

AMENDMENT
Aquatic Plant Management Plan, Lake Wingra, 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 Wisconsin Department of Natural Resources (DNR) researchers Michelle Nault, Martha Barton, Kelly Wagner, and Erin Ridley. This study was completed thanks to financial support from aquatic invasive species grants, and technical assistance funds from the DNR as provided under s. 23.22 (2)(c).

Introduction

This is an update to the Aquatic Plant Management Plan, Lake Wingra, Lower Rock River Basin, Dane County Wisconsin, published in January 2007 by the Dane County Office of Lakes and Watersheds. The 2007 plan was approved by the Wisconsin Department of Natural Resources on March 17, 2007 and by the Dane County Lakes and Watershed Commission on April 12, 2007. 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.

Vilas Lagoon, although hydraulically connected to Lake Wingra, is included in a separate plan with Jenni and Kyle Preserve Ponds, Tenney Park Lagoon, Warner Park Lagoon, and Verona Quarry because they are all shallow, highly disturbed systems with limited plant diversity, similar management needs, and, with the exception of Vilas Lagoon, infrequently harvested.

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.

While this aquatic plant management plan focuses on one particular aspect of lake management, aquatic plants, implementation of this plan occurs in the context of significant involvement by Lake Wingra watershed residents in lake and watershed restoration. Since the Lake Wingra plan was completed in 2007, watershed residents have increasingly demonstrated their care for Lake Wingra's health by involvement in lake and watershed restoration projects. The Friends of Lake Wingra play a central role in bringing together people and groups that have a role or interest in the protection and management of Lake Wingra and its watershed.

Watershed improvement measures have included rebuilding of several stormwater retention ponds in the UW Arboretum to control sediment and phosphorus runoff. In-lake research, including the removal of 6,700 carp in March 2008 and resulting improved water clarity in Lake Wingra, has resulted in noticeable improvements in water quality at the popular Vilas Beach, as well as reduced P levels and increased aquatic macrophytes in response to improved water clarity. The Arboretum's Marion Dunn retention pond is being used in alum research to control phosphorus and sediment from stormwater before reaching the wetlands around Lake Wingra, in hopes of reducing algae blooms. Many watershed residents use rain barrels to irrigate their gardens, and some have worked with the City of Madison to install rain gardens on the terraces between the sidewalks and curb.

The City of Madison Engineering Division is leading a planning process to develop a watershed management plan for the 3,500-acre Lake Wingra watershed. Planning has been underway since February 2013 with the guidance of a steering team composed of members of city staff, Friends of Lake Wingra, UW-Madison Arboretum, University faculty, and other stakeholders.

Recent Plant Survey Methods and Results

Staff from the DNR Research Bureau conducted plant surveys on August 24, 2010, September 1, 2011, and August 28-29, 2012. These plant surveys were conducted as part of a statewide Eurasian watermilfoil monitoring project. The maps found in the appendices reflect the 2012 data.

Based on parameters specific to Wingra, DNR researchers mapped a 543-point sampling grid over the entire lake. Using GPS technology, they navigated by boat to each of the pre-determined grid points. At each of these points they used a two-sided rake sampler to sample approximately 2.5 feet along the bottom. After pulling the plants to the surface, the rake was assigned a fullness rating of 1-3 to estimate density of plant growth (see Figure 1). Each individual plant species on the rake as well as any dislodged by the rake and floating were given similar fullness ratings to estimate abundance. DNR researchers also recorded visual sightings of species within six feet of the sample point, and depth and substrate (lake bottom) type at each point. Any additional species seen in the lake during a general boat survey were recorded separately from the point-intercept data.

Figure 1. Description of rake fullness ratings used during the point-intercept survey

Fullness Rating	Coverage	Description
1		Only few plants on rake head.
2		Rake head is about half full; the rake is covered but the tines are still visible.
3		The rake is completely covered and tines are not visible.

Table 1 below indicates species present in 2010, 2011, and 2012, and indicates the percent frequency of occurrence (littoral). This estimation of 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. Thus, researchers consider only sites in the lake at which, given light requirements, the growth of plants is possible.

Table 2 summarizes other survey statistics. The maximum depth of plant growth is the deepest depth at which plants were found in the lake. 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. 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. Statewide and ecoregion averages are calculated from a subset of approximately 250 lakes across Wisconsin.

Statistical and limnological terms used in this section are more fully described in the 2007 aquatic plant management plan. Please refer to that plan for additional background.

Table 1. Species present

Common Name	Scientific Name	% Frequency of Occurrence (Littoral)		
		2010	2011	2012
Eurasian watermilfoil*	<i>Myriophyllum spicatum</i> *	63.08*	67.86	73.1
Coontail	<i>Ceratophyllum demersum</i>	27.10	22.62	34.7
Wild celery	<i>Vallisneria americana</i>	5.37	5.36	4.0
Muskgrasses	<i>Chara</i> sp.	4.67	3.57	2.4
Water star-grass	<i>Heteranthera dubia</i>	4.44	1.98	.60
Illinois pondweed	<i>Potamogeton illinoensis</i>	4.21	5.16	2.4
White-stem pondweed	<i>Potamogeton praelongus</i>	3.50	4.96	6.4
		2010	2011	2012
Sago pondweed	<i>Stuckenia pectinata</i>	2.57	4.76	3.6
Small duckweed	<i>Lemna minor</i>	2.34	0	1.0
White water lily	<i>Nymphaea odorata</i>	2.34	4.76	5.2
Common waterweed	<i>Elodea canadensis</i>	1.64	.60	.60
Northern watermilfoil	<i>Myriophyllum sibiricum</i>	1.40	2.18	2.8
Flat-stem pondweed	<i>Potamogeton zosteriformis</i>	1.40	1.39	.20
Bushy pondweed	<i>Najas flexilis</i>	1.17	0	0
Clasping-leaf pondweed	<i>Potamogeton richardsonii</i>	0.93	1.19	1.60
Curly-leaf pondweed *	<i>Potamogeton crispus</i> *	0.70*		*boat survey
Common bladderwort	<i>Utricularia vulgaris</i>	0.70	0	0
Frie's pondweed	<i>Potamogeton friesii</i>	0.47	.99	visual
Floating-leaf pondweed	<i>Potamogeton natans</i>	0.47	0	.20
Large Duckweed	<i>Spirodela polyrhiza</i>	0.47	.40	.40
Forked duckweed	<i>Lemna trisulca</i>	0.23	.20	0
Spatdock	<i>Nuphar variegata</i>	0.23	0	.60
Cattail	<i>Typha</i> sp.	0.23	.60	0
Turion duckweed	<i>Lemna turionifera</i>	0	3.77	0
Common watermeal	<i>Wolffia columbiana</i>	0	1.59	.20
Slender naiad	<i>Najas flexilis</i>	0	.40	0
Long-leaf pondweed	<i>Potamogeton nodosus</i>	0	.20	0
Freshwater sponge		0	.40	0
American lotus	<i>Nelumbo lutea</i>	0	0	visual
Cattail	<i>Typha</i> sp.	0	0	visual
Softstem bulrush	<i>Schoenoplectus tabernaemontani</i>	0	0	Boat survey
Swamp loosestrife	<i>Decodon verticillatus</i>	0	0	Boat survey
Common bladderwort	<i>Utricularia vulgaris</i>	0	0	Boat survey

Common Name	Scientific Name	% Frequency of Occurrence (Littoral)		
		General Survey	Boat Survey*	Boat Survey*
Swamp loosestrife	<i>Decodon verticillatus</i>	0	0	0
Softstem bulrush	<i>Schoenoplectus tabernaemontani</i>	0	0	0
Purple loosestrife*	<i>Lythrum salicaria</i> *	Boat Survey*	Boat Survey*	Boat Survey*
Filamentous algae		5.14	6.35	7.8

* = species non-native and potentially invasive in WI

Table 2. Survey summary

	2010	2011	2012	Statewide Average	Ecoregion Average
Maximum Depth of Plant Growth (feet)	10.5	13.0	13.0	15.3	15.4
Number of Species in Lake (including general survey)	27	22	22	16.8	15.0
Floristic Quality Index (FQI)		25.3	21.8	24.1	20.0
Littoral Frequency of Occurrence (%)		76.6	81.1	74.3	79.0

Appendix A includes Lake Wingra summary statistics from the 2012 DNR survey. Appendix B includes Lake Wingra plant statistics from 2012. Appendix C includes mapped plant distributions for Lake Wingra.

Discussion of historical plant community changes

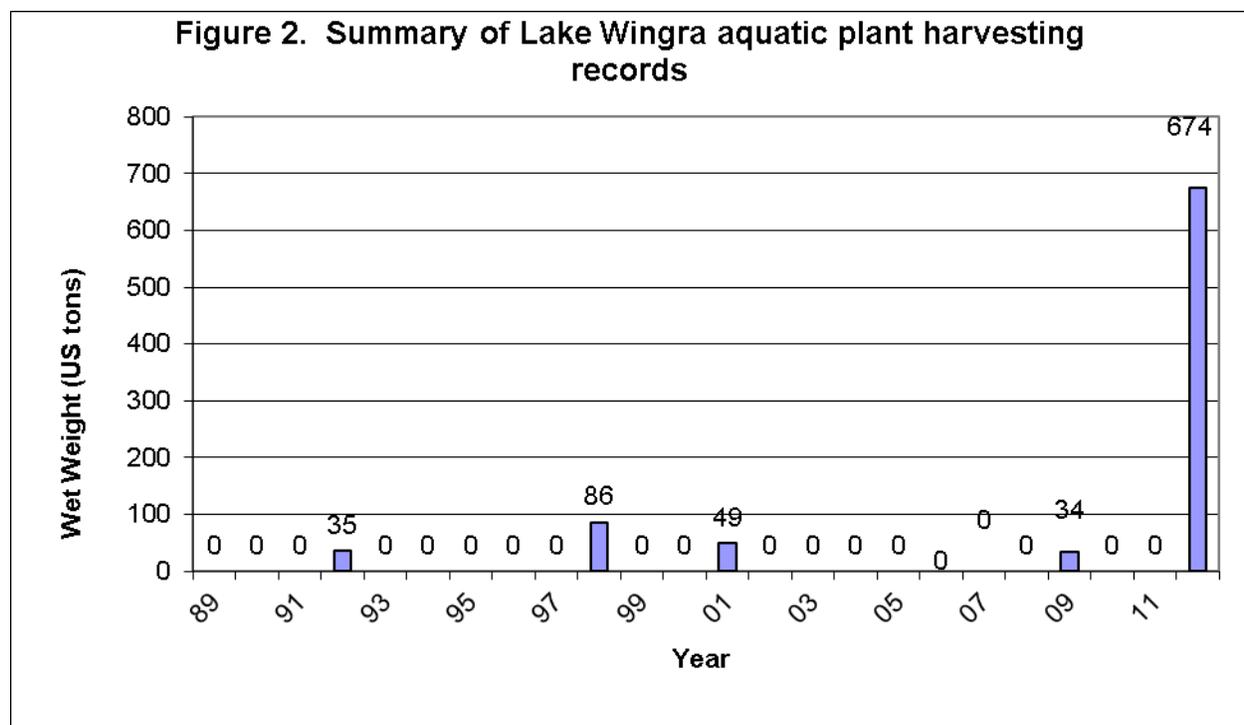
The Wingra plant community's littoral percentage frequency of occurrence (% FOO) of EWM has steadily increased since 2007, likely because of the carp removal project and subsequent increase in water clarity and maximum rooting depth (MDC) of aquatic plants. The maximum depth of plant growth has increased from 8.5 ft. to 13 ft. from 2005-2012. With the increase in clarity, EWM was able to take advantage of newly available lake habitat and expand out to deeper areas of the lake. The frequency of occurrence of plants less than the MDC has also increased from 52% to 81%, indicating more vegetation overall. Species richness within the lake has stayed stable throughout the past few years, with approximately 20 unique species found during the annual survey. Simpson's diversity index has slightly decreased over time, likely due to many areas in the middle of the lake that have only one species (EWM) present, which is driving down the lakewide diversity (nearshore diversity is still very much intact).

The nearshore areas (<6 feet) contain a very diverse and healthy native plant community, while the areas of the lake 6-10 feet are almost an exclusive monoculture of dense EWM, and unfortunately native plants have not yet moved out into these areas.

Recent Chemical and Harvesting Aquatic Plant Management Records

Figure 2 summarizes Dane County's mechanical harvesting operations in Lake Wingra since 1989. Private entities have not treated plants with herbicides in this lake under DNR permit.

Please note that, starting in 2006, Dane County changed the way it records total harvested plant weight. In the 2007 plan, 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.



Mechanical harvesting data presented in the 2007 plan (Figure 6 on p. 14) is incorrect. Most of the harvesting reported for Wingra is actually from Vilas Lagoon, with the possible exception of Wingra harvesting in 2012.

Public input opportunities

Dane County Land and Water Resources Department staff held a well-attended public information and input meeting at Edgewood College on December 13, 2012, with 43 area residents present. Attendees represented Friends of Lake Wingra, UW Arboretum, City of Madison, fishing groups, business owners, and many watershed residents and others who enjoy Lake Wingra for kayaking, boating, hiking around the lake, sailing, biking, sculling, windsurfing, paddle boarding, canoeing and kayaking, and fishing.

At this meeting, Dane County staff presented current plant data from Lake Wingra, 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.

Several comments were provided during the meeting, and on special comment cards. No specific suggestions were made about updating the 2007 plan's goals and recommendations. The main points made related to the harvesting program were the recreational users' interests in more open water for rowing, swimming and sailing, having a harvester dedicated to Lake Wingra, more aesthetically pleasing harvesting lanes (curved not straight), a request for harvesters to be used in the fall to pickup large mats of floating vegetation that piles up on shorelines, and alternatives to harvesting (including winter drawdown)

Public comments were also solicited via email, press release, and the danewaters.com website. Direct emails and correspondence received focused on training and supervision of harvester operators, procedures used during deep water cuts, process for responding to citizen concerns and communicating the harvesting schedule, coordination with UW Arboretum about native species management, designation of harvesting and no harvesting areas and how that is enforced, procedures for removal of cut plants that are not collected during harvesting, the importance of ecological restoration as well as recreation, procedures to protect native species, and a request for buoys to mark a harvested deeper water channel for recreational users.

A draft plan amendment was posted on www.danewaters.com in spring 2013, and comments requested via email and other direct outreach to parties interested in this waterbody. The final draft plan amendment was posted for comment in spring 2014.

Based on public comments, including extensive discussions with the Friends of Lake Wingra, clarifications have been added to this Lake Wingra plan, the Vilas Lagoon section of the Ponds plan, and to the Dane County Lake Management Operations Manual.

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/lwr/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 senescence, 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.

In shallow water, nutrient-rich lakes like Wingra, there is also another influence on plant growth, which Richard Lathrop and others describe in their 2013 paper "Carp Removal to Increase Water Clarity in Shallow Eutrophic Lake Wingra" published in *LakeLine* and available on the Dane County Lakes and Watersheds website (http://danewaters.com/pdf/research/Lake_Wingra_carp_removal_2013.pdf). In these lakes, there are alternate stable states where, at different times, a lake is dominated by algae or macrophytes, regardless of the phosphorus levels in the lake."

Recommended management

Based on staff review of the plant survey data and public input, Dane County recommends the updated management elements found in this section. Dane County staff believe that additional harvesting in deeper waters and away from the shallow nearshore native communities would be beneficial for EWM navigation/nuisance control without having any direct impacts on native plants. The amount of harvesting that Dane County can provide will be determined by budget and harvesting priorities for other county waters.

Lake Wingra Goals

The goals for managing aquatic plants in Lake Wingra are to: (1) protect high value species [NR 107.08(4)] found in the lake, and to (2) periodically control Eurasian watermilfoil when growths undermine lake access or interfere with special events. High value species found in Lake Wingra are: Illinois pondweed (*Potamogeton illinoensis*), clasping-leaf pondweed (*P. richardsonii*), white stem pondweed (*P. praelongis*), sago pondweed (*Struckenia pectinatus*), and wild celery (*Vallisneria Americana*). Other important native plants in Lake Wingra that require protection include floating-leaf pondweed (*P. natans*), variable pondweed (*P. gramineus*), flat-stem pondweed (*P. zosteriformis*), variable-leaf pondweed (*P. gramineus*), muskgrass (*Chara*), water stargrass (*Heteranthera dubia*), bushy pondweed (*Najas flexilis*), bladderwort (*Utricularia vulgaris*), spatterdock (*Nuphar variegata*), and white water lily (*Nymphaea tuberosa*).

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.

This plan amendment, consistent with the 2007 aquatic plant management plans for Lake Wingra and Vilas Lagoon (Vilas Lagoon is included in a plan with other shallow lagoons and ponds that have similar management issues) includes a goal of protection of white water lily and other native plants habitat. Dane County staff balance native species protection with historic recreational uses of the lagoon. For 40 years, for example, harvesting staff have cut and removed plants in Vilas Lagoon to provide for good ice for winter skating. These plants are typically cut in September or October, when they are already dying back. The white water lily beds have expanded in recent years, seemingly not negatively affected by harvesting.

Lake Wingra Recommendations

1. Mechanical harvesting should focus on Eurasian watermilfoil control, in areas where this exotic plant impedes lake access or if open water is needed for special events such as competition rowing or swimming.
2. Mechanical harvesting should avoid nearshore areas to protect the diverse plant community with the following exceptions: the area around the Wingra Park boat

launch, fishing access points along Vilas Park Road, and the Vilas Beach area. The purpose of this nearshore harvesting is to increase shoreline use recreation and lake access.

3. As needed, provide deep mechanical harvesting in an open water channel between Vilas Beach and the Wingra Park boat landing, in order to improve recreational access.
4. Chemical treatments are not recommended and may undermine the ecologically diverse plant community in the lake.
5. Ecologically acceptable methods to remove carp from Lake Wingra were completed with great success in 2007. Both water clarity and native plant distributions have improved since that intervention. Monitoring the carp population is important to maintain diverse plant growth, and may require additional work to keep the carp in check.
6. Consider sampling nearshore nongame fish populations to assess the ecological health of Lake Wingra.
7. Publicly owned shorelines should be designated as Critical Habitat Areas due to the presence of high value native species identified under NR 107.08(4). Aquatic plant management activities within the Critical Habitat Areas would be restricted to protect the important habitat functions. The public beach and boat ramp would not be included in the proposed Critical Habitat Areas. (Designation of Critical Habitat Areas is a Wisconsin Department of Natural Resources decision.)
8. 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.
9. Dane County 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."

In error, the 2007 Lake Wingra plan’s proposed sensitive area (now called critical habitat) map showed Vilas Lagoon as a proposed sensitive area. DNR did not designate any critical habitat areas in response to that plan. The proposed 2013 Lake Wingra plan update no longer shows Vilas Lagoon as a critical habitat area, acknowledging the fact that late season harvesting to facilitate ice skating, at the request of City of Madison Parks, has occurred for many years and this historic recreational use of the lagoon has been balanced with the need for native species protection. The Vilas Lagoon portion of the “Ponds” plan also notes this.

Figure 3. Proposed Lake Wingra Critical Habitat Areas



Lake Wingra 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 senescences, boat propellers etc. are all addressed in the supervision.

The harvesting priorities map below for Lake Wingra shows areas that may be harvested. 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.

Figure 4. Lake Wingra Harvesting Priorities

