H-1270

Long Lake Integrated Aquatic Vegetation Management Plan

98190459

Prepared for:

Kitsap County Fair and Parks Department
1200 NW Fairgrounds Rd
Bremerton, WA 98311
and
Save Long Lake Association

Prepared by:

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November 1997

9819059

WATER
environmental
services, inc.

November 4, 1997

TO: Cyndy Holtz, Director, Kitsap County Fair and Parks Department

FROM: Maribeth V. Gibbons, WATER Environmental Services, Inc., and Harry L. Gibbons, KCM, Inc., Long Lake IAVMP Project Consultants

RE: Final Long Lake Integrated Aquatic Vegetation Management Plan

Enclosed is a copy of the Long Lake Integrated Vegetation Management Plan (IAVMP). This Plan was developed cooperatively by the Long Lake Steering Committee. This committee was composed of members from the Save Long Lake Association, Kitsap County Fair & Parks Department, Project Consultants, WATER and KCM, Washington resource protection agencies, Department of Ecology and Department of Fish and Wildlife.

The IAVMP recommends the following major aquatic plant management **Scenario (E-1)** for Long Lake over a minimum course of five years, as selected by a vote of the Long Lake community:

- a confirmatory aquatic plant survey,
- lake-wide application of systemic herbicide, SONAR, for Brazilian elodea and Eurasian watermilfoil control, with possible retreatment in the next one to two years,
- spot treatment with systemic herbicide, RODEO, for purple loosestrife/selective waterlily control,
- small-scale follow-up treatments of non-natives and problem natives using hand removal, bottom barrier, harvesting or mini-suction dredge, where approriate,
- an alum treatment or nutrient inactivation treatment, if needed
- a public awareness/prevention program,
- a monitoring program to evaluate effectiveness.

To readers of this document, we offer some additional thoughts regarding implementation of the publicly-approved IAVMP for Long Lake. Following the IAVMP planning process has lead to a recommendation that would most likely meet aquatic plant management goals especially targeting nuisance non-native plant species (Brazilian elodea and Eurasian watermilfoil) as outlined by the Long Lake Steering Committee. However, there are some financial, permitting, and logistical constaints that could affect successful implementation of this very intensive management scenario. For example, the mechanisms for public and private funding are limited and financial support for a large-scale, whole-lake SONAR treatment (and probable followup re-treatment in following years) may not be economically feasible. Obtaining all needed permits may also be problematic. Furthermore, such an intensive, large-scale herbicide treatment could seriously upset the algal-macrophyte dynamics in Long Lake, tipping the scales in early post-treatment years to a more blue-green algal dominant system. This would most likely necessitate conducting a mitigating alum treatment. In addition, lakewide SONAR activity may affect non-target plant species (even if temporarily) but may necessitate mitigation of damaged habitat as indicated in the Plan.

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A more realistic and less environmentally intrusive approach would be to follow a long-term, but smaller-scale maintenance program, as presented in **Scenario M-1** in Section J of the IAVMP. This scenario is the preferred choice of the Project Consultants. We are aware that this is counter to the wishes of the Long Lake community members who faithfully attended the public meetings and/or responded to the ballot questionaire. The Long Lake Steering Committee collectively acknowledged the potential funding pitfall for option E-1, but felt that it was important to try the E-1 Scenario management approach. We agree with other Committee members that there are currently too few sources of funding and that considerable additional assistance from County/State agencies and private sectors will be needed to implement this aggressive IAVMP as it now stands. We certainly applaud their efforts to correct such a tremendous problem in Long Lake. Nevertheless, the reality of limited funding and the current hesitancy of State resource agencies to allow multi-year SONAR treatment could offer great hurdles to implementation of the recommended plan at the present time.

It is evident that several crucial issues surrounding large-scale, multi-year use of the systemic herbicide, SONAR, in Long Lake need to be settled. In the interim, though, implementation of the M-1 Treatment Scenario in Long Lake offers a reasonable alternative to tackle noxious purple loosestrife stands in a systematic way along the shoreline **and** manage small problem macrophyte growth areas around the lake. Additionally, this more conservative approach has a better chance of being approved for State implementation funding through Ecology's Aquatic Weed Management Fund. Following this tact and continued communication with State and local agencies regarding the above issues may eventually open the door for future implementation of the recommended scenario E-1 or an appropriate modification.

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ACKNOWLEDGMENTS

WATER is very appreciative of the collective support of the Long Lake Steering Committee in formulating the Long Lake Integrated Aquatic Vegetation Management Plan. Thanks go to Cyndy Holtz, Director of Kitsap County Fair & Parks Department, who served as County Contract Administrator. We deeply appreciate the dedication and efforts of the following Steering Committee members from Long Lake: Scott Sandin, Bill Barron, Jerry Johnson, Nick Hoyt and Terry Brown. Special thanks are extended to Kathy Hamel (Washington Department of Ecology Project Manager), for her guidance during the course of the project and, along with Mary Kautz (Ecology, NW Region), Dan Collins and Bill Freymond (Washington Department of Fish and Wildlife, Inland Fish Div.), and Stephan Kalinowski (WDFW, Region 6) for critical review of the planning document for Long Lake.

Maribeth V. Gibbons of WATER Environmental Services, Inc. was the senior author of the Long Lake Integrated Aquatic Vegetation Management Plan. Dr. Harry L. Gibbons, Jr. of KCM, Inc., provided critical technical review of the Long Lake Plan and was most instrumental during the public workshops and field demonstration of the sediment coring device.

The Long Lake Integrated Aquatic Vegetation Management Project was funded in part by the Washington State Department of Ecology's Aquatic Weed Management Fund.

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LONG LAKE
INTEGRATED AQUATIC VEGETATION MANAGEMENT PLAN

Introduction

Historical Water Quality Troubles and Restoration Efforts

A large, shallow lake (area=330 acres, ave depth=6.5 ft), Long Lake is a popular recreational/residential site located in southern Kitsap County in western Washington. Long Lake has been troubled by ***poor water quality*** and ***nuisance macrophyte growth*** conditions for quite some time (Bortleson et. al., 1976; McConnell et. al., 1976). Progressive lake deterioration has been attributed to increased nutrient and sediment loads associated with accelerating watershed development in the past several decades, as well as internal nutrient recycling (Entranco, 1980). With the purpose of improving overall ***water quality***, the Long Lake Restoration Project was initiated in 1975, focusing in part on land use and storm drainage control (Entranco, 1980). Additionally, phased implementation of in-lake control measures began in 1978 with a small-scale dredging of the North end/outlet (5% of lake bottom). This was followed by a partial six foot (1.8 m) drawdown in 1979 and alum treatment in 1980 to restrict sediment phosphorus release. Of note is that the drawdown project appeared to have only short-term benefits for ***macrophyte control*** (Jacoby et. al., 1982). Results of these earlier lake restoration efforts are presented in Entranco (1980) and discussed along with more recent management activities by Wertz (1996).

Aquatic Weed Problems and Past Control Efforts

In the past several decades, this large, shallow waterbody has experienced excessive, persistent growth of rooted macrophytes, particularly, the invasive, non-native weed, **Brazilian elodea (*Egeria densa*)**. Unfortunately, separate control efforts conducted in the past involving lake drawdown and spot dredging (1978-1979) and mechanical harvesting (most recently conducted from 1988 to 1990) have proven largely unsuccessful for long-term weed control in Long Lake, especially against this exotic species. Increasing concerns over deteriorating conditions and unproductive control efforts prompted the Long Lake community to search for more effective, long-terms means of combating current weed problems to restore and maintain beneficial uses of the lake.

Long Lake Community's Active Involvement in Management

The Save Long Lake Association (LS) has had a long history of involvement in management issues and activities in the lake, since its formation in 1969. Through the years a continuum of lake residents on this committee have worked on lake management endeavors in the lake, including the Long Lake Restoration Project in the 1970's, and assisting University researchers testing various lake restoration measures through the 1980's and 1990's. The SLY with Kitsap County recently formed a Lake Management District (LMD) to fund aquatic plant management planning and implementation in Long Lake, providing local match Moines for this Integrated Aquatic Vegetation Management Plan Project.

A Holistic Plan View

As a direct result of these early planning/investigative efforts, the lake community and Kitsap County, with input from other agencies and local groups, have finalized a five year ***Integrated Aquatic Vegetation Management Plan (IAVMP)*** for Long Lake. This long-term Plan is in

fulfillment of requirements of an Aquatic Weed Management Fund Grant (AWMF) awarded to Kitsap County by the Washington Department of Ecology (Ecology). The resultant Plan uses a ***holistic*** approach to aquatic plant control encompassing both lake and watershed to maximize beneficial uses of Long Lake.

A Note on Focus Area of the Plan

Formulation of this planning document involved first developing a realistic problem statement describing limitations imposed by ***problem aquatic plant growth*** on beneficial uses of Long Lake (See Step A). There may be other problems in the lake, e.g., water quality problems like algal blooms, physical problems with bulkheads, silting in of shallow areas, that are not addressed in this Plan. For example, other types of State-funded management investigations like Ecology's Lake Restoration/Feasibility Studies (Phase I, II) deal with identification and possible correction of ***water quality*** problems in lakes. In fact, as was the case earlier at Long Lake, a multi-phase Restoration Program was implemented during 1978-1980 to improve water quality and recreation potential (Entranco, 1980). The Long Lake Integrated Aquatic Vegetation Management Plan (IAVMP), funded by a different Ecology Program called the Aquatic Weeds Management Fund (AWMF), specifically addresses ***aquatic plant*** problems in the lake. Since the IAVMP process attempts to look at the "big picture" to design unique aquatic plant management solutions, any important non-aquatic-plant lake issues that may affect aquatic plant management decisions are still recognized. In this document, such significant problems uncovered in the background data investigation are noted in the background section, Step D (Describe Waterbody/Watershed Features). However, specific correction and public funding of non-aquatic plant problems would come under a different program, as above noted.

Problem Statement
Step A

Project Site

The Long Lake Project Area (Figure A-1) is located approximately four miles south of Port Orchard in southern Kitsap County in Western Washington State (T23N-R2E). Long Lake lies at an elevation of 118 feet (36 m) above sea level. The 339 acre (1.37 km^2) lake has a historical volume of 2,200 acre-feet (2.7 $X10^6$ m^3), an average depth of 6.5 feet (2 m), and center depth of 12 feet (3.6 m) (Bortleson et. al., 1976). The drainage area is approximately 9.4 square miles (24.3 km^2), encompassing an increasingly urbanized watershed. Salmonberry Creek is the major inlet, entering on the western shore. A single outlet, Curley Creek, drains the lake at the northeastern end, eventually flowing into the Puget Sound. Several unnamed streams enter the lake at the south end.

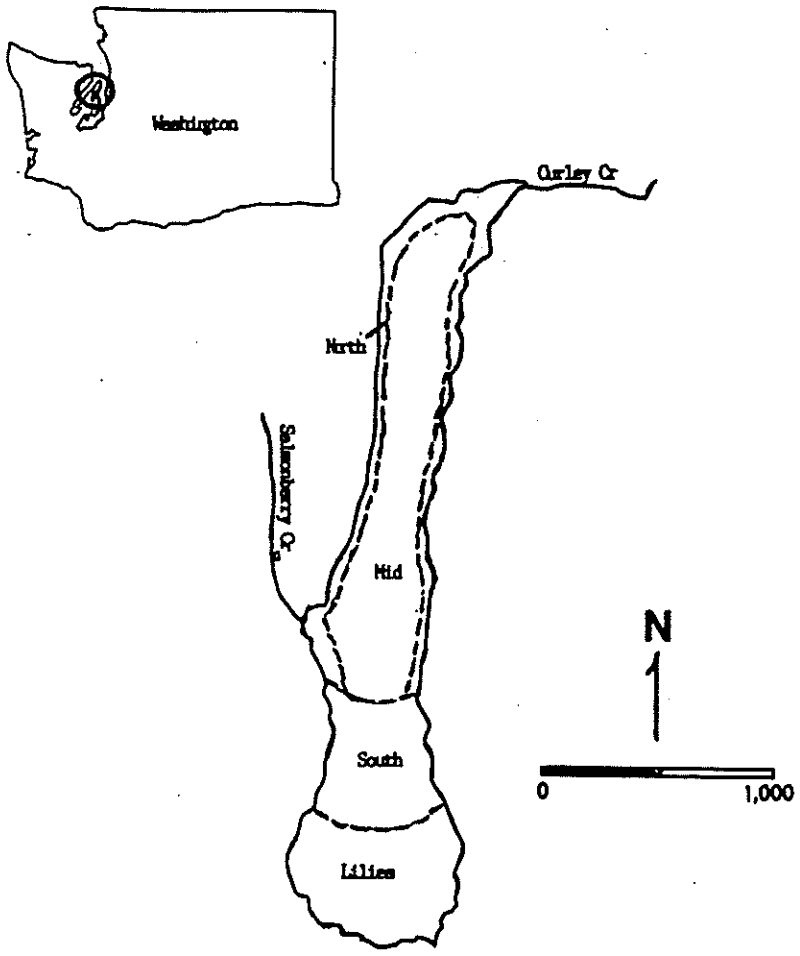


Figure A-1. Long Lake Project Site, showing lake plant sampling sections (after Jacoby, 1981).

Aquatic Plant Species of Concern

Long Lake has experienced nuisance production of freshwater aquatic plants, primarily the noxious, non-native, invasive species, **Brazilian elodea (*Egeria densa*)**, which invaded the lake within the last several decades. Recent identification of pioneering colonies of another exotic invasive weed, **Eurasian watermilfoil (*Myriophyllum spicatum*)**, also threatens lake habitat and usage. Thirdly, noxious **purple loosestrife (*Lythrum salicaria*)** has established a menacing presence along undeveloped lakeshore areas. Nuisance growth of these three invaders, all listed as **Class B Noxious Weeds** by the State of Washington, has resulted in adverse impacts to beneficial uses of the lake. Other floating-leaved plants, particularly white and yellow waterlilies (non-native *Nymphaea odorata* and native *Nuphar polysepalum*) populate the southern half of the lake in densities that are also perceived as problematic for localized recreational use. Unfortunately, separate control efforts conducted in the past involving lake drawdown and spot dredging (1978-1979) and mechanical harvesting (most recently conducted from 1988 to 1990) have proven largely unsuccessful for long-term weed control in Long Lake.

Water Use Limitations

Brazilian elodea is an aggressive, well-adapted competitor, capable of excluding native plant species and forming dense, monotypic stands. In Long Lake, this plant has become well-established throughout the lake over the years and is the dominant macrophyte species. Brazilian elodea is a robust plant and accounts for a large quantity of lake plant biomass (See Steps F and G). Not only a physical impediment to lake usage, the *Egeria* beds themselves are undoubtedly a large source of organic enrichment, building up lake sediments and adding to phosphorus reserves as they increase coverage, grow and senesce each year. Without control, this noxious aquatic weed will most likely continue its persistent occupancy of the lake.

MANAGEMENT NOTE: A complicating concern, though, is that *Egeria* with its associated periphyton may be directly competing with planktonic algae for soluble nutrients, suggesting that extensive plant beds in Long Lake may be acting positively to check potential nuisance algal activity, which has been an historical problem in the lake. Very simply, a substantial reduction in *Egeria* beds might lead to explosive production in phytoplankton algae, particularly the blue-greens. This consequence may require mitigation through another lake alum treatment (See Steps J,K).

Adding to the already extensive problem of Brazilian elodea in this lake is the occurrence of a pioneering infestation of another noxious weed, **Eurasian watermilfoil (*Myriophyllum spicatum*)**. Milfoil is not presently widespread in Long Lake, but appears to be concentrated in the southern "bulb" of the lake. This species is notorious for rapid growth and production of surface "canopies", excluding native vegetation, impeding human and wildlife use. This noxious weed duo of milfoil and Brazilian elodea has wreaked havoc in other Western Washington lakes (e.g., Silver Lake in Cowlitz County; Devils Lake in Oregon), and is capable of doing the same in Long Lake. Pockets of noxious **purple loosestrife (*Lythrum salicaria*)** scattered around much of the shoreline of Long Lake pose additional threats to habitat and wildlife. Finally, expansive production of surfacing waterlilies in the shallow southern end of the lake makes

localized passage and use by humans and animals nearly impossible, especially by late summer.

Dense growth of these nuisance plants will continue to cause impairment of aesthetic enjoyment of and recreational activities in the lake, as well as degrade habitat, decreasing availability of native, beneficial vegetation important to wildlife/fisheries. As there are several swimming areas around the lake, residents and visitors alike have a special concern about safety in recreating along a weed-choked shoreline. Moreover, with the frequent occurrence of mild winters in the Pacific Northwest, extensive and pervasive growth of aquatic plants in Long Lake, particularly Brazilian elodea, is becoming a year-round problem.

Threat to Nearby Waterbodies

While heavy infestations of Eurasian watermilfoil are widespread in the West including Washington State, the occurrence and establishment of Brazilian elodea isn't as prevalent in the Pacific Northwest, being somewhat sporadic West of the Cascades (Kathy Hamel, Wash. Dept. Ecology, pers. comm.). Long Lake is in close proximity to a number of popular recreational lakes in Kitsap County, including Wildcat Lake, Island Lake, and Kitsap Lake. There are currently no other documented cases of *Egeria densa* or *Myriophyllum spicatum* in Kitsap County, making their presence in Long Lake all the more critical as a source of infestation to other regional lakes. Therefore, an aggressive control project targeting Brazilian elodea and Eurasian watermilfoil on Long Lake has great significance for the region.

Regional Significance

Management Goals
Step B

Project Goals

Aquatic plant management goals were established for Long Lake with the purpose of maximizing beneficial uses of the water body, preserving ecological functions, minimizing environmental disturbance, and optimizing control expenses. Moreover, the community will continue (as it has in the past) to share results of integrated lake management activities on Long Lake with other lake associations or interested groups. In developing realistic management goals, it was important to distinguish between *management goals* and *management methods*. Goals are conditions in the lake or funding or management actions that the community wants to achieve and the methods are the means of attaining those conditions. (Treatment methods are examined later in Step H).

Specifically, the Long Lake Integrated Aquatic Vegetation Management Goals are:

- **to enhance water quality and beneficial uses** of the lake by utilizing appropriate nuisance macrophyte control actions in an environmentally sensitive and cost-effective manner
- **to aggressively remove noxious** *Egeria densa* (Brazilian elodea) populations throughout the lake
- **to aggressively remove noxious pioneering populations of** *Myriophyllum spicatum* (Eurasian watermilfoil) throughout the lake
- **to eradicate** *Lythrum salicaria* (purple loosestrife) from the lake
- **to prevent occurrence of surfacing weeds within priority areas,** e.g., boat launch, park beaches and slalom areas in the south end for boating and swimming safety reasons
- **to maintain sufficient lake habitat** for fish, waterfowl, and wildlife
- **to maintain contact** with the local lake community and those with an interest in Long Lake regarding aquatic plant management activities, watershed protection (e.g., BMP's) and management results
- **to evaluate program effectiveness** on a regular basis and make modifications, as needed
- **to prevent reintroduction of** *E. densa, M. spicatum or* **other noxious** invasive weeds into the lake
- **to complement concurrent watershed management program activities**
- **to develop long-term funding sources for integrated management**
- **to reduce overall management program costs** by utilizing volunteer efforts where possible

Public Involvement
Step C

Steering Committee Formed

From project start-up, the Long Lake community as well as those with an interest in management of this lake were encouraged to actively participate in the planning process. The plan itself was crafted by a **steering committee** composed of individuals representing the County, lake community, local commerce, tribal concerns, State environmental agencies, and lake management professionals. The Long Lake IAVMP Steering Committee consisted of the following members:

- Cyndy Holtz (Kitsap County Fair & Parks Dept.)
- Scott Sandin (Long Lake community)
- Bill Barron (Long Lake community)
- Nick Hoyt (Long Lake community)
- Jerry Johnson (Long Lake community)
- Terry Brown (Long Lake community)
- Kathy Hamel (Washington Department of Ecology)
- Mary Kautz (Washington Department of Ecology, NW Region)
- Stephan Kalinowski (Washington Department of Fish and Wildlife)
- Dan Collins (Washington Department of Fish and Wildlife)
- Maribeth Gibbons (WATER Environmental Services, Inc.)
- Harry Gibbons (KCM, Inc.)
- Phylis Meyers (Suquamish Indian Tribe)

Throughout plan development, input and review by the committee were essential to insure crafting of a unique planning document that reflected widespread public and private support. In addition to maintaining frequent written and phone contact with each other, the Committee formally met five times during the course of the project. **Long Lake IAVMP Steering Committee Meetings** were held on May 29, July 23, October 29, 1996, January 21 and February 18, 1997. Committee members also kept the larger community informed as to the status of the emerging plan through holding informal meetings and publishing **newsletters** describing status and progress of the project (Appendix).

Public Meetings Held

Three Public Workshops were held to serve as forums to disseminate information on this planning project, discuss specific macrophyte problems and management techniques, as well as elicit community dialogue on and approval of a recommended action plan. A **Project Kickoff Workshop** was held on July 9, 1996 to introduce the Long Lake IAVMP Project and consultant team and provide an opportunity for general discussion on aquatic plant problems in Long Lake. A **Second Mid-term Planning Workshop** was held on December 10, 1996 to update the community on the status of the Project, present results of the

summer, 1996 macrophyte survey, and begin discussions on possible macrophyte management tactics. **A Final Draft Planning Workshop** was held on May 27, 1997 to review final list of in-lake treatment options proposed by the Steering Committee (Step J). This last meeting provided a forum for presentation of integrated management scenarios, general discussion, and selection of a preferred management option (See Step K). Prior to this last Workshop, a newsletter was sent out to all property owners describing the candidate management options and containing a mail-back ballot for voting (See Appendix, Newsletter Two).

Local Support for Project

The lake community has demonstrated active, long-term support for water quality and aquatic plant management efforts specifically targeting the nuisance non-native species Brazilian elodea in Long Lake. The **Save Long Lake Committee (SLLC)** was formed in 1969 to investigate cleanup of the already eutrophic lake and to monitor increasing shoreline development. The SLLC organized and paid for early aquatic plant harvesting expenses conducted in 1972. Regular **town meetings** have been conducted since the early 1970's on water quality and aquatic plant problems in the lake. In the early 1970's a concerned Long Lake community helped the County initiate a contracted diagnostic water quality study that led to the landmark **Long Lake Rehabilitation Demonstration Project** in the late 1970's (Entranco, 1976, 1980). Through the years, a continuum of lake residents on this committee has continued to promote community involvement, fund raising, lobbying for agency backing, environmental education, and lending support to University of Washington researchers testing different lake restoration measures. The SLLC with Kitsap County recently formed a **Lake Management District (LMD)** to fund aquatic plant management planning and implementation in Long Lake, providing local match moneys for this IAVMP planning project. Aquatic plant problems, funding mechanisms, and possible control methods have been featured in periodic **newsletters** distributed by the SLLC to all members. These included pre-LMD-formation issues in the early 1990's and two recent factsheet supplements on the IAVMP Project prepared by the project consultant. Most importantly, the Long Lake Community has been working hard to **develop additional support for management activities** by reaching out to those with an interest in Long Lake, especially the local Suquamish Indian Tribe. The Appendix provides examples of community interest and support of integrated lake management activities on Long Lake in the form of newsletters, newspaper articles, and general membership and committee meeting minutes.

Long-term Commitment to Implementing Control

As evidenced above, the SLLC has had a long and excellent record of active involvement in water quality and aquatic plant management issues on Long Lake. The recent hardworking efforts of residents serving on the Long Lake IAVMP Steering Committee further indicate the commitment of these individuals in crafting a long-term, workable solution.

Waterbody/Watershed Features
Step D

The Long Lake watershed and lake water quality have been extensively characterized since the early 1970's. One of the first significant sources of background data on eutrophic Long Lake was the limnological sampling and survey performed by the WDOE/USGS in 1973 (Bortleson et. al., 1976; McConnell et. al., 1976). A four-season diagnostic study was subsequently conducted during 1974-75 prior to initiation of the Long Lake Rehabilitation Project, a State and Federally funded Restoration Project that was completed in 1980 (Entranco, 1980). Since the mid-1970's, a variety of lake restoration and aquatic plant management activities have been conducted in Long Lake. The University of Washington has been involved in several monitoring studies (e.g., in-lake responses of the early Rehabilitation Project) and various implementation projects on Long Lake, including periodic macrophyte surveys performed from 1976 through 1994 (summarized in Wertz, 1996). The following is a brief summary of pertinent information on the Long Lake watershed condensed from the above-mentioned sources. The reader is referred to these documents for more specific data.

Physical Features

Long Lake (Figure A-1) is a shallow, lowland lake located approximately four miles south of Port Orchard in southern Kitsap County in Western Washington State (T23N-R2E). Long Lake lies at an elevation of 118 feet (36 m) above sea level. The 339 acre (137 ha) lake has a historical volume of 2,200 acre-feet (2.69 X 10^6 m^3), an average depth of 6.5 feet (2 m), and center depth of 12 feet (4 m) (Bortleson et. al., 1976). Nearly 75% of the lake is less than 10 ft (3 m) in depth, providing a large littoral area. The drainage area is approximately 9.4 square miles (24.3 km^2), encompassing an increasingly urbanized watershed. Salmonberry Creek is the major inlet, entering on the western shore. The single outlet, Curley Creek, drains the lake at the northeastern end, eventually flowing into the Puget Sound. Several unnamed streams enter at the southern end of the lake. Long Lake exhibits a rather high flushing rate varying from 3.6 to 8.0 yr^{-1} (Jacoby et. al., 1982).

The Long Lake basin is somewhat spoon-shaped, stretching nearly two miles in length. Previous investigators have discussed the basin in terms of four different sub-regions, based on substrate type, water depth, and macrophyte community (Jacoby, 1981). The **North region** consists of narrow shoreline (<2 m), with steep slopes and heterogeneous substrate. The North region comprises about 14% of the lake area, receiving inflow from Salmonberry Creek, and draining through Curley Creek at the northeast end. The deep (2-3.5 m) **Midlake basin** represents 51% of the lake area, supporting flocculent, fine-grained sediments. The **South region** accounts for 17% of lake area, and is gently sloping with depths between 2 and 3 m. The very shallow **South Lilies region** averages about 1 m in depth, representing 18% of the lake area, and is densely populated by waterlilies (*Nuphar* and *Nymphaea* spp.) during the summer. The

sediments of the South and Lilies regions are flocculent and peaty in nature. The lake is oriented in a north-south direction, and general movement of flow is toward the outlet in the north. During a recent water quality monitoring period from 1993 to 1994 conducted by the University of Washington (summarized in Wertz, 1996), the lake regions demonstrated similar physical/chemical characteristics. The lake appeared to be moderately to highly productive throughout with many eutrophic features, consistent with earlier survey data.

Watershed Characteristics

Historically, the Long Lake watershed consisted primarily of unproductive lowland forests and small agricultural operations (McConnell et. al., 1976). Over the past several decades, an accelerating transition has occurred from a basically rural to a more suburban watershed, with increased residential and commercial **development on all sides of the lake.** A 23 acre County Park is situated at the north end, acquired as a result of the Lake Rehabilitation Project conducted on Long Lake in the mid-1970's. The topography of the area is such that Long Lake forms a low point with surrounding elevations contributing drainage directly to the lake via surface flow and overland flow (runoff). The major inlet stream, Salmonberry Creek, enters on the western shore, maintaining perennial flow rates throughout the year. Curley Creek outlet drains the lake at the northeastern end. There is also evidence that considerable subsurface inflow of water may occur around the lake in the form of interflow or groundwater movement.

Lake Sediments

Long Lake sediments have been characterized as generally consisting of loose muck/sedimentary peat (Entranco, 1980). Coring tests conducted as part of the earlier Rehabilitation Project showed depths of this mucky/peaty substrate varying from one to two feet overlying various sands and clays in the north end to over 20 ft near the center of the lake. Further testing of lake and watershed sediments showed that a substantial portion of lake sediments was most likely derived from erosion of bogs abutting influent Salmonberry Creek. The predominantly deep, organic lake substrate is also supported by a lake sediment coring project conducted by Eagle Scout volunteers during fall of 1996 (Appendix).

Over the years, the lake substrate continued to build up as sediment was washed into the lake, supporting healthy aquatic plant beds, which seasonally declined and decomposed, further adding organics and nutrients to the lake bottom. The moderate size and shallow nature of the lake combined with enriched sediments translate into a large area of the lake bottom potentially available for aquatic plant colonization (nearly 75% of the lake is less than 10 ft (3 m) in depth). Indeed, according to published literature and anecdotal reports, Long Lake has supported extensive growth of rooted aquatic plants for upwards of 30 years.

Chemical Characteristics

For several decades, Long Lake has demonstrated high biological productivity and nutrient content indicative of eutrophic conditions (Bortleson et. al., 1976; McConnell et. al., 1976). Water quality data were recently collected on Long Lake during 1993-1994 in conjunction with macrophyte surveys (tabulated in Wertz, 1996). Review of this data showed moderate to high nitrogen and phosphorus levels in the lake and

tributaries, particularly during the summer months. Summer secchi disk transparency measures were low to moderate, within the 1-1.9 m range at all stations, reflecting in part the dark color (and turbidity due to plankton?) of the water. Interestingly, in the 1993-1994 study, pH measurements were typically above neutral (pH=7) even ranging upwards to 8 during the growth season. Jacoby et. al. (1982) described elevated pH conditions in Long Lake which was associated with high algal photosynthesis. Water column dissolved oxygen levels generally remained high (>7.0 mg/l) in all four lake regions during the same study, with occasional occurrences of low oxygen tension (<5.0 mg/l) recorded in the hypolimnetic (bottom) waters at the mid and south stations.

Biological Characteristics

The Long Lake fishery historically has supported several **warm-water species**, including largemouth bass, perch, and crappie (UW Cooperative Fishery Research Unit report summarized in Entranco, 1980). A recent electrofishing survey in 1993 indicated close to 100,000 spiny-rays and other warm-water fish present in the lake, consisting mostly of bluegill sunfish, but including largemouth bass, black crappie, pumpkinseed sunfish, and a good brown bullhead population (Washington Department of Fish & Wildlife, Warmwater Fish Population Survey, 1993). Of note is that dense macrophyte growth in Long Lake may be influencing a crowded condition in larger bluegill and crappie by increasing escapement opportunities from predators.

Long Lake and its watershed supports important **anadromous fish** runs, as well as several priority fish species, including prickly sculpin and western brook lamprey (WDFW Priority Habitats and Species database, 1996). Cutthroat trout are also believed to be present in the Long Lake watershed, although their current status is unknown (Stephan Kalinowski, WDFW, pers. comm., 1996).

Inspection of the 1993-1994 water quality data collected by University of Washington researchers revealed relatively high summer epilimnetic **chlorophyll *a*** concentrations (>5 µg/l) at all stations. Summer lake mean chlorophyll *a* computed from the 1993 and 1994 data was 18.4 and 11 µg/l, respectively. **Phytoplankton** samples from all four regions showed high cell volumes of the filamentous blue-greens, *Anabaena* spp. and *Aphanizomenon flos-aquae*, occurring during the summer months of both years, which is consistent with past records of cyano-bacteria blooms. The high summer algal biovolume, mainly due to high blue-green algal densities, most likely accounted for higher summer chlorophyll *a* values measured for both 1993 and 1994. **Zooplankton** (micro-invertebrate) densities were low to moderate in all lake regions during the 1993 and 1994 summer seasons. The zooplankton community appeared to be dominated by small filter-feeders (e.g., cladocerans *Bosmina* and *Ceriodaphnia*, copepod nauplii, and "others"=rotifers?) in terms of density. Higher numbers of small zooplankters suggest exploitation of much minute algal, bacterial and organic matter most likely present in the lake. Larger crustaceans, such as *Daphnia* sp., appeared to be less common during this recent period of water quality data collection.

Trophic Characteristics

Historical and recent limnological data indicate that Long Lake is a very productive (**eutrophic**) waterbody, and has suffered from poor water quality conditions for some time. Eutrophication (increased organic productivity and declining water quality) of the lake has been attributed to the combined effect of an historically enriched lake substrate/watershed (probable affects of early peat-mining in watershed), invasion and successful colonization by Brazilian elodea that have continually enriched lake sediments, and increased shoreline and watershed development (Entranco, 1980).

Waterbody Beneficial Use Areas.
Step E

Human Uses

Long Lake is a *multi-use resource,* supporting a variety of human and wildlife uses (Figure E-1). The lake offers many recreational opportunities for residents and visitors alike. Long Lake provides **year-round public access** in the form of a Washington Department of Fish and Wildlife boat launch located along the western shore of the lake just north of the Salmonberry Creek inlet. Boating access also occurs from private docks around the lake as well as from a small launch site at the County Park on the north end. Primary uses of the lake water are for contact recreation: **fishing, boating, rowing, swimming, and water-skiing.** The lake, which supports a substantial warmwater fishery, receives heavy use by anglers. Two water supply intakes are located along the northeastern shoreline south of Curley Creek outlet, providing a source of domestic **water** for use in the watershed. Much of the lake perimeter is **residentially developed.** Other recreational facilities utilized by residents include a **Kitsap County Park** at the extreme north end, that includes a community center building, a swim beach, and picnic and playgrounds. A well-utilized public fishing pier is also situated at the north end along the Curley Creek outlet embayment, the site of the earlier Lake Rehabilitation Project drawdown/pumping support platform.

Fish, Waterfowl, and Wildlife Utilization

The lake system provides **nesting, forage and cover** for a variety of resident and migratory **fish, waterfowl and wildlife.** The local fishery includes largemouth bass, black crappie, bluegill and pumpkinseed sunfish, and bullhead (Washington Dept. Fish and Wildlife, Warmwater Fish Population Survey, 1993). Rainbow trout has been stocked in the lake in past years (Bill Freymond, WDFW, pers. comm., 1996). Curley Creek (Long Lake outflow) is known to support spawning runs of anadromous fish (steelhead and salmon) (Entranco, 1980; WDFW Priority Habitats and Species, 1996). Forested watershed as well as the lake itself offer habitat to a variety of raptors and waterfowl, including bald eagles (WDFW Priority Habitats and Species database, 1996), osprey, and various duck species (Bill Barron and Scott Sandin, Long Lake community, pers. comm., 1996).

Protected or Sensitive Flora or Fauna

A search of Washington Department of Natural Resources Natural Heritage Program data base revealed no current published record of endangered, threatened or sensitive plant species residing in or around the immediate shoreline of Long Lake. However, the database identified presence of ***Hydrocotyle ranunculoides*** **(floating water pennywort), a State Monitor 1 plant species** in the NW quarter of Section 20 (Appendix). There has also been a report of the occurrence of a rare plant in Long Lake, *Lobelia dortmanna,* but specific location has not yet been recorded (K. Hamel, WDOE, pers. comm., August, 1997) A similar search of the data base from the Priority Habitats and Species Division of Washington Department of Fish and Wildlife identified reports of Priority Species, mountain quail (*Oreortyx pictus*) and bald eagle (*Haliaeetus leucocephalus*) and habitat in the Long Lake vicinity.

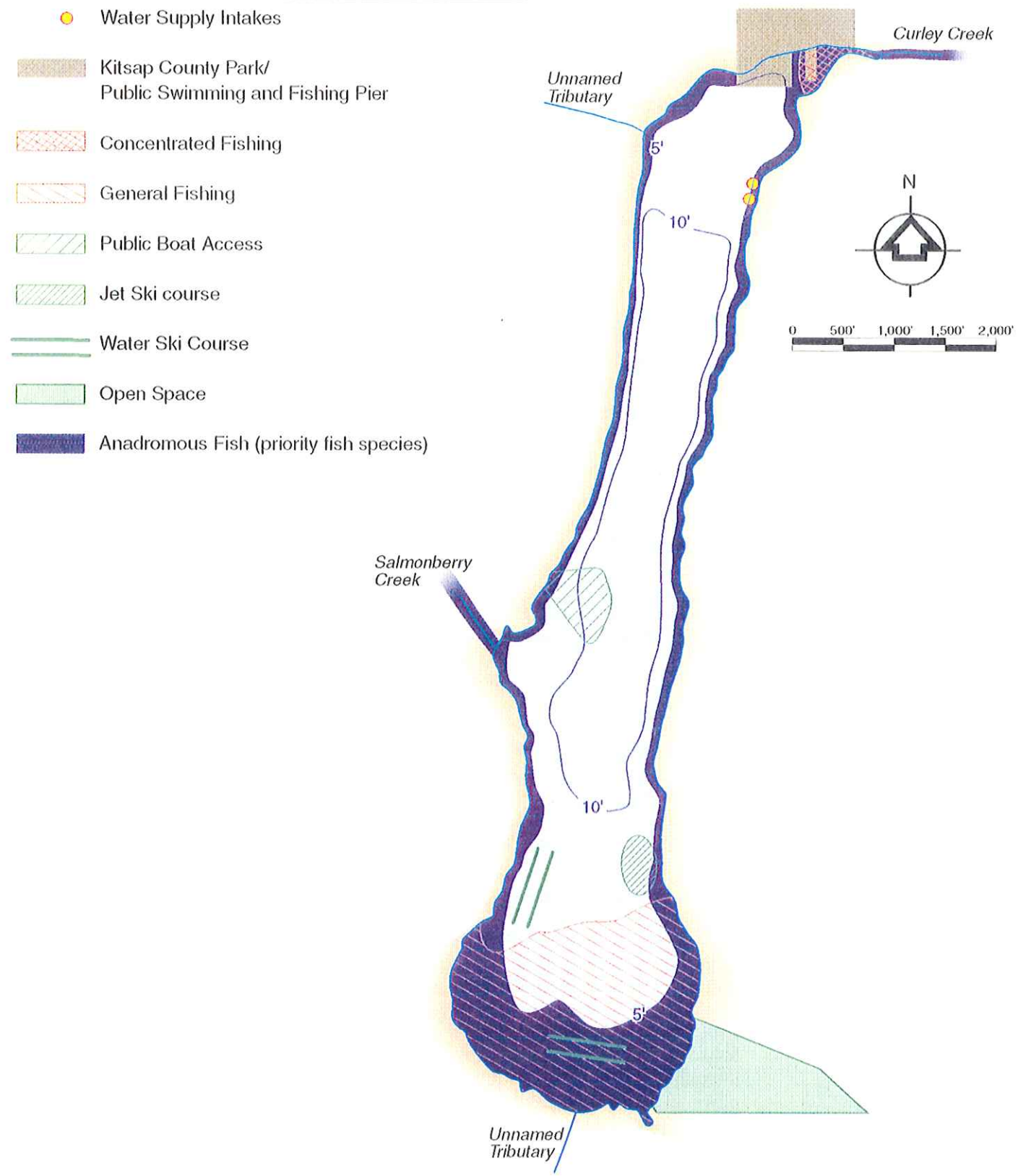


Figure E-1.
LONG LAKE USE ZONE MAP

1996 Aquatic Plant Survey
Step F

Purpose of Survey

An aquatic plant survey was conducted on Long Lake during late August, 1996. The main purpose of the survey was to document current composition, extent, and biomass of the aquatic plant community in the lake. Aquatic plant surveys had been conducted routinely on Long Lake since the late 1970's by University of Washington graduate students (summarized in Wertz, 1996). The most recent survey performed by University personnel was during the summer of 1994. Most of these surveys included quantitative measurements of plant biomass and coverage and were conducted at a time typically corresponding to the height of the growth season. A primary aim of the present survey was to supply additional plant biomass and areal coverage data for the lake, so that better estimates of whole lake plant biomass could be obtained. The late summer 1996 survey effort included fathometer recordings of lake bottom along the primary transects to graphically depict plant bed extent and height, and to obtain an updated profile of lake bottom. Specimens of major plant species found in the lake at the time of the survey were also collected and preserved for permanent archiving.

Survey Methods

During the week of August 26-30, 1996 WATER staff conducted a physical survey of Long Lake to document aquatic plant community composition and extent of growth. Field data on aquatic plant distribution and biomass were obtained by means of a motorboat using a transect sampling system. A series of ten primary transects was established around the lake perimeter (Figure G-1). Transect surveying commenced at the northern end of the lake and continued around the lake at regular shoreline intervals, ending at the southern end.

Except for Transect 10, physical surveying on a transect extended across the lake from shoreline to shoreline. At transect 10, surveying was performed from the mid-point of Transect 9 directly south into the surfacing bed of waterlilies as far as the water skiing lane. Presence of submersed plants was visually determined along each transect by observation through an underwater viewer. In addition, along each of the ten transects, an echogram of the lake bottom illustrating plant beds was obtained using a high-resolution chart-recording fathometer. Fathometer tracings were especially useful when plant beds were difficult to detect visually with the underwater viewer, particularly in deep or turbid waters. The complete series of fathometer recordings is presented in the Appendix C. Nearshore plant beds were inspected from the boat with the underwater viewer while traveling between designated transects to provide as much continuum as possible around the lake littoral for mapping purposes. Surface and underwater photographs were also obtained for further visual documentation.

Water depth measurements and aquatic plant samples were taken along each transect at regular intervals using a modified rake sampler operated from the boat. In all, 25 quantitative plant samples were obtained during the late August, 1996 survey of Long Lake. Samples were later analyzed in the laboratory for plant community composition and dry weight biomass measures according to Standard Methods (APHA, 1985). Species identifications were made using published keys for regional macrophytes (Hotchkiss, 1972; Warrington, 1994, 1980; Hitchcock and Cronquist, 1981). Sediment brought up with each of the plant samples was also examined in order to provide a general characterization of local substrate type (e.g., mucky, sandy, clayey, gravely).

Plant Voucher Specimens

Whole plant specimens were also collected of the major aquatic plant species encountered in Long Lake during the summer, 1996 survey. These specimens were washed, dried, and mounted on specially labeled herbarium paper. These ***voucher specimens*** will serve as a permanent archival record of principal macrophytes occurring in the lake at this point in time.

Aquatic Plant Map Produced

Measurements by the WATER survey crew along the ten transects generated a substantial data base from which a generalized aquatic plant zone map (Figure G-1) was constructed. It is important to note that the map is a reflection of late-summer, 1996 conditions.

Long Lake Aquatic Plant Community
Step G

TABLE G-1.
Major Aquatic Plant Species Found During Late August, 1996 Survey Of Long Lake

Submersed/Floating-leaf Species	Common Name
Egeria densa	Brazilian elodea
Myriophyllum spicatum	Eurasian watermilfoil
Ceratophyllum demersum	Coontail
Potamogeton amplifolius	Big-leaf pondweed
Potamogeton praelongus	White-stem pondweed
Potamogeton zosteriformis	Flat-stem pondweed
Potamogeton berchtoldii/pusillus	Small (Berchtold's) pondweed
Nuphar polysepalum	Yellow waterlily, spatterdock
Nymphaea odorata	White (fragrant) waterlily
Nymphaea spp.	Pink/red ornamental waterlily
Brasenia schreberi	Watershield
Elodea canadensis	Common elodea
Nitella spp.	Nitella (macroalgae, Charales)
Major Emergent Species	**Common Name**
Lythrum salicaria	Purple loosestrife
Scirpus spp.	Bulrush
Iris pseudacorus	Yellow iris
Typha spp.	Cattail
Sparganium sp.	Burreed

Plant Community Composition

The 1996 survey showed that aquatic plants in Long Lake occurred in mixed communities of varying densities around the entire lake and shoreline. More than 13 different plant species were observed in the lake, including floating-leaved and submersed vascular forms, and macroscopic (large) algae. A number of species of emergent plants were also identified growing along the shoreline. Table G-1 lists principal aquatic plant species found during the 1996 Long Lake survey with their common names.

Extent of Coverage

The 1996 survey generally showed submersed plant growth extending from a depth of about 0.5 m (1.6 ft) to 3.2 m (10.5 ft), representing about 70-75% (approx. 250 acres) of total lake surface area (Figure G-1). Only the small, deep central trough area greater than 11 ft was clear of rooted plants. Plant growth was typically denser in the south end of the lake and particularly in southernmost "bulb" of the lake, where filamentous green algal mats were also evident coating submersed plant beds. Limits of submerged macrophytic growth are graphically depicted by fathometer tracings of lake bottom taken along the ten primary survey transects established around Long Lake for the 1996 survey (Appendix C).

Inspection of the fathometer recordings confirmed aquatic plant beds extending to depths up to approximately 11 feet. The outer growth limit was further verified by failure to obtain any quantitative biomass samples at the 3.65 m (12 ft) depth in the deep trough along survey transects T-3, T-4, T-5, and T-6.

Noxious Weed Species Present

The non-native species, **Brazilian elodea, *Egeria densa***, was found to be the dominant member of the ***submersed macrophyte*** community of Long Lake. Brazilian elodea belongs to the family Hydrocharitaceae, which also includes the freshwater genera: *Elodea, Hydrilla,* and *Vallisneria*. This invasive, non-native species of *Egeria* is notorious for its aggressive growth potential, and is listed as a Class B *noxious* plant in the State of Washington. Plants reproduce mainly by fragmentation of stems, and thus the potential for spread by water currents and boating equipment is very great. Persistent growth of this invasive, exotic (non-native) weed has been documented in the lake for at least the past three decades. The summer, 1996 survey confirmed continued presence of Brazilian elodea throughout the lake, inhabiting water depths between 0.5 and 3.2 meters (See Figure G-1). It is important to note that Brazilian elodea in Long Lake does occur in mixed communities of varying densities with other non-native and native aquatic plants.

Eurasian watermilfoil (*Myriophyllum spicatum*), another Class B noxious weed, was also observed in Long Lake at the time of the 1996 survey. Watermilfoil appears to be a somewhat recent intruder to the lake system, and is in a late pioneering phase of colonization of Long Lake. The species was not noted in the last two macrophyte surveys conducted by University of Washington in 1993 and 1994, but lake residents have provided photographic documentation of its presence in Long Lake (Figure G-2) in the summer of 1993 (Bill Barron, Long Lake resident, unpubl. data, 1996). During the summer 1996 survey by WATER, clumps of multi-branched milfoil plants or very small beds were visually apparent only in the southern half of the lake. The weed probably entered the lake at least three or four years ago as fragments caught on boats or trailers putting in at the public launch. Stem fragments represent the primary means of transport and propagation of this weedy milfoil species within and between waterbodies.

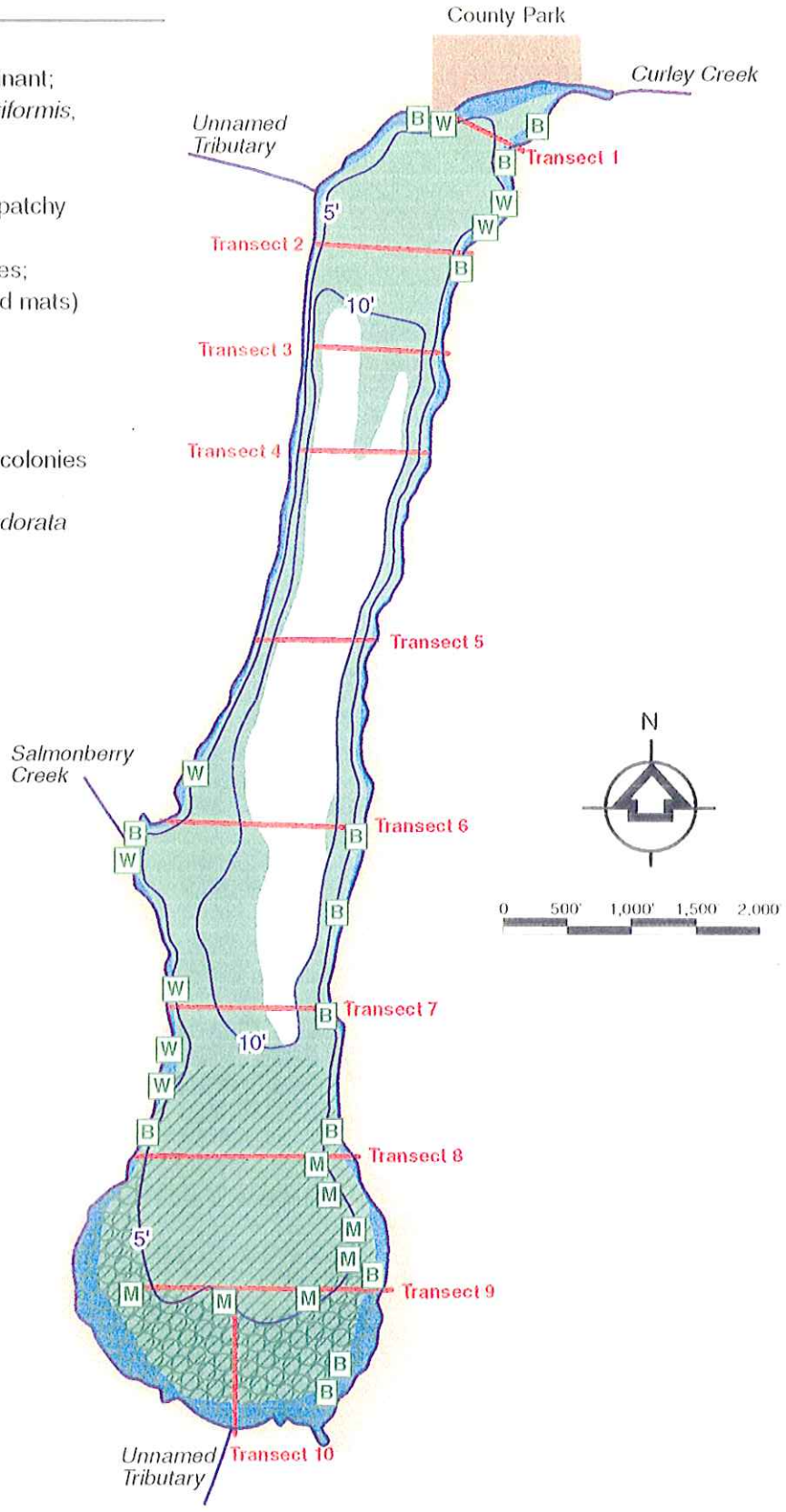
Other Native Plants

Of note was the pervasive occurrence throughout Long Lake of a native plant called coontail (*Ceratophyllum demersum*). Previous surveys have also found this plant to be a major component of the Long Lake macrophyte community (Wertz, 1996). A rootless, *submersed* macrophyte, coontail was typically found in Long Lake floating suspended below the water surface or densely entangled with other rooted aquatic plants. Large floating mats of coontail can be easily transported around the lake by wind and water currents, as well as boating equipment. Striking evidence of *Ceratophyllum* hanging suspended in the water column, particularly in the deeper waters, is portrayed in the fathometer tracings taken along the 1996 Long Lake survey transects (See Appendix C).

Localized surfacing mats of native yellow pond lily (*Nuphar polysepalum*) and white waterlily (*Nymphaea odorata*), the latter species actually native to the Eastern United States, prevailed in the shallow littoral region of the

LEGEND

- *Egeria densa* dominant zone; *Ceratophyllum demersum* subdominant; *Potamogeton praelongus*, *p. zosteriformis*, and *p. amplifolius* patchy
- *Myriophyllum spicatum* zone, very patchy
- Deep zone, negligible rooted species; *Ceratophyllum* (rootless, suspended mats) present
- *Nuphar*, *Nymphaea* zone
- [M] *Myriophyllum spicatum*, prominent colonies
- [W] *Nuphar polysepalum*, *Nymphaea odorata* colonies
- [B] *Brasenia schreberi* colonies



LONG LAKE AQUATIC PLANT MAP

southern end. At the time of the late August, 1996 survey, lily beds created quite an impenetrable barrier, except for the presence of partially opened (managed) areas in the vicinity of the slalom and ski courses. Pockets of ornamental red/pink waterlilies (*Nymphaea* spp.) inhabited the shallows around the lake as well. Watershield (*Brasenia schreberi*), a rooted plant characterized by small oval floating leaves, persisted in conspicuous patches around the entire shoreline of Long Lake, particularly in protected embayments. Watershield generally occurred at depths less than 1.8 m (6 ft).

Figure G-2. Photograph of Eurasian watermilfoil growing in Long Lake in the summer of 1993. (Photo courtesy of Bill Barron, Long Lake).

Several species of pondweed were also found to be important members of the 1996 Long Lake macrophyte community. During the 1996 survey, patchy growth of *Potamogeton praelongus* (white-stem pondweed) was observed around the lake occurring at depths between 1 and 3 meters. This species has long been an important member of the Long Lake macrophyte community (Wertz, 1996). Small pockets of *P. amplifolius* (big-leaf pondweed) were also observed growing, particularly in the northern half of the lake. Interestingly, *P. amplifolius* has not appeared in any of the previous 24 biomass sampling surveys conducted by University of Washington personnel over the 19 year span from 1976 through 1994. Both *P. praelongus* and *P. amplifolius* are large, robust submersed plants belonging to the family Potamogetonaceae, and are often found growing in deep quiet water (up to 6 meters). These species are characterized by upright growth of stems to water surface (simple or compound branching), but do not form surface canopies. Small patches of flat-stem pondweed (*P. zosteriformis*) were also observed scattered

around Long Lake at the time of the 1996 survey. This native species is a thin-leaved pondweed that inhabits waters of 1 to 2.5 m in depth. Of note is that *P. crispus* (crisped pondweed), which had been documented in Long Lake consistently between 1980 and 1986 and again in 1993, was not observed during the 1996 survey.

Other less conspicuous members of the submersed community in Long Lake occurring within the Brazilian elodea/coontail zones included spotty stands of *Elodea canadensis* (common elodea or waterweed) and *Potamogeton berchtoldii/pusillus* (narrow-leaved pondweed), the latter evident in the northern lake section. Rootless, macrophytic algae, *Nitella* spp. (Charales) appeared in low densities, particularly in the southern end. The genus *Nitella* is a common algal inhabitant of soft-water or slightly acid lakes. The presence of this algae, which derives its nutrition from solution, suggests successful competition with planktonic algae for soluble nutrient reserves in the lake water column. Also, as a rootless algae, *Nitella* spp. does not directly compete with rooted macrophytes which extract nutrients primarily from the sediments (Barko and Smart, 1980). However, this macroalgae may come into competition with the submersed, non-rooted plants found in Long Lake, such as *Ceratophyllum demersum* and submersed, marginally-rooted *Elodea canadensis*, which can detach from the bottom and form floating mats.

Presence of Noxious Emergent

Emergents, such as Iris (*Iris* spp.), rushes (*Juncus* spp., *Scirpus* spp.) and reeds (*Typha* sp., *Sparganium* sp.), sedges and grasses were also present in patches around the lakeshore perimeter. As noted earlier, stands of the **noxious Class B emergent, purple loosestrife (*Lythrum salicaria*)**, regularly dot the shoreline of Long Lake.

Biomass Patterns

Table G-2 presents macrophyte species composition and biomass data (as grams per square meter, dry weight) for samples collected during the 1996 survey from selected depths along the ten primary survey transects in Long Lake. Macrophyte biomass was found to vary both by water depth and sampling site within Long Lake. The rooted, submersed *Egeria densa* dominated macrophyte biomass measures for all samples collected along these transects, composing from 40 to 100% of the total sample. Brazilian elodea biomass ranged from 11 to 393 g/m^2, averaging 151 g/m^2 over all the 1996 samples collected in Long Lake. Coontail, *Ceratophyllum demersum*, was the next most prominent species, occurring in all but five of the biomass samples. *Ceratophyllum* samples generally varied from less than 1 g/m^2 to 95g/m^2, with a single high of 639 g/m^2 occurring at the midpoint of Transect 2 at the 7.5 ft depth. These quantitative results confirmed other visual and qualitative observations of prominence of these species in the lake. Pondweed species, *Potamogeton praelongus* and *P. amplifolius*, demonstrated low biomass levels ranging from negligible to upwards of 40 g/m^2. *P. zosteriformis, P. pusillus, Elodea canadensis*, and the macroalgae, *Nitella* spp. demonstrated spotty representation in samples with low biomass measures. Total lakewide average biomass was 203 g/m^2 over all samples collected during the late August 1996 survey in Long Lake. Removing the single high *Ceratophyllum* sample biomass of 639 g/m^2 still resulted in a high lakewide biomass average of 178 g/m^2.

TABLE G-2

Long Lake macrophyte biomass (grams/sq. m., dry wt) for samples collected from selected depths along survey transects. Aquatic plant biomass survey was performed August 26-28, 1996. Non-native, invasive species are listed in bold type.

Transect	Depth (m)	Species	Common Name	Dry Wt. (g/0.3sq. m)	Dry Wt. (g/sq. m)	Total Dry Wt. (g/sq. m)	% Composition
T-1 West	1.1m (3.5 ft)	***Egeria densa***	**Brazilian elodea**	**27.87**	**92.90**		**70.86%**
25 ft fr shore		*Potamogeton amplifolius*	big-leaf pondweed	9.16	30.53		23.29%
(North Section)		*Ceratophyllum demersum*	coontail	2.3	7.67		5.85%
						131.10	
T-1 Mid	2.75m (9 ft)	***Egeria densa***	**Brazilian elodea**	**14.57**	**48.57**		**54.10%**
(North Section)		*Ceratophyllum demersum*	coontail	9.66	32.20		35.87%
		Potamogeton zosteriformis	flat-stem pondweed	2.6	8.67		9.65%
		P. berchtoldii/pusillus	small pondweed	0.1	0.33		0.37%
						89.77	
T-1 East	1.1m (3.5 ft)	***Egeria densa***	**Brazilian elodea**	**34.89**	**116.30**		**99.37%**
30 ft fr shore		*Ceratophyllum demersum*	coontail	0.22	0.73		0.63%
(North Section)						117.03	
T-2 West	2.0m (6.5 ft)	***Egeria densa***	**Brazilian elodea**	**44.41**	**148.03**		**100.00%**
25 ft fr shore						148.03	
(North Section)							
T-2 Mid	2.3m (7.5 ft)	*Ceratophyllum demersum*	coontail	191.71	639.03		84.54%
(Mid-lake Section)		***Egeria densa***	**Brazilian elodea**	**25.24**	**84.13**		**11.13%**
		Potamogeton praelongus	white-stem pondweed	9.56	31.87		4.22%
		Elodea canadensis	common elodea	0.25	0.83		0.11%
						755.87	
T-2 East	1.8m (6 ft)	***Egeria densa***	**Brazilian elodea**	**88.71**	**295.70**		**78.48%**
50 ft fr shore		*Ceratophyllum demersum*	coontail	17.87	59.57		15.81%
(North Section)		*Potamogeton zosteriformis*	flat-stem pondweed	6.46	21.53		5.71%
						376.80	

TABLE G-2. Long Lake macrophyte biomass...August 26-28, 1996 (con't)

Transect	Depth (m)	Species	Common Name	Dry Wt. (g/0.33sq. m)	Dry Wt. (g/sq. m)	Total Dry Wt. (g/sq. m)	% Composition
T-3 West	1.5m (5 ft)	***Egeria densa***	**Brazilian elodea**	**117.63**	**392.10**		**99.16%**
20 ft fr shore		*Ceratophyllum demersum*	coontail	1	3.33		0.84%
(North Section)						395.43	
T-3 Mid	3.05m (10 ft)	***Egeria densa***	**Brazilian elodea**	**3.09**	**10.30**		**78.03%**
(Mid-lake Section)		*Ceratophyllum demersum*	coontail	0.87	2.90		21.97%
						13.20	
T-3 East	1.2m (4 ft)	***Egeria densa***	**Brazilian elodea**	**27.47**	**91.57**		**96.69%**
60 ft fr shore		*Ceratophyllum demersum*	coontail	0.39	1.30		1.37%
(North Section)		*Potamogeton zosteriformis*	flat-stem pondweed	0.55	1.83		1.94%
						94.70	
T-4 West	1.2m (4 ft)	***Egeria densa***	**Brazilian elodea**	**41.61**	**138.70**		**93.57%**
30 ft fr shore		*Ceratophyllum demersum*	coontail	2.86	9.53		6.43%
(North Section)						148.23	
T-4 East	1.2m (4 ft)	***Egeria densa***	**Brazilian elodea**	**20.63**	**68.77**		**86.75%**
40 ft fr shore		*Ceratophyllum demersum*	coontail	3.15	10.50		13.25%
(North Section)						79.27	
T-5 West	2.0m (6.5 ft)	***Egeria densa***	**Brazilian elodea**	**58.31**	**194.37**		**96.96%**
35 ft fr shore		*C. demersum*	coontail	1.83	6.10		3.04%
(North Section)						200.47	
T-5 East	2.1m (7 ft)	***Egeria densa***	**Brazilian elodea**	**30.8**	**102.67**		**100.00%**
50 ft fr shore						102.67	
(North Section)							

TABLE G-2. Long Lake macrophyte biomass...August 26-28, 1996 (con't)

T-6 West	1.4m (4.5 ft)	*Ceratophyllum demersum*	coontail	28.51	95.03		43.53%
100 ft fr shore		***Egeria densa***	**Brazilian elodea**	**25.61**	**85.37**		**39.10%**
(Mid-lake Section)		*Potamogeton praelongus*	white-stem pondweed	11.38	37.93		17.37%
						218.33	
T-6 East	2.3m (7.5 ft)	***Egeria densa***	**Brazilian elodea**	**43.21**	**144.03**		**86.87%**
100 ft fr shore		*Ceratophyllum demersum*	coontail	6.53	21.77		13.13%
(Mid-lake Section)						165.80	
T-7 West	2.4m (8.0 ft)	***Egeria densa***	**Brazilian elodea**	**20.34**	**67.80**		**95.99%**
100 m fr shore		*Ceratophyllum demersum*	coontail	0.85	2.83		4.01%
(South Section)						70.63	
T-7 Mid	3.2 m (10.5 ft)	No plants in sample		0	0.00		0
T-7 East	0.9m (3.0 ft)	*Ceratophyllum demersum*	coontail	16.25	54.17		59.20%
25 ft fr shore		***Egeria densa***	**Brazilian elodea**	**11.20**	**37.33**		**40.80%**
(South Section)						91.50	
T-8 West	1.8m (6 ft)	***Egeria densa***	**Brazilian elodea**	**103.92**	**346.40**		**98.72%**
50 ft fr shore		*Ceratophyllum demersum*	coontail	1.35	4.50		1.28%
(South Section)						350.90	
T-8 East	1.8m (6 ft)	***Egeria densa***	**Brazilian elodea**	**100.49**	**334.97**		**98.95%**
55 ft fr shore		*Ceratophyllum demersum*	coontail	1.07	3.57		1.05%
(South Section)		*Potamogeton praelongus*	white-stem pondweed	0.41	1.37		0.40%
						338.53	

TABLE G-2. Long Lake macrophyte biomass...August 26-28, 1996 (con't)

T-9 West	1.8m (6 ft)	***Egeria densa***	**Brazilian elodea**	**73.41**	**244.70**		**82.54%**
130 m fr shore		*Nitella sp.*	nitella (macroalgae)	13.34	44.47		15.00%
(Lilies Section)		*Ceratophyllum demersum*	coontail	1.59	5.30		1.79%
		Potamogeton praelongus	white-stem pondweed	0.6	2.00		0.67%
						296.47	
T-9/T-10	2.0m (6.5 ft)	***Egeria densa***	**Brazilian elodea**	**67.46**	**224.87**		**42.95%**
Intersection		*Ceratophyllum demersum*	coontail	0.66	2.20		0.42%
(Lilies Section)						523.53	
T-9 East	1.4m (4.5 ft)	***Egeria densa***	**Brazilian elodea**	**24.76**	**82.53**		**100.00%**
120 m from shore							
(Lilies Section)						82.53	
T-9 East	1.5m (5 ft)	***Egeria densa***	**Brazilian elodea**	**110.94**	**369.80**		**100.00%**
125 m from shore							
(Lilies Section)						369.80	
T-10	1.5m (5 ft)	***Egeria densa***	**Brazilian elodea**	**12.72**	**42.40**		**99.69%**
Mid-slalom course		*Nitella sp.*	nitella (macroalgae)	0.04	0.13		0.31%
(Lilies Section)						42.53	
T-10/T-9	see T-9/T-10 above						
Intersection							
(Lilies Section)							

Biomass data for the two primary species (*E. densa* and *C. demersum*), found during the 1996 Long Lake survey were further analyzed in terms of physical distribution in the lake by depth as well as latitudinal and longitudinal orientation (Table G-3). Inspection of this data reveals growth of *E. densa* typically occurring between 1 and 3 meters depth, but concentrated at approximately the 2 m depth, which is consistent with previous long-term survey results (Wertz, 1996). The 1996 average biomass measures for this species appeared to be greater in the southern half of the lake, as well as somewhat higher along the western portion of the lake. Again, increased relative growth of *Egeria* in the southern lake section agrees with results of the previous investigation.

TABLE G-3
Long Lake Major Macrophyte Species Mean Biomass Summary
Aquatic Plant Survey performed August 26-28, 1996.
Dry weight biomass presented in g/sq m.

Physical Measurement Feature	*Egeria densa*	Number Sample Sta	*C. demersum*	Number Sample Sta
Depth Contour (m)				
0-1 m	37 g/sq m	1	54 g/sq m	1
1-2 m	192 g/sq m	17	16 g/sq m	13
2-3 m	89 g/sq m	5	174 g/sq m*	4
3-4 m	10 g/sq m	1	3 g/sq m	1
Longitudinal Orientation				
Northern Half	137 g/sq m	13	70 g/sq m*	11
Southern Half	180 g/sq m	11	24 g/sq m	8
Latitudinal Orientation				
Western Side	190 g/sq m	9	17 g/sq m	8
Midlake	82 g/sq m	5	169 g/sq m*	4
Eastern Side	164 g/sq m	10	22 g/sq m	7

Note: * average reflects sample biomass high of 639 g/sq m at transect T-2

Examination of similar positional 1996 biomass data for *Ceratophyllum* reveals range of growth between 0.5 and 4 m depth, but concentrated growth at 2 and 3 meter interval in Long Lake. It is important to note the occurrence of a single high biomass sample measure of 639 g/m^2 taken at the 2.3 m depth along Transect 2 which skews the average upwards substantially. Given the species' rootless nature and ease of being pushed around the lake by wind, water or boating activities, this particular sample may have represented an artificially concentrated plug of floating plants. Treating this data point as an outlier and removing it from the overall 1996 data set reduces the 1996 lakewide average for this species from 50.6 g/m^2 to 18 g/m^2. The adjusted 1996 mean biomass for *Ceratophyllum* is still considerably higher than previous long-term study data for this species, which showed sustained low biomass levels (<6

g/m^2) over the 19 year span, except for peaks of 18 and 17.5 g/m^2 in 1984 and 1985, respectively, that are comparable to the 1996 condition. Total biomass and the biomass measures of the principal species of concern, *Egeria densa*, obtained during the late August, 1996 survey of Long Lake can be examined relative to quantitative data collected over a 19 year span by University of Washington researchers (summarized in Wertz, 1996). The 24 surveys performed by the University used several different sampling methodologies within this time frame (explained in Wertz, 1996), but were generally comparable in timing of sampling, area of individual sample (0.255 m^2), and total number of samples collected. The 1996 survey, while using a different quantitative sampling apparatus, closely approximated seasonal sampling time, individual quadrat area (0.3 m^2), and relative number of samples of the previous surveys.

Average lakewide biomass for *E. densa* from the present study was computed to be 151 g/m^2. This is nearly twice the lakewide average of 70 g/m^2 computed from previous studies during the period from 1986 to 1994 (Wertz, 1996). In fact, the last of these surveys performed in 1994 showed whole lake average biomass for *E. densa* of only 29 g/m^2. University researchers have noted that since an unexplained crash in the *Egeria* population in Long Lake in 1985, this species has been demonstrating a long-term pattern of decline in this lake. The 1996 survey data result appears to be contrary to this long-term trend. Reasons for this apparent difference are difficult to determine because of inherent between year variability in macrophyte growth due to climatic and other localized environmental variations. It is possible that conditions were more conducive for growth during 1996 than past years.

Problem Plant Zones

The entire nearshore area of the lake between depths of 0.5 m and 3.2 m (3 to 10.5 ft) is a high priority problem zone due to the presence of the noxious weed, **Brazilian elodea (*Egeria densa*)**. The *E. densa* beds in Long Lake are particularly well-established, having persisted for several decades. Dense, plant beds growing near the surface make shoreline access as well as swimming or other contact recreational use difficult and dangerous. These Brazilian elodea areas justify use of special, aggressive control action to remove nuisance populations, if possible. Also of note is the recent invasion of Long Lake by the noxious weed, Eurasian watermilfoil (*Myriophyllum spicatum*). Currently growth of this species appears to be concentrated in the southern half of the lake, where plant beds are still relatively small and scattered within the dominant *Egeria* beds. Furthermore, the territories of *Egeria* and *Myriophyllum* do overlap within this southern section of the lake. Additionally, surfacing mats of waterlilies (*Nuphar* and *Nymphaea* spp.) present localized problem areas, particularly in the shallow (< 2 m depth) south end where water-skiing and slalom activities take place and where access to individual docks is hampered. The conspicuous presence of noxious emergent, purple loosestrife (*Lythrum salicaria*), around much of the Long Lake shoreline also constitutes a high priority problem plant zone.

Beneficial Plant Zones

Long Lake and its watershed support an important salmon fishery and warm-water (spiny-ray) fishery, as well as waterfowl and other wildlife. **Native beds** of pondweed and waterlilies do form an important source of food and refuge in the lake for these and other small aquatic life, and should be maintained at sufficient support levels.

Control Alternative Evaluation
Step H

A variety of methods (chemical, mechanical, biological, physical) are currently available for treatment of nuisance aquatic plant populations in order to protect beneficial uses of a waterbody. Of note is that management methods run the range of very intensive removal of target species to less intensive, short-term control strategies (described as maintenance or cosmetic). Also, control tactics for maximum effectiveness against a target plant species depend on the species' particular morphology and structure, physiology, growth requirements, and growth habit. In other words, control methods that might be quite successful against one species may not be effective for another type of plant. With these in mind, this section reviews individual treatment methodologies currently available for aquatic plant control in the State of Washington. Each of the treatment options will be examined in terms of suitability for controlling nuisance plants in Long Lake, especially the non-native, rooted submersed Brazilian elodea (*Egeria densa*), Eurasian watermilfoil (*Myriophyllum spicatum*), and shoreline emergent purple loosestrife (*Lythrum salicaria*). Because the primary nuisance plants in Long Lake are State Class B Noxious species, the review will focus on the most aggressive control methods aimed at killing or removing the entire plant, including root systems of these serious pests. However, possible use of less intensive control methods (cosmetic control) will also be examined, where appropriate.

Potential Treatment Options Listed

Potential options presented for review are the large-scale treatments: aquatic herbicide application (e.g. fluridone, endothall, glyphosate), hydraulic dredging, mechanical dredging coupled with drawdown, sterile grass carp introduction, and mechanical harvesting. Also considered are methods appropriate for smaller areas: hand-removal, bottom barrier application, and diver-assisted suction dredging. These techniques do vary with respect to effectiveness against rooted plants, like Brazilian elodea, Eurasian watermilfoil and purple loosestrife, as well as rooted floating-leaved waterlilies. Hydraulic suction (barge) dredging, hand removal, bottom barrier and systemic chemical applications such as SONAR® (fluridone) and RODEO® (glysophate) are intensive methods aimed at killing or removing all of these plants, including roots, and are considered aggressive methods with the potential of achieving long-term reductions. Use of herbivorous grass carp, offering **potential long-term** control of submersed Brazilian elodea, is also treated in the review as a result of recent availability of this method in Washington State and recent introduction to local waters (e.g. Silver Lake in Cowlitz County). Depending on target species, scale of problem, stocking rate and other site-specifics, effective use of sterile grass carp can range anywhere from eradication of species to maintenance control. Mechanical harvesting and contact herbicides (e.g., Aquathol) are useful for short-term removal of large areas of surfacing plants, and are included in the discussion as less intensive forms of maintenance control. Other types of control methods,

such as water column dyes, mechanical rotovation (bottom tillage), and lake-level drawdown by itself are not considered appropriate for current use in Long Lake for reasons of site and species specific constraints, and are therefore, not discussed. Drawdown by itself is ineffective in western Washington lowland lakes for long-term control of invasive, non-native plants, and may be useful only when used in conjunction with appropriate dredging methodologies.

Each treatment alternative will be reviewed in terms of principal mode of action, effectiveness of treatment, human and environmental effects (safety, water quality, non-target organisms/plants), costs, and other special political/ administrative concerns. A summary of comparative data on these treatment alternatives (including others not currently considered appropriate for use in Long Lake) are presented in Table H-1. Potential mitigation measures will be presented along with estimates of mitigation costs, where possible.

Mechanical Control Methods

Hydraulic Dredging

Principle This is an intensive technique that involves removal of littoral sediments and associated rooted aquatic plants using hydraulic dredging equipment. Lake sediment removal is most often performed by means of a cutter-head hydraulic pipeline dredge (Cooke et. al., 1993). In terms of operation, plants/sediment loosened by the cutter head travels to the pickup head. The slurry is then suctioned up and carried back to the dredge barge through hoses. The sediment slurry is then piped off-site for disposal.

Control Effectiveness And Duration Large-scale sediment removal techniques can often provide multiple benefits to an aquatic system (Cooke et. al., 1993). Depending on the waterbody, possible enhancements include not only rooted macrophyte control, but also increased depth of waterbody, and removal of nutrients or toxic substances. Efficiency of removal is dependent on equipment, sediment type and condition, with conventional dredges performing well on harder sediment. However, various types of portable hydraulic dredges are available in the U.S. that are more effective for small lakes with softer, flocculent substrate. Longevity of control is dependent on a number of factors including sedimentation rate (the lower the better), watershed-to-surface-area ratios (nominally 10:1), and hydraulic residence time (the longer the better).

Advantages Dredging removes entire plants, including root systems, so regrowth is minimized. Plant pieces are collected and retained, and fragmentation spread is minimized (very important for control of Brazilian elodea and Eurasian watermilfoil that spread by fragments). It can be used to cover areas larger than practicable for diver-operated dredging or diver hand removal, or where herbicides cannot be used. Human health and safety concerns are negligible where operations are conducted prudently.

Drawbacks Hydraulic dredging is very expensive and highly disruptive to the local environment. A major problem often involves finding suitable offsite disposal areas and transporting dredged materials to these sites. As result, more specialized equipment and materials are required and the process is much more costly. Short-term environmental effects include resuspension of sediments and localized turbidity increases in the area of treatment. Release of nutrients and other contaminants from enriched sediments can also be a problem. In addition, some non-target aquatic organisms and vegetation may be inadvertently removed during the process. However, if only a portion of the lake bed is dredged, impacts on benthic aquatic life should be short-lived (Cooke et. al., 1993).

Costs Dredging costs can be very variable, depending on density and volume of sediment removed, equipment condition, transport requirements of dredged material, and eventual use of dredged material (Cooke et. al., 1993). Hydraulic dredging costs typically range from a minimum of $\$3/m^3$ to $\$14/m^3$ (not including disposal costs), although figures as high as \$20 to $\$50/m^3$ have been reported for special cases.

Permits In the State of Washington, use of suction dredging does require hydraulic approval from Washington Department of Fish and Wildlife. Its use also requires a temporary modification of water quality standards from Ecology for increased turbidity. A shoreline management permit may be needed. In addition, it will be necessary to obtain a letter of approval from Washington Department of Natural Resources.

Applicability to Long Lake

This alternative is included in the review of possible controls because of the great extent of nutrient-enriched lake sediments and associated rooted aquatic vegetation and prior use of dredging in Long Lake. Regarding the latter, a small-scale (5% lake area) suction dredging project was previously conducted in the extreme northern end of the lake as part of a multi-phase lake restoration program, but was not specifically intended for long-term macrophyte control (Entranco, 1980). It's also noteworthy up front that in the late 1970's, the cost of even this small suction dredging program in Long Lake (which didn't include costs of dredging a drawdown channel) was upwards of \$0.5 Million (Entranco, 1980).

The idea behind dredging for nutrient control is removal of an appropriate layer of enriched substrate. But to be effective for macrophyte control, depth of sediment dredged must be sufficient to deepen at least below photic zone (approx. 16 ft.). When used for large-scale applications, this alternative is likely to produce highly effective, immediate and long-term control, but is very costly and can result in extensive and immediate environmental impacts. Since Long Lake substrate is deep and flocculent, a large-scale dredging project removing, for example, only 1 meter (3 feet) of sediment over just 130 acres (40% of lake area) at an estimated (mid-range) cost of \$10.00/cubic yard, could total upwards of \$5 Million. While dredging 130 acres would remove a tremendous quantity of macrophyte beds and substrate, it would still leave a substantial area of viable Brazilian elodea in the lake, and not provide by itself a long-term solution to this problem weed. A much greater area and depth of lake bottom would need to be dredged to meet

this goal, with increased financial, logistical and environmental concerns. While this alternative could be a highly effective large-area solution, the cost of treating an area greater than 30 acres (only 10% of lake area) would be prohibitive. If the required dredged depth is very great, there is a real risk of puncturing the protective seal of the lake with a catastrophic drainage of lake water. A more practical, although still pricey alternative might be to use dredging for more localized application, dredging out most seriously affected or high quality areas (50 acres minimum) such as in the southern end of the lake where Brazilian elodea and Eurasian watermilfoil is most problematic.

Mechanical Dredging

Principle Principal of physically excavating sediments similar to hydraulic suction (barge-mounted) dredging describe above, but differs in use of land-based mechanized equipment (e.g., drag-line dredges). This type of dredging could be used in conjunction with lake-level drawdown operation, under optimal environmental, operational and jurisdictional conditions.

Advantages, Drawbacks, Costs, Permits Similar to hydraulic dredging.

Applicability to Long Lake

This alternative has potential for aquatic plant control only if combined with a feasible lake level drawdown. It is included in the review of possible controls because of past use in Long Lake of a drawdown operation that was part of a multiphase lake restoration project primarily intended for water quality enhancement (Entranco, 1980). The historical drawdown (which did **not** include large-scale mechanical dredging and removal of littoral sediments and plant beds, but only localized debris and muck removal) was found to have only limited, short-term effectiveness against *Egeria densa*, with populations rebounding within a year (Jacoby et. al., 1982). A severe drawdown would be required in Long Lake to adequately expose *Egeria* and *M. spicatum* beds (populations inhabit lake bottom up to 10.5 ft or 3.2 m depth) to allow for fully effective and complete mechanical dredging. Environmental impacts, financial requirements, and logistical and jurisdiction coordination problems associated with such a intensive in-lake management effort would most likely be excessive.

Diver-Operated Suction Dredging

Principle Diver dredging has been used since the late 1970s in British Columbia as an improvement to hand removal of sparse colonies of Eurasian watermilfoil. More recently, this method has been successfully utilized in several lakes in Washington State for small-scale removal of non-native watermilfoil plants. The technique utilizes a small barge or boat carrying portable dredges with suction heads that are operated by Scuba® divers to remove individual plants (including roots) from the sediment. Divers physically dislodge plants with sharp tools. The plant/sediment slurry is then suctioned up and carried back to the barge through hoses operated by the diver. On the barge, plant parts are sieved out and retained for later off-site disposal. The water sediment slurry can be discharged back to the water or piped off-site for upland disposal.

Control Effectiveness And Duration Diver dredging can be highly effective under appropriate conditions. Efficiency of removal is dependent on sediment condition, density of aquatic plants and underwater visibility. As it is best used for localized infestations of low plant density where fragmentation must be minimized, the technique has great potential for milfoil and Brazilian elodea control. Depending on local conditions, milfoil removal efficiencies of 85-97% can be achieved by diver dredging. This technique is currently being used for aggressive control of milfoil populations in Silver Lake (City of Everett) with preliminary reports indicating good removal results.

Advantages The method is species-selective and site-specific. Disruption of sediments are minimized. Plant pieces are collected and retained, and fragmentation spread is minimized (very important for control of Brazilian elodea and milfoil). It can be used to cover areas larger than practicable for hand digging or diver hand removal, or where herbicides cannot be used. Diver-dredging can be conducted in tight places or around obstacles that would preclude use of larger machinery.

Drawbacks Diver-dredging is labor-intensive and expensive. In dense plant beds, the utility of this method may be much reduced and other methods (e.g., bottom barrier) may be more appropriate. Returning dredged residue directly to water may result in some fragment loss through sieves. Where upland disposal of dredged slurry is used, more specialized equipment and materials are required and the process is much more costly. Short-term environmental effects can include localized turbidity increases in the area of treatment. Release of nutrients and other contaminants from enriched sediments can also be a problem. In addition, some sediment and non-target vegetation may be inadvertently removed during the process.

Costs Dredging costs can be very variable, depending on density of plants, equipment condition and transport requirements of dredged material. In addition, the use of contract divers for dredging work is subject to stringent State regulations on certification, safety and hourly wage payment, which can affect total project cost. Costs range from a minimum of $1100/day to upwards of $2000/day (not including physical dredged material transport).

Permits In the State of Washington, diver-operated dredging does require a Section 404 permit from U.S. Army Corps of Engineers (COE). Additionally, use of suction dredging requires hydraulic approval from Washington State Department of Fish and Wildlife. Its use also requires a temporary modification of water quality standards from Ecology for increased turbidity. A shoreline management permit may be needed. In addition, it may be necessary to obtain a letter of approval from Washington Department of Natural Resources.

Applicability to Long Lake

Diver-operated dredging may be useful in Long Lake to remove small, isolated patches of Brazilian elodea or Eurasian watermilfoil, and treat areas where herbicides could not be used, such as the colony located near domestic water intakes. It's use in this lake is most appropriate for small-scale, supportive work.

Mechanical Harvesting

Principle Mechanical harvesting is considered a short-term technique to temporarily remove plants interfering with recreational or aesthetic enjoyment of a water body. Harvesting involves cutting plants below the water surface, with or without collection of cut fragments for offshore disposal. To achieve maximum removal of plant material, harvesting is usually performed during summer when submersed and floating-leafed plants have grown to the water's surface.

Conventional single-stage harvesters combine cutting, collecting, storing and transporting cut vegetation into one piece of machinery. Cutting machines are also available which perform only the cutting function. Maximum cutting depths for harvesters and cutting machines range from 5 to 8.2 ft with a swath width of 6.5 to 12.1 ft. Cooke et al. (1993) summarizes aquatic plant cutters and harvesters available in North America.

Control Effectiveness and Duration Since harvesting involves physical removal and disposal of vegetation from the water, the immediate effectiveness in creating open water areas is quite apparent. The duration of control is variable. Factors such as frequency and timing of harvest, water depth, and depth of cut are suspected to influence duration of control. Harvesting has **not** proven to be an effective means of sustaining long-term reductions in growth of milfoil. Regrowth of milfoil to pre-harvest levels typically occurs within 30 to 60 days (Perkins and Sytsma, 1987), depending on water depth and the depth of cut. Aquatic plant researchers Johnson and Bagwell (1978) and Schiller (1983) also suggest probable short-term benefits provided by mechanical harvesting of Brazilian elodea beds, but caution against possible spread of infestation through stem fragmentation.

Advantages Harvesting is most appropriately used for large, open areas with few surface obstructions. There is usually little interference with use of water body during harvesting operations. Harvesting also has the added benefit that removal of in-lake plant biomass also eliminates a possible source of nutrients often released during fall dieback and decay. This is of important consequence in those water bodies with extensive plant beds and low nutrient inputs from outside sources. Furthermore, harvesting can reduce sediment accumulation by removing organic matter that normally decays and adds to the bottom sediments. Depending on species content, harvested vegetation can be easily composted and used as a soil amendment. Mechanical harvesting costs can be relatively low compared to other physical/ mechanical techniques.

Drawbacks Since harvesting removes only the upper stem material, regrowth from roots does occur, requiring annual retreatment. Cut plant material requires collection and removal from the water. Harvesting creates plant fragments. While pondweeds do not reproduce by fragmentation, Brazilian elodea can rapidly disperse by stem breakage. Thus, if plant control program objectives involve reduction of Brazilian elodea spread in the system, harvesting would **not** be an appropriate technique. Harvesting can be detrimental to non-target plants and animals (e.g., fish, invertebrates), which are removed indiscriminately by the process. Harvesting can lead to enhancement of growth of

opportunistic plant species that invade treated areas. Capital costs for machine purchase are high and equipment requires considerable maintenance.

Costs Harvesting program costs depend on factors such as program scale, composition and density of vegetation, equipment used, skill of personnel, and site-specific constraints. Detailed costs are not uniformly reported, so comparing project costs of one program with another can be difficult. However, average costs of local harvesting operations range from $200/acre to $700/acre. Most suitable as a maintenance operation, costs for harvesting would carry over year after year.

Permits Mechanical cutting (including battery-operated equipment) does require hydraulic approval from Washington Department of Fish and Wildlife. Also check with your local government to determine if local regulations apply to mechanical cutting operations.

Applicability to Long Lake

Harvesting does result in production of plant stem fragments. Since Brazilian elodea (*E. densa)* and Eurasian watermilfoil (*M. spicatum*) both reproduce primarily by stem fragmentation, use of this mechanical option as a ***major, large-scale control*** element of these species in Long Lake is not recommended. Additionally, harvesting is incompatible with a major management objective of ***aggressive*** removal of Brazilian elodea populations from Long Lake. However, harvesting could be used as part of an integrated control program against *E. densa* involving use of other large-scale treatments. For instance, harvesting could be employed to remove dead plant material from the water column after sufficient exposure time following systemic herbicide application (e.g., fluridone), although this mop-up component would add substantially to program costs. Or, mechanical harvesting could be employed to create water skiing or slalom "lanes" in the extensive waterlily/Brazilian elodea/milfoil beds in the south end of the lake.

Chemical Control Methods

Historically, use of aquatic herbicides was the principal method of controlling nuisance aquatic weeds in Washington. However, in recent years there has been a move away from such a dominant practice and toward more selective herbicide use following thorough review of target effectiveness, as well as other environmental, economic, political and social implications (WDOE, 1992).

The State of Washington currently permits use of only three aquatic herbicides to control aquatic weeds. They are the systemic herbicides *fluridone* and *glyphosate*, and the contact herbicide *endothall*. *Systemic herbicides* are absorbed by and translocated throughout the plant, capable of killing the entire plant roots and shoots. In contrast, *contact herbicides* kill the plant surface with which it comes in contact, leaving roots alive and capable of regrowth. The systemic herbicides, Fluridone and glyphosate, have the best potential for use in Long Lake, especially against Brazilian elodea (*E. densa)* and purple loosestrife *(Lythrum salicaria)*. Systemic and contact herbicides are reviewed in more detail below.

Fluridone

Principle Fluridone, 1-methyl-3-phenyl-5-[3-trifluoromethyl)phenyl]-4(1H)-pyridinone, is a slow-acting, systemic type herbicide. Fluridone is available as the EPA-registered herbicide SONAR® (SePRO) for use in the management of aquatic plants in freshwater ponds, lakes, reservoirs, and irrigation canals. It is formulated as a liquid (SONAR®4AS) sprayed above or below surface, and in controlled release pellets (SONAR® 5P, SONAR® SRP) spread on the water surface. Fluridone is effectively absorbed and translocated by both plant roots and shoots (Westerdahl and Getsinger, 1988)

Control Effectiveness And Duration Fluridone demonstrates good control of submersed and emergent aquatic plants, especially where there is little water movement. Its use is most applicable for lake-wide or isolated bay treatments to control a variety of exotic and native species. Eurasian watermilfoil (*M. spicatum*) is particularly susceptible to the effects of fluridone. Fluridone demonstrates "good" control of *Egeria densa, Elodea canadensis,* and some pondweed (*Potamogeton* spp.) (Westerdahl and Getsinger, 1988). Typical fluridone injury symptoms include retarded growth, "whitened" leaves and plant death. Effects of fluridone treatment become noticeable 7-10 days after application, with control of target plants often requiring 60-90 days to become evident (Westerdahl and Getsinger, 1988). Because of the delayed nature of toxicity, the herbicide is best applied during the early growth phase of the target plant, usually spring-early summer.

Advantages As a systemic herbicide, fluridone is capable of killing roots and shoots of aquatic plants, thus producing a more long-lasting effect. A variety of emergent and submersed aquatic plants are susceptible to fluridone treatment. As a result of human health risk studies, it has been determined that use of fluridone according to label instructions does not pose any threat to human health (WDOE, 1992). Fluridone also has a very low order of toxicity to zooplankton, benthic invertebrates, fish, and wildlife.

Drawbacks Fluridone is a very slow-acting herbicide, and its effects can sometimes take up to several months. Because of the long uptake time needed for absorption and herbicidal activity, fluridone is not effective in flowing water situations. Also, lakes with high flushing rates may reduce effectiveness of the active ingredient and increase risks for downstream impacts on non-target plants. Because of the potential for drift out of the treatment zone, fluridone is not suitable for treating a defined area within a large, open lake. The potential exists for release of nutrients to the water column and consumption of dissolved oxygen from the decaying plants. Non-target plants may be affected, as a variety of plants do show degrees of susceptibility to fluridone treatment. Mitigation of lost non-target vegetation may be necessary. As fluridone-treated water may result in injury to irrigated vegetation, there are label recommendations regarding irrigation delays following treatment.

Costs Treatment costs (materials and application) by private contractor for any of the formulations are $1000/acre or more, depending on scale of treatment.

Permits The use of aquatic herbicides does require receiving a short-term modification to State water quality standards from Washington State Department of Ecology prior to treatment.

Applicability to Long Lake

Of the small number of aquatic herbicide tools permitted for use in Washington State, proper use of fluridone (at optimal rates and exposure) offers the most practical, potentially effective means of controlling large infestations of the tenacious weeds, Brazilian elodea and Eurasian watermilfoil, both of which persist in Long Lake. Large-scale applications of this herbicide have been made recently in Lake Limerick (Mason County) with very good end-of-first-year growth season results against Brazilian elodea (WATER, 1996). The potential for success is increased with repeated, large-scale, intensive treatment, especially given the success of such a control regimen used against the noxious invader, Eurasian watermilfoil (e.g., Long Lake, Thurston County). Successive year treatment against target Brazilian elodea is a strategy being considered for possible implementation in Lake Limerick.

Glyphosate

Principle Glyphosate (N-(phosphonomethyl)glycine) is a non-selective, broad spectrum herbicide used primarily for control of emergent or floating-leafed plants like purple loosestrife and waterlilies. Glyphosate is a systemic herbicide that is applied to the foliage of actively growing plants. The herbicide is rapidly absorbed by foliage and translocated throughout plant tissues, affecting the entire plant, including roots. Glyphosate is formulated as RODEO® (Monsanto) for aquatic application.

Control Effectiveness And Duration Glyphosate is effective against many emergent and floating-leafed plants, such as waterlilies (*Nuphar* and *Nymphaea* spp.) and purple loosestrife (*Lythrum salicaria*). According to the manufacturer, RODEO® is **not** effective on submersed plants or those with most of the foliage below water. The herbicide binds tightly to soil particles on contact and thus is unavailable for root uptake by plants. As a result, proper application to emergent foliage is critical for herbicidal action to occur. Symptoms of herbicidal activity may not be apparent for up to 7 days, and include wilting and yellowing of plants, followed by complete browning and death.

Advantages As a systemic herbicide, glyphosate is capable of killing the entire plant, producing long-term control benefits. Glyphosate carries no swimming, fishing, or irrigation label restrictions. Glyphosate dissipates quickly from natural waters, with an average half-life of 2 weeks in an aquatic system. The herbicide has a low toxicity to benthic invertebrates, fish, birds and other mammals.

Drawbacks As a non-selective herbicide, glyphosate treatment can have an affect on non-target plant species susceptible to its effects. While the possibility of drift through aerial application exists, it is expected to be negligible if application is made according to label instructions and permit instructions. There are use restrictions where glyphosate is applied within 1/2 mile of potable intakes in either flowing or standing waters.

Current label restrictions on use require that active potable water intakes be shut off for a minimum of 48 hours after application or until the laboratory measured glyphosate level in intake water is below 0.7 ppm.

Costs Treatment costs (materials and application) by private contractor for any of the formulations average approximately $300/acre, depending on scale of treatment.

Permits Use of aquatic herbicides requires receiving a short-term modification to State water quality standards from Washington State Department of Ecology prior to treatment.

Applicability to Long Lake

Since glyphosate is most effective against certain emergent or floating-leaved plants, it's use in Long Lake would be for small-scale, aggressive control of problem plants like purple loosestrife, waterlilies or watershield. In this way, it would be used more for local control by itself or in support of different large-scale treatment element(s) targeting other submersed nuisance plants for instance.

Endothall

Principle Endothall is a contact-type herbicide that is not readily translocated in plant tissues. Endothall formulations (active ingredient endothall acid, 7-oxabicyclo[2,2,1]heptane-2,3-dicarboxylic acid) are currently registered for aquatic use in Washington in either inorganic or amine salts. Aqueous or granular forms of the dipotassium salt of endothall, Aquathol (Elf Atochem), is permitted in State waters with stringent use restrictions on water contact, irrigation and domestic purposes over and above label restrictions. Due to its toxicity, the liquid amine form of endothall, Hydrothol-191, is not permitted for use in fish-bearing waters in the State of Washington.

Control Effectiveness And Duration As a contact herbicide, endothall kills only plant tissues it contacts, usually the upper stem portions. Thus, the entire plant is not killed. It is therefore used primarily for short-term control of aquatic plants. Duration of control is a function of contact efficiency and regrowth from unaffected root masses. Effective reductions in plant biomass can range from a few weeks to several months. In some circumstances, season-long control can be achieved. Carryover effectiveness of endothall treatments into the following growth season is not typical.

Advantages Contact herbicides like endothall generally act faster than translocating herbicides such as fluridone; evidence of tissue death is often apparent in 1-2 weeks. There is usually little or no drift impact from proper application of this product. Overall costs of treatment are less than fluridone applications over the same area.

Drawbacks Because the entire plant is not killed, endothall causes temporary reductions in aquatic plant growth. As a variety of aquatic plants are susceptible to endothall, non-target plant impacts are possible. Although the recently amended label for Aquathol K has no swimming restriction (pending State approvals), Washington State requires an 8 day

swimming restriction following treatment. There are also label restrictions on fish consumption and non-food crop irrigation.

Costs As with fluridone applications, endothall treatments vary with total area and dosage rate. Average costs for a small to moderate area application can run about $500-700/acre.

Permits Use of aquatic herbicides requires receiving a short-term modification to State water quality standards from the Dept. of Ecology prior to treatment.

Applicability to Long Lake

Since endothall kills only plant tissues it contacts, usually the upper stem portions, its use is most appropriate for short-term control of aquatic plants. Thus, endothall treatment is incompatible with a major management objective of aggressive removal of Brazilian elodea (*E. densa*) populations from Long Lake. However, it could be used as a first-strike method in an integrated control program against *Egeria* that relies on other intensive large-scale treatments for long-term control.

Biological Control Methods

Interest in using biocontrol agents for nuisance aquatic plant growth has been stimulated by a desire to find more "natural" means of long-term control as well as reduce use of expensive equipment or chemicals. The possibility of integrating biological controls with traditional physical, mechanical, or chemical methods is an appealing concept. While development and use of effective biocontrol agents for aquatic plant management is still in its childhood, potentially useful candidates have been identified such as plant-eating fish or insects, pathogenic organisms, and competitive plants. Except for exotic species infestation like Brazilian elodea, a realistic objective of biocontrol of aquatic vegetation is not the eradication, but the reduction of target plant species to lower, more acceptable levels (Cooke et. al., 1993). More importantly, control of nuisance plants using biological agents will be a gradual process, although the effects should be long-lasting.

In the State of Washington, the only biological method currently available for aquatic plant control is the introduction of triploid (sterile) grass carp.

Triploid (Sterile) Grass Carp

Principle Grass carp or white amur (*Ctenopharyngodon idella* Val.) are exotic, plant-consuming fish native to large rivers of China and Siberia. Known for their high growth rates and wide range of plant food preference, these fish can control certain nuisance aquatic plants under the right circumstances. In theory, grass carp are most appropriately used for lake-wide, low-intensity, long-term control of submersed plants. However, achieving and sustaining a set plant density may be difficult. Stocking rates are dependent on climate, water temperature, type and extent of plant species and other site-specific constraints. Grass carp require a permit from the Washington Department of Fish and Wildlife (WDFW). To avoid problems encountered in other areas of the country, Washington State regulations adopted in 1990 require:

1. Only sterile (triploid) fish can be planted;
2. Outlets and possibly inlets must be screened to prevent fish from getting into other water bodies;
3. Stocking will be defined by WDFW based on the current planting model. This is to insure that sufficient vegetation is retained for fishery and other habitat needs.

State fisheries personnel with WDFW should be contacted for more information on specific use and stocking of grass carp in State waters.

Control Effectiveness And Duration Effectiveness of grass carp in controlling aquatic weeds depends on feeding preferences and metabolism; rates do appear to be temperature-dependent (WDOE, 1992; Cooke et. al., 1993). Triploid grass carp exhibit distinct food preferences which apparently vary from region to region in the U.S. Recent research reveals that feeding preference and rates can also be dependent on fish age, water chemistry and plant composition (Pauley et. al., 1994). Laboratory and field studies in Washington State have shown that some plant species appear to be highly preferred, such as the thin-leaved pondweeds (*Potamogeton crispus, P. pectinatus* and *P. zosteriformis);* others were variably preferred as coontail (*Ceratophyllum demersum),* and some plants not preferred such as waterlily (*Nuphar*) and watershield (*Brasenia schreberi).* Grass carp appear to graze Brazilian elodea (*Egeria densa*) fairly effectively (Miller and Decell, 1984; Pine and Anderson, 1991). However, researchers in Washington State report in lab tests that *Egeria densa* was highly preferred by large fish, but nearly unpalatable to fingerlings (Pauley et. al., 1994). Preliminary results of grass carp grazing impacts in Silver Lake (Cowlitz County) suggest drastic impacts have occurred within two years on Brazilian elodea, Eurasian watermilfoil, as well as other species of pondweed, coontail, bladderwort and watershield (H Gibbons, KCM, unpubl. data, 1997). Grass carp control effectiveness and duration are site-specific. In general, management studies in Washington waters indicate that substantial removal of vegetation by sterile grass carp may not become apparent until 3-5 years after introduction.

Advantages Depending on the problem plant species and other site constraints, proper use of grass carp can achieve long-term reductions in nuisance growth of vegetation, although perhaps not immediately. In some cases, introduction of grass carp may result in improved water quality conditions, where water quality deterioration is associated with dense aquatic plant growth (Thomas et. al., 1990). Compared to other long-term aquatic plant control techniques (e.g., systemic aquatic herbicides, bottom barriers), costs for grass carp implantation are relatively low.

Drawbacks Since sterile grass carp exhibit distinct food preferences, they do not graze all plants equally well, limiting their applicability. The fish may avoid areas of the water body experiencing heavy recreational use, resulting in less plant removal. Plant reductions may not become evident for several years. Overstocking of grass carp could result in eradication of beneficial plants and have serious impacts on the overall ecology of the water body. Full ecological impacts of grass carp introductions in

Northwest waters are still being determined. An escape barrier on the outlet (if present) is currently required to prevent movement of fish out of the system and avoid impacts on downstream non-target vegetation. Fish loss due to predation, especially by ospreys and otters is possible.

Costs Based on the few large-scale grass carp implantations made in the State of Washington since 1990, costs can range from approximately $50/acre to $2000/acre, at stocking rates ranging from 5 fish/acre to 200 fish/acre and average cost of $10/fish (range $7.50/fish to $15.00/fish).

Permits Washington Department of Fish and Wildlife (WDFW) requires a game fish planting permit prior to grass carp introduction to a water body. A State environmental policy checklist (SEPA) is required, describing the site to be stocked and potential impacts. In addition, if outlet screening is necessary, hydraulic approval is required from the WDFW. Department of Natural Resources National Heritage Program must be contacted for assessment of threatened or endangered plant species. Also necessary is production of a list of property owners with lots adjacent to the targeted waterbody and their consensus to the proposed grass carp planting.

Applicability to Long Lake

Since Brazilian elodea is the primary problem species in Long Lake and appears to be a preferred food item of grass carp (larger fish), the use of grass carp in Long Lake does have potential for large-scale application. However, current constraints involve a WDFW requirement for screening modification of the outlet structure as well as inlet screening, particularly on Salmonberry Creek, to prevent grass carp escape but allow anadromous (salmonid) passage. This design/structural requirement could add significant costs to the total project. More importantly, serious agency and tribal concerns regarding this lake's importance as a salmonid resource could ultimately affect permitting approval for grass carp. For these reasons, a management scenario for Long Lake utilizing sterile grass carp as a major biocontrol for noxious weed species is not considered feasible at this time.

Physical Control Methods

Hand-Digging

Principle Hand-digging and removal of rooted, submersed plants is an intensive treatment option. This method involves digging out the entire plant (stem and roots) with a spade or long knife and disposing residue on shore. In shallow waters less than 3 feet, no specialized gear is required. In deeper waters, hand removal can best be accomplished by divers using Scuba® or snorkeling equipment and carrying collection bags for disposal of plants. The technique is most appropriately applied to **small areas** (e.g., area < 5000 sq ft).

Control Effectiveness And Duration Efficacy of plant removal depends on sediment type, visibility, and thoroughness in removing the entire plant, particularly the roots. A high degree of control over more than one season is possible where complete removal has been achieved.

Advantages The technique results in immediate clearing of the water column of nuisance plants. The technique is very selective in that individual plants are removed. It is most useful in sensitive areas where disruption must be kept to a minimum. Because the technique is highly labor-intensive, it is most suitable for small-area, low plant density treatments. In these cases, the technique is very useful for aggressive control of sparse or small pockets of rooted Eurasian watermilfoil or Brazilian elodea or shoreline purple loosestrife. This method can also be useful for clearing rooted pondweeds or *very small* patches of watershield from areas around docks and beaches.

Drawbacks The technique is time-consuming and costly, especially where contract divers may be used. Diver visibility may become obscured by turbidity generated by swimming and digging activities. Also, it may be difficult for the laborer to see and dig out all plant roots. Environmental impacts are limited to mostly short-term and localized turbidity increases in the overlying water and some bottom disruption.

Costs Costs will vary depending on whether contract divers or laborers are used, or if removal activities are the result of volunteer efforts. In the case of contract divers and dive tenders, expenses can run upward of $1000 to $2400/day with area covered dependent on density of plants.

Permits Hydraulic permit approval (HPA) from WDFW is currently required for hand-digging aquatic plants (managed under the pamphlet).. It is also important to check with local jurisdiction for regulations before beginning any control activities.

Applicability to Long Lake

Hand digging of plant stems and roots could be used for small-scale, intensive removal of nuisance rooted plants (Purple loosestrife, Brazilian elodea, and pondweeds) around private dock areas and short shoreline segments. If root systems are completely removed, this technique provides a more long-term means of control (as compared to hand-cutting described below).

Hand-Cutting

Principle This technique is also a manual method, but differs from hand-digging in that plants are cut below the water surface (roots generally not removed). Because roots are not removed, this is a less intensive removal technique. Implements used include scythes, rakes, or other specialized devices that can be pulled through the weed beds by boat or several people. Mechanized weed cutters are also available that can be operated from the surface for small-scale control.

Control Effectiveness and Duration Root systems and lower stems are often left intact. As a result, effectiveness is usually short-term as regrowth is possible from the uncut root masses. Duration of control is limited to the time it takes the plant to grow to the surface.

Advantages The technique results in immediate removal of nuisance submerged plant growth. Costs are minimal.

Drawbacks Like hand-pulling, the technique is time-consuming. Visibility may become obscured by turbidity generated by cutting activities. Also, since the entire plant is usually not removed, this technique does not result in long-term reductions in growth. Duration of control of rooted plants like Brazilian elodea would be minimal. Environmental impacts are limited to mostly short-term and localized turbidity increases in the overlying water and some bottom disruption. Cut plants must be removed from the water.

Costs Where volunteer efforts are employed, costs are mostly limited to purchase of a cutting implement. This can vary from under $100 for the Aqua Weed Cutter (Sunrise Corp.) to over $1000 for the mechanized Swordfish (Redwing Products).

Permits Hydraulic permit approval (HPA) from WDFW is currently required for hand-cutting or raking of aquatic plants (managed under the pamphlet). Mechanical cutting (including battery-operated equipment) aslo requires hydraulic approval by WDFW. It will be important to check with the local jurisdiction for regulations before beginning any activities.

Applicability to Long Lake

Hand cutting of plant stems would be most appropriate for small-scale, short-term control of nuisance rooted plants around private dock areas and short shoreline segments.

Bottom Barrier Application (Sediment Covers)

Principle Barrier material is applied over the lake bottom to prevent plants from growing, leaving the water clear of rooted plants. Bottom covering materials such as sand-gravel, polyethylene, polypropylene, synthetic rubber, burlap, fiberglass screens, woven polyester, and nylon film have all been used with varying degrees of success. Applications can be made up to any depth, with divers often utilized for deeper water treatments. Usually bottom conditions (presence of rocks or debris) do not impede most barrier applications, although pre-treatment clearing of the site is often useful.

Control Effectiveness and Duration Bottom barriers can provide immediate removal of nuisance plant conditions upon placement. Duration of control is dependent on a variety of factors, including type of material used, application techniques, and sediment composition. Elimination of nuisance plant conditions for at least the season of application has been demonstrated by synthetic materials like Aquascreen and Texel. Where short-term control is desired for the least expense, burlap has been found to provide up to 2-3 years of relief from problematic growth before eventually decomposing (Truelson, 1985; 1989). After satisfactory control has been achieved (usually several months), some barrier materials can be relocated to other areas to increase benefits.

Advantages Bottom barriers can usually be easily applied to small, confined areas such as around docks, moorages or beaches. They are hidden from view and do not interfere with shoreline use. Bottom barriers do not result in significant production of plant fragments (critical for Brazilian elodea and Eurasian watermilfoil treatment). Bottom

barriers are most appropriately used for localized, small-scale control where exclusion of all plants is desirable; where other control technologies cannot be used; and where intensive control is required regardless of cost.

Drawbacks Depending on the material, major drawbacks to the application of benthic barriers include some or all of the following: high materials cost, labor-intensive installation, limited material durability, possible suspension due to water movements or gas accumulation beneath covers, or regrowth of plants from above or below the material. Periodic maintenance of bottom barrier materials is required to remove accumulations of silt and any rooting fragments. In some situations, removal and relocation of barriers may not be possible (e.g., natural fiber burlap does decompose over time). Sediment covers can also produce localized depression in populations of bottom-dwelling organisms like aquatic insects.

Costs Costs vary from approximately $0.30/sq. ft (Texel) to $0.35/sq. ft (Aquascreen) for materials with an additional $0.25-0.50/sq. ft for installation. Locally, prices for rolled burlap material (available in fabric stores, outlets) average from $0.10 to $0.20/sq. ft for materials only.

Permits Bottom barrier applications require hydraulic approval from Washington Department of Fish and Wildlife. In addition, barriers costing more than $2500 may need a shoreline permit under certain jurisdictions, so local Shoreline Master Plan should be checked for compliance. It is important to contact the local Kitsap County Planning Department for more information regarding bottom barrier use.

Applicability to Long Lake

Because most of the better screening materials are somewhat costly and proper applications can be labor-intensive, they are better suited for spot treatments. Thus, potential use in Long Lake would be limited to small areas where no rooted weed growth can be tolerated, such as swim beaches or around docks or boat launch ramps.

TABLE H-1.
SUMMARY OF AQUATIC PLANT MANAGEMENT TECHNIQUES AVAILABLE IN WASHINGTON STATE
(Adapted from Gibbons et. al., 1994)

Method	Appropriate Scale (area or extent)	Duration of Control	Intensity of Control	Cost	Advantages	Disadvantages	Permit(s) Required?
Physical							
Hand-pulling	Small-scale	Season or longer	Moderate to High (with complete removal)	$0 with volunteer labor $500 to $2400/day for contract divers	• Site specific • Species specific • Minimum impact on native plants • Use near obstructions	• Slow, labor intensive, expensive • short-term turbidity increase • Diver visibility can restrict effectiveness	Yes
Hand-cutting	Small-scale	< One season	Moderate	$100 to $1000 for equipment + labor	• Immediate plant removal	• Slow • Fragments generated • Short-term increase in turbidity	Yes
Bottom Barriers	Small-scale	2 to 3 years	High	$0.10 to $0.70/sq. ft. for material $0.25 to $0.50/sq. ft. for installation	• Immediate plant removal • Materials reusable • Site specific • Useful around obstructions	• Not species specific • Benthic organism impacts • Material costs • Maintenance required	Yes
Drawdown	Large-scale	None	Low	Variable	• Useful for repair/ maintenance of shorelines and structures • May enhance growth of emergents (waterfowl habitat)	• Not species specific • May impact wetlands • Loss of recreation • Dissolved oxygen decrease • Benthic invertebrate impacts	Yes
Watershed Controls	Small-scale	None - long-term	Low	Low-mod	• Long-term improvement in water quality • May encourage rooted and discourage non-rooted species	• Does not address nutrient sources used by most aquatic plants • May encourage rooted/discourage non-rooted species •Sometimes difficult to implement	No

TABLE H-1. SUMMARY OF AQUATIC PLANT MANAGEMENT TECHNIQUES AVAILABLE IN WASHINGTON STATE (Continued)

Method	Appropriate Scale (area or extent)	Duration of Control	Intensity of Control	Cost	Advantages	Disadvantages	Permit(s) Required?
Water column dye	Weeks to months	Weeks to months	Low	$12.50/acre-ft.	• Non-toxic • No special equipment needed • Colors water blue	• Shallow, closed systems only • Repeat treatments through growing season required • Not effective when plants near surface • No use in potable, flowing, or chlorinated water • Some classified as herbicides	Yes/No (Those classified as herbicides require a permit)
Mechanical							
Harvesting	Large-scale	Less than one season	Low-Mod	$300 to $1000/acre (May vary with transport costs)	• Immediate plant removal to cutting depth (4 to 8 ft.) • Minimal bottom disturbance • Materials may be composted • Reduces internal loading of nutrients	• Plant disposal • Fragments produced • Fish and invertebrate impacts • Slow • High initial capital $ • Operating depth limited • Operations depend on weather • Not species specific	Yes
Rotovation/ Cultivation	Large-scale	2 to 3 years	Mod-High	$1000 to $1700/acre (depends on plant density and area of treatment)	• Winter treatment minimizes summer season recreation impacts • May increase species diversity	• Bottom disturbance /increased turbidity • Long-term efficacy only on perennials • Bottom obstructions limit use • Not species specific	Yes
Hydraulic dredge	Large-scale	Potentially long	High	variable, average $3-$14/m3	• Removal of entire plant, including roots • Additional benefits of deepening lake, removal or enriched or toxic sediments	• Very costly • Temporary bottom disturbance and increased turbidity in water column • Not species specific, where mixed comm	Yes

TABLE H-1. SUMMARY OF AQUATIC PLANT MANAGEMENT TECHNIQUES AVAILABLE IN WASHINGTON (Continued)

Method	Appropriate Scale (area or extent)	Duration of Control	Intensity of Control	Cost	Advantages	Disadvantages	Permit (s) Required?
Diver-operated dredge	Small-scale	Potentially long (Depends on availability of propagules for recolonization)	Mod-High	$1100-2000/day (coverage depends on plant density)	• Site specific • Species specific • No depth constraints • Used near obstacles	• Labor intensive • Slow • Potential fragment production • Temporary bottom disturbance and increased turbidity	Yes
Biological							
Grass carp	Large-scale	Potentially long	Low-High	$50 to $200/acre (depending on stocking density)	• Low maintenance • Large area covered • Triploid fish are sterile	• Stocking densities not well established • Difficult to fine-tune control • Preference for native species over exotics • Containment structures required • Ecological impacts not fully known • Not site specific • Recapture problems • Susceptible to predation by wildlife or humans	Yes
Chemical							
Fluridone	Large-scale	> 1 year (depends on availability of propagules for recolonization)	High	$1000+/acre	• Systemic herbicide • Some species specificity with correct application rates • Non-toxic	• Requires long contact time • Off-site movement possible • Nutrient release and dissolved oxygen	Yes
Glyphosate	Large-scale	> 1 year (depends on availability of propagules for recolonization)	High	$300/acre	• Systemic herbicide • Non-toxic • No label restrictions on swimming and fishing	• Non-selective herbicide • Emergent plants only	Yes
Endothall	Large-scale	Weeks to months	Moderate	$500 to $700/acre	• Short contact time required • Low toxicity • Low cost • Fast dissipation	• Contact herbicide • Temporary effect • Some label restrictions for swimming and domestic water use	Yes

Long Lake Aquatic Plant Control Intensity Zones
Step I

A critical part of IAVMP development is determining important plant zones in Long Lake and what degree of control should be applied to each of those zones. To reiterate, the ***goal of aquatic plant management is not to remove all vegetation from a waterbody, but to selectively eliminate harmful or noxious plant populations while adequately preserving native stands.*** As a result, macrophyte control decisions can range from leaving select high quality plant beds intact (*no control action*) to implementing aggressive removal measures against noxious or nuisance plant stands (*high level of control*), being careful to minimize impacts to beneficial native species. Development of a ***Control Intensity Map*** provides a useful aid for choosing appropriate treatment options for each area of the lake (See Step J).

Extent of Aquatic Plant Problem in Long Lake

Four types of weed species have been identified as targets for possible control in Long Lake: rooted, submersed **Brazilian elodea, Eurasian watermilfoil,** and emergent **purple loosestrife,** and floating-leaved **waterlilies.** The first three are classified by the State of Washington as a Class B Noxious Weeds. Washington State objectives concerning noxious weed species gives high treatment priority to prevention, control and eradication (if feasible) of these invaders from state waters (WDOE, 1992). In order to achieve this end in a specific waterbody, more intensive, aggressive measures may be justified with the necessary precautions. Rooted species of waterlily (primarily *Nuphar* but also including non-native *Nymphaea odorata*) also occur in localized dense beds around the Long Lake littoral. Because of human safety and navigational problems associated with dense growth of these weeds around the shoreline, aggressive control measures are also appropriate for use against these floating-leaved macrophytes.

Expectations Regarding Exotic Weed Species Removal in Long Lake

With a goal of aggressive lakewide removal of target Brazilian elodea populations in Long Lake, large-scale action will be required, using intensive techniques that kill or remove the entire Brazilian elodea plant, including roots and upper stems. To be sure, elimination of Brazilian elodea from a waterbody is an uncertain process, and is very dependent on age and extent of infestation and management "tools" available and permitted for use. Certainly, the chances for successful removal of this weed from a lake are greater and costs are less when the infestation is in a beginning, pioneering stage than when the plant becomes well established throughout a waterbody as it has in Long Lake. Given the present extent of Brazilian elodea growth throughout most of 339 acre Long Lake, complete removal of this plant may be a difficult task to achieve at best and will require a continuous, intensive, long-term effort to approach this goal.

A goal of complete elimination of Eurasian watermilfoil (*Myriophyllum spicatum*) from Long Lake also requires intensive techniques that kill or remove the entire milfoil plant, including roots and upper stems. However, the milfoil infestation in Long Lake is substantially less extensive at this point in time than that exhibited by Brazilian elodea. The aquatic plant survey conducted as part of this project revealed widely scattered, low density (late stage pioneering) growth to be presently restricted to the southern end of the lake. As such, treatment scale should be much reduced, with a greater chance of completely eliminating populations of this noxious weed from the lake with a diligent, sustained effort.

Purple loosestrife (*Lythrum salicaria*) stands are presently scattered around the entire Long Lake shoreline, varying from a single plant to small beds. Intensive long-term control to eventually eliminate these populations from the lake is also possible.

Highest Intensity Control

Figure I-1 is a Control Intensity Map for Long Lake that clearly shows three different macrophyte control intensity zones. The highest priority zone is that area between the 0.5 and 3.2 m (1.6 to 10.5 ft) depth contours inhabited by the noxious, exotic weed Brazilian elodea and Eurasian watermilfoil (presently documented only in the southern half). This "noxious weed" zone covers all of the lake littoral (upwards of 250 acres). Currently, Brazilian elodea beds in Long Lake occur in moderate densities, but the growth habit is such that much of the plant biomass is concentrated in the upper water column throughout most of the summer/fall seasons. This situation creates a real physical obstacle to movement through the lake by means of rowing or motoring. The presence of this noxious weed in the lake justifies use of ***high intensity control*** efforts to remove plant populations. A second high priority noxious weed zone includes emergent stands of purple loosestrife and extends around the immediate lake shoreline.

Moderate to High Intensity

Stands of other rooted, floating-leaved nuisance species, particularly waterlilies in the south end, also occupy the zone between shoreline and the 2 m (6.5 ft) depth and overlap the Brazilian elodea/milfoil zone. These species occur in mixed beds that, depending on location in the lake, necessitate ***moderate to high intensity control*** efforts. High levels of control involving maximal removal of plants can be applied to those areas where, for safety or navigation reasons, minimal or no surfacing plants can be tolerated. Potential areas would include nearshore slalom courses, ski lanes, and dock areas in the south end. Other areas of the lake may be subjected to a lesser control effort, such as selective spot treatment in embayments (e.g., bay south of Salmonberry Creek).

No Control

Aquatic plant management recognizes the importance of maintaining a healthy, diverse plant community for human and wildlife utilization. As a result, beneficial native plant stands or special habitat areas in a lake are not targeted for any direct action, but are left untouched. In Long Lake, one area has been identified as a **no control zone**. This zone is the open water mid section of the lake, greater than 3.35 m (11 ft) in depth. The zone is primarily inhabited by sparse, low-stature stands of macroalgae (*Nitella* spp.). The large macro-algae compete with microscopic planktonic algae for nutrients in the lake, as well as provide

habitat for fish and aquatic organisms. The summer, 1996 survey also identified this zone as a transitory site of drifting, suspended mats of rootless coontail (*Ceratophyllum demersum*), which are apparently pushed by wind and water currents to this deeper area. Coontail derives most of its nutrition from the water column. Like the macro-algae, coontail thus competes directly with phytoplankton for dissolved nutrients. Plant growth in this deeper region of the lake is not currently and is not expected to be problematic with implementation of a prudent macrophyte management plan.

Past Record of State Monitor I Plant

It is important to note that the Washington Natural Heritage Program Database contains a record of floating water pennywort (*Hydrocotyle ranunculoides*) , a State Monitor 1 plant, occurring in Long Lake in the south end (NW corner of Section 20) in 1994 (Appendix B), but was not observed during the August 1996 survey performed as part of the IAVMP project. It is recommended that during the proposed pre-treatment aquatic plant survey, this potential "special habitat" section of the lake be carefully inspected for occurrence of this species. If found, adjustments in implementation action may need to be taken to protect identified stands, or development of mitigation plan may be required to remove and replant this species after control measures have been completed. A recent spotting of water lobelia (*Lobelia dortmanna*) in Long Lake (Jenifer Parsons, WDOE, 1997) would also necessitate similar verification of location and adjustment in any future implementation action to protect identified stands.

Diligent application of the various control intensity strategies within Long Lake should ultimately result in selective removal of nuisance plant populations, while retaining diverse and abundant native plant stands throughout the lake.

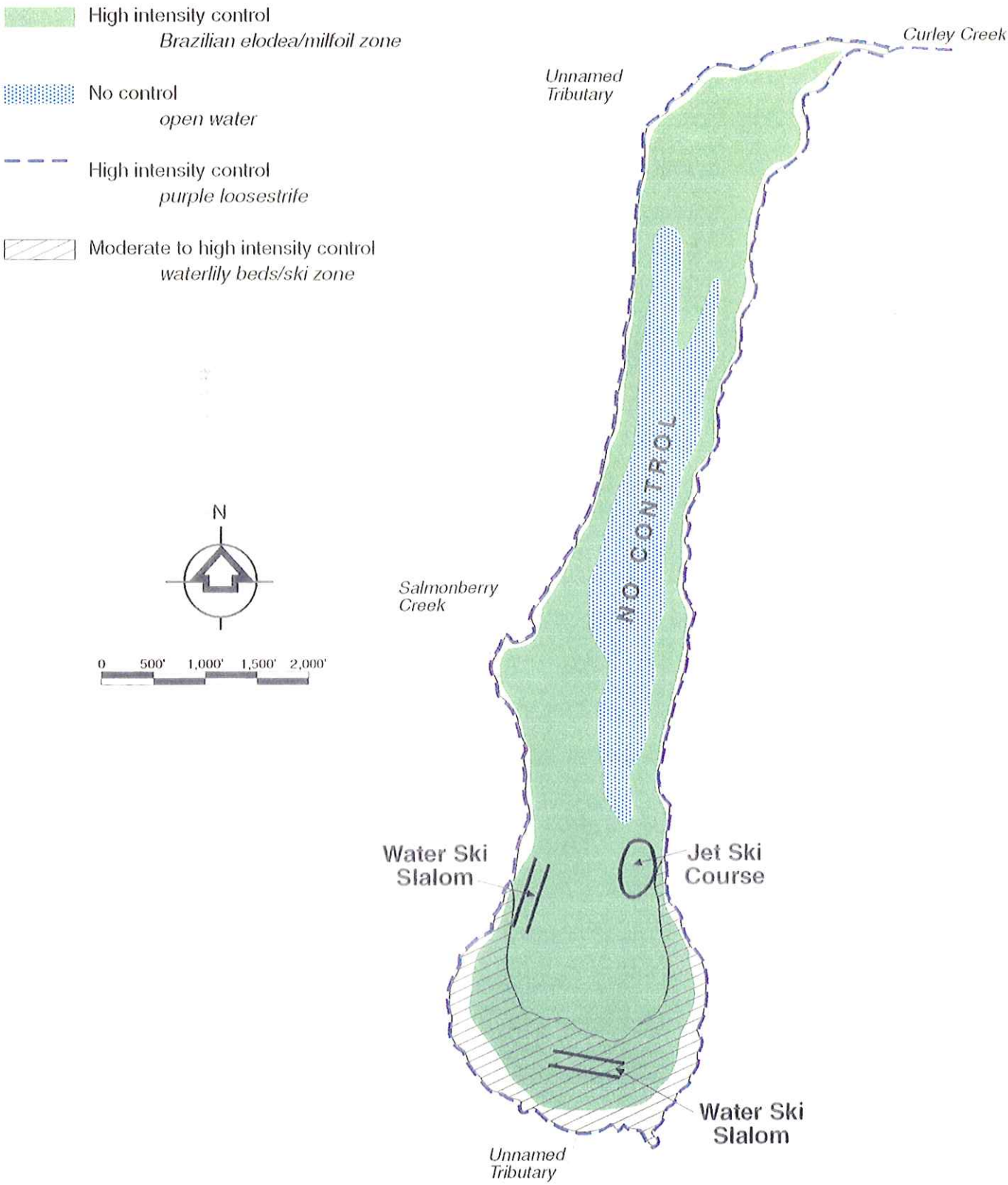


Figure I-1
AQUATIC PLANT CONTROL INTENSITY MAP FOR LONG LAKE

Alternative Integrated Treatment Scenarios For Long Lake
Step J

This section presents alternative in-lake treatment scenarios for management of nuisance aquatic plant populations in Long Lake. As noted in the previous section, four plant types are potential targets for control in Long Lake: the three noxious, non-natives, Brazilian elodea, Eurasian watermilfoil, purple loosestrife, and localized beds of yellow and white (non-native) waterlilies in the south end. After careful evaluation of critical control effectiveness, economic, environmental, political, and site-specific factors, three management strategies have been identified by the Long Lake Steering Committee as possible action alternatives. A No Action scenario is also discussed. These strategies differ in choice of management goals involving **target species, scale of control,** and associated **control intensity.**

Critical Management Issues

A major planning consideration discussed in the previous section was the great extent of Brazilian elodea populations in Long Lake and feasibility of eliminating the species from the lake. Also, rooted Brazilian elodea and Eurasian watermilfoil populations in the lake are not mutually exclusive, but occur intermingled with other plants like waterlilies in the shallows that could affect choice and operational logistics of some control strategies. Furthermore, intensive, large-scale macrophyte control efforts in Long Lake will produce substantial short-term losses in the aquatic macrophyte community, shifting the competitive balance to the macroalgae and phytoplanktonic plant community. This will most likely trigger excessive blue-green algal growth, which is not unexpected given regular historical occurrence of such blooms documented over many years by University of Washington researchers. Additionally, in-lake dilution and flow effects could become important issues due to the presence of several perennial tributaries that discharge into the lake, as well as continuous outflow through Curley Creek at the north end. Management efforts must also provide for maintenance of the existing warmwater and coldwater planted rainbow trout and anadromous fisheries in the lake. Thus, a combination of control alternatives will be necessary, differentially targeting Brazilian elodea and other problem plant areas both in time and space, perhaps resulting in some overlap of problem plant zones covered.

A Balancing Act

At this point it is important to note that benefits of any management program cannot be gained without some short-term adverse impacts. There is ***no ideal management alternative that is at the same time 100% effective against target species, absolutely environmentally safe, and cost-effective.*** The decision-making process regarding design of a specific aquatic plant management program necessitates weighing all factors and achieving a balance between acceptable environmental disruption and cost-effective treatment and a consensus among all affected parties on course of action. In particular, none of the proposed options for Long Lake is without some potential short-term damage to non-target aquatic

organisms and plants. However, timely and careful use of such intensive control tactics should minimize impacts to non-target organisms in the long-term.

Options Narrowed

As described earlier, truly effective Brazilian elodea, Eurasian watermilfoil, and purple loosestrife control alternatives must either kill the roots/shoots or physically remove the entire plant from the sediment. This requirement narrowed down prospective treatment options for Long Lake with these three noxious weeds as the prime targets, and other rooted plants (localized waterlily control) secondarily targeted. Intensive control methods that can be effectively used against Brazilian elodea and other rooted problem plants in Washington State include **hydraulic dredging, application of systemic aquatic herbicides, or implantation of sterile grass carp all for large-scale application, and hand removal, diver dredging, and bottom barrier application for smaller areas.**

Hydraulic dredging of sediments in Long Lake, while probably the most effective option, would be extremely costly because of the large bottom area currently occupied by Brazilian elodea. As a result, it is not considered a feasible large-scale option at this time. A scenario involving lakewide or partial lake planting of sterile grass carp to control noxious Brazilian elodea populations was also investigated during this planning study. However, Washington Department of Fish and Wildlife requirements for inlet/outlet barriers, and agency concerns regarding Long Lake's importance as a salmonid resource that could affect permitting make this scenario unfeasible at this time. A No Action scenario was considered as well by the Long Lake IAVMP committee, but was ultimately rejected for not meeting beneficial lake use goals.

Proposed Treatment Scenarios for Long Lake

The following management scenarios differentially targeting Brazilian elodea, Eurasian watermilfoil, and purple loosestrife (prime targets)/ other (secondary) problem plants are presented for Long Lake in descending order of intensity of treatment and effectiveness against target plants. Of note is that the most intensive actions may possibly have the greatest initial impacts on the ecosystem and require the greatest initial expense. Thus, the order in which the scenarios are presented does not represent a preferred ranking. All of the treatment scenarios consist of an integrated aquatic plant management program extending over ***at least 5 years*** with review each year. The first two utilize a main, large-scale treatment option, supported by other smaller scale options (to cover nooks and crannies missed by large-scale treatment. The third scenario employs small-scale methods only. Thus, the long-term, integrated management program is composed of a ***reactive treatment component,*** consisting of large-scale and/or small-scale methods, a ***proactive public awareness/preventative component,*** a **program monitoring/evaluation element,** ***implementation and funding plan, program administration costs,*** and ***implementation of watershed best management practices.*** For Long Lake, none of the recommended options is expected to have any detrimental impacts on human health, if treatments are performed properly. Table J-1 summarizes Proposed Management Options, including Integrated Treatment Scenario components and projected costs for a minimum 5-year program.

Long-term Management Scenario E-1

The major management goal of this scenario is elimination of Brazilian elodea (BE), Eurasian watermilfoil (EWM), and purple loosestrife (PL) from the lake. Detailed program elements are presented below.

In-lake Treatments

- Whole lake **aquatic plant survey and biomass sampling** in Spring

(Year 1)
- **Whole-lake, sequential application** of systemic herbicide fluridone SONAR) for BE and EWM control
- **Spot treatments** w/systemic herbicide Glyphosate (RODEO) for PL control
  - shoreline applications
  - treatment of islands in south end
  - treat 100 ft buffer zone around islands for PL and incidental waterlily control

(Year 2)
- **Secondary application** of fluridone (SONAR) or equivalent herbicide in south end (up to 50% lake area), if regrowth of target BE is considerable (will also hit any residual EWM patches surviving first SONAR treatment)

(Year 3)
- **Additional fluridone** (SONAR) applications in 10 acre+ units (up to 25% lake area), if needed

(Year 2-5)
- **Spot treatments** w/Glyphosate (RODEO) for PL control, where needed (shorelines, islands)
- **Minor treatments** around shoreline using hand removal, bottom barrier and/or mini suction dredge
- **Minor treatments**--harvesting lanes in ski/slalom courses at south end, if needed

(Year 4-5)
- **Alum treatment** or nutrient inactivation

Other Program Elements (Scenario E-1)

Environmental permits and assessment, if necessary
Use restrictions or modifications
Mitigation of sensitive native plants downstream or in-lake, if needed
Public Outreach and Education Program
Noxious Weed Prevention Program
Program Monitoring and Effectiveness Evaluation
- aquatic plant surveys
- water quality monitoring
- regular meetings of Steering Committee

Watershed Management Program
Implementation and funding plan
Program administration costs

The major treatment component of this scenario consists of an intensive, in-lake application of the ***systemic herbicide, SONAR,*** that is actively absorbed by plant roots and shoots. In year 1, an initial survey of the lake littoral is conducted sometime in late spring (e.g., May-June) to map Brazilian elodea and Eurasian watermilfoil distribution, determine extent of coverage and biomass in lake. Upon completion of the survey, control elements can be initiated, ideally early in the growth season (June to mid-July). In this scenario a large-scale application of SONAR (fluridone) is made along the entire shoreline of Long Lake during the late-spring/early summer season following the survey to confirm extent of Brazilian elodea

and Eurasian watermilfoil growth. A sequential lakewide treatment scheme is recommended over at least an 8-week period to sustain water column concentrations of active ingredient fluridone between 10 ppb a.i. and 20 ppb a.i.), and target species exposure time for optimal effectiveness. Application would be made at the recommended label rates (optimally 20+ ppb a.i.) targeting lake area between 0.5 and 3.2 meter (1.6 and 10.5 ft) water depth (where *Egeria* growth was concentrated as of late August 1996).

Applications of the systemic herbicide, glyphosate (Rodeo), are made by private contractor around the shoreline to control emergent stands of noxious purple loosestrife and incidental waterlily control (e.g., around docks, slalom courses). This shoreline control program can be coordinated to a small extent with WDFW which currently has a control program for treating noxious purple loosestrife but only on State lands (Long Lake WDFW boat launch property).

Year 2+: As in year 1, a pre-treatment aquatic plant survey/biomass sampling of the lake littoral is recommended. Depending on the effectiveness of Brazilian elodea and Eurasian watermilfoil removal in Long Lake following the first year SONAR treatment, another SONAR application may be necessary in the following year to hit regrowth. As a worst case estimate, large-scale applications of SONAR possibly covering up to 50% of the first year treatment area (approximately 100 acres) may be needed in year 2. Because at least two initial herbicide treatments are anticipated (assuming they are permitted), mitigation efforts (to revegetate any damaged downstream or shoreline areas) are delayed to year three to allow time for full effects to become obvious. Later in the season of year two, when evidence of kill effectiveness is more apparent (2-3 months later), cleanup treatment especially of unaffected Brazilian elodea and Eurasian watermilfoil plants by hand removal or bottom screening application may be necessary. Spot treatment (hand removal or glyphosate application) of purple loosestrife may need to be continued on an annual basis to hit residual populations remaining after first year's treatment. In succeeding years, hand removal of small Brazilian elodea patches is recommended, as well as maintenance and reapplication of bottom barriers, if needed.

The prevention program (boat checks, public education) should be continued every year. Annual monitoring and evaluation of treatment effectiveness is highly recommended in order to make appropriate adjustments in succeeding year's management program. Watershed best management practices are also encouraged. An alum treatment or other form of nutrient inactivation may be required in Year 4 or 5 to combat excessive blue-green algal populations that will probably form if substantial loss occurs in aquatic macrophyte community, given regular historical occurrence of such blooms documented over many years by University of Washington researchers. To compensate for physical reduction of cover (=removal of Brazilian elodea beds) for salmonid and spiny-ray fish, the scenario provides a plan for in-lake fish habitat enhancement with natural and artificial structures, if needed.

First Year Costs: Annual aquatic plant survey costs are estimated to be $3000. At an average cost for materials and application by private

contractor of roughly $1300/acre, first year costs for a sequential application of SONAR (230 acres) over at least an 8 week period could be upwards of $300,000. Treatment with RODEO of nuisance emergent plant beds along shoreline and shallow lake (estimated 20 acres) is projected to cost $6,000. It is anticipated that the prevention component would be mainly a volunteer effort, with negligible expenses. Public awareness costs are estimated at $2000. Permit/Environmental Assessment fees could cost up to $5000. Monitoring costs for a consulting limnologist/engineer to monitor carry-over effectiveness are estimated to be $5,000. This puts first year program costs at $321,000.

Costs for Year 2+: The bulk of program costs for scenario 1 will most likely occur in year 1, although large costs may be incurred in year 2 and/or in year 4 or 5. In year 2 there may be a need for additional large-scale SONAR retreatment, depending on efficacy of the first year herbicide treatment against target species. Annual treatment of shoreline emergents (e.g., purple loosestrife, which can have a tremendous seedbank), will most likely be necessary from year 2 on as well, totaling $3,000 for an estimated 10 acre application. Total annual costs for an herbicide-based program for Brazilian elodea control in Long Lake using SONAR and supported by physical removal methods should successively decline after the second year, which assumes a worst case need for retreatment of 50% of the original area (estimated cost of $150,000). If a whole lake alum treatment is needed in year 4 or 5, projected costs for this activity could boost project costs upwards of $290,000 @$900/acre. It should be possible to keep permitting costs to roughly $1000 during years 2 through 5. Mitigation efforts are delayed to the third year to allow time to estimate revegetation needs resulting from any herbicide damage to downstream native plants. Based on results of similar herbicide programs in Washington State, anticipated impacts on emergent plants and associated revegetation cost should be minimal. For example, if 300 m^2 of beneficial shoreline area were affected, revegetation estimates would be about $5,000 relying largely on volunteer labor. Relying mostly on volunteer effort, costs should be minimal for in-lake fish habitat enhancement with logs, boulders or artificial structures to compensate for physical reduction of cover (=removal of Brazilian elodea beds) for salmonid and spiny-ray fish.

Ecological/human impacts: Detrimental impacts of SONAR on other vulnerable non-target in-lake plants are possible, but can be minimized by adjusting timing and rate of application to target Brazilian elodea at their most susceptible point. Because of potential for drift, SONAR may not stay within the treatment zone. The possibility does exist for some downstream effects of SONAR at the outlet end of the lake, but because of dilution effects, these impacts should be minimal. Also, delaying the SONAR treatment to late spring-early summer, when precipitation and outflow are usually on the decline, should further minimize out-of-system, downstream movement of the herbicide. Considering this potential for non-target plant effects, a plan for mitigation of shoreline and downstream plants may be necessary.

Fluridone has a very low order of toxicity to fish and wildlife. At the low concentrations expected to be used in Long Lake, fluridone should have

negligible effect on coldwater species of salmon and trout and other warmwater fish in the lake, and any salmonids present downstream.

There are no expected risks to human health if Long Lake is treated with SONAR. A chemical review of SONAR literature was recently completed by Thurston County Public Health and Social Services Department with regard to usage in Long Lake, which found no significant long-term human health risks associated with the proper use of this herbicide (Thurston County Public Health and Social Services Department Memo, SONAR Review, March 27, 1990).

Water quality impacts of SONAR applications could be substantial. While toxicity effects of fluridone on vegetation are slow, taking up to 1-3 months to become visually evident, sustained nutrient releases from dying plants could trigger possible blue-green algal blooms. If non-target plants are not significantly damaged by the SONAR treatment, unimpacted plants could continue to take up the extra nutrients, providing a mechanism for natural mitigation and perhaps lessening the effects of an artificially-induced algal bloom.

There may be some recreational impacts, affecting mostly swimming, which is discouraged during and immediately after treatment, although there is no label restriction for swimming (See SONAR label, Appendix D). There are irrigation restrictions with SONAR use.

As a non-selective herbicide, glyphosate (RODEO) treatment can have an affect on non-target plant species susceptible to its effects. While the possibility of drift through aerial application exists, it is expected to be negligible if application is made according to label instructions and permit instructions. There are use restrictions where glyphosate is applied within 1/2 mile of potable intakes in either flowing or standing waters. Current label restrictions on use require that active potable water intakes be shut off for a minimum of 48 hours after application or until the laboratory measured glyphosate level in intake water is below 0.7 ppm.

Permits/Special Requirements

Use of aquatic herbicides does require submitting an Aquatic Plant Management Permit Application for short-term modification to state water quality standards to Washington State Department of Ecology before initiation of treatment.

Hydraulic permit required for hand removal, bottom screening, harvesting in lake, obtained from WDFW. Bottom barrier application and herbicide treatment may be subject to Shoreline Management Act and may need Shoreline permit for installation, dependent on scale and total cost of in-lake treatment. Washington Department of Natural Resources (WDNR) Natural Heritage Program must be contacted for assessment of threatened or endangered plant species. Diver dredging requires a Section 404 permit from U.S. Army Corps of Engineers (COE).

Ideally, time required for state agencies to process a permit application is at least 45 days, but could be much longer if the permit application is not properly completed. If multiple permits from local, county or state jurisdictions are required, overall processing time could also be extended.

Special considerations

Recent laboratory results indicate high rates of control of Eurasian watermilfoil using fluridone at concentrations of 10-20 ppb sustained over 8-10 weeks time. However, there is not yet conclusive documentation of successful eradication of particularly Brazilian elodea in a large lake system. It is noteworthy that sequential block treatments of SONAR at these concentrations and duration have been tried against the two target species in the last few years in two Pacific Northwest lakes. Such a strategy appears to have been very effective against Eurasian watermilfoil (e.g., Long Lake, Thurston Co.), and has shown initial promising results against Brazilian elodea in Lake Limerick, Mason Co. (WATER, 1997), although the latter species appears to require a much more intensive effort to kill off than milfoil does. In Long Lake, it is highly probable that the late pioneering infestation of Eurasian watermilfoil (currently documented in the south half of the lake) will be removed with a sustained high intensity effort so described. However, degree and duration of control of Brazilian elodea in Long Lake using this large-scale SONAR strategy is less certain.

Long-term Management Scenario E-2

The major management goal of scenario E-2 is complete removal of late pioneering stage Eurasian watermilfoil only in the south end, and aggressive incremental removal of shoreline purple loosestrife (which could take many years). Detailed program elements follow.

In-lake Treatments

- Whole lake **aquatic plant survey and biomass sampling** in Spring

(Year 1)
- **Large-scale, sequential application** of systemic herbicide fluridone SONAR) for EWM control (will provide incidental control of BE)

(Year 1-5)
- **Spot treatments** w/systemic herbicide Glyphosate (RODEO) for PL control
  - shoreline applications
  - treatment of islands in south end
  - treat 100 ft buffer zone around islands for PL and incidental waterlily control

(Year 2-5)
- **Minor treatments** around shoreline using hand removal, bottom barrier and/or mini suction dredge for EWM regrowth areas
- **Minor treatments**–harvesting lanes in ski/slalom courses at south end, if needed

Other Program Elements

Same as E-1

The major treatment component of this scenario consists of a large-scale, in-lake application of the ***systemic herbicide, SONAR,*** and/or bottom barrier placement over target EWM colonies in the south end of the lake. In year 1, an initial survey of the lake littoral is conducted sometime in late spring (e.g., May-June) to map Eurasian watermilfoil distribution, determine extent of coverage and biomass in lake. Upon completion of the survey, control elements can be initiated, ideally early in the growth season (June to mid-July). In this scenario a large-scale application of SONAR (fluridone) is made in the southern end of Long Lake covering between 50-100 acres during the late-spring/early summer season

following the survey to confirm extent of Eurasian watermilfoil growth. A sequential lakewide treatment scheme is recommended over at least an 8-week period to sustain water column concentrations of active ingredient fluridone between 10 ppb a.i. and 20 ppb a.i.), and target species exposure time for optimal effectiveness.

Applications of the systemic herbicide, glyphosate (Rodeo), are made by private contractor around the shoreline to control emergent stands of noxious purple loosestrife and incidental waterlily control (e.g., around docks, slalom courses). This shoreline control program can be coordinated to a small extent with WDFW which currently has a control program for treating noxious purple loosestrife but only on State lands (Long Lake WDFW boat launch property).

Costs: The bulk of expenses for this scenario employing a combination of chemical and physical methods would most likely occur in the first year. Actual in-lake and shoreline treatments are projected to range between $84,000 to $149,000 for year 1. Annual aquatic plant survey costs are estimated to be $3000. It is anticipated that the prevention component would be mainly a volunteer effort, with negligible expenses. Monitoring costs for a consulting limnologist/engineer to evaluate carry-over effectiveness in the lake are projected to be $5,000. Overall **first-year program costs** for this scenario are estimated to be between **$99,000 and $164,000,** and include permitting and any required environmental assessment, as well as prevention and monitoring. It should be possible to keep permitting costs to roughly $1000 in years 2 and 5. Mitigation efforts are delayed to the third year to allow time to estimate revegetation needs resulting from any herbicide damage to downstream native plants; assuming maximal use of volunteer labor, mitigation costs are projected to be $5,000.

Ecological/human impacts: Detrimental impacts of SONAR on other vulnerable non-target in-lake plants are possible, but can be minimized by adjusting timing and rate of application to target Eurasian watermilfoil at its most susceptible point. Because of potential for drift, SONAR may not stay within the treatment zone. The possibility does exist for some downstream effects of SONAR in the northern end of the lake, but because of dilution effects, these impacts should be minimal. Also, delaying the SONAR treatment to late spring-early summer, when precipitation and outflow are usually on the decline, should further minimize downstream movement of the herbicide. Considering this potential for non-target plant effects, a plan for mitigation of shoreline and downstream native plants may be necessary.

Fluridone has a very low order of toxicity to fish and wildlife. The extremely low concentrations of fluridone expected to be used in Long Lake should have negligible effect on trout and other warmwater fish in the lake and any salmonids present downstream. Water quality impacts of SONAR applications could be substantial. While toxicity effects of fluridone on vegetation are slow, taking up to 1-3 months to become visually evident, sustained nutrient releases from dying plants could trigger possible blue-green algal blooms. If non-target plants are not significantly damaged by the SONAR treatment, unimpacted plants could continue to take up the extra nutrients, providing a mechanism for

natural mitigation and perhaps lessening effects of an artificially-induced algal bloom.

There may be some recreational impacts, affecting mostly swimming, which is discouraged during and immediately after treatment, although there is no label restriction for swimming (See SONAR label, Appendix D). There are irrigation restrictions with SONAR use. There are no expected risks to human health if Long Lake is treated with SONAR.

As a non-selective herbicide, glyphosate (RODEO) treatment can affect susceptible non-target plant species. While the possibility of drift through aerial application exists, it is expected to be negligible if application is made according to label instructions and permit instructions. There are use restrictions where glyphosate is applied within 1/2 mile of potable intakes in either flowing or standing waters. Current label restrictions on use require that active potable water intakes be shut off for a minimum of 48 hours after application or until the laboratory measured glyphosate level in intake water is below 0.7 ppm.

Permits/Special Requirements

Use of aquatic herbicides does require submitting an Aquatic Plant Management Permit Application for short-term modification to state water quality standards to Washington State Department of Ecology before initiation of treatment.

Hydraulic permit approval (HPA) is required from the WDFW for placement of structures for fish habitat enhancement in the lake. Bottom barrier application, hand removal, and harvesting requires hydraulic approval from the WDFW. Bottom barrier may be subject to Shoreline Management Act and may need Shoreline permit for installation, dependent on scale and cost of barrier application. Washington Department of Natural Resources Natural Heritage Program must be contacted for assessment of threatened or endangered plant species. Diver dredging requires a Section 404 permit from U.S. Army Corps of Engineers (COE).

Ideally, time required for State agencies to process a permit application is at least 45 days, but could be much longer if the permit application is not properly completed. If multiple permits from local, county or state jurisdictions are required, overall processing time could also be extended.

Special considerations

Recent laboratory results indicate high rates of control of Eurasian watermilfoil using fluridone at concentrations of 10-20 ppb sustained over 8-10 weeks time. It is noteworthy that sequential block treatments of SONAR at these concentrations and duration have been tried against this target species in the last few years in a Pacific Northwest lake. Such a strategy appears to have been very effective against Eurasian watermilfoil (e.g., Long Lake, Thurston Co.). In Long Lake, it is highly probable that the late pioneering infestation of Eurasian watermilfoil (currently documented in the south half of the lake) will be removed with a sustained high intensity herbicide effort so described. There may also be incidental control of Brazilian elodea in Long Lake using this large-scale SONAR strategy, but long-term results are less certain.

Long-term Management Scenario M-3

The major management goal of Scenario M-3 is localized physical/mechanical/systemic herbicide control of nuisance non-native and native growth around shorelines only up to 20 acres annually. Detailed program elements are described below.

In-lake Treatments

- Whole lake **aquatic plant survey and biomass** sampling in Spring

(Year 1-5)
- **Spot treatments** of purple loosestrife shoreline stands up to 20 acres annually using Glysophate (RODEO)

(Year 2-5)
- **Minor treatments** using hand removal and bottom barrier and/or diver-suction dredge for problem areas of EWM regrowth around lake
- **Minor treatments**–harvesting lanes in ski/slalom courses at south end, if needed

Other Program Elements

Same as E-1

Unlike the previous two scenarios, M-3 Scenario does not intend to eliminate or eradicate nuisance species from Long Lake. This "maintenance mode" scenario involves a combination of small-scale physical/mechanical/chemical treatments to keep priority shoreline areas clear of surfacing nuisance aquatic plants. High use areas include shoreline docks, boat launches, swim beaches. These shallow, critical areas could be kept clear of weeds using more intensive methods such as bottom barrier applications, hand removal, or small suction dredge techniques. Mechanical harvesting or use of contact herbicides, such as Aquathol, may need to be implemented in slalom courses and ski zones in the south end of the lake. Application of systemic herbicide, glyphosate (RODEO), could also be used to combat shoreline stands of emergent purple loosestrife and shallow beds of floating-leaved plants. Sustained, long-term use of glyphosate, even over small areas, could over time significantly impact purple loosestrife populations around the lake. Implementation of watershed measures, annual aquatic plant survey, public awareness-prevention, and monitoring programs are included as in previous scenarios.

Costs: Annual aquatic plant survey costs are estimated to be $3000. At an average cost for materials and application by private contractor of roughly $500/acre, first year costs for a 10-20 acre application of Aquathol for submersed plants and Rodeo for spot lily control could range $5,000-10,000. Costs for small-scale bottom barrier application would depend on target area and barrier material; for example, 1/4 acre treatment would be upwards of $13,000, including purchase of materials. Permitting expenses should be under $2,000 for the first year, depending on acreage of bottom barrier applied, decreasing to about $500 annually thereafter. With a lake management plan involving small-scale systemic and contact herbicide treatment, small-scale bottom screening and hand removal, and inclusion of public awareness and monitoring elements, **first year costs** could run as high as **$33,000**. However, annual expenses for this maintenance mode scenario should continue at total program costs of $25,000 or less (depending on scale of physical/mechanical removal

required). For this maintenance scenario, a five-year minimum program is projected to cost between $125,000 to $129,000.

Ecological/human impacts: Aquathol treatment is not species-specific and could result in removal of target Brazilian elodea as well as other non-target species intermingled with them. Currently, Washington State requires an 8 day swimming restriction following treatment with Aquathol. There are also label restrictions on fish consumption, food and non-food crop irrigation.

As a non-selective herbicide, glyphosate (RODEO) treatment can affect susceptible non-target plant species. While the possibility of drift through aerial application exists, it is expected to be negligible if application is made according to label instructions and permit instructions. There are use restrictions where glyphosate is applied within 1/2 mile of potable intakes in either flowing or standing waters. Current label restrictions on use require that active potable water intakes be shut off for a minimum of 48 hours after application or until the laboratory measured glyphosate level in intake water is below 0.7 ppm.

Permits/Special Requirements
Use of aquatic herbicides does require submitting an Aquatic Plant Management Permit Application for short-term modification to state water quality standards to Washington State Department of Ecology before initiation of treatment.

Bottom barrier application, hand removal, and harvesting requires hydraulic approval from the WDFW. Bottom barrier may be subject to Shoreline Management Act and may need Shoreline permit for installation, dependent on scale and cost of barrier application. Washington Department of Natural Resources Natural Heritage Program must be contacted for assessment of threatened or endangered plant species. Diver dredging requires a Section 404 permit from U.S. Army Corps of Engineers (COE).

Ideally, time required for state agencies to process a permit application is at least 45 days, but could be much longer if the permit application is not properly completed. If multiple permits from several local, county or state jurisdictions are required, the overall processing time period could be extended as well.

No Action Management Scenario N-4

A lake community may decide to take **no action** to manage aquatic plants in the waterbody for a number of reason. Level of growth or occurrence of plant beds within the lake may be such that they pose no immediate concern to the majority of users. On the other hand, nuisance macrophyte problems may be so extensive and possible corrective actions of great financial and/or environmental consequence, that a no control option is chosen in the interim until new strategies can be developed. Sometimes, it is not possible to achieve a clear consensus on choice of practicable lakewide management goals and strategies, resulting in a decision to take no action.

However, with regard to non-native, invasive plant infestations, it is critical to consider possible consequences of a **no action alternative** on human use, habitat, and wildlife utilization of the resource. In particular, if aggressive, lakewide control tactics are not used to eliminate noxious weed populations from Long Lake, these exotic plants can be expected to continue colonization of all available littoral area. Left unchecked, these three non-native species will continue to significantly suppress current native stands, degrading habitat, water quality, and recreational enjoyment of the lake. This may ultimately result in higher future program costs and level of effort to manage these plants. Additionally, without control of these noxious species, Long Lake will remain a seed source for possible spread to and contamination of other lake systems.

TABLE J-1
ALTERNATIVE TREATMENT SCENARIOS FOR LONG LAKE AQUATIC PLANT MANAGEMENT

Treatment Scenarios	*Program Elements	** Costs (est) First Year	** Costs (est) Second Year	** Costs (est) Third Year	** Costs (est) Fourth Year	** Costs (est) Fifth Year	Scenario Cost First 5 Years
Intensive Programs							
E-1 Systemic Herbicide large-scale w/intensive small-scale treatments around lake	*Macrophyte survey/biomass	$3,000	$3,000	$3,000	$3,000	$3,000	
	*SONAR(fluridone) applic	$300,000 230ac	$150,000 165 ac	$0	$0	$0	
	*RODEO(glyphosate)	$6,000 20 ac	$3,000 10 ac	$3,000 10 ac	$3,000 10 ac	$3,000 10 ac	
	*Mitigation-habitat, if needed	$0	$0	$5,000 +volun	$0	$0	
	*Downstream veg surv	volunteer	volunteer	volunteer	volunteer	volunteer	
	*Permitting/(checklist)	$5,000	$1,000	$1,000	$1,000	$1,000	
	*Small-scale treatment (physical/mechanical)	$0	$13,000	$10,000	$10,000	$10,000	
	*Public Ed/Noxious Weed Prev	$2000+volun	$2000+volun	$2000+volun	$2000+volun	$2000+volun	
	*Program Monitor/Eval w/ Steering Committee	$5000+volun	$5000+volun	$3000+volun	$3000+volun	$3000+volun	
	*Alum treatment-whole lake	-	-	-	$290,000 339 ac	-	
TOTALS		**$321,000**	**$177,000**	**$27,000**	**$312,000**	**$22,000**	**$859,000**
E-2 Systemic Herbicide and/or Physical Control south end milfoil colonies w/intensive small-scale treatments around lake	*Macrophyte survey/biomass	$3,000	$3,000	$3,000	$3,000	$3,000	
	*SONAR (fluridone) applic in south end	$65,000 50-100 to $130,000 acres			$0	$0	
	*RODEO(glyphosate) applic	$6,000 20 ac	$3,000 10 ac	$3,000 10 ac	$3,000 10 ac	$3,000 10 ac	
	*Mitigation-habitat	$0	$0	$5,000	$0	$0	
	*Small-scale treatment (physical/mechanical)	$13,000	$25,000	$13,000	$13,000	$13,000	
	*Permitting/(checklist)	$5,000	$1,000	$1,000	$1,000	$1,000	
	*Public Ed/Noxious Weed Prev	$2000+volun	$2000+volun	$2000+volun	$2000+volun	$2000+volun	
	*Program Monitor/Eval w/ Steering Committee	$5000+volun	$5000+volun	$3000+volun	$3000+volun	$3000+volun	
TOTALS		**$99,000 to $164,000**	**$39,000**	**$30,000**	**$25,000**	**$25,000**	**$218,000 to $283,000**

TABLE J-1 (Con't)

ALTERNATIVE TREATMENT SCENARIOS FOR LONG LAKE AQUATIC PLANT MANAGEMENT

Treatment Scenarios	*Program Elements	** Costs (est) First Year	** Costs (est) Second Year	** Costs (est) Third Year	** Costs (est) Fourth Year	** Costs (est) Fifth Year	Scenario Cost First 5 Years
						$0	
Maintenance Program							
M-3 Small-scale Control	*•Macrophyte survey/biomass*	$3,000	$3,000	$3,000	$3,000	$3,000	
w/intensive small-scale treatments around shore	*•Small-scale treatment (physical/mechanical)*	$13,000 1/4 ac	$13,000 1/4 ac	$13,000 1/4 ac	$13,000 1/4 ac	$13,000 1/4 ac	
	•Spot treatment w/RODEO and/or Aquathol herbicides	$5,000 10-20 to $10,000 acres	$3,000 5 acre	$3,000 5 acre	$3,000 5 acre	$1,500 3 acre	
	•Permitting (checklist)	$2,000	$500	$500	$500	$500	
	•Public Ed/Noxious Weed Prev	$2000+volun	$2000+volun	$2000+volun	$2000+volun	$2000+volun	
	•Program Monitor/Eval w/ Steering Committee	$3000+volun	$3000+volun	$3000+volun	$3000+volun	$3000+volun	
TOTALS		**$28,000 to $33,000**	**$24,500**	**$24,500**	**$24,500**	**$23,000**	**$124,500 to $129,500**

* Program elements common to all Scenarios are italicized

** Cost are projections based on contractors' current estimates.

Recommended Action Plan for Long Lake
Step K

Plan Formally Chosen by Public Process

Alternative treatment scenarios for Long Lake were presented both in a Public Meeting/Workshop held at Long Lake on May 27, 1997, as well as in an earlier newsletter mailed to all property owners which contained an official ballot (Appendix A). Official ballots were tallied and Treatment Scenario E-1 was overwhelmingly chosen as the heart of the recommended long-term action plan for the lake (of 48 ballots, 44 for E-1, 1 for E-2, 3 for No Action). The Long Lake IAVMP recommends aggressive treatment of in-lake noxious, nuisance weed populations, along with other lake and watershed management elements to maintain beneficial uses. It must be stressed that aquatic plant management in Long Lake, particularly management of the exotic weed species, Brazilian elodea, will be an **on-going concern** and will take **long-term commitment**. Furthermore, the resulting Plan is **dynamic and flexible**, with checkpoints (Annual evaluations, Steering Committee Meetings) set along the way to allow for any changes in course direction or control tactics. Given the difficulty in routing established Brazilian elodea from a system, a **five-year (minimum) program** using the following elements is recommended.

Treatment Scenario E-1

In-lake Treatments

Whole lake aquatic plant survey and biomass sampling
(Year 1) Large-scale, lake-wide application of systemic herbicide SONAR for Brazilian elodea and Eurasian watermilfoil control
(Year 1+) Spot treatment w/systemic RODEO for purple loosestrife/ waterlily control
(Year 2, 3) Re-treatment of lake with SONAR, if needed
(Year 2+) Spot treatments-harvest ski/slalom courses, if needed
Minor treatments using hand removal, bottom barrier, mini-dredge
(Year 4 or 5) Alum treatment or nutrient inactivation, if needed

Other Program Elements

Environmental permits and assessment, if necessary
Use restrictions or modifications
Mitigation of native plants downstream, if needed
Mitigation of fish habitat loss (use of artificial structures)
Public Outreach and Education Program
Noxious Weed Prevention Program
Program Monitoring and Effectiveness Evaluation
- aquatic plant surveys
- water quality monitoring (N,P sampling)
- regular meetings of Steering Committee

Watershed Management Program
Implementation and funding plan

The aquatic plant management scenario for Long Lake as recommended by the lake community involves large-scale systemic herbicide treatments in the first few years targeting noxious Brazilian elodea, Eurasian watermilfoil and purple loosestrife, followed in succeeding years by small-scale follow-up with hand removal and bottom barriers to prevent re-infestation. The plan also includes provisions for a public awareness program, and an annual monitoring program to evaluate effectiveness. In addition, to maximize benefits of exotic Brazilian elodea removal, it is critical to sustain a noxious weed prevention program so that any new outbreaks can be destroyed. In the later years of the minimum five-year program, some form of nutrient inactivation may be necessary to combat possible blue-green algal blooms triggered by massive disruption of rooted macrophyte (Brazilian elodea) communities. Other program elements include mitigation of fish habitat, if needed, permitting, use restrictions, watershed management, and securing and implementing funding. Components of the recommended treatment scenario and other short- and long-term program elements are described in more detail below.

In-lake Treatments

SONAR Application

The major treatment component of this scenario consists of use of a systemic herbicide in the **first year** to effect major reductions in target Brazilian elodea (*Egeria densa*) beds. Initially, an aquatic plant survey and biomass sampling is conducted in late spring (May-June) to document extent of *Egeria* coverage in the lake. This surveillance is followed (June-mid-July) by a large-scale, sequential application of the systemic herbicide, SONAR. With this herbicide, the active ingredient fluridone is absorbed by target plant roots and shoots and is potentially capable of killing the entire plant. The fluridone application is made targeting *Egeria* beds between 0.5 and 3.2 meter (1.6 to 10.5 foot) water depth (where growth was concentrated as of late August, 1996 survey and to be confirmed in the first year of implementation), approximately 230 acres. The appropriate formulation of SONAR will be used, with application made at the recommended label rate for Brazilian elodea. Since it is critical that exposure/contact time of the active ingredient be optimal for maximum kill effectiveness, fluridone concentrations may need to be maintained for up to 10 weeks for each annual treatment program. For example, a similar *Egeria densa* control project on Lake Limerick in Mason County sustained water column fluridone concentrations between 10 and 20 ppb a.i for 9 weeks (WATER, 1997). A sampling program will be necessary to collect water samples at regular intervals to monitor fluridone concentrations in the lake for the appropriate period.

A follow-up SONAR treatment of remnant *Egeria densa* beds not killed by the first treatment may be necessary in **year 2** of the program. Another large-scale application of SONAR would depend on the nature and extent of regrowth of Brazilian elodea in the lake, but is expected to be substantially less than the initial

treatment (projected up to 50% of area of first treatment). An additional SONAR re-treatment may also be required in year 3 if regrowth is substantial following two years of treatment (minimum area of treatment is 10 acres).

Small-scale Weed Control

The IAVMP for Long Lake recommends small-scale, incremental treatment of shoreline noxious purple loosestrife beds with systemic herbicide, glyphosate (RODEO), each year. Spot treatment of nuisance waterlily growth with glyphosate to clear areas around docks and create boat lanes, particularly in the south end, is also recommended. The plan includes physical plant removal methods to suppress nuisance weed growth around the shoreline, if necessary in years 3 through 5. In year 3, when evidence of carryover effectiveness of SONAR against Brazilian elodea and Eurasian watermilfoil is more apparent, cleanup treatment of residual nuisance plants by hand removal (digging or raking) or bottom screening may be required. A variety of bottom barrier materials are available from local suppliers. Depending on material used, careful maintenance of bottom screens can result in removal and reuse of screens in other areas.

Alum Treatment

An alum treatment or nutrient inactivation may be needed by year 4 or 5 to control any occurrence of nuisance algal blooms in the lake that might arise as a result of major disruption in the rooted macrophyte community (mainly loss of noxious target Brazilian elodea).

Other Program Elements

Permits/Assessment

Use of aquatic herbicides, such as SONAR, does require submitting an Aquatic Plant Management Permit Application for short-term modification to state water quality standards to Washington State Department of Ecology before initiation of treatment. Ideally, this permit application should be filed before the end of February for a late spring-early summer treatment to allow enough time for agency processing.

If bottom screens are employed later in the Long Lake management program, their use may be subject to the Shoreline Management Act. A shoreline permit may be required for installation, dependent on scale and cost of barrier application. Bottom barrier application, hand removal, and harvesting also require hydraulic approval from the Washington State Department of Fish and Wildlife (WDFW). Both of these permits should be completed two to three months prior to planned treatment. Additionally, diver-operated dredging does require a Section 404 permit from the U.S. Army Corps of Engineers.

Washington Department of Natural Resources Natural Heritage Program has already been contacted for assessment of threatened or endangered plant species in the Long Lake vicinity. In addition, WDFW has been contacted regarding priority wildlife habitats and species in the vicinity.

Use Restrictions and Modifications

There may be some recreational impacts with the use of SONAR, affecting mostly swimming, which is discouraged during and immediately after treatment, although there is no label restriction for swimming (See SONAR label, Appendix). However, because SONAR treatments are most effectively made between May-July for Brazilian elodea control, recreational impacts can be kept to a minimum by early season application. There are label irrigation restrictions with SONAR use. As a result, lake water cannot be used for irrigation of grounds for the 10 week SONAR treatment period. It will be necessary to check for use of lake water for potable or irrigation use prior to SONAR application. If either use exists, a temporary, alternative water source must be secured.

Mitigation of Native Plants

No or negligible impacts of fluridone (the active ingredient in SONAR) are anticipated within the wetland fringe at the southern end of the lake, where several small tributaries flow into the lake. SONAR may impact other non-target native plants in Long Lake and possibly in downstream reaches of Curley Creek. However, concerted efforts to employ a prudent application scheme should minimize impacts to emergent plants on the lakeshore perimeter of Long Lake. Also, delaying the SONAR treatment to late spring-early summer, when precipitation and outflow typically decline, should further minimize downstream movement of the herbicide. Previous record of a State Monitor 1 plant species, *Hydrocotyle ranunculoides* (floating water pennywort), in the southeasternmost end of the lake will require confirmation of presence and protective action prior to implementation. Protective efforts as well as development of a mitigation plan for revegetation of damaged areas are expected to satisfy the Governor's Executive Order 11990, Protection of Wetlands. These actions should also satisfy the Washington Department of Fish and Wildlife's recommendation that a minimum of 25% of aquatic vegetation be preserved for wildlife habitat in lakes treated with herbicides.

Mitigation efforts (to revegetate any damaged native emergent plants along shoreline areas and downstream) are delayed to year three to allow time for full effects to become obvious of the SONAR treatment. Mitigation need should be determined in year three by performing a similar basic survey of vegetation bordering shoreline of Long Lake and outflow channel to assess condition of emergent plants. Results in year three should be compared to aquatic vegetation data compiled on this same channel prior to the SONAR treatment. If a database characterizing downstream vegetation does not exist, a pre-treatment survey of vegetation along Curley Creek should be performed by late spring prior to initial SONAR application.

Mitigation of Fish Habitat

Brazilian elodea, the primary target of aquatic plant control in Long Lake, currently accounts for a large portion of macrophyte biomass and areal coverage in the lake. If SONAR treatment prove to be as highly effective as expected against this weed species, macrophyte bed area could decrease considerably by year three. Annual macrophyte surveys with biomass sampling will

provide a quantitative means of assessing status of plant beds in the lake at that time, and whether additional fish habitat mitigation measures are needed. If mitigation of aquatic habitat is recommended, structures like logs and cement blocks can be strategically positioned along the lake bottom to provide artificial habitat/refuge for salmonids, trout and spiny-ray fish.

NOTE: It is noteworthy that, in other Washington lakes that have recently received large-scale SONAR treatment (e.g., Lake Limerick, Pipe Lake), rooted macrophyte communities have experienced temporary replacement by macroalgae (Charophytes) in immediate post-treatment years (WATER, 1997; K. Hamel, WDOE, pers comm. 1997). Low-stature macroscopic algae beds typically provide excellent fishery habitat in themselves, so that habitat augmentation may be minimal where such charophyte beds are considered adequate.

Public Outreach/Education

The Long Lake IAVMP also includes a multi-faceted public outreach/education element. Public outreach efforts are encouraged on a year-round basis to keep the larger community informed as to the status and progress of integrated management in Long Lake, particularly nuisance aquatic plant control. This will be accomplished by continuation of period newsletters mailed to Long Lake property owners, conducting public and informal meetings, and posting lake status information on local bulletin boards. Public Education efforts resulting from the Integrated Aquatic Vegetation Management Plan should complement existing lake and watershed management programs.

Exotic Weed Prevention Program

The purpose of the exotic weed prevention element is to prevent reintroduction of Brazilian elodea, or other non-native invasive plants, to the lake and provide a quick response if new populations are sighted. While Brazilian elodea (*Egeria densa*), Eurasian watermilfoil (*Myriophyllum spicatum*) and emergent purple loosestrife (*Lythrum salicaria*) are presently the species of concern in Long Lake, it is important to prevent introduction of other exotic species, such as hydrilla (*Hydrilla verticillata*), parrotfeather (*M. aquaticum*), and fanwort (*Cabomba caroliniana*), all of which have documented, established populations in western Washington waters. While established, persistent populations have yet to be documented in Washington waters, it is also critical to be on the alert for other exotic nuisance species like water hyacinth (*Eichhornia crassipes*).

Since spread of exotic invaders like Brazilian elodea and milfoil fragments most commonly occurs as a result of transport on boating equipment (Newroth, 1990), efforts to halt spread through educational means and by visual inspection of boats entering/leaving the lake are recommended. A milfoil prevention sign developed by Washington Department of Ecology is currently posted at the public boat launches. A boat checking operation could be undertaken at the south end State boat launch and smaller launch at the north end County Park on the lake, staffed

by volunteer property owners from the community. Inspection efforts should be targeted for typical high-use periods, e.g., from April to July.

Regular patrolling of Long Lake should be conducted to check for outbreaks of Brazilian elodea, Eurasian watermilfoil or other non-native, invasive plants. A group of lake residents should be trained to look for these noxious macrophytes as well as other dangerous exotic invasive plants. The Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans (Gibbons et. al., 1994) provides a description and line drawings of these and other exotic invasive plants. Surveillance should be made monthly from April to October, using an underwater viewer to see into the water, and pulling suspect plant samples with a rake for a surface check. Washington Department of Ecology can be consulted for expert identification of aquatic plants. Furthermore, experience at Long Lake (Thurston County) is proving that underwater surveying using a diver is also an excellent means of checking for new growth of milfoil, as well as treating outbreaks immediately by hand-pulling or bottom screen placement (K. Hamel, WDOE, pers. comm., 1997).

Watershed Management

Consistent with the lake-watershed approach of integrated aquatic plant management, the Plan also emphasizes watershed management to limit inputs of nutrients and other contaminants to the lake from activities on lakeshore properties. Furthermore, informational meetings can be held dealing with the topics of septic system maintenance and property-owner best management practices. A periodic newsletter, such as what has been produced in the past by the Save Long Lake Association, can carry special supplements on watershed management measures and lake protection.

Program Monitoring and Evaluation

The monitoring/evaluation component consists of at least annual surveying and evaluating effectiveness of in-lake control activities and other program elements. By performing a periodic "checkup" of the lake, appropriate adjustments can be made in the succeeding year's management program to maximize program effectiveness. With so much time, effort and money behind the integrated aquatic plant management program, the importance of an annual program evaluation cannot be over-emphasized. Program results should be evaluated with respect to aquatic plant management objectives set for the lake, and produced into a written report. The following offers some guidelines for evaluating progress of the program in achieving major management goals.

Major Goal:

To enhance water quality and beneficial uses of the lake. This will be accomplished by appropriate use of nuisance macrophyte control actions and watershed management practices recommended in the Plan. Success in achieving this goal can be measured quantitatively by annual aquatic plant surveys and regular monitoring of water quality parameters (e.g., nitrogen and phosphorus levels, water transparency, dissolved oxygen, pH). These data can be compared to pre-existent data collected by

limnologists in diagnostic studies (e.g., WATER Environmental Services, University of Washington, and Entranco Engineers). With the assistance of State and tribal fisheries scientists, the condition and health of salmonids and planted trout and spiny-ray species can be assessed in the lake. An additional measure of project success can be supplied through results of an annual opinion survey of lake residents regarding major program goals. Finally, continual tracking of project status and careful review of annual surveys and study results by the Steering Committee is crucial in the evaluation process.

Major Goal:

To aggressively remove noxious Brazilian elodea and Eurasian watermilfoil populations from all known locations in the lake. As discussed earlier, accomplishment of this goal will take aggressive, persistent, long-term efforts. To get a quantitative handle to measure progress on this goal, type and extent of aquatic plants need to be assessed from year to year. Aquatic plant mapping similar to the procedure performed during summer of 1996 should be continued for at least 5 years of the program. During the early summer season, community composition and areal estimates of aquatic plant beds should be made, as well as collection of plant biomass samples at pre-existing survey transects around the lake. These surveys should be supplemented with results of volunteer surveillance as described above. A detailed evaluation report should be prepared including this comparative data, particularly as it relates to the 1996 pre-treatment survey results. Costs for aquatic plant mapping and biomass measures are estimated to be about $3000/year.

Major Goal:

To keep priority areas, the boat launch and selected shoreline residential areas clear of surfacing plants for boating and swimming safety reasons. Nuisance growth of Brazilian elodea, Eurasian watermilfoil, purple loosestrife and waterlilies to a lesser extent, are the main concern in the shallow nearshore areas of Long Lake where swimming and boating occurs. Brazilian elodea should be maximally affected by the first year SONAR treatment. The other plants may be incidentally affected by SONAR application in year 1 (e.g., pondweed beds). Annual, incremental treatment of purple loosestrife around the entire lakeshore and spot treatment of troublesome waterlily areas with systemic herbicide, RODEO, should effect desired reductions in these nuisance species. From year three on, small-scale treatments of shoreline beds of nuisance plants may be necessary, employing hand-pulling (limited) and placement of bottom barriers. Success of these measures can be evaluated quantitatively in terms of the annual aquatic plant mapping results described above. An additional measure of success can be supplied through results of an annual opinion survey of lake residents regarding degree of shoreline obstruction by aquatic plants.

Major Goal:

To maintain sufficient habitat for fish and wildlife. While fluridone applications can be made in a way to maximize selectivity for Brazilian elodea and Eurasian watermilfoil, non-target plants may be variably affected. Thus, declines in plant bed area may be most apparent in year 3 (following year-one and smaller year two herbicide treatment, if needed). Succeeding years should see nuisance plant populations replaced by native species (e.g., low-stature macroalgae), and continued maintenance of habitat for fish and wildlife. Additionally, the strategic positioning of structures like logs and cement blocks along the lake bottom will provide artificial habitat/refuge for salmonids, trout and spiny-ray fish, if necessary. The annual macrophyte survey will provide plant community composition, areal coverage, and biomass estimates, generating a useful means to gage achievement of this goal.

Major Goal:

To complement concurrent watershed management program activities to reduce input of nutrients/contaminants to the lake. This goal can be achieved through an active public outreach/education program on lake protection consisting of workshops, newsletters, or printed or videotaped educational materials made available to the lake community. Use of best management practices (BMP's) by lakeshore property owners, such as environmentally friendly fertilizers, vegetative shoreline buffers, compost bins set well back of shoreline are obvious indicators of a property-owner's dedication to lake protection.

Project Costs

At an average cost for materials and application by private contractor of roughly $1300/acre, first year costs for a large-scale application of SONAR (230 acres) is estimated to be as much as $321,000 (Table K-1). Treatment of nuisance shoreline emergent stands (e.g., purple loosestrife, waterlily areas around docks) with systemic herbicide RODEO is estimated to cost $6000 for up to 20 acres. and Annual aquatic plant survey costs are estimated to be $3000. Annual monitoring costs for a consulting limnologist/engineer to evaluate carry-over effectiveness in the lake are projected to be $3,000. It is anticipated that the prevention component would be mainly a volunteer effort, with negligible expenses. Overall **first-year program costs** for this scenario are estimated to be upwards of **$321,000**, including permitting and any required environmental assessment. The bulk of expenses for this scenario would most likely occur in the first two years with the large-scale SONAR treatment being the big expense item. However, successive annual project costs should decline to below **$25,000 in year three, including possible mitigation of damaged downstream/in-lake native plants, and approximately $15,000 in year five.** Program costs could increase significantly in either of the last two years if a large-scale alum treatment is required to combat significant blue-green algal blooms in the lake.

Table K-1
Estimated Costs For Implementation of Long Lake IAVMP

Treatment Scenarios	*Program Elements	** Costs (est) First Year	** Costs (est) Second Year	** Costs (est) Third Year	** Costs (est) Fourth Year	** Costs (est) Fifth Year
Intensive Programs						
E-1 Systemic Herbicide	*Macrophyte survey/biomass*	$3,000	$3,000	$3,000	$3,000	$3,000
large-scale	•SONAR(fluridone) applic	$300,000	$150,000	$0	$0	$0
	•RODEO(glyphosate)	$6,000	$3,000	$0	$0	$0
w/intensive small-scale	•Mitigation-habitat, if needed	$0	$0	$5,000	$0	$0
treatments around lake	•Downstream veg surv	volunteer	volunteer	volunteer	volunteer	volunteer
	•Permitting/(checklist)	$5,000	$1,000	$1,000	$1,000	$1,000
	•Small-scale treatment					
	(physical/mechanical)	$0	$13,000	$13,000	$13,000	$13,000
	•Public Ed/Noxious Weed Prev	$2000+volun	$2000+volun	$2000+volun	$2000+volun	$2000+volun
	•Program Monitor/Eval					
	w/ Steering Committee	$5000+volun	$5000+volun	$3000+volun	$3000+volun	$3000+volun
	•Alum treatment-whole lake	-	-	-	$290,000	-
ANNUAL TOTALS		$321,000	$177,000	$27,000	$312,000	$22,000
PROJECT TOTAL						$859,000

* Program elements common to all Scenarios are italicized

** Cost are projections based on contractors' current estimates.

Plan Implementation and Funding

Financing IAPMP Plan Implementation

As indicated above, the recommended alternative for aquatic plant management in Long Lake involves a combination of (1) herbicide treatments, (2) follow-up with hand and mechanical removal and bottom barriers to prevent re-infestation, (3) public awareness/noxious weed prevention program, and (4) monitoring program to evaluate effectiveness, and (5) watershed management program. Costs for a minimum five-year integrated lake management program on Long Lake are projected to be $859,000. A combination of grant funding, loan procurement, and local revenue is proposed to fund implementation of the Long Lake IAVMP over at least five years. In order for plan implementation to be successful, the Save Long Lake Association and Kitsap County will continue communicating throughout the plan implementation period with the Suquamish Tribe, the Washington State Department of Fish and Wildlife, the Washington State Department of Ecology, other permitting agencies, the contracted businesses, and other interested parties.

Grant Funding

The Long Lake IAVMP was developed under an Aquatic Weeds Management Fund (AWMF) planning grant from the Washington State Department of Ecology (Ecology). The grant provided 75 percent of the funding; Kitsap County and Save Long Lake Association (SLLA) have provided the remaining 25 percent via cash, staff time and in-kind volunteer services. If a residual balance remains in the current AWMF planning grant after

completion, it will be applied toward expenses of the implementation phase commencing no earlier than 1998.

Kitsap County will also apply for an AWMF implementation grant total of $75,000 (State match) during the next grant application period (currently in suspense, but anticipated re-instatement by 1998). If the grant is awarded, plan implementation would continue in 1999 with SLLA contributing local matching funds and in-kind services. The grant would fund up to 75 percent of the costs of implementing the Long Lake IAVMP with the SLLA funding the remaining 25 percent. It is critical that the local match be secured or guaranteed at the time application for Ecology grant monies is made to be considered in the competitive rating process.

State SRF Loan Funding

Loan funding is another financing avenue being considered by the County/SLLA to be combined with new AWMF moneys and community-generated revenue to permit full implementation of the long-term IAVMP. It is recommended that Kitsap County/SLLA investigate applying for a no-interest loan for at least $200,000 through the State Revolving Fund (SRF) Program administered by Ecology. State funds along with locally generated funds will ensure completion of the costly first year of the Program.

Local Funding Commitment

Local funding for the Long Lake implementation project can be generated by special assessment on Long Lake property owners. This can take the form of a lake management district (LMD), a special district, or a watershed management area under the county storm drainage utility. The SLLA has already demonstrated experience and commitment in establishing a special taxing district in the form of an LMD to provide local funding for this Ecology AWMF Planning Grant. Additional special district financing will be necessary to combine with State grant and loan funds to cover full costs of this aggressive lake management scenario. If the community can repay an annual amount of $40,000 toward a secured SRF loan for the five years beginning the year after completion of the 5-year program, the low interest costs (currently 5%) can also be avoided. However, without securing all these sources of funding, the integrated management program for Long Lake could continue, but in a significantly scaled back form, most likely jeopardizing long-term effectiveness.

Implementation of E-1 Scenario Requires All Sources of Funding

Full implementation of the Long Lake IAVMP is dependent on a number of financing factors including: (1) success of AWMF implementation grant application, (2) success of SRF loan application, and (3) formation of appropriate taxing district or management area, or other local funding mechanism to insure local match.

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Appendix A
Long Lake Workshop and Steering Committee Meeting Notes, Citizen Letters and Newsletters

Long Lake IAVMP Steering Committee Members:

1. Long Lake Community 4477 SE Firmont Dr. Port Orchard, WA 98366	Contact: Phone:	Scott Sandin 360-871-0211
3800 Sunny Slope Rd Port Orchard, WA 98366	Contact: Phone:	Bill Barron 360-674-2778
4532 Westway Dr. SE Port Orchard, WA 98366	Contact: Phone:	Jerry Johnson 360-871-4569
3720 163rd Place SE Bellevue, WA 98008	Contact: Phone:	Nick Hoyt 206-562-5184
8783 SE Willock Rd Olalla, WA 98359	Contact: Phone:	Terry Brown 360-871-3689
2. Kitsap County Fair and Parks Dept 1200 NW Fairgrounds Rd Bremerton, WA 98311	Contact: Phone:	Cyndy Holtz 360-895-3895
3. Washington Dept of Ecology Water Quality Financial Assistance P.O. Box 47600 Olympia, WA 98504-7600	Contact: Phone:	Kathy Hamel 360-407-6562
4. Washington Dept of Ecology Northwest Regional Office 3190 160th Ave SE Bellevue, WA 98008-5452	Contact: Phone:	Mary Kautz 206-649-7036
5. Washington State Dept of Fish and Wildlife Inland Fish Division 48 Devonshire Rd Montesano, WA 98563	Contact: Phone:	Bill Freymond 360-753-2600
6. Washington State Dept of Fish and Wildlife Inland Fish Division E121 Lakeway Drive Shelton, WA 98584	Contact: Phone:	Dan Collins 360-426-8285
7. Washington State Dept of Fish and Wildlife Region 6 502 High Street, Suite 110 Port Orchard, WA 98366	Contact: Phone:	Stephan Kalinowski 360-895-3965
8. WATER Environmental Services, Inc. 9515 Windsong Loop NE Bainbridge Island, WA 98110	Contact: Phone:	Maribeth Gibbons 206-842-9382
9. KCM, Inc. 1917 First Avenue Seattle, WA 98101	Contact: Phone:	Harry Gibbons 206-443-3526
Interested organizations 10. Suquamish Indian Tribe P.O. Box 498 Suquamish, WA 98392	Contact: Phone:	Phylis Meyers 360-598-3311

SAVE LONG LAKE ASSOCIATION AND LONG LAKE STEERING COMMITTEE UPDATE, NOVEMBER 1996

NOXIOUS WEEDS PLAGUE LONG LAKE

For some time now, Long Lake has been troubled by nuisance growth of freshwater aquatic plants, primarily the **noxious**, non-native, invasive species, Brazilian elodea (*Egeria densa*), which invaded the lake within the last several decades. Recent identification of pioneering (new) colonies of another **noxious** invasive weed, Eurasian watermilfoil (*Myriophyllum spicatum*), also threatens lake habitat and usage. Thirdly, **noxious** purple loosestrife (*Lythrum salicaria*) has established a menacing presence along mostly undeveloped lakeshore areas. Nuisance growth of these three invaders (listed as Noxious Class B weeds by the State) has resulted in adverse impacts to beneficial uses of Long Lake, particularly swimming, boating and fish habitat.

A PLAN IS BEGUN

Your local grass-roots group, the Save Long Lake Association (SLLA) has been actively working to build support for initiating a long-term aquatic plant management program on the lake, as well as obtain financing for such an effort. A Lake Management District (LMD) was passed in December, 1995 to provide local funds for aquatic weed management. Additionally, the Long Lake community with Kitsap County Fair and Parks Department has received a grant this year from Washington Department of Ecology to develop an Integrated Aquatic Vegetation Management Plan (IAVMP) for the lake. The goal of integrated aquatic vegetation management is to find a remedy to nuisance aquatic plants that is **site-specific, ecologically sensitive, long-term** and **cost-effective**. The IAVM Plan takes into account both the lake and its associated watershed (i.e., the big picture). It allows for multi-directional control and enhancement of a waterbody/watershed. Furthermore, having such an integrated management plan in place will allow the community to then apply for a State-funded implementation grant to help fund execution of the approved plan.

STEERING COMMITTEE FORMED

To guide the Long Lake IAVMP project, a "Steering Committee" was formed, composed of individuals from the lake community, project consultants, local and State resource agencies, and interested groups. The Long Lake Plan is being developed by the Steering Committee following the stepwise format outlined in Ecology's handbook, "A Citizens Manual for Developing Integrated Aquatic Vegetation Management Plans". Project consultants have been working closely with the Steering Committee in drafting the Plan and have met periodically with the Committee since May of this year. Public Workshops have also been planned at strategic points in the project. The first Project Kickoff Workshop held on July 9 was well-attended (for a summer night!). There was very good discussion on the Long Lake IAVMP project goals, aquatic weed problems, management issues, and financing avenues.

LONG LAKE OPINION SURVEY ANSWERS COMPILED

You may recall that a questionnaire had been sent out to all property owners with the last newsletter prepared by SLLA. You were asked to provide opinions on *perceived problems caused by aquatic plants in Long Lake* and *main goals that should be addressed in the Long Lake IAVMP*. Results of 53 respondents have been tallied. The most serious problems caused by aquatic

plants in Long Lake were *poor water quality, unsafe swimming* and *poor quality boating. Removal of all non-native invasive weeds* from the lake was the major management goal cited.

1996 AQUATIC PLANT SURVEY

An aquatic plant survey of Long Lake was conducted during late August, 1996 as part of the IAVMP project. The purpose of the field survey was to collect updated data on lake and plant conditions for use in fine-tuning the Plan. Plant bed composition and extent were mapped, fathometer tracings of the bottom were made, and dry weight plant biomass measurements were performed. Permanent mounted specimens of major plant species in Long Lake were also produced from samples collected during the August, 1996 survey.

Preliminary results of the 1996 survey showed that the noxious (exotic) weed, Brazilian elodea, is the predominant plant species, occurring in moderate to dense stands throughout Long Lake. Noxious Eurasian watermilfoil appeared as scattered colonies in the southern half of the lake, and was not visible in the northern lake portion. Stands of noxious purple loosestrife dotted the entire shoreline of the lake. The native rootless species, coontail (*Ceratophyllum demersum*), was also an important member of the Long lake community, appearing throughout the lake. Other plants, including a few pondweed species and macroalgae forms occurred in scattered pockets throughout the lake. ***WATER***

PLEASE COME TO PUBLIC WORKSHOP II-NOVEMBER 19, 1996, 7:00 PM AT LONG LAKE COUNTY PARK COMMUNITY BUILDING–We will be discussing the status of the developing plan, results of the summer, 1996 aquatic plant survey, and a general review of aquatic plant management techniques available for use in Washington State and their applicability to Long Lake's problems. Your input in this planning process for Long Lake is critical! If you have any questions about this upcoming workshop or the Long Lake IAVMP Project, please contact any of the following members of the Save Long Lake Association:

Scott Sandin	(360)-871-0211
Bill Barron	(360)-674-2778
Nick Hoyt	(206)-562-5184
Terry Brown	(360)-871-3689
Jerry Johnson	(360)-871-4569

Save Long Lake Association/
Kitsap County Fair & Parks
c/o WATER
9515 Windsong Loop NE
Bainbridge Is., WA 98110

SAVE LONG LAKE ASSOCIATION AND LONG LAKE STEERING COMMITTEE UPDATE, MAY 1997

Following a year of development, an Integrated Aquatic Plant Management Plan (IAPMP) for Long Lake is in its final stages of preparation. Critical factors, such as target plant control effectiveness, economic, environmental, political, and site-specific conditions, were carefully evaluated. **Three management strategies** have been identified by the Long Lake Steering Committee as possible action alternatives. These strategies differ in choice of management goals involving target species (noxious species: Brazilian elodea, Eurasian watermilfoil, and purple loosestrife as prime targets, and other, secondary problem plants), scale of control, and associated control intensity. The committee also investigated a scenario involving lakewide or partial lake planting of sterile grass carp to control the noxious weed, Brazilian elodea. However, Department of Fish and Wildlife requirements for inlet/outlet barriers, and agency concerns regarding the lake's importance as a salmonid resource that could affect permitting make this scenario unfeasible at this time. A No Action scenario was discussed as well. Candidate scenarios will be presented to the lake community for selection in a Public Workshop held on May 27, 1997 (See Box below).

All of the treatment scenarios are part of an integrated aquatic plant management program extending over ***at least 5 years*** with review each year. The **first two utilize a main, large-scale treatment option,** supported by other smaller scale options (to cover nooks and crannies missed by large-scale treatment). The **third scenario employs small-scale methods only.** The long-term, integrated management program also includes **other critical elements:** environmental permits & assessment, use restrictions, mitigation of sensitive native plants downstream or in-lake, if needed, public outreach/education program, noxious weed prevention program, program monitoring and effectiveness evaluation (aquatic plant surveys, water quality monitoring, steering committee meetings), watershed management program, implementation and funding plan, and program administration costs.

Management Scenario E-1

The major management goal of this scenario is aggressive removal of Brazilian elodea (BE), Eurasian watermilfoil (EWM), and purple loosestrife (PL) from the lake. The main treatment action is lakewide application of the systemic herbicide, SONAR for use against EWM and BE. First year program costs are estimated at $321,000, with 5-year total costs estimated to be $859,000. Detailed program elements follow.

In-lake Treatments

(Year 1)

- Lakewide Spring **aquatic plant survey**
- **Whole-lake, sequential application** of systemic herbicide fluridone (SONAR) for BE and EWM control
- **Spot treatments** w/systemic herbicide Glyphosate (RODEO) for PL control (shoreline applications, treatment of islands in south end, and treat 100 ft buffer around islands for PL and some waterlily control)

(Year 2)

- **Secondary application** of SONAR mainly in south end (up to 50% lake area), if regrowth of target BE is great (will also hit any residual EWM patches surviving first SONAR treatment)
- **Spot treatments** w/Glyphosate (RODEO) for PL control (shore, islands)

(Year 3), if needed
- **Additional** (SONAR) treatment in 10 acre+ units (up to 25% lake area)

(Year 2-5)
- **Minor treatments around shore** using hand removal, bottom barrier or mini suction dredge
- **Minor treatments**--harvesting lanes in ski/slalom courses in south, if needed

(Year 4-5)
- **Alum treatment** or nutrient inactivation

Management Scenario E-2

The major management **goal** of scenario E-2 is complete removal of late pioneering stage Eurasian watermilfoil in the south end, and aggressive, incremental removal of shoreline purple loosestrife (which may take many years). This scenario uses either a large-scale application of SONAR of between 50-100 acres (much less than whole-lake E-1), and/or bottom barrier placement over target EWM colonies. First year costs for a possible combination of chemical and physical control is $164,000, with costs dropping from $39,000 in year 2 to maintenance costs of $25,000 to $30,000 (using small-scale treatments) in years 3-5. Five-year total program costs are estimated to be $218,000 to $283,000.

In-lake Treatments

(Year 1)
- **Lakewide** Spring aquatic plant survey
- **Large-scale application** of systemic herbicide SONAR in southern part of lake (estimated 50-100 acres coverage) to remove pioneer EWM (will provide incidental control of BE) AND/OR bottom barrier application over EWM colonies (up to 0.5 acre)

(Years 1-5)
- **Spot treatments** w/Glyphosate (RODEO) for PL control (shores, islands)

(Year 2-5)
- **Minor treatments** using hand removal and bottom barrier and/or suction dredge for problem areas of EWM regrowth around lake
- **Minor treatments**--harvesting lanes in ski/slalom courses in south , if needed

Management Scenario M-3

The major management **goal** of Scenario M-3 is localized physical/mechanical/chemical control of nuisance non-native and native aquatic plant growth around shorelines only, up to 20 acres annually. The combination of methods includes small-scale plant removal, such as possible bottom barrier placement (up to 1/4 acre), hand digging, mechanical harvesting or Aquathol use (contact herbicide) in ski lanes, or herbicide treatment (e.g., use of systemic RODEO for problem waterlilies and loosestrife). First year program costs are projected to be as much as $33,000, with 5-year total costs upwards of $129,500. Detailed program elements are described below.

In-lake Treatments

- **Lakewide** Spring aquatic plant survey

(Year 1-5)
- **Minor treatments** using hand removal and bottom barrier and/or diver-suction dredge along shoreline docks, boat launches, beaches, for purple loosestrife/other nuisance weeds
- **Spot treatments** in waterlily/EWM/BE beds using herbicides: Glyphosate (RODEO), fluridone (SONAR) or Endothall (AQUATHOL)-to clear ski/slalom lanes at south end, if needed

PLEASE COME TO PUBLIC **WORKSHOP III-MAY 27, 1997, 7:00 PM AT LONG LAKE COUNTY PARK COMMUNITY BUILDING**--The three management scenario options for Long Lake will be presented to the lake community for the purpose of choosing a preferred option. Your input in this planning process for Long Lake is critical! If you have questions about the upcoming workshop or the Long Lake IAVMP Project, please contact any of the following members of Save Long Lake Assoc:

Scott Sandin	(360)-871-0211
Bill Barron	(360)-674-2778
Nick Hoyt	(206)-562-5184
Terry Brown	(360)-871-3689
Jerry Johnson	(360)-871-4569

HOW DID WE COME UP WITH THE RECOMMENDED OPTIONS?

Over the last 12 months the Long Lake Steering Committee looked at all the viable options to rid Long Lake of its Non-Native Invasive weeds. The attached newsletter, written by Long Lakes' Aquatic Weed Consultant, identifies 3 options for Long Lake, each one very different in approach, outcome and cost. Please read each one carefully, indicate your choice below and return this page to us as soon as possible. Your vote is very important.

Previous surveys of Long Lake residents showed that Whole Lake Dredging and Grass Carp were the most popular options among residents. Knowing this we looked at these options very carefully. Early on, it was decided that Dredging, although the most permanent solution, was too expensive (in the millions). Grass Carp was the least expensive option and the one that Long Lake residents on the steering committee favored the most. We intensely conferred with the Department of Fish and Wildlife that we should be able to stock the lake with Grass Carp. Unfortunately, the Department of Fish and Wildlife have ruled out planting Grass Carp in Long Lake as a viable option. The reason has to do with the possible negative impact on the Salmon run that passes through and uses Long Lake.

The good news is that a low impact herbicide called Sonar appears to be very effective against our problem weeds. The Department of Fish and Wildlife and the Department of Ecology will very likely allow us to treat the lake with this widely used and agency approved herbicide.

THE STEERING COMMITTEE FAVORS OPTION E-1.

The overall goal for Long Lake is to eradicate all the non-native invasive weeds. Only Option E-1 targets this. The Steering Committee members signed below favor Option E-1 assuming it can be made affordable for Long Lake. This option has a high probability of removing the target non-native weeds from the lake permanently if the proposed treatment is followed.

Bill Barron Terry Brown Nick Hoyt Jerry Johnson Scott Sandin

WHO PAYS FOR TREATMENT IF WE AGREE ON AN OPTION?

Since Long Lake is a public lake used by thousands of people every summer it only makes sense that treatment cost be spread out among all lake users. Fortunately there is a Non-Profit association, Citizens for Preservation of Kitsap County Lakes (CPKCL) lobbying in our behalf for a county-wide lakes management program.

In February, the County Commissioners listened as CPKCL unveiled a no-nonsense Lakes Management Program. The program would clean-up and manage all public lakes in Kitsap County using existing tax money already collected for the Surface and Storm Water Management Program. We estimate the entire program would need about $5 a year of the $45 a year per household the county is now collecting. If CPKCL is successful Long Lake could begin weed removal as early as 1998.

PLEASE CIRCLE YOUR CHOICE BELOW AND MAIL THIS BACK TODAY.

Option E-1:	Whole lake herbicide treatment to eradicate all Non-Native Invasive Weeds
Option E-2:	Eurasian Watermilfoil eradication only (about 12% of the weeds)
Option M-3:	Weed removal in high use areas only (about 6% of the weeds)
Option 4:	No action

Note: Your vote indicates your preferred treatment Option and does not mean you agree with the cost of the treatment or to pay for any treatment whatsoever. We are going to ask the County Commissioners to support a county wide lakes program that would pay for this treatment out of existing tax dollars as mentioned above.

Long Lake Integrated Aquatic Vegetation Management Plan (IAVMP) Project
First Steering Committee Meeting

DATE: May 29, 1996
TIME: 4:00-6:00 pm
PLACE: Kitsap County Fair & Parks Department
Bremerton, WA

AGENDA

1.	Introductions	4:00-4:10 pm
2.	Project Overview	4:10-4:30 pm
3.	Review of Steps for Developing an IAVMP; Steering Committee Member Comments on Problem Statement, Management Goals, and Long Lake Beneficial Uses/Zones	4:30-5:30 pm
4.	Field Work: Schedule and Volunteers	5:30-5:40 pm
5.	Schedule Next Meeting: Steering Comm Mtg #2 First Workshop	5:40-5:50 pm
6.	Adjourn	5:50-6:00 pm

Long Lake IAVMP Project First Steering Committee Meeting Notes
May 29, 1996, 4:00 to 6:00 pm, Kitsap County Fair & Parks Office

Maribeth Gibbons (WATER Env. Svc., Inc.) and **Harry Gibbons** (KCM, Inc.), project consultants, welcomed everyone in attendance to the first Steering Committee Meeting for the Long Lake IAVMP Project. The Long Lake IAVMP Project is being funded through a Department of Ecology Aquatic Weeds Management Fund (AWMF) Grant.

Steering Committee members introduced themselves. **Kathy Hamel** oversees the Freshwater Aquatic Weeds Management Program for the Washington Department of Ecology, and is Ecology's project manager for the Long Lake IAVMP Project. **Cyndy Holtz** is Director of Kitsap County Fair & Parks, which is the local sponsor of the Long Lake IAVMP Project. The Long Lake community was represented by **Scott Sandin, Bill Barron, Jerry Johnson, Nick Hoyt,** and **Terry Brown. Stephan Kalinowski** from the Washington Department of Fish and Wildlife was also in attendance.

Maribeth presented an **overview of the Long Lake IAVMP Project** and the tasks for which the project consultants are responsible. The project goal is for the Long Lake community, Kitsap County Fair & Parks, WATER and KCM to work cooperatively to develop an Integrated Aquatic Vegetation Management Plan for Long Lake that balances recreational, water quality and fish/wildlife habitat. WATER is responsible for three project tasks. Task 1 is development of the draft and final versions of the Long Lake IAVMP. Task 2 consists of holding five steering committee meetings and three public workshops as part of public involvement to solicit input, comments and review of the developing plan. Task 3 consists of an aquatic plant survey that will be conducted by the project consultants with assistance from volunteers during the summer, 1996, and a lake sediment coring instruction for volunteers to further sample their lake. The aquatic plant survey not only includes mapping plant zones in the lake, but also collection of quantitative plant biomass samples and production of archival plant voucher specimens of major species occurring in the lake. The importance of producing permanent plant voucher specimens for Long Lake and filing these with the Department of Ecology was discussed.

Harry next reviewed the **eleven steps** to be followed in designing an integrated aquatic plant management plan (as described in the *Citizens Manual for Developing Integrated Aquatic Vegetation Management Plans*). He emphasized that the Public Involvement Step (Step C) is really the hub of the planning process, and that the Steering Committee represents the larger community and is responsible for steering this planning process.

Maribeth then led a discussion of a **preliminary workup of Step A (Develop the Problem Statement), Step B (Identify Management Goals), and Step E (Identify Waterbody Use Areas)**. She and Harry emphasized that aquatic plants are important components of a freshwater system like Long Lake and that there is a fine balance between macroscopic (large) aquatic plants and microscopic algae.

Regarding the **Problem Statement,** Maribeth noted that the most serious problems in Long Lake were the presence of three Class B noxious plant species, Brazilian elodea, Eurasian watermilfoil, and purple loosestrife. Recreational and wildlife/habitat problems associated with these weeds should head the list in developing the Problem Statement. Scott and Bill noted that Brazilian elodea growth in the lake was by far the worst of the three, although purple loosestrife was also threatening shoreline areas, and that milfoil growth was patchier and less dense. Harry noted that we would have a better handle on the extent of these weed species (and other plants) after the aquatic plant survey was completed later this summer.

The committee next discussed the kind and quality of the **fishery** in Long Lake and possible effects of aquatic plants. Cuttroat trout and migrating salmonids are currently present in the Long Lake system. Sockeye salmon are not believed to be present in Long Lake. Stephan (Fish & Wildlife Habitat Specialist) reported that there were over 100,000 spiny-rays present in the lake. He stated that bass and bullheads were generally considered to be healthy, and probably not as affected by the current dense vegetation in the lake compared to human use impacts. Bill noted that the future of the lake rested in maintaining a balance between pristine habitat conditions and human recreational use. He also noted that in areas of the lake the sheer mass of the weeds often made fishing difficult. Also, proper presentation of lures to the fish was hampered by dense weed beds. Both Scott and Bill observed that waterlilies in the south end are not perceived to be as much a problem as aquatic plant growth in other sections of the lake.

The question of possible use of sterile grass carp as an aquatic plant biocontrol in Long Lake was touched on only (as actual methods won't be examined until later in the planning process). Stephan didn't foresee the use of grass carp being allowed in Long Lake, but did note that Washington Department of Fish and Wildlife did not yet have a long-term policy on small lakes.

Bill and Scott explained that many people have different perceptions of what the problems are in Long Lake, and that it will be important to isolate for planning purposes ***aquatic weed problem perceptions*** from ***other lake problems*** (like bulkheads). For example, because of increased sedimentation over the years, the condition of Curley Creek outlet is considered a problem, but really is **not** an aquatic plant problem per se. Swimmers itch (due to snails acting as vectors for the parasites) is a health problem that occurs in Long Lake that can be associated with aquatic plant growth. To avoid confusion up front, Scott suggested that the very first part of the plan should identify what problems are NOT included in development of the IAVMP.

Discussion continued on the topic of sedimentation in the lake and effects on the fishery. It was noted that spawning of cold water fish did not occur in sedimented areas of the lake. In addition, because of the very shallow nature of Long Lake, water temperatures were generally too high to allow spawning.

Maribeth then asked if anyone on the committee was aware if any ***sensitive plant communities or wildlife species*** were present at Long Lake, since this is an important aspect to consider in the planning process. Long Lake community steering committee members identified bald eagles and osprey living in the vicinity of Long Lake and utilizing the lake, and Stephan indicated that there was even a Virginia reel observed in the south end of the lake. Maribeth informed the committee that as part of the plan, she would be contacting the Washington Departments of Natural Resources and Fish and Wildlife to check their data bases for rare and sensitive plants and animals in the Long Lake watershed.

The Committee then moved on to discuss **Aquatic Plant Management Goals for Long Lake (Step B of the IAVMP)** to maximize beneficial uses within the natural capacity of the lake. Maribeth instructed that it was important to distinguish between management goals and management methods. Goals are conditions in the lake that the community would like to achieve, and methods are the means of accomplishing those goals.

The Long Lake community members, led by Scott and Bill, looked first at deciding on intensity of control of the three noxious weeds present in the lake. Primary goals initially identified are to **eradicate** milfoil and loosestrife from the lake if possible, and to **aggressively control** the widespread Brazilian elodea infestation in the lake, perhaps concentrating on high use areas. Next, the deep central area and the park beach were identified as **priority zones** that should be kept clear of aquatic plants. Scott and Bill pointed out that there were a few areas used in the

south end as **boat slalom courses** that should be targeted for control, such as creating lanes amongst the waterlilies.

The issue of **long-term funding** of aquatic plant management in Long Lake was next considered. Discussion centered on the recent Lake Management District (LMD) voted on specifically to fund the current aquatic plant management planning activities on Long Lake. Generally, LMD's can extend up to 10 years. Kathy noted that the community would have the chance to compete for implementation funds through Ecology's AWMF Program to finance some of the immediate control measures that came out of the IAVM Plan, but that the community would have to consider additional funding (private and/or public) mechanisms to keep necessary management activities going. It is important to note that the ultimate aim of the Plan is, after initial intensive treatment costs, to eventually decrease management costs to a low sustainable level. Kathy explained that if the community was to apply for implementation funds through Ecology, they would need a sponsor, like the County, a Water District, Conservation District, or County Weed Board (Kitsap doesn't have one currently). Cyndy observed that while Kitsap County Fair & Parks was currently sponsoring this Ecology-funded Planning project, the Public Works Department would probably be the appropriate sponsor for any future publicly funded projects on the lake. Kathy informed the committee of the existence of a West side Noxious Weed Coordinator operating through the Washington Department of Fish and Wildlife. An East side coordinator, Marty Genrich, also has been appointed. She would obtain the Western coordinator's name by the next steering committee meeting.

The committee then reviewed and offered comments on a preliminary **Lake Use Zone map** for Long Lake (Step E) developed by Maribeth as part of the Plan. Scott and Bill offered to continue working on the map, providing more details and sending the revised version back to Maribeth before the First Workshop on July 9.

Lastly, the committee decided that the **First Public Workshop** to kick off the project should be held on July 9 (7-9 pm) at the Long Lake Community Center. It was also agreed that the **next Steering Committee Meeting** should be held on July 23 at the Long Lake Community Center, followed by a soil coring demonstration by Harry on the lake. Scott suggested that advance notice of these meetings and workshops be sent out to all Long Lake property owners in a separate mailing. He would work with the County on this. Also, he would try to get the local newspaper to run a short announcement.

LONG LAKE STEERING COMM MTG
5/29/96
SIGN IN

NAME	AFFILIATION	PHONE
Kathy Hamel	Ecology	407-6562
Tony [illegible]	Save Long Lake	871-5689
Jerry Johnson	Long Lake	871-4569
Harry Gibbons	KCM	206/443-3526
Maribeth Gibbons	WATER ENVIR SVCS.	206) 842-9382
Bill Barron	Save Long Lake	(360)674-2776
Cyndy Wolf	K.C. Fair & Parks	(360) 895-3895
Phil [illegible]	LONG LAKE	(206)562-5184
Stephan A. Kalinowski	WDFW	360-895-3965
Scott S. Jenkins	Long Lake	360-871-0011

Long Lake Integrated Aquatic Vegetation Management Plan (IAVMP) Project
Project Kickoff Workshop I

DATE:	July 9, 1996
TIME:	7:00-9:00 pm
PLACE:	Long Lake Community Center
PRESENTED BY:	Kitsap County Fair & Parks Long Lake Community WATER Environmental Services, Inc. & KCM, Inc.

AGENDA

1. Introduction
2. Review of Long Lake Community Aquatic Plant Management Efforts to Date
3. Long Lake IAVMP Project Overview
4. Review of Steps for Developing an IAVMP in Washington State
5. Update on IAVMP Project Progress To Date
   Review Draft Problem Statement, Management Goals, and Long Lake Beneficial Uses/Zones
6. Upcoming Field Work: Aquatic Plant Survey and Sediment Coring/Sampling Demonstration
7. Adjourn

LONG LAKE IAVMP PRELIMINARY WORKUP OF PLANNING STEPS

Step A. Develop Problem Statement.

This step involves developing a realistic problem statement describing limitations imposed by **problem aquatic plant growth** on beneficial uses of the lake. There may be other perceived problems in the lake, e.g., water quality problems, physical problems with bulkheads, silting in of shallow areas. Other types of State-funded management investigations like Ecology's Lake Restoration/Feasibility Study (Phase I, II) deal with identification and possible correction of water quality problems in eligible lakes. The IAVMP, funded by an Ecology Program called Aquatic Weeds Management Fund (AWMF), specifically looks at aquatic plant problems in the lake. Since the IAVMP process attempts to look at the "big picture" to design unique aquatic plant management solutions, other significant problems are usually noted in the background section, Step D (Describe Waterbody/Watershed Features) and may affect specific aquatic plant management decisions.

Long Lake Draft Aquatic Plant "Problems"

- Invasion by **noxious, non-native invasive** species--weed species
  - Brazilian elodea (*Egeria densa*)
  - Eurasian watermilfoil (*Myriophyllum spicatum* L.)
  - Purple Loosestrife (*Lythrum salicaria*)
- Detrimental to **habitat/wildlife**
  - displace native vegetation
  - affect waterfowl/wildlife usage
- Degrade **recreational use**
  - fishing area/quality
  - swimming
  - aesthetic enjoyment
  - rowing, boating, slalom courses
- Decrease **lake volume**/water quantity
- **Safety hazard** to swimmers, waders
- Other **native plant problems**
  - dense **waterlilies** in shallows affect certain recreational uses

Step B. Define Management Goals.

The next step is to identify **reasonable** management goals that maximize beneficial uses of the water body, yet are compatible with the water body's capacity to meet human needs. In developing realistic management goals, it's important to distinguish between *management goals* and *management methods*. Goals are conditions in the lake or funding or management actions that the community wants to achieve and the methods are the means of attaining those conditions. (Actual treatment methods are examined later in Step H of the planning process).

Long Lake Draft Aquatic Plant Management Goals:

- Seek to **balance** recreational uses/habitat/water quality in a cost-effective, environmentally sensitive way acceptable to the larger community
- Determine **degree of removal of non-native, noxious,invasive** plant species
  - –**Eurasian watermilfoil**-goal for intensive removal throughout lake
  - –**Purple loosestrife**-goal for intensive removal throughout lake
  - –**Brazilian elodea**-goal for intensive removal in high priority zones
- Identify **priority areas** in lake to be kept clear of all plants
  - –deep central area of lake
  - –park beach/launch
- Regularly **monitor effectiveness** of control program; make modifications, if needed
- Preserve **special habitat** around lake
- Seek to develop **long-term funding sources**
- Utilize **volunteer effort** where possible

LONG LAKE IAVMP

7/9/96 WORKSHOP I SIGN UP

NAME	ADDRESS	PHONE
WANDA MEDINA	7555 Clover Valley	871-3675
Muriel Hewitt	7129 Clover Valley Rd SE	871-6369
Keith Hewitt	7129 Clover Valley Rd SE	
Rick Kratsch	6425 Clover Valley RD	871-6440
David Kratsch	6425 Clover Valley Rd	871-6440
J. Maddox	7134 Long Lake Rd SE	
Marilyn Anderson	5569 S.E. Sedgwick	871-1551
Ed Anderson	" " "	" "
Nick Hoyt	3270 163rd Pl. SE. Bellevue	(206)562-5184
Jerry Johnson	4532 Westview Dr SE P.O.	871-4569
Marian Gerber	5720 Long Lake Rd SE P.O. 11841-10th Ave S. Seattle Wa	871-7290 242-7778
Molly Pickard	7564 Long Lake Rd. S.E	871-5322
Kimberly Waterman	7846 Long Lake Rd SE	871-0852
Larry & Sharon Zuba	4629 SE. Mullenix	876-5642
Robert Rieger	8582 Long Lake	871 1005
Bill Oliver	5901 Long Lake	871-0466

Long Lake Integrated Aquatic Vegetation Management Plan (IAVMP) Project
Second Steering Committee Meeting

DATE: July 23, 1996
TIME: 4:00-6:00 pm
PLACE: Long Lake Community Center
Port Orchard, WA

AGENDA

1. Review of Results of First Public Workshop held July 9, 1996

2. Additional Steering Committee Member Comments on Long Lake Problem Statement, Management Goals, and Beneficial Uses/Zones

3. Project Update

4. Upcoming Field Work
   Aquatic Plant Survey to be conducted in late August
   Review Consultant and Volunteer Survey Protocol

5. Schedule Next Meeting: Steering Comm Mtg #3
   Second Public Workshop

6. Adjourn

(Meeting immediately followed by demonstration of lake sediment coring technique to be used by volunteers during a supplemental summer sampling program.)

Long Lake IAVMP Project Second Steering Committee Meeting Notes
July 23, 1996, 4:00 to 6:00 pm, Long Lake Community Center

Maribeth Gibbons (WATER Env. Svc., Inc.) and **Harry Gibbons** (KCM, Inc.), project consultants, welcomed everyone in attendance to the Second Steering Committee Meeting for the Long Lake IAVMP Project. The Long Lake IAVMP Project is being funded through a Department of Ecology Aquatic Weeds Management Fund (AWMF) Grant.

Including Maribeth and Harry, other Long Lake Steering Committee members in attendance were: **Mary Kautz** (Washington Department of Ecology, Northwest Regional Office) and Long Lake community members, **Scott Sandin, Bill Barron, Jerry Johnson, Nick Hoyt,** and **Wendy Clark. Kathy Hamel** (Washington Department of Ecology) and **Cyndy Holtz** (Director of Kitsap County Fair & Parks) were unable to attend.

Maribeth presented an **overview of results of the First Public Workshop of Long Lake IAVMP Project** which was held on July 9, 1996 in the Long Lake Community Center. This workshop provided a chance to explain the Long Lake IAVMP Project, and go over the preliminary write-up of Steps A (Develop Problem Statement), B (Identify Management Goals) and E (Identify Waterbody Usage Areas) of the draft Plan that the Committee had prepared at the First Steering Committee Meeting. Turnout for the Workshop on a summer weekday evening was considered good with over 20 people present. There was good discussion on the historical and current water quality problems in Long Lake, general costs of some management techniques, and public and private funding sources available. It was noted by one of the Steering Committee members attending the workshop that he thought the public wanted to hear more about methods. Maribeth and Harry explained that this is a topic that will be discussed more at the next (Second) Workshop. Also several committee members advised that at the next Workshop the consultants should stress to the Long Lake community that having a Plan in place is necessary for the next logical step for management action (i.e., to qualify for implementation funds through Ecology's AWMF Program), to obtain required permits and because doing so makes sense.

Maribeth then asked for Steering Committee Member **comments on the three draft Plan Steps** A, B and E that were presented to the committee at the First Steering Committee Meeting. It was recommended that the Goal Statement include ***prevention of the spread of Brazilian elodea***. No other additional comments were presented on the other two Steps.

Maribeth then gave a **status report on the Long Lake IAVMP Project** with a preview of upcoming milestones. In particular, she explained that the whole lake **aquatic plant survey** would be conducted by the project consultants with assistance from volunteers during the last week of August, 1996. The aquatic plant survey would not only include mapping plant zones in the lake, but also collection of quantitative plant biomass samples, and production of archival plant voucher specimens of major species occurring in the lake. The importance of producing permanent plant voucher specimens for Long Lake and filing these with the Department of Ecology was discussed. Bill and Scott noted that a purple loosestrife map had been produced a year or two ago identifying locations of this noxious weed around Long Lake shoreline, and was submitted to the Washington Department of Agriculture. It was recommended that WDA be contacted to get a copy of this map for the present IAVMP project.

Bill and Scott advised the committee that **earlier studies of Long Lake** prior to drawdown had been conducted in mid-1970's by Entranco Engineers and University of Washington, and suggested acquiring the reports if possible from these sources or Kitsap County Dept of Community Development (Jim Swanson) or Dept of Fair & Parks (Larry Cote). All the Long Lake community members on the Committee agreed that a lot of negative attitudes exist

regarding previous studies done on Long Lake to date. They wanted the consultants to know what they would be up against ahead of time so that they could respond to these issues.

The Long Lake Community had previously sent out a questionnaire to property owners to get opinions on perceived *problems caused by aquatic plants in Long Lake,* as well as *main goals that should be addressed in the Long Lake IAVMP.* The results of the survey that had been received to date, including a summary of common comments, were summarized and presented to the Committee for review and discussion. The most serious problems caused by aquatic plants in Long Lake appeared to be poor water quality and unsafe swimming conditions. The major management goal cited was to remove all non-native invasive weeds from the lake.

The committee decided that the **Second Public Workshop** should be held on November 19 (7-9 pm) at the Long Lake Community Center with the purpose of summarizing the status of the project following the macrophyte survey. It was agreed that the **Third Steering Committee Meeting** should be held prior to this Workshop on October 29 from 4-6 pm at the Kitsap County Fair & Parks Building. The members asked that a project summary newsletter be prepared by the consultants for review by the date of the 3rd Steering Committee Meeting, so that it could be mailed to all property owners two weeks before the Second Workshop date.

The Second Long Lake Steering Committee Meeting ended with a **soil coring demonstration** by Harry on the lake. A soil coring project on Long Lake was to be conducted by an Eagle Scout volunteer with assistance from other scouts in order to earn a badge. It was suggested that sediment coring sites on the lake should coincide with macrophyte survey transects established by WATER. The Eagle scout was to be in attendance at this lakeside demonstration by Harry, but unfortunately he didn't make it. Harry was able to show members of the Steering Committee who lived on Long Lake so that they could later demonstrate the technique to the Eagle Scout. Harry left the sediment coring devise with Bill Barron for this purpose.

LONG LK STEERING COMMITTEE MTG

7/23/96

SIGN-IN

NAME	ADDRESS	PHONE
MARIBETH GIBBONS	WATER ENV. SERV. 9515 WILLOWS ONG CP NE	(206) 842.9382
Mary Faute	NW-ECOLOGY 3270 163RD PL. SE. BELLEVUE	(206) 562-5184
NICK HOYT	4477 SE FIRMONT DR PORT ORCHARD, WA 98366	(360) 871-0211
SCOTT SANDIN	3866 Sunnystope Rd SW Port Orchard 98366	360/674-2775
Bill Barron	KCM 1917 1st Avenue, [illegible]	206/443-3526
Harry Gibbons	4532 Westlake Dr. SE [illegible]	[illegible]
Jerry Johnson	4477 SE Firmont	(Same as Scott)
Wendy Clark		
KATHY HAMEL } COULD NOT ATTEND		
CINDY HOLTZ }		

Citizen Questionnaire for Long Lake's Integrated Aquatic Vegetation Management Plan

Please give us your opinion for each "possible problem" that you feel may be caused by, or exaggerated by, non-native weeds and/or aquatic plants.

If you feel the non-native weeds and/or aquatic plants are not affecting the possible problem then please circle the "not a problem" response.

Possible Problem	In my opinion this possible problem is…			
unsafe swimming	serious	needs attention	not a problem	not sure
poor quality fishing	serious	needs attention	not a problem	not sure
poor quality boating	serious	needs attention	not a problem	not sure
poor water quality/bad color	serious	needs attention	not a problem	not sure
lower property value	serious	needs attention	not a problem	not sure
high winter water levels	serious	needs attention	not a problem	not sure
usable lake area shrinking	serious	needs attention	not a problem	not sure
other	serious	needs attention	not a problem	not sure
other	serious	needs attention	not a problem	not sure

What do you feel should be the main goals of Long Lake's IAVMP?

I feel the IAVMP should address…	How high a priority is this goal.			
removing all of non-native invasive weeds	high	low	do nothing	not sure
reducing the quantity of lily pads at south end	high	low	do nothing	not sure
removing tall weeds for the first 50' from shore	high	low	do nothing	not sure
dredging to remove weeds and muddy bottom	high	low	do nothing	not sure
cleaning just the wading areas in front of homes	high	low	do nothing	not sure
other	high	low	do nothing	not sure
other	high	low	do nothing	not sure

Please complete this questionnaire today, fold it so the return address shows, tape it closed and put it in the mail.

The Save Long Lake Association and Long Lake Steering Committee thank you for your time and opinion, both are greatly appreciated.

Possible problems that may be caused by, or exaggerated by, non-native weeds and/or aquatic plants
Results of 53 returned surveys

unsafe swimming

serious	needs attention	not a problem	not sure
11	**24**	7	5

poor quality fishing

serious	needs attention	not a problem	not sure
9	15	12	11

poor quality boating

serious	needs attention	not a problem	not sure
11	**23**	11	1

poor water quality/bad color

serious	needs attention	not a problem	not sure
27	10	4	9

lower property value

serious	needs attention	not a problem	not sure
11	14	11	11

high winter water levels

serious	needs attention	not a problem	not sure
18	11	14	5

usable lake area shrinking

serious	needs attention	not a problem	not sure
19	11	9	5

Main goals of Long Lake's IAVMP
Results of 53 returned surveys

removing all of non-native invasive weeds

high	low	do nothing	not sure
42	4	0	3

reducing the quantity of lily pads at south end

high	low	do nothing	not sure
17	13	11	6

removing tall weeds for the first 50 feet from the shore

high	low	do nothing	not sure
27	10	10	4

dredging to remove weeds and muddy bottom

high	low	do nothing	not sure
32	8	4	6

cleaning just the wading areas in front of homes

high	low	do nothing	not sure
15	16	8	6

Additional goals

addressing weeds - high priority

biological solutions - high priority

dredge 100%, treat and sell dredge spoil as fertilizer, etc. - high priority

preserve wildlife - high priority

clean quality water - high priority

maintenance after cleaning - high priority

preventing over use and abuse of lake water quality (i.e., litter from boaters - unstructured boating use) - high priority

Long Lake Integrated Aquatic Vegetation Management Plan (IAVMP) Project
Third Steering Committee Meeting

DATE: October 29, 1996
TIME: 4:00-6:00 pm
PLACE: Kitsap County Fair & Parks Department
Bremerton, WA

AGENDA

1. Project Update
2. Review of Results of Aquatic Plant Survey conducted by WATER staff on Long Lake in late August, 1996
3. Review of WATER-prepared Newsletter updating the IAVMP Project to be mailed to Long Lake property owners before Workshop II
4. Discussion on planned agenda for Workshop II planned for November 19, 1996
4. Other comments/questions from Committee on the Project
5. Schedule Next Meeting: Steering Comm Mtg #4
   Third Public Workshop
6. Adjourn

Long Lake IAVMP Project Third Steering Committee Meeting Notes
October 29, 1996, 4:00 to 6:00 pm, Long Lake Community Center

Maribeth Gibbons (WATER Env. Svc., Inc.) and **Harry Gibbons** (KCM, Inc.), project consultants, welcomed everyone in attendance to the Third Steering Committee Meeting for the Long Lake IAVMP Project. The Long Lake IAVMP Project is being funded through a Department of Ecology Aquatic Weeds Management Fund (AWMF) Grant.

Including Maribeth and Harry, other Long Lake Steering Committee members in attendance were: **Kathy Hamel** (Washington Department of Ecology), **Mary Kautz** (Washington Department of Ecology, Northwest Regional Office) and Long Lake community members, **Scott Sandin, Bill Barron, and Nick Hoyt. Cyndy Holtz** (Director of Kitsap County Fair & Parks) was unable to attend.

Maribeth gave a **status report on the Long Lake IAVMP Project** with a preview of upcoming milestones. She stated that the Long Lake IAPMP Project was currently at about the midway point. Background data collection on the lake and watershed was nearly completed. She was still working on getting existing fisheries data from the local Washington Department of Fish and Wildlife personnel (Steve Kalinowski had offered to provide recent fish stocking data). Results of the Washington Natural Heritage Program Database search on any sensitive plant and wildlife species in the area were also still pending.

Maribeth presented an **overview of results of** the whole lake **aquatic plant survey** conducted by the project consultants during the last week of August, 1996. Brazilian elodea was the dominant aquatic plant in the Long Lake system, occurring throughout the lake in varying densities, but more concentrated in the southern half. Eurasian watermilfoil appeared to be in a pioneering phase of colonization of the lake, apparently restricted to the southern end of the lake (probably entered on boats putting in at the public launch in the last couple of years). Purple loosestrife was found dotting much of the lake shoreline. The survey showed that the native plant, coontail (*Ceratophyllum demersum*), a submersed, essentially rootless plant, was a conspicuous member of Long Lake plant community. This species occurred in higher densities primarily in the deep trough area and the southern half of the lake. Extensive, surfacing mats of yellow and white waterlilies (*Nuphar* and *Nymphaea* spp.) were also prevalent in the southern end of the lake. Other native plants (pondweeds, macroalgae *Nitella* spp.) were present in the macrophyte community, but to a lesser extent. The aquatic plant survey data and biomass samples are being used to map plant zones in the lake, as well as to produce archival plant voucher specimens of major species occurring in the lake. The importance of producing permanent plant voucher specimens for Long Lake and filing these with the Department of Ecology was discussed. Bill Barron provided Maribeth with a purple loosestrife map that had been produced a year or two ago identifying locations of this noxious weed around Long Lake shoreline, and was submitted to the Washington Department of Agriculture.

Maribeth presented a draft copy of the First Newsletter describing status of the Long Lake IAPMP Project for the committee's review. This newsletter traced history of grass roots efforts to kick start management planning in the lake, summarized results of the late summer aquatic plant survey, and gave results of a questionnaire sent out by Save Long Lake Association to property owners to get opinions on perceived *problems caused by aquatic plants in Long Lake*, as well as *main goals that should be addressed in the Long Lake IAVMP*. The most serious problems perceived to be caused by aquatic plants in Long Lake appeared to be poor water quality and unsafe swimming conditions. The major management goal cited was to remove all non-native invasive weeds from the lake. Scott suggested a larger, more prominent paragraph in the newsletter be created describing date and agenda of the upcoming Public Workshop, with a list/phone #s of all Long Lake Steering Committee contacts (Bill, Scott, Nick, Terry & Jerry).

The Steering Committee next discussed the proposed **agenda for the Final (Third) Public Workshop**. Maribeth explained that this Workshop would be a forum to review the draft Long Lake IAPMP, to present for discussion several alternative Integrated Management Scenarios developed with the Committee, and achieve public consensus on a recommended Integrated Aquatic Plant Management Scenario for Long Lake. Harry and Maribeth generally discussed mechanical, physical, chemical and biological aquatic plant control methods currently permitted in Washington State, and their applicability to the Long Lake situation. Scott and Bill suggested looking at the feasibility of a **major summer lake drawdown** operation to expose a large area of lake bottom/ plant beds that could be dozed and removed offsite. The smaller remaining area of the lake could be managed for noxious aquatic plants using other methods (herbicides?, other mechanical treatments?) To cut down on equipment expenses, Scott suggested the possibility of getting bulldozers, semi-trucks and other heavy equipment donated to the Long Lake cause. Harry and Maribeth noted that a major drawdown such as this could be tricky both logistically and jurisdictionally, and would involve buy-off and coordination of many local, State and Federal agencies and tribes. The project consultants would do some further checking on this novel idea to determine if it would be a feasible alternative.

The committee decided that the **Final Public Workshop** should be held on February 18, 1997 (7-9 pm) at the Long Lake Community Center with the purpose of presenting the Draft IAPMP with possible Management Scenarios to the Public for their choice. It was agreed that the **Fourth Steering Committee Meeting** should be held prior to this Workshop on January 21, 1997 from 4-6 pm at the Kitsap County Fair & Parks Building. Maribeth noted that she would work on and provide by the next committee meeting a draft copy of the IAPMP with possible Management Scenarios that could be further discussed and refined prior to the Final Workshop.

LONG LAKE IAVMP SCM #3
10/29/96
4-6p

NAME	ADDRESS	SIGNATURE
MARIBETH GIBBONS	WATER ENVIR. 9515 WINDSONG LP	[illegible]
[illegible]	Ecology	[illegible]
Scott Sandor	4477 SE Fairmont Dr [illegible]	[illegible]
mary kautz	ECOLOGY	[illegible]
Harry Gibbons	KCM 9515 Windsong Loop NE Seattle, WA 98101	[illegible]
[illegible]	3270 163RD PL. S.E. BELLEVUE, WA 98008	[illegible]
Bill Barron	3800 Sunnyslope Rd SW Port Orchard, WA 98366	[illegible]

Long Lake Integrated Aquatic Vegetation Management Plan (IAVMP) Project
Midterm Planning Workshop II

DATE:	December 10, 1996 (resched from November 19)
TIME:	7:00-9:00 pm
PLACE:	Long Lake Community Building
PRESENTED BY:	Kitsap County Fair & Parks Long Lake Community WATER Environmental Services, Inc. & KCM, Inc.

AGENDA

1. Introduction
2. Overview of Long Lake IAVMP Project
3. Update on IAVMP Project Progress To Date
   --Where we're at in the Planning Process
4. Results of Summer, 1996 Aquatic Plant Survey of Long Lake
5. General Review of Aquatic Plant Control Methods Available in Washington State and Applicability to Long Lake
6. Looking Ahead to What's Next in the IAVMP Project
   --How the Plan will be Finalized
7. Other Comments
8. Adjourn

LONG LAKE IAVMP PROJECT WORKSHOP II

SIGN-IN SHEET

~~11/19/96~~ rescheduled 12/10/96

NAME	AFFILIATION	ADDRESS	SIGNATURE
Scott Sandin	Long Lake	4477 SE Firmont Dr	Scott B Sandin
Mary Kautz	Ecology	Bellevue	Mary Kautz
Harry Gibbons	KCM	1917 1st Ave Seattle	[illegible]
Vick Hoyt	Long Lake	3270 163rd PL S.E. Bellevue	[illegible]
Cheryl Hoyt		"	Cheryl Hoyt
Wanda Medina		7555 Clover Valley	Medina
Muriel Hewitt		7129 Clover Valley Rd	Muriel Hewitt
Bill Barron	SLLA	3800 Sunnyslope Rd Port Orchard	Bill B
Terry Brown	Save Long Lake	8735 SW Willock Rd	[illegible]
Janet & Thomas Kuperstein		4502 Firmont Dr	Thomas

Long Lake Integrated Aquatic Vegetation Management Plan (IAVMP) Project
Fourth Steering Committee Meeting

DATE: January 21, 1997
TIME: 4:00-6:00 pm
PLACE: Kitsap County Fair & Parks Department
Bremerton, WA

AGENDA

1. Project Update
2. Review of results of Workshop II held on December 10, 1996
3. Review and discuss *Preliminary* IAVMP Treatment Scenarios and narrow down to most feasible Scenarios to present to community for choice at Final Workshop
3. Discussion on planned agenda for Final Workshop III tentatively planned for February 18, 1997
4. Other comments/questions from Committee on the Project
5. Schedule Next Meeting: Final Steering Comm Mtg #5
   Confirm Meeting Date for Third (Final) Public Workshop
6. Adjourn

Long Lake IAVMP Project Fourth Steering Committee Meeting Notes
January 21, 1997 4:00 to 6:00 PM, Kitsap County Fair & Parks Department

Maribeth Gibbons (WATER Env. Svc., Inc.) and **Harry Gibbons** (KCM, Inc.), project consultants, welcomed everyone in attendance to the Fourth Steering Committee Meeting for the Long Lake IAVMP Project. The Long Lake IAVMP Project is being funded through a Department of Ecology Aquatic Weeds Management Fund (AWMF) Grant.

Including Maribeth and Harry, other Long Lake Steering Committee members in attendance were: **Mary Kautz** (Washington Department of Ecology, Northwest Regional Office), Dan Collins (Washington Dept of Fish and Wildlife, Inland Fish Div, Reg 6) and Long Lake community members, **Scott Sandin, Bill Barron, Nick Hoyt, Terry Brown and Jerry Johnson.** Stephan Kalinowski (WDFW, Habitat Mngmt, Reg 6) attended the latter part of the meeting. **Kathy Hamel** (Washington Department of Ecology), **Cyndy Holtz** (Director of Kitsap County Fair & Parks) and **Bill Freymond** (Washington Dept of Fish and Wildlife, Inland Fish Div, Reg 6) were unable to attend.

Maribeth gave a **status report on the Long Lake IAVMP Project** with a preview of upcoming milestones. She stated that the Long Lake IAPMP Project was nearing completion and was currently at the very critical point of developing several potentially feasible management scenarios for Long Lake that, with the Committee's approval (hopefully at this meeting), could be presented to the larger lake community for final selection at the upcoming Final Public Workshop. She and Harry then reviewed with the Committee a wide range of integrated treatment scenarios for Long Lake, with the purpose of narrowing these down to a few of the most practicable scenarios for Long Lake.

The two large-scale mechanical dredging scenarios **(E-2A, E-2B, E-5)** were the most intensive in-lake treatments, with the most potential for environmental impacts, and were potentially the most costly. Because mobilization costs alone could be considerable, a minimum of 50 acres dredged was recommended, with project costs still being very high. Whole lake SONAR (systemic herbicide) treatment **(E-1, E-4)** could also be quite a spendy proposition approaching 1 Million Dollars, given the great size of the lake and extent of infestation of target Brazilian elodea.

There was much discussion regarding the Sterile Grass Carp Planting Scenarios **(E-3, E-6,E-8).** Dan C. noted that Coho salmon (which are considered endangered species in some parts of the State) do utilize the Long Lake system and spawn in Salmonberry Creek. Their presence in this system is therefore significant and any in-lake management scenario would be carefully scrutinized by resource agencies with this in mind. Some of the citizens raised questions about WDFW's requirement of screening important inlets and outlets in lakes where sterile grass carp plants are made. Dan replied that it was crucial to prevent their passage out of the lake and thus protect stream habitat and ultimately the fishery resource. Also with regard to sterile grass carp plantings, warm-water fisheries in the lake must be considered in addition to anadromous fish. In particular, as aquatic plant beds are eliminated as a result of feeding activity of the carp, placement of artificial barriers may be needed.

With regard to **E-8**, the discussion then turned to the possibility of using a more portable, temporary "corral" fencing structure that could be deployed in the lake to contain the grass carp within a defined area of the lake for "spot treatment. After a suitable period of time working the initial corralled area, the remaining grass carp could be trapped out, the corral could be removed and replaced in another area of the lake, and the trapped carp replanted in the new area for subsequent treatment. Harry suggested that a preliminary design of such a barrier might consist of a double metal curtain (e.g., small mesh chain-link fencing) anchored to the lake

bottom by steel rebar spikes. This design should withstand otter attacks, which have historically been a problem ripping into finer fabric screening material. The height of the corral barrier above water will also be crucial, given previously documented ability of grass carp to jump over low fences. Dan Collins indicated that this novel enclosure proposal might be of serious interest to WDFW.

Maribeth brought to the committee's attention the need for **consensus on management goals regarding intensity of control of the three noxious plant species present in Long Lake,** particularly the extremely aggressive goal of **eradication.** Agreeing on the management goals is necessary to determine management intensity zones in the lake, and ultimately the management methods (Scenario) employed. She suggested that the committee members review section Step B-Management Goals of the draft plan prior to selecting feasible management scenarios from the current list, so that goals matched methods selected. A question was raised by a citizen committee member about Ecology's policy requiring eradication if noxious plant species inhabit a lake system. Unfortunately, Ecology's official position on this issue couldn't be presented, since Kathy Hamel was not at the meeting. Generally speaking, Maribeth and Harry noted that they perceived eradication of a noxious species might be a viable goal if such a project was determined to be affordable, logistically feasible, and received buy-off from all significant agencies and groups. Maribeth said that she would discuss Ecology's policy regarding eradication and the Aquatic Weeds Management Fund (AWMF) Program before the next Steering Committee meeting.

Despite much discussion and comments on these preliminary scenarios, it was clear by the end of this meeting that **more time and work was needed by the Committee** to pare down the long preliminary list to a few practicable scenarios that could be recommended to the general public to obtain community agreement on a selected action plan at the final Workshop. The consultants suggested putting together a table for Committee review describing all the Scenarios, including a new scenario which is a variation of Scenario E-8, making use of a removable grass carp corral. The Committee also asked for **written ballpark estimates on in-lake treatments** to aid in making better comparisons. The consultants would also include this information in the above-described table. Maribeth would compose the table, mail it out to all members, and asked that each of the Committee review the updated information on scenarios and contact her with his/her top choices prior to the next Steering Committee Meeting.

The committee members decided to **cancel the Final Public Workshop that was tentatively scheduled to be held on February 18,** and **instead hold the last steering committee meeting on that date at the Kitsap County Fair & Parks Office from 4:00 to 6:00** PM to finalize choice of scenarios to be presented to the lake community at a later date. Maribeth would check with Cyndy Holtz on availability of the meeting room on that date and contact all committee members if there was a problem.

LONG LK. IAVMP
STEERING COMM MTG #4
1/21/97

NAME	AFFILIATION	PHONE
DAN Collins	WDFW	(360) 424-8255
Bill Barron	SLT	(360) 674-2776
Mary Kautz	EC	(206) 64-[illegible]
Harry Gibbons	KCM	206/443-3526
MARIBETH GIBBONS	WATER ES.	206/842-9382
Nicholas Vogt	SLLA	(206) 562-5184
Scott B. Jamelli	SLLA	(360) 871-6611
Terry Bicon	SLL.1	(360) 571-3091
Jerry Johnson	SLLA	360 871-4569
Stephan Kalinowski	WDFW	360-895-3965

Date: January 24, 1997

To: Members of the Long Lake IAVMP Steering Committee

From: Maribeth Gibbons (WATER) & Harry Gibbons (KCM), Project Consultants

Subject: Review of Preliminary Management Scenarios for Long Lake IAVMP Project, amended as a result of recent Steering Comm Mtg held JAN 21., 1997

The 4th Long Lake IAVMP Steering Committee Meeting was held on Tuesday, January 21, 1997 from 4:00 to 6:00 pm at Kitsap County Fair & Parks Office in Bremerton. At this meeting the committee discussed the draft IAVM Plan developed by the project consultants, including potential (preliminary) management scenario choices, in preparation for presentation to the general public at the final Public Workshop.

There was much discussion and comment on these preliminary scenarios, but by the end of the meeting, it was clear that **more time and work was needed by the Committee** to pare the list down to a few practicable scenarios that could be recommended to the general public to obtain community agreement on a selected action plan at the final Workshop. The Committee also asked for **written ballpark estimates on in-lake treatments** to aid in making better comparisons. Additionally, the members decided to **cancel the previously scheduled Public Workshop to be held on February 18 and instead hold the last steering committee meeting on that date at the Kitsap County Fair & Parks Office from** 4:00 to 6:00 pm to finalize choice of scenarios to be presented to the lake community at a later date.

As requested, Harry and I have produced a simple table with estimates of in-lake treatments for all the scenarios. We've also revised the original Scenario list to include a new scenario that was proposed at the last meeting, which is a variation of Scenario E-8, making use of a removable grass carp corral. We would appreciate your further review of these scenarios and ask that you send me your top several choices before the last Steering Committee Meeting on February 18 (by February 15, please). I will compile everyone's choices and we can use this as a basis for discussion at this meeting.

Thank you for your review of and input on this very critical part of the Long Lake IAVMP Project. If you have any questions in the meantime, please give me a call at (206) 842-9382 or Harry at (206) 443-3526.

LONG LAKE
INTEGRATED AQUATIC VEGETATION MANAGEMENT PLAN
PRELIMINARY SCENARIOS

AMENDED SINCE JAN. 21, 1997 STEERING COMM. MEETING

A number of *preliminary IAVMP scenarios* are presented for Long Lake that vary in meeting major management goals dealing with noxious or other nuisance plant species. In addition to in-lake treatment of nuisance weed populations, all scenarios include lake and watershed management elements to maintain beneficial uses. While infestation by several exotic weed species may be considered a priority problem in Long Lake, the plan emphasizes the importance of watershed management in limiting inputs of nutrients and other contaminants to this lake system that can and has exacerbated water quality (and nuisance plant) problems over the years. The plan also includes provisions for a public awareness program, and an annual monitoring program to evaluate effectiveness. Furthermore, to maximize benefits of exotic Brazilian elodea, Eurasian watermilfoil, and purple loosestrife removal, it is critical to sustain a noxious weed prevention program so that any new outbreaks can be destroyed. Other program elements include permitting, use restrictions, and securing and implementing funding. It must be stressed that aquatic plant management in Long Lake, particularly major goal management of the exotic weed species, Brazilian elodea and Eurasian watermilfoil, will be an on-going concern and will take **long-term commitment**. Furthermore, the resulting Plan is dynamic and flexible, with checkpoints (Annual evaluations, Steering Committee Meetings) set along the way to allow for any changes in course direction or control tactics. Given the difficulty in routing established exotics like Brazilian elodea from a system, a five-year program using the following elements is recommended. The preliminary Long Lake management scenarios are presented from very intensive control strategies against the major non-native weed species (E-2 probably the most intensive) to the least intensive or least area impacted.

NOTE: The Steering Committee will review these preliminary management scenario options. Selection of the most feasible and acceptable of these scenarios (or variations) by the Steering committee (ideally 2 or 3 scenarios) will be described in Step J (Choose Integrated Scenario), and will be presented to the lake community for their choice in the final Public Workshop. The final scenario choice will be detailed out in Step K (Action Plan).

- **Spot treatments** w/Glysophate (RODEO) for p. loosestrife control
  - shoreline applications
  - treatment of islands in south end

(Year 2) • **Alum treatment** or nutrient inactivation

(Year 2-5) • **Minor treatments** using hand removal and bottom barrier and/or mini suction dredge for B.elodea, E watermilfoil, p. loosestrife

• **Minor treatments**– harvesting lanes in ski/slalom courses at south end, if needed

Other Program Elements

Same as E-1

Long-term Management Scenario E-2B

(MAJOR GOAL: complete removal of Brazilian elodea, Eurasian watermilfoil, and purple loosestrife)

In-lake Treatments

• **Whole lake** aquatic plant survey and biomass sampling in Spring

(Year 1) • **Large-scale** lake-level drawdown/mechanical dredging of substrate to a depth of 2m between 1.0 and 3.5 meter contours (approx. 70-80% lake area)

• **Upland disposal** of sediment/plant fragment spoils

• **Small-scale**, intensive removal of B elodea, E. watermilfoil along undredged deep zone >3.5 m using diver-dredging, bottom barrier, or other manual removal

• **Spot treatments** w/Glysophate (RODEO) for P. loosestrife control
  - shoreline applications
  - treatment of islands in south end

(Year 2) • **Alum treatment** or nutrient inactivation

(Year 2-5) • **Minor treatments** using hand removal and bottom barrier and/or mini suction dredge for B. elodea, E Watermilfoil, p. loosestrife

• **Minor treatments**– harvesting lanes in ski/slalom courses at south end, if needed

Other Program Elements

Same as E-1

Long-term Management Scenario E-3

(MAJOR GOAL: complete removal of Brazilian elodea, Eurasian watermilfoil, and purple loosestrife)

In-lake Treatments

• **Whole lake** aquatic plant survey and biomass sampling in Spring

(Year 1) • **Outlet/(inlet?)** grass carp containment structure design and construction

• **Spot treatments** w/Glysophate (RODEO) for p. loosestrife control
  - shoreline applications
  - treatment of islands in south end
  - treat 100 ft buffer zone around islands p. loosestrife and incidental waterlily control

(Year 2) • **Major treatment** involving planting of sterile grass carp

• **Spot treatments** w/Glysophate (RODEO) for p. loosestrife control

(Year 2-5) • **Minor treatments** using hand removal and bottom barrier and/or suction dredge

• **Minor treatments**– harvesting lanes in ski/slalom courses at south end, if needed

Other Program Elements

Same as E-1

Long-term Management Scenario E-1

(MAJOR GOAL: complete elimination of Brazilian elodea, Eurasian watermilfoil, and purple loosestrife from lake)

In-lake Treatments

Whole lake aquatic plant survey and biomass sampling in Spring

(Year 1)
- **Whole-lake application** of systemic herbicide fluridone (SONAR) for Br. elodea and E. watermilfoil control
- **Spot treatments** w/systemic Glysophate (RODEO) for P. loosestrife control
  - shoreline applications
  - treatment of islands in south end
  - treat 100 ft buffer zone around islands for p. loosestrife and incidental waterlily control

(Year 2)
- **Secondary application** of fluridone (SONAR) or equivalent herbicide in south end (up to 50% lake area), if regrowth of target B. elodea is considerable (will also hit any residual milfoil patches surviving 1st SONAR treatment)
- **Spot treatments** w/Glysophate (RODEO) for p. loosestrife control, where needed (shorelines, islands)

(Year 3)
- **Additional fluridone** (SONAR) applications in 10 acre+ units (up to 25% lake area)

(Year 2-5)
- **Minor treatments** using hand removal and bottom barrier and/or mini suction dredge
- **Minor treatments**– harvesting lanes in ski/slalom courses at south end, if needed

(Year 4-5)
- **Alum treatment** or nutrient inactivation

Other Program Elements (Scenario E-1)

Environmental permits and assessment, if necessary
Use restrictions or modifications
Mitigation of sensitive native plants downstream or in-lake, if needed
Public Outreach and Education Program
Noxious Weed Prevention Program
Program Monitoring and Effectiveness Evaluation
- aquatic plant surveys
- water quality monitoring
- regular meetings of Steering Committee

Watershed Management Program
Implementation and funding plan
Program administration costs

Long-term Management Scenario E-2A

(MAJOR GOAL: complete removal of Brazilian elodea, Eurasian watermilfoil, and purple loosestrife)

In-lake Treatments

- **Whole lake** aquatic plant survey and biomass sampling in Spring

(Year 1)
- **Large-scale** hydraulic dredging of substrate to a depth of 1-2 m between 1.0 and 3.5 meter contours (approx. 70-80% lake area)
- **Upland disposal** of sediment/plant fragment spoils
- **Small-scale**, intensive removal of B. elodea, E. watermilfoil along undredged shorelines <1 m and deep zone >3.5 m using diver-dredging, bottom barrier, or other manual removal

*****Long-term Management Scenario E-8A

(MAJOR GOAL: complete removal of late pioneering stage Eurasian watermilfoil and B. elodea in barriered portion of lake only)

In-lake Treatments

•Same as E-8, except deploying in year 1 a reusable grass carp containment corral (up to 1500 ft) made of double row of chain-link fencing sandwiching a structural fabric, unit all secured with rebar stakes. Use corral in one area of lake for 3-5 years, then after removing residual grass carp, dismantle and replace elsewhere in lake.

Other Program Elements

Same as E-1

Long-term Management Scenario M-1

(MAJOR GOAL: localized physical/mechanical control of nuisance non-native and native growth around shorelines only)

In-lake Treatments

•Whole lake aquatic plant survey and biomass sampling in Spring

(Year 1-5) •Minor treatments using hand removal and bottom barrier and/or diver-suction dredge along shoreline docks, boat launches, beaches

•Minor treatments– harvesting lanes in ski/slalom courses at south end, if needed

Other Program Elements

Same as E-1

Long-term Management Scenario M-2

(MAJOR GOAL: localized physical/mechanical/systemic herbicide control of nuisance non-native and native growth around shorelines only)

In-lake Treatments

•Whole lake aquatic plant survey and biomass sampling in Spring

(Year 1-5) •Minor treatments using hand removal and bottom barrier and/or diver-suction dredge along shoreline docks, boat launches, beaches

•Spot treatments in waterlily/milfoil/B. elodea beds using Glysophate (RODEO) or fluridone (SONAR)–creating lanes in ski/slalom courses at south end, if needed

Other Program Elements

Same as E-1

NOTE: *** New scenario based on input from Jan.21 Steering Comm Mtg.**

Long-term Management Scenario E-4,E-5,E-6 (same as E-1, E-2,E-3, respectively except without RODEO since MAJOR GOAL is to completely eliminate only Egeria densa and Eurasian watermilfoil)

Long-term Management Scenario E-7

(MAJOR GOAL: complete removal of late pioneering stage Eurasian watermilfoil only)

In-lake Treatments

- **Whole lake** aquatic plant survey and biomass sampling in Spring
- (Year 1) **Large-scale application** in south end only of fluridone (SONAR) for E. watermilfoil control (may provide incidental control of B. elodea in south)
- (Year 2) **Secondary application** of fluridone (SONAR) or equivalent herbicide in south end, if regrowth of target E. watermilfoil is considerable (may also affect non-target Brazilian elodea)
- (Year 2-5) **Minor treatments** using hand removal and bottom barrier and/or suction dredge
- **Minor treatments**– harvesting lanes in ski/slalom courses at south end, if needed
- (Year 4-5) **Alum treatment** or nutrient inactivation

Other Program Elements

Same as E-1

Long-term Management Scenario E-8

(MAJOR GOAL: complete removal of late pioneering stage Eurasian watermilfoil only, but also will control B. elodea)

In-lake Treatments

- **Whole lake** aquatic plant survey and biomass sampling in Spring
- (Year 1) **Deployment** of in-lake grass carp containment barriers across south end of lake (below Salmonberry Creek?). If deployment at State launch (above Salmonberry Cr.), may need to consider inlet containment structure on Salmonberry Cr.
- (Year 1) **Major treatment** involving planting of sterile grass carp in south end of lake only for target E watermilfoil, but also control of B. elodea
- (Year 2-5) **Minor treatments** using hand removal and bottom barrier and/or suction dredge for remnant E. watermilfoil
- **Minor treatments**– harvesting lanes in ski/slalom courses at south end, if needed
- (Year 5) **Remove grass** carp from south end to north end (or remove entirely from lake), leaving barrier in place, for new goal target B. elodea
- (Year 5) **Minor physical** treatment of areas not controlled by grass carp in area between Salmonberry Creek and Curley Creek

Other Program Elements

Same as E-1

Cost estimates for Long Lake IAVMP (IN-LAKE TREATMENTS ONLY) - add $5000-10,000/yr for OTHER PROBLEM ELEMENTS.

Senario	Year	activity	unit cost	cost	total cost
E-1	1	Sonar	$1,000/ac	$300,000	
	1	Rodeo	$300/ac	$6,600	
	2	Sonar	$1,000/ac	$150,000	
	2	Rodeo	$300/ac	$1,800	
	3	Sonar	$1,000/ac	$50,000	
	2,3,4,5	Barrier	$1.25/sq ft	$54,450	
	4 or 5	Alum	$900/ac	$288,000	
					$850,850
E-2A	1	hy-dredging	$5/cu yd	$6,400,000	264 ac. @ 3' depth
	1	disposal	$5/cu yd	$6,400,000	
	1	barrier	$1.25/sq ft	$54,450	
	1	Rodeo	$300/ac	$6,600	
	2	Alum	$900/ac	$288,000	
	2,3,4,5	Barrier	$1.25/sq ft	$54,450	
					$13,203,500
E-2B	1	draw/dredging	$12/cu yd	$15,100,000	
	1	disposal	$3.5/cu yd	$4,400,000	
	1	barrier	$1.25/sq ft	$54,450	
	1	Rodeo	$300/ac	$6,600	
	2	Alum	$900/ac	$288,000	
	2,3,4,5	Barrier	$1.25/sq ft	$54,450	
					$19,903,500
E-3	1	Containment	$150,000	$150,000	(INLET/OUTLET)
	1	Rodeo	$300/ac	$6,600	
	2	Grass Carp	$7.50/ea	$36,000	15 CARP/ACRE
	2	Rodeo	$300/ac	$6,600	
	2,3,4,5	Barrier	$1.25/sq ft	$54,450	
					$253,650
E-4	1	Sonar	$1,000/ac	$300,000	
	2	Sonar	$1,000/ac	$150,000	
	3	Sonar	$1,000/ac	$50,000	
	2,3,4,5	Barrier	$1.25/sq ft	$54,450	
	4 or 5	Alum	$900/ac	$288,000	
					$842,450
E-5	1	hy-dredging	$5/cu yd	$6,400,000	
	1	disposal	$5/cu yd	$6,400,000	
	1	barrier	$1.25/sq ft	$54,450	
	2	Alum	$900/ac	$288,000	
	2,3,4,5	Barrier	$1.25/sq ft	$54,450	
					$13,196,900
E-6	1	Containment	$150,000	$150,000	
	2	Grass Carp	$7.50/ea	$36,000	
	2,3,4,5	Barrier	$1.25/sq ft	$54,450	
					$240,450
SOUTH E-7	1	Sonar	$1,000/ac	$150,000	
	2	Sonar	$1,000/ac	$50,000	
	2,3,4,5	Barrier	$1.25/sq ft	$54,450	
	4 or 5	Alum	$900/ac	$288,000	
					$542,450
E-8 & E-8A	1	REMOVABLE Containment	COARAV $100/ft	$150,000	
	1	Grass Carp	$7.50/ea	$7,200	
	5	BOTTOM Barrier	$1.25/sq ft	$12,500	
[E-8A →	5	Transfer area	$40/ft	$60,000]	
	5	Grass Carp	$7.50/ea	$7,200	
		REPLANT			$236,900 [E-8A)
					~$200,000 (E-8)

Long Lake Integrated Aquatic Vegetation Management Plan (IAVMP) Project
Fifth Steering Committee Meeting

DATE: February 18, 1997
TIME: 4:00-6:00 pm
PLACE: Kitsap County Fair & Parks Department
Bremerton, WA

AGENDA

1. Project Update-This is final official meeting of the Long Lake IAVMP Steering Committee

2. Review and discuss ballot results on revised *Preliminary* IAVMP Treatment Scenarios sent out after Fourth Meeting and narrow down to most feasible Scenarios to present to community for choice at Final Workshop

3. Set date and planned agenda for Final Public Workshop III

4. Other comments/questions from Committee on Draft Plan or Project in general

5. Adjourn

Long Lake IAVMP Project Fifth Steering Committee Meeting Notes
February 18, 1997 4:00 to 6:00 PM, Kitsap County Fair & Parks Department

Maribeth Gibbons (WATER Env. Svc., Inc.) and **Harry Gibbons** (KCM, Inc.), project consultants, welcomed everyone in attendance to the Fifth Steering Committee Meeting for the Long Lake IAVMP Project. The Long Lake IAVMP Project is being funded through a Department of Ecology Aquatic Weeds Management Fund (AWMF) Grant.

Including Maribeth and Harry, other Long Lake Steering Committee members in attendance were: **Kathy Hamel** (Washington Department of Ecology), **Cyndy Holtz** (Director of Kitsap County Fair & Parks), **Dan Collins** (Washington Dept of Fish and Wildlife, Inland Fish Div, Reg 6), and Long Lake community members, **Scott Sandin, Bill Barron, and Jerry Johnson**. attended the latter part of the meeting. **Mary Kautz** (Washington Department of Ecology, Northwest Regional Office), Stephan Kalinowski (WDFW, Habitat Mngmt, Reg 6), and **Nick Hoyt, Terry Brown** (Long Lake community) were unable to attend.

Maribeth gave a **status report on the Long Lake IAVMP Project,** noting that this was the last official scheduled meeting of the Steering Committee. She and Harry then reviewed with the Committee members top three scenario preferences from the revised Preliminary IAVMP Treatment Scenarios that had been sent out after the Fourth Steering Committee Meeting for further review. The idea was to narrow down the large list of potentially feasible management scenarios for Long Lake to a few of the most practicable scenarios. Thus, the Committee's preferred choices would be presented to the larger lake community for final selection at the Final Public Workshop.

Maribeth brought to the committee's attention the need for **consensus on management goals regarding intensity of control of the three noxious plant species present in Long Lake,** particularly the extremely aggressive goal of **eradication.** Agreeing on the management goals is necessary to determine management intensity zones in the lake, and ultimately the management methods (Scenario) employed. There was discussion about the difficulty or removing Brazilian elodea from a system where it has been entrenched over a large area for many years. Again, it was pointed out that in the State of Washington there are not many permitted tools in the aquatic plant management tool box that are highly effective against this noxious weed. The best bets are systemic herbicide SONAR and grass carp, but each has constraints especially with respect to the Long Lake site. A comment was made that contact herbicides could also be used for spot treatment that would give immediate although short-term results, but the lake residents didn't really want to consider this alternative.

With regard to SONAR use against Brazilian elodea, not much documentation exists on successful eradication of this species from a large lake in the State of Washington. A multi-year, aggressive herbicide treatment scheme is absolutely necessary with a such a goal. This type of program is being tested in Lake Limerick in Mason County, with first year post-treatment results becoming available later this year. A lakewide application of SONAR in Long Lake would cost an estimated $300,000 for just one year's effort.

Bill indicated a desire to focus on eradication of the pioneering milfoil colonies and shoreline purple loosestrife around the lake. SONAR is effective against milfoil, usually at lower concentrations than that required for Brazilian elodea control, while systemic RODEO can be used against emergents like loosestrife with high success.

There was much discussion regarding the Sterile Grass Carp Planting Scenario E-8. Dan noted that Coho salmon (which are considered endangered species in some parts of the State) do utilize the Long Lake system and spawn in Salmonberry Creek. Their presence in this system is

therefore significant and any in-lake management scenario would be carefully scrutinized by resource agencies with this in mind. Some of the citizens raised questions about WDFW's requirement of screening important inlets and outlets in lakes where sterile grass carp plants are made. Dan replied that it was crucial to prevent their passage out of the lake and thus protect stream habitat and ultimately the fishery resource. Also with regard to sterile grass carp plantings, warm-water fisheries in the lake must be considered in addition to anadromous fish. In particular, as aquatic plant beds are eliminated as a result of feeding activity of the carp, placement of artificial barriers may be needed. Dan indicated that the agency probably wouldn't currently grant a permit for whole lake grass carp planting in Long Lake because of serious concerns regarding significant anadromous fish runs present in the lake. To date in lakes where an important anadromous fish resource was the site in question, the agency has not yet granted a permit for the use of lakewide grass carp for aquatic plant control. There is also uncertainty of predicting real control of target plants, especially with respect to eradication.

The next topic discussed was **funding mechanisms** that Long Lake community could access for aquatic plant control. Kathy explained the Aquatic Weed Management Fund (AWMF) administered by Department of Ecology. Through a sponsor like the County, the community could apply for as much as $100,000 for implementation, consisting of state match amount of $75,000 and local match of $25,000. She emphasized that demonstrating readiness to proceed on a project (showing actual dedicated funds or guaranteed means of obtaining funds) is a critical factor in the evaluation committee choice of final awardees. The low-interest State Revolving Loan Fund (SRF) is another means of financing lake management projects over a long term. Aquatic plant management projects are typically not really eligible under Centennial Clean Water program, and thus would not be a viable source for Long Lake.

Cyndy described several local funding avenues, including setting up a Lake Management District (LMD), similar to what was done by the community to provide local match funds for this Ecology Planning grant. A special LMD is more flexible than the tradition LMD. A Junior Taxing District only requires 10 signatures to be placed before the County to consider, with a Board of three individuals who decide on the actual assessment. Scott described current interest and a proposal to set up a county-wide lakes management program dealing with nuisance aquatic plant growth. Since there is a State launch at Long Lake, a question was raised regarding availability of moneys from WDFW to fund an aquatic plant management program. Dan replied that it would be difficult to obtain user fees from the agency. However, a coin-operated locked gate on the launch is a possibility (something being looked into by Dawn Severin in Skagit County).

Considering all the discussion, the Long Lake Steering Committee decided on three preferred management alternatives to present to the public for their vote. They are E-1 (Whole-lake SONAR treatment), E-8 (partial grass carp plant in south end/SONAR in north end), and M-2 (Spot treatment of loosestrife and waterlilies). Kathy would get a contact name from WDFW regarding the agency's program for spraying purple loosestrife on State property to see if their program could be coordinated with contracted treatment around the rest of the Long Lake shoreline. (NOTE: As a result of agency concerns regarding difficulty of carp recapture and the practicality of the portable barrier recommended in E-8, this scenario was later dropped in favor of E-7 (SONAR in south end)).

Maribeth was asked to include a mail-back ballot in the final newsletter she was preparing for distribution to all property owners explaining these committee-preferred alternatives. Prior to the Final Workshop, the ballots would be tallied and official results presented to those assembled at the Workshop. She would also notify all committee members as to the date of this Workshop, tentatively set for late May, 1997.

LONG LAKE IAVMP PROJECT
STEERING COMMITTEE MEETING SIGN-IN SHEET
2/18/97

NAME	AFFILIATION	ADDRESS	SIGNATURE
MARILBETH GIBBONS	WATER E.S	951ST WINJSONG LPNE BAINBRIDGE IS WA	Marilbeth Gibbons
Harry Gibbons	KCM	1917 First Avenue Seattle, WA	
Cory Johnson	SLLA	4532 Westerly Dr SE Port Orchard	Cory Johnson
Kathy Hamel	Ecology	PO Box 47600, Olympia 98504-7600	KS Hamel
Cynthia Hoff	KC Parks	12210 NE Ferndale Rd Bothell, WA	Cynthia Hoff
Scott Sandin	SLLA	4477 SE Fremont Dr PO	Scott Sandin
Bill Frazier	SLLA	3800 Sunnyside Rd PO Box Skelton	Bill Frazier
Dave Collins	W.D.F.& W	E. 121 Lakeview Dr.	Dave Collins

Date: March 18, 1997

To: Members of the Long Lake IAVMP Steering Committee

From: Maribeth Gibbons (WATER) & Harry Gibbons (KCM), Project Consultants

Subject: Review of Control Intensity and Management Scenario Sections for Long Lake IAVMP Project, resulting from Steering Comm Mtg held Feb. 18, 1997

The 5th (last official) Long Lake IAVMP Steering Committee Meeting was held on Tuesday, February 18, 1997 from 4:00 to 6:00 pm at Kitsap County Fair & Parks Office in Bremerton. At this meeting the committee discussed the draft IAVM Plan developed by the project consultants, primarily for the purpose of having committee consensus on a final potential list of management scenario choices for presentation to the general public at the final Public Workshop (hopefully to be held in the latter part of April).

As a result of committee discussion at this last meeting, the potential Scenario list has been narrowed down to three possible options (a 4th No Action Option is also included as a matter of course). We would appreciate your further review of these scenarios described in the Alternative Integrated Treatment Scenarios Section and the Control Intensity Section of the final Plan. If you have any comments on these sections, please let me know ASAP, as I must compile a newsletter summarizing these possible choices to send out to the lake community before the Final Public Workshop. I will contact you shortly with a date for the final Public Workshop.

Thank you for your review of and input on this very critical part of the Long Lake IAVMP Project. If you have any questions in the meantime, please give me a call at (206) 842-9382 or Harry at (206) 443-3526.

Long Lake Integrated Aquatic Vegetation Management Plan (IAVMP) Project
Midterm Planning Workshop III

DATE:	May 27, 1997
TIME:	7:00-9:00 pm
PLACE:	Long Lake Community Building
PRESENTED BY:	Kitsap County Fair & Parks Department Save Long Lake Association WATER Environmental Services, Inc. and KCM, Inc.

AGENDA

1. Introduction
2. Overview of Long Lake IAVMP Project
3. Presentation of Alternative Aquatic Plant Management Scenarios as Developed by the Long lake IAVMP Steering Committee

   Tonight's goal is to get public input and direction on the Integrated Aquatic Vegetation Management Plan for Long Lake.
4. Discussion and Comments on the Long Lake IAVM Plan and Possible Funding mechanisms for Implementation of Plan
5. Aquatic Plant Management Planning Experience in Local Lakes With Similar Problems
6. Other Comments
7. Adjourn

LONG LAKE IAVMP PROJECT
WORKSHOP III MEETING SIGN-IN SHEET
5/27/97

NAME	AFFILIATION	ADDRESS	SIGNATURE
MARIBETH GIBBINS	WATER ENVIR	9515 WINDSONG LP LACEY, WA	Maribeth V. Gibbins
Harry Gibbons	KCM	1917 1st Aven, Seattle	
JACK LEFLOSKI	CPKCL	1700 KITSAP LK RD Bremerton	Jack Lefloski
Tom + George Cressman		6055 Long Lake Rd. SE	Tom Cressman
Keith Hewitt		7129 Clover Valley SE	Keith Hewitt
Kim Waterman		7846 Long Lake Rd	Kimberly A Waterman
DAN ROBINSON	LAKE LIMERICK	E 7921 SHELTON SPANAWAY	Dan Robinson
WANDA MEDINA		7555 Clover Valley	Wanda Medina
Marilyn Anderson		5569 SE Sedgwick	
RANDY NATTER		5200 SE DELTA PL	
Dan + Ruth Burns		4549 SE Fitness ct	Port Orchard
Marcia Berber		7720 Long Lake Rd	Port Orchard
Jerry Johnson		4532 Westway DR SE	Port Orchard
Tom Beaver		6783 SE Wilkes Rd	Olalla
Nick Mayt		3270 163rd Pl. S.E.	Bellevue
Mary Kaufy	ECY		Bellevue
Kathy Haberl	"		Olympia
Kathryn Nyckoff	Lake Thurston Cty	7425 20th Ave SE.	Olympia
Bill Bartan	SLLA	3800 Sunnyside Rd SW Port Orchard	Bill B

ALSO WAS INSERT IN NEWSLETTER 2

IN PERSON 3-21-97

HOW DID WE COME UP WITH THE RECOMMENDED OPTIONS?

Over the last 12 months the Long Lake Steering Committee looked at all the viable options to rid Long Lake of its Non-Native Invasive weeds. The attached newsletter, written by Long Lakes' Aquatic Weed Consultant, identifies 3 options for Long Lake, each one very different in approach, outcome and cost. Please read each one carefully, indicate your choice below and return this page to us as soon as possible. Your vote is very important.

Previous surveys of Long Lake residents showed that Whole Lake Dredging and Grass Carp were the most popular options among residents. Knowing this we looked at these options very carefully. Early on, it was decided that Dredging, although the most permanent solution, was too expensive (in the millions). Grass Carp was the least expensive option and the one that Long Lake residents on the steering committee favored the most. We intensely conferred with the Department of Fish and Wildlife that we should be able to stock the lake with Grass Carp. Unfortunately, the Department of Fish and Wildlife have ruled out planting Grass Carp in Long Lake as a viable option. The reason has to do with the possible negative impact on the Salmon run that passes through and uses Long Lake.

The good news is that a low impact herbicide called Sonar appears to be very effective against our problem weeds. The Department of Fish and Wildlife and the Department of Ecology will very likely allow us to treat the lake with this widely used and agency approved herbicide.

THE STEERING COMMITTEE FAVORS OPTION E-1.

The overall goal for Long Lake is to eradicate all the non-native invasive weeds. Only Option E-1 targets this. The Steering Committee members signed below favor Option E-1 assuming it can be made affordable for Long Lake. This option has a high probability of removing the target non-native weeds from the lake permanently if the proposed treatment is followed.

Bill Barron Terry Brown Nick Hoyt Jerry Johnson Scott Sandin

WHO PAYS FOR TREATMENT IF WE AGREE ON AN OPTION?

Since Long Lake is a public lake used by thousands of people every summer it only makes sense that treatment cost be spread out among all lake users. Fortunately there is a Non-Profit association, Citizens for Preservation of Kitsap County Lakes (CPKCL) lobbying in our behalf for a county-wide lakes management program.

In February, the County Commissioners listened as CPKCL unveiled a no-nonsense Lakes Management Program. The program would clean-up and manage all public lakes in Kitsap County using existing tax money already collected for the Surface and Storm Water Management Program. We estimate the entire program would need about $5 a year of the $45 a year per household the county is now collecting. If CPKCL is successful Long Lake could begin weed removal as early as 1998.

PLEASE CIRCLE YOUR CHOICE BELOW AND MAIL THIS BACK TODAY.

Option E-1:	Whole lake herbicide treatment to eradicate all Non-Native Invasive Weeds
Option E-2:	Eurasian Watermilfoil eradication only (about 12% of the weeds)
Option M-3:	Weed removal in high use areas only (about 6% of the weeds)
Option 4:	No action

Note: Your vote indicates your preferred treatment Option and does not mean you agree with the cost of the treatment or to pay for any treatment whatsoever. We are going to ask the County Commissioners to support a county wide lakes program that would pay for this treatment out of existing tax dollars as mentioned above.

TABLE J-1

ALTERNATIVE TREATMENT SCENARIOS FOR LONG LAKE AQUATIC PLANT MANAGEMENT

Treatment Scenarios	*Program Elements	** Costs (est) First Year	** Costs (est) Second Year	** Costs (est) Third Year	** Costs (est) Fourth Year	** Costs (est) Fifth Year	Scenario Cost First 5 Years
Intensive Programs							
E-1 Systemic Herbicide	*Macrophyte survey/biomass*	$3,000	$3,000	$3,000	$3,000	$3,000	
large-scale	•SONAR(fluridone) applic	$300,000 230ac	$150,000 185 ac	$0	$0	$0	
	•RODEO(glyphosate)	$6,000 20 ac	$3,000 10 ac	$0	$0	$0	
w/intensive small-scale	•Mitigation-habitat	$0	$0	$5,000 +volun	$0	$0	
treatments around lake	•Downstream veg surv	volunteer	volunteer	volunteer	volunteer	volunteer	
	•Permitting/(checklist)	$5,000	$1,000	$1,000	$1,000	$1,000	
	•Small-scale treatment (physical/mechanical)	$0	$13,000	$13,000	$13,000	$13,000	
	•Public Ed/Noxious Weed Prev	$2000+volun	$2000+volun	$2000+volun	$2000+volun	$2000+volun	
	•Program Monitor/Eval w/ Steering Committee	$5000+volun	$5000+volun	$3000+volun	$3000+volun	$3000+volun	
	•Alum treatment-whole lake	-	-	-	$290,000 339 ac	-	
TOTALS		**$321,000**	**$177,000**	**$27,000**	**$312,000**	**$22,000**	**$859,000**
E-2 Systemic Herbicide and/or Physical Control	*Macrophyte survey/biomass*	$3,000	$3,000	$3,000	$3,000	$3,000	
	•SONAR (fluridone) applic	$65,000 50-100			$0	$0	
south end milfoil colonies	in south end	to $130,000 acres					
	•RODEO(glyphosate) applic	$6,000 20 ac	$3,000 10 ac	$3,000 10 ac	$3,000 10 ac	$3,000 10 ac	
w/intensive small-scale	•Mitigation-habitat	$0	$0	$5,000	$0	$0	
treatments around lake	*•Small-scale treatment (physical/mechanical)*	$13,000	$25,000	$13,000	$13,000	$13,000	
	•Permitting/(checklist)	$5,000	$1,000	$1,000	$1,000	$1,000	
	•Public Ed/Noxious Weed Prev	$2000+volun	$2000+volun	$2000+volun	$2000+volun	$2000+volun	
	•Program Monitor/Eval w/ Steering Committee	$5000+volun	$5000+volun	$3000+volun	$3000+volun	$3000+volun	
TOTALS		**$99,000 to $164,000**	**$39,000**	**$30,000**	**$25,000**	**$25,000**	**$218,000 to $283,000**

TABLE J-1 (Con't)

ALTERNATIVE TREATMENT SCENARIOS FOR LONG LAKE AQUATIC PLANT MANAGEMENT

Treatment Scenarios	*Program Elements	** Costs (est) First Year	** Costs (est) Second Year	** Costs (est) Third Year	** Costs (est) Fourth Year	** Costs (est) Fifth Year	Scenario Cost First 5 Years
						$0	
Maintenance Program							
M-3 Small-scale Control	*•Macrophyte survey/biomass*	$3,000	$3,000	$3,000	$3,000	$3,000	
w/intensive small-scale treatments around shore	*•Small-scale treatment (physical/mechanical)*	$13,000	$13,000	$13,000	$13,000	$13,000	
	•Spot treatment w/RODEO and/or Aquathol herbicides	$5,000 10-20 to $10,000 acres	$3,000 5 ac	$3,000 5 ac	$3,000 5 ac	$1,500 3 ac	
	•Permitting (checklist)	$2,000	$500	$500	$500	$500	
	•Public Ed/Noxious Weed Prev	$2000+volun	$2000+volun	$2000+volun	$2000+volun	$2000+volun	
	•Program Monitor/Eval w/ Steering Committee	$3000+volun	$3000+volun	$3000+volun	$3000+volun	$3000+volun	
TOTALS		**$28,000 to $33,000**	**$24,500**	**$24,500**	**$24,500**	**$23,000**	**$124,500 to $129,500**

* Program elements common to all Scenarios are italicized

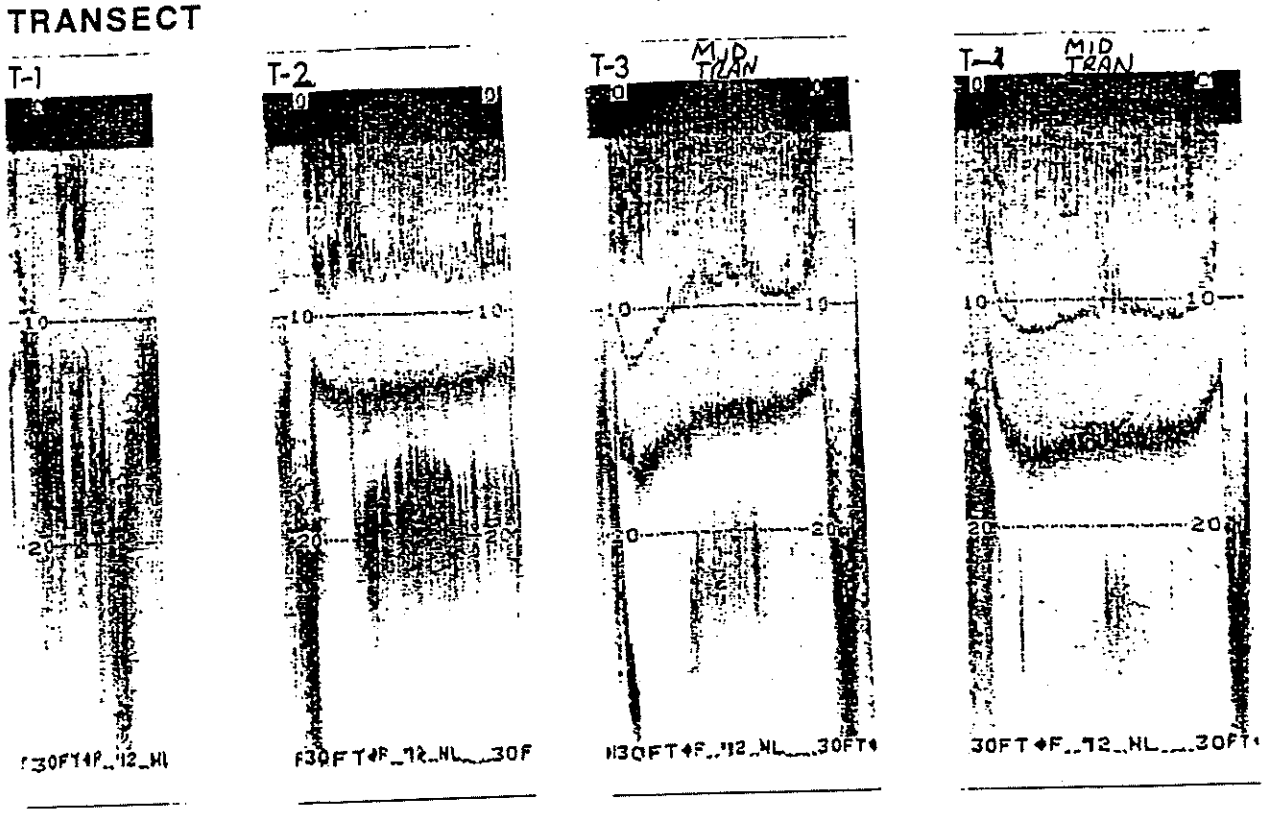
** Cost are projections based on contractors' current estimates.

Appendix B
Washington Natural Heritage Program Database Search of Long Lake Watershed

Appendix C
Summer, 1996 Long Lake Aquatic Plant Survey
Fathometer Recordings

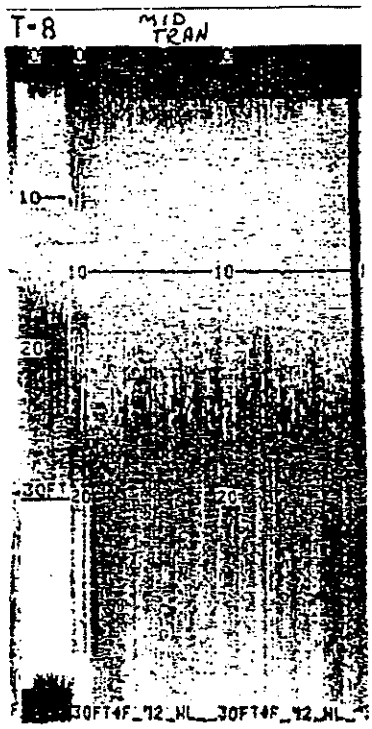
LONG LAKE AQUATIC PLANT SURVEY
AUGUST 26-28, 1996

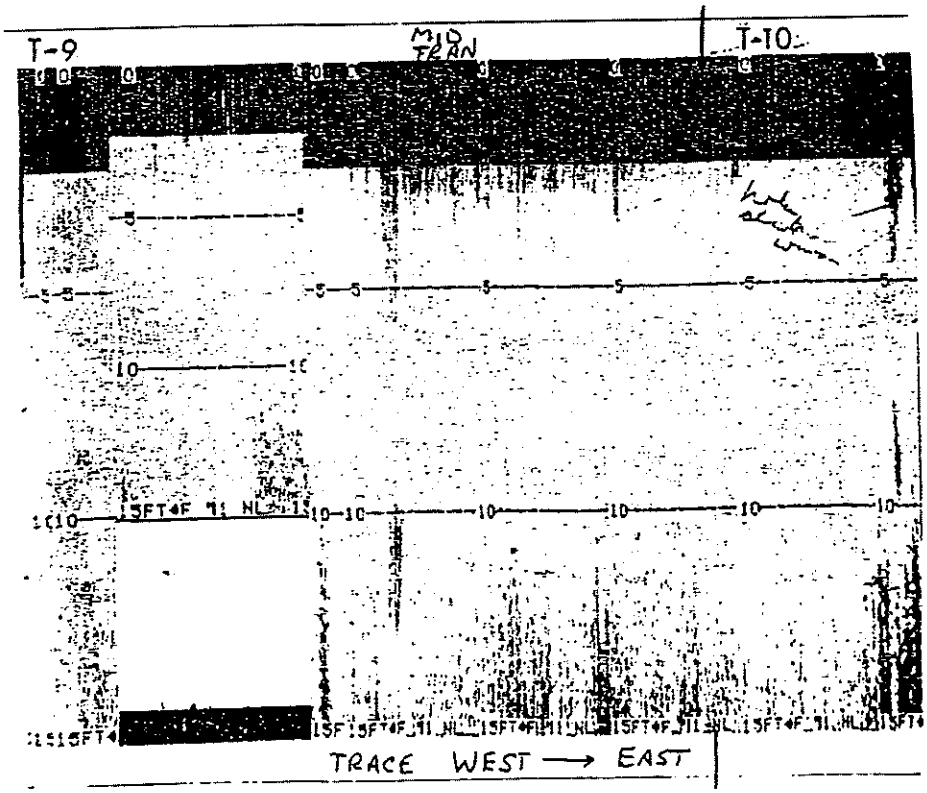
TRANSECT



LONG LAKE AQUATIC PLANT SURVEY
AUGUST 26-28, 1996

TRANSECT





Appendix D
Manufacturer Labels
for SONAR®, AQUATHOL®, and RODEO®

This sample label is current as of February 15, 1995. The product descriptions and recommendations provided in this sample label are for background information only. Always refer to the label on the product before using Monsanto or any other agrichemical product.

RODEO®

EMERGED AQUATIC WEED AND BRUSH HERBICIDE

BY Monsanto

Complete Directions for Use in Aquatic and Other Noncrop Sites.

EPA Reg. No. 524-343

AVOID CONTACT WITH FOLIAGE, GREEN STEMS, EXPOSED NONWOODY ROOTS, OR FRUIT OF CROPS, DESIRABLE PLANTS AND TREES, SINCE SEVERE INJURY OR DESTRUCTION MAY RESULT.

*RODEO is a registered trademark of Monsanto Company.

1995-1 21061T1-1CC

Read the entire label before using this product.

Use only according to label instructions.

Read "LIMIT OF WARRANTY AND LIABILITY" before buying or using. If terms are not acceptable, return at once unopened.

REFORMULATION IS PROHIBITED. SEE INDIVIDUAL CONTAINER LABEL FOR REPACKAGING LIMITATIONS.

LIMIT OF WARRANTY AND LIABILITY

This Company warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes set forth in the Complete Directions for Use label booklet ("Directions") when used in accordance with those Directions under the conditions described therein. NO OTHER EXPRESS WARRANTY OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE OR MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY IS MADE. This warranty is also subject to the conditions and limitations stated herein.

Buyer and all users shall promptly notify this Company of any claims whether based in contract, negligence, strict liability, other tort or otherwise.

Buyer and all users are responsible for all loss or damage from use or handling which results from conditions beyond the control of this Company, including, but not limited to, incompatibility with products other than those set forth in the Directions, application to or contact with desirable vegetation, unusual weather, weather conditions which are outside the range considered normal at the application site and for the time period when the product is applied, as well as weather conditions which are outside the application ranges set forth in the Directions, application in any manner not explicitly set forth in the Directions, moisture conditions outside the moisture range specified in the Directions, or the presence of products other than those set forth in the Directions in or on the soil or treated vegetation.

THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE LIMIT OF THE LIABILITY OF THIS COMPANY OR ANY OTHER SELLER FOR ANY AND ALL LOSSES, INJURIES OR DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT (INCLUDING CLAIMS BASED IN CONTRACT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE) SHALL BE THE PURCHASE PRICE PAID BY THE USER OR BUYER FOR THE QUANTITY OF THIS PRODUCT INVOLVED, OR, AT THE ELECTION OF THIS COMPANY OR ANY OTHER SELLER, THE REPLACEMENT OF SUCH QUANTITY, OR, IF NOT ACQUIRED BY PURCHASE, REPLACEMENT OF SUCH QUANTITY. IN NO EVENT SHALL THIS COMPANY OR ANY OTHER SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES.

Buyer and all users are deemed to have accepted the terms of this LIMIT OF WARRANTY AND LIABILITY which may not be varied by any verbal or written agreement.

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

Keep out of reach of children.

CAUTION!

HARMFUL IF INHALED

Avoid breathing vapors or spray mist.

Remove contaminated clothing and wash clothing before reuse.

Wash thoroughly with soap and water after handling.

FIRST AID: IF INHALED, remove individual to fresh air. Seek medical attention if breathing difficulty develops.

In case of an emergency involving this product, Call Collect, day or night, (314) 694-4000.

Environmental Hazards

Do not contaminate water when disposing of equipment washwaters. Treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants. This oxygen loss can cause fish suffocation.

In case of: SPILL or LEAK, soak up or remove to a landfill.

Physical or Chemical Hazards

Spray solutions of this product should be mixed, stored and applied using only stainless steel, aluminum, fiberglass, plastic or plastic-lined steel containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED STEEL OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

ACTIVE INGREDIENT:	
*Glyphosate, *N*-(phosphonomethyl)glycine, in the form of its isopropylamine salt	53.8%
INERT INGREDIENTS:	46.2%
	100.0%

*Contains 648 grams per litre or 5.4 pounds per U.S. gallon of the active ingredient, glyphosate, in the form of its isopropylamine salt. Equivalent to 450 grams per litre or 4 pounds per U.S. gallon of the acid, glyphosate.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in any manner inconsistent with its labeling.

For more product information, call toll-free 1-800-332-3111.

Storage and Disposal

Do not contaminate water, foodstuffs, feed or seed by storage or disposal.

See container label for STORAGE AND DISPOSAL instructions.

GENERAL INFORMATION

This product, a water-soluble liquid, mixes readily with water and nonionic surfactant to be applied as a foliar spray for the control or destruction of many herbaceous and woody plants.

This product moves through the plant from the point of foliage contact to and into the root system. Visible effects on most annual weeds occur within 2 to 4 days but on most perennial brush species may not occur for 7 days or more. Extremely cool or cloudy weather following treatment may slow the activity of this product and delay visual effects of control. Visible effects are a gradual wilting and yellowing of the plant which advances to complete browning of above-ground growth and deterioration of underground plant parts.

Unless otherwise directed on this label, delay application until vegetation has emerged and reached the stages described for control of such vegetation under the "Weeds Controlled" section of this label.

Unemerged plants arising from unattached underground rhizomes or root stocks of perennials or brush will not be affected by the spray and will continue to grow. For this reason best control of most perennial weeds or brush is obtained when treatment is made at late growth stages approaching maturity.

Always use the higher rate of this product per acre within the recommended range when vegetation is heavy or dense.

elf atochem

ATO

AQUATHOL®

GRANULAR AQUATIC HERBICIDE

ACTIVE INGREDIENT	
Dipotassium salt of endothall*	10.1%
INERT INGREDIENTS	89.9%
TOTAL	100.0%

*7-oxabicyclo [2.2.1]heptane-2,3-dicarboxylic acid equivalent 7.2%

KEEP OUT OF REACH OF CHILDREN

DANGER

STATEMENT OF PRACTICAL TREATMENT

IF IN EYES, hold eyelids open and flush with a steady, gentle stream of water for 15 minutes. Call a physician.

IF SWALLOWED, drink promptly a large quantity of milk, egg whites, gelatin solution or if these are not available, drink large quantities of water. Avoid alcohol. Call a physician immediately.

IF ON SKIN, immediately flush with plenty of water for at least 15 minutes. Remove and wash contaminated clothing before reuse.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

See Side Panel for Additional Precautionary Statements

EPA Registration No. 4581-201

EPA Establishment No. 228-IL-1

40 Lbs. Net Weight

ELF Atochem North America, Inc.
Agchem Division
Philadelphia, PA

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS (AND DOMESTIC ANIMALS)

DANGER

CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE. HARMFUL IF SWALLOWED, ABSORBED THROUGH SKIN OR INHALED. AVOID CONTACT WITH SKIN OR CLOTHING. DO NOT GET IN EYES. WEAR GOGGLES OR FACE SHIELD WHEN HANDLING. Avoid breathing dust. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

ENVIRONMENTAL HAZARDS

Avoid contact with or drift to other crops or plants as injury may result.

Do not use water from treated areas for irrigation or for agricultural sprays on food crops or for domestic purposes within 7 days of treatment.

Do not use fish from treated area for food or feed within 3 days of treatment.

GENERAL INFORMATION

AQUATHOL GRANULAR is a granular aquatic herbicide for use in ponds and lakes which, under field test conditions has shown to be effective against a broad range of aquatic plants with a margin of safety to fish. Dosage rates indicated for the applications of AQUATHOL GRANULAR are measured in "Parts Per Million" (ppm). 1 ppm as a dosage rate means that there would be 1 part of AQUATHOL GRANULAR'S active ingredient in 1,000,000 parts of water. Only ½ to 5 ppm are generally required for aquatic weed control, whereas some fish species are tolerant to approximately 100 ppm or over. For best results treat areas of one acre or more and/or margins of at least 100 feet in large bodies of water.

Thoroughly clean application equipment immediately after use.

NOTE: Area treated with AQUATHOL GRANULAR may be used for swimming 24 hours after treatment.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

HOW TO APPLY:

AQUATHOL GRANULAR is a contact killer, consequently, do not apply before weeds are present. Application as early as possible after weeds are present is recommended to permit use of lower application rates. However, for best results water temperature should be at a minimum of 65 F. If an entire pond is treated at one time, or if the dissolved oxygen level is low at time of application, decay of weeds may remove enough oxygen from the water causing fish to suffocate. Water containing very heavy vegetation should be treated in sections to prevent suffocation of fish. Sections should be treated 5-7 days apart. Carefully measure size and depth of area to be treated and determine proper amount of AQUATHOL GRANULAR to apply from chart. For best results apply on a calm day where there is little wave action.

Scatter AQUATHOL GRANULAR as evenly as possible over treated areas. A cyclone seeder is useful for this purpose. In instances where the nuisance to be controlled is an exposed surface problem (i.e. some of the broadleaved pond weeds) it is important to get good contact coverage of the problem.

Necessary approval and/or permits should be obtained in states where required.

HOW TO DETERMINE DOSAGE RATE (Active Ingredient)

AQUATHOL GRANULAR is recommended for the control of the following aquatic weeds at the rates indicated. Since AQUATHOL GRANULAR's active ingredient is water soluble and tends to diffuse from the area treated, select the dosage rate applicable to the area to be treated. Use the lower rate in each range of rates when the growth is young and growing and/or where the weed stand is not heavy. Marginal treatments of large bodies of water require highest rates as indicated.

WEEDS CONTROLLED AND AQUATHOL GRANULAR DOSAGE RATE CHART

Common Name	Latin Name	Entire Pond Or Large Area Treatment	Spot Or Lake Margin Treatment
Bass Wood	Potamogeton amplifolius	2.0-3.0 ppm	3.0-4.0 ppm
Bur Reed	Sparganium spp.	3.0-4.0 ppm	4.0-5.0 ppm
Coontail	Ceratophyllum spp.	1.0-2.0 ppm	2.0-3.0 ppm
Milfoil	Myriophyllum spp.	2.0-3.0 ppm	3.0-4.0 ppm
Pondweed			
Bushy	Najas spp.	0.5-1.5 ppm	2.0-3.0 ppm
Curly-Leaf	Potamogeton crispus	0.5-1.5 ppm	2.0-3.0 ppm
Flat-Stem	Potamogeton zosteriformis	2.0-3.0 ppm	3.0-4.0 ppm
Floating-Leaf	Potamogeton natans	1.0-2.0 ppm	2.0-3.0 ppm
Horned	Zannichellia spp.	1.0-2.0 ppm	2.0-3.0 ppm
Sago	Potamogeton pectinatus	1.0-2.0 ppm	2.0-3.0 ppm
_____	Potamogeton nodosus	2.0-3.0 ppm	3.0-4.0 ppm
_____	Potamogeton diversifolius	1.0-2.0 ppm	2.0-3.0 ppm
_____	Potamogeton fijiformis	2.0-3.0 ppm	3.0-4.0 ppm
_____	Potamogeton pusillus	1.0-2.0 ppm	2.0-3.0 ppm
Water Star Grass	Heteranthera spp.	2.0-3.0 ppm	3.0-4.0 ppm

HOW TO DETERMINE QUANTITY TO BE APPLIED

The following charts indicate the total quantity of material to be applied for certain size areas.

APPROXIMATE POUNDS OF AQUATHOL GRANULAR FOR ONE ACRE*
TREATMENT DOSAGE IN POUNDS FOR VARIOUS CONCENTRATIONS IN PPM

DEPTH	0.5 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm	3.0 ppm	4.0 ppm	5.0 ppm
1 Ft. Deep	13 lbs.	27 lbs.	40 lbs.	54 lbs.	67 lbs.	81 lbs.	108 lbs.	135 lbs.
2 Ft. Deep	27 lbs.	54 lbs.	81 lbs.	108 lbs.	134 lbs.	161 lbs.	215 lbs.	269 lbs.
3 Ft. Deep	40 lbs.	81 lbs.	121 lbs.	161 lbs.	202 lbs.	242 lbs.	323 lbs.	403 lbs.
4 Ft. Deep	54 lbs.	108 lbs.	161 lbs.	215 lbs.	269 lbs.	323 lbs.	430 lbs.	538 lbs.
5 Ft. Deep	67 lbs.	135 lbs.	202 lbs.	269 lbs.	336 lbs.	403 lbs.	538 lbs.	673 lbs.
6 Ft. Deep	81 lbs.	161 lbs.	242 lbs.	323 lbs.	403 lbs.	484 lbs.	646 lbs.	807 lbs.

FOR 1000 SQUARE FEET TREATMENT
DOSAGE IN POUNDS FOR VARIOUS CONCENTRATIONS IN PPM

DEPTH	0.5 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm	3.0 ppm	4.0 ppm	5.0 ppm
1 Ft. Deep	0.3 lbs.	0.6 lbs.	0.9 lbs.	1.2 lbs.	1.5 lbs.	1.9 lbs.	2.5 lbs.	3.1 lbs.
2 Ft. Deep	0.6 lbs.	1.2 lbs.	1.9 lbs.	2.5 lbs.	3.1 lbs.	3.7 lbs.	4.9 lbs.	6.2 lbs.
3 Ft. Deep	0.9 lbs.	1.9 lbs.	2.8 lbs.	3.7 lbs.	4.6 lbs.	5.6 lbs.	7.4 lbs.	9.3 lbs.
4 Ft. Deep	1.2 lbs.	2.5 lbs.	3.7 lbs.	4.9 lbs.	6.2 lbs.	7.4 lbs.	9.9 lbs.	12.4 lbs.
5 Ft. Deep	1.5 lbs.	3.1 lbs.	4.6 lbs.	6.2 lbs.	7.7 lbs.	9.3 lbs.	12.4 lbs.	15.4 lbs.
6 Ft. Deep	1.9 lbs.	3.7 lbs.	5.6 lbs.	7.4 lbs.	9.3 lbs.	11.1 lbs.	14.8 lbs.	18.5 lbs.

*One acre equals approximately 208' x 208'

Where the area to be treated is greater than those listed in the charts proceed as follows:

a. Compute the approximate surface acreage
b. Compute the average depth
c. Multiply a. by b. to determine the total number of acre/feet
d. Multiply the pounds required at the 1 foot depth under the rate to be used by the number of acre/feet to determine total quantity to be used.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Storage Instructions: Store in the original container, preferably in a locked storage area. Do not store in a manner where cross contamination with other pesticides, fertilizers, food or feed could occur. If spilled during storage or handling sweep up spillage and dispose of in accordance with the Pesticide Disposal Instructions listed below.

Pesticide Disposal Instructions: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Disposal Instructions: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY AND DISCLAIMER

Elf Atochem North America warrants that this material conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the Directions for Use, subject to the risks referred to therein. ELF ATOCHEM MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. IN NO CASE SHALL ELF ATOCHEM OR SELLER BE LIABLE FOR CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, BUSINESS REPUTATION, OR CUSTOMERS; LABOR COST; OR OTHER EXPENSES INCURRED IN PLANTING OR HARVESTING.

Elf Atochem and seller offer this product and the buyer and user accept it subject to the foregoing conditions of sale and warranty which may be varied only by agreement in writing signed by a duly authorized representative of Elf Atochem.

5-F103S-03 C1 (2/92)

Made and Printed in U.S.A.

elf atochem

ATO

AQUATHOL® K

AQUATIC HERBICIDE

ACTIVE INGREDIENT	
Dipotassium salt of endothall*	40.3%
INERT INGREDIENTS	59.7%
TOTAL	100.0%

*7-oxabicyclo [2.2.1]heptane-2,3-dicarboxylic acid equivalent 28.6%
Contains per gallon 4.23 lb. dipotassium endothall
(equivalent to 3.0 lbs. endothal acid)

KEEP OUT OF REACH OF CHILDREN

DANGER POISON

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED, drink promptly a large quantity of milk, egg whites, gelatin solution or if these are not available, drink large quantities of water. Avoid alcohol. Call a physician immediately.

IF ON SKIN, immediately flush with plenty of water for at least 15 minutes. Remove and wash contaminated clothing before reuse.

IF IN EYES, immediately flush with plenty of water for at least 15 minutes. Call a physician.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

See Side Panel for Additional Precautionary Statements

NOTE: For GENERAL INFORMATION and DIRECTIONS FOR USE refer to accompanying brochure.

EPA Registration No. 4581-204 EPA Establishment No. 4581-TX-1

Net Contents ____ Gallons/____ Liters

ELF ATOCHEM NORTH AMERICA, INC.
Aghem Division
2000 Market Street, Philadelphia, PA 19103

Common Name	Latin Name	Entire Pond Or Large Area Treatment	Spot Or Lake Margin Treatment
Bass Weed	Potamogeton amplifolius	2.0-3.0 ppm	3.0-4.0 ppm
Bur Reed	Sparganium spp.	3.0-4.0 ppm	4.0-5.0 ppm
Coontail	Ceratophyllum spp.	1.0-2.0 ppm	2.0-3.0 ppm
Hydrilla	Hydrilla verticillata	2.0-3.0 ppm	3.0-4.0 ppm
Milfoil	Myriophyllum spp.	2.0-3.0 ppm	3.0-4.0 ppm
Pondweed			
Bushy	Najas spp.	0.5-1.5 ppm	2.0-3.0 ppm
Curly-Leaf	Potamogeton crispus	0.5-1.5 ppm	2.0-3.0 ppm
Flat-Stem	Potamogeton zosteriformis	2.0-3.0 ppm	3.0-4.0 ppm
Floating-Leaf	Potamogeton natans	1.0-2.0 ppm	2.0-3.0 ppm
Horned	Zannichellia spp.	1.0-2.0 ppm	2.0-3.0 ppm
Sago	Potamogeton pectinatus	1.0-2.0 ppm	2.0-3.0 ppm
_____	Potamogeton americanus	2.0-3.0 ppm	3.0-4.0 ppm
_____	Potamogeton diversifolius	1.0-2.0 ppm	2.0-3.0 ppm
_____	Potamogeton filiformis	2.0-3.0 ppm	3.0-4.0 ppm
_____	Potamogeton pusillus	1.0-2.0 ppm	2.0-3.0 ppm
Water Star Grass	Heteranthera spp.	2.0-3.0 ppm	3.0-4.0 ppm

RATE OF APPLICATION—LAKES AND PONDS

The following chart indicates the total quantity of material to be applied.

APPROXIMATE GALLONS OF AQUATHOL K FOR ONE ACRE (208' x 208') TREATMENT

DEPTH	DOSAGE IN GALLONS FOR VARIOUS CONCENTRATIONS IN PPM						
	0.5 ppm	1.0 ppm	1.5 ppm	2.0 ppm	3.0 ppm	4.0 ppm	5.0 ppm
1 ft.	0.3	0.6	1.0	1.3	1.9	2.6	3.2
2 ft.	0.6	1.3	1.9	2.6	3.8	5.1	6.4
4 ft.	1.3	2.6	3.8	5.1	7.7	10.2	12.8
6 ft.	1.9	3.8	5.8	7.6	11.5	15.3	19.2

RATE OF APPLICATION—IRRIGATION AND DRAINAGE CANALS**

The following indicates the total quantity of material to be applied.

GALLONS OF AQUATHOL K REQUIRED TO TREAT 1 MILE BY 1 FOOT DEEP*

PPM	WIDTH OF CANAL IN FEET			
	5	10	15	20
1.0 ppm	0.4	0.75	1.2	1.5
2.0 ppm	0.75	1.5	2.3	3.0
3.0 ppm	1.2	2.3	3.5	4.5
4.0 ppm	1.5	3.0	4.5	6.0
5.0 ppm	2.0	3.8	5.7	7.5

The minimum contact time with weeds for optimum results should be 2 hours.

*For deeper water, adjust rate accordingly. **Not for this use in California.

WARRANTY AND DISCLAIMER

Elf Atochem North America warrants that this material conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the Directions for Use, subject to the risks referred to therein. ELF ATOCHEM MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. IN NO CASE SHALL ELF ATOCHEM OR SELLER BE LIABLE FOR CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, BUSINESS REPUTATION, OR CUSTOMERS; LABOR COST; OR OTHER EXPENSES INCURRED IN PLANTING OR HARVESTING.

Elf Atochem and seller offer this product and the buyer and user accept it subject to the foregoing conditions of sale and warranty which may be varied only by agreement in writing signed by a duly authorized representative of Elf Atochem.

GENERAL INFORMATION

AQUATHOL K is a liquid concentrate soluble in water which is effective against a broad range of aquatic plants with a margin of safety to fish.

Dosage rates indicated for the application of AQUATHOL K are measured in "Parts Per Million" (ppm) of dipotassium endothall. Only 0.5 to 5.0 ppm are generally required for aquatic weed control, whereas some fish species are tolerant to approximately 100 ppm or over.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

AQUATIC WEEDS CONTROLLED AND DOSAGE RATE CHARTS

AQUATHOL K is recommended for the control of the following aquatic weeds in irrigation and drainage canals, ponds and lakes at the rates indicated. Since the active ingredient is water soluble and tends to diffuse from the area treated, select the dosage rate applicable to the area to be treated. Use the lower rate in each range of rates where the growth is young and growing and/or where the weed stand is not heavy. Marginal treatments of large bodies of water require higher rates as indicated.

HOW TO APPLY:
AQUATHOL K is a contact killer; consequently, do not apply before weeds are present. Application as early as possible after weeds are present is recommended to permit use of lower application rates. However, for best results water temperature should be at 65°F or above. If an entire pond is treated at one time, or if the dissolved oxygen level is low at time of application, decay of weeds may remove enough oxygen from the water, causing fish to suffocate. Water containing very heavy vegetation should be treated in sections to prevent suffocation of fish. Sections should be treated 5-7 days apart. Carefully measure size and depth of area to be treated and determine amount of AQUATHOL K to apply from chart. For best results apply on a calm day where there is little wave action.

AQUATHOL K should be sprayed on the water or injected below the water surface and should be distributed as evenly as possible. It may be applied as it comes from the container or diluted with water depending on the equipment. Some dilution will give better distribution.

In instances where the nuisance to be controlled is an exposed surface problem (i.e., some of the broad-leaved pond weeds) it is important to get good contact coverage utilizing the highest concentration (least water dilution) compatible with the type of equipment used so that even distribution is achieved.

Necessary approval and/or permits should be obtained in states where required.

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS (AND DOMESTIC ANIMALS)

DANGER

FATAL IF ABSORBED THROUGH SKIN. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CORROSIVE, CAUSES IRREVERSIBLE EYE DAMAGE. DO NOT GET IN EYES, ON SKIN OR ON CLOTHING. WEAR PROTECTIVE CLOTHING, RUBBER GLOVES, AND GOGGLES OR FACE SHIELD WHEN HANDLING. Wash thoroughly with soap and water after handling and before eating or smoking. Remove contaminated clothing and wash before reuse. Avoid breathing spray mist.

ENVIRONMENTAL HAZARDS

Avoid contact with or drift to other crops or plants as injury may result. Wash out spray equipment with water after each operation.

Do not use fish from treated areas for food or feed within 3 days of treatment. Do not use water from treated areas for watering livestock, for preparing agricultural sprays for food crops, for irrigation or for domestic purposes within the following periods:

Up to 0.5 ppm dipotassium salt
(0.35 ppm acid equivalent)— 7 days after application

Up to 4.25 ppm dipotassium salt
(3.0 ppm acid equivalent)—14 days after application

Up to 5.0 ppm dipotassium salt
(3.5 ppm acid equivalent)—25 days after application

NOTE: Areas treated with AQUATHOL K may be used for swimming twenty-four hours after treatment.

Treated water can be used for sprinkling bent grass immediately.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Storage Instructions: Store in the original container. Do not store in a manner where cross-contamination with other pesticides, fertilizers, food or feed could occur. Storage at temperatures below 32°F may result in the product freezing or crystalizing. Should this occur the product must be warmed to 50°F or higher and thoroughly agitated. In the event of a spillage during handling or storage, absorb with sand or other inert material and dispose of absorbent in accordance with the Pesticide Disposal Instructions listed below.

Pesticide Disposal Instructions: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Disposal Instructions: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

5-C102S-02 C1 (2/92)

Made and Printed in U.S.A.

Supplemental Labeling

SePRO Corporation 11550 North Meridian St., Suite 200 Carmel, Indiana 46032 USA

Sonar* A.S. Herbicide (EPA Reg. No. 67690-4)
Sonar for Control of Eurasian Watermilfoil in Whole Lake or Reservoir Treatments

- It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
- This labeling must be in the possession of the user at the time of application and is inteuded for use only by Federal, State or local public agency personnel trained in aquatic weed control, or by licensed commercial applicators under contract to or supervised by the above agencies.
- Note to applicators (State and Local Coordination): Before application under any project program, notification and approval of local and state authorities may be required, either by letter of agreement or issuance of special permits for such use.
- All Directions for Use, General Information, Application Information, Precautions and Limitations on the Sonar A.S. label apply to this supplemental labeling.

Use Rates for Control of Eurasian Watermilfoil in Whole Lake or Reservoir Treatments:
The following application rates may be used for control of Eurasian watermilfoil when treating lakes or reservoirs where little dilution with untreated water is expected to occur. Under these conditions, Sonar may be applied to provide a concentration of 0.01 to 0.02 ppm (10 to 20 ppb) of active ingredient in treated water. Application rates necessary to achieve these active ingredient concentrations in treated water are shown in the following table. For optimum control, it is recommended that applications be made early in the growing season.

Average Water Depth of Treatment Site (feet)	Quarts of Sonar A.S. per Treated Surface Area
1	0.027-0.05
2	0.05-0.11
3	0.08-0.16
4	0.11-0.22
5	0.14-0.27
6	0.16-0.32
7	0.19-0.38
8	0.22-0.43
9	0.24-0.49
10	0.27-0.54

When treated with these use rates, other less susceptible species listed under Aquatic Plants Controlled may exhibit only temporary injury or stunting followed by recovery and normal growth. These 0.01-0.02 ppm rates may be applied where functioning potable water intakes are present. Note: When applications for management of Eurasian watermilfoil are made to only portions of lakes or reservoirs such as bays or fingers of these water bodies, the higher rates and use directions listed on the label accompanying the product under Applications to Lakes and Reservoirs are recommended.

*Trademark of SePRO Corporation

Post-it™ Fax

T3CSPOOI Approved 6/21/94

Specimen Label

Herbicide

A herbicide for management of aquatic vegetation in fresh water ponds, lakes, reservoirs, drainage canals and irrigation canals

Active Ingredient:
fluridone: 1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1*H*)-pyridinone..... 41.7%
Inert Ingredients..... 58.3%
Total.....100.0%
Contains 4 pounds active ingredient per gallon.

EPA Reg. No. 67690-4

Precautionary Statements

Hazards to Humans and Domestic Animals

Keep Out of Reach of Children

CAUTION PRECAUCION

Precaucion al usuario: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.

Harmful If Swallowed, Absorbed Through Skin, Or If Inhaled

Avoid breathing of spray mist or contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling. Wash exposed clothing before reuse.

First Aid

If in eyes: Flush eyes or skin with plenty of water. Get medical attention if irritation persists.
If swallowed: Call a physician or poison control center, drink one or two glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.
If inhaled: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

Environmental Hazards

Follow use directions carefully so as to minimize adverse effects on nontarget organisms. In order to avoid impact on threatened or endangered aquatic plant or animal species, users must consult their State Fish and Game Agency or the U.S. Fish and Wildlife Service before making applications.

Do not contaminate water when disposing of equipment washwaters. Trees and shrubs growing in water treated with Sonar A.S. herbicide may occasionally develop chlorosis. Do not apply in tidewater/brackish water.

Lowest rates should be used in shallow areas where the water depth is considerably less than the average depth of the entire treatment site, for example, shallow shoreline areas.

Directions for Use

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
Read all Directions for Use carefully before applying.
Shake well before using.

Storage and Disposal

Do not contaminate water, food, or feed by storage or disposal.
Storage: Store in original container only. Do not store near feed or foodstuffs. In case of leak or spill, use absorbent materials to contain liquids and dispose as waste.
Pesticide Disposal: Wastes resulting from use of this product may be used according to label directions or disposed of at an approved waste disposal facility.
Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

*Trademark of SePRO Corporation

Sonar® A.S. Herbicide

General Information

Sonar A.S. herbicide is a selective systemic aquatic herbicide for management of aquatic vegetation in fresh water ponds, lakes, reservoirs, drainage canals and irrigation canals. Sonar A.S. is absorbed from water by plant shoots and from hydrosoil by the roots of aquatic vascular plants. It is important to maintain the recommended concentration of Sonar A.S. in contact with the weeds as long as possible. Rapid water movement or any condition which results in rapid dilution of Sonar A.S. in treated water will reduce its effectiveness. In susceptible plants, Sonar A.S. inhibits the formation of carotene. In the absence of carotene, chlorophyll is rapidly degraded by sunlight. Herbicidal symptoms of Sonar A.S. appear in seven to ten days and appear as white (chlorotic) or pink growing points. Under optimum conditions 30 to 90 days are required before the desired level of aquatic weed management is achieved with Sonar A.S. Species susceptibility to Sonar A.S. may vary depending on time of year, stage of growth, and water movement. For best results, apply Sonar A.S. prior to initiation of weed growth or when weeds begin active growth.

Sonar A.S. is not corrosive to application equipment.

General Use Precautions

Obtain Required Permits: Consult with appropriate state or local water authorities before applying this product. Permits may be required by state or local public agencies.

Chemigation: Do not apply Sonar A.S. through any type of irrigation system.

Potable Water Intakes: In lakes and reservoirs, do not apply Sonar A.S. within one-fourth mile (1320 feet) of any functioning potable water intake. **Note: Existing potable water intakes which are no longer in use, such as those replaced by potable water wells or connections to a municipal water system, are not considered to be functioning potable water intakes.**

Irrigation: Irrigation with water treated with Sonar A.S. may result in injury to the irrigated vegetation. SePRO recommends informing those who irrigate from areas treated with Sonar A.S. of the irrigation time frames presented in the table below. These time frames are suggestions which should be followed to reduce the potential for injury to vegetation irrigated with water treated with Sonar A.S.:

Application Site	Days After Application: Established Tree Crops	Established Row Crops Turf/Plants	Newly Seeded Crops/Seedbeds or Areas to be Planted Including /Overseeded Golf Course Greens
†Ponds and Static Canals	7	30	30
Canals	7	14	30
††Lakes and Reservoirs	7	14	14

†For purposes of Sonar A.S. labeling, a pond is defined as a body of water 10 acres or less in size. A lake or reservoir is greater than 10 acres.

††In lakes and reservoirs where one-half or greater of the body of water is treated, use the pond and static canal irrigation restrictions.

Weed Control Information

Vascular Aquatic Plants Controlled by Sonar A.S.

Floating Plants:

Common duckweed (*Lemna minor*)†

Emersed Plants:

spatterdock (*Nuphar luteum*)
waterlily (*Nymphaea* spp.)

†Controlled only with a surface application of Sonar AS.

Submersed Plants:

bladderwort (*Utricularia* spp.)
common coontail (*Ceratophyllum demersum*)
common elodea (*Elodea canadensis*)
egeria, Brazilian elodea (*Egeria densa*)
fanwort, cabomba (*Cabomba caroliniana*)
hydrilla (*Hydrilla verticillata*)
naiad (*Najas* spp.)
pondweed (*Potamogeton* spp., except Illinois pondweed)
watermilfoil (*Myriophyllum* spp.)

Shoreline Grasses:

paragrass (*Brachiaria mutica*)

Vascular Aquatic Plants Partially Controlled by Sonar A.S.

alligatorweed (*Alternanthera philoxeroides*)
American lotus (*Nelumbo lutea*)
cattail (*Typha* spp.)
common watermeal (*Wolffia columbiana*)††
creeping waterprimrose (*Ludwigia peploides*)
giant cutgrass (*Zizaniopsis miliacea*)
Illinois pondweed (*Potamogeton illinoensis*)
parrotfeather (*Myriophyllum brasiliense*)
reed canarygrass (*Phlaris arundinaceae*)
smartweed (*Polygonum* spp.)
spikerush (*Eleocharis* spp.)
southern watergrass (*Hydrochloa caroliniensis*)
torpedograss (*Panicum repens*)
waterpurslane (*Ludwigia palustris*)
watershield (*Brasenia schreberi*)

††Partial control only with a surface application of Sonar A.S. at the maximum labeled rate.

Vascular Aquatic Plants Not Controlled by Sonar A.S.

algae (*Chara* and *Nitella*)
American frogbit (*Limnobium spongia*)
arrowhead (*Sagittaria* spp.)
bacopa (*Bacopa* spp.)
big floatingheart, banana lily (*Nymphoides aquatica*)
bulrush (*Scirpus* spp.)
floating waterhyacinth (*Eichhornia crassipes*)
maidencane (*Panicum hemitomon*)
pickerelweed, lanceleaf (*Pontederia cordata*)
rush (*Juncus* spp.)
tapegrass, American eelgrass (*Vallisneria americana*)
waterlettuce (*Pistia stratiotes*)
water pennywort (*Hydrocotyle umbellata*)

Mixing and Application Directions

The aquatic plants present in the treatment site should be identified prior to application to determine their susceptibility to Sonar A.S. It is important to determine the area (acres) to be treated and the average depth in order to select the proper application rate. Do not exceed the maximum labeled rate for a given treatment site per annual growth cycle.

Shake Sonar A.S. well before using. Add the recommended amount of Sonar A.S. to water in the spray tank during the filling operation. Agitate while filling and during spraying. Surface or subsurface application of the spray can be made with conventional spray equipment. Sonar A.S. can also be applied near the surface of the hydrosoil using weighted trailing hoses. A spray volume of 5 to 100 gallons per acre may be used. Sonar A.S. may also be diluted with water and the concentrated mix metered into the pumping system.

Application to Ponds

Sonar A.S. may be applied to the entire surface area of a pond. Rates may be selected to provide 0.06 to 0.09 ppm of active ingredient in the treated water. Application rates necessary to obtain these active ingredient concentrations in treated water are shown in the following table. When average water depth of the treatment site is greater than 5 feet, apply 1 to 1.5 quarts of Sonar A.S. per treated surface acre.

Average Water Depth of Treatment Site (feet)	Quarts of Sonar A.S. per Treated Surface Acre
1	0.16 - 0.25
2	0.33 - 0.50
3	0.50 - 0.75
4	0.65 - 1.00
5	0.80 - 1.25

Use the higher rate within the rate range where there is a dense weed mass or when treating more difficult to control species.

Application to Lakes and Reservoirs

For best results in lakes and reservoirs, Sonar A.S. treatment areas should be a minimum of 5 acres in size. Treatment of areas smaller than 5 acres or treatment of narrow strips such as boat lanes or shorelines may not produce satisfactory results due to dilution by untreated water. In lakes and reservoirs, do not apply Sonar A.S. within one-fourth mile (1320 feet) of any functioning potable water intake.

Rates may be selected to provide 0.075 to 0.15 ppm of active ingredient in the treated water. Application rates necessary to obtain these active ingredient concentrations in treated water are shown in the following table. When average water depth of the treatment site is greater than 10 feet, apply 3 to 4 quarts of Sonar A.S. per treated surface acre.

Average Water Depth of Treatment Site (feet)	Quarts of Sonar A.S. per Treated Surface Acre
1	0.2 - 0.4
2	0.4 - 0.8
3	0.6 - 1.2
4	0.8 - 1.6
5	1.0 - 2.0
6	1.2 - 2.4
7	1.4 - 2.8
8	1.6 - 3.2
9	1.8 - 3.6
10	2.0 - 4.0

Use the higher rate within the rate range where there is a dense weed mass or when treating more difficult to control species.

Use Rates for Control of Eurasian Watermilfoil in Whole Lake or Reservoir Treatments: The following application rates may be used for control of Eurasian watermilfoil when treating lakes or reservoirs where little dilution with untreated water is expected to occur. Under these conditions, Sonar may be applied to provide a concentration of 0.01 to 0.02 ppm (10 to 20 ppb) of active ingredient in treated water. Application rates necessary to achieve these active ingredient concentrations in treated water are shown in the following table. For optimum control, it is recommended that applications be made early in the growing season.

Average Water Depth of Treatment Site (feet)	Quarts of Sonar A.S. per Treated Surface Acre
1	0.027 - 0.05
2	0.05 - 0.11
3	0.08 - 0.16
4	0.11 - 0.22
5	0.14 - 0.27
6	0.16 - 0.32
7	0.19 - 0.38
8	0.22 - 0.43
9	0.24 - 0.49
10	0.27 - 0.54

When treated with these use rates, other less susceptible species listed under Aquatic Plants Controlled may exhibit only temporary injury or stunting followed by recovery and normal growth. These 0.01 to 0.02 ppm rates may be applied where functioning potable water intakes are present. Note: When applications for management of Eurasian watermilfoil are made to only portions of lakes or reservoirs such as bays or fingers of these water bodies, the higher rates and use directions listed on this label for Applications to Lakes and Reservoirs are recommended.

Application Rate Calculation - Ponds, Lakes and Reservoirs

The amount of Sonar A.S. to be applied to provide the desired ppm concentration of active ingredient in treated water may be calculated as follows:

Quarts of Sonar A.S. required per treated surface acre = Average water depth of treatment site (feet) x Desired ppm concentration of active ingredient x 2.7

For example, the quarts per acre of Sonar A.S. required to provide a concentration of 0.075 ppm of active ingredient in water with an average depth of 5 feet is calculated as follows:

5 x 0.075 x 2.7 = 1.0 quart per treated surface acre.

When measuring quantities of Sonar A.S., quarts may be converted to fluid ounces by multiplying quarts to be measured x 32. For example, 0.25 quarts x 32 = 8 fluid ounces.

Note: Calculated rates should not exceed the maximum allowable rate in quarts per treated surface acre for the water depth listed in the application rate table for the site to be treated.

Application to Drainage Canals and Irrigation Canals

In drainage and irrigation canals, Sonar A.S. should be applied at the rate of 2 quarts per treated surface acre. Where water retention is possible, the performance of Sonar A.S. will be enhanced by restricting water flow. In moving bodies of water, use an application pattern that will provide a uniform distribution and avoid concentration of the herbicide.

Warranty Disclaimer

SePRO Corporation warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. SEPRO CORPORATION MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Plant injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of SePRO Corporation or the seller. All such risks shall be assumed by Buyer.

Limitation of Remedies

The exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories), shall be limited to, at SePRO's election, one of the following:

(1) Refund of purchase price paid by buyer or use for product bought, or
(2) Replacement of amount of product used.

SePRO Corporation shall not be liable for losses or damages resulting from handling or use of this product unless SePRO Corporation is promptly notified of such loss or damage in writing. In no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

The terms of the Warranty Disclaimer above and this Limitation of Remedies cannot be varied by any written or verbal statements or agreements. No employee or sales agent of SePRO Corporation or the seller is authorized to vary or exceed the terms of the Warranty Disclaimer or this Limitation of Remedies in any manner.

Prepare the desired volume of spray solution by mixing the amount of this product in water shown in the following table:

Spray Solution

DESIRED VOLUME	AMOUNT OF RODEO®					
	3/4%	1%	1½%	1½%	5%	8%
1 gallon	1 oz.	1 oz.	1 oz.	2 oz.	6 oz.	10 oz
25 gallons	1½ pt.	1 qt.	1½ qt.	1½ qt.	5 qt.	2 gal.
100 gallons	3 qt.	1 gal	1½ gal.	1½ gal.	5 gal	8 gal

2 tablespoons = 1 ounce

For use in knapsack sprayers it is suggested that the recommended amount of this product be mixed with water in a larger container. Fill sprayer with the mixed solution and add the correct amount of surfactant.

WEEDS CONTROLLED

ANNUAL WEEDS

Apply to actively growing annual grasses and broadleaf weeds.

Allow at least 3 days after application before disturbing treated vegetation. After this period the weeds may be mowed, tilled or burned. See "Directions for Use," "General Information" and "Mixing and Application Instructions" for labeled uses and specific application instructions.

Broadcast Application—Use 1 1/2 pints of this product per acre plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution if weeds are less than 6 inches tall. If weeds are greater than 6 inches tall, use 2 1/2 pints of this product per acre plus 2 or more quarts of an approved nonionic surfactant per 100 gallons of spray solution.

Hand-Held, High-Volume Application—Use a 3/4 percent solution of this product in water plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution and apply to foliage of vegetation to be controlled.

When applied as directed under the conditions described in this label, this product plus nonionic surfactant WILL CONTROL the following ANNUAL WEEDS:

Balsamapple**
Momordica charantia

Barley
Hordeum vulgare

Barnyardgrass
Echinochloa crus-galli

Bassia, fivehook
Bassia hyssopifolia

Bluegrass, annual
Poa annua

Bluegrass, bulbous
Poa bulbosa

Brome
Bromus spp.

Buttercup
Ranunculus spp.

Chart
Bromus secalinus

Chickweed, mouseear
Cerastium vulgatum

Cocklebur
Xanthium strumarium

Corn, volunteer
Zea mays

Crabgrass
Digitaria spp.

Dwarfdandelion
Krigia cespitosa

Falseflax, smallseed
Camelina microcarpa

Fiddleneck
Amsinckia spp.

Flaxleaf fleabane
Conyza bonariensis

Fleabane
Erigeron spp.

Foxtail
Setaria spp.

Foxtail, Carolina
Alopecurus carolinianus

Groundsel, common
Senecio vulgaris

Horseweed/Marestail
Conyza canadensis

Kochia
Kochia scoparia

Lambsquarters, common
Chenopodium album

Lettuce, prickly
Lactuca serriola

Morningglory
Ipomoea spp.

Mustard, blue
Chorispora tenella

Mustard, tansy
Descurainia pinnata

Mustard, tumble
Sisymbrium altissimum

Mustard, wild
Sinapis arvensis

Oats, wild
Avena fatua

Panicum
Panicum spp.

Pennycress, field
Thlaspi arvense

Pigweed, redroot
Amaranthus retroflexus

Pigweed, smooth
Amaranthus hybridus

Ragweed, common
Ambrosia artemisiifolia

Ragweed, giant
Ambrosia trifida

Rocket, London
Sisymbrium irio

Rye
Secale cereale

Ryegrass, Italian*
Lolium multiflorum

Sandbur, field
Cenchrus spp.

Shattercane
Sorghum bicolor

Shepherdspurse
Capsella bursa-pastoris

Signalgrass, broadleaf
Brachiaria platyphylla

Smartweed, Pennsylvania
Polygonum pensylvanicum

Sowthistle, annual
Sonchus oleraceus

Spanishneedles*
Bidens bipinnata

Stinkgrass
Eragrostis cilianensis

Sunflower
Helianthus annuus

Thistle, Russian
Salsola kali

Starry, umbrella
Holosteum umbellatum

Velvetleaf
Abutilon theophrasti

Wheat
Triticum aestivum

Witchgrass
Panicum capillare

*Apply 3 pints of this product per acre.

**Apply with hand-held equipment only.

Annual weeds will generally continue to germinate from seed throughout the growing season. Repeat treatments will be necessary to control later germinating weeds.

PERENNIAL WEEDS

Apply this product as follows to control or destroy most vigorously growing perennial weeds. Unless otherwise directed, allow at least 7 days after application before disturbing vegetation.

Add 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution to the rates of this product given in this list. See the "General Information," "Directions for Use" and "Mixing and Application" sections in this label for specific uses and application instructions.

NOTE: If weeds have been mowed or tilled, do not treat until regrowth has reached the recommended stages. Fall treatments must be applied before a killing frost.

Repeat treatments may be necessary to control weeds regenerating from underground parts or seed.

When applied as recommended under the conditions described, this product plus surfactant WILL CONTROL the following PERENNIAL WEEDS:

Alfalfa
Medicago sativa

Alligatorweed*
Alternanthera philoxeroides

Anise/Fennel
Foeniculum vulgare

Artichoke, Jerusalem
Helianthus tuberosus

Bahiagrass
Paspalum notatum

Bermudagrass
Cynodon dactylon

Bindweed, field
Convolvulus arvensis

Bluegrass, Kentucky
Poa pratensis

Blueweed, Texas
Helianthus ciliaris

Brackenfern
Pteridium spp.

Bromegrass, smooth
Bromus inermis

Canarygrass, reed
Phalaris arundinacea

Cattail
Typha spp.

Clover, red
Trifolium pratense

Clover, white
Trifolium repens

Cogongrass
Imperata cylindrica

Cordgrass
Spartina spp.

Cutgrass, giant*
Zizaniopsis miliacea

Dallisgrass
Paspalum dilatatum

Dandelion
Taraxacum officinale

Dock, curly
Rumex crispus

Dogbane, hemp
Apocynum cannabinum

Fescue
Festuca spp.

Fescue, tall
Festuca arundinacea

Guineagrass
Panicum maximum

Hemlock, poison
Conium maculatum

Horsenettle
Solanum carolinense

Horseradish
Armoracia rusticana

Ice Plant
Mesembryanthemum crystallinum

Johnsongrass
Sorghum halepense

Kikuyugrass
Pennisetum clandestinum

Knapweed
Centaurea repens

Lantana
Lantana camara

Lespedeza: common, sericea
Lespedeza striata
Lespedeza cuneata

Loosestrife, purple
Lythrum salicaria

Lotus, American
Nelumbo lutea

Maidencane
Panicum hematomon

Milkweed
Asclepias spp.

Muhly, wirestem
Muhlenbergia frondosa

Mullein, common
Verbascum thapsus

Napiergrass
Pennisetum purpureum

Nightshade, silverleaf
Solanum eleagnifolium

Nutsedge: purple, yellow
Cyperus rotundus
Cyperus esculentus

Orchardgrass
Dactylis glomerata

Pampasgrass
Cortaderia jubata

Paragrass
Brachiaria mutica

Phragmites**
Phragmites spp.

Quackgrass
Agropyron repens

Reed, giant
Arundo donax

Ryegrass, perennial
Lolium perenne

Smartweed, swamp
Polygonum coccineum

Spatterdock
Nuphar luteum

Starthistle, yellow
Centaurea solstitialis

Sweet potato, wild*
Ipomoea pandurata

Thistle, artichoke
Cynara cardunculus

Thistle, Canada
Cirsium arvense

Timothy
Phleum pratense

Torpedograss*
Panicum repens

Tules, common
Scirpus acutus

Vaseygrass
Paspalum urvillei

Velvetgrass
Holcus spp.

Waterhyacinth
Eichornia crassipes

Waterlettuce
Pistia stratiotes

Waterprimrose
Ludwigia spp.

Wheatgrass, western
Agropyron smithii

*Partial control.

**Partial control in southeastern states. See specific recommendations below.

Alligatorweed—Apply 5 pints of this product per acre as a broadcast spray or as a 1 1/4 percent solution with hand-held equipment to provide partial control of alligatorweed. Apply when most of the target plants are in bloom. Repeat applications will be required to maintain such control.

Bermudagrass—Apply 7 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and when seed heads appear.

Bindweed, field/Silverleaf Nightshade/Texas Blueweed—Apply 6 to 7 1/2 pints of this product per acre as a broadcast spray west of the Mississippi River and 4 1/2 to 6 pints of this product per acre east of the Mississippi River. With hand-held equipment, use a 1 1/2 percent solution. Apply when target plants are actively growing and are at or beyond full bloom. For silverleaf nightshade, best results can be obtained when application is made after berries are formed. Do not treat when weeds are under drought stress. New leaf development indicates active growth. For best results apply in late summer or fall.

Brackenfern—Apply 4 1/2 to 6 pints of this product per acre as a broadcast spray or as a 3/4 to 1 percent solution with hand-held equipment. Apply to fully expanded fronds which are at least 18 inches long.

Cattail—Apply 4 1/2 to 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and are at or beyond the easy-to-full bloom stage of growth. Best results are achieved when application is made during the summer or fall months.

Cogongrass—Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray. Apply when cogongrass is at least 18 inches tall and actively growing in late summer or fall. Allow 7 or more days after application before tillage or mowing. Due to uneven stages of growth and the dense nature of vegetation preventing good spray coverage, repeat treatments may be necessary to maintain control.

Cordgrass—Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 to 2 percent solution with hand-held equipment. Schedule applications in order to allow 6 hours before treated plants are covered by tidewater. The presence of debris and silt on the cordgrass plants will reduce performance. It may be necessary to wash targeted plants prior to application to improve uptake of this product into the plant.

Crabgrass, giant—Apply 6 pints of this product per acre as a broadcast spray or as a 1 percent solution with hand-held equipment to provide partial control of giant crabgrass. Repeat applications will be required to maintain such control, especially where vegetation is partially submerged in water. Allow for substantial regrowth to the 7 to 10-leaf stage prior to retreatment.

Dogbane, hemp/Knapweed/Horseradish—Apply 6 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and must have reached the late bud-to-flower stage of growth. For best results, apply in late summer or fall.

Fescue, tall—Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 1 percent solution with hand-held equipment. Apply when target plants are actively growing and must have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained.

Guineagrass—Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and when most have reached at least the 7-leaf stage of growth.

Johnsongrass/Bluegrass, Kentucky/Bromegrass, smooth/Canarygrass, reed/Orchardgrass/Ryegrass, perennial/Timothy/Wheatgrass, western—Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the boot-to-head stage of growth. When applied prior to the boot stage, less desirable control may be obtained. In the fall apply before plants have turned brown.

Lantana—Apply this product as a 3/4 to 1 percent solution with hand-held equipment. Apply to actively growing lantana at or beyond the bloom stage of growth. Use the higher application rate for plants that have reached the woody stage of growth.

Loosestrife, purple—Apply 4 pints of this product per acre as a broadcast spray or as a 1 to 1 1/2 percent solution using hand-held equipment. Treat when plants are actively growing at or beyond the bloom stage of growth. Best results are achieved when application is made during summer or fall months. Fall treatments must be applied before a killing frost.

Lotus, American—Apply 4 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Treat when plants are actively growing at or beyond the bloom stage of growth. Best results are achieved when application is made during summer or fall months. Fall treatments must be applied before a killing frost. Repeat treatment may be necessary to control regrowth from underground parts and seeds.

Maidencane/Paragrass—Apply 5 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Repeat treatments will be required, especially to vegetation partially submerged in water. Under these conditions, allow for regrowth to the 7 to 10-leaf stage prior to retreatment.

Milkweed, common—Apply 4 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached the late bud-to-flower stage of growth.

Nutsedge: purple, yellow—Apply 4 1/2 pints of this product per acre as a broadcast spray, or as a 3/4 percent solution with hand-held equipment to control emerging nutsedge plants and immature nutlets attached to treated plants. Apply when target plants are in flower or when new nutlets can be found at rhizome tips. Nutlets which have not germinated will not be controlled and may germinate following treatment. Repeat treatments will be required for long-term control.

Pampasgrass—Apply a 1 1/2 percent solution of this product with hand-held equipment when plants are actively growing.

Phragmites—For partial control of phragmites in Florida and the counties of other states bordering the Gulf of Mexico, apply 7 1/2 pints per acre as a broadcast spray or apply a 1 1/2 percent solution with hand-held equipment. In other areas of the U.S., apply 4 to 6 pints per acre as a broadcast spray or apply a 3/4 percent solution with hand-held equipment for partial control. For best results, treat during late summer or fall months when plants are actively growing and in full bloom. Due to the dense nature of the vegetation, which may prevent good spray coverage and uneven stages of growth, repeat treatments may be necessary to maintain control. Visual control symptoms will be slow to develop.

Quackgrass/Kikuyugrass/Muhly, wirestem—Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment when most quackgrass or wirestem muhly is at least 8 inches in height (3 to 4-leaf stage of growth) and actively growing. Allow 3 or more days after application before tillage.

Reed, giant/fice plant—For control of giant reed and ice plant, apply a 1 1/2 percent solution of this product with hand-held equipment when plants are actively growing. For giant reed, best results are obtained when applications are made in late summer to fall.

Southernbark—Apply 6 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Apply when most plants are in full bloom. For best results, apply during the summer or fall months.

Sweet potato, wild—Apply this product as a 1 1/2 percent solution using hand-held equipment. Apply to actively growing weeds that are at or beyond the bloom stage of growth. Repeat applications will be required. Allow the plant to reach the recommended stage of growth before retreatment.

Thistle: Canada, artichoke—Apply 3 to 4 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment for Canada thistle. To control artichoke thistle, apply a 2 percent solution as a spray-to-wet application. Apply when target plants are actively growing and are at or beyond the bud stage of growth.

Torpedograss—Apply 6 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 percent solution with hand-held equipment to provide partial control of torpedograss. Use the lower rates under terrestrial conditions, and the higher rates under partially submerged or a floating mat condition. Repeat treatments will be required to maintain such control.

Tules, common—Apply this product as a 1 1/2 percent solution with hand-held equipment. Apply to actively growing plants at or beyond the seedhead stage of growth. After application, visual symptoms will be slow to appear and may not occur for 3 or more weeks.

Waterhyacinth—Apply 5 to 6 pints of this product per acre as a broadcast spray or apply a 3/4 to 1 percent solution with hand-held equipment. Apply when target plants are actively growing and at or beyond the early bloom stage of growth. After application, visual symptoms may require 3 or more weeks to appear with complete necrosis and decomposition usually occurring within 60 to 90 days. Use the higher rates when more rapid visual effects are desired.

Waternettuce—For control, apply a 3/4 to 1 percent solution of this product with hand-held equipment to actively growing plants. Use higher rates where infestations are heavy. Best results are obtained from mid-summer through winter applications. Spring applications may require retreatment.

Waterpennywort—Apply this product as a 3/4 percent solution using hand-held equipment. Apply to plants that are actively growing at or beyond the bloom stage of growth, but before fall color changes occur. Thorough coverage is necessary for best control.

Other perennials listed on this label—Apply 4 1/2 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 percent solution with hand-held equipment. Apply when target plants are actively growing and most have reached early head or early bud stage of growth.

WOODY BRUSH AND TREES

When applied as recommended under the conditions described, this product plus surfactant CONTROLS or PARTIALLY CONTROLS the following woody brush plants and trees:

Alder
Alnus spp.

Ash*
Fraxinus spp.

Aspen, quaking
Populus tremuloides

Bearclover, Bearmat
Chamaebatia foliolosa

Birch
Betula spp.

Blackberry
Rubus spp.

Broom:
French
Cytisus monspessulanus
Scotch
Cytisus scoparius

Buckwheat, California*
Eriogonum fasciculatum

Cascara*
Rhamnus purshiana

Catsclaw*
Acacia greggi

Ceanothus
Ceanothus spp.

Chamise
Adenostoma fasciculatum

Cherry:
Bitter
Prunus emarginata
Black
Prunus serotina
Pin
Prunus pensylvanica

Coyote brush
Baccharis consanguinea

Creeper, Virginia*
Parthenocissus quinquefolia

Dewberry
Rubus trivialis

Dogwood
Cornus spp.

Elderberry
Sambucus spp.

Elm*
Ulmus spp.

Eucalyptus, bluegum
Eucalyptus globulus

Hasardia*
Haplopappus squarrosus

Hawthorn
Crataegus spp.

Hazel
Corylus spp.

Hickory
Carya spp.

Holly, Florida Brazilian Peppertree
Schinus terebinthifolius

Honeysuckle
Lonicera spp.

Hornbeam, American
Carpinus caroliniana

Kudzu
Pueraria lobata

Locust, black*
Robinia pseudoacacia

Manzanita
Arctostaphylos spp.

Maple:
Red**
Acer rubrum
Sugar
Acer saccharum
Vine*
Acer circinatum

Monkey Flower*
Mimulus guttatus

Oak:
Black*
Quercus velutina
Northern pine
Quercus palustris
Post
Quercus stellata
Red
Quercus rubra
Southern red
Quercus falcata
White*
Quercus alba

Persimmon*
Diospyros spp.

Poison ivy
Rhus radicans

Poison Oak
Rhus toxicodendron

Poplar, yellow*
Liriodendron tulipifera

Prunes
Prunus spp.

Raspberry
Rubus spp.

Redbud, eastern
Cercis canadensis

Rose, multiflora
Rosa multiflora

Russian-olive
Elaeagnus angustifolia

Sage: black, white
Salvia spp.

Sagebrush, California
Artemisia californica

Salmonberry
Rubus spectabilis

Salt cedar*
Tamarix spp.

Saltbush, Sea myrtle
Baccharis halimifolia

Sassafras
Sassafras albidum

Sourwood*
Oxydendrum arboreum

Sumac:
Poison*
Rhus vernix
Smooth*
Rhus glabra
Winged*
Rhus copallina

Sweet gum
Liquidambar styraciflua

Swordfern*
Polystichum munitum

Tallowtree, Chinese
Sapium sebiferum

Thimbleberry
Rubus parviflorus

Tobacco, tree*
Nicotiana glauca

Trumpetcreeper
Campsis radicans

Waxmyrtle, southern*
Myrica cerifera

Willow
Salix spp.

*Partial control

**See below for control or partial control instruction.

NOTE: If brush has been mowed or tilled or trees have been cut, do not treat until regrowth has reached the recommended stage of growth.

Apply the recommended rate of this product plus 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution when plants are actively growing and, unless otherwise directed, after full-leaf expansion. Use the higher rate for larger plants and/or dense areas of growth. On vines, use the higher rate for plants that have reached the woody stage of growth. Best results are obtained when application is made in late summer or fall after fruit formation.

In arid areas, best results are obtained when application is made in the spring or early summer when brush species are at high moisture content and are flowering. Ensure thorough coverage when using hand-held equipment. Symptoms may not appear prior to frost or senescence with fall treatments.

Allow 7 or more days after application before tillage, mowing or removal. Repeat treatments may be necessary to control plants regenerating from underground parts or seed. Some autumn colors on undesirable deciduous species are acceptable provided no major leaf drop has occurred. Reduced performance may result if fall treatments are made following a frost.

See the "Directions for Use" and "Mixing and Application Instructions" sections in this label for labeled use and specific application instructions.

Applied as a 5 to 8 percent solution as a directed application as described in the "HAND-HELD AND HIGH-VOLUME EQUIPMENT" section, this product will control or partially control all species listed in this section of this label. Use the higher rate of application for dense stands and larger woody brush and trees.

Apply the product as follows to control or partially control the following woody brush and trees

Alder/Blackberry/Dewberry/Honeysuckle/Oak, Post/Raspberry—For control, apply 4 1/2 to 6 pints per acre as a broadcast spray or as a 3/4 to 1 1/4 percent solution with hand-held equipment.

Aspen, Quaking/Hawthorn/Trumpetcreeper—For control, apply 3 to 4 1/4 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/4 percent solution with hand-held equipment.

Birch/Elderberry/Hazel/Salmonberry/Thimbleberry—For control, apply 3 pints per acre of this product as a broadcast spray or as a 3/4 percent solution with hand-held equipment.

Broom: French, Scotch—For control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment.

Buckwheat, California/Hazardia/Monkey Flower/Tobacco, Tree—For partial control of these species, apply a 3/4 to 1 1/2 percent solution of this product as a foliar spray with hand-held equipment. Thorough coverage of foliage is necessary for best results.

Catclaw—For partial control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.

Cherry: Bitter, Black, Pin/Oak, Southern Red/Sweet Gum/Prunes—For control, apply 3 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 to 1 1/2 percent solution with hand-held equipment.

Coyote brush—For control, apply a 1 1/4 to 1 1/2 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.

Dogwood/Hickory/Salt cedar—For partial control, apply a 1 to 2 percent solution of this product with hand-held equipment or 6 to 7 1/2 pints per acre as a broadcast spray.

Eucalyptus, blesgum—For control of eucalyptus resprouts, apply a 1 1/2 percent solution of this product with hand-held equipment when resprouts are 6 to 12-feet tall. Ensure complete coverage. Apply when plants are actively growing. Avoid application to drought-stressed plants.

Holly, Florida/Wax myrtle, southern—For partial control, apply this product as a 1 1/2 percent solution with hand-held equipment.

Kudzu—For control, apply 6 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Repeat applications will be required to maintain control.

Maple, Red—For control, apply as a 3/4 to 1 1/4 percent solution with hand-held equipment when leaves are fully developed. For partial control, apply 2 to 7 1/2 pints of this product per acre as a broadcast spray.

Maple, Sugar/Oak: Northern Pin, Red—For control, apply as a 3/4 to 1 1/4 percent solution with hand-held equipment when at least 50 percent of the new leaves are fully developed.

Poison Ivy/Poison Oak—For control, apply 6 to 7 1/2 pints of this product per acre as a broadcast spray or as a 1 1/2 percent solution with hand-held equipment. Repeat applications may be required to maintain control. Fall treatments must be applied before leaves lose green color.

Rose, multiflora—For control, apply 3 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment. Treatments should be made prior to leaf deterioration by leaf-feeding insects.

Sage, black/Sagebrush, California/Chamise/Tallowtree, Chinese—For control of these species, apply a 3/4 percent solution of this product as a foliar spray with hand-held equipment. Thorough coverage of foliage is necessary for best results.

Saltbush, Sea myrtle—For control, apply this product as a 1 percent solution with hand-held equipment.

Willow—For control, apply 4 1/2 pints of this product per acre as a broadcast spray or as a 3/4 percent solution with hand-held equipment.

Other woody brush and trees listed in this label—For partial control, apply 3 to 7 1/2 pints of this product per acre as a broadcast spray or as a 3/4 to 1 1/2 percent solution with hand-held equipment.

AQUATIC AND OTHER NONCROP SITES

When applied as directed and under the conditions described in the "Weeds Controlled" section in this label, this product will control or partially control the labeled weeds growing in the following industrial, recreational and public areas or other similar aquatic and terrestrial sites.

Aquatic Sites—This product may be applied to emerged weeds in all bodies of fresh and brackish water which may be flowing, nonflowing or transient. This includes lakes, rivers, streams, ponds, estuaries, rice levees, seeps, irrigation and drainage ditches, canals, reservoirs, wastewater treatment facilities, wildlife habitat restoration and management areas and similar sites.

If aquatic sites are present in the noncrop area and are part of the intended treatment, read and observe the following directions:

This product does not control plants which are completely submerged or have a majority of their foliage under water.

There is no restriction on the use of treated water for irrigation, recreation or domestic purposes.

Consult local state fish and game agency and water control authorities before applying this product to public water. Permits may be required to treat such water.

NOTE: Do not apply this product within 1/2 mile up-stream of an active potable water intake in flowing water (i.e., river, stream, etc.) or within 1/2 mile of an active potable water intake in a standing body of water such as lake, pond or reservoir. To make aquatic applications around and within 1/2 mile of active potable water intakes, the water intake must be turned off for a minimum period of 48 hours after the application. The water intake may be turned on at or to 48 hours if the glyphosate level in the intake water is below 0.7 part per million as determined by laboratory analysis. These aquatic applications may be made ONLY in those cases where there are alternative water sources or holding ponds which would permit the turning off of an active potable water intake for a minimum period of 48 hours after the applications.

For treatments after drawdown of water or in any ditches, allow 7 or more days after treatment before reintroduction of water to achieve maximum weed control. Apply this product within 1 day after drawdown to ensure application to actively growing weeds.

Floating mats of vegetation may require retreatment. Avoid wash-off of sprayed foliage by spray boat or recreational boat backwash or by rainfall within 6 hours of application. Do not re-treat within 24 hours following the initial treatment.

Applications made to moving bodies of water must be made while traveling upstream to prevent concentration of this herbicide in water. When making any bankside applications, do not overlap more than 1 foot into open water. Do not spray in bodies of water where weeds do not exist. The maximum application rate of 7 1/2 pints per acre must not be exceeded in any single broadcast application that is being made over water.

When emerged infestations require treatment of the total surface area of impounded water, treating the area in strips may avoid oxygen depletion due to decaying vegetation. Oxygen depletion may result in fish kill.

Other Noncrop-Type Sites—This product may be used to control the listed weeds in terrestrial noncrop sites and/or in aquatic sites within these areas.

Airports	Petroleum Tank Farms
Golf Courses	Pipeline, Power, Telephone & Utility Rights-of-Way
Habitat Restoration & Management Areas	Pumping Installations
Highways & Roadsides	Railroads
Industrial Plant Sites	Schools
Lumberyards	Storage Areas
Parking Areas	Similar Sites
Parks	

WILDLIFE HABITAT RESTORATION AND MANAGEMENT AREAS

This product is recommended for the restoration and/or maintenance of native habitat and in wildlife management areas.

Habitat Restoration and Maintenance—When applied as directed, exotic and other undesirable vegetation may be controlled in habitat management areas. Applications may be made to allow recovery of native plant species, to open up water to attract waterfowl, and for similar broad-spectrum vegetation control requirements in habitat management areas. Spot treatments may be made to selectively remove unwanted plants for habitat enhancement. For spot treatments, care should be exercised to keep spray off of desirable plants.

Wildlife Food Plots—This product may be used as a site preparation treatment prior to planting wildlife food plots. Apply as directed to control vegetation in the plot area. Any wildlife food species may be planted after applying this product, or native species may be allowed to reinfest the area. If tillage is needed to prepare a seedbed, wait 7 days after applying this product before tilling to allow for maximum effectiveness.

WIPER APPLICATIONS

For wick or wiper applications, mix 1 gallon of this product with 2 gallons of clean water to make a 33 percent solution. Addition of a nonionic surfactant at a rate of 10 percent by volume of total herbicide solution is recommended.

Where applications can be used to control or suppress annual and perennial weeds listed on this label. In heavy weed stands a double application in accordance directions may improve results. See the "Weeds Controlled" section of this label for recommended timing, growth stage and other instructions for achieving optimum results.

CUT STUMP APPLICATION

Woody vegetation may be controlled by treating freshly cut stumps of trees and resprouts with this product. Apply this product using suitable equipment to ensure coverage of the entire cambium. Cut vegetation close to the soil surface. Apply a 50 to 100 percent solution of this product to freshly cut surface immediately after cutting. Delay in applying this product may result in reduced performance. For best results, trees should be cut during periods of active growth and full leaf expansion.

When used according to directions for cut stump application this product will CONTROL, PARTIALLY CONTROL or SUPPRESS most woody brush and tree species, some of which are listed below:

Alder *Alnus spp.*	Poplar* *Populus spp.*
Coyote brush* *Baccharis consanguinea*	Reed, giant *Arundo donax*
Dogwood* *Cornus spp.*	Salt cedar *Tamarix spp.*
Eucalyptus *Eucalyptus spp.*	Sweet gum* *Liquidambar styraciflua*
Hickory* *Carya spp.*	Sycamore* *Platanus occidentalis*
Madrone *Arbutus menziesii*	Tan oak *Lithocarpus densiflorus*
Maple* *Acer spp.*	Willow *Salix spp.*
Oak *Quercus spp.*	

*This product is not approved for this use on these species in the state of California.

INJECTION AND FRILL APPLICATIONS

Woody vegetation may be controlled by injection or frill application of this product. Apply this product using suitable equipment which must penetrate living tissue. Apply the equivalent of 1 ml of this product per 2 to 3 inches of trunk diameter. This is best achieved by applying 25 to 100 percent concentration of this product either to a continuous frill around the tree or as cuts evenly spaced around the tree below all branches. As tree diameter increases in size, better results are achieved by applying dilute material to a continuous frill or more closely spaced cuttings. Avoid application techniques that allow runoff to occur from frill or cut areas in species that exude sap freely after frills or cutting. In species such as these, make frill or cut at an oblique angle so as to produce a cupping effect and use undiluted material. For best results, applications should be made during periods of active growth and full leaf expansion.

This treatment WILL CONTROL the following woody species:

Oak *Quercus spp.*	Sweet gum *Liquidambar styraciflua*
Poplar *Populus spp.*	Sycamore *Platanus occidentalis*

This treatment WILL SUPPRESS the following woody species:

Black gum* *Nyssa sylvatica*	Hickory *Carya spp.*
Dogwood *Cornus spp.*	Maple, red *Acer rubrum*

*This product is not approved for this use on this species in the state of California.

RELEASE OF BERMUDAGRASS OR BAHIAGRASS ON NONCROP SITES

RELEASE OF DORMANT BERMUDAGRASS AND BAHIAGRASS

When applied as directed, this product will provide control or suppression of many winter annual weeds and tall fescue for effective release of dormant bermudagrass or bahiagrass. Make applications to dormant bermudagrass or bahiagrass.

For best results on winter annuals, treat when weeds are in an early growth stage (below 6 inches in height) after most have germinated. For best results on tall fescue, treat when fescue is at or beyond the 4 to 6-leaf stage.

WEEDS CONTROLLED

Rate recommendations for control or suppression of winter annuals and tall fescue are listed below.

Apply the recommended rates of this product in 10 to 25 gallons of water per acre plus 2 quarts nonionic surfactant per 100 gallons of total spray volume.

WEEDS CONTROLLED OR SUPPRESSED*

NOTE: C = Control
S = Suppression

WEED SPECIES	RODEO® FLUID OZ/ACRE 6	9	12	18	24	48
Barley, little *Hordeum pusillum*	S	C	C	C	C	C
Bedstraw, catchweed *Galium aparine*	S	C	C	C	C	C
Bluegrass, annual *Poa annua*	S	C	C	C	C	C
Chervil *Chaerophyllum tainturieri*	S	C	C	C	C	C
Chickweed, common *Stellaria media*	S	C	C	C	C	C
Clover, crimson *Trifolium incarnatum*	•	S	S	C	C	C
Clover, large hop *Trifolium campestre*	•	S	S	C	C	C
Speedwell, corn *Veronica arvensis*	S	C	C	C	C	C
Fescue, tall *Festuca arundinacea*	•	•	•	•	S	S
Geranium, Carolina *Geranium carolinianum*	•	•	S	S	C	C
Henbit *Lamium amplexicaule*	•	S	C	C	C	C
Ryegrass, Italian *Lolium multiflorum*	•	•	S	C	C	C
Vetch, common *Vicia sativa*	•	•	S	C	C	C

*These rates apply only to sites where an established companion turf is present.

RELEASE OF ACTIVELY GROWING BERMUDAGRASS

NOTE: USE ONLY ON SITES WHERE BAHIAGRASS OR BERMUDAGRASS ARE DESIRED FOR GROUND COVER AND SOME TEMPORARY INJURY OR YELLOWING OF THE GRASSES CAN BE TOLERATED.

When applied as directed, this product will aid in the release of bermudagrass by providing control of annual species listed in the "Weeds Controlled" section in this label, and suppression or partial control of certain perennial weeds.

For control or suppression of those annual species listed in this label, use 3/4 to 2 1/4 pints of this product as a broadcast spray in 10 to 25 gallons of spray solution per acre, plus 2 quarts of a nonionic surfactant per 100 gallons of total spray volume. Use the lower rate when treating annual weeds below 6 inches in height (or length of runner in annual vines). Use the higher rate as size of plants increases or as they approach flower or seedhead formation.

Use the higher rate for partial control or longer-term suppression of the following perennial species. Use lower rates for shorter-term suppression of growth.

Bahiagrass	Johnsongrass**
Dallisgrass	Trumpetcreeper*
Fescue (tall)	Vaseygrass

*Suppression at the higher rate only.
**Johnsongrass is controlled at the higher rate.

Use only on well-established bermudagrass. Bermudagrass injury may result from the treatment but regrowth will occur under most conditions. Repeat applications in the same season are not recommended, since severe injury may result.

BAHIAGRASS SEEDHEAD AND VEGETATIVE SUPPRESSION

When applied as directed in the "Noncrop Sites" section of this label, this product will provide significant inhibition of seedhead emergence and will suppress vegetative growth for a period of approximately 45 days with single applications and approximately 120 days with sequential applications.

Apply this product 1 to 2 weeks after full green-up of bahiagrass or after the bahiagrass has been mowed to a uniform height of 2 to 4 inches. Applications must be made prior to seedhead emergence. Apply 5 fluid ounces per acre of this product, plus 2 quarts of an approved nonionic surfactant per 100 gallons of total spray volume in 10 to 25 gallons of water per acre.

Sequential applications of this product plus nonionic surfactant may be made at approximately 45-day intervals to extend the period of seedhead and vegetative growth suppression. For continued vegetative growth suppression, sequential applications must be made prior to seedhead emergence.

Apply no more than 2 sequential applications per year. As a first sequential application, apply 3 fluid ounces of this product per acre plus nonionic surfactant. A second sequential application of 2 to 3 fluid ounces per acre plus nonionic surfactant may be made approximately 45 days after the last application.

ANNUAL GRASS GROWTH SUPPRESSION

For growth suppression of some annual grasses, such as annual ryegrass, wild barley and wild oats growing in coarse turf on roadsides or other industrial areas, apply 3 to 4 ounces of this product in 10 to 40 gallons of spray solution per acre. Mix 2 quarts of a nonionic surfactant per 100 gallons of spray solution. Applications should be made when annual grasses are actively growing and before the seedheads are in the boot stage of development. Treatments made after seedhead emergence may cause injury to the desired grasses.

Product is protected by U.S. Patent No. 4,405,531. Other patents are pending. No license granted under any non-U.S. patent(s).

EPA Reg. No. 524-343

In case of an emergency involving this product,
Call Collect, day or night, (314) 694-4000.

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AGRICULTURAL PRODUCTS
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