Lake Minnetonka Conservation District (LMCD)

Comprehensive Eurasian Watermilfoil and Curly-Leaf Pondweed Management Plan

Prepared By: LMCD AIS Sub-Committee
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INTRODUCTION

I. Background

Lake Minnetonka is a 14,043 acre public body of water located in Hennepin and Carver counties. The Lake Minnetonka Conservation District (LMCD), which was created by state statute in 1967, balances the interests of the abutting property owners and the interests of the general public. Watercraft types on Lake Minnetonka are diverse, and include recreational watercraft (cruisers and runabouts), fishing, sailing, pontoons, and personal watercraft. There are also a number of pathways for the public to access Lake Minnetonka. These pathways include: 1) docks and moorings on abutting properties; 2) docks at commercial marinas, restaurants, municipal sites, and yacht clubs; 3) public and private accesses; and 4) watercraft for hire (charter boats). When preparing this Plan, the sub-committee took into consideration the public and private interests of all Lake Minnetonka stakeholders.

Aquatic plants provide habitat for fish and wildlife, as well as water quality benefits. Studies have consistently shown that fish abundance is greater in vegetated habitats than in un-vegetated habitats (Dibble et al. 1996; Pratt and Smokorowski 2003; Wei et al. 2004). Aquatic plants provide fish and wildlife with food, spawning, nesting habitat, and cover from predators (Dibble et al. 1996; Petr 2000; Valley et al. 2004). In addition, aquatic plants anchor sediments and sequester nutrients like phosphorous and nitrogen, thus reducing turbidity caused by sediment and algae blooms (Barko and James 1998, Petr 2000). However, excessive growth of invasive species such as Eurasian watermilfoil (EWM) and Curly-leaf pondweed (CLP) can negatively affect recreational use of the lake and displace native plant species. Control of these invasive species is periodically warranted to minimize these impacts. This Plan discusses the LMCD's involvement in the control of these species. See Appendix A for further details on the benefit of native aquatic plants.

II. History

A. Discovery

In 1987, EWM was discovered on Lake Minnetonka. In response to this, the LMCD coordinated a series of public meetings and forums to evaluate the best means of managing EWM. At that time, it was determined that mechanical harvesting was the best means to manage EWM on Lake Minnetonka. Additionally, a EWM Task Force was established with the primary goal to provide professional guidance to the LMCD on:

1. The EWM Mechanical Harvesting Program; and

2. Other EWM management techniques.

B. Scientific Management Team

Early on, a Scientific Management Team was established as a sub-committee of the EWM Task Force. This sub-committee included representatives from the LMCD, Minnesota Department of Natural Resources (MN DNR), Freshwater Foundation, University of Minnesota (U of M), U.S. Army Corps of Engineers (Army Corps), Three Rivers Park District (TRPD), Lake Restoration, Lake Management, and Midwest Aquacare. This group researched EWM control methods throughout the country; tracked the spread of EWM in Lake Minnetonka and other lakes; and reviewed proposed control projects such as whole bay herbicide treatments, "weed pullers", iron applications, and biological control research. Dr. Ray Newman from the U of M

was an integral part of this committee. At that time, the LMCD EWM Task Force was the multi-agency committee for aquatic invasive species (AIS) in Minnesota.

C. Professional Guidance

A summary of the historical guidance provided by the EWM Task Force on the primary goal listed above is as follows:

LMCD EWM Mechanical Harvesting Program

The involvement of the Task Force was more substantial during the initial stages of this program (in particular when the LMCD and the various stakeholders were discussing the best means to manage EWM on Lake Minnetonka). Once the harvesting equipment was purchased in 1989, the Task Force provided guidance with regards to the LMCD contracting for harvesting vs. the hiring of seasonal employees. The Task Force continues to play a supporting role for this program on an as-needed basis.

Exploring Other Management Techniques

The Task Force has been quite active over the years on this goal. A summary of the activity is as follows:

1) Research in the early 1990's on the use of biological control (weevils). This was closely coordinated between the MN DNR and Dr. Ray Newman at the University of Minnesota. This project was on-going for a number of years on Smiths Bay and funded through the Legislative Commission on Minnesota Resources. An augmentation study was conducted on this in 2001.
2) An assessment in the mid 1990's on the use of equipment that "pulls weeds" as an alternative to sickle-bar harvesting equipment.
3) Participation in a number of herbicide treatment projects over the years. Some of these include:
    a. The use of Sonar (fluridone) in the early 1990's on Libbs Lake (consideration was also given to St. Albans Bay).
    b. Triclopyr studies on Lake Minnetonka in the mid and late 1990's.
    c. A Milfoil Demonstration Project on Carmans, Grays, and Phelps Bays in 2006. This was the impetus for the creation of a formal Lake Vegetation Management Plan (LVMP) in 2007 and 2008 for these three bays.
    d. Five year, three bay coordinated herbicide treatments on Carmans, Grays, and Phelps Bays from 2008 through 2012.

D. Whole Bay Coordinated Herbicide Treatments

During the winter of 2007 and 2008, an LVMP for coordinated herbicide treatments was prepared for Carmans, Grays, and Phelps Bays. The primary goals of this demonstration project were to:

1. Evaluate whether EWM and CLP could be managed with lower dosages of herbicides on a whole bay.

2. Evaluate whether these treatments would damage the native plants in these three bays.

The LVMP was co-signed by the LMCD and the Lake Minnetonka Association (LMA) and was prepared by the LMCD's Aquatic Invasive Species (AIS) Task Force (formerly known as

the EWM Task Force). At that time, the Task Force was comprised of agency and technical representatives who served as the LVMP's advisory committee.

Representatives on this Task Force in 2012 include appointed LMCD Board members (Task Force Chairman Kelsey Page and Task Force Vice Chairman Jeff Morris), Hennepin County Environmental Services (Hennepin County), LMA, Minnehaha Creek Watershed District (MCWD), MN DNR, TRPD, Lisa Whalen (former LMCD Board member), Dick Woodruff (former LMCD Board member), Gabriel Jabbour (Tonka Bay Marina), and Jay Green (Anglers for Habitat).

In April of 2012, the AIS Task Force assessed the results of the treatments from 2008 through 2011 based on the LVMP goals and objectives. A Summary Report from the Task Force was prepared and presented to the LMCD Board of Directors (see Appendix B). The consensus of the Task Force was that the LMCD Board should not extend the three-bay project beyond 2012, or expand the project to other bays, until a comprehensive vegetation management plan is developed for all of Lake Minnetonka. The LMCD Board concurred with this recommendation.

COMPREHENSIVE EWM AND CLP MANAGEMENT PLAN (PLAN)

I. Purpose

This Plan is to provide guidance to the LMCD and its local partners for the management and control of existing EWM and CLP in Lake Minnetonka. This Plan is not a formal MN DNR LVMP.

II. Plan Components

The most problematic plants in Lake Minnetonka, which produce surface mats and interfere with recreational activities, are EWM and CLP (in particular EWM). When preparing this Plan, the sub-committee agreed that the Plan needs to reflect the following considerations:

- The Plan needs to be balanced, cost effective, environmentally sound, and not cause detrimental ecological impacts.
- The Plan needs to reflect how the general public and property owners use the lake and how these uses are affected by aquatic vegetation.
- Conversely, recreational uses affect aquatic vegetation and impact the health of the lake.
- The Plan needs to balance the lake's use and lake's health.
- Management activities will maintain or increase native aquatic plants and water quality.
- Management activities for invasive aquatic plants, which lead to the increase of native aquatic plant population, will be given preference.
- The Plan needs to be flexible because vegetation growth and lake conditions change.
- The Plan must provide a long-term, holistic approach.

III. AIS Sub-Committee

In June of 2012, the LMCD's AIS Task Force met to discuss how to prepare a Plan for Lake Minnetonka. The consensus was to establish a sub-committee to prepare the first draft of the Plan to be reviewed. Task Force members that agreed to serve on this sub-committee include John Barten (TRPD), Eric Fieldseth (MCWD), Dick Osgood (LMA), and Chip Welling (MN DNR). Additionally, Task Force Chairman Kelsey Page and LMCD Executive Director Greg Nybeck have

participated on this sub-committee. After a series of seven meetings from June into September, the first draft of the Plan was presented to the AIS Task Force on October 12, 2012.

IV. Goals and Objectives

A. Problem Statement

EWM and CLP are problematic plants where they produce surface mats that interfere with recreational activities. This Plan recognizes that there are additional invasive aquatic plants, not yet or marginally established in Lake Minnetonka, which have the potential to cause problems affecting recreational use of the lake, negatively affecting the health of the lake, or could serve as a source of spread to other uninfested water bodies. Therefore, a monitoring plan would need to be established for early detection, rapid response, and roles and responsibilities.

B. Management Goals

The following management goals have been established by the sub-committee for this Plan:

1. Enhance navigability for recreational and commercial use in public areas of Lake Minnetonka affected by EWM and CLP.

2. Management activities will maintain or increase native aquatic plants and water quality.

3. Management activities will leverage the broadest sources of available funds.

C. Management Areas

Public Areas- The sub-committee is recommending that the LMCD limit financial participation for control activities to public areas of the lake where there will be an identified public benefit. For this Plan, the sub-committee has defined public areas as the following:

1. All areas 100 feet offshore and outside of the authorized dock use areas as established by LMCD Code; or

2. All areas adjacent to publically owned land or other public access points and destinations.

Private Areas - Plant control in areas outside of the defined public use areas would be the responsibility of the private property owners. Generally, these are areas within 100 feet of the lake shoreline.

D. Management Tools

A number of EWM and CLP management tools were considered as part of this Plan. These included:

1. Mechanical harvesting;

2. Systemic herbicides;

3. Contact herbicide;

4. Hand-pulling; and

5. Biological weevils.

Of these tools, the sub-committee recommends that the use of mechanical harvesting and herbicides (both systemic and contact) should be used to manage EWM and CLP on Lake Minnetonka. Both tools have pros and cons and Table 1 in Appendix C provides a summary of the strengths and weakness of each tool. The sub-committee recommends that mechanical harvesting continue to be used on Lake Minnetonka; while also adding herbicide treatments where whole bay or large scale treatments are appropriate and cost effective. In 2012, the MCWD conducted demonstration projects to establish whether hand-pulling is a useful tool to manage flowering rush on some parts of Lake Minnetonka, and whether biological weevils are a useful tool to manage EWM on Christmas Lake.

Table 2 (see Appendix D) was established to guide planning and decision making, but not guide operations, to determine whether EWM or CLP are, or could become, nuisances within the public use areas of Lake Minnetonka. Table 2 provides an overview of potential problem areas only because these areas are over estimates of the actual problem areas. Specific notes for considering this information in this table include the following:

- CLP has not generally been problematic nor the principal target of vegetation control in Lake Minnetonka.
- The littoral area refers to the area where rooted plants inhabit, which is generally limited by light penetration. The MN DNR defines the littoral area as the 15 foot water depth contour. EWM and other plants may grow deeper (especially in clear water) or shallower (especially in turbid water). The depth of the colonization does not necessarily indicate the overall extent of problematic EWM growth.
- Potential problem area, in this context, is only the littoral area. For operations, a detailed delineation of actual problem areas will be required prior to implementation of any controls.
- Private areas of the lake, as used here, refer to those areas within the littoral area that are adjacent to privately owned property. The public/private demarcation used here only serves as a guideline for delineating areas where public funds might be used for broader invasive plant control.

IMPLEMENTATION

I. Mechanical Harvesting

A. Project Management

Mechanical harvesting will be used to manage EWM and CLP in public areas. Private areas are the responsibility of the abutting property owners to manage EWM and CLP. The LMCD currently owns a fleet of three harvesters (with ancillary equipment) that has historically operated from mid June through mid August. Harvesting priorities are based on impediments to public navigation, which are addressed through a combination of channel and clear cutting. The LMCD has historically served as the project manager and the sub-committee recommends that this continue in the future. The LMCD may decide, on an as-needed basis, to use contact or systemic herbicides in smaller areas, as a complement to mechanical harvesting.

B. Funding

There are currently two established funding sources for the LMCD's Mechanical Harvesting Program on Lake Minnetonka. These sources include: 1) a taxable levy through the 14 Lake

Minnetonka communities consistent with the LMCD's state enabling legislation, and 2) an annual grant from the MN DNR.

C. Monitoring, Evaluation, and Reporting

The LMCD has historically assessed EWM growth by an aerial survey, complemented by an on-the-water survey during operations. Pre-season, mid-season, and post-season reports are prepared by LMCD staff and presented to the LMCD Board to update them on plans and accomplishments of the program. Key statistical data documented by the LMCD staff includes, harvester loads, truck loads, and acres harvested. The general public is kept informed on the program, in particular the location of past and upcoming harvesting locations, through a weekly update that is posted on the LMCD's website. The sub-committee recommends that additional efforts should be explored to further inform the general public.

II. Whole Bay or Large Scale Herbicide Treatments

The sub-committee has identified eight management areas as suitable candidates for whole bay or large scale herbicide treatments (within current financial, technical, and regulatory constraints) as a complement to existing mechanical harvesting in public areas. The criteria used by the sub-committee to rank the suitability of the 42 areas on Lake Minnetonka, as well as a matrix spreadsheet, are detailed in Appendix E. Additionally, Table 3 in Appendix F outlines key information such as; existence of licensed multiple docks, public launch ramps, Quiet Water Areas, an average of MN DNR permits for herbicide treatments, and average Secchi disc readings; which was used in preparing the herbicide treatment matrix in Appendix E. The areas identified as suitable for whole bay or large scale treatments, meeting the criteria in Section B2 (as follows), currently include:

1. St. Albans Bay
2. Grays Bay
3. St. Louis Bay
4. Carsons Bay
5. Carmans Bay
6. Phelps Bay
7. Gideon Bay
8. North Arm Bay (*)

(*) A pre-inventory of EWM, CLP, and other aquatic vegetation has not been conducted on this bay, which would be a prerequisite for a whole bay or large scale herbicide treatment.

A. Funding

The LMCD Board recognizes that sources of both private and public funding may be available to support herbicide treatments on Lake Minnetonka. It is expected that funds provided by other public agencies or via grant programs will likely be directed through the LMCD, although the LMCD has no specific requirements for this to occur. The LMCD is also willing to accept and manage private funds; recognizing that not all private sources may want to rely on public agencies to accomplish specific treatment results. The LMCD is also aware that private funding tends to be greater when treatments provide localized benefits.

Where privately funded or managed large scale treatments coexist with public efforts, it is expected that all treatment providers will operate though a single annual treatment plan coordinated by a sub-committee of the LMCD's AIS Task Force. The LMCD Board feels this

type of lake-wide plan is needed to minimize additive or adverse effects of large scale herbicide treatments, and to ensure common and consistent methods are applied to reporting treatment effectiveness.

B. Monitoring, Evaluation, and Reporting

1. The sub-committee is recommending that the efficacy and need to treat be determined by use of objective measurement criteria. The previous measurement matrix included point-intercept frequency of occurrence and biomass measurements. However, the point intercept method did not appear to reflect the actual levels of nuisance plant growth, and biomass monitoring as an alternative was very expensive. The committee is therefore recommending that a combination of point-intercept sampling, supplemented by hydro-acoustic biomass estimates be used to determine treatment needs and efficacy. At a minimum, sampling needs to be completed in a targeted area once before a treatment and once post-treatment, preferably in mid to late summer. Delineation of the actual treatment area prior to treatment will be done through a visual survey of plant locations.
2. Evaluation – The sub-committee recommends that the LMCD participate in treatment projects only when the point-intercept and hydro-acoustic data, collected by a third party vendor, determine that an impediment to public recreation exists or is likely to occur in the following year. The assessment of problem conditions will be completed by a sub-committee of the LMCD's AIS Task Force.
3. The criteria used to determine treatment needs are as follows:
    - Frequency of occurrence, as measured by the point-intercept method, exceeds 50 percent;
    - Hydro-acoustic measurements indicate the EWM/CLP bio-volume is problematic or has the potential to be problematic in over half of the targeted littoral area;
    - EWM plants are observed to be forming surface mats in areas that boaters cannot avoid;
    - This information will be provided to the LMCD and LMA by October 15 of the year preceding a proposed treatment.
4. Reporting – Following each whole bay or large scale chemical treatment, the project manager will provide to the LMCD Board a summary report including the following:
    - Acres treated and chemical used;
    - Pre- and Post-treatment point intercept and hydro-acoustic data;
    - An analysis of target plant control efficacy;
    - A summary of non-target plant percent frequency and density;
    - Cost of the program, both total and per-acre;
    - Areas where native plant damage is observed or measured; projected or recommended treatment in the following year; and
    - Report indicating the data collection would be due by October 15th of the preceding year.

C. Project Management

In the 2008-2012 whole bay or large scale herbicide treatments, the LMA served as the project manager. Project management for future whole bay or large scale herbicide treatments could be done by the public agency, most likely the LMCD, a non-public sector organization such as the LMA, or private operators. The Task Force could not reach a consensus on the ongoing ownership of project management. Because of this, it is expected that multiple treatment

providers will exist in any given year and the LMCD's role will provide coordination of all large scale treatment providers on an annual basis.

III. Roles and Responsibilities

LMCD

1. Serve as the project manager for the mechanical harvesting program and possibly herbicide treatment projects (most likely those with a significant level of public funding).
2. Facilitate annual assessment of EWM and CLP by the AIS Task Force or through an AIS Sub Committee, including recommendations to the LMCD Board on the management tool(s) to be used.
3. Secure the necessary permits and grant funds from the MN DNR for the mechanical harvesting program and for LMCD managed herbicide treatment project(s).
4. Provide some level of annual funding for the mechanical harvesting program and herbicide treatment project(s).
5. Request a whole bay or large scale herbicide treatment.
6. Facilitate lake-wide coordination of all large scale treatment programs on an annual basis.

MN DNR

1. Participation on the LMCD's AIS Task Force and AIS Sub-Committee.
2. Participation in the monitoring, evaluation, reporting of the herbicide treatment project(s).
3. Issue the necessary permits for the mechanical harvesting and herbicide treatment project(s).
4. Grant funds to some level.

LMA

1. Participation on the LMCD's AIS Task Force and AIS Sub-Committee.
2. Serve as the liaison between the LMCD and the abutting property owners on bays where whole bay or large scale herbicide treatment projects are planned.
3. Raise private or matching funds to some level.
4. Request a whole bay or large scale treatment.
5. Where funding sources prescribe, manage large scale herbicide treatments, within the lake-wide AIS Task Force annual treatment framework.

Other Governmental Agencies (Hennepin County, MCWD, TRPD, and Army Corps)

1. Participation on the LMCD's AIS Task Force and AIS Sub-Committee.
2. Potential matching funds by other governmental agencies.
3. Provide in-kind services where possible.
4. Provide knowledge transfer for other treatment methodologies and programs from across the nation.

Appendix A

Chip Welling
Excerpt on Benefits of Native Plants
9/5/12

For the Minnetonka plan

5 September 2012

Chip Welling
MnDNR

Aquatic plants provide habitat for fish and wildlife as well as water quality benefits. Studies have consistently shown that fish abundance is greater in vegetated habitats than in un-vegetated habitats (Dibble et al. 1996; Pratt and Smokorowski 2003; Wei et al. 2004). Aquatic plants provide fish and wildlife with food, spawning, and nesting habitat, and cover from predators (Dibble et al. 1996; Petr 2000; Valley et al. 2004)). In addition, aquatic plants anchor sediments and sequester nutrients like phosphorous and nitrogen, thus reducing turbidity caused by sediment and algae blooms (Barko and James 1998, Petr 2000).

Recent research in Minnesota on the effects on fish of lake-wide selective control of invasive aquatic plants showed that this management did not affect the number of species or abundance of littoral fish (Kovalenko et al. 2010).

Near-shore aquatic plants, which are the most frequent targets of control efforts by shoreline property owners, are particularly important as habitat for young or small fish (Poe et al. 1986; Bryan and Scarnecchia 1992; Weaver et al. 1997). Ongoing DNR surveys show that shallow vegetated bays have greater species diversity of nongame fish and amphibians than other habitat types (personal communication, Pam Perry, DNR nongame wildlife biologist). Surveys have also documented functional extirpations (i.e., absence of species in targeted surveys) of blackchin shiners, blacknose shiners, and banded killifish in several metro-area lakes that have likely suffered aquatic plant habitat degradation (personal communication, Ray Valley, DNR fisheries research biologist).

Many species of birds and mammals are likewise dependent on aquatic plants for food and nesting sites. Waterfowl eat the seeds and tubers produced by various water plants (Bellrose 1976). Aquatic plants support numerous insects and other aquatic invertebrates, which are eaten by waterfowl (Krull 1970) and are important sources of food (protein) for laying females (Batt et al. 1992:7-9). The reproductive success of waterfowl is closely tied to available aquatic plants, which provide food and cover for laying hens (Bellrose 1976).

Emergent aquatic vegetation provides nesting cover for a variety of waterfowl, shorebirds, wading birds and songbirds (Bellrose 1976). The muskrat, an important furbearer, is almost entirely dependent on aquatic vegetation for food and shelter (Errington 1941).

There seems to be an overall positive effect of submersed aquatic plants on water clarity in lakes. Scheffer et al. (1993:275) showed that lakes with abundant submersed plants tend to have higher clarity than lakes with similar levels of nutrients in which vegetation is sparse or absent. Carter et al. (1988) documented higher Secchi disk transparencies within a bed of submersed plants in comparison with a location in open water without plants. The importance of submersed plants in maintaining water clarity is reflected in observations of decreases in water clarity following lake-wide reductions in submersed plants resulting from treatment with herbicides (O'Dell et al. 1995:314; Welling et al. 1997; Valley et al. 2006).

While the science documenting the habitat and water quality value of aquatic plants is strong, the relationship between aquatic plants and the abundance of fish and other wildlife is complex and studies point to the difficulty in defining a precise threshold in aquatic plant abundance at which habitat quality declines. As a result, it is necessary and reasonable to take a "precautionary management approach" in setting limits for aquatic plant control (Rosenberg 2002; Valley et al. 2004). This approach acknowledges that aquatic plants are important habitat and that control limits need to be conservative to avoid negative impacts to the state's public waters. This rationale was supported in a previous administrative law judge's report when the DNR defended the current rule, which limits pesticide control of submersed aquatic plants to 15% of the littoral area, even though scientific research had not documented that 15% was the best limit for all lakes (Exhibit 1).

Invasive aquatic plants may displace native species and hinder recreation more than native species. At the same time, invasive and native plants often occur together; therefore, while it is necessary and reasonable to consider this criterion when determining how much control to allow, the presence of invasive aquatic plants should not be considered the sole criterion in determining whether or not to allow the maximum amount of control. In addition, in some heavily degraded lakes that have abundant invasive aquatic plants, few native plants, and low water clarity, excessive control may result in worse problems such as a net loss in aquatic plant cover, algae blooms, and increased turbidity (Welling et al. 1997; Valley et al. 2006).

It is necessary and reasonable to consider whether a water body subject to a proposed permit is a shallow lake or bay, or wetland that naturally supports abundant aquatic plants. These areas are

extremely important for fish and wildlife habitat and wetland loss and habitat degradation is considered a major environmental issue affecting waterfowl and other wildlife abundance (Dahl 2006; Dahl 1990; Bellrose 1976). It is necessary and reasonable to view aquatic plant control differently in these areas than on deeper lakes, because aquatic plant control should not be permitted to change the ecological character of a wetland or shallow lake. It is not reasonable for the DNR to permit shoreline owners to alter the natural character of a shallow lake or wetland in order to engage in unimpeded surface water recreation.

Literature Cited

Alexander, M.L., M.P. Woodford, S.C. Hotchkiss. 2008. Freshwater macrophyte communities in lakes of variable landscape position and development in northern Wisconsin, U.S.A. Aquatic Botany 88:77-86.

Barko, J. W., and W.F. James. 1998. Effects of submerged aquatic macrophytes on nutrient dynamics, sedimentation, and resuspension. 197-214 IN: Jeppesen, E., M. Sondergaard, M. Sondergaard, and K. Christoffersen, Editors. The structuring role of submerged macrophytes in lakes. Ecological Studies 131. Springer-Verlag, NY

Batt, B.D.J., A.D. Afton, M.G. Anderson, C. D. Ankeny, D.H. Johnson, J.A. Kadlec, and G.L. Krapu, editors. Ecology and management of breeding waterfowl. University of Minnesota Press, Minneapolis and London.

Bellrose, F.C. 1976. Ducks, geese and swans of North America. Stackpole Books, Cameron and Keller Streets, Harrisburg, PA, 17105.

Bolduan, B.R., G.C. Van Eeckhout, H.W. Quade, and J.E. Gannon. 1994. *Potamogeton crispus* – the other invader. Lake and reservoir management 10:113-125.

Bremigan, M.T., S.M. Hanson, P.A, Soranno, K.S. Cheruvelil, and R.D. Valley. 2005. Aquatic vegetation, largemouth bass, and water quality responses to low-dose fluridone two years post treatment. Journal of Aquatic Plant Management 43:57-64.

Byran, M.D., and D.L. Scarnecchia. 1992. Species richness, composition, and abundance of fish larvae and juveniles inhabiting natural and developed shorelines of a glacial Iowa lake. Environmental Biology of Fishes 35: 329-341.

Carter, V., J.W. Barko, G.L. Godshalk, and N.B. Rybicki. 1988. Effects of submersed macrophytes on water quality in the tidal Potomac River, Maryland. Journal of Freshwater Ecology 4:493-501.

Chase, J.M., and T.M. Knight. 2006. Effects of eutrophication and snails on Eurasian Watermilfoil (*Myriophyllum spicatum*) invasion. Biological Invasions, 8:1643-1649.

Craig, R.E., and R.M. Black. 1986. Nursery habitat of muskellunge in Southern Georgian Bay. Lake Huron, Canada. American Fisheries Society Symposium 15:79-86.

Crowell, W.J., N.A. Proulx, and C.H. Welling. 2006. Effects of repeated fluridone treatments over nine years to control Eurasian watermilfoil in a mesotrophic lake. Journal of Aquatic Plant Management 44:133-136.

Dahl, T.E. 1990. Wetland losses in the United States 1780's to 1980's. U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C. 13pp.

Dahl, T.E. 2006. Status and trends of wetlands in the conterminous United States 1998 to 2004. U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C. 112pp. (see page 17)

Dibble, E.D., K.J. Killgore, and S.L. Harrel. 1996. Assessment of fish-plant interactions. American Fisheries Society Symposium 16:357-372.

Drake, M.T., and R.D. Valley. 2005. Validation and application of a fish-based index of biotic integrity for small central Minnesota lakes. North American Journal of Fisheries Management 25:1095-1111.

Egertson, C.J., and J.A. Downing. 2004. Relationship of fish catch and composition to water quality in a suite of agriculturally eutrophic lakes. Canadian Journal of Fisheries and Aquatic Sciences 61:1784-1796. (see abstract)

Engel, S. 1990. Ecosystem responses to growth and control of submerged macrophytes: a literature review. Wisconsin Department of Natural Resources, Technical Bulletin 170, Madison.

Engel, S., and J.L. Pederson. 1998. The construction, aesthetics, and effects of lakeshore development: A literature review. Research Report 177. PUBL-SS-577-99 Wisconsin Department of Natural Resources, Box 7921, Madison, WI 53707.

Errington, P.L. 1941. Versatility in feeding and population maintenance of the muskrat. Journal of Wildlife Management 5:68-89.

Henderson, C.L., C.J. Dindorf, and F.J. Rozumalski. 1998. Lakescaping for Wildlife and Water Quality. Minnesota Department of Natural Resources

James, W.F., J.W. Barko, H.L. Eakin, and P.W. Sorge. 2002. Phosphorus budget and management strategies for an urban Wisconsin lake. Lake and Reservoir Management 18:149-163.

James, W.F., D.I. Wright, H.L. Eakin, and J.W. Barko. 2004. Impacts of Mechanical Macrophyte Removal Devices on Sediment Scouring in Littoral Habitats: I. Historical survey of operations in Minnesota lakes. Technical Note APCRP-EA-13, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

James, W.F., D.I. Wright, J.W. Barko, and H.L. Eakin. 2006. Impacts of Mechanical Macrophyte Removal Devices on Sediment Scouring in Littoral Habitats: II. Experimental Operation in the Littoral Zone of Eau Galle Reservoir, Wisconsin. Technical Note APCRP-EA-13, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Kelly, T., and J. Stinchfield. 1998. Lakeshore development patterns in northeast Minnesota: status and trends. Minnesota DNR, Office of Management and Budget Services, St. Paul.

Kovalenko, K.E., E.D. Dibble, and J.G. Slade. 2010. Community effects of invasive macrophyte control: Role of invasive plant abundance and habitat complexity. Journal of Applied Ecology 47:318-328.

Krull, J.N. 1970. Aquatic plant-macroinvertebrate associations and waterfowl. Journal of Wildlife Management 34:707-718

Lyons, J. 1989. Changes in the abundance of small littoral-zone fishes in Lake Mendota, Wisconsin. Canadian Journal of Zoology 67:2910-2916.

Madsen, J.D., J.W. Sutherland, J. A. Bloomfield, L.W. Eichler, and C.W. Boylen. 1991. The decline of native vegetation under dense Eurasian watermilfoil canopies. Journal of Aquatic Plant Management 29:94-99.

Madsen, J.D., K.D. Getsinger, R.M. Stewart, and C.S. Owens. 2002. Whole lake fluridone treatments for selective control of Eurasian watermilfoil: II. Impacts on submersed plant communities. Lake and Reservoir Management 18:191-200.

Moyle, P.B., and T. Light. 1996. Biological invasions of freshwater: empirical rules and assembly theory. Biological Conservation 78:149-161.

O'Dell, K.M., J. van Arman, B.H. Welch, and S.D. Hill. 1995. Changes in water chemistry in a macrophyte-dominated lake before and after herbicide treatment. Lake and Reservoir Management 11:311-316.

Olson, M.H., S.R. Carpenter, P. Cunningham, S. Gafney, B.R. Herwig, N.P. Nibbelink, T. Pellet, C. Storlie, A.S. Trebitz, and K.A. Wilson. 1998. Managing macrophytes to improve fish growth: a multi-lake experiment. Fisheries 23: 6-12.

Petr, T. 2000. Interactions between fish and macrophytes in inland waters: a review. Food and Agriculture Organization of the United Nations, Fisheries Technical Report 396. Rome.

Pierce, R.B. 2006. Ecological and life history associations of northern pike with aquatic vegetation - a literature review. Minnesota Dept. of Natural Resources, Division of Fish and Wildlife unpublished report.

Poe, T.P., C.O. Hatcher, and C.L. Brown. 1986. Comparison of species composition and richness of fish assemblages in altered and unaltered littoral habitats. Journal of Freshwater Ecology. Vol. 3, No. 4: 525-536.

Pothoven, S.A., B. Vondracek, and D.L. Pereira. 1999. Effects of vegetation removal on bluegill and largemouth bass in two Minnesota lakes. North American Journal of Fisheries Management 19:748-757.

Pratt, T.C., and K.E. Smokorowski. 2003. Fish habitat management implications of the summer habitat use by littoral fishes in a north temperate, mesotrophic lake. Canadian Journal of Fisheries and Aquatic Science. 60: 286-3000.

Radomski, P. 2006a. Historical changes in abundance of floating-leaf and emergent vegetation in Minnesota lakes. North American Journal of Fisheries Management, in press.

Radomski, P. 2006b. An assessment and rationale for the alternative shoreland management standards. Minnesota DNR, Division of Waters, St. Paul.

Radomski, P., and T.J. Goeman. 2001. Consequences of human lakeshore development on emergent and floating-leaf vegetation abundance. North American Journal of Fisheries Management 21: 46-61.

Rosenberg, A.A. 2002. The precautionary approach in application from a manager's perspective. Bulletin of Marine Science 70:577-588.

Rybicki, N.B., and J.M. Landwehr. 2007. Long-term changes in abundance and diversity of macrophyte and waterfowl populations in an estuary with exotic macrophytes and improving water quality. Limnology and Oceanography 52(3):1195-1207/

Scheffer, M., S.H. Hosper, M-L. Meijer, B. Moss, and E. Jeppesen. 1993. Alternative equilibria in shallow lakes. Trends in ecology and evolution 8:275-279.

Scheffer, M., and S.R. Carpenter. 2003. Catastrophic regime shifts in ecosystems: linking theory to observation. Trends in Ecology and Evolution 18:648-656.

Skogerboe, J.G., and Getsinger, K.D. 2006. Selective control of Eurasian watermilfoil and curlyleaf pondweed using low doses of endothall combined with 2,4-D. Technical Note APCRP-CC-05, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Smith, C.S. and J.W. Barko. 1990. Ecology of Eurasian watermilfoil. Journal of Aquatic Plant Management 28: 55-64.

Valley, R.D., T.K. Cross, and P. Radomski. 2004. The role of submersed aquatic vegetation as habitat for fish in Minnesota lakes, including the implications of non-native plant invasions and their management. Minnesota Department of Natural Resources, Special Publication 160, St. Paul.

Valley, R.D., W. Crowell, C.H. Welling, and N. Proulx. 2006. Effects of a low dose fluridone treatment on submersed aquatic vegetation in a eutrophic Minnesota lake dominated by Eurasian watermilfoil and Coontail. Journal of Aquatic Plant Management 44:19-25.

Wagner, K.I., J. Hauxwell, P.W. Rasmussen, F. Koshere, P. Toshner, K. Aron, D.R. Helsel, S. Toshner, S. Provost, M. Gansberg, J. Masterson, and S. Warwick. 2007. Whole-lake herbicide treatments for Eurasian watermilfoil in four Wisconsin lakes: Effects on vegetation and water clarity. Lake and Reservoir Management 23:83-94.

Weaver, M.J., J.J. Magnuson, and M.K. Clayton. 1997. Distribution of littoral fishes in structurally complex macrophytes. Canadian Journal of Fisheries and Aquatic Sciences 54:2277-2289.

Wei, A., P. Chow-Fraser, and D. Albert. 2004. Influence of shoreline features on fish distribution in the Laurentian Great Lakes. Canadian Journal of Fisheries and Aquatic Sciences 61:1113-1123.

Welling, C., W. Crowell, and D. Perleberg. 1997. Evaluation of fluridone herbicide for selective control of Eurasian watermilfoil: Final Report. Unpublished report dated 15 April by the Minnesota Department of Natural Resources, Ecological Services Section, 500 Lafayette Road, Box 25, St. Paul MN 55155-4025.

Wilcox, D.A., and J.E. Meeker. 1992. Implications for faunal habitat related to altered macrophyte structure in regulated lakes in northern Minnesota. Wetlands 12:192-203.

Appendix B

Assessment of 2008-2011 Coordinated Herbicide Treatments on Carmans, Grays, and Phelps Bays (Summary Report)

Assessment of 2008-2011 Coordinated Herbicide Treatments on Carmans, Grays, and Phelps Bays

Summary Report from the Aquatic Invasive Species (AIS) Task Force to the LMCD Board of Directors

BACKGROUND

In 2008, the Aquatic Invasive Species (AIS) Task Force created a Lake Vegetation Management Plan (LVMP) for a five-year demonstration project on Carmans, Grays, and Phelps Bays. The problems to be addressed in this LVMP included the following:

1. Eurasian watermilfoil (EWM) is the most problematic plant in the three bays because it interferes with most recreational activities, creates a shoreland cleanup and maintenance chores, and probably diminishes ecological health. Other invasive species, such as curlyleaf pondweed (CLP), should be controlled as well.
2. Native submersed plants also interfere with recreational use and riparian access in some areas; but it is recognized that some kind of rooted submersed plants will always be present, so control of native plants should be balanced with their protection.
3. Water lilies are sometimes problematic, although there is an appreciation that water lilies provide valuable habitat.
4. The overall plant management is poorly coordinated.

LMCD STRATEGIC PLAN

The Lake Minnetonka Conservation District (LMCD) Board of Directors has adopted a Strategic Plan for Lake Minnetonka. One objective in this Plan is to "Reduce the levels of existing AIS." A goal for this objective is for the LMCD to "Manage the three-bay treatment project on Carmans, Grays, and Phelps Bays." Per Agreement, the Lake Minnetonka Association (LMA) has served as the project manager from 2008-2011, with the LMCD contributing financially and utilizing the AIS Task Force as the technical committee, per the approved LVMP.

A task was established for this goal in 2011. In particular, to "Evaluate the three bay treatment project with the goals and objectives established in the 2008 LVMP." A detailed Report from the AIS Task Force, with recommendations as to expansion to other bays and funding options, is the deliverable to the LMCD Board. Representatives on this Task Force include appointed LMCD Board members (Kelsey Page and Jeff Morris), Hennepin County Environmental Services (Hennepin County), Lake Minnetonka Association (LMA), Minnehaha Creek Watershed District (MCWD), Minnesota Department of Natural Resources (MN DNR), Three Rivers Park District (TRPD), Lisa Whalen (former LMCD Board member), Dick Woodruff (former LMCD Board member), Gabriel Jabbour (Tonka Bay Marina), and Jay Green (Anglers For Habitat).

ASSESSMENT OF LVMP GOALS AND OBJECTIVES

A number of goals and objectives were established in the LVMP for the management of aquatic plants on Lake Minnetonka. A summary of these goals and objectives, including an assessment of the herbicide treatments conducted, are detailed below within this Report.

- **Goal A- EWM and other invasive plants, such as CLP, will be controlled throughout the respective bays in manner that is safe and effective to reduce interference with recreational activities, reduce lakeshore clean-up, and improve ecological health.**

Objective A-1. EWM will be controlled to levels of 20% occurrence (littoral zone) during the year of treatment (year 1) and maintained to frequencies below 20% in subsequent years (years 2-5). CLP levels will be evaluated in the early season of year 2, then controlled to levels of 20%

occurrence (littoral zone) during the year of treatment (year 1) and maintained to frequencies below in subsequent years (years 2-5). A metric relating to the density or matting coverage of EWM will be developed during year 1 and EWM will be controlled to less than that benchmark in years 2-5.

A great deal has been learned on this objective, which is summarized as follows:

- An initial assumption was that bay-wide treatments would take place in the first three years (2008-2010), with spot treatments planned on an as-needed basis in the final two years (2011-2012). This assumption has not held true. Whole bay treatments were required in 2011 in Carmans and Phelps Bays to reduce EWM occurrence to target levels.
- LMA representatives and lakeshore residents on the treatment bays report reduced interference with recreational activities and reduced lakeshore cleanup. The overall goal of controlling EWM and CLP in a safe and efficient manner to reduce these nuisance conditions appears to have been accomplished.
- Measuring the ecological health of the treatments bays proved extremely difficult. No conclusions regarding this aspect of the goal can be made.
- The objective of developing a measurement metric relating to density or matting coverage of EWM proved difficult and expensive and was dropped from the program after year one.
- Spot treatments in 2010 did not reduce the frequency of EWM in either Grays or Phelps Bays. The desired control objectives were achieved only in the years of whole bay treatments in 2009 (Grays and Phelps Bays) and 2011 (Carmans Bay).
- EWM frequency of occurrence typically increased within one year of partial or no treatment. It appears that bay-wide treatments will be needed on a reoccurring basis (approximately every two years) in order to achieve the 20% frequency control objective.
- Despite EWM frequencies above 45% in Grays Bay and Phelps Bay in 2010, whole bay treatments were not performed. The observed high occurrence frequency of EWM did not cause a reported increase in nuisance conditions, thus, the treatment objectives were modified.
- The herbicide treatment protocols have changed each year, in consultation with the technical committee. These changes have factored in: 1) the amount of herbicide to which the plants are exposed, and 2) the timing of the exposure. In 2008 and 2010, early season treatment of EWM and CLP was done through a combination of triclopyr and endothall. These treatments were not very effective for EWM control but appeared to be successfully control CLP. In 2009 and 2011, late season treatment of EWM was done utilizing triclopyr. These treatments were much more effective; although there was some damage to native species (see Goal B below for further details below).
- EWM frequencies (early season/late season) for 2007 through 2011 were as follows:

Bays	2007	2008	2009	2010	2011
Carmans	58/60	59/72	--/77	74/77	60/4
Grays	86/86	50/54	37/1	45/57 (*)	56/90
Phelps	65/67	60/69	29/20	50/51 (*)	41/24

Note: Yellow colored cells represent early season treatments and green colored cells represent late season treatments. Asterisk represent spot treatments.

- CLP frequencies (early season/late season) for 2007 through 2011 were as follows:

Bays	2007	2008	2009	2010	2011
Carmans	28/4	4/0	--/0	3/0	21/0
Grays	20/3	5/0	23/1	0/0	0/0
Phelps	36/5	1/7	40/3	0/0	24/1

Objective A-2. The water clarity in the bays will not be diminished as a result of the treatments.

This objective has been complied with. Data collected by the MCWD confirm that no declines in water quality in the treatment bays occurred during the four years of the project.

Objective A-3. An annual assessment of user perceptions with respects to treatments' impacts on reducing interference with recreational activities and a reduction in lakeshore cleanup chores will be conducted to provide an additional basis for evaluating treatment effects.

In 2008, the LMA polled all bay residents on the treated bays via e-mail. Questions that feedback was received on, which were coordinated through the technical committee, included:

1. Did EWM interfere with recreation?
2. Were there improvements in your lakeshore clean up chores?
3. What was the overall effectiveness of the treatments?

The total number of responses to this survey, 17, was low so little weight can be given to these responses. However, some anecdotal feedback has been received from bay residents that they have been pleased with the outcome of the treatments, which cannot be substantiated. A similar survey was not conducted in 2009-2011.

- **Goal B- Native submersed plants should be protected, except in localized areas where they pose a nuisance (see Goal C), although control will be allowed in localized areas where native plants inhibit access to open water or prohibit recreation (see Goal C).**

Objective B-1. The overall native submersed plants, as measured by the mean number of native plants per point (littoral zone), will be maintained or allowed to increase. The biomass of native submersed plants will be measured from 35 random sites (per bay) in year 1, and that will be used as a benchmark such that native submersed plant biomass will be maintained at or above that level in years 2-5.

A great deal has been learned on this objective, which is summarized as follows:

- The measurement of native plant biomass was not completed for any treatment years. The expense and time demands of biomass sampling were the main impediments to the completion of this objective.
- Biomass assessments would be valuable because of the discrepancy between the reported % frequency data and anecdotal reports of treatment effectiveness. For example, although the % frequency in Grays Bay increased to 90 in the fall of 2011, LMA representatives reported that

residents experienced a significant reduction in nuisance conditions. Likewise, the % of frequency data suggest minimal impact on native plants by 2011, but lake users reported significant loss of lily pads and other native plants in the treatment bays.

- There was a decrease in the mean number of native species per point in 2008 and 2009 relative to 2007 (the pre-treatment year). Decreases in the number of native plants per sample point tended to occur following whole bay late season treatments. The native plant population appeared to recover by 2011. The MN DNR has accepted this temporary decrease as an acceptable level of risk.
- Objective B-1 was modified to indicate the critical objective is to maintain the native plant population over multiple years, not necessarily in the year of the treatment.
- The mean number of submersed native plants per littoral sampling point are summarized below:

Bays	2007	2008	2009	2010	2011
Carmans	1.6/1.6	1.2/1.8	--/1.7	2.0/2.1	1.7/1.9
Grays	2.9/2.9	2.4/2.7	2.3/2.3	2.8/2.8	1.8/3.2
Phelps	2.2/2.4	1.8/2.3	2.0/2.1	2.2/2.5	2.0/2.5

- **Goal C- Provide limited individual nuisance or access control when bay-wide selective control applications are performed.**

<u>Objective C-1</u>. Any subsequent chemical treatments within the same season shall be subject to inspection and shall be granted no more than 50 shoreline feet, or half their lake frontage whichever is less, by 50 feet lakeward plus a 15 foot channel to open water. Off shore treatment of native submersed plants shall not be permitted. Should native submersed plants rebound to a large extent causing recreational nuisance, this limitation will be revisited. These treatments for submersed plants other than CLP or EWM shall require a separate permit and shall require annual signatures for such treatment. No permit fee will be assessed to those already having paid a permit fee for early season control of non-native submersed plants.

This objective has been complied with.

- **Goal D- This plan will be considered as a framework for possible expansion in the future to other bays in Lake Minnetonka**

<u>Objective D-1</u>. This LVMP will be expanded to other bays in Lake Minnetonka, depending on a number of factors, included, but not limited to: a) the outcomes of the control and protection actions in the three bays (this plan), b) interest or demand from other bays, c) a significant change in the EWM or CLP situation elsewhere in Lake Minnetonka, and d) availability of financial resources.

After the treatments occurred in 2009, a request was made to expand the herbicide treatments to Gideon and St. Albans Bays. The Task Force recommendations were: 1) this was a three-bay project, for five years, and 2) that expansion would be premature due to the necessary scientific analysis to measure the goals outlined in the LVMP for remaining three years of this project. However, the Task Force stated that the LMA (or some other group) could propose a stand alone program and submit a permit

application(s) to the MN DNR. The MN DNR would then make a decision on whether to approve (or deny) the application(s). The LMCD Board concurred with this recommendation.

Subsequent applications were submitted by Gideon and St. Albans Bay residents, in partnership with the LMA, and approved by the MN DNR prior to herbicide treatments on these bays in 2011. These treatments are stand alone programs and are not being assessed in this Report.

EXPANSION TO OTHER BAYS (FUNDING SOURCES)

Over $500,000 has been invested in this project from 2008–2011 through public and private partnerships (see table below for further details). This does not include funds committed to this project for professional oversight and plant monitoring from the U.S. Army Corps of Engineers and the MN DNR.

Summary of Project Costs (2008-2011)			
Year	**Herbicide Treatments**	**Project Management**	**Total Costs**
2008	$148,131	$27,836	$175,967
2009	$116,999 (*)	$17,550	$134,549
2010	$87,386	$13,109	$100,495
2011	$85,580 (**)	$10,800	$96,380
Totals	**$438,096**	**$69,295**	**$507,391**
* A treatment was not done in Carmans Bay in 2009			
** A treatment was not done in Grays Bay in 2011			

The consensus of the Task Force was that the LMCD Board should not extend the current three-bay project beyond 2012, or expand this project to other bays, until a comprehensive vegetation management plan is developed for Lake Minnetonka. Some of the minimum components the plan could include are as follows:

- A focus on bays where nuisance growth of EWM covers 50% or more of the surface use area.
- Control activities should demonstrate a public navigational or recreational benefit for the general public.
- An assessment on closed bays vs. open bays for large scale herbicide treatments needs to be completed.
- A focus on bays that have plant fragments drifting to other bays should be prioritized.
- Possible funding sources (private and public) needs to be identified.

Appendix C

Table 1- MN DNR Comparison of Mechanical Harvesting vs. Herbicides

Comparison of Mechanical Harvesting vs. Herbicides
(Prepared by MN DNR)

	Mechanical Harvesting	Herbicides
Effectiveness of Control		
Reliability [difficulty in obtaining consistent results in different lakes (Potential failure of treatments)]	Never fails [to remove plants]	Can fail
Time to relief	Immediate	7 to 14 days
Vegetation is collected and removed from the lake	Yes (Nutrients in plants are removed from lake)	No (Nutrients in plants are NOT removed from lake)
Duration of control (and need for multiple treatments)	Shorter?	Longer?
Creation of channels	Good	Not so good
Control of plants over a large area	Not so good	Good
Additional Considerations		
Cost	Often higher	Often lower
Percentage of cost attributable to labor	high	low
Capital investment	high	None [for customer]
Duration of work	Continues over the season	One or a few days
Variability in cost	higher	lower
Disposal of harvested plants	Can be difficult to find a place where plants can be delivered	Not applicable (plants decompose in lake)
Potential spread within a lake	Should not be employed on lakes where the distribution of milfoil is limited	Can be employed on lakes where the distribution of milfoil is limited
Effects on non-target organisms or lake ecosystem		
Removes invertebrates, fish, frogs, snakes, turtles, etc	Yes	No
When target plant is an exotic, removal or destruction of native vegetation	Yes	Yes or no, depending on particular herbicide used
Increased fragmentation	More	Less
Disturbs sediment and causes suspension of sediment in the water column, which in turn may reduce water clarity	Often does, likely to a greater extent	May do so, likely to a lesser extent
Potential negative effects of introducing chemicals into the aquatic environment	No (except hydraulic fluid and oil from breaks in lines)	Yes
Restrictions on use of water after treatment	No	In some cases
Selectivity	Limited or none	Some are, some are not
Minnesota Regulations (M.R. 6280)		
Small area can be treated without a permit to control milfoil or other submersed aquatic plants	Yes	No (***Always*** requires a permit from the DNR)
Limit on the amount of area that may be treated	50% of the littoral zone	15% of the littoral zone

Appendix D

Table 2- Lake Minnetonka Invasive Plant Information

Appendix D

Table 2 was developed as follows:

- Individual lake segments or bays were derived from the LMCD 'Index of Lake Minnetonka Areas' – some areas have been combined.

- **Total (surface) Areas** were taken from the LMCD's Management Plan (Table 2-1).

- **Historic Problem** is a category intended to indicate where EWM or CLP have historically been problematic in the respective areas. Problems are ranked as:
  - **Yes** – EWM is problematic and/or has been controlled throughout most of the area.
  - **No** - EWM is not problematic. Some areas have not had control due to physical constraints (eg. Bridges) for the harvesters.
  - **Limited** – Indicates EWM is only problematic or requires control in limited areas.

- **Shore Length (Miles and Feet)** - were taken from the LMCD's Management Plan (Table 2-1).

- **Littoral Acres** – was taken from the LMCD's 'Allowable Harvest Area,' which is an attachment to their harvesting permit from the MN DNR (see clarification of 'littoral' below).

- **Potential Problem Areas** – is identical to **Littoral Acres** except here it is divided into **Public** and **Private Acres** (see clarification of 'problem' and 'private' below):
  - **Private Acres** is the **Shore Length** multiplied by 100-feet (and converted to acres).
  - **Public Acres** is **Littoral Acres** minus **Private Acres.**

- **Total Problem Acres** (percentage of the area) – is the **Littoral Area** as a percentage of the **Total Acres.**

Area #	Management Area	Total Area (Acres)	Historic Problem (Yes, No, Limited)	Shore Length (miles)	Shore Length (feet)	Littoral Area (acres) TOTAL	Littoral Area (acres) Public	Littoral Area (acres) Private	Littoral Area (% of Mgmt. Area) TOTAL	Littoral Area (% of Mgmt. Area) Public	Littoral Area (% of Mgmt. Area) Private
1	Halsted Bay	545	No	7.3	38,544	**322**	234	88	**59**	43	16
2	Priests Bay	144	Yes	2.1	11,088	**76**	51	25	**53**	35	18
3	Cooks Bay	343	Yes	2.2	11,616	**131**	104	27	**38**	30	8
4	W. Upper Lake	873	Yes	4.6	24,288	**193**	137	56	**22**	16	6
5	S. Upper Lake	722	Yes	6.6	34,848	**320**	240	80	**44**	33	11
6	Smithtown Bay	110	Yes	1.2	6,336	**33**	18	15	**30**	17	13
7	Phelps Bay	345	Yes	3.7	19,536	**272**	227	45	**79**	66	13
8 & 10	E. Upper Lake/Old Channel Bay	920	Yes	4.9	25,872	**261**	202	59	**28**	22	6
9	Carmans Bay	294	Yes	3.9	20,592	**187**	140	47	**64**	48	16
11	Spring Park Bay	378	Yes	2.6	13,728	**141**	109	32	**37**	29	8
12	Black Lake	76	Yes	3.2	16,896	**64**	25	39	**84**	33	51
13	Emerald Lake	13	Yes	1.0	5,280	**15**	3	12	**115**	22	93
14	Seton Lake	44	Yes	2.2	11,616	**41**	14	27	**93**	33	61
15	Harrisons Bay	215	Limited	3.5	18,480	**183**	141	42	**85**	65	20
16	Jennings Bay	290	No	3.5	18,480	**174**	132	42	**60**	45	15
17 & 19	West Arm Bay & Coffee Cove	571	Limited	5.7	30,096	**383**	314	69	**67**	55	12
18	Forest Lake	82	No	1.8	9,504	**49**	27	22	**60**	33	27
20 & 21	Crystal Bay (East & West)	812	Yes	6.7	35,376	**285**	204	81	**35**	25	10
22	North Arm Bay	319	Yes	4.7	24,816	**186**	129	57	**58**	40	18
23	Stubbs Bay	195	No	2.5	13,200	**104**	74	30	**53**	38	16
24	Maxwell Bay	300	Yes	3.7	19,536	**174**	129	45	**58**	43	15
25	Lafayette Bay	454	Yes	3.8	20,064	**195**	149	46	**43**	33	10
26	Smiths Bay	266	Yes	1.9	10,032	**244**	221	23	**92**	83	9
27	Tanager Lake	51	No	1.1	5,808	**50**	37	13	**98**	72	26
28	Browns Bay	696	Yes	3.5	18,480	**209**	167	42	**30**	24	6
29	Wayzata Bay	778	Yes	5.5	29,040	**198**	131	67	**25**	17	9
30	Grays Bay	180	Yes	3.2	16,896	**127**	88	39	**71**	49	22
31	Libbs Lake	17	Yes	1.1	5,808	**23**	10	13	**135**	57	78
32	Robinsons Bay	92	Yes	3.5	18,480	**27**	(15)	42	**29**	(17)	46
33	St. Louis Bay	20	Yes	0.6	3,168	**20**	13	7	**100**	64	36
34	Carsons Bay	116	Yes	2.7	14,256	**88**	55	33	**76**	48	28
35	St. Albans Bay	161	Yes	2.9	15,312	**102**	67	35	**63**	42	22
36	Excelsior Bay	90	Yes	1.2	6,336	**79**	64	15	**88**	72	16
37	Gideons Bay	330	Yes	4.4	23,232	**150**	97	53	**45**	29	16
38, 39, 40, 41	Echo Bay, Lower Lake S., Big Island Passage, & Veterans Bay	1,111	Yes	6.8	35,904	**310**	228	82	**28**	20	7
42	Lower Lake N.	2,090	No	5.5	29,040	**450**	383	67	**22**	18	3
TOTALS		**14043**		**125.3**	**661,584**	**5,866**	**4,347**	**1,519**			

Appendix E

Whole Bay or Large Scale Herbicide Treatment Matrix

Appendix E

This Plan has prepared a decision matrix to identify which management areas could be candidates for whole bay or large scale herbicide treatments. All of the management areas were ranked using criteria that summarizes key features on a management area basis. This information was further refined into a decision matrix that took into account the three criteria. These included: 1) suitability for success (considers the size of the management area and whether it was an open area), 2) public use (considers the number of Boat Storage Units (BSUs) on the management area, whether it is a public corridor, and whether it has a public access), and 3) treatment need (considers littoral zone percentage, whether there have been historic problems, and water clarity).

Eight management areas have been ranked as suitable candidates for whole bay or large scale herbicide treatments. These included: 1) St. Albans Bay, 2) Grays Bay, 3) St. Louis and Carsons Bays, 4) Carmans Bay, 5) Phelps Bay, 6) Gideon Bay, and 7) North Arm Bay. A series of autoranking certain criteria were conducted by the sub-committee to reduce the number of management areas from 42 to eight. This included:

- Assigning a low Priority to management areas that have had minimal amount of historic EWM problems (highlighted in "yellow" on the decision matrix).
- Assigning a low priority to management areas that were greater than 500 acres in size (highlighted in "blue" on the decision matrix).
- Assigning a low priority to management areas that were large and open (highlighted in "green" on the decision matrix).
- Assigning low priority to management areas that had a littoral percentage of less than 40% based on overall area size (highlighted in "purple" on the decision matrix).
- Assigning low priority to management areas that had a "Moderate" amount of historic EWM problems (highlighted in "tan" on the decision matrix).

Although only eight management areas are currently considered suitable candidates for whole bay or large scale herbicide treatments, the plan recognizes that additional management areas may be added to the list if conditions change. In the event that problematic EWM growth occurs in management areas that historically have not had nuisance conditions, these areas would be considered for treatment. Likewise, as the water quality in bays such as Jennings and Halsteds improves, the potential for nuisance EWM growth will increase. These bays could then be considered for herbicide treatment.

Whole Bay or Large Scale Herbicide Treatment Matrix (2012)

Area #	Management Area	Total Area	Suitability for Success		Public Use			Treatment need			
		Acres	Size	Openness	BSU	Corridor	Public Access	Littoral %	Historic problems	Clarity	Ranking
35	St. Albans Bay	161	H	H	H	M	H	H	H	H	1
30	Grays Bay	180	H	H	M	M	H	H	H	H	2
33 & 34	St. Louis & Carsons Bays	136	H	M	H	L	M	H	H	H	3
9	Carmans Bay	294	H	M	L	H	L	H	H	H	4
7	Phelps Bay	345	M	M	M	H	M	H	H	H	5
37	Gideons Bay	330	M	M	H	M	M	M	H	M	6
22	North Arm Bay	319	M	H	L	M	M	M	H	M	7
2	Priests Bay	144	H	M	L	M	L	H	M	M	
12, 13, & 14	Black, Emerald, & Seton Lakes	133	H	H	H	H	L	H	M	M	
24	Maxwell Bay	300	M	H	H	M	H	H	M	M	
31	Libbs Lake	17	H	H	L	L	L	H	M	L	
36	Excelsior Bay	90	H	M	H	M	H	H	M	H	
3	Cooks Bay	343	M	M	M	H	M	L	H	H	
11	Spring Park Bay	378	M	M	H	M	H	L	M	H	
25	Lafayette Bay	454	M	H	M	H	L	L	H	H	
6	Smithtown Bay	110	M	L	L	L	L	M	M	H	
26	Smiths Bay	266	M	L	M	H	M	H	M	H	
4	West Upper Lake	873	L	L	L	M	M	L	M	H	
5	South Upper Lake	722	L	L	H	H	M	M	H	H	
8 & 10	East Upper Lake & Old Channel	920	L	L	L	H	L	L	M	H	
20 & 21	Crystal Bay (East & West)	812	L	H	L	H	L	L	H	H	
29	Wayzata Bay	778	L	M	H	H	H	L	H	H	
38, 39, 40, 41	Echo Bay, Lower Lake S., Big Island Passage, & Veterans Bay	1,111	L	L	H	H	H	L	H	H	
1	Halsted Bay	545	L	H	M	L	M	H	L	L	
15	Harrisons Bay	215	H	M	H	H	M	H	L	L	
16	Jennings Bay	290	H	H	M	L	L	H	L	L	
17 & 19	West Arm Bay & Coffee Cove	571	M	M	H	H	H	H	L	M	
18	Forest Lake	82	H	H	L	L	L	H	L	L	
23	Stubbs Bay	195	H	H	L	L	L	M	L	M	
27	Tanager Lake	51	H	H	M	L	L	H	L	L	
28	Browns Bay	696	L	L	M	M	M	L	L	H	
32	Robinsons Bay	92	M	L	L	M	L	L	L	H	
42	Lower Lake N.	2,090	L	L	L	H	M	L	L	H	

Size Criteria: High (H) = <300 acres M= 300 to 500 acres L = > 500 acres
Isolation; High = enclosed M = Small open L = Large open
BSU (Boat Storage Units) H = > 200 M = 200 - 60 L = < 60
Corridor H = major movement corridor M = Minor movement or dead end with public access L = dead end bay no access
Public access H = 2+ public access or marina M = 1 access or marina L = no public access or marina
Littoral area H = > 55% M = 40 to 55 % L = < 40 adjusted for overall bay size
Historic problems: H = harvesting, whole bay treatments, and 6+ permits M = harvesting, 3 to 6 permits L = no harvesting o to 3 pe
Clarity: H = SD > 2.8 M = SD 1.5 to 3.0 L = SD < 1.5

Appendix F

Table 3- Lake Minnetonka Key Features

Lake Minnetonka Conservation District (LMCD)
Aquatic Invasive Species (AIS) Sub-Committee
Lake Minnetonka Key Features

Area #	Management Area	Licensed Multiple Dock Licenses	Public Launch Ramps	Quiet Water Areas	MN DNR Permits	Average Secchi Depths	Other
1	**Halsted Bay**	1. Cardinal Cove Beach Assoc. (5 BSUs) 2. Eagle Bluff Assoc. (6 BSUs) 3. Halstead Acres Improvement Assoc. (8 BSUs) 4. Trillium Bay HOA (17 BSUs) 5. Woodland Cove (117 BSUs) ***Sub-Total: 153 BSUs***	1. City of Minnetrista- Halstead Drive (40 c/t spaces)	None	2009 (6 permits for 26 properties) 2010 (6 permits for 21 properties) 2011 (11 permits for 25 properties)	2009- 1.06 meters 2010- 0.98 meters 2011- 1.07 meters	
2	**Priests Bay**	1. City of Mound Commons Docking Program (# of boats have historically been approximately 30) ***Sub-Total: 30 BSUs***	None	None	2009 (4 permits for 21 properties) 2010 (6 permits for 19 properties) 2011 (6 permits for 19 properties)	2009- 1.95 meters 2010- 2.09 meters 2011- 1.42 meters	
3	**Cooks Bay**	1. Al & Alma's (26 BSUs) 2. Chapman Place Marina (27 BSUs) 3. City of Mound- Lost Lake (61 BSUs) 4. City of Mound Commons Docking Program (# of boats have historically been approx. 53) ***Sub-Total: 167 BSUs***	1. City of Mound (estimated 29 c/t spaces in and outside of the lot.	None	2009 (15 permits for 31 properties) 2010 (11 permits for 23 properties) 2011 (11 permits for 21 properties)	2009- 2.28 meters 2010- 2.84 meters 2011- 1.79 meters	1. The breakdown of the BSUs at Al & Alma's includes: 1) 20 transient BSUs, and 2) 6 overnight storage BSUs for LMCD licensed charter boats 2. 24 transient BSUs on Lost Lake 3. Parking restrictions at Mound public access (Sat., Sun. and Holidays)
4	**West Upper Lake**	1. City of Mound Commons Docking Program (# of boats have historically been approx. 4) 2. Lake Minnetonka Regional Park (20 BSUs) 3. Loring Acres Beach Assoc. (8 BSUs) 4. Maple Forest Association (8 BSUs) 5. Woodend Shores Beach Assoc. (23 BSUs) ***Sub-Total: 63 BSUs***	1. Lake Minnetonka Regional Park (59 c/t spaces)	None	2009 (8 permits for 14 properties) 2010 (8 permits for 12 properties) 2011 (10 permits for 13 properties)	2009- 2.71 meters 2010- 3.25 meters 2011- 1.94 meters	1. The 20 BSUs at the Lake Minnetonka Regional Park are transient 2. Woodend Shores Beach Assoc. has a private access (presumably for its residents)
5	**South Upper Lake**	1. Baycliffe POA (15 BSUs) 2. Bayshore III HOA (8 BSUs) 3. Boulder Bridge HOA (40 BSUs) 4. Crane Island Assoc. (36 BSUs) 5. Howards Point Marina (96 BSUs) 6. Palmer Point HOA (6 BSUs) 7. A.F. Rossberg (6 BSUs) 8. ULMYC (30 BSUs) ***Sub-Total: 237 BSUs***	None	None	2009 (9 permits for 20 properties) 2010 (6 permits for 19 properties) 2011 (5 permits for 18 properties)		On-lake facilities provided at Howards Point Marina are detailed on the current Hennepin County map
6	**Smithtown Bay**	1. Harborage HOA (9 BSUs) 2. Smithtown Bay Assoc. (17 BSUs) ***Sub-Total: 26 BSUs***	None	None	2009 (5 permits for 9 properties) 2010 (5 permits for 11 properties) 2011 (4 permits for 9 properties)	2009- 2.77 meters 2010- 3.62 meters 2011- 2.04 meters	
7	**Phelps Bay**	1. City of Mound Commons Docking Program (# of boats have historically been approximately 123) ***Sub-Total: 123 BSUs***	1. City of Minnetrista- Tuxedo Blvd. (4 c/t spaces, no on-street parking)	None	2009 (6 permits for 75 properties) 2010 (7 permits for 94 properties) 2011 (10 permits for 54 properties)	2009- 2.67 meters 2010- 3.09 meters 2011- 2.13 meters	
8 & 10	**East Upper Lake and Old Channel Bay**	1. Clay Cliffe HOA (9 BSUs) ***Sub-Total: 9 BSUs***	None	None	2009 (4 permits for 13 properties) 2010 (3 permits for 11 properties) 2011 (2 permits for 10 properties)		
9	**Carmans Bay**	1. Pheasant Lawn HOA (10 BSUs) 2. Walters Port Assoc. (5 BSUs) ***Sub-Total: 15 BSUs***	None	None	2009 (15 permits for 141 properties) 2010 (6 permits for 132 properties) 2011 (6 permits for 153 properties)	2009- 3.09 meters 2010- 3.57 meters 2011- 2.22 meters	

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Area #	Management Area	Licensed Multiple Dock Licenses	Public Launch Ramps	Quiet Water Areas	MN DNR Permits	Average Secchi Depths	Other
11	**Spring Park Bay**	1. Bayview Apts. (26 BSUs) 2. Hennepin County (65 BSUs) 3. Lakewinds Assoc. (57 BSUs) 4. Mtka Edgewater Apts. (16 BSUs) 5. Pelican Point HOA (40 BSUs) 6. RDP Partners (32 BSUs) ***Sub-Total: 236 BSUs***	1. Hennepin County Public Access (80+ c/t spaces in lot & at overflow lot).	None	2009 (4 permits for 7 properties) 2010 (4 permits for 7 properties) 2011 (4 permits for 9 properties)	2009- 2.90 meters 2010- 3.22 meters 2011- 2.24 meters	40 of the 65 Hennepin County BSUs are transient
12	**Black Lake**	1. City of Mound Commons Docking (# of boats have historically been approx. 70) 2. Presbyterian Homes on Lake Mtka. (11 BSUs) ***Sub-Total: 81 BSUs***	None	North portion of the entire bay.	2009 (6 permits for 16 properties) 2010 (7 permits for 16 properties) 2011 (4 permits for 14 properties)	2009- 2.05 meters 2010- 2.33 meters 2011- 1.69 meters	
13	**Emerald Lake**	1. City of Mound Commons Docking (# of boats have historically been approx. 5) 2. Seton Twin Homes (6 BSUs) ***Sub-Total: 11 BSUs***	None	Entire Bay	2009 (2 permits for 4 properties) 2010 (0 permits for 0 properties) 2011 (0 permits for 0 properties)		
14	**Seton Lake**	1. City of Mound Commons Docking (# of boats have historically been approx. 33) 2. 5th Street Ventures (13 BSUs) 3. Park Island Apts. (50 BSUs) 4. Seton View Assoc. (8 BSUs) ***Sub-Total: 104 BSUs***	None	Entire Bay	2009 (1 permit for 1 property) 2010 (0 permits for 0 properties) 2011 (0 permits for 0 properties)		
15	**Harrisons Bay**	1. City of Mound Commons Docking (# of boats have historically been approx. 170) 2. Driftwood Shores HOA (10 BSUs) 3. Harrison Harbor Twinhome Assoc. (7 BSUs) 4. Minnetonka Boat Rentals (44 BSUs) ***Sub-Total: 231 BSUs***	None	Small area leading out of Seton Channel.	2009 (7 permits for 15 properties) 2010 (6 permits for 10 properties) 2011 (4 permits for 8 properties)	2009- 1.11 meters 2010- 1.22 meters 2011- 1.07 meters	1. 2 of the 44 BSUs at Minnetonka Boat Rentals are transient 2. On-lake facilities provided at Mtka. Boat Rentals are detailed on the current Hennepin County map
16	**Jennings Bay**	1. City of Mound Commons Docking (# of boats have historically been approx. 58) 2. Jennings Cove DOA (20 BSUs) 3. Maple Crest Estates (5 BSUs) 4. Ridegwood Cove DOA (7 BSUs) 5. Seahorse Condominiums (76 BSUs) ***Sub-Total: 166 BSUs***	None	None	2009 (3 permits for 11 properties) 2010 (6 permits for 11 properties) 2011 (5 permits for 10 properties)	2009- 1.31 meters 2010- 1.11 meters 2011- 1.06 meters	Seahorse Condominiums has a private launch ramp (presumably for its residents)
17 & 19	**West Arm Bay & Coffee Cove**	1. City of Mound Commons Docking (# of boats have historically been approx. 5) 2. Lord Fletchers Apts. (32 BSUs) 3. Lord Fletchers of the Lake (71 BSUs) 4. Rockvam Boatyards, Sites 1 & 2 (180 BSUs) 5. Seton Village (20 BSUs) 6. West Beach Apts. (5 BSUs) ***Sub-Total: 313 BSUs***	None	None	2009 (3 permits for 15 properties) 2010 (6 permits for 17 properties) 2011 (3 permits for 14 properties)	2009- 1.52 meters 2010- 1.37 meters 2011- 1.31 meters	1. Lord Fletchers Apts. has a private launch ramp (presumably for its residents) 2. All 71 BSUs at Lord Fletchers of the Lake are transient 3. On-lake facilities provided at Rockvam Boatyards are detailed on the current Hennepin County map

Lake Minnetonka Conservation District (LMCD)
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Lake Minnetonka Key Features

Area #	Management Area	Licensed Multiple Dock Licenses	Public Launch Ramps	Quiet Water Areas	MN DNR Permits	Average Secchi Depths	Other
18	**Forest Lake**	1. Forest Arms Improvement Assoc. (14 BSUs) 2. Rita Zebeck Residence (7 BSUs) ***Sub-Total: 21 BSUs***	None	None	2009 (0 permits for 0 properties) 2010 (0 permits for 0 properties) 2011 (0 permits for 0 properties)	2009- 0.87 meters 2010- 1.50 meters 2011- 1.07 meters	
20 & 21	**West and East Crystal Bay**	1. Lafayette Club (24 BSUs) 2. City of Minnetonka Beach (20 BSUs) ***Sub-Total: 44 BSUs***	None	None	2009 (13 permits for 29 properties) 2010 (5 permtis for 15 properties) 2011 (6 permits for 15 properties)	2009- 3.04 meters 2010- 3.34 meters 2011- 1.77 meters	The 24 BSUs at the Lafayette Club are transient
22	**North Arm Bay**	1. Victoria Estates HOA (6 BSUs) ***Sub-Total: 6 BSUs***	1. Hennepin County Public Access (59 c/t spaces in lot, on-street parking prohibited).	Small area near Windjammer Point.	2009 (12 permits for 41 properties) 2010 (11 permits for 38 properties) 2011 (13 permits for 29 properties)	2009- 2.02 meters 2010- 2.15 meters 2011- 1.91 meters	
23	**Stubbs Bay**	1. Kevin Garnett Residence (8 BSUs) 2. Dr. Glen Nelson Residence (8 BSUs) 3. Jon Schwartzman Residence (8 BSUs) ***Sub-Total: 24 BSUs***	None	None	2009 (4 permits for 9 properties) 2010 (3 permits for 7 properties) 2011 (1 permit for 8 properites)	2009- 1.32 meters 2010- 1.41 meters 2011- 1.32 meters	
24	**Maxwell Bay**	1. North Shore Marina (162 BSUs) 2. Wayzata Marine (77 BSUs) ***Sub-Total: 239 BSUs***	1. MN DNR Public Access (90 c/t spaces in lot, on-street parking prohibited).	South portion of the entire bay & Norenberg inlet.	2009 (4 permits for 17 properties) 2010 (6 permits for 28 properties) 2011 (8 permits for 20 properties)	2009- 1.93 meters 2010- 1.93 meters 2011- 1.97 meters	1. On-lake facilities provided at North Shore Marina are detailed on the current Hennepin County map 2. On-lake facilities provided at Wayzata Marine are detailed on the current Hennepin County map
25	**Lafayette Bay**	1. City of Minnetonka Beach (58 BSUs) 2. Lafayette Ridge HOA (16 BSUs) 3. West Point Place HOA (8 BSUs) ***Sub-Total: 82 BSUs***	None	Huntington Point	2009 (7 permits for 30 properties) 2010 (6 permits for 28 properties) 2011 (3 permits for 24 properties)	2009- 3.33 meters 2010- 3.36 meters 2011- 2.38 meters	
26	**Smiths Bay**	1. Foxhill HOA (16 BSUs) 2. North Shore Marina- Smiths Bay (79 BSUs) ***Sub-Total: 95 BSUs***	None	West side of bay near Arcola Bridge.	2009 (1 permit for 2 properties) 2010 (2 permits for 2 properties) 2011 (9 permits for 9 properties)		On-lake facilities provided at North Shore Marina are detailed on the current Hennepin County map
27	**Tanager Lake**	1. Browns Bay, LLC (40 BSUs) 2. North Shore Marina- Browns Bay (67 BSUs) ***Sub-Total: 107 BSUs***	None	East side of bay near commercial docks.	2009 (0 permits for 0 properties) 2010 (0 permits for 0 properties) 2011 (0 permits for 0 properties)	2009- 1.02 meters 2010- 1.28 meters 2011- 0.93 meters	1. On-lake facilities provided at Browns Bay, LLC are detailed on the current Hennepin County map 2. On-lake facilities provided at North Shore Marina are detailed on the current Hennepin County map
28	**Browns Bay**	1. Browns Bay, LLC (58 BSUs) 2. North Shore Marina- Browns Bay (47 BSUs, which includes 1 for service) ***Sub-Total: 105 BSUs***	None	None	2009 (6 permits for 11 properties) 2010 (6 permits for 10 properties) 2011 (6 permits for 11 properties)		1. On-lake facilities provided at Browns Bay, LLC are detailed on the current Hennepin County map 2. On-lake facilities provided at North Shore Marina are detailed on the attached Hennepin County map
29	**Wayzata Bay**	1. Groveland HOA (32 BSUs) 2. Herzog Acres (15 BSUs) 3. Taylor Residence (5 BSUs) 4. City of Wayzata (116 BSUs) 5. WCSC & WYC (232 BSUs) 6. Wayzata Bay Mgmt. (80 BSUs) **Sub-Total: 480 BSUs**	1. City of Wayzata-Co. Rd. 16 Public Access (24 on-street c/t spaces).	1. Cedar Point East Channel 2. East side of bay along County Road 101 Causeway.	2009 (5 permits for 19 properties) 2010 (9 permits for 23 properties) 2011 (3 permits for 19 properties)	2009- 3.81 meters 2010- 3.88 meters 2011- 3.12 meters	1. 16 of the City of Wayzata's 116 BSUs are transient. 2. On-lake facilities provided at Wayzata Bay Mgmt. are detailed on the current Hennepin County map

Lake Minnetonka Conservation District (LMCD)
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Area #	Management Area	Licensed Multiple Dock Licenses	Public Launch Ramps	Quiet Water Areas	MN DNR Permits	Average Secchi Depths	Other
30	**Grays Bay**	1. Grays Landing HOA (10 BSUs) 2. City of Minnetonka (30 BSUs) 3. Locust Hills (44 BSUs) 4. Meadowbrook Boat Club (4 BSUs) ***Sub-Total: 88 BSUs***	1. MN DNR Public Access (119 c/t spaces).	Entire bay (holidays & weekends from 4 p.m. on Fridays until midnight on Sundays).	2009 (6 permits for 76 properties) 2010 (6 permits for 80 properties) 2011 (3 permits for 25 properties)	2009- 2.34 meters 2010- 2.58 meters 2011- 3.39 meters	
31	**Libbs Lake**	1. Libbs Lake Boat Club (16 BSUs) 2. Meadowbrook Boat Club (6 BSUs) ***Sub-Total: 22 BSUs***	None	Entire bay	2009 (0 permits for 0 properties) 2010 (0 permits for 0 properties) 2011 (0 permits for 0 properties)		
32	**Robinsons Bay**	1. Cedarhurst Assoc. (22 BSUs) ***Sub-Total: 22 BSUs***	None	None	2009 (2 permits for 2 properties) 2010 (3 permits for 4 properties) 2011 (3 permits for 4 properties)		
33	**St. Louis Bay**	1. City of Deephaven (168 BSUs) 2. MYC- Sites 2 & 3 (126 BSUs) 3. Walden Tract X (6 BSUs) ***Sub-Total: 300 BSUs***	None	Entire Bay	2009 (2 permits for 7 properties) 2010 (3 permits for 7 properties) 2011 (3 permits for 9 properties)		1. 28 of the 168 City of Deephaven BSUs are a District Mooring Area 2. 46 of the 126 MYC BSUs are transient
34	**Carsons Bay**	1. Chimo HOA (16 BSUs) 2. City of Deephaven (108 BSUs) 3. Grandview Pont Assoc. (8 BSUs) 4. Maple Hills HOA (9 BSUs) 5. T. Michael Miller Residence (6 BSUs) 6. MYC- Site 1 (56 BSUs) ***Sub-Total: 203 BSUs***	1. City of Deephaven Public Access (19 on-street & remote lot c/t spaces).	Entire Bay	2009 (9 permits for 59 properties) 2010 (7 permits for 55 properties) 2011 (5 permits for 56 properties)	2009- 3.36 meters 2010- 3.23 meters 2011- 2.72 meters	1. 25 of the 108 City of Deephaven BSUs are a District Mooring Area 2. 20 of the 56 MYC BSUs are a District Moorning Area
35	**St. Albans Bay**	1. Beans Greenwood Marina (120 BSUs) 2. City of Greenwood (27 BSUs) 3. Hary T Kreslins Residence (8 BSUs) 4. St. Albans Bay Villas (19 BSUs) 5. Tonka Bay Sales- Site 2 (90 BSUs) ***Sub-Total: 264 BSUs***	None	West side of bay near Excelsior Bay channel.	2009 (13 permits for 29 properties) 2010 (14 permits for 19 properties) 2011 (10 permits for 14 properties)	2009- 3.46 meters 2010- 3.76 meters 2011- 2.63 meters	1. On-lake facilities provided at Beans Greenwood Marina are detailed on the current Hennepin County map 2. On-lake facilities provided at Tonka Bay Sales are detailed on the current Hennepin County map
36	**Excelsior Bay**	1. Bayshore Manor Condos (20 BSUs) 2. Baview Event Center (37 BSUs) 3. City of Excelsior (140 BSUs) 4. Excelsior Bay Associates (49 BSUs) 5. Excelsior Bay Harbor (93 BSUs) 6. Maynards (40 BSUs) **Sub-Total: 379 BSUs**	None	Most of the Bay	2009 (3 permits for 7 properties) 2010 (5 permits for 7 properties) 2011 (3 permits for 3 properties)		1. Of the 140 City of Excelsior BSUs, 16 are transient and 12 are a District Mooring Area 2. On-lake facilities provided at Excelsior Bay Harper are detailed on the current Hennepin County map

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Lake Minnetonka Key Features

Area #	Management Area	Licensed Multiple Dock Licenses	Public Launch Ramps	Quiet Water Areas	MN DNR Permits	Average Secchi Depths	Other
37	**Gideons Bay**	1. City of Excelsior (6 BSUs) 2. Gideons Point HOA (47 BSUs) 3. Mtka Portable Dredging (15 BSUs) 4. SYC-Sites 1 & 2 (117 BSUs) 5. City of Tonka Bay (97 BSUs) 6. Willow Woods Corp. (5 BSUs) ***Sub-Total: 287 BSUs***	None	None	2009 (9 permits for 60 properties) 2010 (14 permits for 53 properties) 2011 (7 permits for 46 properties)	2009- N/A 2010- N/A 2011- 2.65 meters	
38, 39, 40, & 41	**Echo Bay, Lower Lake South, Big Island Passage, and Veterans Bay**	1. Big Island Inc. (12 BSUs) 2. City of Orono- Big Island Park (15 BSUs) 3. Curly's Mtka Marina (147 BSUs) 4. Lindbo Landing (42 BSUs) 5. Mtka Power Squadron (45 BSUs) 6. Tonka Bay Marina (144 BSUs) ***Sub-Total: 405 BSUs***	1. City of Tonka Bay Public Access (no c/t spaces east of County Road 19).	Channel between Echo Bay & Lafayette Bay.	2009 (7 permits for 27 properties) 2010 (5 permits for 20 properties) 2011 (6 permits for 20 properties)	**Lower Lake South** 2009- 3.65 meters 2010- 3.83 meters 2011- 2.87 meters	1. On-lake facilities provided at Curly's Mtka Marina are detailed on the current Hennepin County map 2. On-lake facilities provided at Tonka Bay Marina are detailed on the current Hennepin County map
42	**Lower Lake North**	1. City of Minnetonka Beach (8 BSUs) ***Sub-Total: 8 BSUs***	None	Cruiser's Cove	2009 (3 permits for 9 properties) 2010 (6 permits for 10 properties) 2011 (2 permits for 9 properties)	**Lower Lake North** 2009- 3.67 meters 2010- 4.10 meters 2011- 3.08 meters **Peavey Pond** 2009- 2.03 meters 2010- 2.14 meters 2011- 2.17 meters	