Aquatic Plant Management Plan, Yahara River and Upper Mud Lake, 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

Prepared by Sue Jones, Dane County Office of Lakes and Watersheds, with assistance from Jim Leverance, Darren Marsh, and Pat Sheahan. Mapping by Michelle Richardson, Dane County Land and Water Resources Department, Administration Division.

Plant surveys conducted by James Scharl of Stantec Consulting Services in 2012 for the Dane County Office of Lakes and Watersheds. The Wisconsin Department of Natural Resources (WDNR) provided funding to the Office of Lakes and Watersheds to support this plan development.

Introduction

This is the first Aquatic Plant Management Plan prepared for the Yahara River including Upper Mud Lake. The 2007 Lake Kegonsa Aquatic Plant Management Plan included Lower Mud Lake on the Yahara River, and therefore the 2013 Lake Kegonsa plan update continues to include Lower Mud Lake. 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 encompasses the following sections of the Yahara River:

- Monona to Upper Mud (includes "Interlake")
- Upper Mud
- Waubesa to Lower Mud
- Lower Mud to Kegonsa

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.

Plant Survey Methods and Results

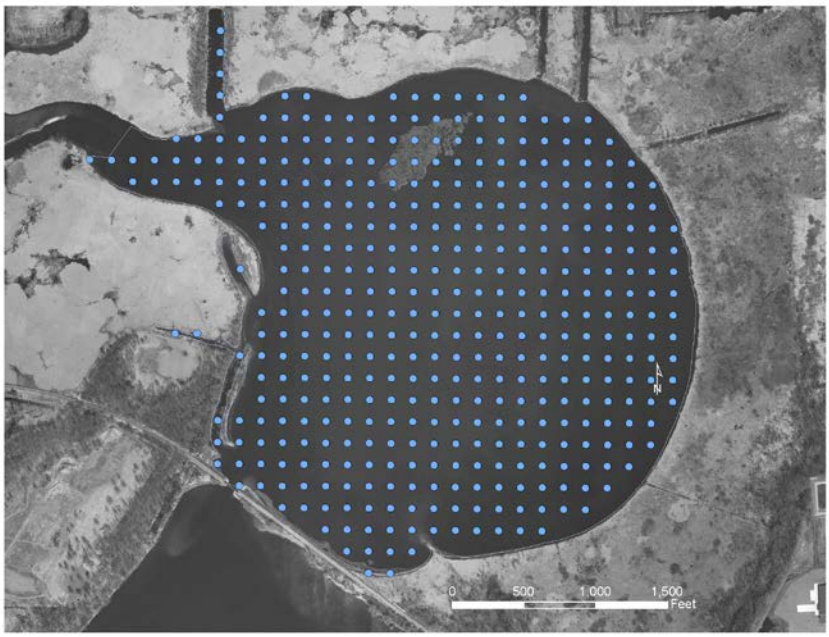
Dane County contracted with Stantec Consulting Services Inc. to conduct the aquatic plant community of the Yahara River and Upper Mud Lake during July of 2012:

Yahara River - Monona to Upper Mud Lake (surveyed 7/17/12)
Upper Mud Lake (surveyed 7/16/12)
Yahara River – Waubesa to Lower Mud Lake (surveyed 7/19/12)

Yahara River – Lower Mud Lake to Lake Kegonsa (surveyed 7/20/12)

Stantec followed state protocols and alternate methods where appropriate, approved by WDNR. For Upper Mud Lake, Stantec used the point intercept method (see Figure 1 grid). For the Yahara River segments, since no formal aquatic plant sampling protocol exists for rivers, Stantec worked with the WDNR and Dane County Office of Lakes and Watersheds to develop a suitable sampling plan. For these surveys, sample points were created in the field and set up in transects across the river. Points were sampled near each bank side, mid-river, and half way between near-bank and mid-river sample locations where channel width allowed. Transects were spaced approximately 150-200 feet apart, based on river conditions. This created 35 transects with 137 total points from Lake Monona to Upper Mud Lake, 32 transects with 115 points between Lake Waubesa and Lower Mud Lake, and 58 transects with 199 points from Lower Mud Lake to Lake Kegonsa.

Figure 1 – Sampling grid map for Upper Mud Lake



Tables 1 and 2 below indicate species present during the 2012 survey of the Yahara River and Upper Mud Lake, respectively. Figure 2 indicates Yahara River species richness from 2012.

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 2012 Upper Mud Lake plant statistics. Appendix B includes 2012 Yahara River plant statistics. Appendix C includes maps of aquatic plant distributions for Upper Mud Lake and the Yahara River for 2012, by segment (Monona to Upper Mud, Waubesa to Lower Mud, and Lower Mud to Kegonsa).

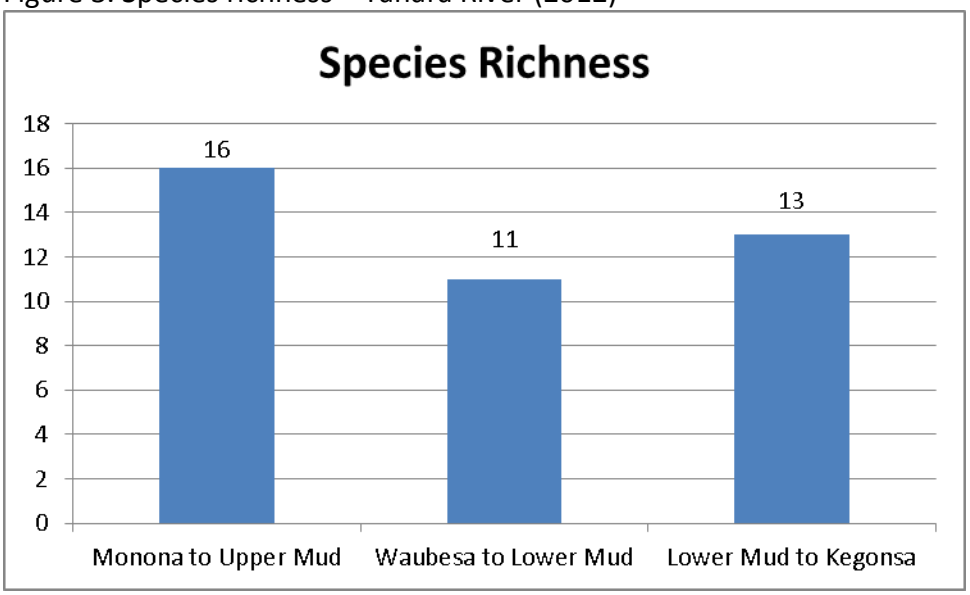
Table 1. Species present during 2012 aquatic plant survey – Yahara River

Genus	Species	Common Name	Category	Section (X = present)		
				Monona to Upper Mud	Waubesa to Lower Mud	Lower Mud to Kegonsa
Algae	*sp.*	Filamentous algae	Submersed	X	X	X
Ceratophyllum	*demersum*	Coontail	Submersed	X	X	X
Chara	*sp.*	Muskgrass	Submersed	X		X
Elodea	*canadensis*	Common waterweed	Submersed	X	X	X
Heteranthera	*dubia*	Water star-grass	Submersed	X	X	X
Lemna	*minor*	Small duckweed	Free-floating	X	X	X
Myriophyllum	*spicatum*	Eurasian watermilfoil	Submersed - Invasive	X	X	X
Najas	*flexilis*	Slender naiad	Submersed	X		
Nymphaea	*odorata*	White water lily	Floating-leaf	X	X	X
Potamogeton	*crispus*	Curly-leaf pondweed	Invasive	X		
Potamogeton	*richardsonii*	Clasping-leaf pondweed	Submersed	X	X	X
Potamogeton	*zosteriformis*	Flat-stem pondweed	Submersed	X	X	X
Stuckenia	*pectinata*	Sago pondweed	Submersed	X		
Vallisneria	*americana*	Wild celery	Submersed	X	X	X
Wolffia	*columbiana*	Common watermeal	Free-floating	X		X
Zannichellia	*palustris*	Horned pondweed	Submersed	X	X	X

Table 2. Species present during 2012 aquatic plant survey – Upper Mud Lake

Genus	Species	Common Name	Category
Algae	*sp.*	Filamentous algae	Submersed
Ceratophyllum	*demersum*	Coontail	Submersed
Elodea	*canadensis*	Common waterweed	Submersed
Elodea	*nuttalli*	Slender waterweed	Submersed
Heteranthera	*dubia*	Water star-grass	Submersed
Lemna	*minor*	Small duckweed	Free-floating
Lemna	*trisulca*	Forked duckweed	Free-floating
Myriophyllum	*spicatum*	Eurasian watermilfoil	Invasive
Nymphaea	*odorata*	White water lily	Floating-leaf
Potamogeton	*crispus*	Curly-leaf pondweed	Submersed - Invasive
Potamogeton	*richardsonii*	Clasping-leaf pondweed	Submersed
Potamogeton	*zosteriformis*	Flat-stem pondweed	Submersed
Stuckenia	*pectinata*	Sago pondweed	Submersed
Vallisneria	*americana*	Wild celery	Submersed
Wolffia	*columbiana*	Common watermeal	Free-floating
Zannichellia	*palustris*	Horned pondweed	Submersed

Figure 3. Species richness – Yahara River (2012)



Discussion of plant community

Definition of terms used in this section

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 Appendices A and B). 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.

Simpson's Diversity Index is used to quantify the biodiversity of a habitat, and takes into account the number of species present, as well as the abundance of each species.

Upper Mud Lake

Upper Mud Lake had a diverse, densely vegetated community to the point of limiting navigational access in areas during the 2012 survey. Sixteen species were found to a maximum depth of 18 feet across a majority of the littoral zone (the shallow part of a lake where most of the rooted plants are found). No historical data exists for Upper Mud Lake.

The aquatic plant community of Upper Mud Lake was surveyed on July 16, 2012, using the point intercept method. Maximum depth of plants was 18 feet, frequency of occurrence at photic zone was 88.8%, and 16 species were sampled. FQI and average C were 18.58 and 5.15, respectively. These values can be used to gauge the health of the lake, and show a stable, healthy plant community with good diversity for a highly-used lake in southern Wisconsin.

A diverse aquatic plant community was present during the 2012 survey. In total, 16 species were surveyed and evenly distributed throughout the lake with a Simpson Diversity Index of 0.86. Aquatic plant growth was dense throughout much of the lake with coontail, Eurasian watermilfoil (EWM), and filamentous algae being the most prevalent plant species sampled. Curly-leaf pondweed was also sampled, but may not be accurately represented from this survey due to its life cycle and tendency to die-back by mid-summer. A healthy mix of native aquatic plants was found throughout much of the lake as well and were represented in various community types: free-floating, submersed, and floating-leaf. Though no emergent aquatic plants were directly sampled, they were visually observed and present along a majority of the shoreline outside of the sample grid and were dominated by cattail.

Current management practices are limited to aquatic plant harvesting within the navigational channel, when necessary. These practices have created a stable, healthy aquatic plant community in Upper Mud Lake and should be continued as necessary. If a better gauge of curly-leaf pondweed (CLP) presence is wanted, an early season survey should be completed before these invasive plants die back (early to mid-May).

Yahara River

The Yahara River from its outflow of Lake Monona to its entrance into Lake Kegonsa was surveyed and split into three distinct sections: Lake Monona to Upper Mud Lake, Lake Waubesa dam to Lower Mud Lake, and Lower Mud Lake to Lake Kegonsa. A similar aquatic plant

community was found in all three sections. No historical data exists for any of these sections of the river. (Lower Mud Lake plant data is included in the 2007 Lake Kegonsa and Lower Mud Lake Aquatic Plant Management Plan, amended in 2013).

The aquatic plant communities of the Yahara River were surveyed on July 17, 2012 from Lake Monona to Upper Mud Lake, July 19 from Lake Waubesa to Lower Mud Lake, and July 20 from Lower Mud Lake to Lake Kegonsa. Diverse and consistent aquatic plant communities were found in all study locations of the Yahara River. Nearly all sample points were vegetated, with 100% of locations vegetated from Lake Waubesa down to Lake Kegonsa, while the stretch from Lake Monona to Upper Mud Lake had 97.8% of the sites vegetated. Aquatic plant growth was thick in many areas and dominated mainly by wild celery and water star-grass, often in dense beds. Though EWM is present in all sections of the river, native species compromise a vast majority of the communities. During 2012, FQI was highest from Monona to Upper Mud Lakes at 18.58, but relatively constant at 17.49 from Lower Mud to Lake Kegonsa and 15.33 from Waubesa to Lower Mud Lakes. A stable, consistent aquatic plant community is also bolstered by an average coefficient range of 5.11 to 5.27, indicating similar communities within each section.

Recent Chemical and Harvesting Aquatic Plant Management Records

Figure 3 summarizes Dane County's mechanical harvesting operations in the Yahara River. Figure 4 summarizes Dane County's mechanical harvesting operations in what is locally called "Interlake" (north of Upper Mud Lake, under US Highway 12 and 18) since 2007. Dane County's highest priority for harvesting during periods of high water and flooding is in the Yahara River, especially between lakes Waubesa and Kegonsa. The large harvesting totals indicated in 2008-2011 coincide with periods of intense precipitation events and high water. There have been no chemical treatments of aquatic plants by private entities.

Figure 3. Historical Yahara River aquatic plant harvesting records

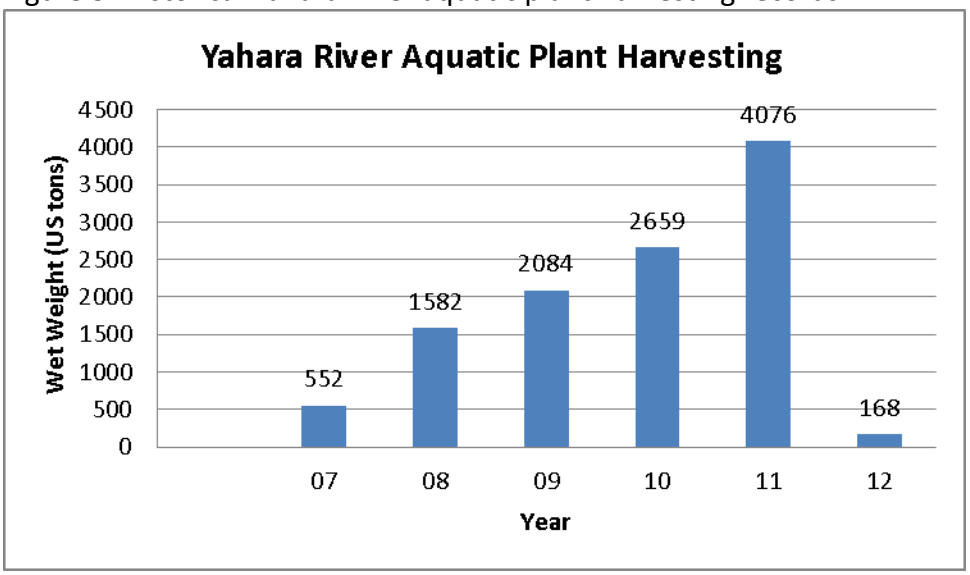
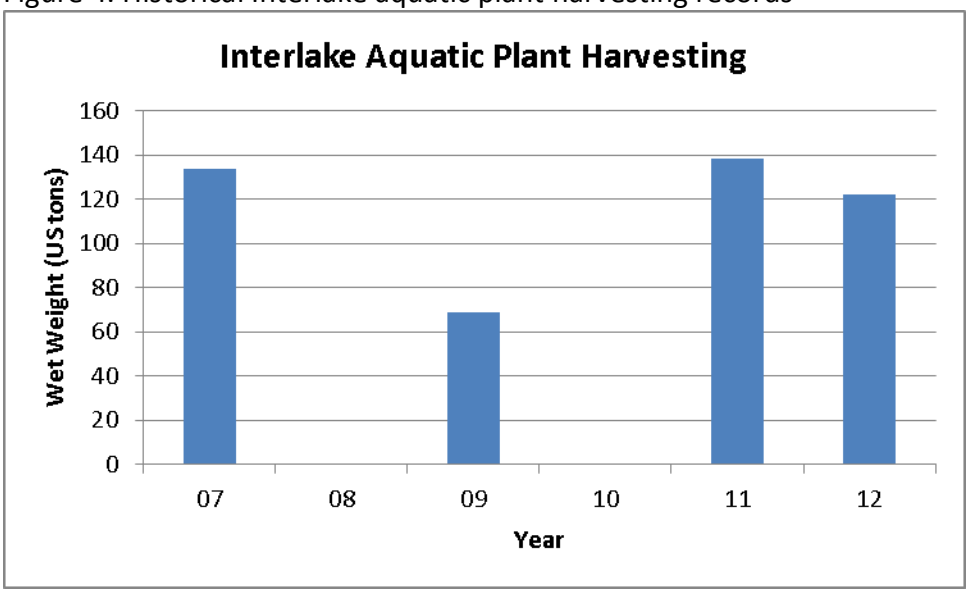


Figure 4. Historical Interlake aquatic plant harvesting records



Public input opportunities

Dane County Land and Water Resources Department staff held a public information and input meeting on April 16, 2013 at the Village of McFarland Municipal Center -- Training Room, with 18 area residents present. The focus of the meeting was lakes Waubesa and Kegonsa, the Yahara River, Upper and Lower Mud Lake, Jenni and Kyle Ponds, and Verona Quarry.

Attendees represented Friends of Lake Kegonsa Society, Lake Waubesa Conservation Association, Waubesa Beach Neighborhood Association, and others who enjoy Lake Kegonsa and Lake Waubesa for recreation and aesthetics.

At this meeting, Dane County and DNR staff presented current plant data (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.

Several comments were provided during the meeting. No specific suggestions were made about goals and recommendations for Upper Mud Lake or the Yahara River segments.

Public comments were also solicited via email, press release, and the danewaters.com website. No direct emails or correspondence was received regarding Upper Mud Lake or the Yahara River segments.

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. 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

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

The goals of Dane County's mechanical harvesting program are 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.

Upper Mud Lake

1. Harvesting is not recommended because boat traffic maintains the channel. Upper Mud Lake wetland and aquatic plants provide water quality benefits to the downstream lakes.
2. 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.
3. 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.

Yahara River

1. As conditions warrant (e.g. during emergency high water and flood conditions), conduct large-scale mechanical harvesting of aquatic plants in Lower Mud Lake and in the river between Lower Mud Lake and Lake Kegonsa to increase flow. When cutting is performed, it should avoid mechanical hazard zones.
2. 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.
3. 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

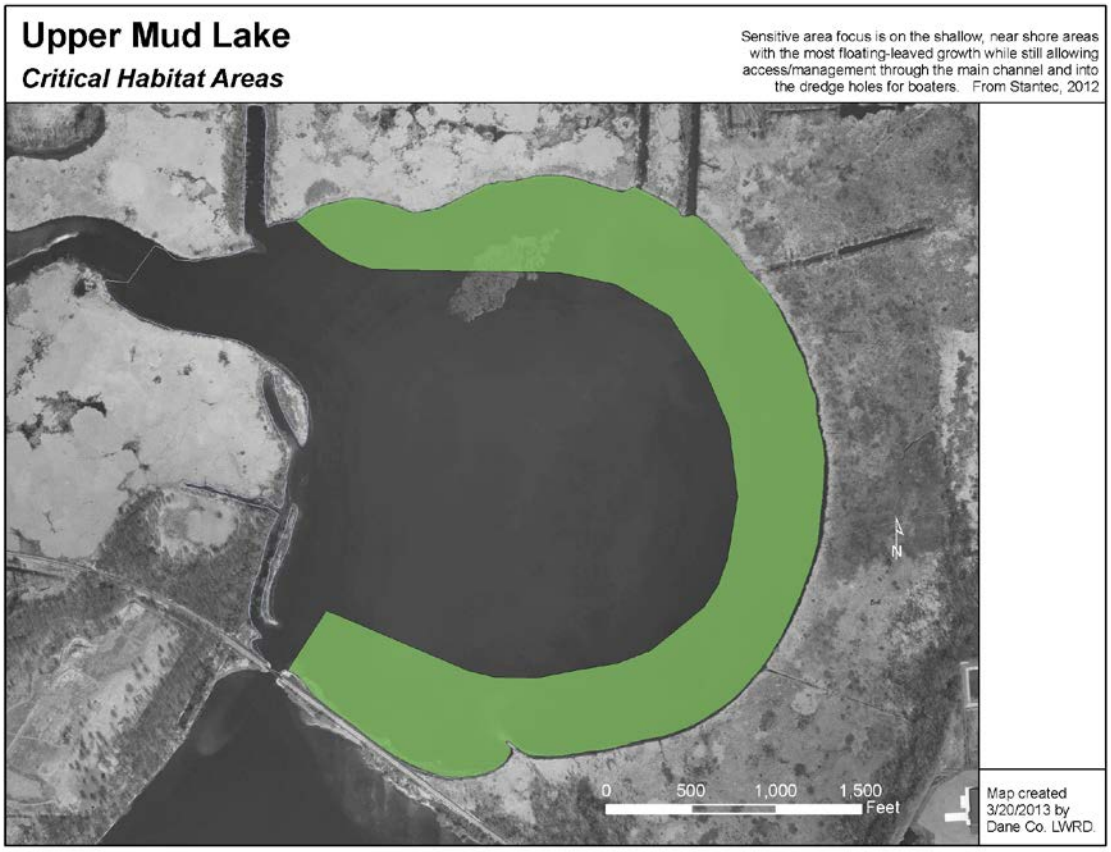
Wisconsin DNR's website describes the importance of the DNR's designation of Critical Habitat Areas as follows: "Every waterbody has critical habitat - those areas that are most important to the overall health of the aquatic plants and animals. Remarkably, eighty percent of the plants and animals on 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."

Upper Mud Lake

No Critical Habitat Areas had been historically proposed within Upper Mud Lake. Similar to Lower Mud Lake, Upper Mud has limited shoreline development and extensive emergent and floating-leaf plant communities along vast majorities of the shoreline with a main navigational access within the Yahara River channel. Dane County recommends designating these near-shore habitat areas to coincide where similar conditions exist (see Figure 5).

Figure 6. Proposed Critical Habitat Areas for Upper Mud Lake



Yahara River – Lake Monona to Upper Mud Lake

No Critical Habitat Areas are currently designated for this portion of the Yahara River. This section of river has heavily developed shorelines and serves as a well-used boating thoroughfare from Lake Monona, through Upper Mud Lake, and to Lake Waubesa. In conjunction with this use, it currently receives mechanical aquatic plant harvesting to maintain access. With these issues in mind, Dane County does not recommend designating any sensitive areas within this portion of the Yahara River.

Yahara River – Lake Waubesa to Lower Mud Lake

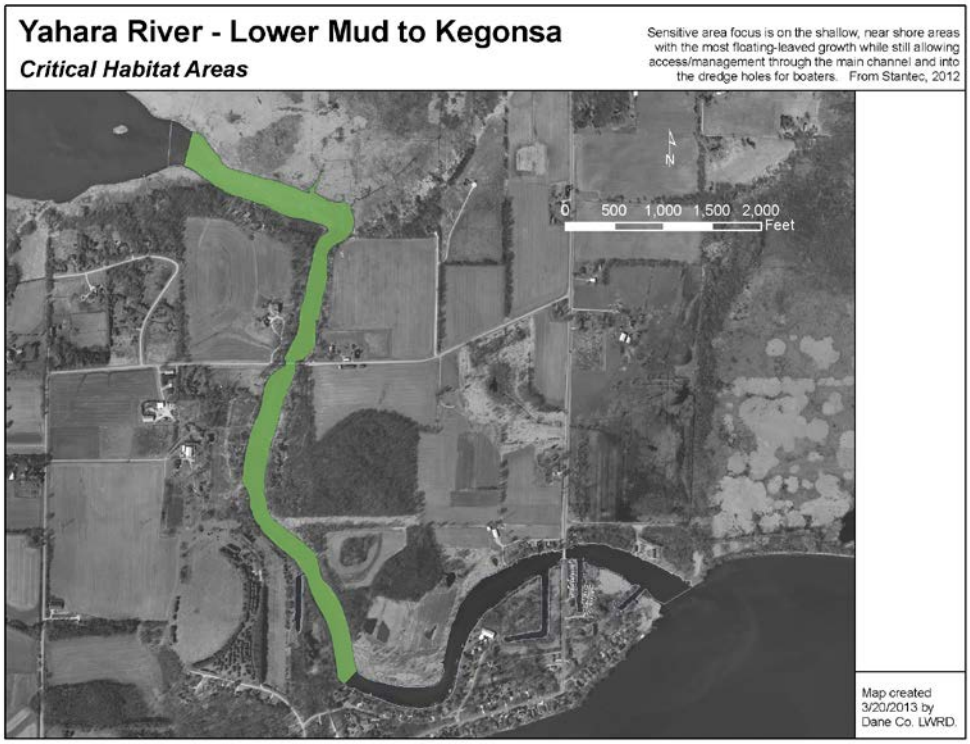
No Critical Habitat Areas had previously been proposed for this portion of the Yahara River. This portion of the river typically has shallow water with a slow flow and shorelines that are moderately developed with some stretches of no development. Because of heavy aquatic plant growth and its shallow nature, recreational use is limited to smaller boats. Even without Critical Habitat Area designation, this section has remained stable and, as such, Dane County does not recommend any Critical Habitat Area designations within this portion of the Yahara River.

Yahara River – Lower Mud Lake to Lake Kegonsa

Currently only a small portion of this section of the Yahara River had a proposed Critical Habitat Areas (then indicated as “sensitive” areas) in the Lake Kegonsa Aquatic Plant Management Plan (2007); from CTH-AB to the Fish Camp Road boat landing. The lower third of the river (up to one half mile upstream of the CTH-AB bridge) is more developed and is periodically harvested for aquatic plants. Though this portion of the river does experience heavy aquatic plant growth, this same condition helps to improve the water clarity as it flows into Lake Kegonsa and creates excellent habitat for fisheries.

Dane County staff propose that DNR create a new Critical Habitat Area from the outlet of Lower Mud Lake to one half mile upstream of the CTH-AB bridge (Figure 6). This section of river features limited development with many areas of rocky and submerged woody debris habitat while protecting water quality as it flows downstream. This new designation would create approximately 1.25 additional miles of Critical Habitat Area on this portion of the Yahara River.

Figure 6. Proposed Critical Habitat Areas for Yahara River from Lower Mud Lake to Lake Kegonsa



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.