OSGOOD CONSULTING/ CHRISTMAS LAKE HOMEOWNER'S ASSOCIATION

Lake Vegetation Management Plan

Christmas Lake (Hennepin County)

March 2007 DRAFT

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EXECUTIVE SUMMARY

The LVMP is targeted at controlling the large infestation of Eurasian watermilfoil in Christmas Lake. The plant was first confirmed in the lake in 1992. EWM was spot treated with several herbicidal methods in the late 1990s, but it has continued to thrive in the lake. Since 1999, harvesting has been the main method of EWM control with the cost shared by the homeowner's association and the homeowners. The EWN control focus has been on nuisance control to provide recreational access to the lake for boat owners. Some homeowners obtain permits and treat their problem areas with spot herbicidal treatments.

With plant inventories done in 2001, 2003 and 2006, it has become clear that EWM is reducing the density of several other water plants as it aggressively grows in the lake. Harvesting has not caused this situation to get better. In fact, it appears that the harvesting is promoting the growth of EWM as the cuttings may be spreading around the lake. Since many experts regard the diversity of native water plants a measure of lake quality, and Christmas Lake has a high diversity of plants compared to other lakes in the metropolitan area, this trend is a cause for concern and must be addressed.

The Board of Christmas Lake at this time has made the decision to continue with harvesting as the EWM control method because the Board is concerned about the short-term and long-term effects of the use of herbicides in Christmas Lake. Even so, this LVMP discusses the current situation with EWM in Christmas Lake and develops the background and plans of several treatment options in order to respond to potentially changing conditions and attitudes of the homeowners.

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LAKE VEGETATION MANAGEMENT PLAN

1. Description of the Lake and Water Quality

A. Lake Name: Christmas Lake.

B. Lake Identification Number (DOW Number): 27-0137.

C. County: Hennepin & Carver.

D. Acreage Total: 276 acres.

a. Type of estimate: Planimetered (from the Metropolitan Council).

E. Acreage Littoral: 114 acres at 25 feet (depth of plant growth from 2006 DNR survey).

F. Percentage Littoral: 41 %.

G. Classification of Lake: General Development.

2. Water Quality

A. Clarity as indicated by Secchi disk observations in feet or meters (specify).

- For most recent year, mean value: 21 feet. Range: 16-31 feet Number of Obs.: 31
- Trend: slightly decreasing from 1971 to 2005. Number of Obs.: 27.
- There is a long data record for Secchi disk in Christmas Lake. Over this period, summer average Secchi disk ranges from 13 to 27 feet and fluctuates with a decreasing trend.
- Data is summarized and presented graphically at the Minnehaha Creek Watershed District web site (http://www.minnehahacreek.org/documents/FINALChristmasLakePlan.PDF).

B. If available, concentration of total phosphorus (parts per billion – ppb).

- For most recent year, mean value: 18 ppb. Range: 15-30 ppb Number of Obs.: 13.

- Trend: there appears to be a trend of slightly increasing surface phosphorus concentration from 2003 to 2005. Number of Obs.: 3 summer averages. In addition, hypolimnetic phosphorus increases are noted and appear to exceed historic levels. This could be indicative of advancing eutrophication.

C. If available, concentration of Chlorophyll-a (parts per billion – ppb).

- For most recent year, mean value: 0.5 ppb. Range: 0-7 ppb. Number of Obs.: 13.

- Trend: Not obviously changing from 1971 to 2005. Number of Obs.: 27.

3. Aquatic Vegetation (requires survey of lake – See Items 12-14)

Aquatic plant surveys were conducted by MN DNR staff on July 23, 2003; June 1, 2006 and August 4, 2006 (Appendices A & B). In addition, aquatic plant surveys were conducted on June 15 and September 26, 2001 (McComas and Stuckert 2002). The data reported here are from the above-mentioned sources.

A. Submersed aquatic vegetation

- Grows to a maximum depth of 25 feet in 2006.

- Plants at or near water surface to a depth of approximately 15 feet.

- Number of native species present:

Year	Total # of Native SAV	Ave. # of Native SAV/Site
2001	19 species of SAV	--
2003	21 species of SAV	3.3
2006	21 species of SAV	1.7 / 2.4

(List of species, including scientific names and source of survey(s), Appendix A)

- Number of non-native, invasive species present: 2

  Eurasian watermilfoil (EWM) and curlyleaf pondweed (CWP) were present in 2001, 2003 and 2006.

- Eurasian watermilfoil present: Yes (summary based on 2006 data).

  1. Year when Eurasian watermilfoil was confirmed in lake: 1992.

  2. If Eurasian watermilfoil is the target of control beyond that typically done by owners of shoreline for access to the lake. Yes.

3. Frequency of occurrence: 57-63%.

4. Frequency of occurrence of matted Eurasian watermilfoil at the water's surface: 17%.

   Matting milfoil was not measured in the 2006 survey. The frequency of occurrence where the abundance rating was 3 or greater was used as an estimate of matting potential (20 of 117 sites or 17% in August). Based on 114 littoral acres, this represents a matting potential of 19 acres. Because mechanical harvesting occurred during the season, this estimate may be low.

5. Based on a sample area size of 114+ acres

6. Based on a sample number of 117 points

7. Grows to a depth of 25 feet

8. Maximum depth at which matting occurs: 12 feet.

9. Area of Eurasian watermilfoil that is matted on the water's surface: 19+ acres.

10. Acres of matting as percentage of littoral acres: 19+%.

- Curly-leaf pondweed present: Yes.

  1. Year when Curly-leaf pondweed was confirmed in lake: Prior to 2001.

  2. If Curly-leaf pondweed is the target of control beyond that typically done by owners of shoreline for access to the lake. Maybe, depends on response to milfoil control.

  3. Frequency of occurrence: 28% (2001); 17% (2006).

  4. Frequency of occurrence of matted Curly-leaf pondweed at the water's surface: Not measured.

  5. Based on a sample area size of 32 acres (2001); 19 acres (2006).

  6. Based on a sample number of 117 points (2006).

  7. Grows to a depth of 20 feet.

  8. Maximum depth at which matting occurs: Not measured.

  9. Area of curly-leaf pondweed that is matted on the water's surface: Not measured.

  10. Acres of matting as percentage of littoral acres: Not measured.

B. Water lilies and watershield – floating-leaved aquatic vegetation

1. Number of native species present: 3, excluding duckweed (see Appendix A).

2. Number of non-native, invasive species present: 0.

C. Emergent aquatic vegetation

1. Number of native species present: None >15%.
2. Purple loosestrife present: No.
3. Flowering rush present: No.
4. Other(s) present: No.

4. Public Participation

A. Number of residences on the lake to which notice of intent to plan was sent.

145, via Homeowner's Association Survey (Appendix C).

B. Number of meetings held to develop plan and number of attendees at each meeting.

- Christmas Lake Homeowners Association, Board of Directors (13 April 2006)
- Christmas Lake Homeowners Association, Annual Member Meeting (10 May 2006)
- Christmas Lake Homeowners Association, Pontoon Tour of Lake (10 July 2006)
- Christmas Lake Homeowners Association, Board of Directors (11 October 2006)
- Christmas Lake Homeowners Association, Board of Directors (11 December 2006)
- MN DNR Staff, CLHA President & Osgood to review draft LVMP (16 January 2007)
- Christmas Lake Homeowners Association, Board of Directors (20 February 2007)
- Christmas Lake Homeowners Association, Board of Directors (27 March 2007)

C. Other means by which people were involved in development of the plan.

A survey was sent to all lakeshore owners on Christmas Lake. The detailed responses are found in Appendix C and the main conclusions are:

- There are disparate and conflicting opinions regarding the progression of EWM and the impacts (positive and negative) of the recent harvesting operations in Christmas Lake.
- EWM interferes with swimming and boating.
- EWM poses significant maintenance concerns, such as raking beaches and shore areas.
- Other plants pose minor, if any, problems.
- Prior to EWM, other plants posed slight, if any, problems(there have been accounts outside of the homeowners' survey that have indicated curlyleaf pondweed and water lilies had been considered nuisances in some areas of Christmas Lake in the past).

- There is a strong desire to manage or control EWM, but this is tempered by an equally strong desire to protect lake health and water quality.
- There is a broad concern regarding the use of herbicides to manage or control EWM.
- The 'do nothing' option should only be considered if there are no other acceptable or feasible options for controlling EWM.
- Mechanical controls, such as raking, pulling, SCUBA or harvesting) is the desired option of many for controlling EWM on large scales.
- The use of herbicides for controlling EWM may be considered, but only if demonstrated to be safe and effective.
- There is a wide range of opinion and concern regarding the level of demonstrated safety needed to allay concerns with herbicides.
- There is a significant opposition to any use of herbicides.
- There appears to be consensus that protecting or restoring native plants, including water lilies, is desirable.
- There is a desire for more information regarding the safety, efficacy, cost and feasibility of all EWM control options and approaches.

5. Problems to be Addressed in This Plan:

The overall problem assessment is stated:

Eurasian watermilfoil has reached the point in Christmas Lake where it interferes with some people's recreational use and enjoyment and it has had a demonstrable negative impact on native submersed aquatic vegetation. As well, the frequency and abundance of water lilies appear to have been diminished. There appears to have been a decline in lake water quality, although this has not been associated with the Eurasian watermilfoil infestation.

A. Plants interfere with recreational use of the lake:

- Water lilies have been cited as interfering with recreational use by some residents, but this species will be specifically protected in this plan.

- Eurasian watermilfoil, matting potential in 19 acres (see maps in Appendix B).

B. Invasive, non-native, submersed plants cause ecological problems.

Identify problem(s): Eurasian watermilfoil and possibly curly-leaf pondweed.

1) Native submersed aquatic plants are being displaced.

There is a clear and consistent reduction in the frequency of occurrence of native submersed aquatic vegetation since 2001. This decrease is associated with an increase in the frequency of

occurrence of Eurasian watermilfoil. It is a reasonable expectation that native submersed aquatic vegetation will continue to decline, lacking successful control of Eurasian watermilfoil.

2) Declines in water quality (increased concentrations of phosphorus and associated algal blooms) are associated with the die-off or senescence of curly-leaf pondweed.

While there are some indications of increasing lake phosphorus concentration, these cannot be conclusively associated with curly-leaf pondweed. Curly-leaf pondweed could become a factor in nutrient enrichment as a response to Eurasian watermilfoil control.

C. Invasive, non-native, floating-leaf or emergent plants, e.g., pink waterlilies or flowering rush, are causing ecological problems.

Identify problem(s): None.

D. Desirable communities of native aquatic plants are being lost.

Eleven native species of submerged aquatic vegetation have a demonstrated decline since 2001; no native species have increased (appendix A).

E. Threatened or endangered species of native aquatic plants are present or vulnerable to loss or both.

None.

6. Goals for Management of Aquatic Plants

The overall management goal of the Christmas Lake Homeowners' Association in this Plan is to:

Minimize or control the ecological impacts and recreational nuisances of Eurasian watermilfoil in Christmas Lake while preserving and protecting water quality and lake health.

The Christmas Lake Homeowners' Association prepared a lake management plan in 1996 that included these goals:

1. Restore the lake condition as closely as possible to its natural chemical make-up, and promote a diverse native plant and animal community.
2. Educate citizens about the lake's ecology and lake management techniques.
3. Encourage a monitoring program to help evaluate the lake over time.

The goals in this Plan are consistent with the earlier lake management plan.

The goal statements below further support or refine the overall goal.

Goal A: Reduce interference with recreational use of the lake caused by: Eurasian watermilfoil.

Anticipated size of treatment area to reduce interference: approximately 19 acres.

Measurable Outcome: Control by individual lakeshore owners, subject to MN DNR rules (Appendix D) and this plan. Other outcomes may be incidental to Goal B, below.

Goal B: Increase abundance of native submersed aquatic plants by control of invasive, non-native submersed plants: Eurasian watermilfoil and curly-leaf pondweed, if it becomes significant.

Anticipated size of treatment area to reduce invasive plants: area where EWM affects native plants within the littoral area.

Measurable Outcomes:

a. EWM frequency <20%.
b. Increase the frequency of occurrence of native plants to 2001 levels.
c. No increase in occurrence of CWP.

Goal C: Attempt to reduce peaks in concentrations of phosphorous, and associated algal blooms by control of curly-leaf pondweed (CWP).

Not applicable at this time.

Goal D: Protect high quality communities of native aquatic plants.

See Goal B.

Goal E: Protect threatened or endangered species of native aquatic plants sensitive areas or plants.

Not applicable at this time.

Goal F: Protect aquatic plants in shallow bays or fish spawning areas.

Not applicable at this time.

Goal G: Restore or enhance aquatic plants on lakeshore habitat.

Not applicable at this time.

Goal H: Other: (Describe): Protect or restore water lilies.

Measurable Outcome: Increase in the frequency of occurrence of water lilies.

7. Actions to Achieve Goals

Christmas Lake is a clean, clear lake with abundant native plants, now threatened by EWM. The Christmas Lake Homeowners' Association (CLHA) is highly concerned that the management and control be preformed in a manner that preserves the lake's high quality. Further the Association wants to assure that any control methods used be safe for the environment, fish, wildlife and people.

The Association understands that to achieve the stated goals within their desired margin of safety will likely require compromise and balance among conflicting values. The discussion below provides balancing considerations between minimal control of EWM and the impacts it will cause and more aggressive control and the impacts (known and unknown) it may cause.

Categorical Control Strategies for EWM

Aquatic plant control attempts to protect aquatic plants for their role in healthy aquatic ecosystems while controlling the impacts of undesirable plants (see AERF 2005). AERF (2005) presents a summary of 'Best Management Practices' in several categories. The categories applicable to EWM control are summarized below.

Mechanical and Physical Controls

Hand Cutting/Pulling – Direct pulling of EWM by individuals, including SCUBA. This is a low-tech method applicable at small scales and shallow water depths. Relative to the CLHA goals, this method is not practical, except at small scales and for those willing to perform this operation.

Harvesting – Cutting EWM and other high profile plants using a mechanical harvester. This method is 'selective' only to the extent EWM may form canopies, so the cutting may preferentially remove EWM. This method is considered a maintenance method and offers no long term control of EWM. Relative to the CLHA goals, harvesting may be useful for EWM nuisance control in small- to medium-scales, but is not considered applicable for ecological restoration.

Diver Suction Dredging – A vacuum-like machine is used to remove (by suction) plants and roots. This method is slow and expensive and not practical for Christmas Lake.

Rotovating – Simply, an underwater roto-tiller designed to disrupt EWM by causing mechanical damage. This method is non-selective and would cause more harm than good in Christmas Lake.

Weed Rolling – Weed rollers are small mechanical devices that prevent plants from rooting by rolling over shallow sediment areas. Depending on the bottom types, weed rollers can be damaging. Relative to the CLHA goals, this method is not practical, except at small scales and for those willing to perform this operation.

Drawdown – Lake levels are drawn down to allow the lake muds to de-water and damage or kill plants or reproductive parts of plants. This method is not practical for Christmas Lake for many reasons, but the most significant reason is depth of plant growth – the lake would need to be drawn down 20 to 25 feet.

Benthic Barrier – Materials place on the lake bottom to prevent plants from growing. This method is very expensive, except at small scales. Relative to the CLHA goals, this method is not practical, except at small scales and for those willing to perform this operation (the MN DNR prohibits this method).

Nutrient Inactivation – Chemical precipitants are added to the lake sediments to inactive nutrients needed by aquatic plants. Because most rooted plants are limited by nitrogen and this method inactivated phosphorus, it is not applicable.

Chemical Controls

(There is an expanded discussion of herbicides in the next section.)

2,4-D – Systemic, selective plant growth inhibitor.

Diquat – Contact, disrupts plant cell membranes.

Endothall – Contact, inactivates plant protein syntheses.

Fluridone – Systemic, disrupts carotenoid synthesis.

Triclopyr – Systemic, selective plant growth regulator.

Biological Controls

Grass Carp – An exotic fish that eats plants. Unfortunately, it tends to eat EWM last.

Milfoil Weevil – A native aquatic weevil that, through its life history, lives on and in EWM and damages the plant. Requires weevils collected and cultured from MN lakes. This method has not been shown to provide reliable EWM control.

Native Plant Restoration/Enhancement – Planting of desirable plants to compete with or inhibit EWM expansion. No useful case studies, although native plant enhancement could be an outcome of successful EWM control.

Doing Nothing

The ecological consequences of doing nothing may be high. According to John Madsen (2000), Eurasian watermilfoil, if unmanaged, "…can have severe negative effects on water quality, native plant distribution, and the abundance and diversity of aquatic insects and fish." Doing nothing to retard the impact of EWM in Christmas Lake will likely result in further declines in native plant abundance and the associated ecological impacts following the diminished habitat quality.

Herbicides

A cursory evaluation of the categorical EWM control methods from above makes it clear that chemical herbicides are the only feasible option available to accomplish the CLHA's goal of controlling the

ecological and recreational impacts of EWM. Other control methods, may be feasible for control or selective control of EWM, but are applicable only at small scales.

Selectivity

Selectivity refers to the ability of the herbicide to preferentially kill or control target plants while leaving desirable plants minimally damaged or undamaged. Nonselective or broad spectrum herbicides kill or control all or most plants.

Selective effects of herbicides can be produced through dose, exposure time or combinations of different chemicals.

A selective herbicide could be used to accomplish CLHA's EWM goals.

Registration and Safety Testing

Aquatic herbicides sold in the US are regulated by the US EPA under federal laws. Part of the registration process includes specific use instructions, which are provided on the 'label,' a legal document. The registration process involves testing to consider safety, health and environmental concerns. No herbicide may be registered for aquatic use if it has more than a 1:1,000,000 chance of "causing significant harmful effects to human health, wildlife, or the environment."

States may have regulations more restrictive than federal regulations. Herbicide use for comprehensive EWM control (over and above nuisance control) requires a variance from MN DNR rules (see Appendix D).

Other Health and Safety Concerns

In addition to direct environmental effects of herbicides, as are tested by the US EPA, there may be indirect effects worth noting. These indirect effects include unintended effects following a herbicide application, such as killing or displacing native plants or other flora and fauna important for or indicative of lake health. The use of selective herbicides for ecological restoration following an infestation of EWM or CWP is an evolving field. Significant progress has been made to the point where indirect effects can be minimized, at least to the point where the risks of not treating often outweigh the risks of treatments.

Lakewide vs. Individual Control Options

The CLHA's overall goal is to control EWM on a lakewide basis, but also to provide relief from nearshore recreational nuisances. To consider lakewide control, some consideration to balancing this objective with options for individual controls must be considered. To the extent lakewide control can be accomplished, some, but probably not all, nearshore nuisances will persist. It is reasonable that the normal nuisance control activities available to individuals (see Appendix D) ought to be curtailed to some extent to provide balance in light of the larger management objectives.

A decision matrix for these control methods is presented in Appendix E.

Test Plots

The CLHA is interested in the option of test plots to evaluate whether various controls may be effective and not harm Christmas Lake's high quality. Test plots will be presented as an option; however, there is some urgency for controlling EWM as the lake's native plants have been and will likely continue to be degraded, so evaluating test plots would cause a delay. In addition to a delay in the comprehensive control of EWM, there will likely be a substantial cost premium for conducting a pilot project, as subsequent comprehensive treatments will likely need to 're-treat' test plot areas. Finally, there will be logistical and design challenges with small-scale pilot projects, which may minimize their usefulness.

Notification and Authorization Requirements

Should a comprehensive herbicide application for selective Eurasian watermilfoil be proposed, signatures from a majority of lakeshore owners will be needed to proceed (as well as a variance to MN DNR rules). These signature authorizations are valid for three years, or perhaps the duration of this Plan. Because a selective herbicide application would be for the benefit of the whole lake, and because most herbicides must be applied broadly (as opposed to spot treatments) to be effective, individual lakeshore owners would not be given the option of having their lakefront bypassed by a proposed treatment.

Management Actions

Management actions for the four identified goals (lettered according to the MN DNR LVMP format) are proposed below.

***Goal A*: Reduce interference with recreational use of the lake caused by: Eurasian watermilfoil.**

Anticipated size of treatment area to reduce interference: approximately 19 acres.

Measurable Outcome: Control by individual lakeshore owners, subject to MN DNR rules (Appendix D) and this plan. Other outcomes may be incidental to Goal B, below.

Control Options

Several control options are presented; all assume there will be some level of lakewide control under Goal B. The options are in reference to currently allowed or permitted individual controls (Appendix D).

Option 1 – allow no individual controls.

Option 2 – Allow restricted individual controls. Restrictions could include smaller treatment areas, avoidance of lilies or mechanical methods only. Typically the MN DNR would restrict nuisance controls by individuals to not exceed the areas already allow for mechanical control without a permit. For herbicides treatments (which would require a permit), these areas would be limited to a 50-by-50 foot area, or 50- by-one half the shoreline, whichever is smaller.

Option 3 – allow the current individual controls.

The costs for any of these options would be borne by individual lakeshore owners.

Goal B. Increase abundance of native submersed aquatic plants by control of invasive, non-native submersed plants: Eurasian watermilfoil and curly-leaf pondweed, if it becomes significant.

Anticipated size of treatment area to reduce invasive plants: area where EWM affects native plants within the littoral area.

Measurable Outcomes:

a. EWM frequency <20%.
b. Increase the frequency of occurrence of native plants to 2001 levels.
c. No increase in occurrence of CWP.

Control Options

a. Lakewide control using selective herbicides is the only feasible management option that will address this goal. Selective herbicides will provide comprehensive control of EWM and allow the recovery of native plants. Thus, selective herbicides will not eradicate EWM, will significantly reduce its abundance and frequency of occurrence. As EWM is controlled in this way, native plants are likely to increase in frequency. Since EWM will not be eradicated, some level of ongoing maintenance control will be required to keeps its levels low.

It is recommended that specific products or combinations of products as well as timing and dose be evaluated from proposals submitted by professional applicators experienced with the use of these products. In addition, some give performance guarantees. Based on other cases, a range of doses and other factors, these products and cost ranges can be used for planning.

Two herbicides have been considered – fluridone and triclopyr. Triclopyr is the better option because it can be applied to all areas of Christmas Lake where EWM grows.

A three- to five-year lakewide control is assumed below. The new OTF formulation of triclopyr will best address the management goal. Follow-up treatments with other products will be necessary for spot control and possibly control of CWP:

Costs (for lakewide treatment):

Year One:	$70,000 to $90,000
Years Two+	$6,000 to $20,000

A specific proposal for treatment, monitoring and follow-up treatments will provide more detailed cost estimates.

Test plots. One or more products could be applied to test plots to evaluate the degree of selectivity, the efficacy of control and possible impacts to lake water quality. To minimize 'edge' effects and to treat a large enough area to confidently 'see' and water quality impacts, a minimum test area of 10 acres is advised. Fluridone would pose special challenges, as the liquid formulation, which would be used lakewide, could not be used in a test plot due to the high rates of dilution.

Depending on the products being evaluated, the application costs will likely range from $500 to $1,500 per acre.

Monitoring:

Ongoing monitoring is required to evaluate the effectiveness of the treatment relative to controlling EWM, tracking whether CWP becomes problematic and assessing native plant growth. The results of annual monitoring are used to prescribe subsequent treatments. Annual monitoring costs will be approximately $5,000, but depends on MN DNR requirements and assistance. This level of monitoring is also advised if test plots are implemented because the progress of the EWM infestation should be tracked up to the time a comprehensive treatment occurs.

Goal D. Protect high quality communities of native aquatic plants.

See other goals. No additional control options are presented.

Goal H. Other: (Describe): Protect or restore water lilies.

Measurable Outcome: Increase in the frequency of occurrence of water lilies.

Control Options

[Except for protecting certain areas of the lake from control activities or intense motorboat use, there is no reliable method for restoring lilies.]

A. Methods of control (describe if appropriate)

The map marking the areas of harvesting control will be provided with the permit application.

i. Mechanical control:

i. Means: Midwest Harvesting

Acres to be mechanically controlled: __

ii. Herbicide:

Products: _____

Acres to be treated with herbicide: __

Rate(s) of application: _____

Timing of application: _____

Other: _____

B. Methods for reestablishment of aquatic plants (describe if appropriate)(includes drawdown)

[map marked with areas where reestablishment of aquatic plants is anticipated required and must be attached – See _____]

C. Alternate standards for control (describe if appropriate)

(It is envisioned that this approach might be taken on lakes where protection of habitat or other concerns warrant the establishment of standards for control of aquatic plants different than those found in M.R. 6280)

8. Conditions of Operations and Permits

(This section must be filled out if the plan describes how APM permits will be issued or variances that will be allowed. The DNR will provide the operating and permitting conditions associated with this plan such as where treatment is allowed, if a DNR inspection is required, whether selective herbicides need to be used, if treatment needs to be avoided near certain plant communities)

See attached document – Conditions for Plan Implementation and Permitting

A. Type of Plan (See Directions for definitions)

___ Operational Management

_**X**_ Pilot Management

Operational management includes control of aquatic plants in limited areas where vegetation is causing unavoidable recreational nuisance, plans that focused on identifying lakeshore/aquatic vegetation protection standards, or plans that focus on unique problems that occur periodically (e.g. management of floating bogs)

Pilot management includes control of aquatic plants, often invasive species, to produce ecological benefits. These include increases in native submersed plants and, in the case of curly-leaf, reductions in levels of phosphorus and phytoplankton, which should increase water clarity. Pilot projects involve approaches to control that show promise based on research done in environments with high levels of experimental control. Pilot projects are conducted to determine whether desired goals can be achieved in lakes, and whether unintended negative consequences occur. A pilot project is one in which the effects of the project are carefully monitored so that we can better predict the results of similar types of projects in the future. Because lakes vary with respect to depth, water clarity, plant communities, and in many other ways, pilot projects need to be done in a variety of different lakes before the effects of particular treatments are well understood.

B. Variance(s) allowed and justification(s) (check all that apply)

_x_ i. Application of pesticides to control submerged vegetation along more than 100 feet of shoreline per site belonging to an individual riparian property owner (M.R. 6280.0350, Subpart 4, A), (list justification below)

[Example justification: To maximize the control of curly-leaf pondweed by treating as large a contiguous area as possible to minimize dilution of herbicide.]

_x_ ii. Application of pesticides to control aquatic macrophytes that are not dense growths (M.R. 6280.1000, Subp. 5). (list justification below)

_x_ iii. Application of pesticides to control dense growths (M.R. 6280.1000, Subp. 5) of aquatic macrophytes that do not interfere with watercraft use, swimming, or other traditional recreational uses (M.R. 6280.0250, Subpart 2, A, (2)) [Includes the prohibition on application of pesticides to improve the appearance of undeveloped shoreline (M.R. 6280.0250, Subp. 4, B)?].

_x_ iv. Application of pesticides to control submerged vegetation in more than 15 percent of the littoral area (M.R. 6280.0350, Subp. 4, A). (list justification below)

__ v. Application of pesticides to control aquatic macrophytes in natural environment lakes established pursuant to part 6120.3000 (M.R. 6280.0250, Subp. 4, E.). (list justification below)

__ vi. Application of pesticides to control submerged or floating aquatic macrophytes after 1 August deadline (M.R. 6280.0450, Subp. 2). (list justification below)

__ vii. Mechanical control of pesticides to control aquatic macrophytes in more than 50 percent of the littoral area (M.R. 6280.0350, Subp. 3, B). (list justification below)

Justifications (identify which variance and provide the rational for all items checked above):

> The plan proposes a 'pilot management' approach to produce ecological benefits. Specifically, EWM (and CWP, should it become more abundant) will be controlled to allow native plants to recover to greater frequencies. A comprehensive selective herbicide treatment with follow up maintenance treatments is the only feasible technique to accomplish this objective.

Below is feedback from the DNR on this LVMP that has been obtained prior to submittal of the plan. There is also a position presented by Dick Osgood on attaining the goals of the CHLA. These positions are in conflict and will require resolution with the DNR and the Christmas Lake Homeowners prior to any herbicidal treatment of Christmas Lake.

C. MN DNR Staff Meeting to Review Draft LVMP

Dick Osgood (project consultant), Harley Feldman (CLHA President) and MN DNR staff (Wendy Crowell, Neil Vanderbosch & Chip Welling) met on 16 January 2007 to discuss the draft LVMP and offer comments and direction. Highlights of that meeting were:

Problem Identification

There was consensus that:

- EWM in Christmas Lake was increasing and causing ecological impacts that included a reduction in the frequency of occurrence of native plants.
- That if uncontrolled, EWM would probably continue to increase and native plants would probably continue to decrease.
- That if EWM was controlled, meaning a reduction in its frequency of occurrence, native plants would probably increase.

There was not consensus regarding:

- Whether comprehensive (whole-lake or whole-littoral area) treatment with an herbicide could or should occur.

Management and Control Alternatives

There was consensus that:

- A selective herbicide, fluridone, 2-4, D or triclopyr, was the only feasible alternative that could address the objective of ecological damage (as opposed to nuisance control). No other control option would address this objective.
- Because of concerns with protecting water lilies, fluridone was preferable compared to triclopyr or 2,4-D.
- Fluridone at 4-6 ppb would be the appropriate concentration, depending on the outcome of a pre-treatment assessment of the susceptibility to fluridone of Eurasian watermilfoil plants growing in Christmas Lake.

There was not consensus regarding:

- Whether these herbicides would be permitted for a comprehensive treatment.

Proposed Management Approach

There was discussion, but no consensus regarding:

- A step-wise, incremental management plan was most likely to be permitted and most likely to be palatable with the CLHA membership.
- Such an approach attempts to balance the risks of no control and continued ecological impacts with the realities regarding concerns of CLHA members.

The DNR also stipulated that a majority of homeowners were required to support any herbicide treatment plan before it could be approved by the DNR.

D. MN DNR Letter Dated March 20, 2007

A letter was received from the DNR summarizing its input to the Christmas Lake EWM problem as a follow-up to the meeting in D. The main points of the letter are:

- "The Minnesota Department of Natural Resources (MnDNR) is willing to consider an application for a permit to treat a large area or areas with an auxin-like herbicide, perhaps in combination with endothall, which would be at least partially selective for milfoil. This treatment should be done early, in spring, when temperatures are low and native plants are dormant or largely so to enhance selectivity. Monitoring of any such treatment would be helpful and perhaps required, particularly if an area with water lilies were to be treated."
- "The MnDNR is not likely to support a proposal to treat the whole littoral zone with an auxin-like herbicide, perhaps in combination with endothall. Generally, the potential risk of harm of such a large treatment to non-target, native plants cannot be conclusively evaluated at this time, based in the information in the literature. Consequently, it is difficult to determine whether such a treatment would be more benefit, as opposed to potential risk to the vegetation of Christmas Lake."
- "The MnDNR is also not likely to support a proposal to treat the whole lake with fluridone herbicide. As you know, this would require that a concentration of at least 2-3 ppb of herbicide be maintained for at least 60 days to control milfoil. Such an exposure of vegetation to herbicide also means risk of potential damage to no-target, native submersed plants, which would experience a longer exposure to herbicide than would be the case with an auxin-like product. The Northern watermilfoil would likely be extirpated by such a treatment , and such treatment is not likely to eradicate milfoil. Consequently, it is difficult to determine whether such treatment would be more of a benefit, as opposed to potential risk to the vegetation of Christmas Lake."

E. Dick Osgood Letter commenting on the DNR Letter Dated March 20, 2007

A letter was received from Dick Osgood with his professional comments on the DNR response in E. The main points are listed below:

- Eurasian watermilfoil in Christmas Lake has, and lacking any mitigation, will likely continue to cause the reduction of the frequency of native plants. This damage will have cascading impacts on fish habitat, water quality and possibly other aspects of lake health.

- To address the CLHA's goals, the use of selective herbicides is the only feasible tool available.

- There are several selective herbicides that could address the CLHA's goals – fluridone, triclopyr and auxin/endothal.

- The use of any selective herbicide will have the risk of causing some damage to some native plants or water lilies; but the risk of not treating is real and will result in continued damage to the lake's native plants.

- Using a selective herbicide in a portion of the littoral zone (as opposed to the entire littoral zone) will have the effect of prolonging the aggressive nature of the milfoil infestation because a) it will increase the vulnerability of the treated areas for rapid re-infestation while there remains significant amounts of milfoil left in the lake, and b) damage to native plants will continue in the untreated areas. The MN DNR's response addresses what they will consider permitting, and not (in my opinion) what will best address the CLHA's goals.

- To address the CLHA's goals, I recommend using fluridone as the best available treatment option for Christmas Lake, and I do not recommend any partial-littoral zone treatment.

- I am aware my recommendation against a partial treatment is not consistent with what the MN DNR will consider permitting and my recommendation to use fluridone would not appear to be considered favorably. As you know, the development LVMP requires the MN DNR's approval, so this disagreement will need to be resolved. It will be necessary for the CLHA to first come to a consensus before you can negotiate with the DNR.

9. Responsibilities

A. Individual Landowners:
Homeowners have the responsibilities to: 1) pay for any harvesting of EWF within 150' of their lakeshore, and 2) pay for any herbicide treatments within a permit granted by the DNR.

B. Lake Association:
The Christmas Lake Homeowners Association has the responsibility to contract for any harvesting of EWM in the common areas of the lake, i.e. outside the 150' zone from the homeowners property line. The association will assess dues for the payment of such harvesting. In the case that the homeowners support and the DNR approves the application of herbicides, the association will collect dues to pay for the herbicide application and contract with the applicator.

C. Local Units of Government:
The cities of Shorewood and Chanhassen has responsibilities to work with the homeowners to develop solutions to problems such as runoff, water quality, water safety, and traffic control for cars using the Christmas Lake public access.

D. Department of Natural Resources:
The DNR has the responsibilities to: 1) assess the situation on Christmas Lake regarding the invasion of invasive water plants, 2) executive plant inventories to measure the density of all water plants in Christmas Lake on a periodic basis, 3) make recommendations as to treatment methods for the control of invasive water plants, and 4) provide permits for the treatment of invasive species of water plants where the DNR approves the particular treatment.

E. Other Government Agencies:
The Minnehaha Creek Watershed District has the responsibility to create a long term plan for Christmas Lake addressing run-off, water shed and water quality.

10. Monitoring (this section must be completed for Pilot Management plans) - incomplete

Monitoring required?

____ YES (See attached document – Monitoring Requirements)
____ NO

(In the case of pilot projects, it is expected that monitoring will be required for all projects since their effectiveness is not well understood. The DNR will work collaboratively with the lake association to develop the requirements for monitoring, if any, associated with this plan. A document will be written to describe the monitoring that must be done, methods to be used, summarization of the results of the monitoring, and who is responsible for completing the identified work.)

11. Duration and Review of the LVMP

The plan will be effective upon approval by the DNR.

The plan will remain in effect until: 2007 through 2011.

Minor adjustments to this LVMP may be made following review in any year by mutual agreement.

12. Preparation, Approval, and Distribution of the LVMP

A. Preparation of the LVMP was based on results of a survey of the aquatic vegetation done by:

Wendy Crowell
[Name - print]
[Organization]

_____
[Name - print]
[Organization]

_____
[Name - print]
[Organization]

B. The LVMP document was prepared by:

Dick Osgood _____ _____
[Name - print] [Organization]

Harley Feldman_____
[Name - print] [Organization]

_____
[Name - print] [Organization]

_____
[Name - print] [Organization]

_____
[Name - print] [Organization]

_____
[Name - print] [Organization]

C. Signatures of Approval

_____ Minnesota Department of Natural Resources _____
[Signature] Regional Fisheries Manager or designee [Date]

_____ Minnesota Department of Natural Resources _____
[Signature] (other): _____ [Date]

D. Signatures of Agreement

_____ _____ _____
[Signature] [Organization}

[Date]

_____ _____ _____

[Signature] [Organization}

[Date]

E. Distribution of approved LVMP

i. Division of Ecological Services: _____

ii. Section of Wildlife: _____

iii. Division of Trails and Waterways: _____

iv. _____ (other) _____

References

Aquatic Ecosystem Restoration Foundation (AERF). 2005. Aquatic plant management: Best management practices in support of fish and wildlife habitat. (This document is available through the North American Lake Management Society (NALMS.org).

Madsen, J.D. 2000. Advantages & disadvantages of aquatic plant management. Lakeline 20(1):22-34.

McComas, S. and J. Stuckert. 2002. Christmas Lake, Chanhassen, Minnesota Aquatic Plant Surveys for 2001. Prepared for the City of Chanhassen.

Wagner, K. 2001. Chapter 7: Management Techniques within the Lake or Reservoir. *In*: Holdren, C., W. Jones and J. Taggert. Managing Lakes and Reservoirs. North American Lake Management Society, Terrene Institute, U.S. environmental Protection Agency.

Appendix A

CHRISTMAS LAKE – AQUATIC PLANT SURVEY RESULTS SUMMARY (2001, 2003 & 2006)
FREQUENCY OF OCCURRENCE (%) VEGETATION; INCREASING (+) OR DECREASING (-)

** >15% FREQUENCY ON AT LEAST ONE DATE*

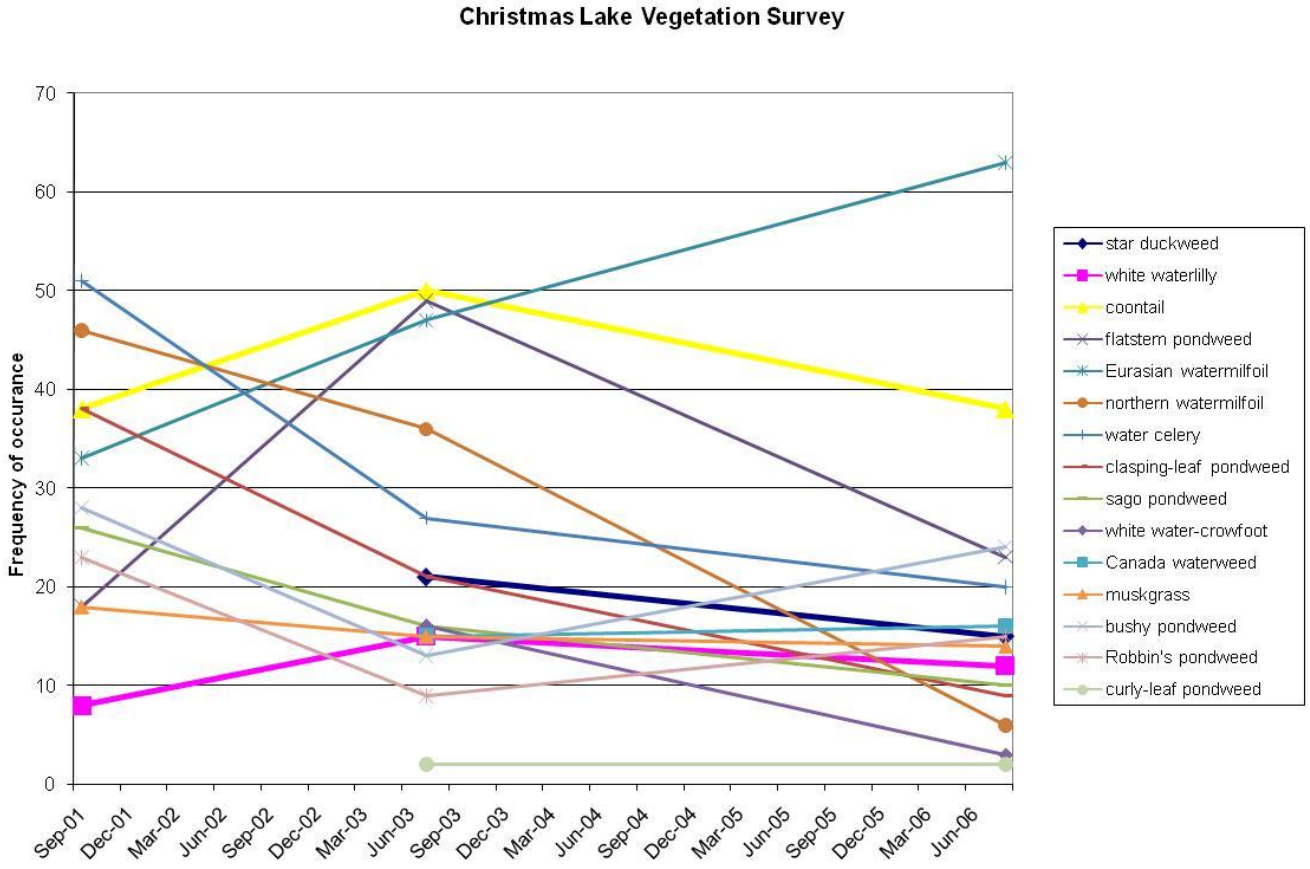
	6/15/01	9/26/01	7/23/03	6/1/06	8/4/06
Submerged Aquatic Vegetation (invasive)					
(+) Eurasian watermilfoil *Myriophyllum spicatum*	14	33	47	57	63
Curlyleaf pondweed *Potamogeton crispus*	28	--	2	17	2
Submerged Aquatic Vegetation (native)					
(-) Largeleaf pondweed *Potamogeton amplifolius*	25	31	<15	<15	<15
(-) Illinois pondweed *Potamogeton illinoisis*	25	31	<15	--	<15
(-) Floatingleaf pondweed *Potamogeton natans*	3	31	<15	<15	<15
(-) Sago pondweed *Stukena pectinata*	--	26	16	2	10
White-stem pondweed *Potamogeton praelongus*	8	--	<15	<15	<15
(-) Stringy pondweed *Potamogeton pusillus*	14	--	<15	<15	--
(-) Claspingleaf pondweed *Potamogeton richardsonii*	31	38	21	6	9
(-) Robbin's pondweed *Potamogeton robbinsii*	19	23	9	11	15

Flatstem pondweed *Potamogeton zosteriformis*	22	18	49	15	23
Bushy pondweed *Najas flexillis*	8	28	13	7	24
Coontail *Ceratophyllum demersum*	47	38	50	26	38
(-) Northern watermilfoil *Myriophyllum sibiricum*	31	46	36	7	6
Wild celery *Vallisneria americana*	6	51	27	0	20
(-) Marsh marigold *Megalodonta beckii*	--	26	--	--	--
(-) Water crowfoot *Ranunculus longirostris*	31	--	16	11	3
(-) Water Stargrass *Zosterella dubia*	33	--	<15	<15	<15
Canadian waterweed *Elodea canadensis*	14	--	15	15	16
Chara (Muskgrass) *Chara spp.*	33	18	15	23	14
Floating-leaf Aquatic Vegetation					
White waterlily *Nymphaea odoranta*	--	8	15	9	12
(-) Spatterdock *Nuphar variegatum*	10	10	--	--	--
Nuphar sp.	--	--	<15	<15	<15

2001 data from McComas and Stuckert (2002).

2003 and 2006 data from Appendix B.

The chart below summarizes the data from the table above. The data points included are those from 9/26/01, 7/23/03, and 8/4/06, roughly the same time each summer. As the chart shows, EWM is growing out many of the other native water plants.



Appendix B

CHRISTMAS LAKE – AQUATIC PLANT SURVEY RESULTS (2003 & 2006)

Christmas Lake, Hennepin County (27-137)
Aquatic plant survey results: July 23, 2003, June 1, 2006 and August 4, 2006

Wendy Crowell, Minnesota Department of Natural Resources
October 6, 2006

Christmas Lake is a 257-acre lake found in Shorewood in western Hennepin County. It has a maximum depth of 87 feet, and 77 acres are 15 feet deep or less[1]. The Minnesota Pollution Control Agency lists this lake as mesotrophic, or moderately fertile, based on water clarity, chlorophyll *a*, and total phosphorus[2]. The non-native invasive species Eurasian watermilfoil (*Myriophyllum spicatum*) was first discovered in Christmas Lake in 1992.

Aquatic plant surveys were conducted on Christmas Lake on July 23, 2003, June 1, 2006, and August 4, 2006. These surveys were done using the point-intercept, or grid survey method (Madsen 1999[3]). A grid of 117 points were surveyed on each date (Figure 1). Sample points were spaced 60 meters (198 feet) apart. An average of 80% of these sample points contained vegetation (Table 1). At each point, water depth was recorded. Surveyors recorded all plant species found within a one meter squared sample site at a pre-designated side of the boat. A double garden rake-head attached to a rope was used to survey vegetation not visible from the surface. In some cases, plants could be identified to the level of genus, but not species. Consequently, they are reported as taxa, which includes both plants identified to genus and those identified to species. Frequency of occurrence was calculated for each taxon as the number of sites in which that taxon occurred divided by the total number of sample sites.

The frequency of Eurasian watermilfoil increased from 47% in 2003 to 63% in 2006 (Table 1, Figures 2 and 3). This increase in Eurasian watermilfoil was associated with a greater than 50% decline in the frequency of northern watermilfoil, flat-stem pondweed, clasping-leaf pondweed, and white water crow-foot (Table 1). It was also associated with a decline in the average number of native submersed taxa per sample site (Table 1).

[1] http://www.dnr.state.mn.us/lakefind/showreport.html?downum=27013700

[2] http://www.pca.state.mn.us/water/clmp/lkwqReadFull.cfm?lakeid=27-0137

[3] Madsen, J. D. 1999. Point intercept and line intercept methods for aquatic plant management. *APCRP Technical Notes Collection* (TN APCRP-M1-02). U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/aqua

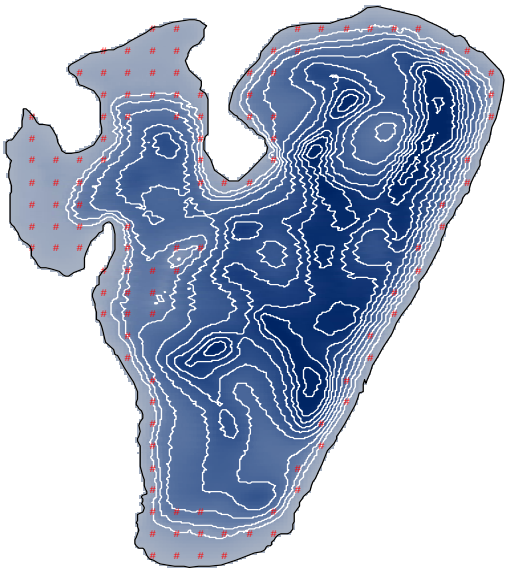


Figure 1. Aquatic plant sampling points on Christmas Lake (Hennepin County). 117 sample points. Depth contours every 10 feet.

Table 1. Aquatic Plants of Christmas Lake (Hennepin County). 117 sample points surveyed.

	Survey Date:	July 23, 2003	June 1, 2006	August 4, 2006
Common Name	**Scientific Name**	**Frequency of Occurrence; all taxa > 15% on at least one date (%) ***		
star duckweed	*Lemna triscula*	21	14	15
white waterlily	*Nymphaea odorata*	15	9	12
coontail	*Ceratophyllum demersum*	50	26	38
flatstem pondweed	*Potamogeton zosteriformis*	49	15	23
Eurasian watermilfoil	*Myriophyllum spicatum*	47	57	63
northern watermilfoil	*M. sibiricum*	36	7	6
water celery	*Vallisneria americana*	27	0	20
clasping-leaf pondweed	*P. richardsonii*	21	6	9
sago pondweed	*Stukenia pectinata*	16	2	10
white water-crowfoot	*Ranunculus* cf *longirostris*	16	11	3
Canada waterweed	*Elodea canadensis*	15	15	16
muskgrass	*Chara* sp.	15	23	14
bushy pondweed	*Najas flexilis*	13	7	24
Robbin's pondweed	*P. robbinsii*	9	11	15
curly-leaf pondweed	*P. crispus*	2	17	2
Total number of taxa		27	26	29
Average number of submersed taxa per sample site		3.8	2.4	3.0
Average number of native submersed taxa per sample site		3.3	1.7	2.4
Percent vegetated sample sites		81	74	85

* Other taxa that were found:
July 23, 2003: *Bidens beckii, Eleocharis acicularis, Nuphar* sp., *P. amplifolius, P.fresii, P. illioensis, P. natans, P. nodosus, P. praelongus, P.*cf. *pusillus, Spirodella polyrhiza,* and *Zosterella dubia.*

June 1, 2006: *Bidens beckii, Nitella* sp., *Nuphar* sp., *P. amplifolius, P. gramineus P. natans, P. nodosus, P. praelongus, P.cf. pusillus, Saggitaria sp., Sparganium* sp., and *Zosterella dubia.*

August 4, 2006: *Bidens beckii, Drepanocladus sp., Nitella sp., Nuphar sp., P. amplifolius, P. gramineus, P. illinoensis P. natans, P. nodosus, P. praelongus, Spirodella polyrhiza, Scirpus americana, Utricularia sp.,* and *Zosterella dubia.*

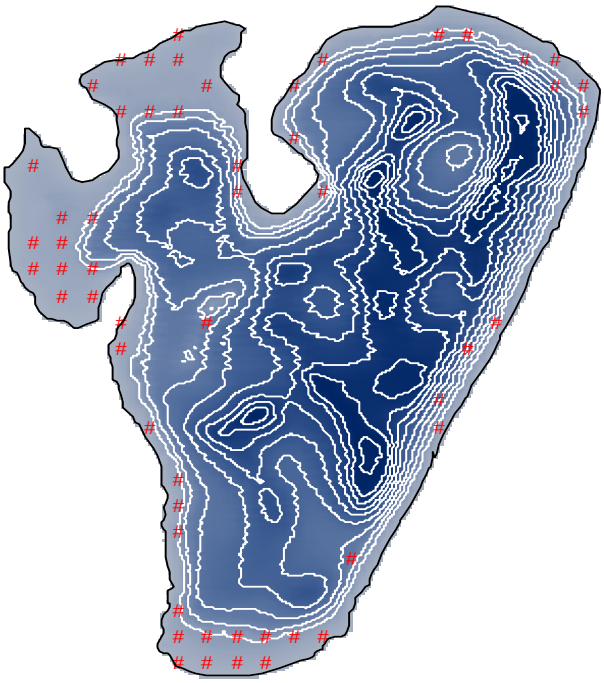
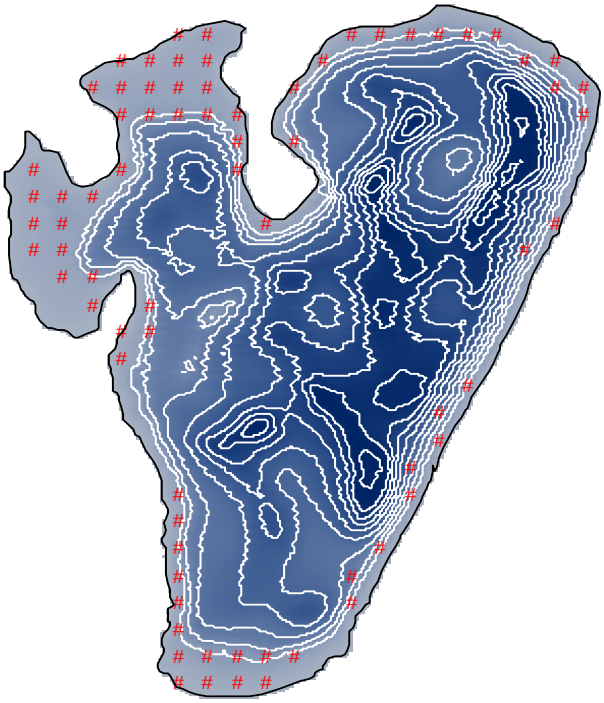


Figure 2. Distribution of Eurasian watermilfoil in Christmas Lake (Hennepin County), July 23, 2003. Eurasian watermilfoil was present at 55 of the sites surveyed, (47%). Depth contours every 10 feet.

Figure 3. Distribution of Eurasian watermilfoil in Christmas Lake (Hennepin County), August 4, 2006. Eurasian watermilfoil was present at 74 of the sites surveyed, (63%). Depth contours every 10 feet.



Appendix C

CHRISTMAS LAKE HOMEOWNER'S ASSOCIATION – SURVEY SUMMARY

The above-referenced survey was sent to all Christmas Lake homeowners in August 2006.

* * * * *

The Christmas Lake Association has engaged Osgood Consulting to develop a Lake Vegetation Management Plan (LVMP) to address concerns with Eurasian watermilfoil and other nuisance plants in the future. An important step in developing the LVMP is to understand the needs and concerns of the Association members, who will be called upon to support and implement any future management activities. This survey is designed to understand the perception of plant-related problems, identify preliminary management goals and explore management options.

The results of this survey will be reviewed with the Association members this fall.

* * * * *

Number of Surveys Sent:	145
Number of Surveys Returned:	35 (24% returned)

Responses are listed in order of most-to-least frequent. Percentages are of those who responded.

Problem Identification

Eurasian watermilfoil has become a widespread problem in Christmas Lake. The plant now encircles the entire lakeshore and interferes with recreation as well as doing ecological damage. The questions below are designed to understand how you perceive and experience any problems with milfoil or other plants.

1. **List any problems you experience relating to the increased growth of Eurasian watermilfoil.**

Interferes with swimming	54%
Interferes with boating, docks	54%
Increased beach maintenance, raking	37%
None or minor problems	11%
Displaces lily pads	9%
No answer	9%
Aesthetic	6%
Interferes with fishing	6%
Good for fishing	3%

Is spreading	3%

2. **List any problems you experience relating to other plants.**

None or no problems	57%
No answer	23%
Yes, sometimes	17%

3. **Did you experience these or other problems prior to Eurasian watermilfoil becoming abundant in Christmas Lake?**

No	60%
Slightly	14%
No answer	11%
Curlyleaf pondweed	6%
Coontail	3%
Preserve, protect lily pads	3%

Management Goals

Presumably, the goals for managing Eurasian watermilfoil and other nuisance plants in Christmas Lake will relate to mitigating the identified problems. Common management goals include reducing or controlling nuisances caused by problem plants and protecting non-problem plants that tend to be good for overall lake health.

4. **Please provide your thoughts regarding management goals for the LVMP:**

Control, eradicate milfoil if possible	34%
Protect water quality, fish habitat & wildlife	31%
Restore or protect lily pads	14%
Keep mechanical harvesting	11%
Against chemicals or experimental controls	11%
No answer	11%
Assistance to homeowners (financial)	6%
Milfoil not considered a nuisance	6%
Long-term focus, no quick fixes	6%
Get multiple opinions	6%
Chemical treatment to limit spread	3%
Collect cuttings	3%
Control milfoil only by docks	3%
Prevent introductions by boats	3%
Allow individuals to control only	3%
Watershed controls	3%

Management Actions

To some extent, the development of feasible management options depends on physical and technical conditions. Your input to the options listed below will help to understand concerns regarding the management options themselves. Please comment on each:

5. **Do nothing. This is always an option.**

No, not an option	51%
No answer	37%
Yes or yes if no other option	9%

6. **Mechanical control, including hand-pulling, raking or harvesting.**

Yes, an option*	66%
No answer	14%
No, avoid or not practical	11%
Appropriate only at small scales	9%

*Comments included raking, pulling, SCUBA

7. **Herbicides, including small-scale spot treatments (as is done by some individuals presently) targeted at milfoil.**

OK, if no adverse effects	40%
No or oppose	29%
Yes, OK	17%
Need more information	14%
No answer	14%

8. **Larger-scale selective (meaning selecting to kill target plants like milfoil, but not kill non-target plants) treatment.**

Yes, if safe and effective	54%
No, oppose or low priority	25%
No answer	11%
Need more information	9%

9. **Larger-scale treatments targeted at milfoil and other "offensive" plants.**

No, oppose or low priority	34%
Yes, if safe and effective	29%
Need more information	17%
No answer	14%
Yes	9%

Appendix D

SUMMARY OF MN DNR RULES CONTROLLING NUISANCE AQUATIC PLANTS

ACTIVITIES NOT ALLOWED

- Laying a plastic mat on the lake bottom.
- Removing vegetation within a posted fish-spawning area.
- Removing aquatic plants from an undeveloped shoreline.
- Removing plants where they do not interfere with swimming, boating, or recreation.

ACTIVITIES NOT REQUIRING A PERMIT

Cutting or pulling submerged vegetation by individuals can occur without a permit, provided that:

- The cleared area does not exceed 2,500 square feet **and** does not exceed more than 50 feet or one half the length of and individual's shoreline, whichever is less.
- The cutting or pulling cannot alter the course, current or cross-section of the lake bottom.
- Plants must be disposed far enough from the shoreline so they do not wash back into the lake.

ACTIVITIES REQUIRING A PERMIT

- Destruction of emergent plants.
- Mechanical removal of areas greater than 2,500 square feet.
- Applying herbicides or algaecides.
- Moving or removing a floating bog.
- Transplanting aquatic plants into protected waters.
- Using beach-cleaning or sand-sifting machines below the ordinary high water mark.

* * * As a matter of practice, the MN DNR will permit chemical treatments for no more that 100 feet or 50% of shoreline property (whichever is less) and extending 100-150 feet into the lake.

Appendix E

EURASIAN WATERMILFOIL MANAGEMENT MATRIX – LAKEWIDE CONTROL METHODS

	Cost	Advantages	Risks & Disadvantages	Expected Results	Variance	Use Restrictions
Mechanical & Physical						
Hand Cutting & Pulling (including SCUBA)	Low (small scales); high (large scales)	Low tech, can be selective	Costly or impractical at large scales	Good control at small scales with ongoing maintenance	Only if > 2,500 square feet	None
Mechanical Harvesting	Medium to high	Larger scale control	Maintenance, but not control. Not selective	Good maintenance level control	Yes, if >50% of littoral area	None
Diver Suction Dredging	High	May be selective	High cost, sediment disruption	Good control, if done lakewide	Yes	None
Weed Rollers	Low to medium	Effective control at small scales and shallow depths	Non-selective, bottom disruption	Complete control in small areas	None, within permit requirements	None
Drawdown	Medium to high	Effective if successful	Requires significant drawdown levels for extended period, non-selective	Good control, but also impacts to native plants	Probably	None
Benthic Barriers	Low at small scales	Effective at small scales in shallow depths	Non-selective, small scale	Good control, but also impacts to native plants	Yes	None
Nutrient Inactivation	N/A					
Chemical						
2,4-D	Medium to high	May be selective	Some toxicity, public	Reasonable control	Yes, for lakewide	Yes

			perception		application	
Diquat	N/A					
Endothall	Medium to high	Selectivity rate and timing dependent	Not effective when used alone	May be effective lakewide when used in combination	Yes, for lakewide application	Yes
Fluridone	Medium to high	Selective control possible, low toxicity	Requires lakewide application, long contact time	Good control, but ongoing maintenance	Yes	Depends on herbicide residual, plants irrigated
Triclopyr	Medium to high	Selective EWM control expected, low toxicity, fast acting	Slight risk of non-target plant impacts	Good control possible	Yes	Irrigation delay and potable water setback
Combination	Medium to high	Depends	Depends	Depends	Yes	Depends on herbicides
Biological						
Grass Carp	N/A					
Native Weevils	Medium to high	Specific to EWM	Not operational	Reasonable control, if effective	Yes	None
Native Plant Restoration	?	Ecologically preferred	No case studies	Unknown	Probably	None
Doing Nothing	Financial cost low	No risk of treatment failure	Ecological impacts	Continued infestation	n/a	n/a