AMENDMENT
Aquatic Plant Management Plan, Lake Monona and Monona Bays, Lower Rock River Basin, Dane County Wisconsin

Approved by the Dane County Lakes and Watershed Commission on April 10, 2014 and by the Wisconsin Department of Natural Resources on March 27, 2014

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Plant surveys conducted by James Scharl of Stantec Consulting Services Inc. in 2011 for the Dane County Office of Lakes and Watersheds. The Wisconsin Department of Natural Resources provided funding to the Office of Lakes and Watersheds to support this plan amendment.

Introduction

This is an update to the Aquatic Plant Management Plan, Lake Monona, Lower Rock River Basin, Dane County Wisconsin, published in December 2011 by the Dane County Office of Lakes and Watersheds. The Wisconsin Department of Natural Resources approved the 2011 plan in December 2011. Aquatic Plant Management Plans are required under NR 109.04(d), Wisconsin Administrative Code, to guide mechanical harvesting activities and the effective management of aquatic plants in water bodies.

This plan is prepared in support of Dane County's permit for its mechanical aquatic plant harvesting program, operated in accordance with NR 109 Wisconsin Administrative Code. Individuals and groups that propose herbicide treatments of aquatic plants in Dane County waters would need to go through a separate planning and permitting process with the Wisconsin Department of Natural Resources.

Recent Plant Survey Methods and Results

Dane County contracted with Stantec Consulting Services Inc. to conduct the aquatic plant community of Lake Monona on August 3-4, 2011 and Monona Bays on July 28, 2011.

Stantec followed state protocols and used the point intercept method. Refer to the point intercept maps in the 2011 plan for the sampling locations for the Monona and Monona Bays surveys.

Tables 1 and 2 below indicate species present during the 2011 survey for Lake Monona and Monona Bays, respectively, and Figures 1 and 2 indicate species richness from 2008-2011 for Monona and Monona Bays.

Species richness is a count of the total number of different plant species found in a lake. Generally, the better the water quality the higher the species richness count.

Appendix A includes Lake Monona plant statistics from the 2011 Stantec survey. Appendix B includes Monona Bay plant statistics from the 2011 Stantec survey. Appendix C includes mapped plant distributions for Lake Monona and Monona Bay from 2011.

Table 1. Species present during 2011 aquatic plant survey – Lake Monona

Genus	Species	Common Name	Category
Algae	*sp.*	Filamentous algae	Submersed
Ceratophyllum	*demersum*	Coontail	Submersed
Chara	*sp.*	Muskgrass	Submersed
Elodea	*canadensis*	Common waterweed	Submersed
Heteranthera	*dubia*	Water star-grass	Submersed
Lemna	*minor*	Small duckweed	Free floating
Myriophyllum	*spicatum*	Eurasian watermilfoil	Submersed-Invasive
Nelumbo	*lutea*	American lotus	Emergent
Potamogeton	*crispus*	Curly-leaf pondweed	Submersed - Invasive
Potamogeton	*richardsonii*	Clasping-leaf pondweed	Submersed
Potamogeton	*zosteriformis*	Flat-stem pondweed	Submersed
Ranunculus	*aquatillis*	Stiff water crowfoot	Submersed
Vallisnera	*americana*	Wild celery	Submersed
Zannichellia	*palustris*	Horned pondweed	Submersed

Figure 1. Species richness – Lake Monona 2008-2011

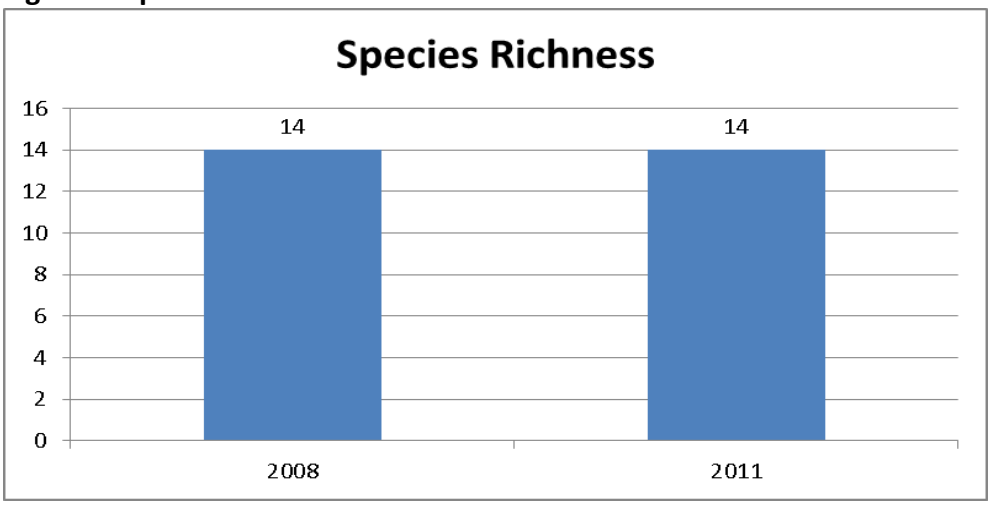
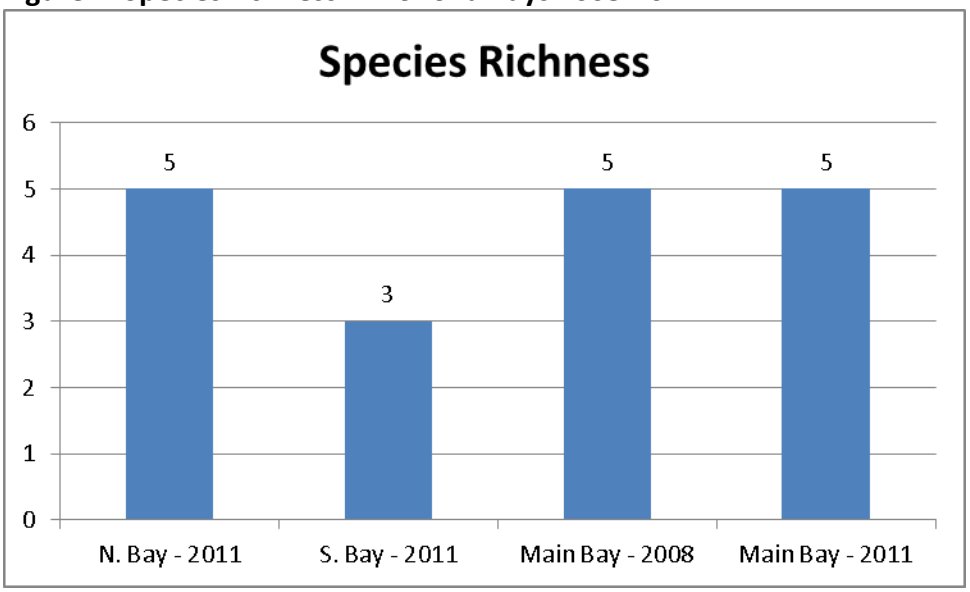


Table 2. Species present during 2011 aquatic plant survey – Monona Bays

Genus	Species	Common Name	Category	Locations Sampled
Ceratophyllum	*demersum*	Coontail	Submersed	All Bays
Elodea	*canadensis*	Common waterweed	Submersed	N & S Bays only
Myriophyllum	*spicatum*	Eurasian watermilfoil	Submersed-Invasive	All Bays
Potamogeton	*crispus*	Curly-leaf pondweed	Submersed-Invasive	N Bay only
Potamogeton	*pusillus*	Small pondweed	Submersed	Main Bay only
Stuckenia	*pectinata*	Sago pondweed	Submersed	Main Bay only
Zannichellia	*palustris*	Horned pondweed	Submersed	Main & N Bays only

Figure 2. Species richness – Monona Bays 2008-2011



Species richness is a count of the total number of different plant species found in a lake. The higher the species richness value the better, and generally better quality results in higher species richness values.

Discussion of historical plant community changes

Definition of terms used in this section

Statistical and limnological terms (e.g. Floristic Quality Index, Coefficient of Conservatism) used in this section are more fully described in the 2011 Lake Monona and Monona Bays aquatic plant management plan. Please refer to that plan for additional background.

Maximum depth of plant growth is the deepest depth at which plants were found in the lake. This is a function of water clarity. The clearer the water, the better the light penetration and

presumably the deeper plants are able to grow. Not all plants grow in deep water. Some may prefer the shallower parts of the lake, but with clearer water the opportunity to grow deeper is available. Oligotrophic lakes (very clear water lakes) will have some plants growing in waters deeper than 20 feet. Hypereutrophic lakes (the opposite of oligotrophic) are characterized by excessive algal blooms and turbid poor water quality and clarity. Rooted plants are few, and restricted to either unusual weather conditions or very shallow water where light can penetrate. Plant diversity is usually restricted to species that can tolerate poor water clarities.

Frequency of occurrence is calculated by taking the total number of times a species is sampled divided by the total number of points at which depth was less than or equal to the maximum depth of plant growth.

The photic zone is the area where light penetrates enough to support plant growth.

The Floristic Quality Index (FQI) is a metric that evaluates the closeness of the flora in a lake to that of an undisturbed condition. The higher a FQI value, the closer that plant community is to an undisturbed ecosystem. Just for reference, compare a lake's numbers to the statewide average (24) or ecoregion average (20)(lakes also within the Southeast Glacial Plans ecoregion - see map here http://dnr.wi.gov/topic/landscapes/documents/StateMaps/Map_S1_ELs.pdf), calculated from a subset of approximately 250 lakes across Wisconsin.

Coefficients of conservatism (C) range from 0 to 10 and represent an estimated probability that a plant is likely to occur in a landscape relatively unaltered from what is believed to be a pre-settlement condition (see the end of Table 3 in Appendix A). The lower numbers indicate more of a disturbed ecosystem, while the higher numbers indicate a community more like one that would have been found before human settlement.

Lake Monona

Lake Monona was last sampled in 2008. Since then, the aquatic plant community has seen little change. During both the 2008 and 2011 surveys, 14 species were found with coontail and Eurasian watermilfoil (EWM) being the two most prevalent species. There are a few, minor changes evident in the community as a whole and single species abundance.

Lake Monona was re-surveyed on August 3-4, 2011. For the 2011 plant community, maximum depth of plant growth decreased to 11 feet from 14 in 2008. This can potentially be caused by reduced water clarity either overall or in the particular year of the survey, which does vary from year to year. In turn, total frequency of occurrence at photic zone sites also decreased slightly from 80.53% to 74.01% in 2011. The Floristic Quality Index (FQI) and mean coefficient of conservatism (C) calculated both rose from 2008 to 2011. These values can be used to gauge the health of the lake and potentially show an increasingly healthy aquatic plant community on the lake.

Though 14 species were found during each survey, there were limited changes in species composition between the two. Muskgrass, horned pondweed, and flat-stem pondweed were all not identified during the 2008 survey but were present in 2011. Conversely, leafy pondweed, large duckweed, and sago pondweed were present in 2008 but not 2011. While these species were likely present during each survey, due to the relatively low frequency of occurrence and the dynamic nature of aquatic ecosystems their abundance may have changed slightly between the two surveys. Given this, the presence or absence of these species should not be a cause for concern, but should be monitored on future surveys.

Monona Bays

The Monona Bays (North, South, and the Main bay) have historically had limited aquatic plant communities present. This trend was again found during the 2011 aquatic plant surveys. A maximum of five species was found in North Bay and the Main Bay while only three species were found in South Bay. Historical data exists only for the Main Bay.

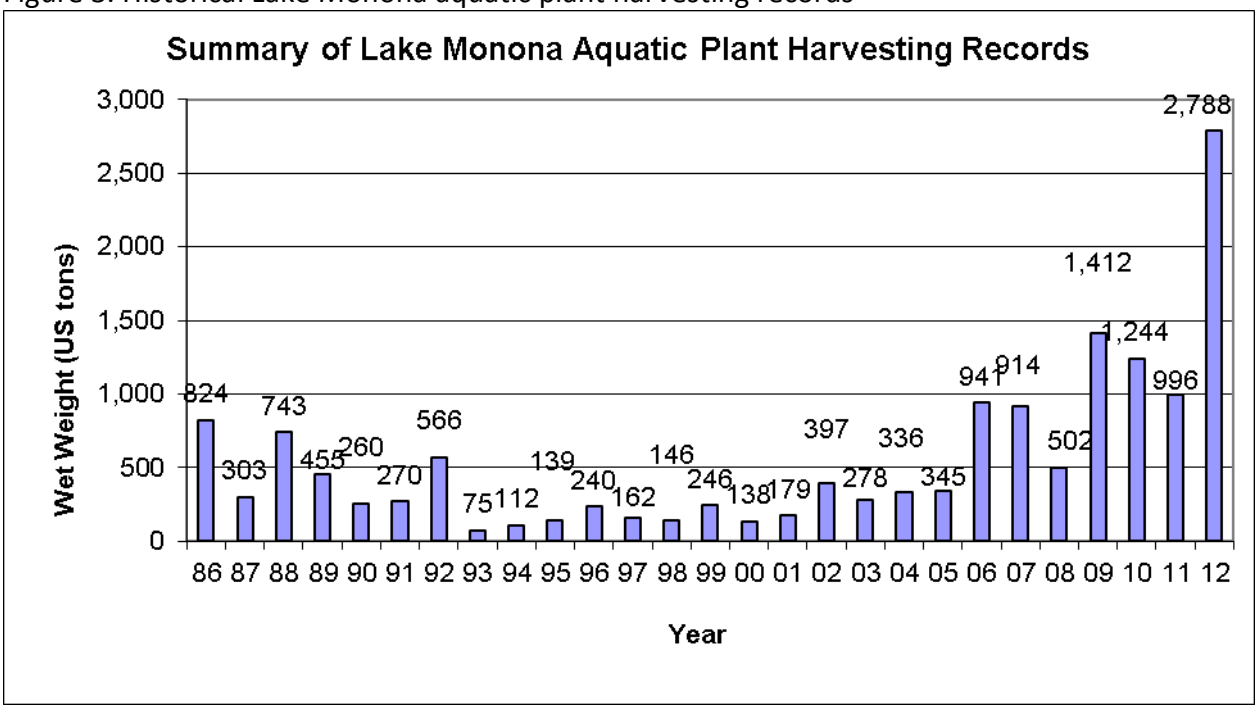
The aquatic plant communities of the Bays were resurveyed on July 28, 2011. For the 2011 plant community, maximum depth of plants remained consistent at 7-8 feet throughout all bays, but decreased from the 2008 maximum depth of 12 feet found in the Main Bay. Total frequency of occurrence at photic zone sites increasing varied from a low of 12.72% in the Main Bay to 42.11% and 48.65% in South and North Bays, respectively, in 2011. In 2008, total frequency of occurrence was at 35.69% in the Main Bay. From 2008, the FQI and average C was 6.93 and 4.00, respectively within the Main Bay. In 2011, this rose to 10.00 and 5.00. North Bay had a FQI of 7.51 and average C of 4.33 while South Bay had a FQI of 4.24 and average C of 3.00 in 2011. These values can be used to gauge the health of the lake and show a stable plant community with limited diversity.

Similar aquatic plant communities were present during each survey and in each respective bay. In all areas and throughout all surveys, coontail and EWM were the most prevalent plant species sampled. Within the Main Bay, small pondweed and horned pondweed were not identified during the 2008 survey but were present in 2011. Conversely, leafy pondweed and filamentous algae were present in 2008 but not 2011. While these species were likely present during each survey, due to the relatively low frequency of occurrence and the dynamic nature of aquatic ecosystems their abundance may have changed slightly between the two surveys. Given this, the presence or absence of these species should not be a cause for concern, but should be monitored on future surveys.

Recent Chemical and Harvesting Aquatic Plant Management Records

Figure 3 summarizes Dane County's mechanical harvesting operations in Lake Monona since 1986. Figure 4 indicates chemical treatments of aquatic plants by private entities. Figure 5 summarizes mechanical harvesting operations in Monona Bays since 1986. There have not been permitted chemical treatments in Monona Bay.

Figure 3. Historical Lake Monona aquatic plant harvesting records



Please note that, starting in 2006, Dane County changed the way it records total harvested plant weight. In the 2011 aquatic plant management plan for Lake Monona and Monona Bays, one truck load of harvested plants was equated with one ton. Beginning in 2006, Dane County uses a formula to more precisely estimate the wet weight of one truck load, expressed in U.S. tons. What may seem to be a dramatic increase in harvested plant amounts compared to 2005 and earlier is likely mostly due to this change in estimating harvested weights.

Figure 4. Historical Lake Monona chemical treatment records

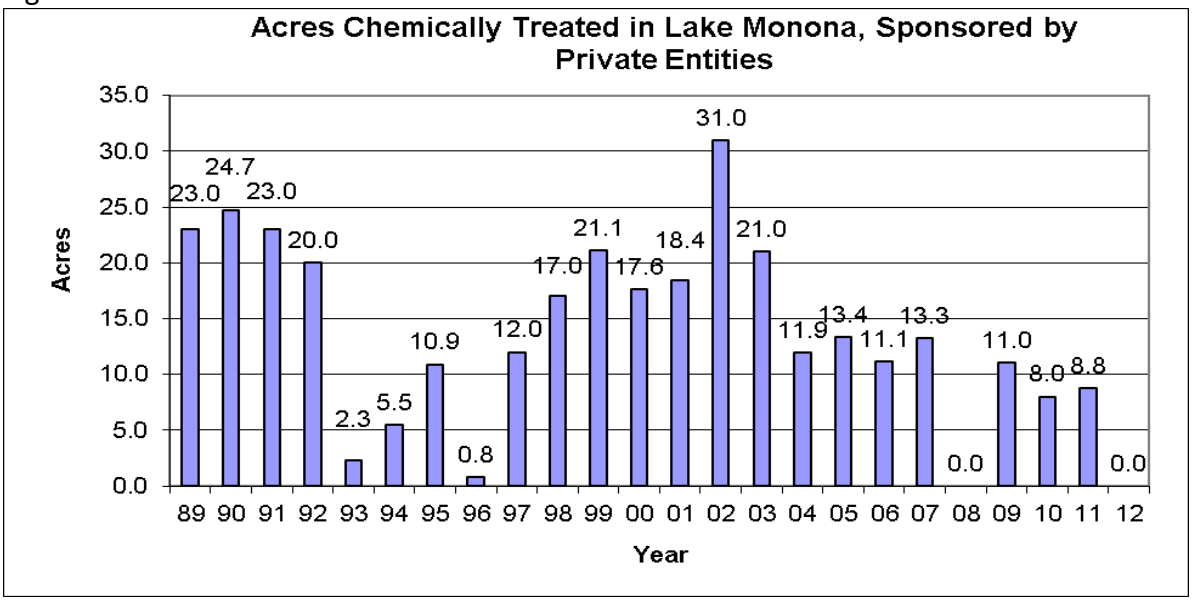
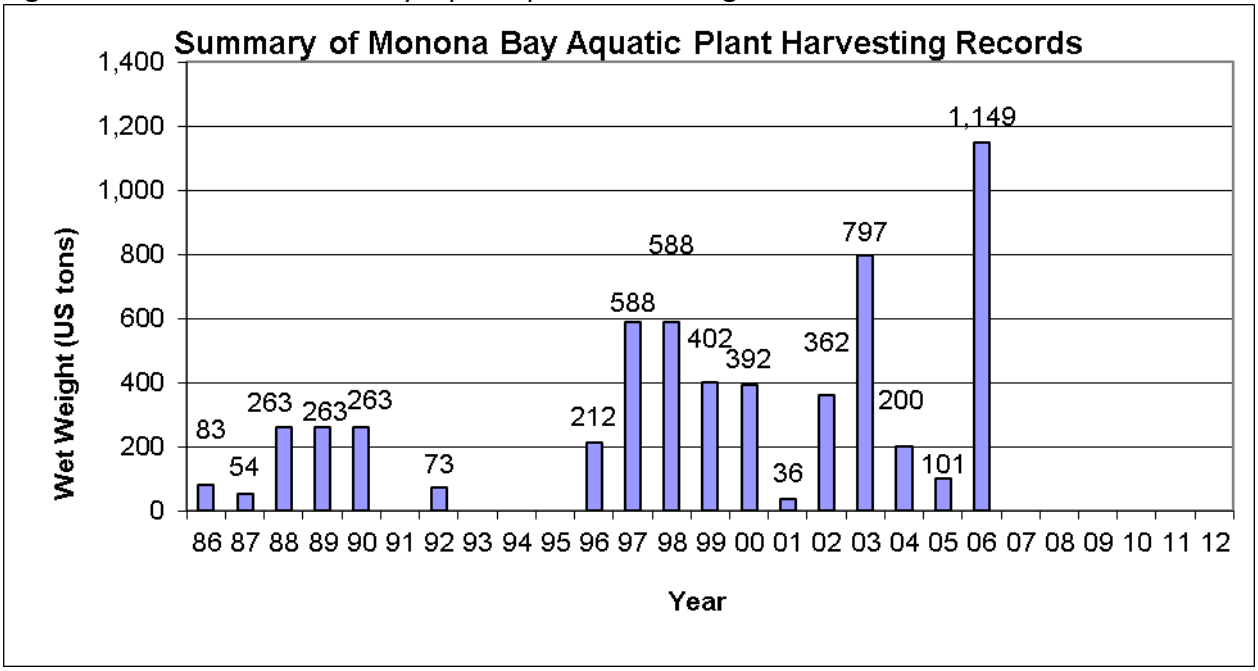


Figure 5. Historical Monona Bay aquatic plant harvesting records



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Public input opportunities

Dane County Land and Water Resources Department staff held a public information and input meeting on March 20, 2013, at the Middleton City Hall, with approximately five area residents present. The focus of the meeting was lakes Mendota and Monona; Fish, Indian and Crystal Lakes; Tenney, Warner and Vilas Lagoons. Attendees represented the Yahara Lakes Association and Lake Mendota and Monona residents who enjoy these lakes for recreation and aesthetics.

At this meeting, Dane County and DNR staff presented current plant data from Lake Monona and Monona Bays (the maps found in Appendix C), following an overview of the ecological importance of aquatic plants and the current harvesting operation. Dane County staff invited comments on suggested revisions to the plan goals, recommendations, and harvesting operations.

No specific suggestions were made about updating the 2011 plan's goals and recommendations.

Public comments were also solicited via email, press release, and the danewaters.com website. No direct emails or correspondence was received regarding Lake Monona and Monona Bays.

A draft plan amendment was posted on the www.danewaters.com website in spring 2013, and comments requested via email and other direct outreach to parties interested in this waterbody. No comments were received on the draft plan amendment for Monona and Monona Bays. The final draft plan amendment was posted for comment in spring 2014, and no comments were received.

Aquatic Plant Management in Dane County

The overall goal of Dane County's mechanical harvesting program is to cut and harvest Eurasian watermilfoil and other invasives to help provide for reasonable use of the lakes for boating, fishing and swimming, while preserving the health and balance of the lake ecosystem. During periods of high water, harvesting of plants in the Yahara River between lakes Waubesa and Kegonsa becomes the highest priority.

Aquatic plant growth varies from lake to lake and year to year. Dane County employs a Plant Scout to evaluate plant growth conditions and recommend appropriate harvesting in response, within the limits of the plan harvesting priority areas and DNR permit. In times of heavy plant growth, local residents often advocate for additional harvesting in their areas, harvesting longer into the season (into the fall), or dedicating a harvester for a particular waterbody. County managers need to balance staff and harvesting equipment resources and priorities with needs and ecological conditions countywide. Local groups or individuals always have the option of contracting with the county for additional harvesting and special event harvesting, within the boundaries of the permit. Additional information about contract harvesting is available here: www.countyofdane.com/lwrd/parks/aquatic_plant_harvesting2.aspx#garden.

Dane County, Wisconsin Department of Natural Resources, and the U.S. Army Corps of Engineers completed a research project in 2013 that evaluated the response of selective early-season herbicide application and cutting of aquatic plants on Turville Bay, the southwest area of Lake Monona, on Eurasian watermilfoil (EWM, an invasive aquatic exotic plant) and on native plant communities. The complete project report and a summary fact sheet are available at www.danewaters.com.

Eurasian watermilfoil begins growing early in the year, and creates a dense growth canopy which shades out native plant species. Cooperating scientists and managers wondered if controlling EWM early in the season would give an advantage to native plants. The research project found that both herbicide and harvested early-season treatment resulted in significant decreases in EWM. Mechanical harvesting produced more variable results, but better protected native coontail plants. The herbicide treatment resulted in longer control of EWM than mechanical harvesting.

One outcome of this research is that Dane County staff may identify small areas in larger lake systems for early-season mechanical harvesting to provide nuisance control of EWM, as resources and priorities permit.

Dane County holds annual training sessions for new and returning harvester operators before the harvesting season begins. In that training, permanent and seasonal staff receive instruction on many topics including aquatic invasive species prevention protocols, plant identification, and communications. The Lakes Management Supervisor directs the day-to-day operations of the staff, guided by the Parks Director who is informed of plant conditions and harvesting needs by the Plant Scout. Particular concerns with a water body; deep versus shallow harvesting; collection of plant fragments from harvesters, plant senesces, and boat propellers etc. are all addressed in the supervision.

Working closely with the Wisconsin Department of Natural Resources, the Dane County Land and Water Resources Department has developed harvesting priority maps that are included in many of the aquatic plant management plans and referred to in DNR harvesting permits issued to Dane County. Not every area that is identified for potential harvesting on the map will be harvested in any given harvesting season if there is little to no plant growth, because attention to higher priority areas does not permit it, or due to budget constraints. Harvester operators are instructed not to cut and remove plants outside of harvesting priority areas identified on these maps, unless authorized by their Supervisor in consultation with the Wisconsin Department of Natural Resources.

Harvesting machines are designed to collect and remove plant fragments. Dane County also helps clean up plant materials at beaches and other public access points, even when the plant material is not associated with harvesting operations.

Limits of the equipment, staff, and budget mean that plant harvesting for aesthetics, collection of wind-blown plant fragments due to boat propeller action, and the removal of plants that release from the sediment and float free in the fall cannot generally be accomplished. However, program managers do their best to accommodate requests for collection of naturally-occurring windblown and boat motor chopped plant fragments near shorelines, as time and budget permit. The Dane County Lake Management Operations Manual provides instructions to harvesting machine operators about plant fragment collection.

There is a common misperception that excessive external nutrients carried into lakes in runoff from the watershed causes macrophyte (large aquatic plant) problems. In fact, external nutrient loading usually produces algal blooms that shade and reduce macrophyte biomass. Attempts to control biomass by controlling nutrients in the water column are unproductive, according to G. Dennis Cooke and others in the third edition of Restoration and Management of Lakes and Reservoirs (2005). This is because rooted macrophytes, such as the nuisance Eurasian watermilfoil, usually get their phosphorus and nitrogen directly from sediments. In the short-term, reduced phosphorus in the water column resulting from watershed controls may actually

result in more macrophyte growth, because clearer water permits more light penetration that fosters plant growth.

It could take many years to reduce the historical nutrient additions to lake sediments especially in agricultural areas. Much important work is underway in the Yahara River watershed to reduce watershed phosphorus loadings. Long-term, scientists and managers hope that community efforts can reduce sediment phosphorus, thereby more directly affecting plant growth.

Recommended management for Lake Monona and Monona Bays

Dane County staff have reviewed the plant survey data and public input, and recommend the updated management elements found in this section.

Monona Goals

Because Eurasian watermilfoil has dominated the littoral zone (the shallow part of the lake where most of the rooted aquatic plants grow) for several decades, the goals for managing Lake Monona aquatic plants are to: (1) improve recreational access in the lake, (2) protect proposed Critical Habitat Areas defined under Wisconsin Administrative Codes, and (3) continue to restore documented and possible declines of high value species [NR 107.08(4)] in the lake including clasping-leaf pondweed (*Potamogeton richardsonii*), horned pondweed (*Zannichelia palustris*), wild celery (*Vallisneria Americana*) and sago pondweed (*Struckenia pectinatus*). Other important native plants that have declined in Lake Monona and also require protection include flat-stem pondweed (*P. zosteriformis*) yellow water lily (*Nuphar*), white water lily (*Nymphaea tuberosa*), American lotus (*Nelumbo lutea*), *Chara*, slender naiad (*Najas flexilis*), leafy pondweed (*Potamogeton foliosus*), and water stargrass (*Heteranthera dubia*). These overarching aquatic plant management goals are coupled with the more specific goals of Dane County's mechanical harvesting program: to cut and harvest Eurasian watermilfoil and other invasives to help provide for reasonable use of the lakes for boating, fishing and swimming, while preserving the health and balance of the lake ecosystem.

Monona Recommendations

1. Conduct large-scale mechanical harvesting in areas where EWM grows in dense monotypic stands. Goals for managing EWM are to improve boating access and fish habitat, and to expand native rooted plant species.
2. Consider options for reducing motorboat impacts to floating-leaf plants (American lotus and white water lily) in Turville Bay.
3. Consider expanding floating-leaf plant beds and introducing high value species (historically found in the lake) within sheltered bays.
4. The Dane County Plant Scout should document occurrences of high value native plants in regular scouting reports, including shoreline reference and GPS location. Dane

County staff should make an annual summary report of these occurrences available to the public.

5. Dane County's mechanical harvesting crews should continue to take steps to prevent the spread of exotic invaders across Dane County lakes and streams. These steps include removing any visible plants, mud, debris, water, fish or animals from the machinery and thoroughly washing the equipment.

Proposed Critical Habitat Areas

Wisconsin DNR's website describes the importance of the DNR's designation of Critical Habitat Areas as follows: "Every waterbody has critical habitat - those areas that are most important to the overall health of the aquatic plants and animals. Remarkably, eighty percent of the plants and animals on the state's endangered and threatened species list spend all or part of their life cycle within the near shore zone. As many as ninety percent of the living things in lakes and rivers are found along the shallow margins and shores. Wisconsin law mandates special protections for these critical habitats. Critical Habitat Designation is a program that recognizes those areas and maps them so that everyone knows which areas are most vulnerable to impacts from human activity. A critical habitat designation assists waterfront owners by identifying these areas up front, so they can design their waterfront projects to protect habitat and ensure the long-term health of the lake they where they live.

<u>Lake Monona</u>

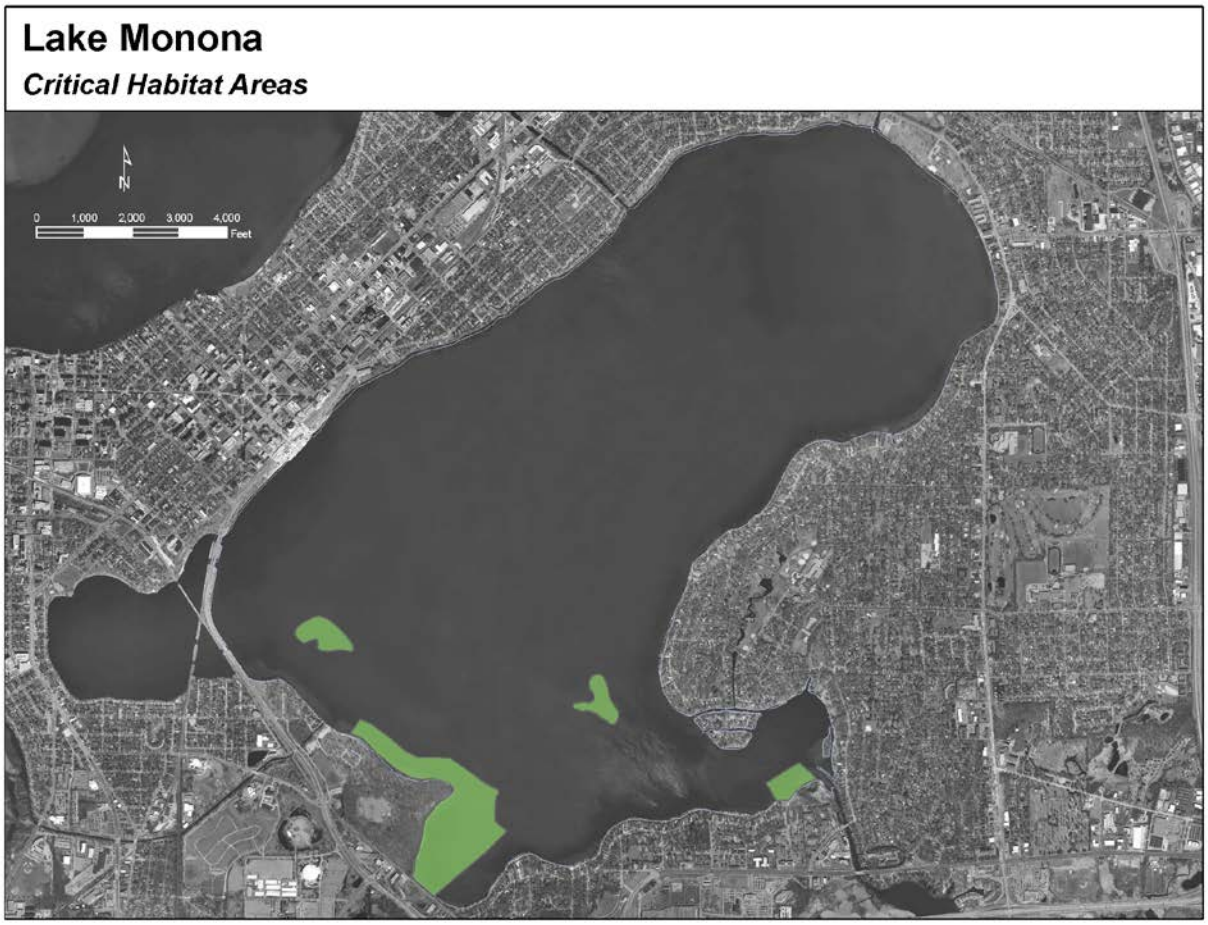
At this time, Dane County staff do not recommend any changes to the Lake Monona Critical Habitat Areas (formerly indicated as "sensitive areas" in the 2011 Aquatic Plant Management Plan). These areas already protect the undeveloped shoreline and offshore reef areas on the lake. Areas of emergent and floating-leaf vegetation, especially American lotus, have not deviated from those outlined in this report as well.

<u>Monona Bays</u>

Dane County staff recommend that the north shore on Monona Bay, recommended in 2011 as a "sensitive area," no longer have any Critical Habitat Area designation, as it occasionally is harvested to allow for recreational access.

Figure 6 indicates the amended combined Critical Habitat Area map for both Monona and Monona Bay.

Figure 6. Proposed Critical Habitat Areas for Lake Monona and Monona Bay



Harvesting Priorities

Dane County holds annual training sessions for new and returning harvester operators before the harvesting season begins. In that training, permanent and seasonal staff receive instruction on many topics including aquatic invasive species prevention protocols, plant identification, and communications. The Lakes Management Supervisor directs the day-to-day operations of the staff, guided by the Parks Director who is informed of plant conditions and needs by the Plant Scout. Particular concerns with a water body, deep v. shallow harvesting, collection of plant fragments from harvesters, plant senesces, boat propellers etc. are all addressed in the supervision.

Figure 7 is the updated mechanical harvesting priority map for Monona and Monona Bay. Additional background on harvesting priorities is found in the Lake Management Operations Manual and posted on the Office of Lakes and Watersheds website (www.danewaters.com). Annual training and daily supervision of harvester operators reinforce that plants should be harvested only from these planned areas, unless a variance from the plan has been approved

by Wisconsin DNR. Actual effort is dictated based on plant conditions, as evaluated and reported by Dane County's Plant Scout.

Changes to the priorities map from the 2011 plan:

- Added north and south Monona Bay as recreational harvest areas
- Changed area east of Hudson Beach on north shore of Monona from "undeveloped shoreline" to recreational cut
- Changed area offshore of Hudson beach from "fish habitat – no cut" to "experimental shallow cuts and filamentous algae control"
- Eliminated "no cut" distinctions for fish habitat and native plants – to streamline (fewer categories)
- Olbrich Beach – eliminated recreational cut corridor, as this area of the lake is too shallow to access with harvesters.
- West of Wingra Creek outlet to Lake Monona, expanded "no cut" and ""experimental shallow cuts and filamentous algae control" areas to reflect actual extent of machinery hazard and plant bed there
- In Squaw Bay (southeast shore, where Yahara River flows out and downstream), added a recreational access lane leading to River outflow
- Along the Squaw Bay shoreline (along the Yahara River in the eastern part of Paunack Park, added a "no-cut" area at the undeveloped shoreline section that is Paunack Marsh, the last remaining wetland on Lake Monona.

Figure 7. Lake Monona (including Monona Bay) harvesting priorities