorus levels will allow for increased plant growth and possibly cause problematic algae blooms. There is one known point source for phosphorus introduction to Montello Lake, the Westfield Wastewater Treatment Facility.

The LTPP predicted a total phosphorous amount of 36,725 pounds per year being added to the waterbody through point and non-point sources. The amount of phosphorus put into the watershed through each land use is different (Table 2 and Chart 2). Row crop agricultural is the highest contributor of phosphorus into the lake at approximately 29,361 lbs./year. Forest lands cover slightly less than row crop agricultural, but contribute significantly less phosphorus per year at only 2,515 lbs. Phosphorus listed as an "open water" source accounts for natural deposits into the lake, such as from leaves falling off trees, and a small portion of recycling that already in the Lake. This accounts for the third least annual phosphorus input at 494 lbs. of the lake's budget per year based on the model.

Table 2: Phosphorus input by land use type. Montello Lake, Marquette County, WI

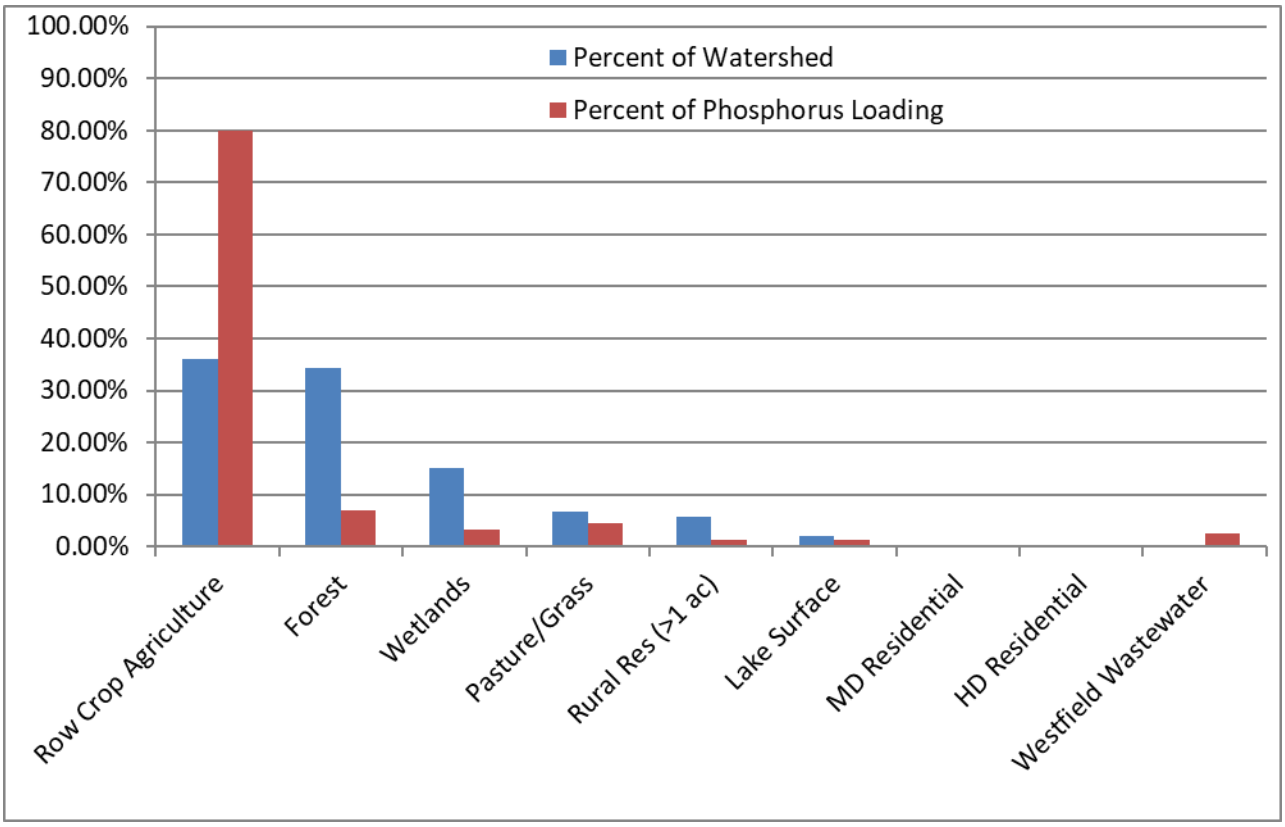
		Phosphorus Loading	
Land Use	**Acres**	**lbs / year**	**Average lb / acre / year**
Row Crop Agriculture	32910	29361	0.89
Forest	31319	2515	0.08
Wetlands	13734	1225	0.09
Pasture/Grass	6245	1672	0.27
Rural Residential (>1 ac)	5221	466	0.09
Lake Surface	1847	494	0.27
Moderate Density Residential (1/4 ac)	146	65	0.45
High Density Residential (1.8 ac)	18	24	1.33
Westfield Wastewater Treatment Facility	0	903	---
OVERALL	**91440**	**36725**	**0.39**



Areas of natural land cover, such as forests and wetlands, have reduced runoff and release lower rates of phosphorus into the lakes compared to developed areas with higher amounts of impervious surfaces, such as roads and buildings. Meaning, though forests and wetlands may occupy nearly 50% of the total land cover, they only contribute 10.2% of the total phosphorus into the Lake. As noted above, row crop agricultural land is the largest contributor of excess nutrients. Though it's the largest landcover at 36% of the total watershed, it attributes nearly 80% of the annual phosphorus load into the lake (Table 3 and Chart 3).

Table 3: Percent phosphorus loading by source. Montello Lake, Marquette County, WI

Land Use	Acres	Percent of Watershed	Percent of Phosphorus Loading
Row Crop Agriculture	32910	35.99%	79.95%
Forest	31319	34.25%	6.85%
Wetlands	13734	15.02%	3.34%
Pasture/Grass	6245	6.83%	4.55%
Rural Res (>1 ac)	5221	5.71%	1.27%
Lake Surface	1847	2.02%	1.35%
Moderate Density Residential (1/4 ac)	146	0.16%	0.18%
High Density Residential (1/8 ac)	18	0.02%	0.07%
Westfied Wastewater Treatment Facility	0	0.00%	2.46%
TOTAL	**91440**	**100.00%**	**100.00%**

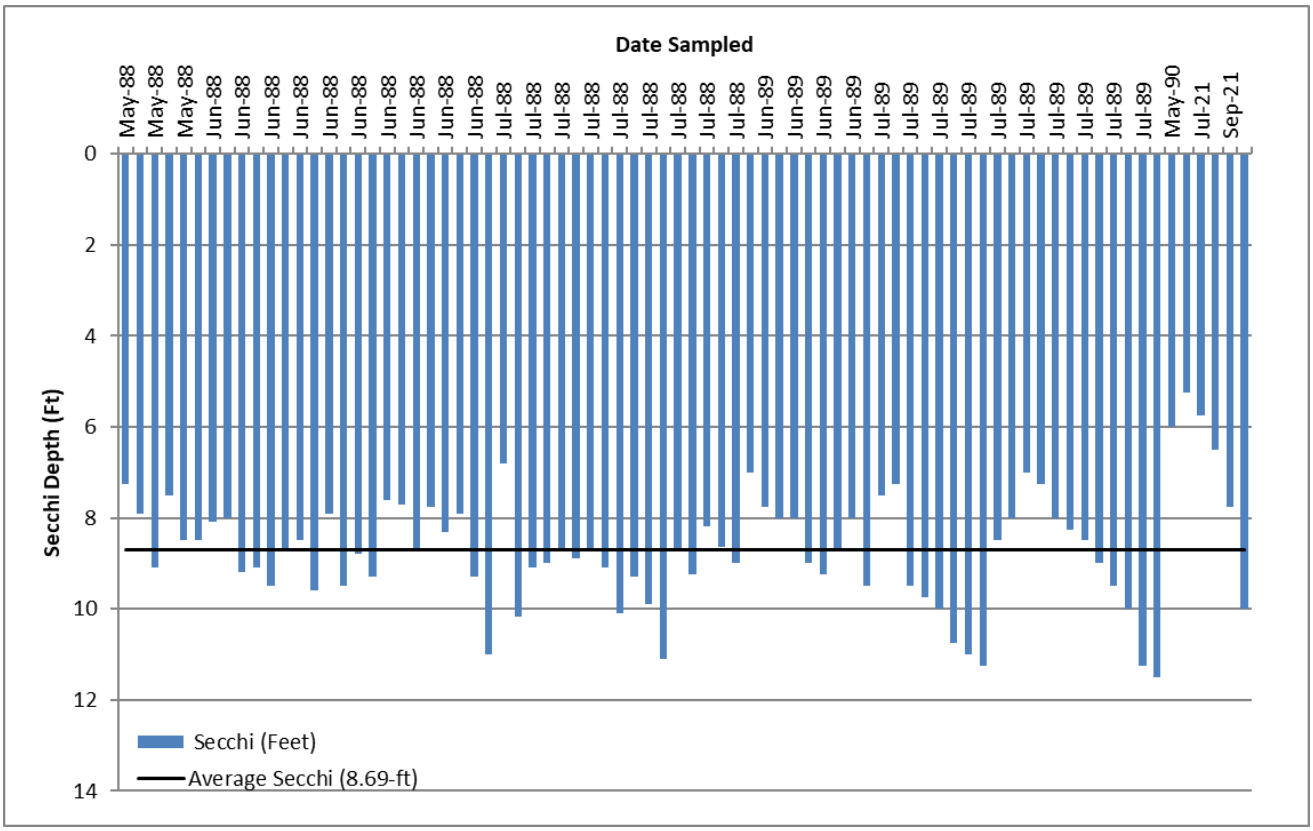


Water Quality Summary

Montello Lake's water quality data has been limited to only sporadic sampling for water quality and total phosphorus. Most of the past samples were collected by volunteers under the WDNR's Citizen Lake Monitoring program. Samples collected over time include:

- Water clarity (Secchi depth) – 1988-90, 2021
- Total phosphorus – 1995-1998
- Chlorophyll-*a* – not sampled

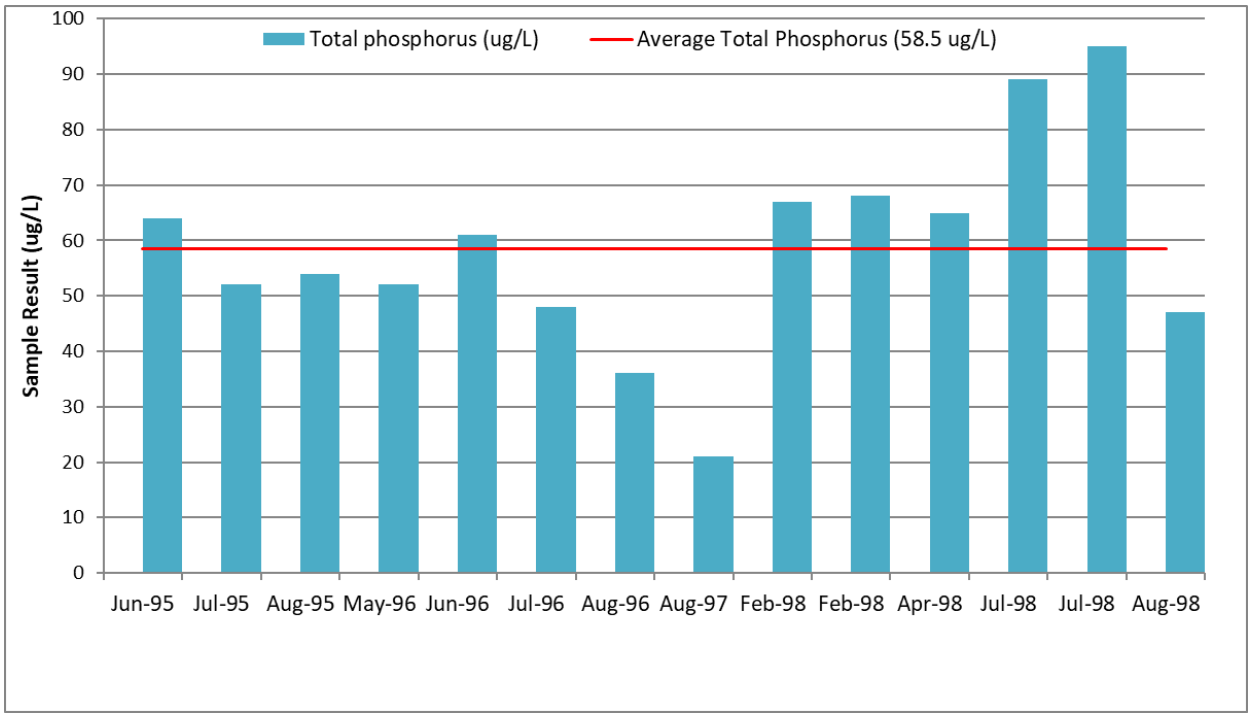
Higher **secchi depth** (water clarity) readings indicate clearer water and deeper light penetration, allowing plants to grow in deeper areas of the lake. Historical water clarity for the lake is 8.69 feet (Chart 4), indicating slightly below average when compared to the average for all lakes in Wisconsin (10ft). However, for a very nutrient-rich impoundment the water clarity is very good. Man made lakes and those with more disturbance and development, such as many lakes in central Wisconsin, tend to have below average water clarity due to increased impact from disturbance, which increases nutrient and sediment loads in the water when compared to natural waterbodies.



Nutrients within the water play an important part in the productivity of the water, leading to impacts on water quality. These include total phosphorus, nitrogen, and chlorophyll-*a*. **Phosphorus** is the key nutrient or food source influencing plant growth in waterbodies. Phosphorus promotes excessive aquatic plant growth and originates from a variety of sources, many of which are related to human activities. Major sources include human and animal wastes, soil erosion, wastewater treatment plants, detergents, septic systems and runoff from farmland or lawns. Soluble reactive phosphorus is the amount of phosphorus in solution that is available to plants. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form. All samples averaged 0.0585 mg/L (58.5 ug/L) for total phosphorus, indicating poor quality, below Wisconsin lakes on average, and significant availability of nutrients (Chart 5).The table below outlines average phosphorus readings and their respective water quality:

Water quality vs. Total Phosphorus

Water Quality Index	Total Phosphorus (mg/L)	
Very Poor	0.150+	
Poor	0.053 – 0.149	← Montello Lake: 0.0585 mg/l
Fair	0.031 – 0.052	
Good	0.016 – 0.030	
Very Good	0.002 – 0.015	
Excellent	0.001 or less	



Chlorophyll-a is a green pigment present in all plant life and necessary for photosynthesis. The amount present in surface water depends on the number of algae and is used as a common indicator of water quality. Higher chlorophyll-a values indicate lower water clarity. Values of 10 ug/L and higher are associated with algal blooms, while values between 5 and 10 ug/L indicate good water quality. In lakes, these values cycle annually during the open water period. They begin low after ice out and increase throughout the year as the water warms and algae growth increases, sometimes spiking and creating a bloom condition (>10 ug/L). High amounts of phosphorus present fuel algae blooms, which can outcompete zooplankton. Zooplanktons are tiny living organisms in the water column and are important food sources for small panfish and minnows. Chlorophyll-a has not been sampled in the Lake.

Water quality is a component of all three above factors: Water clarity (secchi), total phosphorus and chlorophyll-a. All factors are linked to each other, and as one changes so do the others. For example, if nutrient loads, such as phosphorus or nitrogen, increase that increases available resources for algae (chlorophyll-a), which can cause an increase in this reading all while leading to a decrease in water clarity. Data is collected over time and averaged, allowing these factors to be used to assess the Trophic State Index (TSI) for a lake. TSI values are assigned to a lake based on all three values and are a measure of a lakes' biological productivity. Lakes with higher TSI values are more biologically productive, but have lower water clarity, increased nutrient input and the potential for frequent algae blooms. On the opposite end, lakes with low nutrient input and very clear water are typically less productive, having lower TSI values.

Historical water clarity, total phosphorus and chlorophyll-a data have not been collected at enough intervals to show a reliable trend. However, they do indicate that water quality is not as impacted by high nutrient levels as expected as water quality rates as mesotrophic while total phosphorus is eutrophic. The overall average indicates that Montello Lake is a eutrophic lake with an average TSI rating of 52.66.

Category	TSI	Lake Characteristics	Total P *(ug/l)*	Chlorophyll a *(ug/l)*	Water Clarity *(feet)*
Oligotrophic	1-40	Clear water; oxygen rich at all depths, except if close to mesotrophic border; then may have low or no oxygen; cold-water fish likely in deeper lakes.	< 12	<2.6	>13
Mesotrophic	41-50	Moderately clear; increasing probability of low to no oxygen in bottom waters.	12 to 24	2.6 to 7.3	13 to 6.5
Eutrophic	51-70	Decreased water clarity; probably no oxygen in bottom waters during summer; warm-water fisheries only; blue-green algae likely in summer in upper range; plants also excessive.	> 24	>7.3	<6.5
Montello Lake	**52.66**	**Mesotrophic**	**58.5**	**---**	**8.69**

Adopted from Carlson 1977, Lillie and Mason, 1983, and Shaw 1994 et al

AQUATIC PLANTS

Aquatic plants are vital to the health of a water body. Unfortunately, they are often negatively referred to as “weeds”. The misconceptions this type of attitude brings must be overcome in order to properly manage a lake ecosystem. Rooted aquatic plants are extremely important for the well-being of a lake community and they possess many positive attributes. Despite their importance, they sometimes grow to nuisance levels that hamper recreational activities and are common in degraded ecosystems. The introduction of AIS often can increase nuisance conditions, particularly when they successfully out-compete native vegetation and occupy large portions of a lake.

To assess the state of the current plant community, a full point-intercept survey was completed on August 12-13, 2024 following all WDNR survey protocol. The survey included sampling at 576 pre-determined locations uniformly spaced 49 meters apart to document the following at each site:

- Individual species present and their density
- Water depth
- Bottom substrate

Each location was assigned coordinates and loaded into a GPS unit, which was used to navigate to each point. Data collected at each point was then entered into a WDNR spreadsheet, which outputs various aquatic plant community indexes and data, allowing for a comparison to past data to monitor changes over time. Information on methods and all referenced tables or charts is included in Appendix B

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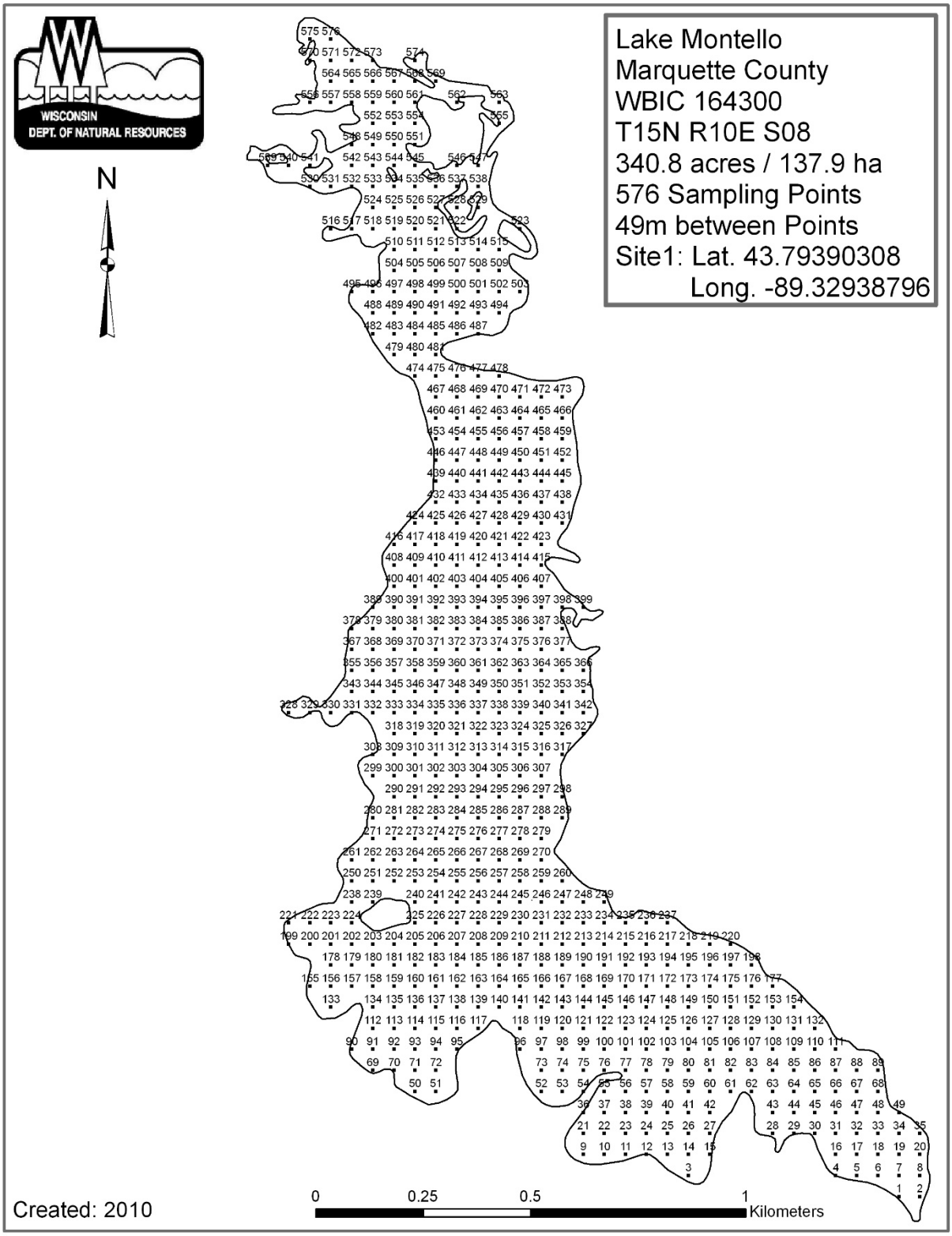


N7828 Town Hall Rd
Eldorado WI 54932

www.wisconsinlpr.com

Phone: (920) 872-2032
Fax: (920) 872-2036

2024 Point Intercept Survey

In 2024, the aquatic plant survey identified continued very good diversity with large swaths of moderate to high density growth. In total, 20 species were identified including two AIS; hybrid water-milfoil and curly-leaf pondweed (Table 6). All remaining species sampled are common in Wisconsin and included a wide variety of native pondweed species, which are important fisheries habitat.

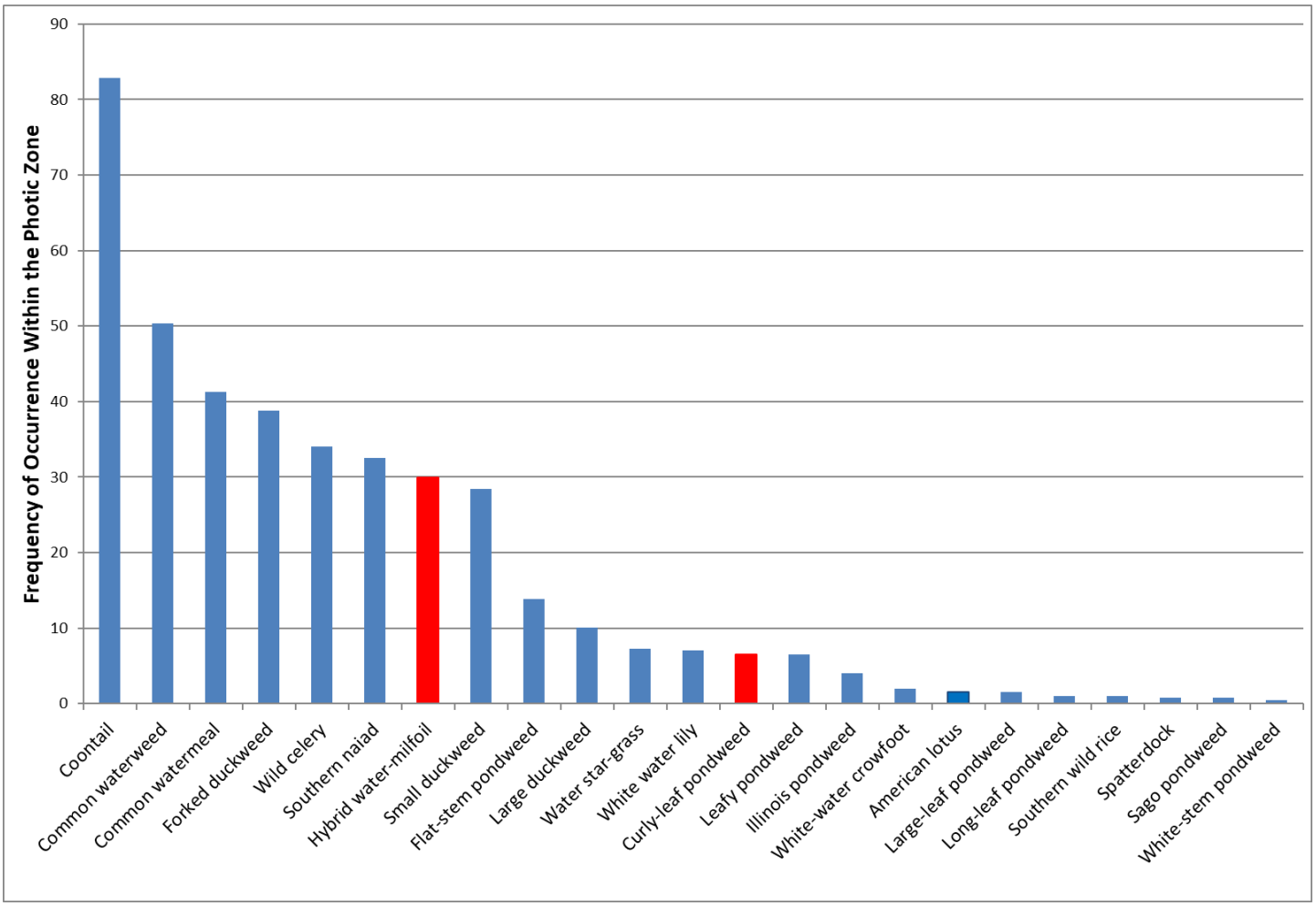
Table 5: Aquatic Plant Community Statistics. Montello Lake, Marquette County, WI.

Community Statistics	2024
Number of sites sampled	397
Number of sites with vegetation	383
Number of sites shallower than maximum depth of plants	397
Frequency at sites shallower than maximum depth of plants	96.5%
Simpson Diversity Index	0.9
Maximum depth of plants (feet)	12.5
Species richness	24
Average rake fullness	1.54
Average number of all species per site	4.11
Average number of all species per vegetated site	4.26
Average number of native species per site	3.74
Average number of native species per vegetated site	3.88

In 2024 and past surveys, the species sampled in Montello Lake were present in four categories: emergent, near shore species which are rooted below the water's surface with growth extending above the water (cattail - *Typha sp.*); submersed species which root on the lake bottom and remain below the water's surface (common waterweed – *Elodea canadensis*); floating-leaf species which root on the lake bottom but have leaves that float on the water's surface (white water lily – *Nymphaea odorata*); and free-floating species that are small and freely drift across the lake's surface (small duckweed – *Lemna minor*).

The photic zone, or area of the lake where light penetration can support plant growth, extended to 12.5-ft in 2024, nearly the entire lake's area. Plant growth was very dense with 96.5% of this area vegetated. Much of the sediment was compromised of muck, sand, or a mixture of the two. A mixture of sand and organic rich muck sediment provides ideal conditions for aquatic plant growth with an excellent nutrient source and solid footing for roots to establish in. In some areas of muck, the loose sediment allows plants to easily uproot due to wave or boat action and float to the surface, creating an additional nuisance to lake users.

Species richness was above average for area lakes at 24 and exhibited excellent diversity per sample point with 3.88 native species per vegetated site. This has remained stable from the 2017 survey and over 1.0 additional species per site from earlier. A great spread of species was noted throughout the system, as exhibited by a Simpson Diversity Index (SDI) of 0.90. An SDI value closer to 1.0 indicates a healthier, more evenly spread plant community. Table 6, Appendix B displays frequency data by individual species for the 2024 and prior surveys. Coontail (*Ceratophyllum demersum)* and common waterweed were the most dominant species present. Both species have been one of the most dominant species during the prior surveys and cause much of the dense, nuisance growth. Figures 3-12 display the locations of the most common species, and any AIS found during sampling.



Though there are two AIS noted as being present in Montello Lake (CLP & HWM), only HWM was sampled at high frequency during the 2024 survey. HWM was sampled at 119 locations, or 30% of photic-zone sample points, but was the seventh most common species (Figures 3-4). As an invasive species with aggressive growth tendencies, HWM spreads by growing from plant fragments, which can be hastened through mechanical harvesting. HWM has the potential to become an extreme nuisance and detriment to a lake's ecosystem and has done so in the past on Montello Lake. The 2024 survey indicates a slight decrease in frequency and moderate decrease of density of HWM from 2017, even without direct management actions for its control. Even though HWM is present at a moderately high frequency, it was mainly found at low to moderate density when sampled (average of 1.05 rake-density). There were no areas of dense and topped-out HWM noted to be present (Figure 4). Harvesting may have been able to reduce larger areas of surface matted HWM growth by the time of the survey. Much of the navigational nuisance is continuing to be caused by a dense mix of species, primarily including coontail, common waterweed, and wild celery.

Curly-leaf pondweed was first noted in 1993, but no direct management efforts for its control have taken place historically. During past surveys CLP was noted at scattered locations at best and was not identified in the 2016 survey. Minimal locations of CLP were noted in 2024 as it was found at a 6.55% frequency (Figure 5). However, CLP's life cycle is unique to aquatic plants in Wisconsin. If

often begins growing in late fall, overwinters as a small plant 4-8" tall, and continues growth right after ice-out the following spring. This gives CLP a competitive advantage early in the year and often leads to dense populations.

Come mid-summer, CLP begins to naturally die back. The ideal time to map CLP populations is in early spring prior to this occurrence. The point intercept surveys are designed to capture all plans, primarily native species, at their peak densities. Timing of these surveys often under sample populations of CLP. However, in past surveys CLP was not noted to be dense at these times either. Populations of CLP, if present, have become part of the natural assemblage of plants and do not present nuisance conditions.

Floristic Quality Index

To compare changes in the plant community over time within Montello Lake and to similar lakes in Wisconsin, the floristic quality index (FQI) can be used. FQI provides the ability to compare aquatic plant communities based on species presence. This value varies throughout Wisconsin, ranging from 3.0 to 44.6, with a statewide average of 22.2. To achieve this, each plant species, except for AIS, is assigned a coefficient of conservatism value (C value). A plant's C value relates to a plant species' ability to tolerate disturbance. Low C values (0-3) indicate that a species is very tolerant of disturbance, while high C values (7-10) indicate species with a low tolerance of disturbance and are typically found in systems of higher water quality. Intermediate C values (4-6) indicate plant species that can tolerate moderate disturbance. The calculated FQI for from the 2024 plant survey is 27.06 with an average C value of 5.90 (Table 7).

Not only does this track change over time within the lake but also allows for comparison of the Lake to lakes with similar environmental conditions within a delineated area, called an eco-region, to be compared. Montello Lake is located within the North Central Hardwoods Forests eco-region. Lakes within this region are typically natural lakes created by glaciation. Alpine Lake is found near the eastern border of the ecoregion within the Central Sand Ridges sub-region. Most lakes within this area are primarily seepage lakes that formed in low areas between the ridges of deposits created by glaciation.

Land use varies within the region from primarily forest to agricultural watersheds, with most lakes having at least moderate development along the shoreline floristic quality. Lakes in the North Central Hardwoods Forests eco-region have slightly lower plant community metrics like FQI and coefficient of conservatism when compared to the average for all Wisconsin Lakes due to these issues.

After years of mechanical harvesting, AIS impacts, and heavy use and development Montello Lake displays a high-quality plant community for the eco-region. Total species found (24), FQI (27.06), and average coefficient (5.9) are all above the upper quartile for the North Central Hardwoods Forests eco-region. All these indicators also increased from the last survey in 2017. Montello Lake also compares favorable when compared to other lakes throughout the State as its average species is also in the upper quartile white the FQI is just under the upper quartile limit (Table 8).

Table 8: FQI and Average Coefficient of Montello Lake Compared to Wisconsin North Central Hardwoods Forests

	Avg. Coefficient of Conservatism			Floristic Quality			Number of Species		
Quartile*	Lower	Mean	Upper	Lower	Mean	Upper	Lower	Mean	Upper
Wisconsin Lakes	5.5	6	6.9	16.9	22.2	27.5	8	13	20
North Central Hardwoods Forests	5.2	5.6	5.8	17	20.9	24.4	10	14	19
Average: 2011-2024		5.73			25.92			22.86	
2024		5.90			27.06			24	
2017		5.76			26.40			23	
2016		5.61			23.81			19	
2015		6.04			29.60			27	
2014		5.50			23.33			20	
2013		5.57			25.53			24	
2011		5.75			25.71			23	

* - Values indicate highest value of the lowest quartile, mean, and lowest value of the upper quartile

Historical Comparison

The aquatic plant community of Montello Lake has been sampled periodically throughout its recent history. Multiple surveys using similar sampling methods provide a unique opportunity to gauge changes over the years. Aquatic plant sampling protocol recommended by WDNR is completion of point-intercept surveys. These surveys are to be more repeatable over the years. A full point-intercept survey was first completed in 2011 and repeated using the same sample sites in 2013-17 and 2024.

The relative plant community within the lake has fluctuated slightly over time in species composition while remaining stable overall. Species diversity, average coefficient of conservatism, and FQI all display the overall stability trend over time and are shown below for all metrics when comparing historical survey data (Tables 4-11).

Over the most recent surveys (2016, 2017, and 2024) as shown above, the aquatic plant community has seen changes in overall species composition while maintaining many community metrics. Species sampled in prior surveys but not present in 2024 include alpine pondweed (2011 and 2013), common bladderwort (2014), floating-leaf pondweed (2013-2017), muskgrass (2015 & 2016), slender naiad (all past surveys), small pondweed (2015), and stiff pondweed (2015).

Conversely, the 2024 survey had only one newly identified species, a hybrid pondweed cross between white-stem pondweed and curly-leaf pondweed (*Potamogeton x undulatus*). Two additional species were both sampled again for the first time in ten or more years: forked duckweed and white-stem pondweed. Composition of the plant community changes by year and the lack of finding species in 2024 that were present in past surveys and vice versa is not immediately concerning, especially due to the healthy and diverse community found in Montello Lake. The 2024 survey indicated recorded highs in diversity per sample point at 3.88 native species and the second highest recorded Simpson Diversity Index, FQI and average coefficient of conservatism. All of these indicate a healthy, natural aquatic plant community.

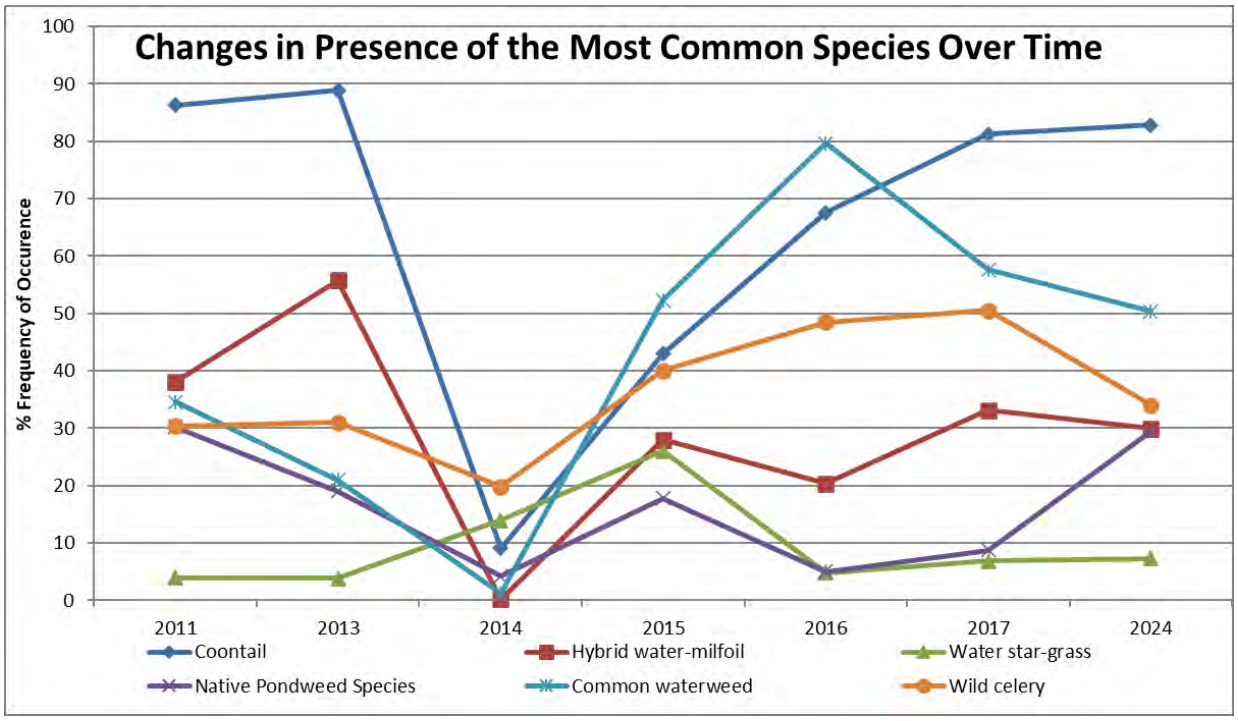
Table 9: Species sampled by year. Montello Lake, Marquette Co., Wisconsin.

Species	Presence by Year						
	2011	2013	2014	2015	2016	2017	2024
Free Floating							
Common watermeal	X	X	X	X	X	X	X
Forked duckweed	X						X
Large duckweed	X	X	X	X	X	X	X
Small duckweed	X	X	X	X	X	X	X
Floating-Leaf							
Spatterdock	X	X	X	X	X	X	X
White Water lily	X	X	X	X	X	X	X
Emergent							
American lotus	X	X	X	X	X	X	X
Cattail		X	X				
Southern wild rice		X	X	X	X	X	X
Submergent							
Alpine pondweed	X	X					
Common bladderwort				X			
Common waterweed	X	X	X	X	X	X	X
Coontail	X	X	X	X	X	X	X
Curly-leaf pondweed	**X**	**X**	**X**	**X**		**X**	**X**
Filamentous algae	X	X		X		X	
Flat-stem pondweed	X	X	X	X	X	X	X
Floating-leaf pondweed		X	X	X	X	X	
Frie's pondweed				X			
Horned pondweed		X	X				
Hybrid Pondweed							X
Hybrid water-milfoil	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Illinois pondweed	X	X		X		X	X
Large-leaf pondweed	X					X	X
Leafy pondweed						X	X
Long-leaf pondweed	X	X	X	X	X	X	X
Muskgrass				X	X		
Northern water-milfoil	X						
Sago pondweed	X	X		X	X	X	X
Slender naiad	X	X	X	X	X	X	
Small pondweed				X			
Southern naiad						X	X
Stiff pondweed				X			
Stiff water crowfoot	X	X	X	X	X	X	X
Water star-grass	X	X	X	X	X	X	X
White-stem pondweed				X			X
Wild celery	X	X	X	X	X	X	X

Table 10: Historical Aquatic Plant Community Statistics

	2011	2013	2014	2015
Total Number of Species	23	24	20	27
Total Points Sampled	576	576	576	576
Photic Zone Frequency	95.15	99.15	52.32	90.47
FQI	25.7	25.5	23.33	29.6
Average Coefficient	5.75	5.57	5.5	6.04
Most Common Species	Coontail	Coontail	Wild celery	Common waterweed
	Small duckweed	Eurasian water-milfoil	White water lily	Coontail
	Eurasian water-milfoil	Common watermeal	Water star-grass	Wild celery
	Common watermeal	Small duckweed	Coontail	Eurasian water-milfoil
	Elodea	Wild celery	Small duckweed	Water star-grass

	2016	2017	2024
Total Number of Species	19	23	24
Total Points Sampled	576	576	576
Photic Zone Frequency	96.98	92.68	96.47
FQI	23.81	26.4	26.39
Average Coefficient	5.61	5.76	5.9
Most Common Species	Common waterweed	Coontail	Coontail
	Coontail	Common waterweed	Common waterweed
	Wild celery	Common watermeal	Common watermeal
	Common watermeal	Small duckweed	Forked duckweed
	Eurasian water-milfoil	Wild celery	Wild Celery



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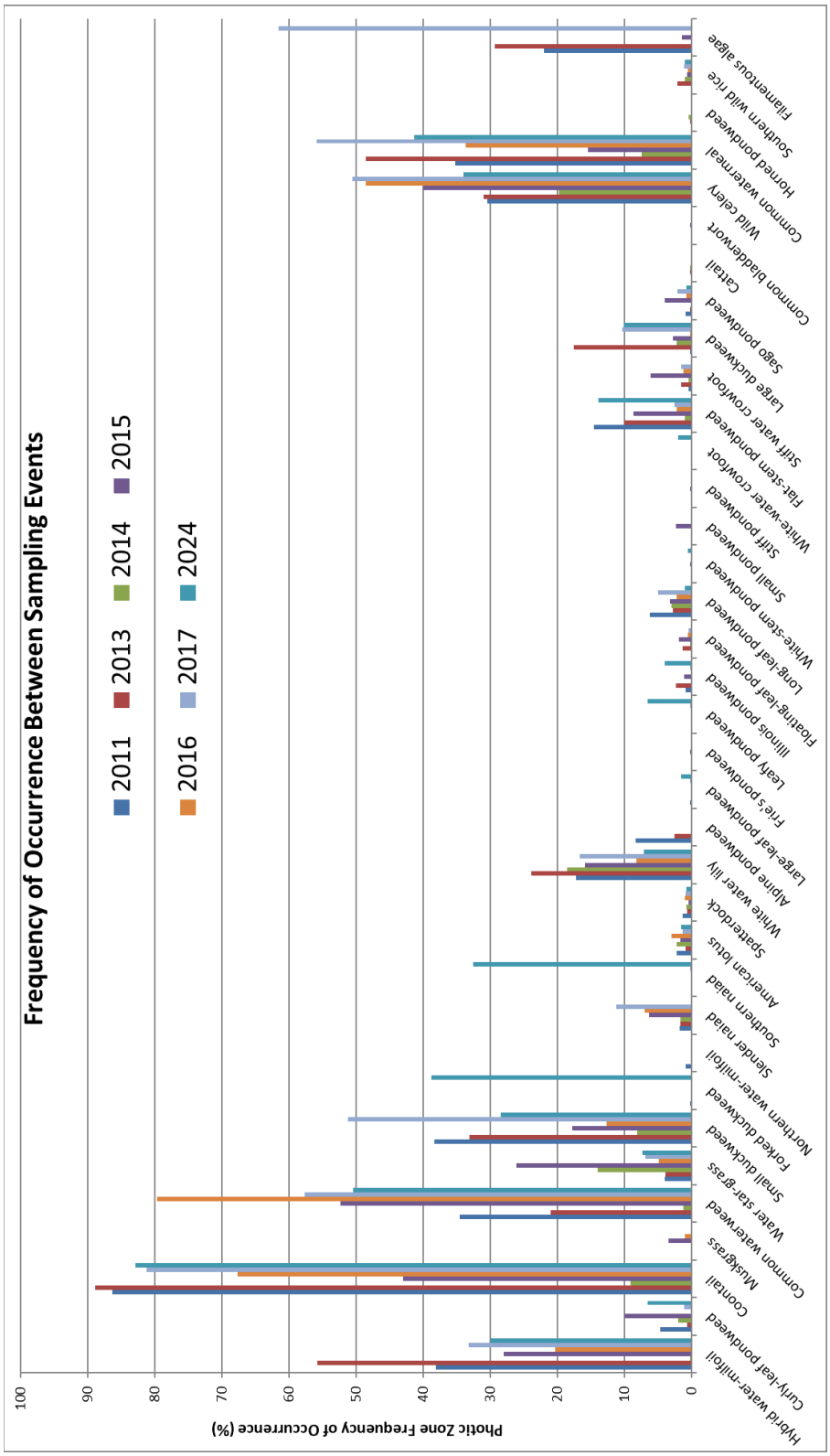

N7828 Town Hall Rd
Eldorado WI 54932

www.wisconsinlpr.com

Phone: (920) 872-2032
Fax: (920) 872-2036

Data comparison between years shows that the lake continually exhibits a dynamic and diverse aquatic plant community. Dominant species will vary year to year depending on many factors including weather patterns, community composition in year's prior, water levels and more. Some conditions may be favorable for certain species during one growing year but not others and vice versa. This is common and indicative of a healthy lake. Variance is normal and that noted within the lake is currently not a cause for concern.

To further assess changes between 2024 and the previous survey statistical analysis was completed using a Chi-square test with a 5% Type-I error rate. This error rate is standard in ecological studies and equals that there is a 5% chance of claiming statistically significant change when no real change occurred. Only those species that display a p-value of 0.05 or lower changed significantly population-wise between years. To calculate these values, the total number of sample locations each species was found at is compared between years. Table 11 displays statistical changes, if any, for each species sampled in 2024 versus the 2015-2017 surveys.

In comparing 2024 and 2017 survey data statistically significant changes were noted in seven species that increased, and seven that decreased. Populations of HWM, the main AIS in Montello Lake, decreased slighlty while curly-leaf populations increased significantly. Even with a significant increase, curly-leaf pondweed was still identified at low-density background levels. Changes between surveys are expected as an aquatic plant community is dynamic. However, these changes can be used to identify potential concerns when reviewing long term trends. A concern is the potential impact an increasing population of AIS has on the Montello Lake aquatic plant community. Curly-leaf pondweed increased significantly from 2017 to 2024 but it does not appear to have any impact on the native aqutic plants present.

Pondweed species are valuable fisheries habitat species and can be an indicator of higher quality, less disturbed sitations. The 2015 survey was completed 1-year after an over-winter drawdown for HWM control. Since then, populations of HWM have remained at low levels while the native large-leaf, leafy, and Illoins pondweeds all increased signficantly and white-stem pondweed was sampled for the first time since 2015. it was the sixth most common species sampled with a frequency of occurrence of 11.15%. White-stem pondweed is a high-quality species in Wisconsin, typically indicating more natural conditions and is increasing in Montello Lake.

HWM spreads by fragmentation and mechanical harvesting often can spread populations of HWM by increasing fragmentation. Community indicators may also show an impact from increased HWM populations. In 2024, the Simpson Diversity Index, FQI, and average coeffecient were the second highsest recorded while average native species per point was the highest recorded. All these community indicators show an increasingly stable and diverse community even with the presence of two potentially impactfull AIS species and moderate mechanical harvesting.

In many biologically productive lakes, some native species can grow to nuisance levels, hampering navigation and enjoyment of the waterbody. The 2024 survey and past surveys note coontail, elodea, and occasionally wild celery can be a large portion of the material harvested and have remained prevalent in Montello Lake. A combination of dense, native species growth and populations of HWM continue to cause navigational nuisance within the system.

Table 11: Statistical Significance of Species between Sampling Events, Montello Lake, Marquette County, WI.

Species	2015 v 2024		2016 v 2024		2017 v 2024	
	Significance	+ / -	Significance	+ / -	Significance	+ / -
Eurasian water-milfoil	n.s.	+	***	+	n.s.	-
Curly-leaf pondweed	n.s.	-	***	+	***	+
Coontail	***	+	***	+	n.s.	+
Muskgrass	***	-	*	-	---	---
Common waterweed	n.s.	+	***	-	*	-
Water star-grass	***	-	n.s.	+	n.s.	+
Small duckweed	***	+	***	+	***	-
Forked duckweed	***	+	***	+	***	+
Slender Naiad	---	---	---	---	***	-
Southern Naiad	***	+	***	+	***	+
American lotus	n.s.	-	n.s.	-	n.s.	+
Spatterdock	n.s.	+	n.s.	-	n.s.	-
White water lily	***	-	n.s.	-	***	-
Alpine pondweed	---	---	---	---	---	---
Large-leaf pondweed	**	+	**	+	*	+
Frie's pondweed	n.s.	-	---	---	---	---
Leafy pondweed	***	+	***	+	***	+
Illinois pondweed	**	+	***	+	***	+
Floating-leaf pondweed	**	-	n.s.	-	n.s.	-
Long-leaf pondweed	*	-	n.s.	-	***	-
White-stem pondweed	n.s.	+	n.s.	+	n.s.	+
Small pondweed	**	-	---	---	---	---
Stiff pondweed	n.s.	-	---	---	---	---
Flat-stem pondweed	**	+	***	+	***	+
White water crowfoot	**	-	n.s.	+	n.s.	+
Large duckweed	***	+	***	+	n.s.	-
Sago pondweed	**	-	n.s.	-	n.s.	-
Cattail	---	---	---	---	---	---
Common bladderwort	n.s.	-	---	---	---	---
Wild celery	n.s.	-	***	-	***	-
Common watermeal	***	+	*	+	***	-
Southern wild rice	n.s.	+	n.s.	+	n.s.	-
Filamentous algae	*	-	---	---	***	-

* - somewhat significant change, ** - moderatly significant change, *** - very significant change

n.s. - Change not significant

--- - Specie was not sampled in both comparison years

AQUATIC PLANT MAINTENANCE ALTERNATIVES

Based on the goals of the stakeholders outlined above, several management alternatives are available for this APM plan. Some general alternatives are discussed below. More information on management alternatives are included in Appendix B. The following management alternatives are based on historical, aquatic plant management approaches and incorporate needs established throughout the planning process and recommendations of Wisconsin Lake & Pond Resource.

AQUATIC PLANT MAINTENANCE ALTERNATIVES

A combination of management alternatives may be used on a lake with a healthy native aquatic plant community with invasive or non-native plant species present. Maintenance alternatives tend to be more protection-oriented because no significant plant problems exist or the issues are at levels that are generally acceptable to lake user groups with no active manipulation required. These alternatives can include an educational plan to inform lake shore owners of the value of a natural shoreline and encourage the protection of the lake water quality and the native aquatic plant community.

AQUATIC INVASIVE SPECIES MONITORING

Two AIS were identified within the Project Area during past aquatic plant surveys; curly-leaf pondweed and hybrid water-milfoil. To monitor existing populations of current AIS and for new AIS in the future, a consistent and systematic monitoring program that conducts surveys for AIS is highly recommended. In some lake systems native aquatic plants “hold their own” and AIS never grow to nuisance levels; however, in others active management is required. The spread of AIS can be caused by several factors, including water quality.

It is recommended to complete pre and post treatment aquatic plant monitoring in any areas that are actively managed for AIS control to evaluate management effectiveness. Aquatic plant communities may undergo changes for a variety of reasons, including varying water levels, water clarity, nutrient levels, and aquatic plant management actions. In general, lake-wide aquatic plant surveys are recommended every year to monitor changes in the overall aquatic plant community during large-scale treatments and then again, every 5 years once small scale, maintenance treatments take place to monitor the effects of the aquatic plant management activities.

In addition to invasive plants, excessive native plant growth combined with shallow water depths can cause navigational issues for lake users. These have historically been addressed through a harvesting program.

CLEAN BOATS/CLEAN WATERS CAMPAIGN

Prevention of the introduction of new AIS to the lake and spread of existing AIS from the lake was the top management priority indicated in the user survey responses. To prevent the spread of AIS from Montello Lake, a monitoring program such as Clean Boats/Clean Waters (CB/CW) is a good choice. This program is carried out by trained volunteers who inspect incoming and outgoing boats at launches. Boat landing signage also accompanies the use of CB/CW to inform lake users of proper identification of AIS and boat inspection procedures. Education of Village members about inspecting watercraft for AIS before launching a boat or leaving access sites on other lakes could help prevent new AIS infestations.

CB/CW use on Montello Lake has not been enacted. Engaging in participation in this program is strongly encouraged. Scheduling volunteers for CB/CW landing inspection is often difficult due to time constraints for volunteers. The WDNR offers grant assistance through the Surface Waters

program to pay for CB/CW landing inspectors. This establishes a set and known schedule for boat landing monitoring, offering added protection for the Lake. If acquiring CB/CW monitors becomes difficult for Montello Lake and the District it is recommended they apply through this grant to program to hire a dedicated monitor. This is often done in conjunction with County-wide AIS monitoring efforts.

AQUATIC PLANT PROTECTION AND SHORELINE MANAGEMENT

Protection of the native aquatic plant community is needed to slow the spread of AIS from lake to lake and within a lake once established. Therefore, riparian landowners should refrain from removing native vegetation. Additionally, AIS can thrive in nutrient (phosphorus and nitrogen) enriched waters or where nutrient rich sediments occur. Two relatively simple actions can prevent excessive nutrients and sediments from reaching the lake.

The first activity is the restoration of natural shorelines, which act as a buffer for runoff containing nutrients and sediments. This can be a potential issue within the lake, as Montello Lake has a large watershed with large areas in residential development. Good candidates for shoreline restorations include areas that are mowed to the lake's edge, or that have structures directly adjacent to the lake edge. Establishing natural shoreline vegetation can sometimes be as easy as not mowing to the water's edge. Native plants can also be purchased from nurseries for restoration efforts. Shoreline restoration has the added benefits of providing wildlife habitat and erosion prevention. Or many times a simple "no mow" buffer strip 35'–50' back from the water's edge can provide effective and economical restoration for shoreline property owners. A vegetated buffer area can also prevent surface water runoff from roads, parking areas and lawns from carrying nutrients to the lake. Currently, much of the lake's north, east, and south shorelines are developed, providing potential avenues for increased impacts from runoff.

The second easy nutrient prevention effort is to use lawn fertilizers only when a soil test shows a lack of nutrients. Importantly, fertilizers containing phosphorus, though readily available to the consumer, are illegal for use in Wisconsin, unless a soil test shows a deficiency in phosphorus. The fertilizers commonly used for lawns and gardens have three major plant macronutrients: Nitrogen, Phosphorus and Potassium. These are summarized on the fertilizer package by three numbers. The middle number represents the amount of phosphorus. Since most Wisconsin lakes are "Phosphorus limited," meaning additions of phosphorus can cause increased aquatic plant or algae growth, preventing phosphorus from reaching the lake is a good practice. Local retailers and lawn care companies can provide soil test kits to determine a lawn's nutrient needs. To help prevent fertilizer runoff into local lakes, a small improvement can be done by lakeshore residents simply restricting fertilization of private properties within 35' of the waterbody. Of course, properties with an intact natural buffer require very little maintenance, and no fertilizers.

The Marquette County Land & Water Conservation Department may be able to help with shoreline restoration projects, rain gardens and/or additional shoreline protection. Interested landowners can contact the Land Resources and Environment Department at (608) 296-2815 ext. 4 to request additional information.

An additional option is the DNR Healthy Lakes grant program. This program provides initiative for lakeshore owners to improve their shoreline through simple and inexpensive best management practices. Deadline for pre- application is September 15th with funding of up to $25,000 per group or $1,000 per best management practice on a 75% DNR / 25% applicant cost sharing. Further information can be obtained at: http:// http://healthylakeswi.com

PUBLIC EDUCATION AND INVOLVEMENT

The District should continue to keep abreast of current AIS issues throughout the County and State. The County Land Use and Resource Management Department, WDNR Lakes Coordinator and the UW Extension are good sources of information. Many important materials can be found at the following website: http://www.uwsp.edu/cnr-ap/UWEXlakes

MANUAL (HAND) REMOVAL

Native plants may be found at nuisance levels in scattered locales throughout the waterway. Manual removal efforts, including hand raking or hand pulling unwanted native plants (except wild rice in the northern region), is allowed under Wisconsin law to a maximum width of 30 feet (recreational zone) per riparian property. The intent is to provide pier, boatlift, or swimming raft access in the recreation zone. A permit is not required for hand pulling or raking if the maximum width cleared does not exceed this 30-foot recreation zone (manual removal of any native aquatic vegetation beyond the 30-foot area would require a permit from the WDNR that satisfies the requirements of Chapter NR 109, Wisconsin Administrative Code, see Appendix C).

Manual removal of aquatic plants can be quite labor intensive and time consuming. This technique is well suited for small areas in shallow water. Hiring laborers to remove aquatic vegetation is an option but also increases cost. SCUBA divers can be contracted to remove unwanted vegetation in deeper areas. Benefits of manual removal by property owners include low cost compared to chemical control methods, quick containment of pioneering (new) populations of invasive aquatic plants and the ability for a property owner to slowly and consistently work on active management. The drawback of this alternative is that pulling aquatic plants includes the challenge of working in the water, especially deep water, the threat of letting fragments escape and colonize a new area, and the fact that control of any significant sized population is quite labor intensive, and therefore very costly; $1,500 - $2,000 or more, per acre depending on plant densities.

NUISANCE AQUATIC PLANT GROWTH CONTROL – MECHANICAL OR CHEMICAL

Aquatic plants may be mechanically harvested up to five feet below the water surface and leaving at least 12-inches of plant growth without disturbing or contacting the lakebed. Harvesting can be a practical and efficient means of controlling plant growth as it generally removes the plant biomass from the lake. It can also be effective in reducing nuisance caused by early-season curly-leaf pondweed growth if the plants are cut prior to the start of turion production. Harvesting can be an effective measure to control large-scale nuisance growth of aquatic plants.

The advantages of harvesting are that the harvester typically leaves enough plant material in the lake to provide shelter for fish and to stabilize the lake bottom. Navigation lanes cut by harvesting also allow predator fish, such as bass or pike, better ambush opportunities. Many times, prey like minnows or panfish can hide in thick vegetation lacking predation, potentially causing stunting to the population due to too many prey individuals and not being thinned out by predators.

The disadvantages of harvesting are that it does cause fragmentation and may facilitate the spread of some plants, including EWM, and may disturb sediment in shallow water increasing water turbidity and suspended sediment issues. Another disadvantage is harvesters are limited in depths to which they can effectively operate; typically, it must be greater than 2’ – 3’ of water. Aquatic plant harvesting is subject to State permitting requirements under NR109 which are renewable every 5 years. Mechanical harvesting requires significant infrastructure to complete, many times requiring the purchase of a harvester by the group and has significant startup costs.

Currently, harvesting has been done annually since at least 1983 and is an accepted and practicable control technique for Montello Lake. Harvesting can impact native species and enhance the spread of HWM. HWM has been present in high frequency prior to harvesting began but is often found at low densities. Additionally, Montello Lake contains a diverse, high quality native plant community that has remained relatively stable to many outside stressors.

The current harvesting permit expires soon and is based on results from the 2021 plan that may not accurately portray current conditions. As an accepted practice already in place, mechanical harvesting is recommended to continue. An updated and renewed mechanical harvesting permit should be sought and use the Mechanical Harvesting Map attached (Figure 13). Harvesting should only be completed in the outlined areas to alleviate nuisance conditions for pier, swimming or boat access.

Contact herbicides can provide effective season long relief an alternative, some areas of excessive plant growth in shallow water areas that cannot be effectively managed by harvesting. Navigational channels 30' – 50' in width, as described in the section above, can be created using chemical herbicides. Since selectivity is not a concern for navigational treatment, contact herbicides such as diquat or more recently flumioxazin are used for submersed species. They are typically mixed with a copper-based algaecide for increased efficacy. For floating leaf species, herbicides such as imazapyr is typically used with a surfactant or sticking agent. A combination of harvesting and treatment is sometimes a wise approach to compare length of control, costs, and season long performance. Please note, chemical control requires a separate NR107 permit.

INVASIVE PLANT MANAGEMENT ALTERNATIVES

Aquatic Invasive Species Herbicide Management

An aquatic herbicide treatment may be an appropriate way to treat larger areas of AIS and to conduct restoration of native plants. When using chemicals to control AIS, it is a good idea to reevaluate the lake's plant community and the extent of the AIS conditions before, during and after chemical treatment. The chosen herbicide may impact native plant communities including coontail, common waterweed, naiad species and others, especially during whole-lake applications and/or extended periods of herbicide exposure. The WDNR may require another aquatic plant survey and may require an AIS survey prior to approving a permit for treatment. Surveys should be included for all aquatic plant treatments and is typically a WDNR requirement.

The science regarding what chemicals are most effective, dosages, timing and how they should be applied is constantly evolving and being updated. Current WDNR and Army Corps of Engineer research have shown that herbicide applied to water diffuses off-site due to a variety of environmental and physical conditions including wind, waves, water depth, and treatment area relative to lake volume. Due to these actions, as treatment areas decrease, herbicide retention time needed for impact is lessened due to diffusion off-site because of the small amount of area treated and herbicide applied relative to the entire water volume. To combat this, it is recommended to apply at higher rates when compared to a whole-lake rate and typically with granular herbicide with a combination of active ingredients in hopes to extend contact time.

Chemical treatment is usually a long-term commitment and requires a specific plan with a goal set for "tolerable" levels of the relevant AIS. One such landmark might be 25% or less of the littoral area being occupied by aquatic invasive plants. WDNR recommends conducting a whole-lake point-

intercept survey on a five-year basis (for Montello Lake the next would be 2029). Such a survey may reveal new AIS and at the very least provide good trend data to see how the aquatic plant community is evolving.

Herbicide provides the opportunity for broader control over a larger area than hand pulling, and unlike harvesters, allow for a true restoration effort. Disadvantages include negative public perception of chemicals in natural lakes, the potential to affect non-target plant species, and the fact that water use restrictions may be necessary after application.

CURLY-LEAF PONDWEED

Curly-leaf pondweed is the second most prevalent aquatic invasive plant species targeted for chemical treatment in the State. At present, endothall, a systemic herbicide, is the most common active ingredient in herbicides used for CLP management in Wisconsin. Imazamox has been used periodically in the last several years. Imazamox has shown promise in that it is a systemic herbicide for CLP control and can potentially have a much lower impact to the native plant community than a contact herbicide and appears to show increased year after treatment control than endothall. It is not entirely clear as to why this happens, but it may be due to the systemic effect on turion production within the plants, resulting in fewer plants the following year. Penoxsulam is a newer active ingredient showing selective control of curly-leaf pondweed at very low rates. Continued research is ongoing on its longevity and selectiveness.

Granular based formulations are generally more costly and used for smaller spot type treatments, while liquid formulations are less costly and generally used for larger contiguous treatment areas or whole-lake type treatments. To decrease any potential impact to native plants and be as selective as possible for CLP, treatments are completed in the spring when native plant growth is minimal, typically prior to 60˚ water temperatures, but perhaps most importantly prior to the start of turion production. CLP seems to prefer and flourish in mucky or highly flocculent substrate, which is found in many areas of Montello Lake's sediments. Given the inability to locate populations of CLP during the most recent surveys and large locations of appropriate substrate, its presence was expected to have been more prevalent. Monitoring may be the best option for management.

EURASIAN WAER-MILFOIL

Though not presently in Montello Lake, EWM is the most managed AIS within Wisconsin lakes. EWM is an extremely opportunistic plant and could easily expand within Montello Lake if introduced. Should such an event take place, it is prudent to include potential management actions for EWM within this plan, to provide a quick and concise reference for management.

At present, 2,4-D has been the most common active ingredient for selective systemic herbicides used for EWM management in Wisconsin, although triclopyr use is increasing and has been commonly used in Minnesota for well over a decade. Granular based formulations are typically more costly and used for smaller spot type treatments, while liquid formulations tend to be less costly and used for larger contiguous treatment areas or whole-lake type treatments. To maximize effectiveness and decrease any potential impact on native plants to the greatest extent possible, treatments should be completed in the spring when native plant growth is minimal.

Current WDNR and Army Corps of Engineer research have shown that herbicide applied to water diffuses off-site due to a variety of environmental and physical conditions including wind, waves, water depth, and treatment area relative to lake volume. Due to these actions, as treatment areas decrease, herbicide retention time needed for impact is lessened due to diffusion off-site because of the small amount of area treated and herbicide applied relative to the entire water volume. To combat

this, it is recommended to apply at higher rates when compared to a whole-lake rate and typically with a granular herbicide, a combination of active ingredients, or change of active ingredient in hopes to extend contact time. Recently, the active ingredient florpyrauxifen-benzyl has been approved for EWM control. This active ingredient requires very limited contact time and has shown to offer excellent control with reduced non-target impacts in comparison to previously used modes of action. If EWM abundance and density increase and require active management within Montello Lake and smaller treatment areas (< 2.0 ac) are mapped, it is recommended to use florpyrauxifen-benzyl, a fast-acting systemic herbicide, at appropriate rates of around 5-20 parts per billion (ppb). This approach has shown to be an effective management tool in various lakes throughout Wisconsin and is continuing to be researched for efficacy and long-term control.

Some populations of EWM across the State have been identified as a hybrid. It is worth noting there are various hybrid strains of EWM being genetically confirmed throughout the State and many of these show resistance to typical systemic herbicides. Research projects are currently underway with the WDNR and herbicide manufacturers. For better control, combination herbicides (systemic, such as 2,4-D & contact, such as endothall) at 1:2 or 1:3 ratio as well other modes of action like pigment bleaching herbicides (fluridone) may be more effective on these strains of hybrid EWM. For fluridone applications are most successful on a whole-lake volume basis maintaining a 4-12 PPB residual for 90+ days. Fluridone is also available in different pelletized slow-release formations that are designed to release off the carrier over extended periods of time, from several weeks to several months.

The size of the population tends to dictate the type of control. Small treatment areas or beds less than 5 acres are often consider spot treatments and usually targeted with faster acting contact active ingredients. When there are multiple “spot” treatment areas within a lake, it most often makes more sense from economic and efficacy standpoints to target the “whole” lake for treatment. This typically entails calculating the entire volume of water within the lake, in acre/feet, and applying an herbicide at a low dose at a lake wide rate.

Aquatic Invasive Plant Harvesting

Mechanical Harvesting

Aquatic plants may be mechanically harvested up to five feet below the water surface and can be a practical and efficient means of controlling plant growth as it generally removes the plant biomass from the lake. Harvesting can also be used to facilitate native aquatic plant growth by “top cutting” AIS growth that has canopied out. This is done by removing a canopy of AIS that shades out native, lower growing species, such as pondweed species. Use of a top cut only in areas of dense AIS growth can provide additional sunlight for growth, increasing diversity and available fisheries habitat quality.

Manual (hand) Removal

If a small, isolated stand of AIS is present, hand pulling may be a viable option. No permit is required to remove non-native invasive aquatic vegetation if the removal is conducted completely by hand with no mechanical assistance. All aquatic plant material must be removed from the water to minimize dispersion and regermination of unwanted aquatic plants. Portions of the roots may remain in the sediments, so removal may need to be repeated periodically throughout the growing season. This can be a very effective control mechanism for EWM if the entire plant mass and root structure are completely removed. The drawback of this alternative is that pulling aquatic plants includes the challenge of working in the water, especially deep water, threat of letting fragments escape and colonize a new area, and control of any significant sized population is quite labor intensive and very costly. Hand harvesting costs using professionally contracted SCUBA divers are around $2,000 - $3,000 or more, per acre depending on plant densities.

Water Level Manipulation (Drawdown)

Being a man-made impoundment, Montello Lake has a unique opportunity for AIS control using water level manipulation (drawdown). Control of AIS using a drawdown is completed by lowering the water level to expose plants and their roots to freezing and/or drying conditions.

An over-winter drawdown is used to achieve control through freezing. Water levels are typically reduced beginning in early Fall (September) to allow reptiles and amphibians to adjust for overwintering. Once the target water level is achieved it is held there throughout the winter and refiled in mid Spring (April). Over-winter drawdowns have been used in the past on Montello Lake, including in the winters of 2002-03, 2008-09, and 2013-14. Another variation is to expose the plants to drying conditions through a drawdown completed during the open-water season.

Drawdowns are a cost-effective option to control large populations of AIS. However, they are non-selective in nature with non-target impacts to all species present. Additionally, a drawdown of any measure during any period is potentially controversial due to its large impact on all users.

Though partial drawdowns have been completed in the past on Montello Lake and have been successful, there is still discussion that needs to occur prior to planning. Pas support for drawdowns for AIS control has been split with nearly no middle ground. Large concerns of the respondents were the impact to the fishery and loss of use of the waterway. Additionally, nearly no support was present for drawdowns during the open water season, complete water level drawdowns, and drawdowns of any measure that extends for an entire year.

Using a drawdown for AIS control was moderately supported overall with a partial over-winter drawdown of 4-ft or less the most accepted approach. A drawdown of this measure is the best option for Montello Lake. First, a partial drawdown of up to 4-ft still allows the power company to generate electricity. Since any loss of income from a drawdown by the power company must be reimbursed by the District, a partial drawdown limits power loss and financial impact to the District.

Second, impact to the fishery is the highest concern of lake users. Partial drawdowns still leave a significant pool of water left for fisheries to overwinter. Establishing an emergency, no-fishing period during drawdowns has been used by the DNR on other projects and will provide additional protection to the Montello Lake fishery during a drawdown.

Finally, a partial drawdown can impact a large portion of the HWM present. After drawdown but prior to freezing up an herbicide application may be completed to target the HWM left in the remaining pool. A similar technique was used during the 2013-14 drawdown and proved highly successful for HWM control. A secondary result of a partial drawdown is a significant reduction of nuisance vegetation. The 2013-14 drawdown resulted in an over 90% reduction in need for mechanical harvesting the year after and 50% reduction two years after drawdown.

OVERALL LAKE MANAGEMENT GOALS

Montello Lake man-made impoundment on the Montello River with good water clarity, potentially high nutrient loading, a diverse aquatic plant community, and moderate recreational use. The management actions recommended below are based on the findings of this APM plan and chosen to protect and enhance the conditions present.

- Largely, the aquatic plant community of Montello Lake is of high quality with great diversity and includes 22 native species (Page 14 & Figures 6-12)
- Though of high diversity, aquatic plants can and do grow to nuisance levels, requiring active management through mechanical harvesting since 1983 and periodic chemical control (Page 5)
- Aquatic invasive species are a constant threat to the quality of the lake and historically have been documented at high frequency, specifically HWM. Current populations have reduced significantly in density and moderately in frequency (Page 15 & Figures 3-5)
- Current management actions and uses have shown minimal lasting negative impact to the native aquatic plant over time while reducing the nuisance caused by non-native species. However, due to high nutrient loads, aquatic plants in Montello Lake continue to cause a navigational nuisance to users (Page 24). Management actions are the most accepted and recommended by lake users to achieve results.

Even with multiple AIS present and large populations of HWM, a potentially aggressive AIS, their impact on the system appears to be minimized through current management. Though the aquatic plant community in Montello Lake is healthy, it consistently grows dense and impacts recreational use on the water. Dense aquatic plant growth includes numerous native species and only worsens navigational issues throughout the lake and negatively impacted users of the lake, with many residents and users wanting management actions to reduce such issues.

Only those options that will be supported by the users and The District with high likelihood of approval from the WDNR will be selected to help accomplish management goals. However, not all desired management options are viable or feasible for each situation. All options are discussed further in Appendix B. Based on the above, the following recommended action plan includes a combination of management actions to achieve desired results.

As an aquatic plant management plan, a continued clear focus of the plan is to prevent the spread of AIS into or out of Montello Lake while reducing the extent and density of AIS already established if it becomes a problem. Management planning will follow Integrated Pest Management (IPM) with an approach that provides a variety of control actions, active ingredients, and monitoring to gauge results. Based on the above, the following recommended action plan includes a combination of management actions to achieve desired results.

Goal: Renew the mechanical harvesting permit

Primary Action: The current permit expires soon and was issued using the 2021 APM plan. Use the contents of this plan, including Figure 13, to update the harvesting permit based on current conditions.

Goal: Reduce Nuisance Aquatic Plant Growth Hampering Navigation

Primary Action: Mechanically harvest up to 41.19 acres for nuisance relief to increase recreational access for lake use within common navigational channels for riparian and public boat access. See the harvesting map for recommended harvest areas (Figure 13). The following guidelines should be used for all mechanical plant harvesting activities:

- Only cut in depths of three feet or more
- Only cut to a maximum depth of ½ the water column or 5-ft, whichever is shallower
- Avoid cutting in environmentally sensitive areas
- All cut material should be inspected for fish and animals. Any organisms found should be immediately returned to the water
- All cut materials should be collected and deposited at the designated disposal site as indicated on the permit
- Free floating plants or algae uprooted by waves and boating action may be surface skimmed without the use of the cutting head if outside of designated harvest areas
- Harvested material to be disposed of at: Town of Montello, W2631 Hwy C, Montello WI or the Kevin Lichenberg property at N4016 19th Ct., Montello WI

Secondary Action: Hand harvest areas of vegetation in front of the public beaches in areas too shallow for a mechanical harvester to operate to improve or maintain swimming access

- Hand harvest vegetation from a depth of 0-2 ft
- All harvested materials should be collected and removed from the water, then deposited at the designated disposal site

Secondary Action: Maintain navigational access through herbicide applications in areas too shallow or difficult to mechanically harvest. Apply for a small-scale (<10 acre) WDNR permit for navigational relief

- Manage areas with a mixture of the active ingredients copper, diquat, and/or flumioxazin at prescribed rates, depending on water depth.
- Limit application width to 30' and only for riparian access to allow access to open water and/or mechanical harvesting lanes.

Goal: Manage AIS to improve recreation, increase use opportunities, and maintain native plants by reducing AIS abundance and frequency within the littoral zone. For Montello Lake, 316 acres. If active AIS management is pursued, the goal should be to maintain the presence of the target species over a 3–5-year period.

Currently, HWM occupies significant coverage of the littoral zone (71.12 acres, Figure 4), but has not been actively managed to reduce populations. The following levels of AIS coverage and density within the littoral zone and can be used to trigger active management of the target species, primarily HWM:

- 25-49% coverage of the littoral zone for small scale, spot management of areas of moderate or high density

Or

- 50% or more littoral zone coverage for large-scale control at up to whole-lake approaches.

Primary Action: Continue monitoring for and mapping of AIS.

- Annual bed-mapping surveys to document spread and density of AIS already present
- Continually monitor for introduction of newly introduced AIS
- If a newly introduced AIS is found, follow the rapid response plan below:
  - Collect a sample and submit to WDNR for confirmation
  - Record spread, density, and location of species – preferably with GPS capable equipment
  - Initiate fast and targeted management, if necessary. This may include any of the following options:
    - Apply for appropriate WDNR permit, if necessary.
    - Hand pulling – does not require a permit if done without mechanical equipment
    - Targeted mechanical harvesting – either through conventional equipment or DASH (permit required)
    - Targeted chemical control – active ingredients, rates, and application methods may vary based on target species (permit required)
    - Pre- and post-treatment monitoring of any active control areas
    - Annual monitoring of any areas of pioneer infestation noted
    - Apply for a WDNR AIS Rapid Response Grant through the Surface Water program for financial assistance

Possible HWM Control Action: If populations of HWM exceed the above listed triggers, the District may choose to pursue active management. If active management is chosen, the following density ratings should be used along with bed sizes listed in the below options. The following densities are used to describe the HWM populations:

1. **Spots** – small locations of individual plants or clumps that were not large enough to map around their perimeter.
2. **Scattered** – locations of HWM that had plants close enough to map as an area, but were still widely scattered. HWM is merely present and not a large component of the biomass.
3. **Low** – HWM identified in distinct beds. While individual plants or clumps may reach the surface, most are lower growing or not as dense. Often mixed with other vegetation.
4. **Moderate** –HWM occupies over half the water column with many plants or clumps at or just below the surface. Few other plant species found.
5. **High** – locations of HWM that were at or near the surface and occupied much of the water column. HWM may be the only plant found growing in these locations.

***Small-Scale control Action*:** Small-scale HWM control to maintain low populations may be a desired. This may include a variety approaches and control methods based on the dominance and size of small-scale EWM control areas.

- HWM areas less than 0.25 acres of **any density** and/or dominance
  - Monitoring only through annual surveys
  - Hand pulling by shoreline residents
  - Diver Assisted Suction Harvesting (DASH) stands of moderate or high density
- HWM areas 0.25 – 1.0 acres
  - Monitoring only through annual surveys
  - Hand pulling by shoreline residents

- DASH for stands **up to moderate density**
- Fast-acting, selective chemical control for stands of **moderate or high density** or more in protected bays.
  - The active ingredients 2,4-D, florpyrauxifen benzyl, flumioxazin, or diquat may be used at appropriate label rates

- HWM areas greater than 1.0 acres
  - Mechanical harvesting to top-cut stands of HWM of **moderate or high density**.
  - Fast-acting, selective chemical control for stands of **moderate or high density**
    - The active ingredients 2,4-D, florpyrauxifen benzyl, flumioxazin, or diquat may be used at appropriate label rates

***Large Scale Control Action*:** Targeted, whole-lake based control efforts. This may include a variety of actions or active ingredients and be dosed at up to whole-lake volume rates.

- Partial over-winter drawdown for HWM control.
  - Recommended extend of drawdown of 3-4 ft
  - Enact an emergency rule to suspend fishing during a drawdown period
  - Complete a full point-intercept aquatic plant survey the growing season before and at least one growing season after any drawdown
  - If possible, couple a drawdown to coincide with the dam's owners or operators repair work that may require lower water levels
  - Actively engage the public in any drawdown activities
    - Hold a pre-application discussion meeting
    - Gauge user input

- Mechanical harvesting to top-cut broad stands of HWM to prevent or reduce canopying and open areas for native plants remain or become established.

- If a chemical approach is selected control should be completed to time application to early/mid spring when plants are young and total biomass is low.

- Application may be completed using a variety of active ingredients and rates. Consideration should be given to expected longevity and selectivity of control.

- Some recommended active ingredients and application rates are as follows:
  - Active ingredient 2,4-D at 0.25-0.40 PPM and active ingredient endothall at 0.6-0.80 PPM
  - Active ingredients diquat and endothall at up to 0.36 PPM and 1.8 PPM, respectively.
  - Active ingredient florpyrauxifen benzyl at appropriate label rates.

- An aquatic invasive species assessment survey should be completed 1-year prior to assess conditions and verify they exceed management triggers above. In addition, the survey should be repeated 1-year post control activities to gauge results. The assessment survey may be completed as a whole-lake point intercept survey or targeted AIS meander survey. Bed locations and dominance should be mapped to accurately assess conditions.

Goal: Obtain financial assistance for lake management activities.

Primary Action: Upon the advice of the District's consultant or biologist, apply for an grant through the WDNR's Surface Water Grant program in the appropriate category for selected management actions. The deadline for pre-application is September 15 and can fund up to 75% of eligible project costs.

Goal: Initiate comprehensive water quality monitoring within Montello Lake through the WDNR Citizen Lake Monitoring Network and support CB/CW efforts.

Primary Action: Begin monitoring in 2025 and beyond for water quality through secchi readings, chlorophyll-a, and total phosphorus. Samples should be taken once monthly between May – September or at least 3 times a year spaced 30 days apart, or at a bare minimum once a year mid-summer.

Primary Action: Begin participation in the Clean Boats / Clean waters program and commit to a minimum of 30 hours of monitoring per year. This may be done in cooperation with overlapping boat landing monitoring by local groups, such as Golden Sands Resource Conservation & Development Council.

There are multiple resources and organizations able to help achieve plan goals and related actions. Contacts for those mentioned in the plan and additional groups are included as follows.

Wisconsin Department of Natural Resources
Ted Johnson – Water Resources Management Specialist
(920) 362-0181
TedM.Johnson@wisconsin.gov

Golden Sands Resource Conservation & Development Council, Inc.
Chris Hamerla – Regional AIS Coordinator
(715) 343-6215 Ext. 704
Chris.hamerla@goldensandsrcd.org

Marquette County Land & Water Conservation Department
Pat Kilbey – County Conservationist
(608) 296-2815 ext. 5
patrick.kilbey@wi.nacdnet.net

University of Wisconsin – Extension Lakes
(715) 346-2116
uwexlakes@uwsp.edu

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APPENDIX A – SUPPORTING AQUATIC PLANT DOCUMENTATION

Appendix A – Supporting Aquatic Plant Documentation

The point intercept method was used to evaluate the existing emergent, submergent, floating-leaf and free-floating aquatic plants. If a species was not collected at a specific point, the space on the datasheet was left blank. For the survey, the data for each sample point was entered into the WDNR "Worksheets" (i.e., a data-processing spreadsheet) to calculate the following statistics:

Taxonomic richness (the total number of taxa detected)

- **Maximum depth of plant growth**
- **Community frequency of occurrence** (number of intercept points where aquatic plants were detected divided by the number of intercept points shallower than the maximum depth of plant growth)
- **Mean intercept point taxonomic richness** (the average number of taxa per intercept point)
- **Mean intercept point native taxonomic richness** (the average number of native taxa per intercept point)
- **Taxonomic frequency of occurrence within vegetated areas** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points where vegetation was present)
- **Taxonomic frequency of occurrence at sites within the photic zone** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points which are equal to or shallower than the maximum depth of plant growth)
- **Relative taxonomic frequency of occurrence** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the sum of all species' occurrences)
- **Mean density** (the sum of the density values for a particular species divided by the number of sampling sites)
- **Simpson Diversity Index (SDI)** is an indicator of aquatic plant community diversity. SDI is calculated by taking one minus the sum of the relative frequencies squared for each species present. Based upon the index of community diversity, the closer the SDI is to one, the greater the diversity within the population.

Floristic Quality Index (FQI) (This method uses a predetermined Coefficient of Conservatism (C), that has been assigned to each native plant species in Wisconsin, based on that species' tolerance for disturbance. Non-native plants are not assigned conservatism coefficients. The aggregate conservatism of all the plants inhabiting a site determines its floristic quality. The mean C value for a given lake is the arithmetic mean of the coefficients of all native vascular plant species occurring on the entire site, without regard to dominance or frequency. The FQI value is the mean C times the square root of the total number of native species. This formula combines the conservatism of the species present with a measure of the species richness of the site.

APPENDIX B – ADDITIONAL MANAGEMENT OPTIONS

Management Options for Aquatic Plants

Option	Permit Needed	How it Works	Pros	Cons
No Management	No	No active plant management	Possible protects native species that can enhance water quality and provide habitat for aquatic fauna: • No financial cost • No system disturbance • No harmful effects of chemicals • Permit not required	May allow small populations of invasive plants to become larger and more difficult to control later • Requires intensive monitoring
Mechanical Control	Required under NR 109	Plants reduced by mechanical means	Flexible control	Must be repeated, often more than once per season, sometimes weekly
		Wide range of techniques from manual to mechanized	Can balance habitat and recreational needs	Can suspend sediments and increase highly turbidity and nutrient release
a. Handpulling/ Manual raking	Yes/No	Scuba divers or snorkelers remove plants are removed with a rake	Little to no damage done to lake or to native plant species	Very labor intensive and costly by hand or plants
		Works best in soft sediments	Can be highly selective Can be done by shoreline property owners within an area <30 ft wide or removing EWM or CLP Can be very effective at removing problems particularly following early detection of an invasive specie	Needs to be carefully monitored Roots, runners and even fragments of some without permits species (including EWM) will start new where selectively planted, so all of plant must be removed Small scale control only plants Can be very costly if subcontracted
b. Harvesting	Yes	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	Good for CLP management if cut prior to turion production and is then cut to be kept in check through its growth cycle Usually minimal impact to the lake Harvested lanes through dense weed beds can increase growth and forage ability of some fish Can remove some nutrients from the lake	Fragments of EWM can re-root Difficulty in finding disposal sites Can remove some small fish and reptiles from lake Initial cost of harvester expensive High transport, maintenance and operational costs Liability if owned
Biological Control	Yes	Living organisms (e.g. insects or fungi) eat or infect plants	Self sustaining organism will over winter resume eating its host the next year Lowers density of problem plant to allow growth of natives	Effectiveness will vary as control agent’s population fluctuates Provides moderate control – complete control unlikely Control response may be slow. Must have enough control agent to be effective

Management Options for Aquatic Plants

a. Weevils on EWM	Yes	Native weevil prefers EWM to other native water milfoil	Native to Wisconsin: Weevil cannot "escape" and become a problem Selective control of target species Longer term control with limited management	Excessive cost need to stock large numbers, even if some already present and are costly **$1.00/each** Need good habitat for over wintering on shore (leaf litter) associated with undeveloped shorelines High Panfish populations decrease densities through predation
b. Pathogens	Yes	Fungal/bacterial/viral pathogen introduced to target species to induce mortality	May be species specific May provide long term control Few dangers to humans or animals	Largely experimental; effectiveness and longevity unknown Possible side effects not understood
c. Allelopathy	Yes	Aquatic plants release chemical compounds that inhibit other plants from growing	May provide long term, maintenance free control Spikerushes (*Eleocharis* spp.) appear to inhibit Eurasian watermill foil growth	Initial transplanting slow and labor intensive Spikerushes native to Wisconsin 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. Restoration of native plants	Possibly, strongly recommend plan and consultation with DNR	Diverse native plant community established to help repel invasive species	Native plants provide food and habitat for aquatic fauna Diverse native community more repellant to invasive species Supplements removal techniques	Initial transplanting slow and labor intensive Nuisance invasive plants may outcompete plantings Largely experimental; few well documented successful cases and very costly
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. Drawdown	Yes, may require Environmental Assessment	Lake water lowered; plants killed when sediment dries, compacts or freezes	Can be effective for EWM, especially when done over winter, 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
		Must have a water level control or device or siphon	Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction	Species growing in deep water (e.g. EWM) that survive may increase, particularly if desired native species are reduced
		Season or duration of drawdown can change effects	Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization and increased water quality Successful for EWM	May impact attached wetlands and shallow wells near shore Not a good control measure for CLP

Management Options for Aquatic Plants

			Low cost if not a hydroelectric dam Restores natural water fluctuation important for all aquatic ecosystems	Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning Winter drawdown must start in early fall or will kill hibernating reptiles and amphibians Controversial
b. Dredging	Yes	Plants are removed along with sediment	Increases water depth	Expensive
		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 and permitting required		Sediment testing is expensive Removes benthic organisms Dredged materials must be disposed if Severe impact on lake ecosystem
c. Dyes	Yes	Colors water, reducing light and reducing plant and algal growth	Impairs plant growth without increasing turbidity Usually non-toxic, degrades naturally over a few weeks	Appropriate for very slam water bodies Should not be used in pond or lake with outflow Impairs aesthetics Affects to microscopic organisms unknown
d. Mechanical circulation (Solarbees)	Yes	Water is circulated and oxygenated	Reduces blue green algae	Method is experimental; no published studies have been done
		Oxygenation of water decreases ammonium-nitrogen, which is a preferred nutrient source of EWM, theoretically limiting EWM growth (has not been demonstrated scientifically)	May reduce levels of ammonium-nitrogen in the water and at the sediment interface, which could reduce EWM growth Oxygenated water may reduce phosphorus release from sediments if mixing is complete Reduces chance of fish kills by aerating water	Although EWM prefers ammonium-nitrogen to nitrate, it will uptake nitrate efficiently, so EWM growth may not be affected Units are aesthetically unpleasing Units could be a navigational hazard
e. Non-point source nutrient control	No	Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use)	Attempts to correct source of problem, not treat symptoms Could improve water clarity and reduce occurrences of algal blooms	Results can take years to be evident due to internal recycling of already resent lake nutrients Expensive

Management Options for Aquatic Plants

			Native plants may be able to compete invasive species better in low nutrient conditions	Requires landowner cooperation and regulation Improved water clarity may increase plant growth
Chemical Control	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 Can be used for restoration activities	May kill desirable plant species, e.g. native water milfoil or native pondweeds 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 Controversial
a. 2,4-D (DMA-4; Sculpin	Yes	Systemic[1] herbicide selective to broadleaf[2] plants that inhibit 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 Can be used in synergy with endotholl for early season CLP and EWM treatments Widely used aquatic herbicides	Cannot be used in combination with copper herbicides (used for algae) Toxic to fish
b. Endothall (Aquathol)	Yes	Broad-spectrum[3], contact [4] herbicide that inhibits protein synthesis	Especially effective on CLP and also effective on EWM	Kills many native pondweeks
		Applied as liquid or granules	May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring Can be selective depending on concentration and seasonal timing Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds	Not as effective in dense plant beds Not to be used in water supplies Toxic to aquatic fauna (to varying degrees)
c. Diquat (Reward)	Yes	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 Limited direct toxicity on fish and other animals	Toxic to aquatic invertebrates Needs to be reapplied several years in a row

Management Options for Aquatic Plants

				Ineffective in muddy or cold water (<50°F)
d. Fluridone (Sonar)	Yes	Broad-spectrum, systemic pigment bleaching herbicide that inhibits photosynthesis, some reduction in non target effects can be achieved by lowering dosage	Effective on EWM for 2 to 4+ years Applied at very low concentration typically on lake wide basis of less than 8 PPB Specific granular formulation release over extended periods of time 30 – 60 days eliminating peaks and lessening impacts to non targets (natives)	Affects some non-target plants, particularly native milfoils, coontails, elodea and naiads, even at low concentrations. These plants are important to combat invasive species Requires long contact time: 60-90 + days Requires residual monitoring
			Slow decomposition of plants may limit decreases in dissolved oxygen Low toxicity to aquatic animals	Demonstrated herbicide resistance in hydrilla subjected to repeat treatments Unknown effect of repeat whole lake treatments on lake ecology
e. Glyphosate (Rodeo)	Yes	Broad spectrum, systemic herbicide that disrupts enzyme formation and function	Effective on floating and emergent plants such as purple loosestrife	Effective control for 1-5 years
		Usually used for purple loosestrife stems or cattails	Selective if carefully applied to individual plants	Ineffective in muddy water
		Applied as liquid spray or painted on loosestrife stems	Non-toxic to most aquatic animals at recommended dosages	Cannot be used near potable water intakes No control of submerged plants
f. Triclopyr (Renovate)	Yes	Systemic herbicide selective to broadleaf plants that disrupts enzyme function	Effective on many emergent and floating plants	Impacts may occur to some native plants at higher does (e.g. coontail)
		Applied as liquid spray or liquid	More effective on dicots, such as purple loosestrife; may be more effective than glyphosate Results in 3-5 weeks Low toxicity to aquatic animals No recreational use restrictions following treatment	May be toxic to sensitive invertebrates at higher concentrations Retreatment opportunities may be limited due to maximum seasonal rate (2.5 ppm) Sensitive to UV light; sunlight can break herbicide down prematurely Relatively new management option for aquatic plants (since 2003)
g. Copper compounds (Cutrine, Captain)	Yes	Broad-spectrum, systemic herbicide that prevents photosynthesis	Reduces algal growth and increases water clarity	Elemental copper accumulates and persists in sediments
		Used to control planktonic and filamentous algae	No recreational or agricultural restrictions on water use following treatment Herbicidal action on hydrilla, an invasive plant not yet present in Wisconsin	Short term results Small-scale control only, because algae are easily windblown

Management Options for Aquatic Plants

					Toxic to invertebrates, trout and other fish, depending on the hardness of the water Long-term effects of repeat treatments to benthic organism unknown Clear water may increase plant growth
h.	**Lime slurry**	Yes	Applications of lime temporarily raise water pH, which limits the availability of inorganic carbon to plants, preventing growth	Appears to be particularly effective against EWM and CLP Prevents release of sediment phosphorus, which reduces algal growth Increases growth of native plants beneficial as fish habitat	Relatively new technique, so effective dosage levels and exposure requirements are not yet known Short-term increase in turbidity due to suspended lime particles High pH detrimental to aquatic invertebrates May restrict growth of some native plants
i.	**Alum (aluminum sulfate)**	Yes	Remove phosphorus from water column and creates barrier on sediment to prevent internal loading of phosphorus	Most often used against algal problems Lasts up to 5 years	Most not eat fish for 30 days from treatment area
			Dosage must consider pH, hardness and water volume	Improves water clarity	Minimal effect on aquatic plants, or increased light penetration may increase aquatic plants Potential ecosystem toxicity issues for aquatic animals, including fish at some concentrations
j.	**Phoslock**	yes	Remove/sequesters phosphorus from water column and creates barrier on sediment to prevent internal loading of phosphorus	Most often used against algal problems/blooms Improves water quality	Higher cost than Alum
			Dosing based on water quality parameters and volumes	Lasts up to 5 years Made from natural materials/carriers and tends to be more environmentally friendly than alum	

***EWM** - Eurasian water-milfoil
***CLP** - Curly-leaf pondweed

[1]**Systemic herbicide -** Must be absorbed by the plant and moved to the site of action. Often slower-acting than contact herbicides.

[2]**Broadleaf herbicide -** Affects only dicots, one of two groups of plants. Aquatic dicots include waterlilies, bladderworts, watermilfoils, and coontails.

[3]**Broad-spectrum herbicide -** Affects both monocots and dicots.

[4]**Contact herbicide -** Unable to move within the plant; kills only plant tissue it contacts directly

Techniques for Aquatic Plant Control Not Allowed in Wisconsin

Option	How it Works	Pros	Cons
Biological Control			
a. Carp	Plants eaten by stocked carp	Effective at removing aquatic plants Involves species already present in Madison lakes	Illegal to transport or stock carp in Wisconsin Carp cause resuspension of sediments, increased water temperature, lower dissolved oxygen levels and reduction of light penetration Widespread plant removal deteriorates habitat for other fish and aquatic organisms Complete alteration of fish assemblage possible Dislodging of plants such as EWM or CLP turions can lead to accelerated spreading of plants
b. Crayfish	Plants eaten by stocked crayfish	Reduces macrophyte biomass	Illegal to transport or stock crayfish in Wisconsin Control not selective and may decimate plant community Not successful in productive, soft-bottom lakes with many fish predators Complete alteration of fish assemblage possible
Mechanical Control			
a. Cutting (no removal)	Plants are “mowed” with underwater cutter	Creates open water areas rapidly Works in water up to 25 ft	Root system remains for regrowth Fragments of vegetation can re-root and spread infestation throughout the lake Nutrient release can cause increased algae and bacteria and be a nuisance to riparian property owners Not selective in species removed small-scale control only
b. Rototilling	Sediment is tilled to uproot plant roots and stems	Decreases stem density, can affect entire plant	Creates turbidity
	Works in deep water (up to 17 ft)	Small scale control May provide long-term control	Not selective in species removed Fragments of vegetation can re-root Complete elimination of fish habitat

Techniques for Aquatic Plant Control Not Allowed in Wisconsin

			Releases nutrients Increased likelihood of invasive species recolonization
c. Hydroraking	Mechanical rake removes plants from lake Works in deep water (14 ft)	Creates open water areas rapidly	Fragments of vegetation can re-root May impact lake fauna Creates turbidity Plants regrown quickly Requires plant disposal
Physical Control			
a. Fabrics/Bottom Barriers	Prevents light from getting to lake bottom	Reduces turbidity in soft substrate areas Useful for small areas	Eliminates all plants, including native plants important for a healthy lake ecosystem 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

APPENDIX C – WI ADMIN CODES NR 107 & 109

Chapter NR 107

AQUATIC PLANT MANAGEMENT

Note: Chapter NR 107 as it existed on February 28, 1989 was repealed and a new Chapter NR 107 was created effective March 1, 1989.

NR 107.01 Purpose. The purpose of this chapter is to establish procedures for the management of aquatic plants and control of other aquatic organisms pursuant to s. 227.11 (2) (a), Stats., and interpreting s. 281.17 (2), Stats. A balanced aquatic plant community is recognized to be a vital and necessary component of a healthy aquatic ecosystem. The department may allow the management of nuisance-causing aquatic plants with chemicals registered and labeled by the U.S. environmental protection agency and labeled and registered by firms licensed as pesticide manufacturers and labelers with the Wisconsin department of agriculture, trade and consumer protection. Chemical management shall be allowed in a manner consistent with sound ecosystem management and shall minimize the loss of ecological values in the water body.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89; correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.

NR 107.02 Applicability. Any person sponsoring or conducting chemical treatment for the management of aquatic plants or control of other aquatic organisms in waters of the state shall obtain a permit from the department. Waters of the state include those portions of Lake Michigan and Lake Superior, and all lakes, bays, rivers, streams, springs, ponds, wells, impounding reservoirs, marshes, watercourses, drainage systems and other ground or surface water, natural or artificial, public or private, within the state or its jurisdiction as specified in s. 281.01 (18), Stats.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89; correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.

NR 107.03 Definitions. (1) "Applicator" means the person physically applying the chemicals to the treatment site.

(2) "Chemical fact sheet" means a summary of information on a specific chemical written by the department including general aquatic community and human safety considerations applicable to Wisconsin sites.

(3) "Department" means the department of natural resources.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89.

NR 107.04 Application for permit. (1) Permit applications shall be made on forms provided by the department and shall be submitted to the district director for the district in which the project is located. Any amendment or revision to an application shall be treated by the department as a new application, except as provided in s. NR 107.04 (3) (g).

Note: The DNR district headquarters are located at:
1. Southern — 3911 Fish Hatchery Road, Fitchburg 53711
2. Southeast — 2300 N. Dr. Martin Luther King Jr. Dr., Box 12436, Milwaukee 53212
3. Lake Michigan — 1125 N. Military Ave., Box 10448, Green Bay 54307
4. North Central — 107 Sutliff Ave., Box 818, Rhinelander 54501
5. Western — 1300 W. Clairemont Ave., Call Box 4001, Eau Claire 54702
6. Northwest — Hwy 70 West, Box 309, Spooner 54801

(2) The application shall be accompanied by:

(a) A nonrefundable permit application fee of $20, and, for proposed treatments larger than 0.25 acres, an additional refundable acreage fee of $25.00 per acre, rounded up to the nearest whole acre, applied to a maximum of 50.0 acres.

1. The acreage fee shall be refunded in whole if the entire permit is denied or if no treatment occurs on any part of the permitted treatment area. Refunds will not be prorated for partial treatments.

2. If the permit is issued with the proposed treatment area partially denied, a refund of acreage fees shall be given for the area denied.

(b) A legal description of the body of water proposed for treatment including township, range and section number;

(c) One copy of a detailed map or sketch of the body of water with the proposed treatment area dimensions clearly shown and with pertinent information necessary to locate those properties, by name of owner, riparian to the treatment area, which may include street address, local telephone number, block, lot and fire number where available. If a local address is not available, the home address and phone number of the property owner may be included;

(d) A description of the uses being impaired by plants or aquatic organisms and reason for treatment;

(e) A description of the plant community or other aquatic organisms causing the use impairment;

(f) The product names of chemicals proposed for use and the method of application;

(g) The name of the person or commercial applicator, and applicator certification number, when required by s. NR 107.08 (5), of the person conducting the treatment;

(h) A comparison of alternative control methods and their feasibility for use on the proposed treatment site.

(3) In addition to the information required under sub. (2), when the proposed treatment is a large-scale treatment exceeding 10.0 acres in size or 10% of the area of the water body that is 10 feet or less in depth, the application shall be accompanied by:

(a) A map showing the size and boundaries of the water body and its watershed.

(b) A map and list identifying known or suspected land use practices contributing to plant-related water quality problems in the watershed.

(c) A summary of conditions contributing to undesirable plant growth on the water body.

(d) A general description of the fish and wildlife uses occurring within the proposed treatment site.

(e) A summary of recreational uses of the proposed treatment site.

(f) Evidence that a public notice of the proposed application has been made, and that a public informational meeting, if required, has been conducted.

1. Notice shall be given in 2 inch x 4 inch advertising format in the newspaper which has the largest circulation in the area affected by the application.

2. The notice shall state the size of the proposed treatment, the approximate treatment dates, and that the public may request within 5 days of the notice that the applicant hold a public informational meeting on the proposed application.

a. The applicant will conduct a public informational meeting in a location near the water body when a combination of 5 or more individuals, organizations, special units of government, or local units of government request the meeting in writing to the applicant with a copy to the department within 5 days after the notice is made. The person or entity requesting the meeting shall state a specific agenda of topics including problems and alternatives to be discussed.

b. The meeting shall be given a minimum of one week advance notice, both in writing to the requestors, and advertised in the format of subd. 1.

(g) The provisions of pars. (a) to (e) shall be repeated once every 5 years and shall include new information. Annual modifications of the proposed treatment within the 5-year period which do not expand the treatment area more than 10% and cover a similar location and target organisms may be accepted as an amendment to the original application. The acreage fee submitted under sub. (2) (a) shall be adjusted in accordance with any proposed amendments.

(4) The applicant shall certify to the department that a copy of the application has been provided to any affected property owners' association, inland lake district, and, in the case of chemical applications for rooted aquatic plants, to any riparian property owners adjacent to and within the treatment area.

(5) A notice of the proposed treatment shall be provided by the department to any person or organization indicating annually in writing a desire to receive such notification.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89.

NR 107.05 Issuance of permit. (1) The department shall issue or deny issuance of the requested permit between 10 and 15 working days after receipt of an acceptable application, unless:

(a) An environmental impact report or statement is required under s. 1.11, Stats. Notification to the applicant shall be in writing within 10 working days of receipt of the application and no action may be taken until the report or statement has been completed; or

(b) A public hearing has been granted under s. 227.42, Stats.

(2) If a request for a public hearing is received after the permit is issued but prior to the actual treatment allowed by the permit, the department is not required to, but may, suspend the permit because of the request for public hearing.

(3) The department may deny issuance of the requested permit if:

(a) The proposed chemical is not labeled and registered for the intended use by the United States environmental protection agency and both labeled and registered by a firm licensed as a pesticide manufacturer and labeler with the Wisconsin department of agriculture, trade and consumer protection;

(b) The proposed chemical does not have a current department aquatic chemical fact sheet;

(c) The department determines the proposed treatment will not provide nuisance relief, or will place unreasonable restrictions on existing water uses;

(d) The department determines the proposed treatment will result in a hazard to humans, animals or other nontarget organisms;

(e) The department determines the proposed treatment will result in a significant adverse effect on the body of water;

(f) The proposed chemical application is for waters beyond 150 feet from shore except where approval is given by the department to maintain navigation channels, piers or other facilities used by organizations or the public including commercial facilities;

(g) The proposed chemical applications, other than those conducted by the department pursuant to ss. 29.421 and 29.424, Stats., will significantly injure fish, fish eggs, fish larvae, essential fish food organisms or wildlife, either directly or through habitat destruction;

(h) The proposed chemical application is in a location known to have endangered or threatened species as specified pursuant to s. 29.604, Stats., and as determined by the department;

(i) The proposed chemical application is in locations identified by the department as sensitive areas, except when the applicant demonstrates to the satisfaction of the department that treatments can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

1. 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.

2. The department shall notify any affected property owners' association, inland lake district, and riparian property owner of locations identified as sensitive areas.

(4) New applications will be reviewed with consideration given to the cumulative effect of applications already approved for the body of water.

(5) The department may approve the application in whole or in part consistent with the provisions of subs. (3) (a) through (i) and (4). Denials shall be in writing stating reasons for the denial.

(6) Permits may be issued for one treatment season only.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89; corrections in (3) (g) and (h) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.

NR 107.06 Chemical fact sheets. (1) The department shall develop a chemical fact sheet for each of the chemicals in present use for aquatic nuisance control in Wisconsin.

(1m) Chemical fact sheets for chemicals not previously used in Wisconsin shall be developed within 180 days after the department has received notice of intended use of the chemical.

(2) The applicant or permit holder shall provide copies of the applicable chemical fact sheets to any affected property owners' association and inland lake district.

(3) The department shall make chemical fact sheets available upon request.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89.

NR 107.07 Supervision. (1) The permit holder shall notify the district office 4 working days in advance of each anticipated treatment with the date, time, location, and proposed size of treatment. At the discretion of the department, the advance notification requirement may be waived.

(2) Supervision by a department representative may be required for any aquatic nuisance control project involving chemicals. Supervision may include inspection of the proposed treatment area, chemicals, and application equipment before, during or after treatment. The inspection may result in the determination that treatment is unnecessary or unwarranted in all or part of the proposed area, or that the equipment will not control the proper dosage.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89.

NR 107.08 Conditions of the permit. **(1)** The department may stop or limit the application of chemicals to a body of water if at any time it determines that chemical treatment will be ineffective, or will result in unreasonable restrictions on current water uses, or will produce unnecessary adverse side effects on nontarget organisms. Upon request, the department shall state the reason for such action in writing to the applicant.

(2) Chemical treatments shall be performed in accordance with label directions, existing pesticide use laws, and permit conditions.

(3) Chemical applications on lakes and impoundments are limited to waters along developed shoreline including public parks except where approval is given by the department for projects of public benefit.

(4) Treatment of areas containing high value species of aquatic plants shall be done in a manner which will not result in adverse long-term or permanent changes to a plant community in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in specific aquatic ecosystems, including *Potamogeton amplifolius, Potamogeton Richardsonii, Potamogeton praelongus, Potamogeton pectinatus, Potamogeton illinoensis, Potamogeton robbinsii, Eleocharis spp., Scirpus spp., Valisneria spp., Zizania aquatica, Zannichellia palustris* and *Brasenia schreberi.*

(5) Treatment shall be performed by an applicator currently certified by the Wisconsin department of agriculture, trade and consumer protection in the aquatic nuisance control category whenever:

(a) Treatment is to be performed for compensation by an applicator acting as an independent contractor for hire;

(b) The area to be treated is greater than 0.25 acres;

(c) The product to be used is classified as a "restricted use pesticide"; or

(d) Liquid chemicals are to be used.

(6) Power equipment used to apply liquid chemicals shall include the following:

(a) Containers used to mix and hold chemicals shall be constructed of watertight materials and be of sufficient size and strength to safely contain the chemical. Measuring containers and scales for the purpose of measuring solids and liquids shall be provided by the applicator;

(b) Suction hose used to deliver the chemical to the pump venturi assembly shall be fitted with an on-off ball-type valve. The system shall also be designed to prevent clogging from chemicals and aquatic vegetation;

(c) Suction hose used to deliver surface water to the pump shall be fitted with a check valve to prevent back siphoning into the surface water should the pump stop;

(d) Suction hose used to deliver a premixed solution shall be fitted with an on-off ball-type valve to regulate the discharge rate;

(e) Pressure hose used to discharge chemicals to the surface water shall be provided with an on-off ball-type valve. This valve will be fitted at the base of the hose nozzle or as part of the nozzle assembly;

(f) All pressure and suction hoses and mechanical fittings shall be watertight;

(g) Equipment shall be calibrated by the applicator. Evidence of calibration shall be provided at the request of the department supervisor.

(h) Other equipment designs may be acceptable if capable of equivalent performance.

(7) The permit holder shall be responsible for posting those areas of use in accordance with water use restrictions stated on the chemical label, but in all cases for a minimum of one day, and with the following conditions:

(a) Posting signs shall be brilliant yellow and conspicuous to the nonriparian public intending to use the treated water from both the water and shore, and shall state applicable label water use restrictions of the chemical being used, the name of the chemical and date of treatment. For tank mixes, the label requirements of the most restrictive chemical will be posted;

(b) Minimum sign dimensions used for posting shall be 11 inches by 11 inches or consistent with s. ATCP 29.15. The department will provide up to 6 signs to meet posting requirements. Additional signs may be purchased from the department;

(c) Signs shall be posted at the beginning of each treatment by the permit holder or representing agent. Posting prior to treatment may be required as a permit condition when the department determines that such posting is in the best interest of the public;

(d) Posting signs shall be placed along contiguous treated shoreline and at strategic locations to adequately inform the public. Posting of untreated shoreline located adjacent to treated shoreline and noncontiguous shoreline shall be at the discretion of the department;

(e) Posting signs shall be made of durable material to remain up and legible for the time period stated on the pesticide label for water use restrictions, after which the permit holder or representing agent is responsible for sign removal.

(8) After conducting a treatment, the permit holder shall complete and submit within 30 days an aquatic nuisance control report on a form supplied by the department. Required information will include the quantity and type of chemical, and the specific size and location of each treatment area. In the event of any unusual circumstances associated with a treatment, or at the request of the department, the report shall be provided immediately. If treatment did not occur, the form shall be submitted with appropriate comment by October 1.

(9) Failure to comply with the conditions of the permit may result in cancellation of the permit and loss of permit privileges for the subsequent treatment season. A notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder accompanied by a statement of appeal rights.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89; correction in (7) (b) made under s. 13.93 (2m) (b) 7., Stats., Register, September, 1995, No. 477.

NR 107.09 Special limitation. Due to the significant risk of environmental damage from copper accumulation in sediments, swimmer's itch treatments performed with copper sulfate products at a rate greater than 10 pounds of copper sulfate per acre are prohibited.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89.

NR 107.10 Field evaluation use permits. When a chemical product is considered for aquatic nuisance control and does not have a federal label for such use, the applicant shall apply to the administrator of the United States environmental protection agency for an experimental use permit under section 5 of the federal insecticide, fungicide and rodenticide act as amended (7 USC 136 et seq.). Upon receiving a permit, the permit holder shall obtain a field evaluation use permit from the department and be subject to the requirements of this chapter. Department field evaluation use permits shall be issued for the purpose of evaluating product effectiveness and safety under field conditions and will require in addition to the conditions of the permit specified in s. NR 107.08 (1) through (9), the following:

(1) Treatment shall be limited to an area specified by the department.

(2) The permit holder shall submit to the department a summary of treatment results at the end of the treatment season. The summary shall include:

(a) Total chemical used and distribution pattern, including chemical trade name, formulation, percent active ingredient, and dosage rate in the treated water in parts per million of active ingredient;

(b) Description of treatment areas including the character and the extent of the nuisance present;

(c) Effectiveness of the application and when applicable, a summary comparison of the results obtained from past experiments using the same chemical formulation;

(d) Other pertinent information required by the department; and

(e) Conclusions and recommendations for future use.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89.

NR 107.11 Exemptions. (1) Under any of the following conditions, the permit application fee in s. NR 107.04 (2) (a) will be limited to the basic application fee:

(a) The treatment is made for the control of bacteria on swimming beaches with chlorine or chlorinated lime;

(b) The treatment is intended to control algae or other aquatic nuisances that interfere with the use of the water for potable purposes;

(c) The treatment is necessary for the protection of public health, such as the control of disease carrying organisms in sanitary sewers, storm sewers, or marshes, and the treatment is sponsored by a governmental agency.

(2) The treatment of purple loosestrife is exempt from ss. NR 107.04 (2) (a) and (3), and 107.08 (5).

(3) The use of chemicals in private ponds is exempt from the provisions of this chapter except for ss. NR 107.04 (1), (2), (4) and (5), 107.05, 107.07, 107.08 (1), (2), (8) and (9), and 107.10.

(a) A private pond is a body of water located entirely on the land of an applicant, with no surface water discharge or a discharge that can be controlled to prevent chemical loss, and without access by the public.

(b) The permit application fee will be limited to the non-refundable $20 application fee.

(4) The use of chemicals in accordance with label instructions is exempt from the provisions of this chapter, when used in:

(a) Water tanks used for potable water supplies;

(b) Swimming pools;

(c) Treatment of public or private wells;

(d) Private fish hatcheries licensed under s. 95.60, Stats.;

(e) Treatment of emergent vegetation in drainage ditches or rights-of-way where the department determines that fish and wildlife resources are insignificant; or

(f) Waste treatment facilities which have received s. 281.41, Stats., plan approval or are utilized to meet effluent limitations set forth in permits issued under s. 283.31, Stats.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89; corrections in (4) (d) and (f) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.

Published under s. 35.93, Wis. Stats., by the Legislative Reference Bureau.

Chapter NR 109

AQUATIC PLANTS: INTRODUCTION, MANUAL REMOVAL AND MECHANICAL CONTROL REGULATIONS

NR 109.01 Purpose. The purpose of this chapter is to establish procedures and requirements for the protection and regulation of aquatic plants pursuant to ss. 23.24 and 30.07, Stats. Diverse and stable communities of native aquatic plants are recognized to be a vital and necessary component of a healthy aquatic ecosystem. This chapter establishes procedures and requirements for issuing aquatic plant management permits for introduction of aquatic plants or control of aquatic plants by manual removal, burning, use of mechanical means or plant inhibitors. This chapter identifies other permits issued by the department for aquatic plant management that contain the appropriate conditions as required under this chapter for aquatic plant management, and for which no separate permit is required under this chapter. Introduction and control of aquatic plants shall be allowed in a manner consistent with sound ecosystem management, shall consider cumulative impacts, and shall minimize the loss of ecological values in the body of water. The purpose of this chapter is also to prevent the spread of invasive and non-native aquatic organisms by prohibiting the launching of watercraft or equipment that has any aquatic plants or zebra mussels attached.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03; correction made under s. 13.92 (4) (b) 7., Stats., Register March 2011 No. 663.

NR 109.02 Applicability. A person sponsoring or conducting manual removal, burning or using mechanical means or aquatic plant inhibitors to control aquatic plants in navigable waters, or introducing non-native aquatic plants to waters of this state shall obtain an aquatic plant management permit from the department under this chapter.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

NR 109.03 Definitions. In this chapter:

(1) "Aquatic community" means lake or river biological resources.

(2) "Beneficial water use activities" mean angling, boating, swimming or other navigational or recreational water use activity.

(3) "Body of water" means any lake, river or wetland that is a water of this state.

(4) "Complete application" means a completed and signed application form, the information specified in s. NR 109.04 and any other information which may reasonably be required from an applicant and which the department needs to make a decision under applicable provisions of law.

(5) "Department" means the Wisconsin department of natural resources.

(6) "Manual removal" means the control of aquatic plants by hand or hand-held devices without the use or aid of external or auxiliary power.

(7) "Navigable waters" means those waters defined as navigable under s. 30.10, Stats.

(8) "Permit" means aquatic plant management permit.

(9) "Plan" means aquatic plant management plan.

(10) "Wetlands" means an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

NR 109.04 Application requirements and fees. (1) Permit applications shall be made on forms provided by the department and shall be submitted to the regional director or designee for the region in which the project is located. Permit applications for licensed aquatic nursery growers may be submitted to the department of agriculture, trade and consumer protection.

Note: Applications may be obtained from the department's regional headquarters or service centers. DATCP has agreed to send application forms and instructions provided by the department to aquatic nursery growers along with license renewal forms. DATCP will forward all applications to the department for processing.

(2) The application shall be accompanied by all of the following unless the application is made by licensed aquatic nursery growers for selective harvesting of aquatic plants for nursery stock. Applications made by licensed aquatic nursery growers for harvest of nursery stock do not have to include the information required by par. (d), (e), (h), (i) or (j).

(a) A nonrefundable application fee. The application fee for an aquatic plant management permit is:

1. $30 for a proposed project to manage aquatic plants on less than one acre.

2. $30 per acre to a maximum of $300 for a proposed project to manage aquatic plants on one acre or larger. Partial acres shall be rounded up to the next full acre for fee determination. An annual renewal of this permit may be requested with an additional application fee of one-half the original application fee, but not less than $30.

(b) A legal description of the body of water including township, range and section number.

(c) One copy of a detailed map of the body of water with the proposed introduction or control area dimensions clearly shown. Private individuals doing plant introduction or control shall provide the name of the owner riparian to the management area, which includes the street address or block, lot and fire number where available and local telephone number or other pertinent information necessary to locate the property.

(d) One copy of any existing aquatic management plan for the body of water, or detailed reference to the plan, citing the plan references to the proposed introduction or control area, and a de-

scription of how the proposed introduction or control of aquatic plants is compatible with any existing plan.

(e) A description of the impairments to water use caused by the aquatic plants to be managed.

(f) A description of the aquatic plants to be controlled or removed.

(g) The type of equipment and methods to be used for introduction, control or removal.

(h) A description of other introduction or control methods considered and the justification for the method selected.

(i) A description of any other method being used or intended for use for plant management by the applicant or on the area abutting the proposed management area.

(j) The area used for removal, reuse or disposal of aquatic plants.

(k) The name of any person or commercial provider of control or removal services.

(3) (a) 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.

(b) Within 30 days of receipt of the plan, the department shall notify the applicant of any additional information or modifications to the plan that are required. If the applicant does not submit the additional information or modify the plan as requested by the department, the department may dismiss the aquatic plant management permit application.

(c) The department shall approve the aquatic plant management plan before an application may be considered complete.

(4) The permit sponsor may request an annual renewal in writing from the department under s. NR 109.05 if there is no change proposed in the conditions of the original permit issued.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

NR 109.05 Permit issuance. (1) The department shall issue or deny issuance of the requested permit within 15 working days after receipt of a completed application and approved plan as required under s. NR 109.04 (3).

(2) The department may specify any of the following as conditions of the permit:

(a) The quantity of aquatic plants that may be introduced or controlled.

(b) The species of aquatic plants that may be introduced or controlled.

(c) The areas in which aquatic plants may be introduced or controlled.

(d) The methods that may be used to introduce or control aquatic plants.

(e) The times during which aquatic plants may be introduced or controlled.

(f) The allowable methods used for disposing of or using aquatic plants that are removed or controlled.

(g) Annual or other reporting requirements to the department that may include information related to pars. (a) to (f).

(3) The department may deny issuance of the requested permit if the department determines any of the following:

(a) Aquatic plants are not causing significant impairment of beneficial water use activities.

(b) The proposed introduction or control will not remedy the water use impairments caused by aquatic plants as identified as a part of the application in s. NR 109.04 (2) (e).

(c) The proposed introduction or control will result in a hazard to humans.

(d) The proposed introduction or control will cause significant adverse impacts to threatened or endangered resources.

(e) The proposed introduction or control will result in a significant adverse effect on water quality, aquatic habitat or the aquatic community including the native aquatic plant community.

(f) The proposed introduction or control is in locations identified by the department as sensitive areas, under s. NR 107.05 (3) (i) 1., except when the applicant demonstrates to the satisfaction of the department that the project can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

(g) The proposed management will result in significant adverse long-term or permanent changes to a plant community or a high value species in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in specific aquatic ecosystems, including Potamogeton amplifolius, Potamogeton Richardsonii, Potamogeton praelongus, Stuckenia pectinata (Potamogeton pectinatus), Potamogeton illinoensis, Potamogeton robbinsii, Eleocharis spp., Scirpus spp., Valisneria spp., Zizania spp., Zannichellia palustris and Brasenia schreberi.

(h) If wild rice is involved, the stipulations incorporated by *Lac Courte Oreilles v. Wisconsin*, 775 F. Supp. 321 (W.D. Wis. 1991) shall be complied with.

(i) The proposed introduction or control will interfere with the rights of riparian owners.

(j) The proposed management is inconsistent with a department approved aquatic plant management plan for the body of water.

(4) The department may approve the application in whole or in part consistent with the provisions of sub. (3). A denial shall be in writing stating the reasons for the denial.

(5) (a) The department may issue an aquatic plant management permit on less than one acre in a single riparian area for a 3-year term.

(b) The department may issue an aquatic plant management permit for a one-year term for more than one acre or more than one riparian area. The permit may be renewed annually for up to a total of 3 years in succession at the written request of the permit holder, provided no modifications or changes are made from the original permit.

(c) The department may issue an aquatic plant management permit containing a department-approved plan for a 3 to 5 year term.

(d) The department may issue an aquatic plant management permit to a licensed nursery grower for a 3-year term for the harvesting of aquatic plants from a publicly owned lake bed or for a 5-year term for harvesting of aquatic plants from privately owned beds with the permission of the property owner.

(6) The approval of an aquatic plant management permit does not represent an endorsement of the permitted activity, but repre-

sents that the applicant has complied with all criteria of this chapter.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03; reprinted to restore dropped language from rule order, Register October 2003 No. 574.

NR 109.06 Waivers. The department waives the permit requirements under this chapter for any of the following:

(1) Manual removal or use of mechanical devices to control or remove aquatic plants from a body of water 10 acres or less that is entirely confined on the property of one person with the permission of that property owner.

Note: A person who introduces native aquatic plants or removes aquatic plants by manual or mechanical means in the course of operating an aquatic nursery as authorized under s. 94.10, Stats., on privately owned non-navigable waters of the state is not required to obtain a permit for the activities.

(2) A riparian owner who manually removes aquatic plants from a body of water or uses mechanical devices designed for cutting or mowing vegetation to control plants on an exposed lake bed that abuts the owner's property provided that the removal meets all of the following:

(a) 1. Removal of native plants is limited to a single area with a maximum width of no more than 30 feet measured along the shoreline provided that any piers, boatlifts, swimrafts and other recreational and water use devices are located within that 30-foot wide zone and may not be in a new area or additional to an area where plants are controlled by another method; or

2. Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 when performed in a manner that does not harm the native aquatic plant community; or

3. Removal of dislodged aquatic plants that drift on-shore and accumulate along the waterfront.

(b) Is not located in a sensitive area as defined by the department under s. NR 107.05 (3) (i) 1., or in an area known to contain threatened or endangered resources or floating bogs.

(c) Does not interfere with the rights of other riparian owners.

(d) If wild rice is involved, the procedures of s. NR 19.09 (1) shall be followed.

(4) Control of purple loosestrife by manual removal or use of mechanical devices when performed in a manner that does not harm the native aquatic plant community or result in or encourage re-growth of purple loosestrife or other nonnative vegetation.

(5) Any aquatic plant management activity that is conducted by the department and is consistent with the purposes of this chapter.

(6) Manual removal and collection of native aquatic plants for lake study or scientific research when performed in a manner that does not harm the native aquatic plant community.

Note: Scientific collectors permit requirements are still applicable.

(7) Incidental cutting, removal or destroying of aquatic plants when engaged in beneficial water use activities.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

NR 109.07 Invasive and nonnative aquatic plants. **(1)** The department may designate any aquatic plant as an invasive aquatic plant for a water body or a group of water bodies if it has the ability to cause significant adverse change to desirable aquatic habitat, to significantly displace desirable aquatic vegetation, or to reduce the yield of products produced by aquaculture.

(2) The following aquatic plants are designated as invasive aquatic plants statewide: Eurasian water milfoil, curly leaf pondweed and purple loosestrife.

(3) Native and nonnative aquatic plants of Wisconsin shall be determined by using scientifically valid publications and findings by the department.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

NR 109.08 Prohibitions. **(1)** No person may distribute an invasive aquatic plant, under s. NR 109.07.

(2) No person may intentionally introduce Eurasian water milfoil, curly leaf pondweed or purple loosestrife into waters of this state without the permission of the department.

(3) No person may intentionally cut aquatic plants in public/navigable waters without removing cut vegetation from the body of water.

(4) (a) No person may place equipment used in aquatic plant management in a navigable water if the person has reason to believe that the equipment has any aquatic plants or zebra mussels attached.

(b) This subsection does not apply to equipment used in aquatic plant management when re-launched on the same body of water without having visited different waters, provided the re-launching will not introduce or encourage the spread of existing aquatic species within that body of water.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

NR 109.09 Plan specifications and approval. **(1)** Applicants required to submit an aquatic plant management plan, under s. NR 109.04 (3), shall develop and submit the plan in a format specified by the department.

(2) The plan shall present and discuss each of the following items:

(a) The goals and objectives of the aquatic plant management and protection activities.

(b) A physical, chemical and biological description of the waterbody.

(c) The intensity of water use.

(d) The location of aquatic plant management activities.

(e) An evaluation of chemical, mechanical, biological and physical aquatic plant control methods.

(f) Recommendations for an integrated aquatic plant management strategy utilizing some or all of the methods evaluated in par. (e).

(g) An education and information strategy.

(h) A strategy for evaluating the efficacy and environmental impacts of the aquatic plant management activities.

(i) The involvement of local units of government and any lake organizations in the development of the plan.

(3) The approval of an aquatic plant management plan does not represent an endorsement for plant management, but represents that adequate considerations in planning the actions have been made.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

NR 109.10 Other permits. Permits issued under s. 30.12, 30.20, 31.02 or 281.36, Stats., or under ch. NR 107 may contain provisions which provide for aquatic plant management. If a permit issued under one of these authorities contains the appropriate conditions as required under this chapter for aquatic plant management, a separate permit is not required under this chapter. The permit shall explicitly state that it is intended to comply with the substantive requirements of this chapter.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

NR 109.11 Enforcement. **(1)** Violations of this chapter may be prosecuted by the department under chs. 23, 30 and 31, Stats.

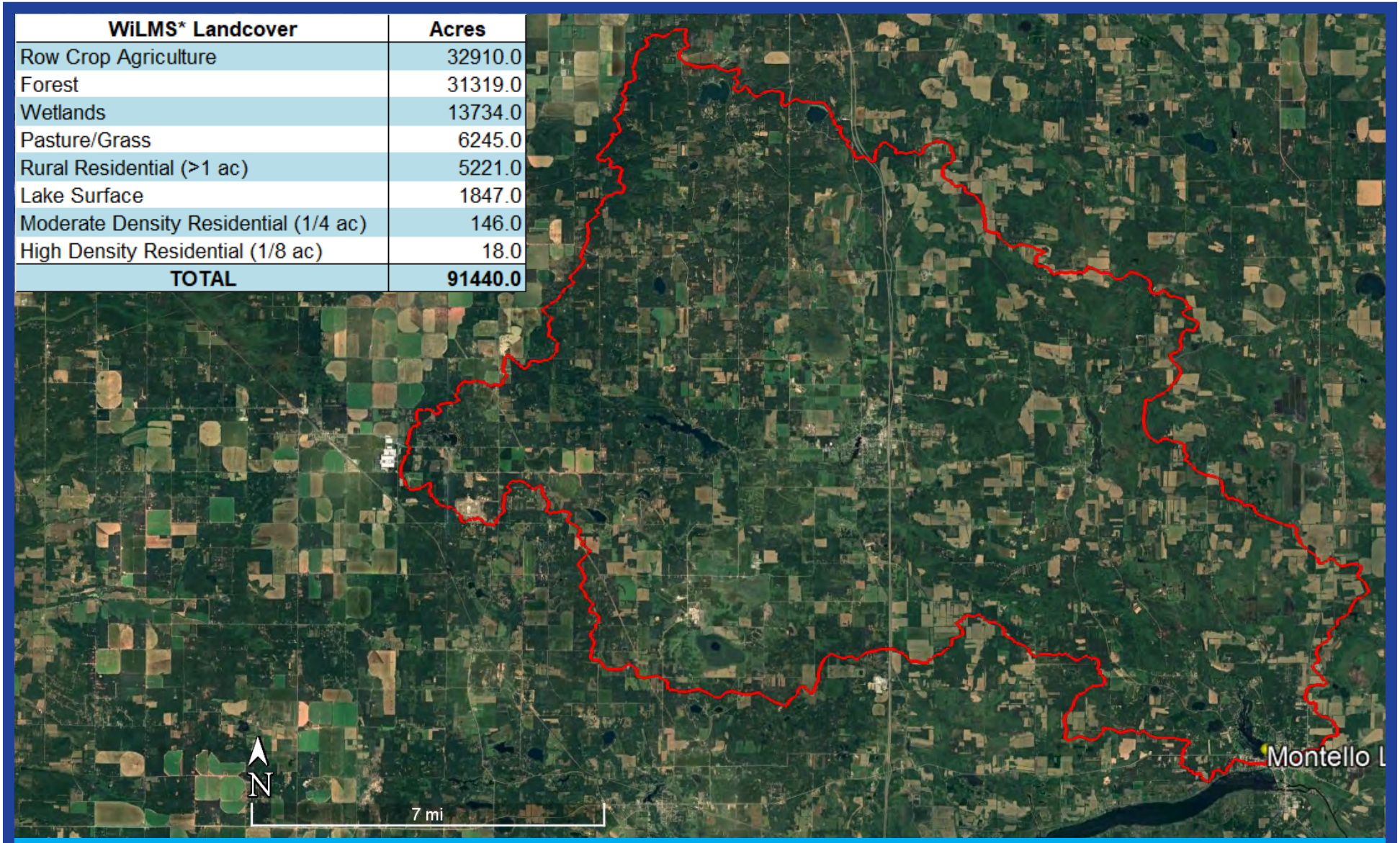
(2) Failure to comply with the conditions of a permit issued under or in accordance with this chapter may result in cancellation of the permit and loss of permit privileges for the subsequent

year. Notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

FIGURES

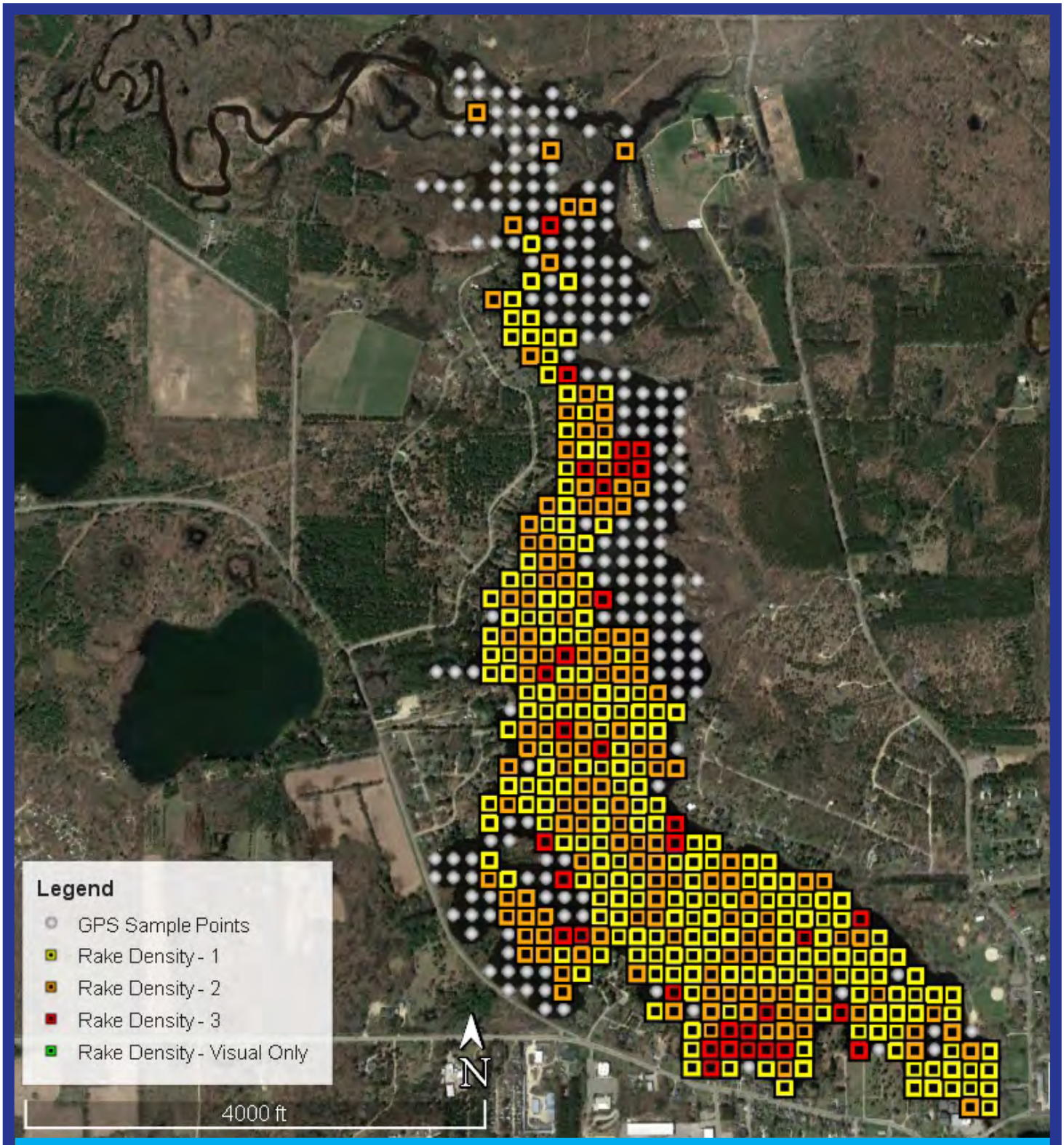
WiLMS* Landcover	Acres
Row Crop Agriculture	32910.0
Forest	31319.0
Wetlands	13734.0
Pasture/Grass	6245.0
Rural Residential (>1 ac)	5221.0
Lake Surface	1847.0
Moderate Density Residential (1/4 ac)	146.0
High Density Residential (1/8 ac)	18.0
TOTAL	**91440.0**



WISCONSIN
LAKE & POND RESOURCE

Montello Lake Watershed Coverage

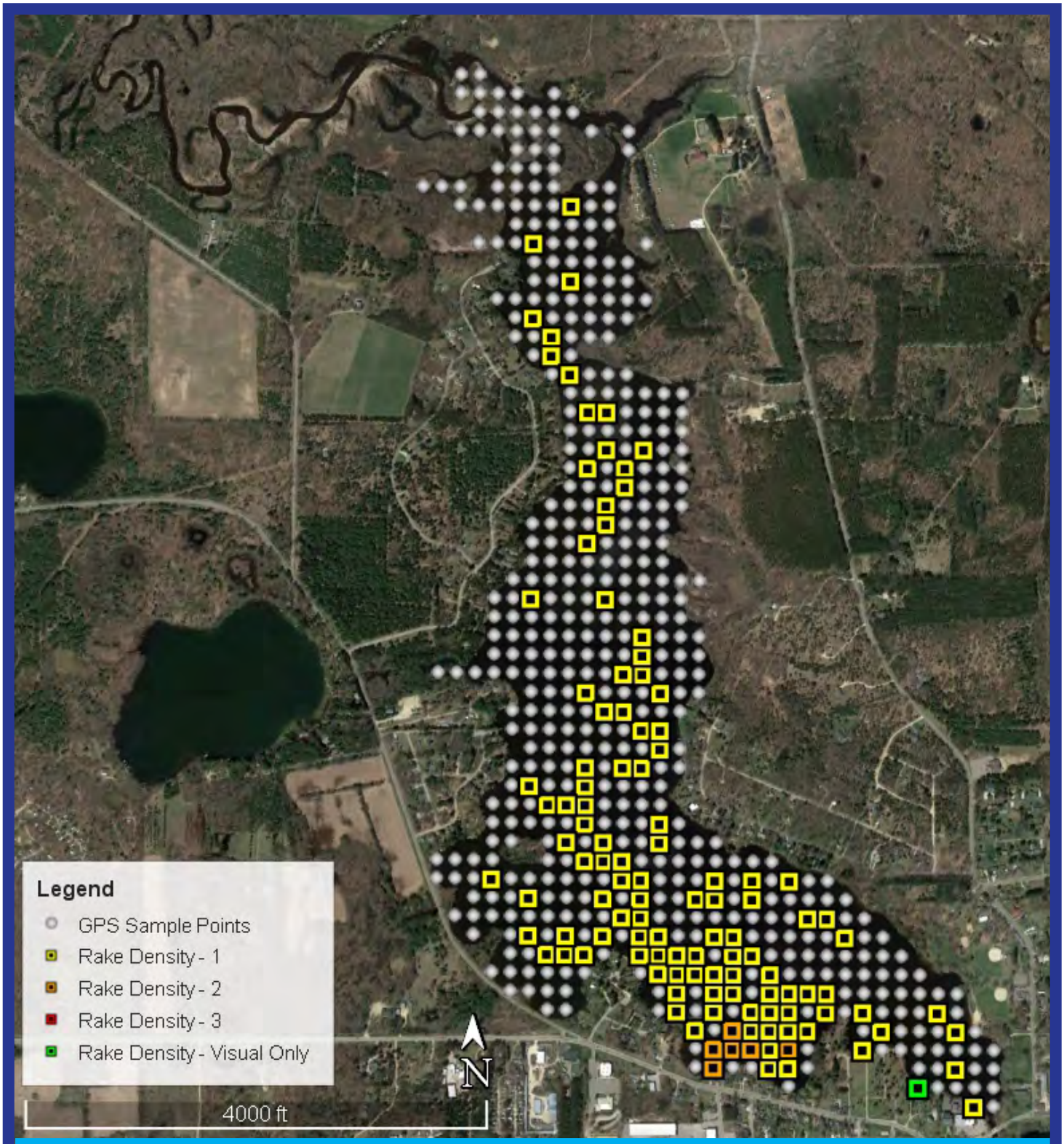
Fig 1
Montello Lake
Marquette Co., WI



Total Rake Fullness

WISCONSIN
LAKE & POND RESOURCE

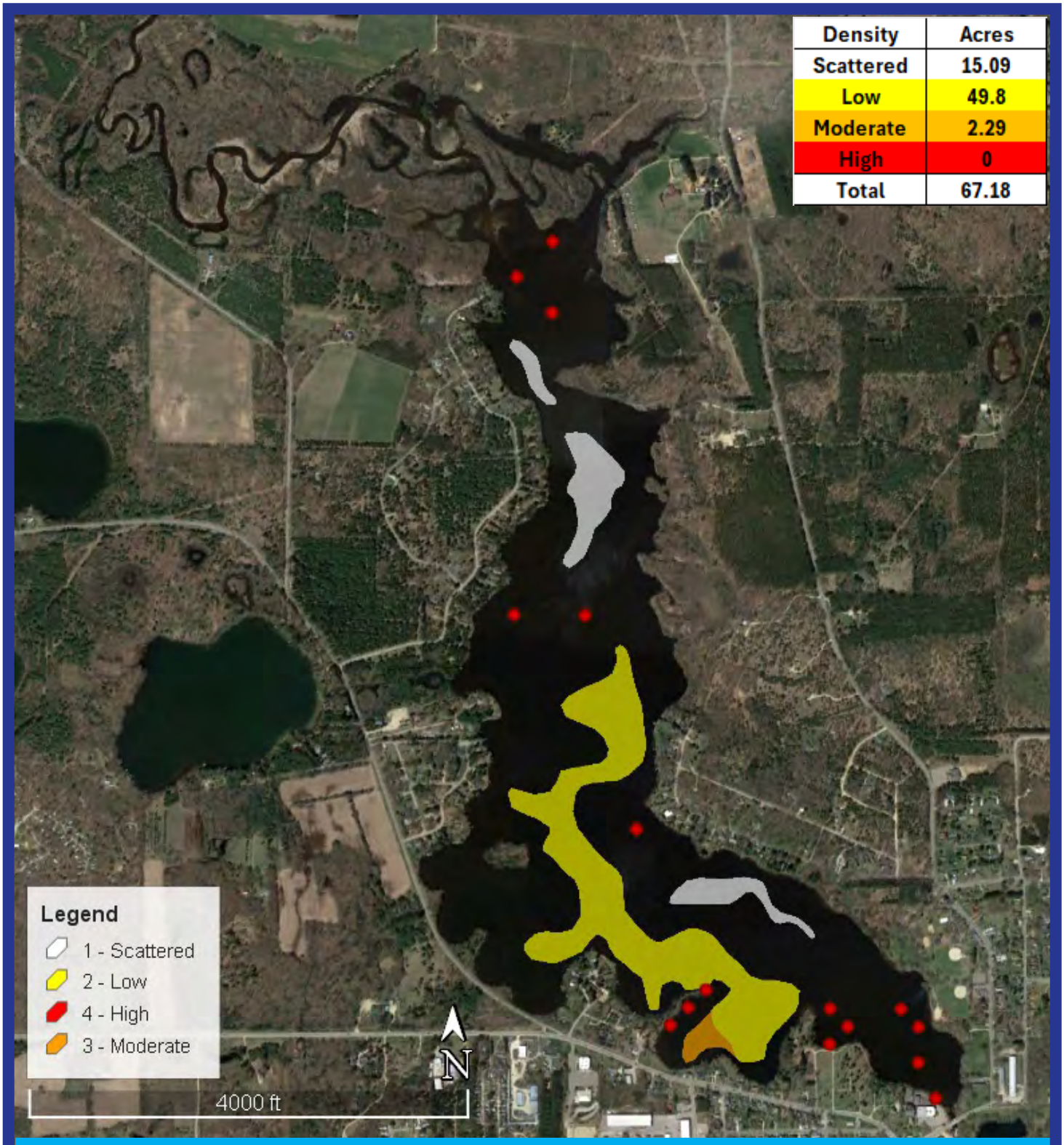
Fig 2
Montello Lake
Marquette Co., WI
Surveyed: 08/12/24



Eurasian water-milfoil Locations

WISCONSIN
LAKE & POND RESOURCE

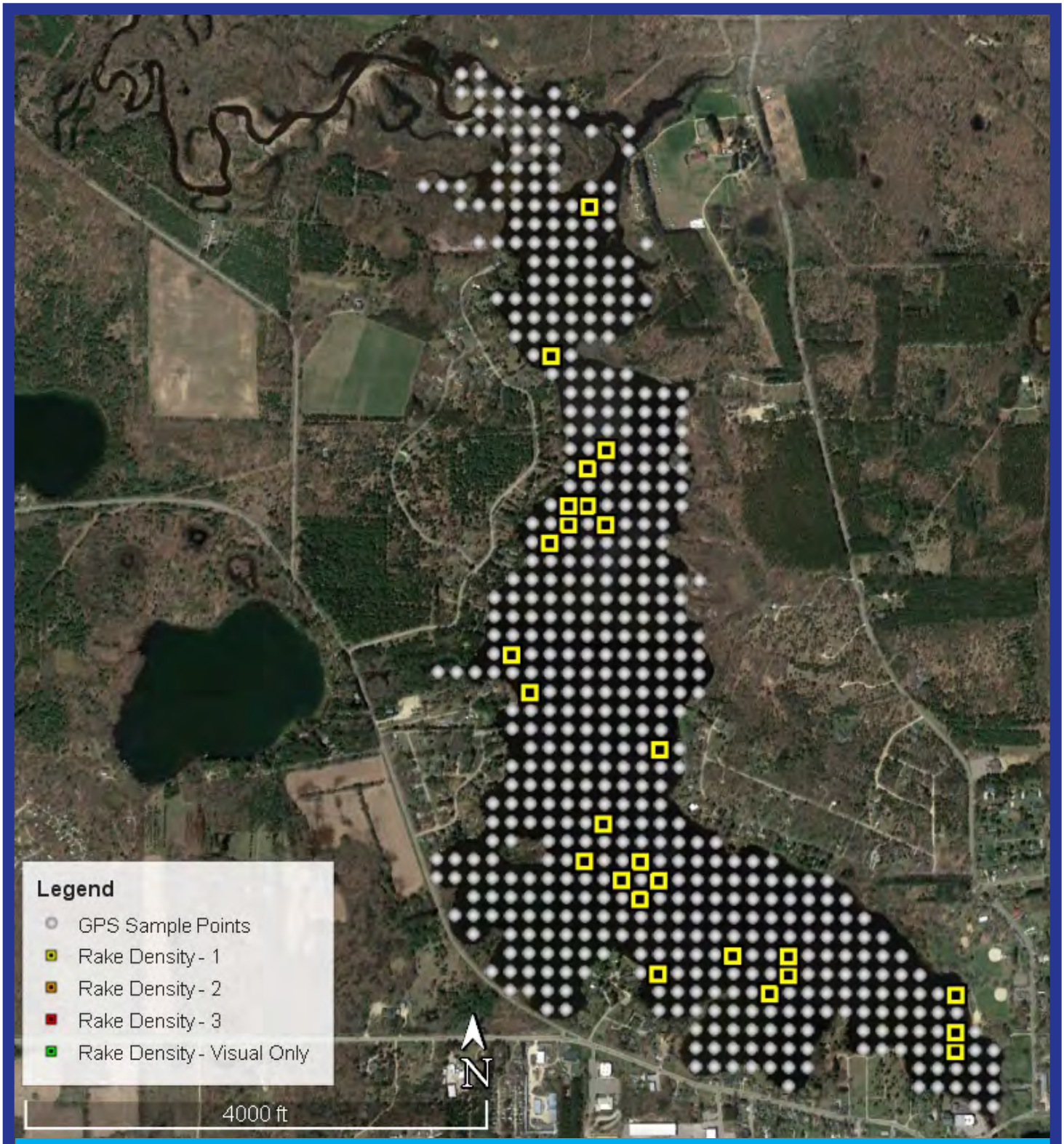
Fig 3
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Eurasian Water-milfoil Density

WISCONSIN
LAKE & POND RESOURCE

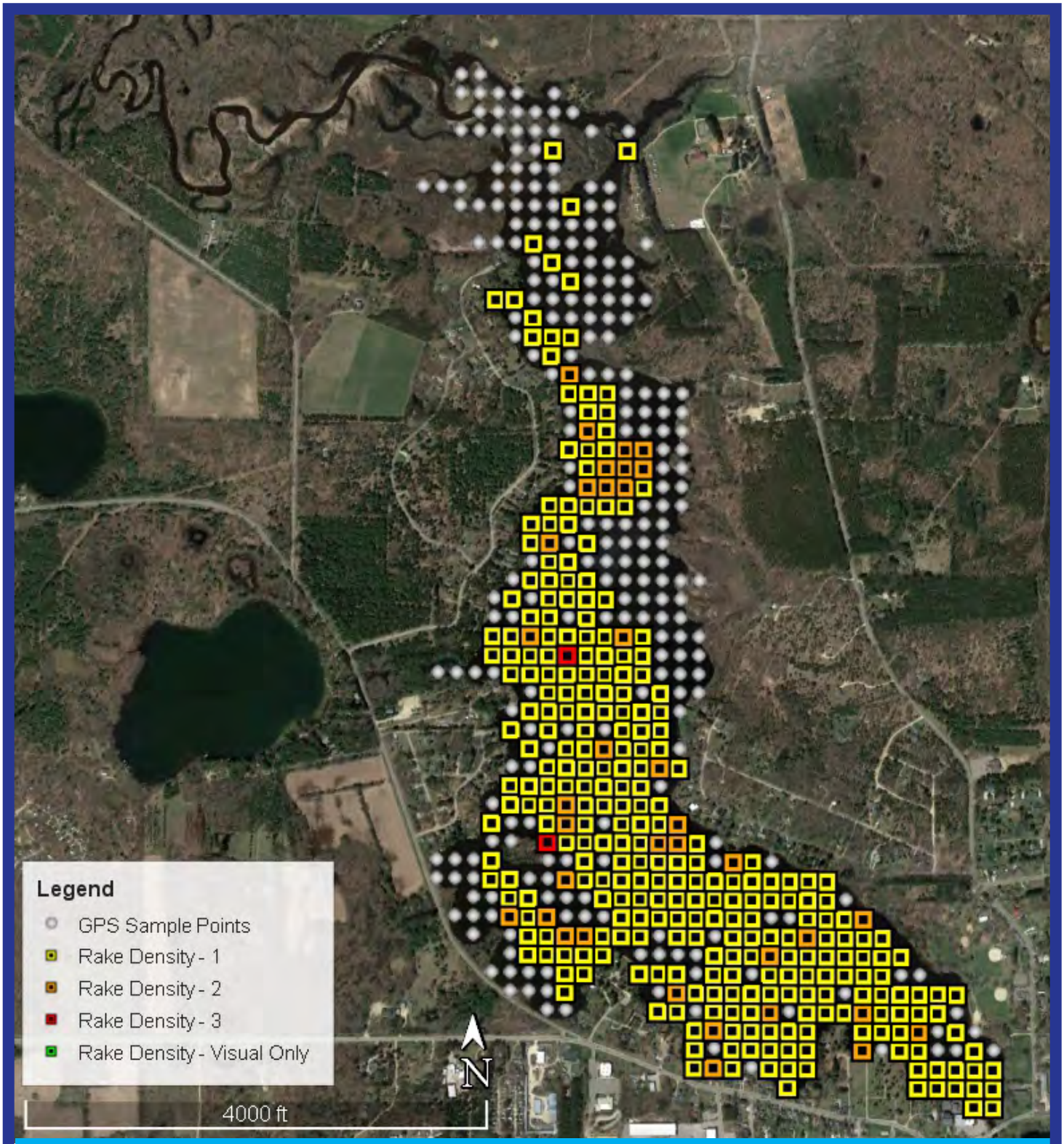
Fig 4
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Curly-leaf Pondweed Locations

WISCONSIN
LAKE & POND RESOURCE

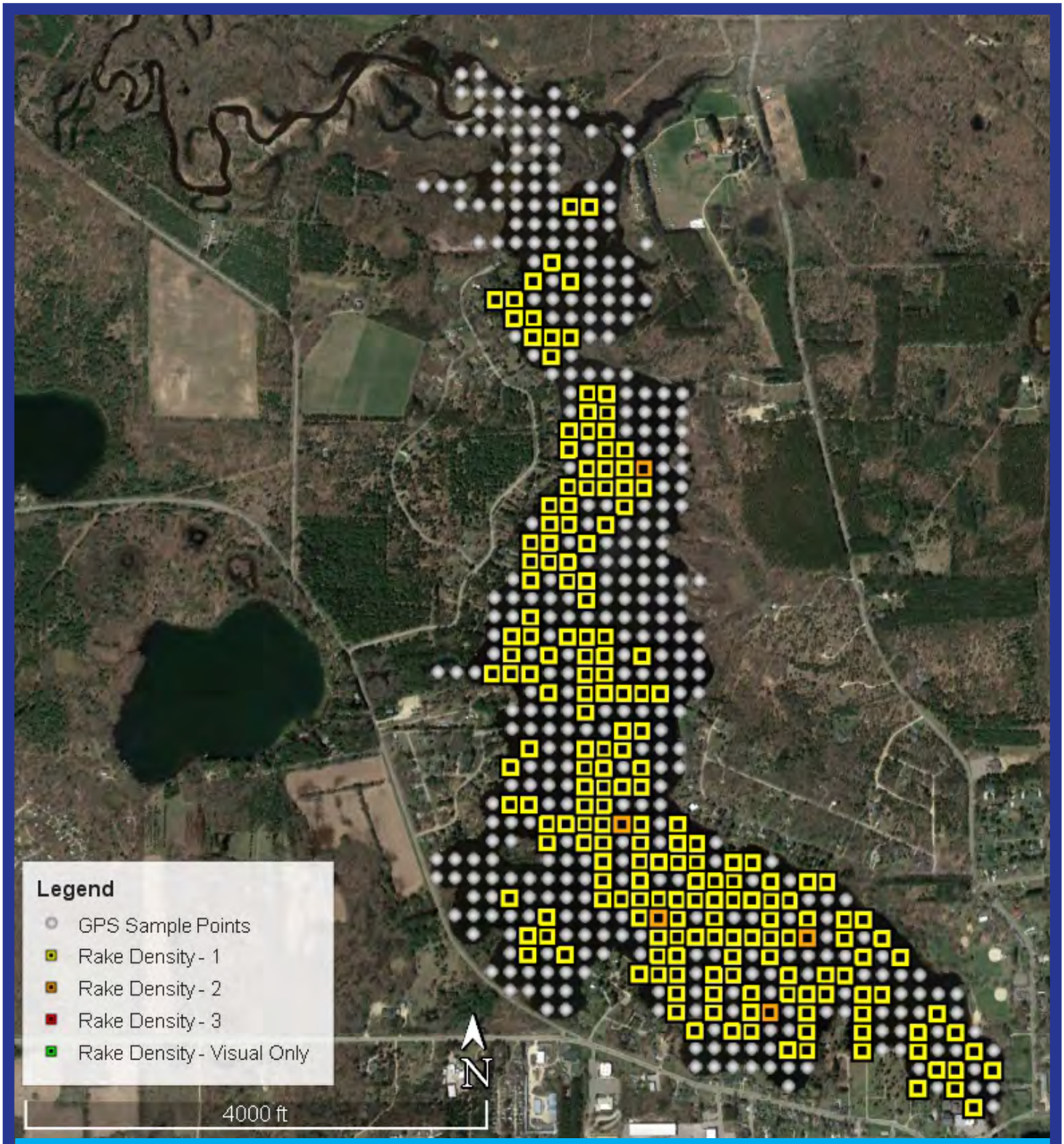
Fig 5
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Coontail Locations

WISCONSIN
LAKE & POND RESOURCE

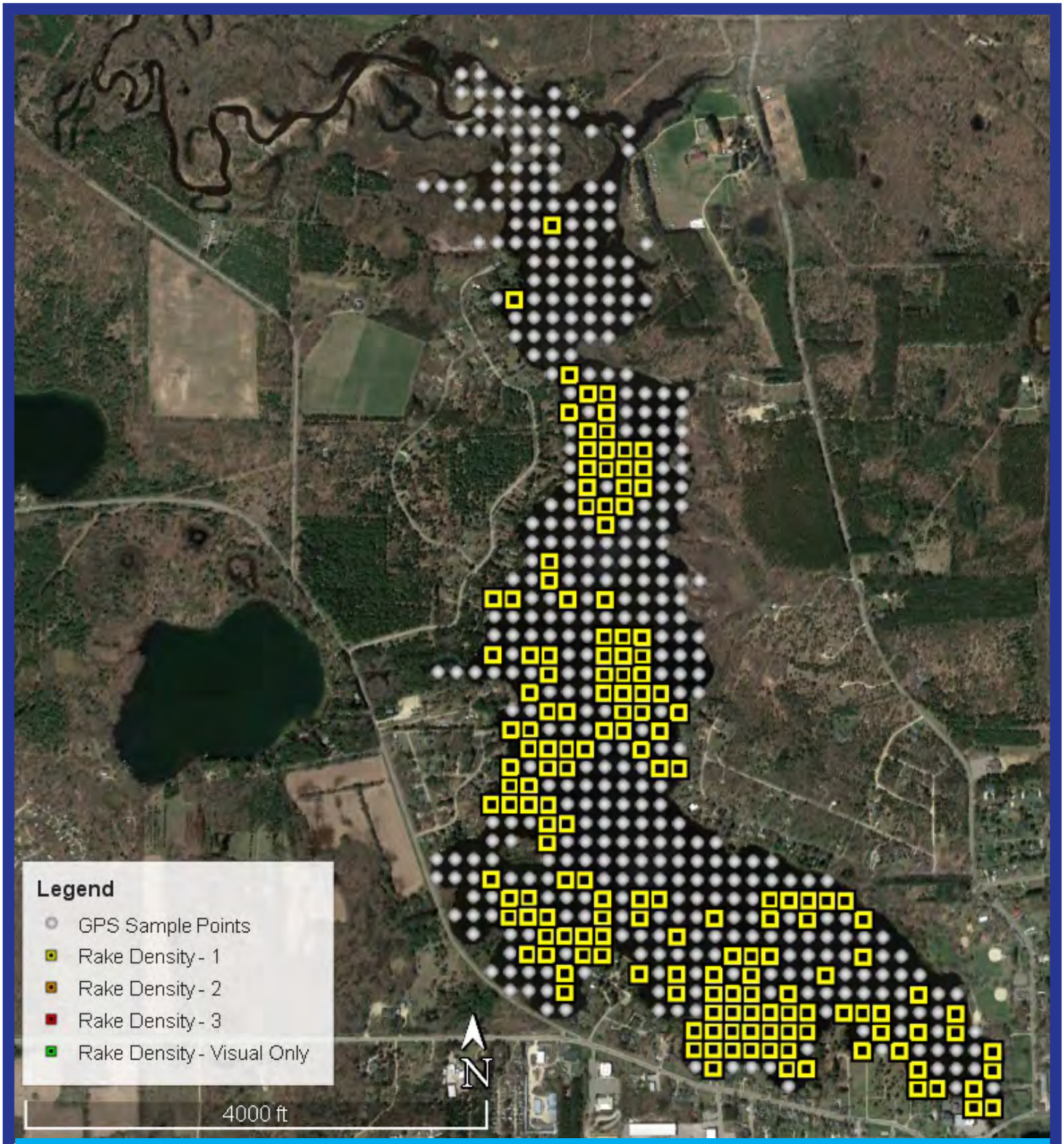
Fig 6
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Common Waterweed Locations

WISCONSIN
LAKE & POND RESOURCE

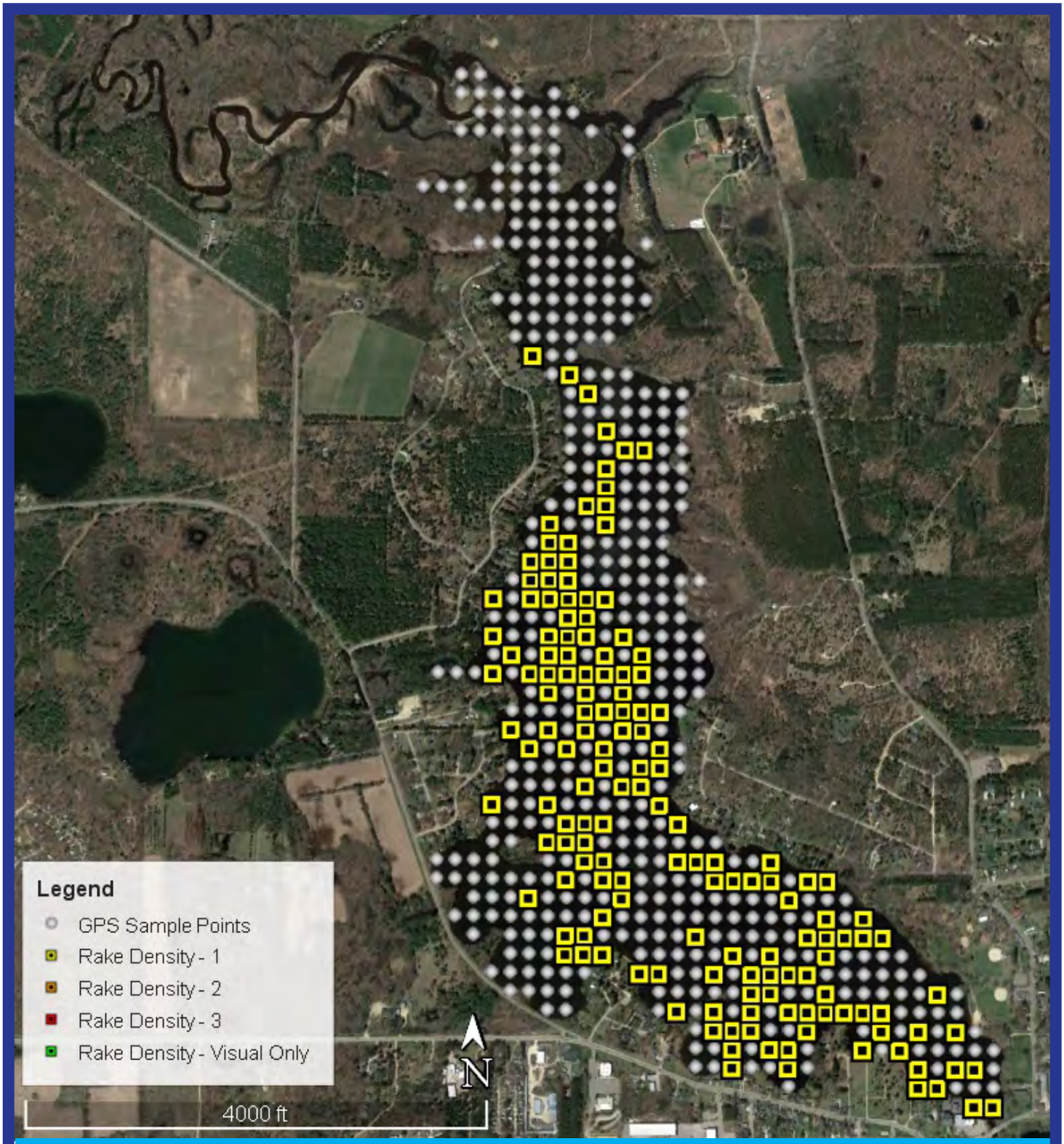
Fig 7
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Watermeal Locations

WISCONSIN
LAKE & POND RESOURCE

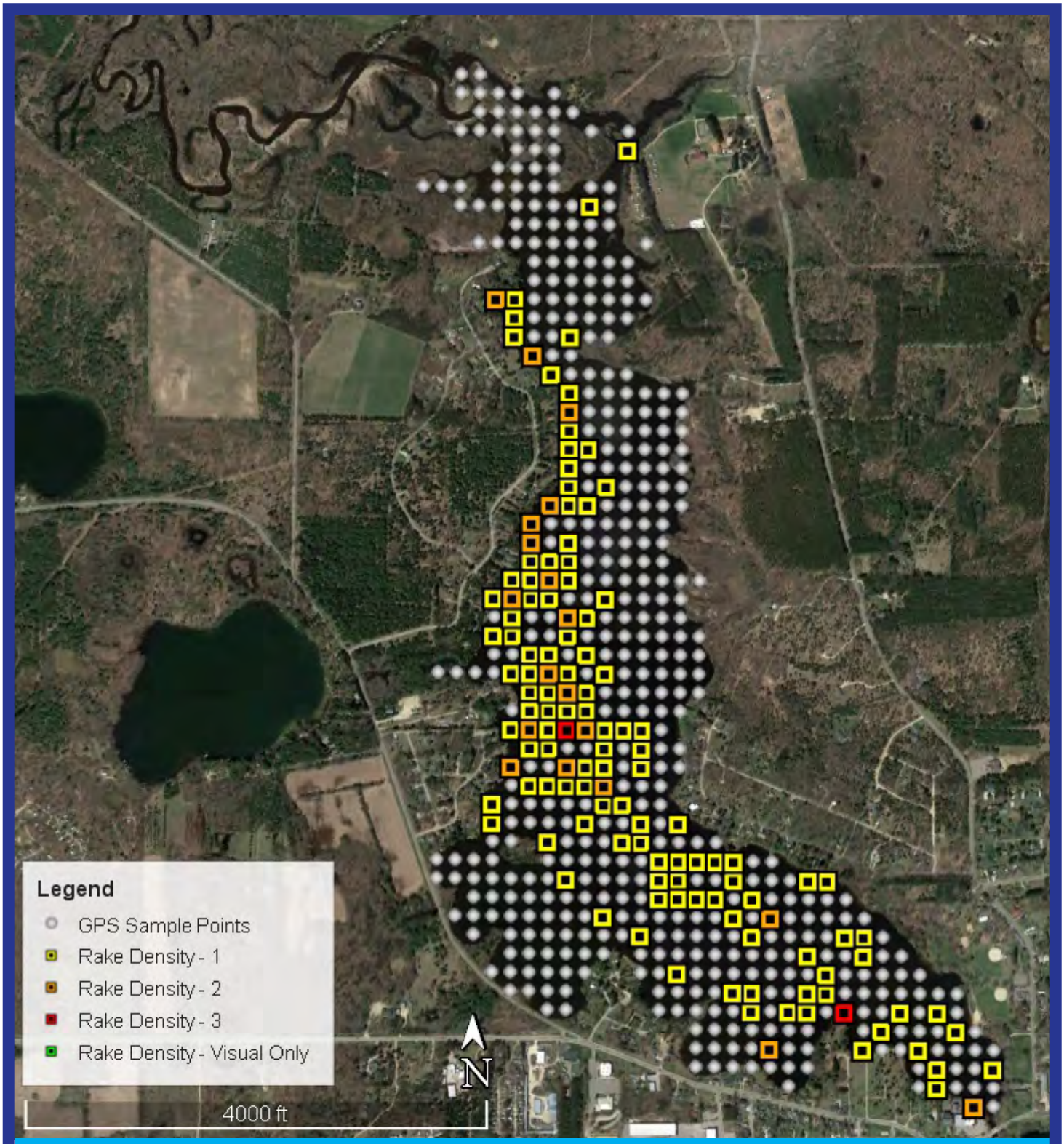
Fig 8
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Forked Duckweed Locations

WISCONSIN
LAKE & POND RESOURCE

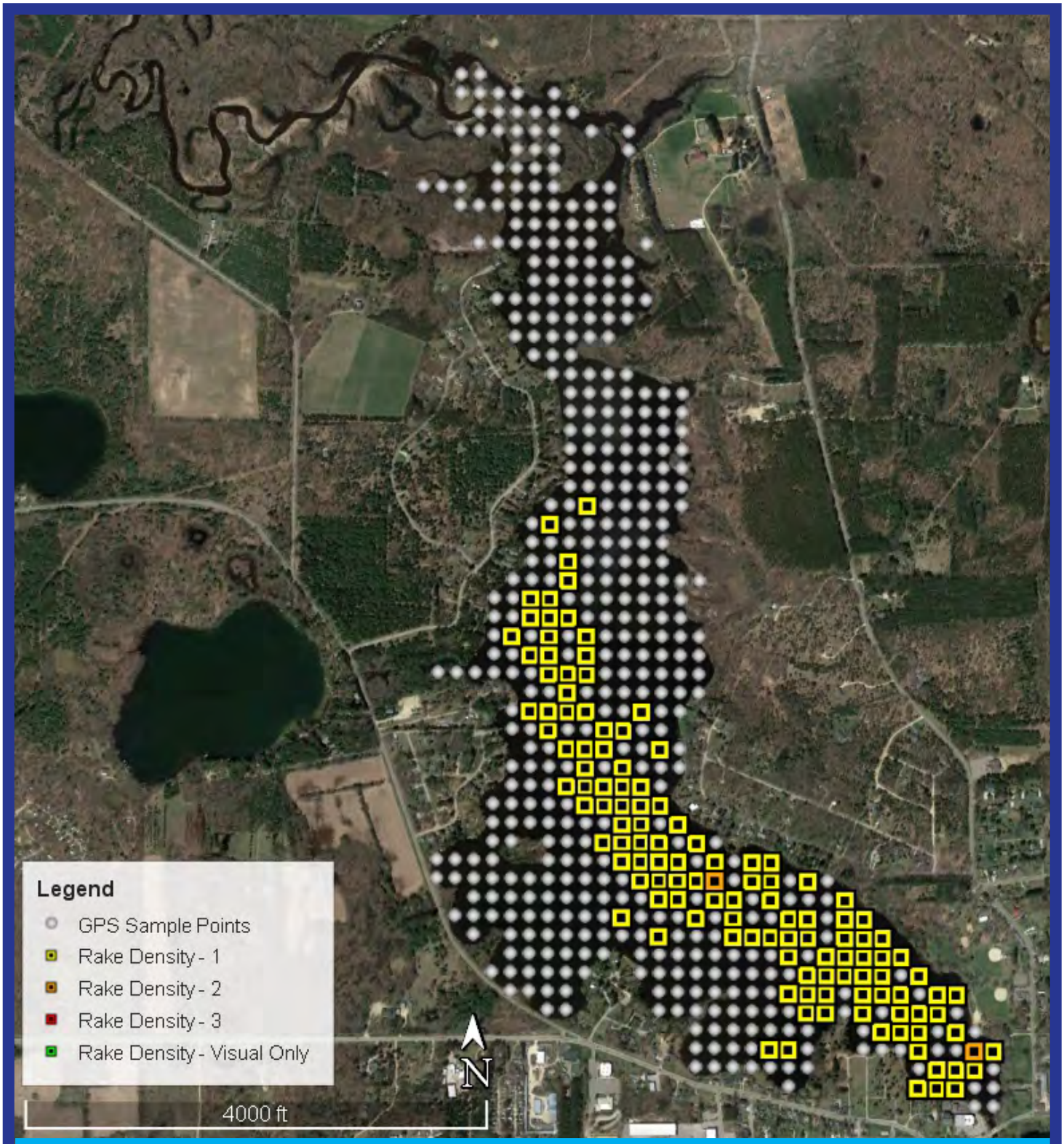
Fig 9
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Wild Celery Locations

WISCONSIN
LAKE & POND RESOURCE

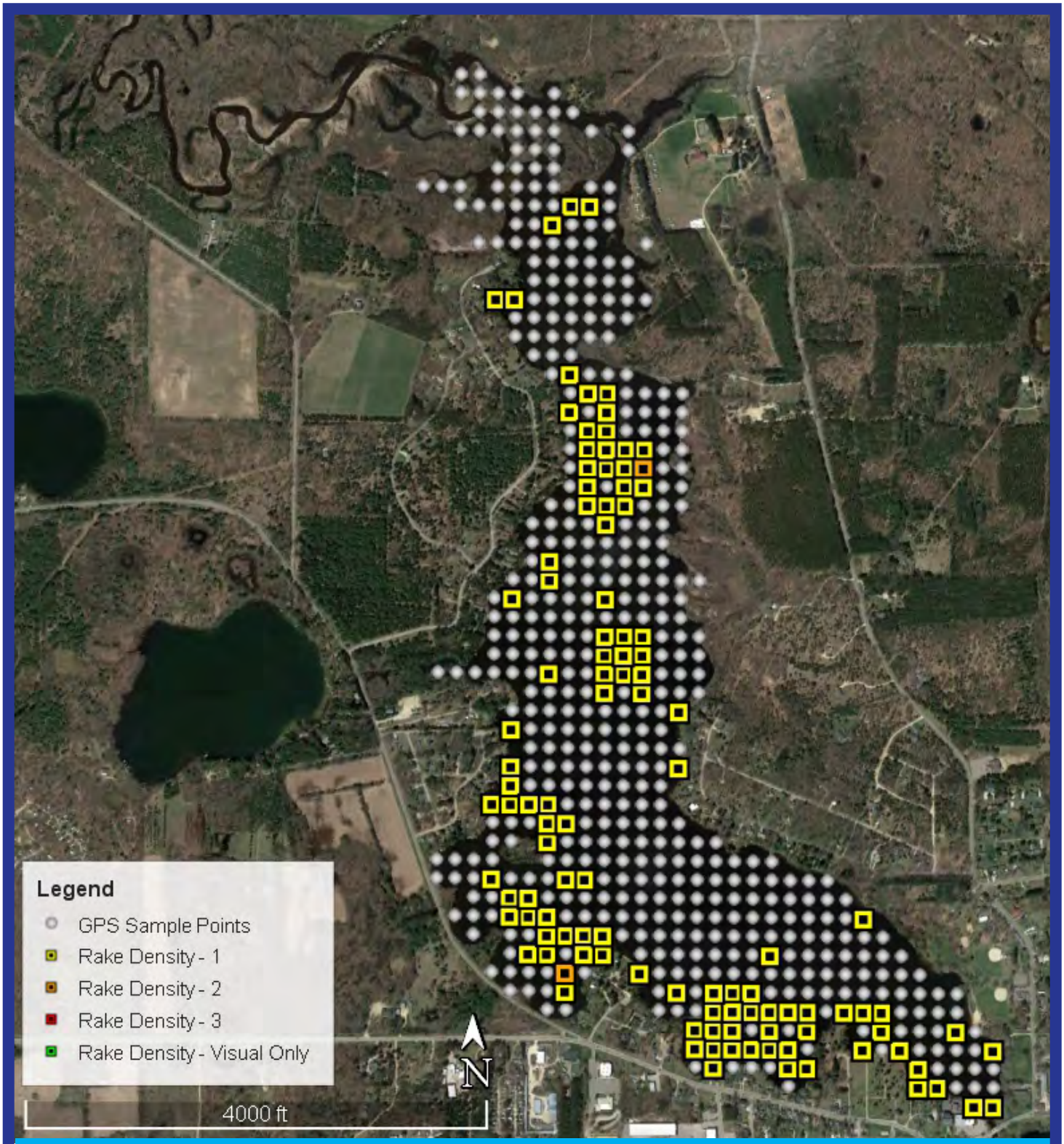
Fig 10
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Southern Naiad Locations

WISCONSIN
LAKE & POND RESOURCE

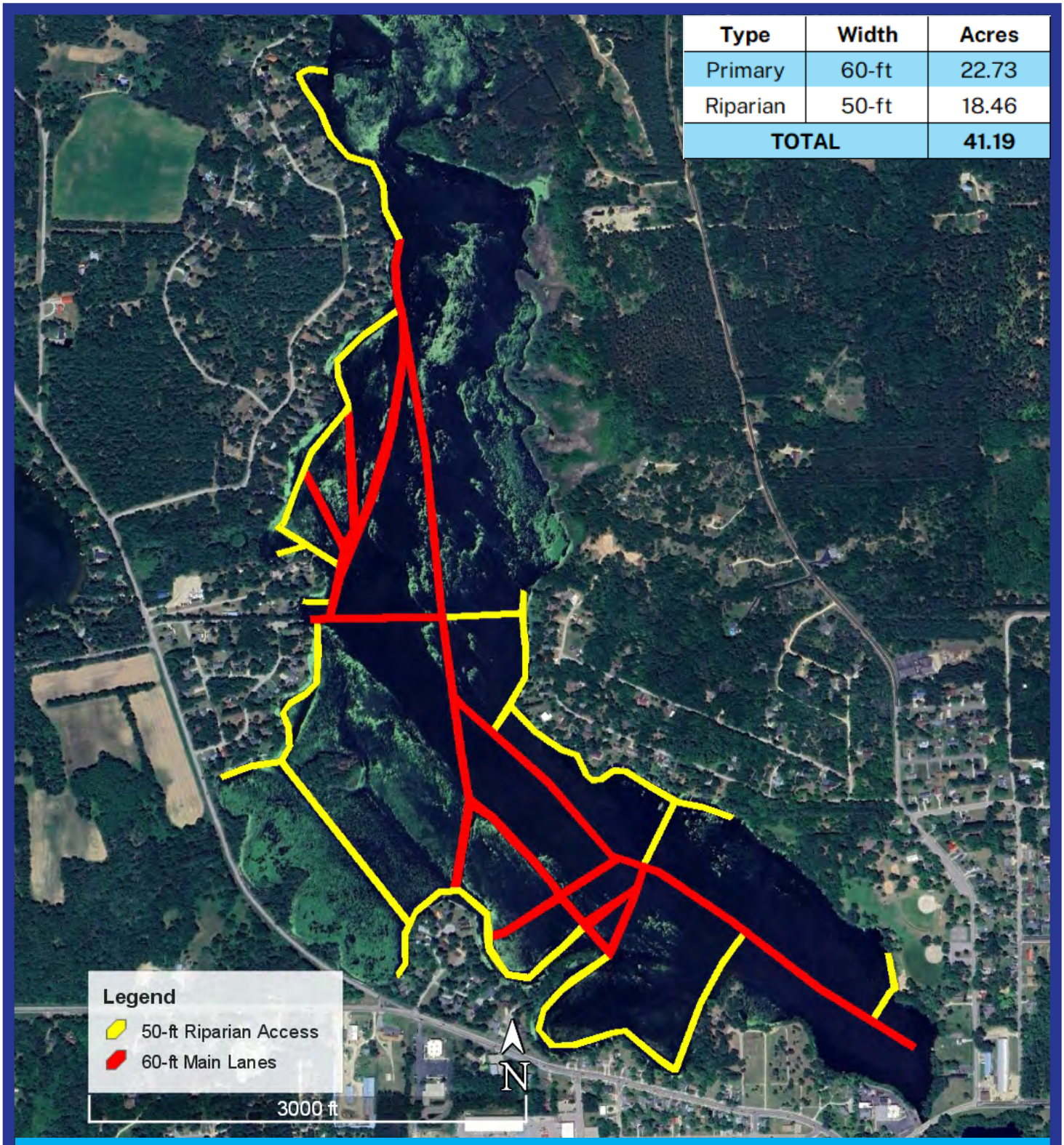
Fig 11
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Small Duckweed Locations

WISCONSIN
LAKE & POND RESOURCE

Fig 12
Montello Lake
Marquette Co. WI
Surveyed: 08/12/24



Mechanical Harvesting Locations

WISCONSIN
LAKE & POND RESOURCE

Fig 13
Montello Lake
Marquette Co., WI

TABLES

N7828 Town Hall Rd
Eldorado WI 54932

www.wisconsinlpr.com

Phone: (920) 872-2032
Fax: (920) 872-2036

Table 4: Aquatic Plant Community Statistics, Montello Lake, Marquette County, Wisconsin

	2011*	2013	2014	2015	2016	2017	2024
Number of sites sampled**	471	472	498	494	497	437	397
Number of sites with vegetation	432	464	259	427	482	405	383
Number of sites shallower than maximum depth of plants	454	468	495	472	497	437	397
Frequency of occurrence at sites shallower than maximum depth of plants (%)	95.15	99.15	52.32	90.47	96.98	92.68	96.47
Simpson Diversity Index	0.89	0.86	0.87	0.9	0.83	0.87	0.9
Maximum Depth of Plants (Feet)	9	11	11	8.5	12	12.5	12.5
Taxonomic Richness (Number Taxa - includes visuals)	23	24	20	27	19	23	24
Average Number of Species per Site (less than max depth of plant growth)	3.48	3.49	0.93	2.92	2.94	3.95	4.11
Average Number of Species per Site (sites with vegetation)	3.67	3.54	1.79	3.23	3.05	4.26	4.26
Average Number of Native Species per Site (less than max depth of plant growth)	2.83	2.92	0.91	2.54	2.74	3.61	3.74
Average Number of Native Species per Site (sites with vegetation)	3.22	2.99	1.78	2.88	2.84	3.89	3.88

*Surveys before 2011 were not full-point intercept and are not included

**Not all 576 sites could be reached due to navigation issues caused by shallow water and/or dense plant growth

Table 6: Frequency of Occurrence of Aquatic Plant Species by Year, Montello Lake, Marquette County, Wisconsin.

Species	Frequency of Occurrence by Year^						
	2011	2013	2014	2015	2016	2017	2024
Hybrid water-milfoil	**38.11**	**55.77**	**0.2**	**27.97**	**20.32**	**33.18**	**29.97**
Curly-leaf pondweed	**4.63**	**0.64**	**2.02**	**9.96**	**---**	**1.14**	**6.55**
Coontail	86.34	88.89	9.09	43.01	67.61	81.24	82.87
Muskgrass	---	---	---	3.39	1.01	---	---
Common waterweed	34.58	20.94	1.21	52.33	79.68	57.67	50.38
Water star-grass	3.96	3.85	13.94	26.06	4.83	6.86	7.30
Small duckweed	38.33	33.12	8.08	17.80	12.68	51.26	28.46
Forked duckweed	0.22	---	---	---	---	---	38.79
Northern water-milfoil	0.88	---	---	---	---	---	---
Slender naiad	1.76	1.71	1.62	6.36	7.04	11.21	---
Southern naiad	---	---	---	---	---	0.23	32.49
American lotus	2.2	0.85	2.22	1.69	3.02	1.37	1.51
Spatterdock	1.32	0.64	0.81	0.42	1.01	0.92	0.76
White water lily	17.18	23.93	18.59	15.89	8.25	16.68	7.05
Alpine pondweed	8.37	2.56	---	---	---	---	---
Large-leaf pondweed	0.22	---	---	---	---	0.23	1.51
Frie's pondweed	---	---	---	0.21	---	---	---
Leafy pondweed	---	---	---	---	---	0.23	6.55
Illinois pondweed	0.88	2.35	---	1.06	---	0.23	4.03
Floating-leaf pondweed	---	1.28	0.2	1.91	0.60	0.46	---
Long-leaf pondweed	6.17	2.78	3.03	3.18	2.21	5.03	1.01
White-stem pondweed	---	---	---	0.21	---	---	0.50
Small pondweed	---	---	---	2.33	---	---	---
Stiff pondweed	---	---	---	0.21	---	---	---
Flat-stem pondweed	14.54	10.04	1.01	8.69	2.21	2.52	13.85
White water crowfoot	0.44	1.5	0.4	6.14	1.21	1.60	2.02
Large duckweed	0.22	17.52	2.22	2.75	0.20	10.30	10.08
Sago pondweed	0.88	0.21	---	4.03	0.80	2.06	0.76
Cattail	---	0.21	0.2	---	---	---	---
Common bladderwort	---	---	---	0.21	---	---	---
Wild celery	30.4	30.98	19.8	40.04	48.49	50.57	34.01
Common watermeal	35.24	48.5	7.47	15.47	33.60	55.84	41.31
Horned pondweed	---	0.21	0.4	---	---	---	---
Southern wild rice	---	2.14	1.01	0.64	0.60	1.14	1.01
Filamentous algae	22.03	29.27	---	1.48	---	61.56	---

* - recorded as visual only

--- - species not sampled

^ - surveys prior to 2011 were not completed as point-intercepts and are not included

Table 7: FQI Breakdown by species for Montello Lake, Marquette County, Wisconsin

	Coefficient of Conservatism						
Common Name	**2011**	**2013**	**2014**	**2015**	**2016**	**2017**	**2024**
Coontail	3	3	3	3	3	3	3
Muskgrass	---	---	---	7	7	---	---
Common waterweed	3	3	3	3	3	3	3
Water star-grass	6	6	6	6	6	6	6
Small duckweed	4	4	4	4	4	4	4
Forked duckweed	6	---	---	---	--	---	6
Northern water-milfoil	6	---	---	---	---	---	---
Slender naiad	6	6	6	6	6	6	---
Southern naiad	---	---	---	---	---	8	8
American lotus	7	7	7	7	7	7	7
Spatterdock	6	6	6	6	6	6	6
White water lily	6	6	6	6	6	6	6
Alpine pondweed	9	9	---	---	---	---	---
Large-leaf pondweed	7	---	---	---	---	7	7
Frie's pondweed	---	---	---	8	---	---	---
Leafy pondweed	---	---	---	---	---	6	6
Illinois pondweed	6	6	---	6	---	6	6
Floating-leaf pondweed	---	5	5	5	5	5	---
Long-leaf pondweed	7	7	7	7	7	7	7
White-stem pondweed	---	---	---	8	---	---	8
Small pondweed	---	---	---	7	---	---	---
Stiff pondweed	---	---	---	8	---	---	---
Flat-stem pondweed	6	6	6	6	6	6	6
Stiff water crowfoot	8	8	8	8	8	---	---
White water crowfoot	---	---	---	---	---	8	8
Large duckweed	5	5	5	5	5	5	5
Sago pondweed	3	3	---	3	3	3	3
Cattail	---	1	1	---	---	---	---
Common bladderwort	---	---	---	7	---	---	---
Wild celery	6	6	6	6	6	6	6
Common watermeal	5	5	5	5	5	5	5
Horned pondweed	---	7	7	---	---	---	---
Southern wild rice	---	8	8	8	8	8	8
Total Species	20	21	18	24	18	21	21
Mean C	5.75	5.57	5.50	6.04	5.61	5.76	5.90
Floristic Quality Index (FQI)	**25.71**	**25.53**	**23.33**	**29.60**	**23.81**	**26.40**	**27.06**