Bonney Lake IAVMP

March, 2006

Prepared for the City of Bonney Lake

By
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March, 2006

City of Bonney Lake

To whom it may concern:
This letter forwards the completed Bonney Lake Integrated Aquatic Vegetation Management Plan (IAVMP) to the City of Bonney Lake for review and approval. The Bonney Lake IAVMP has been in development since April 2005. Since work on the plan began the Washington State Department of Ecology has decided to no longer review and /or comment on such plans. IAVMP plans are no longer required for obtaining NPDES permits. IAVMP planning was initiated under the guidelines that the Department of Ecology would officially approve the plan when completed. Ecology did not provided any comments directed at the first draft of the plan submitted to the agency in October 2005.

In reviewing this IAVMP document major changes to the draft have taken place in respect to the water quality section of the plan. Additional data has been provided and incorporated into the text of the document. A final weed survey of the lake was conducted during the week of October 13, 2005.

Please make copies of the IAVMP and distribute accordingly.

Respectfully,
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Executive Summary

The purpose of this plan is to establish, document and update the management of aquatic vegetation in Bonney Lake. Targeted goals would include those objectives required to appropriately fulfill the needs of the local community, meet the needs of all biological activities associated with the lake system while complying with all State, Federal and local policy necessary to maintain the lake as a healthy productive aquatic environment.

The plan as developed incorporates selected methods of aquatic plant control in conjunction with the ability to monitor the efficacy of any control alternatives implemented. All viable control alternatives have been evaluated on a lake specific basis utilizing criteria associated with impacts related to lake use, lake quality, and economics. It is important to note that financial considerations and site access were key components of the selection process. Some alternatives could not be seriously considered due to either the fiscal restraints imposed on the management scenario and/or the inability to successfully implement the control alternative.

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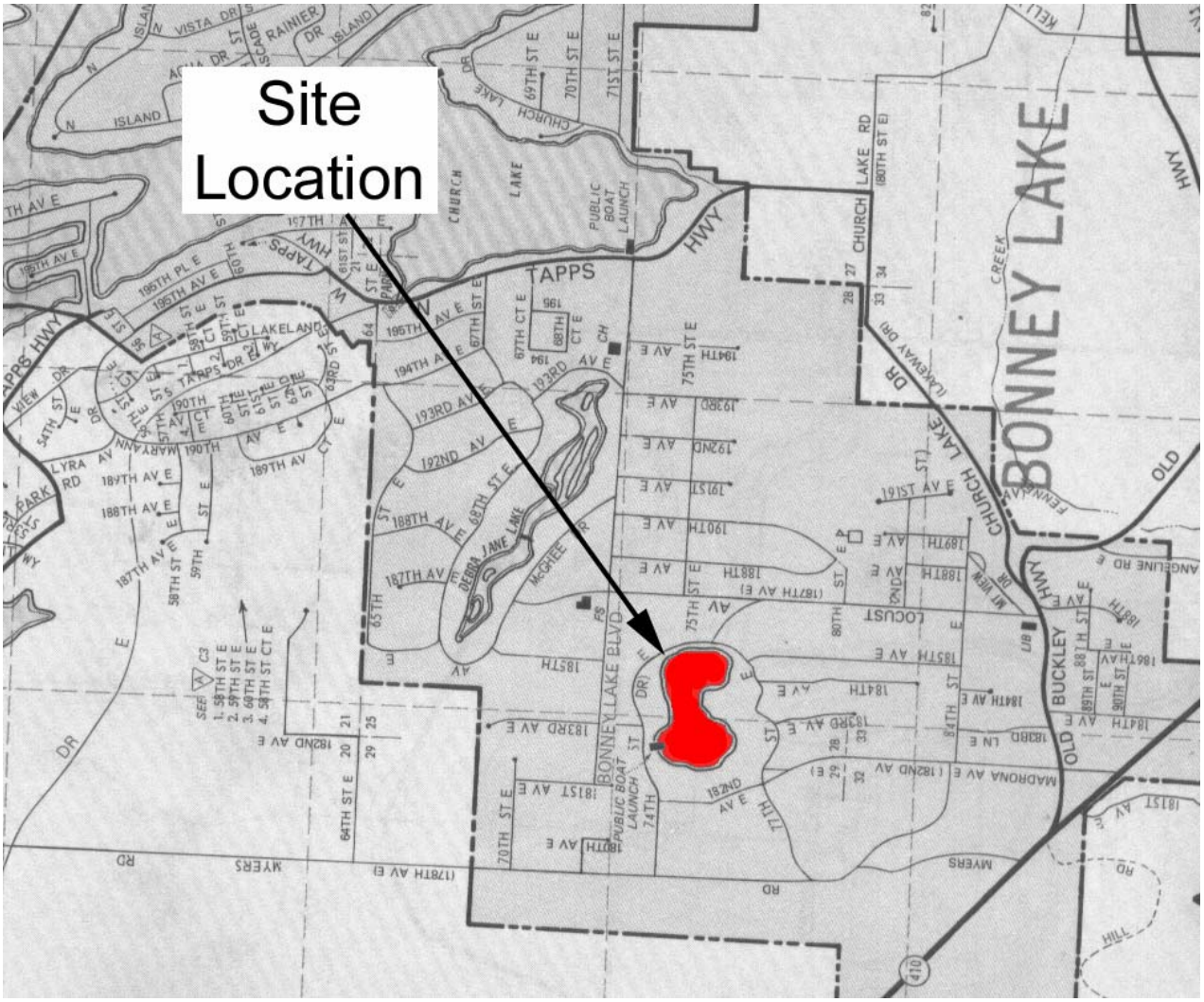
Site Map Bonney Lake



Preface:

In 2004 the Bonney Lake Community Club initiated movement toward developing an Integrated Aquatic Management Plan (IAVMP) as requested by the Washington State Department of Ecology. The complete IAVMP as outlined and mandated through numerous Ecology publications called for an evaluation of a variety of solutions and programs that included but were not limited to, the education of lake residents regarding lawn fertilization practice, placement of bottom barriers in selected areas, mechanical control methods and chemical treatment of the most problematic areas with EPA approved chemicals.

Most work on the plan was accomplished by Northwest Aquatic Eco-Systems with assistance from local residences, City of Bonney Lake and various community groups.

I. Problem Statement

Bonney Lake is a natural waterbody that was developed as the foundation for the local community. There are approximately 43 parcels surrounding the lake shoreline. The need to maintain the waterbody at an acceptable recreational and environmental level has always been a top priority to the City and local community. Any degradation in the current lake activities and or conditions could prove to negatively impact property values in the area. The ability to promote the lake as a healthy complete use recreational facility continues to remain a top priority. Bonney Lake offers a wide range of beneficial uses to the local community, surrounding neighbors, fish, and wildlife. However, an overgrowth of vegetation, algae and storm water influx continues to negatively impact many of these beneficial uses.

Excessive alga is limiting recreational activities such as fishing and swimming while negatively impacts water quality and lake viewing aesthetics.

Non-native plants noxious fragrant water lily (Nymphaea ordorata), purple loosestrife (Lythrum salicaria), yellow flag iris (Iris pseudacorus), Japanese knotweed (Polygonum cuspidatum), & Reed Canary Grass (Phalaris arundinacea), are proliferating at an excessive rate lakewide. Uncontrolled growth continues to encroach upon native plants crowding out beneficial species while impacting native plant diversity, and wildlife habitat of the lake.

Although Najas guadalupensis and Najas flexilis has many beneficial uses to waterfowl, small fish and insects, a mono culture of Najas guadalupensis, and Najas flexilis is severely impacting the recreational uses including swimming and fishing. While also negatively affecting water quality, nutrient levels, wildlife diversity, and lake viewing aesthetics. The thick growth is a safety threat to swimmers and waders.

An increasing influx of storm water, due in part to construction and loss of trees within the watershed, is increasing the nutrient load and sediment contamination, thus contributing to excessive algae and plant growth resulting in a reduced lake depth, which in turn is impacting the lake turnover and mixing.

The resulting excessive decaying vegetation from all plant species and algae growth is negatively impacting swimming, water quality, wildlife habitat, and lake aesthetics.

From interaction with the Bonney Lake Community the following problems have been outlined as the current and potential impacts of excessive aquatic vegetation in Bonney Lake.

- Public opinion directed at concerns the lake is "polluted"
- Current and potential hindrance/hazard to swimming.
- Current and potential hindrance to fishing.
- Potential hindrance to boating (small boats and canoes)
- Continuing expansion of water lilies and potential for dominance in the lake
- Potential decrease in water quality (excessive algae blooms)
- Potential decrease in aesthetic appeal of the lake
- Potential decrease in property values

II. Past Management Efforts

Bonney Lake has been treated twice with two registered aquatic herbicides since 1995 Fluridone and Rodeo (personal communication Dana McCauley, Karen Witters). There is also communication that the lake may have also been treated once prior to 1995. Both products are systemic herbicides. Rodeo use was directed at floating leafed plants (lily pads) while the fluridone application targeted pondweeds. The 2004 Rodeo treatments resulted in questionable results while the earlier fluridone application successfully controlled the pondweed population. Recently concern has been directed at the possibility that the fluridone application eliminated the pondweed composition of the macrophyte community and has resulted in the current mono-culture plant community (Naja) presently residing within the lake system.

Numerous non-chemical approaches have been utilized and encouraged by the local concerned citizens on an private individual basis to manage lake weed and algae problems. Hand pulling, and hand cutting are those alternatives several property owners have attempted and continue to utilize throughout the summer months. Both hand pulling and the use of the cutters removed the weeds immediately. However difficulty in the ability to remove and dispose of all the pulled or cut weeds was evident during the process by the floating weeds left remaining in the lake.

III. Management Goals

The overarching management goal of the property owners is to provide for the control of algae, nuisance and noxious aquatic macrophytes in such a manner that allows for sustainable healthy native plant and animal communities to thrive in an environment dominated by acceptable water quality. All of which facilitates safe recreational enjoyment of the lake.

One important step in the development and implementation of a plant control plan (IAVMP) is to define goals against which the program can be evaluated. Setting management goals is an important step as they are used to assess the success of the management practices and the need to implement alternative measures.

Bonney Lake is a public lake system, the goals of the management activities need to be addressed from both an economical and environmental standpoint. When selecting a management tool the concept of project cost versus benefit to the lake will be a key issue in determining which types of tools can be implemented by the local residents and the City of Bonney Lake.

Bonney Lake Management Goals:

• Provide control of the submerged vegetation to allow recreational use, but still provide adequate fish and wildlife habitat.

• Reduce the near-shore problem vegetation in order to prevent premature expansion or filling in of the waterfront, provide easy access to the waterfront properties and maintain the aesthetics & property value of the waterfront.

• Assess water quality conditions and manage algae problems as they appear.

• Minimize the impacts local watershed activities will have on the water quality of the lake; recognize non-point nutrient sources within the Bonney Lake watershed.

• Continue to regularly monitor aquatic plant growth and lake conditions in order to maintain a healthy lake system.

• Monitor the lake for pioneering infestations of invasive non-native aquatic plants.

• Choose and implement control alternatives which are approved by the majority of the public, a low cost to benefit ratio and prevent adverse environmental problems to the waterbody.

• Implementation of a management strategy that has the ability to be changed as the needs of the community and or as the lake system evolves. Such latitude needs to be recognized in order to achieve these goals.

IV. Watershed and Waterbody Characteristics

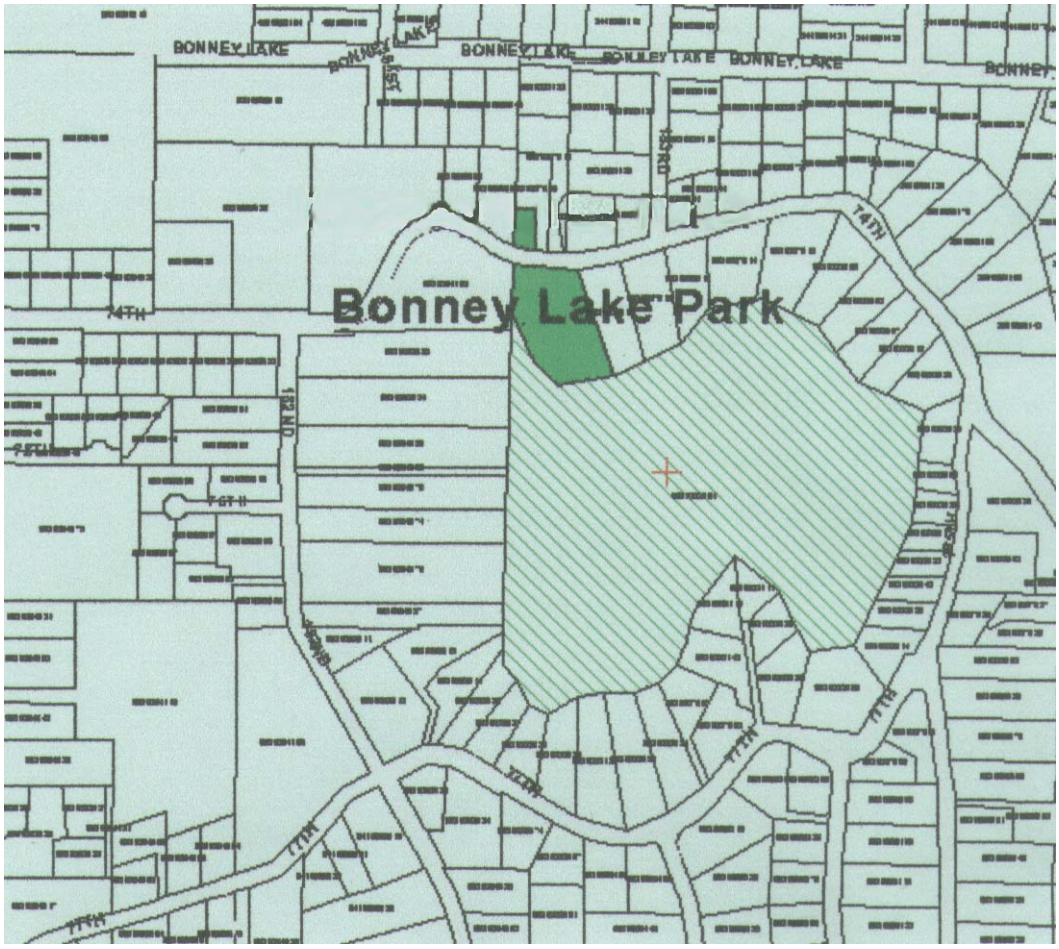
A. Watershed Characteristics

1. <u>Location and size of Watershed:</u>

To understand a water body and its problems, one must have an understanding of the surrounding features and the role they play in the lake system. Lake systems typically extend beyond their shoreline boundaries to include water that drains into the lake. These land use activities and runoff properties will eventually impact the biological and chemical activities in a lake. One example would be the nutrient loading that streams, stormwater, groundwater and septic systems contribute to the system. Phosphorus and nitrogen are critical nutrients for plant growth, excessive or direct loading of these nutrients can rapidly accelerate plant growth in a lake. The loading of other debris and pollutants can also dramatically impact the biological and chemical processes in lakes.

Bonney Lake is located in Pierce County in the City of Bonney Lake within the Puyallup White River Water Shed, Water Resource Inventory #10. The sub-watershed which directly encompasses the lake is relatively small. Bonney Lake is the center of a small residential single family community consisting of approximately 43 residential building lots. There is very limited commercial and or industrial use within the sub-watershed located within the City of Bonney Lake.

SHORELINE DEVELOPMENT



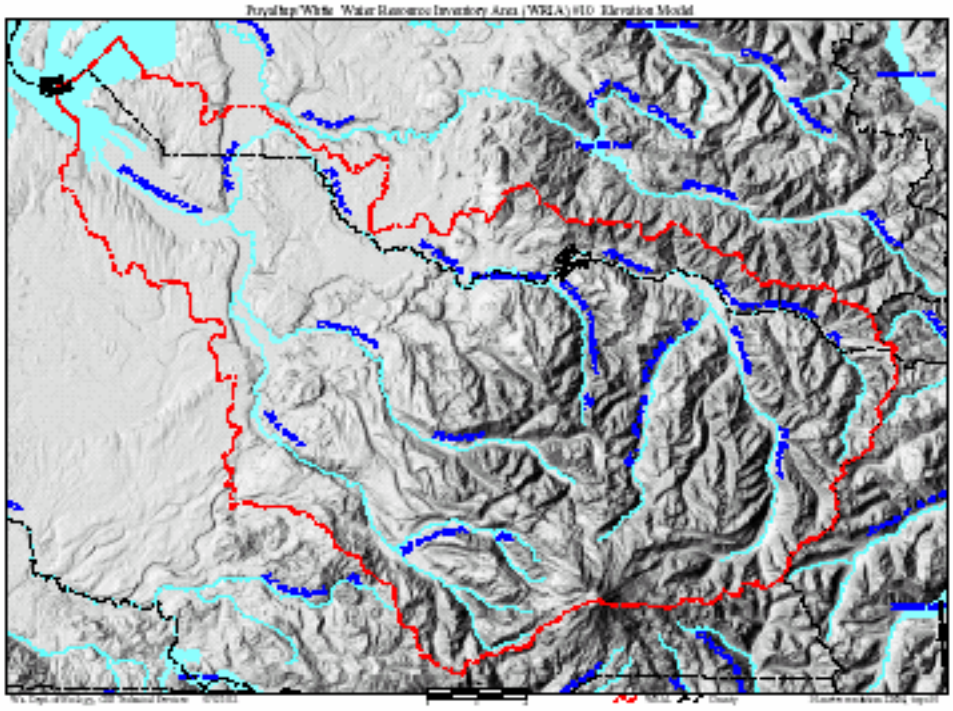
Bonney Lake was most likely created during the Vashon Glacier recession. This resulting depression collects water, surface runoff and groundwater flow. The Bonney Lake water recharging resources results from a complex interaction of the local climate, geology, and land use activities within the sub watershed.

In the vicinity of the lake, the land is relatively rolling in nature. There are no significant inlet streams and the intermittent outlet channel drains southeasterly to Fennel Creek which empties into the Puyallup River. Wetlands occupy the northwestern section of the shoreline adjacent to the public launch and city park.

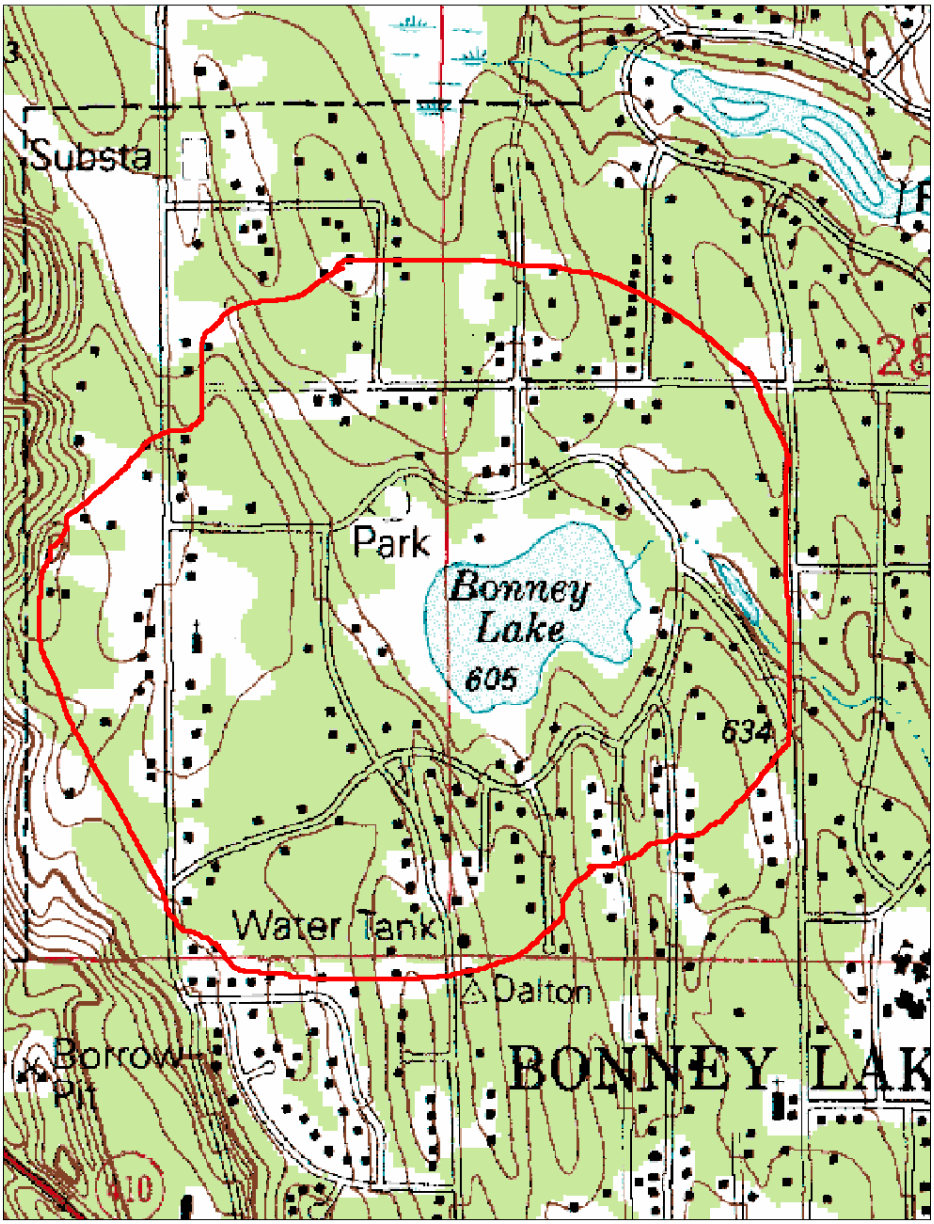
The developed area is mostly sloped. All precipitation falling on the roads and driveways within the sub watershed runs off and is directed toward the lake via roadside culverts and the local storm water system. These discharge points potentially introduce a wide range of pollutants into Bonney Lake including (but not limited to) organic and inorganic sediments, fertilizers, pesticides, vehicle pollutants (gasoline, oils, etc.) and nutrients. Other than roadside culverts and the current storm water system there are no known point sources of pollution to the lake.

Sewers occupy only a small percentage of the watershed however all of the homes abutting the lake and within the City of Bonney Lake are connected to the sewer system. Other non point sources would include those toxins and or elevated nutrients that may be entering the lake from underwater springs and or the groundwater aquifer.

WATER RESOURCE INVENTORY #10



BONNEY LAKE SUB-WATERSHED

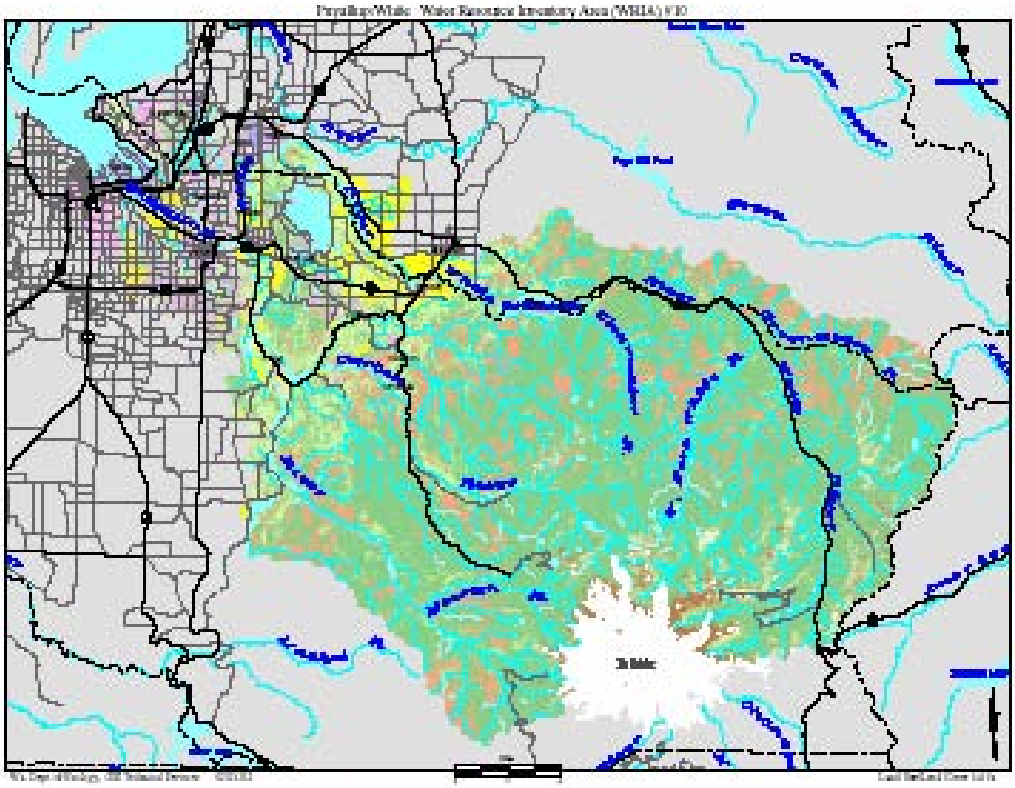


BONNEY LAKE TOPO (exaggerated)

2. Land Use Activities:

The majority of the land within the Bonney Lake sub-watershed remains in a natural typical residential wooded state. The forest lands within the surrounding area are primarily owned by timber companies. There are no commercially developed sections of the sub-watershed. Numerous public and private lakes reside within a close proximity to Bonney Lake. There are no known commercially recognized agricultural operations in the immediate area of Bonney Lake. Agricultural and farming uses appear to be limited to family vegetable gardens.

Land Use



Water Resource Inventory Areas and Land Use/Land Cover

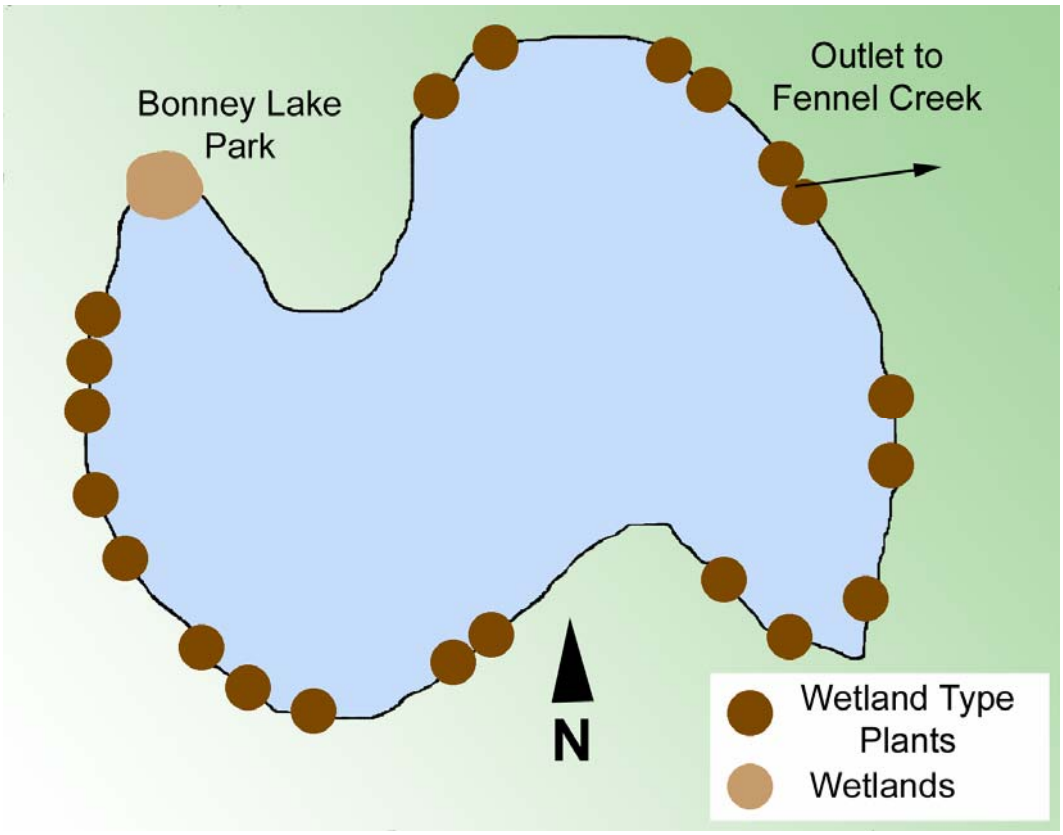
- Agriculture
- Forest (evergreen)
- Forest (mixed)
- Transitional
- Shrub
- Grass (herbaceous)
- Barren
- Urban (commercial)
- Urban (residential)
- Glacier
- Water
- Federal/State Highway
- Secondary Route
- Rivers/Streams
- WRIA Boundary
- County/State Boundary

3. Stream and Wetland Locations:

There are no significant streams and or runoff channels entering the lake. A wetland is located in the northwestern corner of the lake adjacent to Bonney Lake Park. This wetland encompasses approximately 1.5 acres. Over 50% of the lake shoreline supports wetland associated plants. Outlet waters flow to an unnamed creek which enters Fennel Creek and flows into the Puyallup River. There is some natural spring activity within the lake as well as direct storm water draining into the lake from rain events.

The wetland directly northwest of the lake which drains into the lake has the potential to become a point pollution source. This wetland may prove to be a positive nutrient source during the fall and winter months when wetland plants are decomposing and in their dormant state. During the summer months when the plants are actively growing these same plants may provide a means of reducing nutrients into the lake.

Bonney Lake Outlets, Inlets and Wetlands



4. Nonpoint Nutrient Source Locations:

Often growth associated with recreation has a tendency to modify some of the lake characteristics that initially spurred development. Growth often incurs negative impacts to associated waterbodies and wetlands as a result of nonpoint nutrient sources. Nonpoint sources are identified as those nutrient sources that have no defined origin. Inappropriate

management of septic tanks, solid wastes, fertilization, construction of roads, buildings and normal development activities can increase sediment and nutrient delivery to a lake. Increased sediment deposition combined with high nutrient loading may create conditions conducive to vegetative growth. When this occurs, the aging process of water bodies will be accelerated and the functions and values of the water body and surrounding areas may be compromised.

Sediments entering lakes are influenced by land slope, land use and drainage patterns. If poor management of the watershed were to occur more sediment would reach the lake. The ability of Bonney Lake to retain sediment is attributed to such characteristics as slow moving water caused by a constricted outlet, intermittent outflow and vegetation. Currently, the most realistic sources of additional sediment deposits and other water quality degradation problems associated with the lake can be attributed to the stormwater entering the lake.

Waters entering the lake via the watershed are susceptible to increased nutrient levels. Best Management Practices which need to be maintained throughout the region by local government recognizes the impacts these nutrients have on waterbodies. Although it is the local governments responsibility to promote and institute BMP's it is also the responsibility of the local community to assist government in implementing any such programs. The local community and government has always maintained the lake and all water quality issues associated with the lake as a high priority management concern.

B. Waterbody Characteristics

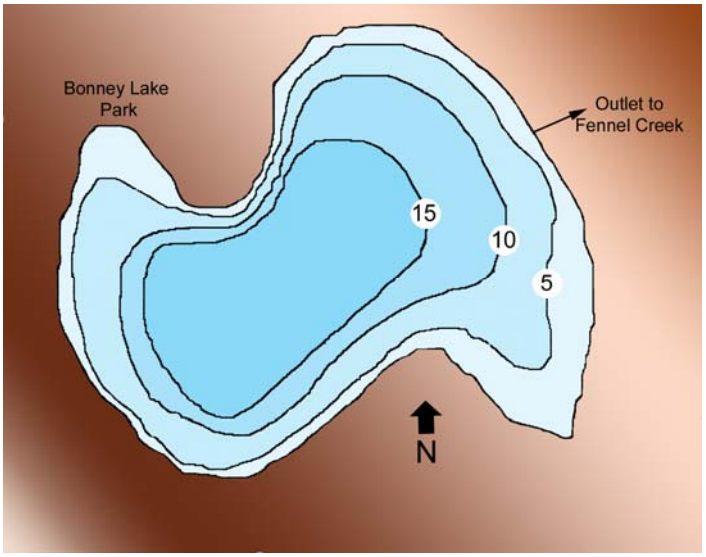
1. <u>Location, Size, Depth, and Shape of Waterbody</u>:

Location: Section 28, Township 20N, Range5E
Size: 17 acres
Depths; Mean 10 ft., Maximum 19ft

Bonney Lake is located in the City of Bonney Lake within Pierce County. The lake provides the mainstay for the local area and the adjacent shoreline property owners. Community access to the lake is through private property and the Bonney Lake Park. Bonney Lake Park is operated under the direction of the City of Bonney Lake.

The local community and the City of Bonney Lake manages the lake for the surrounding area residents. The outlet allows high water to flow from the lake without flooding near lake shoreline properties while maintaining downstream water responsibilities.

Bottom Contour



2. <u>Water Sources and Flushing Rate</u>:

There are no inlet creeks or streams supplying water to the lake. The only water recharge sources are rain events and natural occurring springs. Water exits the lake during the winter and early spring months. During the critical summer months Bonney Lake has no flushing rate. Water within the lake remains stagnant until the fall rains begin to recharge and flush the lake. Due to the shallow nature of the lake, flushing rates are dependent upon the amount of rainfall falling within the sub watershed. No formal flushing rates have been recorder and/or investigated.

3. <u>Water Quality</u>:

Lake water quality has been monitored on a very limited basis over the past 15 years. Although field testing of general lake parameters has been conducted, chemical analysis of lake water related parameters requiring laboratory analysis (phosphorous, nitrogen and chlorophyll a) have only recently been addressed. Since 2004 Bonney Lake has been monitored under the direction of the Pierce County Stream Team program. Although the Homeowners Association and the City recognizes the benefits of implementing a broader water quality monitoring program, budgetary restraints and the overall benefits received from the monetary expenditures are unclear.

Utilizing sporadic data in trying to define and or pinpoint specific lake associated problems is highly speculative in nature and susceptible to numerous interpretative scenarios. Seasonal monitoring typically provides for the establishment of baseline data that can later be used in evaluating environmental conditions lakewide. With the absence of any long term consistent past water analysis, present and past summer historical visual lake conditions can be evaluated and utilized in determining lake trends and future planning requirements.

Since 1973 when nearly 80 % of the shoreline was already developed the Bonney Lake sub-watershed has experienced normal growth for the area. The immediate shoreline is nearly 100% developed.

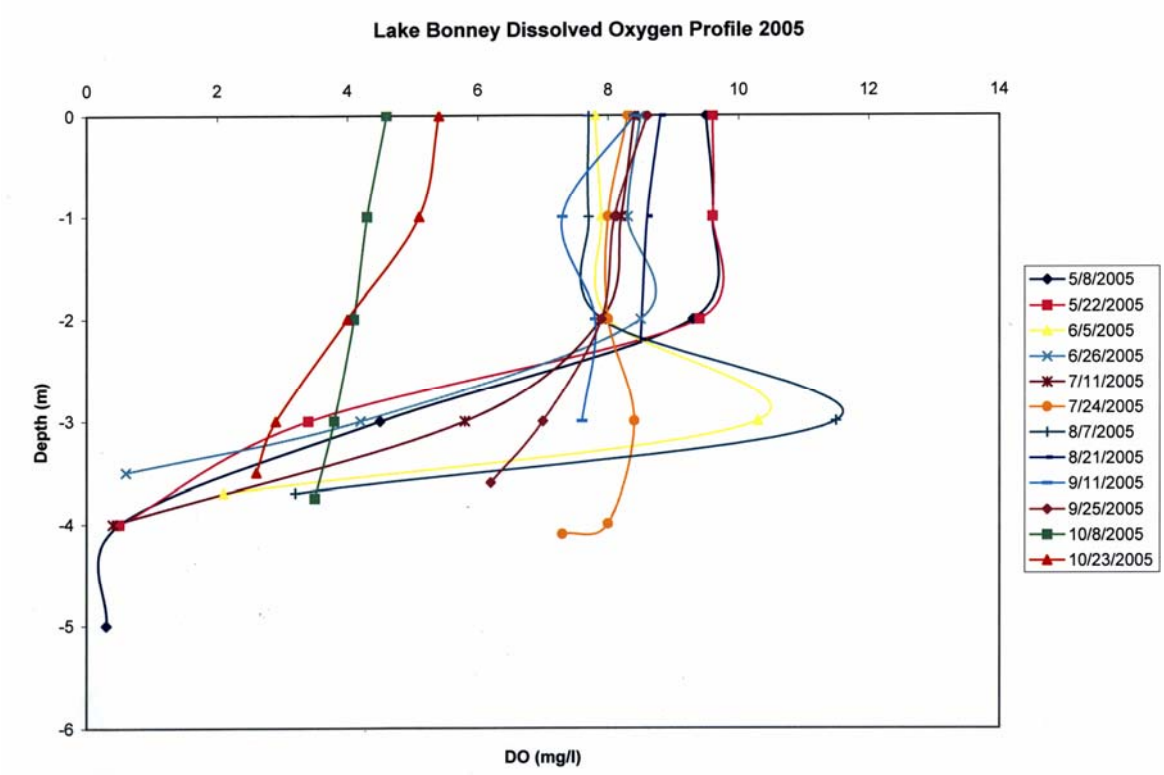
Current macrophyte surveys and community opinion clearly identifies that problems associated with aquatic weed growth has increased as a result of limited action since the fluridone application.

As the City of Bonney Lake and surrounding watershed has developed, there were always concerns with impacts such development may have on the water quality and thus the overall health of the lake. One major factor contributing to present and future degradation of the water quality is the sediment and nutrient load delivered by surface water events via roadside culverts and storm drains. These rain events represent a pool of nutrients and sediments that stimulate algae productivity, as well as growth of aquatic weeds.

Overtime, the eutrophication process in a shallow system like Bonney Lake can be rapidly accelerated and sediments will begin to slowly fill in the lake. Management alternatives to slow this process and allow the lake to continue functioning as a balanced and healthy system are often necessary to impede the process.

Temperature and dissolved oxygen profiles are often used to determine the extent of stratification and mixing. These parameters are important in understanding the distribution of chemical/biological characteristics of a lake system.

Limited monitoring of Bonney Lake imposes restrictions on the ability to utilize these parameters in evaluating the lake. The shallow nature of the system in conjunction with cold spring water inflow from the deeper bottom lakebed likely provides for weak stratification of the water body. 1973 data in conjunction with data collected during 2004-2005 indicates a seasonal temperature gradient between surface and bottom waters. More importantly the data revealed an oxygen deficit at the deeper colder water depths. These low oxygen levels provide the means for the phosphorous heavy bottom sediments to re-suspend ortho phosphorous nutrients back into the water column. Once re-suspended these nutrients become available for both algae and weed growth. Low oxygen levels which result in the re-suspension of nutrients is referred to as “anaerobic” conditions. Typically the shallow nature of a water body often allows for ample water movement vertically in the water column created by normal weather patterns thus avoiding anaerobic conditions.



Stream Team Monitoring Data

Date	Secchi Depth (m)	Site Depth (m)	Water Temp (C) Top	Dissolved Oxygen (mg/l) Top	Water Temp (C) Bottom	Dissolved Oxygen (mg/l) Bottom	Chlorophyll a (mg/m^3) shallow	Total Phosphorus (mg/l) shallow	Total Phosphorus (mg/l) deep	Lake Level (ft.)	Water Color	# of Geese	Suspended Algae
Bonney - 2004													
5/23/2004	2.1	4.7	18.9	8.8	9.2	0.1	<10*	<0.01*	0.05	NA	8	12	moderate
6/6/2004	2.3	4.3	20.1	9.6	14.0	10.0	<10*	<0.01*		NA	7	9	light
6/27/2004	2.5	4.3	23.4	8.2	21.5	8.2	<2[a]	0.04		NA	7	12	moderate
7/11/2004	2.2	3.8	22.3	10.7	18.5	2.5	<2*	0.02		NA	2	15	moderate
7/25/2004	1.8	4.9	25.3	11.4	12.2	0.2	NA	NA		1.54	6	9	light
8/22/2004	2.7	4.2	23.7	9.5	21.3	5.4	2	0.02	0.33[b]	1.18	7	15	light
9/12/2004	1.0	3.2	20.7	10.9	19.8	10.7	6	0.02		1.2	7	15	light
9/26/2004	3.0	4.3	16.6	10.6	16.6	10.3	13	<0.01*		2	7	0	light
10/10/2004	3.0	3.5	16.2	11.9	15.2	10.0	279	0.06		1.24	8	0	moderate
10/24/2004	1.8	4.0	12.5	11.6	12.3	10.0	307	0.12	0.04	NA	7	2	light
Bonney - 2005													
5/8/2005	3.2	5.4	17.3	9.5	7.9	0.3	4	0.01	0.02	2.9	8	4	moderate
5/22/2005	3	4.7	16.7	9.6	10.3	0.5	8	0.03		3.1	7		light
6/5/2005	2.7	4.7	18.2	7.8	12.2	2.14	3	0.01					moderate
6/26/2005	2.4	4	21.2	8.5	15	0.6	10	0.02		2.9	7	8	moderate
7/11/2005	2.6	4.2	21.4	8.4	13.5	0.4	4	<0.01*		2.75	7	7	light
7/24/2005	2.4	4.6	23.8	8.3	13.4	7.3	4	0.01		2.52	7	7	light
8/7/2005	3.1	4.1	24.4	7.7	16.5	3.2	<2*	0.02		2.18	8	9	moderate
8/21/2005	2.7	3.1	23.5	8.8	22.7	8.5	7	<0.01*		1.91	7	15	light
9/11/2005	2	3.1	19.6	8.4	18.6	7.6	14	0.06		1.6	7	24-36	light
replicates							40 (2meters)	0.06					
9/25/2005	2.3	4.1	19.1	8.6	15.9	6.2	9	0.01		1.44	8	30	moderate
10/9/2005	2.75	4.75	15.2	4.6	14.6	3.5	72	0.05		1.46	6	50	light
10/23/2005	3.3	4.5	14.7	5.4	14.2	2.6				1.42	7	30	light

[a] Detection limit is now 2 mg/m^3

[b] Sample appeared to have sediment from the bottom in it.

* Below detection limits.

Algae ID & Count

Algae ID & Count

0/9/2005 **Lake Bonney**

1 meter

Algae count/ml	5000
Green	75% Ulothrix
Blue-Green	4% Microcystis
Diatoms	7% Cymbella, Navicula
Flagellates	14% Dinobryon, Chlamydomonas

State Water Quality Data 1976

WATER-QUALITY DATA (IN MG/L UNLESS OTHERWISE INDICATED)

SAMPLE SITE	1	
DATE	8/ 9/73	
TIME	1515	1520
DEPTH (FT)	3.	14.
TOTAL NITRATE (N)	0.00	0.02
TOTAL NITRITE (N)	0.00	0.00
TOTAL AMMONIA (N)	0.06	0.24
TOTAL ORGANIC NITROGEN (N)	0.38	0.26
TOTAL PHOSPHORUS (P)	0.015	0.044
TOTAL ORTHOPHOSPHATE (P)	0.005	0.014
SPECIFIC CONDUCTANCE (MICROMHOS)	49	59
WATER TEMPERATURE (DEG C)	22.8	18.9
COLOR (PLATINUM-COBALT UNITS)	15	65
SECCHI-DISC VISIBILITY (FT)	11	
DISSOLVED OXYGEN	8.0	0.5

LAKE SHORELINE COVERED BY EMERSED PLANTS	26- 50 %
LAKE SURFACE COVERED BY EMERSED PLANTS	11- 25 %

DATE	8/ 9/73
TIME	1520
NUMBER OF FECAL COLIFORM SAMPLES	2
FECAL COLIFORM, MINIMUM (COL./100ML)	1
FECAL COLIFORM, MAXIMUM (COL./100ML)	11
FECAL COLIFORM, MEAN (COL./100ML)	6

Within the scientific community the most common way lakes are classified is by their trophic state. Different trophic states are defined in relation to the amount of biological activity within the system. Lakes that are "nutrient poor" are characteristically those with clear water, low algae concentrations and low nutrient levels. While lakes that are "nutrient rich" characteristically support low water clarity, high algae concentrations and high nutrient levels. Three trophic states (Carlson, 1977) have been established to categorize water bodies associated with nutrient levels. Lakes high in nutrients are considered to be Eutrophic, low in nutrients (Oligotrophic) and Mesotrophic which are those water systems between the Eutrophic and Oligotrophic classification.

All lakes pass through the three trophic states in a natural process called "Eutrophication". Eutrophication is the term used to describe the natural aging of a lake. Eutrophication is a biological process that occurs very slowly however at times the process can be greatly accelerated by human activities within the watershed. Human activities associated with eutrophication are often referred to as "cultural eutrophication". Classifying lakes based on trophic levels is a useful way to biologically assess gross changes in a lakes' water quality over an extended period of time. Numerous classification criteria establishing trophic levels have been researched and developed Vollenweider 1970, Carlson 1977 and Canfield 1983.

Trophic State Classification (Vollenweider 1970)

Trophic State	Total Phosphorous (ug/l)	Chlorophyll a (ug/l)	Transparency (meters)
Oligotrophic	**<10**	**<4**	**>5**
Mesotrophic	**10-20**	**4-10**	**2-5**
Eutrophic	**>20**	**>10**	**<2**

Evaluation of current data suggests that Bonney Lake is in the late Mesotrophic early Eutrophic stage of development. The City and local community recognizes the importance of monitoring the trophic level of the lake however budgetary restraints may restrict further monitoring efforts.

4. <u>Shoreline Use (residential, rural. industrial, etc.):</u>

Shoreline use is governed by local building and growth ordinances established and maintained through the City of Bonney Lake and Pierce County. Zoning around the lake permits one residence per building lot. Lots are generally less than 1/2 acre in size. There is no industrial use of the immediate shoreline area.

5. <u>Fisheries:</u>

There are no chinook, coho, chum salmon, steelhead and cutthroat trout fisheries in Bonney Lake proper. Bonney Lake maintains a healthy diverse fisheries consisting of

spiny ray, bass, eastern brook trout, and rainbow trout. Bonney Lake outflow waters eventually exit to the Puyallup River, a salmon bearing system.

7. Wetland Areas:

There is one defined wetland around the shoreline of Bonney Lake. Numerous wetland plant types are characteristically observed along the remainder of the shoreline. A search of DNR Natural Heritage data bases associated with wetland and sensitive plants confirms no sensitive or endangered plants present within the system at this time. Wetlands serve many important functions regarding water quality and quantity.

The wetland identified along the northwest shoreline of the lake which drains into Bonney Lake performs the typical functions of most wetlands. These functions vary from wetland to wetland and are dependent upon wetland type, geologic setting, position in the watershed and outlet conditions. Wetland responsibilities include water quality protection, flood control, shoreline stabilization, contribution to groundwater and stream flows, and wildlife and fisheries habitat. Pollutants, including sediments, fertilizers, pesticides, grease and oil, are washed into wetland areas by runoff from urban, agricultural, and forested areas. Wetlands can improve water quality by acting as a biological filter, trapping sediments, removing nutrients and detoxifying chemicals. Conversely, wetlands may be adversely impacted when providing these water quality benefits. Water stored in wetlands is released slowly to recharge groundwater and to maintain stream flows during drier periods. Wetlands provide essential habitats that furnish food and cover for some species of wildlife and fish. Wetlands can be destroyed or severely impaired by activities associated with agriculture, forestry, mining, and urban development such as filling, dredging, land clearing and vegetation removal.

There have been no studies and or research associated with the wetlands supplying inflow water to the lake. How this wetlands specifically impacts the biology and aquatic environment of the lake is not known at this time and far exceed the scope of this management plan.

8. Wildlife.

Bonney Lake provides wildlife habitat for a variety of game and non-game species. Species typically found associated with these habitat types are deer, eagles, osprey, mallard, songbirds, Canada goose, great blue heron, beaver, river otter, and raccoon.

Forested areas within portions of the watershed provide for a diverse variety of plant life, sport and non sport game fauna. Timber within the area is dominated by Douglas fir. Western hemlock, cedar, and alder. Lower canopy plants and ground cover species include salal, huckleberry, and fern. The rhododendron another native plant is commonly identified and very abundant throughout the area.

V. Current and Potential Beneficial and Recreational Uses of the Waterbody

Bonney Lake is a public lake with boating and fishing access. The local community and government has mobilized with the intent purpose of operating and managing the lake in conjunction with local development while offering year round recreational opportunities associated with typical lake usage. Interested lake community member working in hand with the local government have historically promoted sound stewardship of the lake and its surroundings, while concurrently ensuring continued safe recreational activities for community residents.

Bonney Lake is a multi recreational water facility providing every category of water related sports and or recreational opportunities. Swimming, fishing, boating (electric motors only) and bird watching occurs lake wide. The semi-private nature of the shoreline provides only one small public access point supporting no formal swimming facility. The lake shoreline supports nesting areas for waterfowl and contains no rare plants and or animals that require special water use restrictions. There are two lakeside landowners that have registered water rights associated with their parcels. Beneficial uses in review would include but are not limited to the following:

- Conservancy Areas associated with nesting sites and spawning areas
- Boating and boat access
- Swimming areas
- Fishing areas
- Public Launch
- Irrigation use
- Shoreline recreational walking paths

For use within this document when referencing aquatic weed control zones and or treatment sites, conservancy areas will be defined as follows: Those lake areas where the macrophyte composition consists of native aquatic plants that typically and historically have not posed either an environmental and or health hazard to recreational users of the lake. These lake areas will receive no aquatic weed control measures until such time that the conservancy area designation is removed from the site. Lake areas can remain classified as “conservancy zones” for one growing season or for an extended length of time.

Lake conservancy zones are divided into two classifications one zone is related to the littoral shoreline zone of the lake while the other zone typically encompasses the deeper main water body. Littoral zone conservancy areas change on a year to year basis depending on the severity of macrophyte growth encountered during any specific season. At a minimum 25% of the littoral zone at any given time will be maintained as a conservancy zone. Deeper water conservancy zones typically retain the classification for an extended period of time. Deeper water sites generally pose limited nuisance weed concerns.

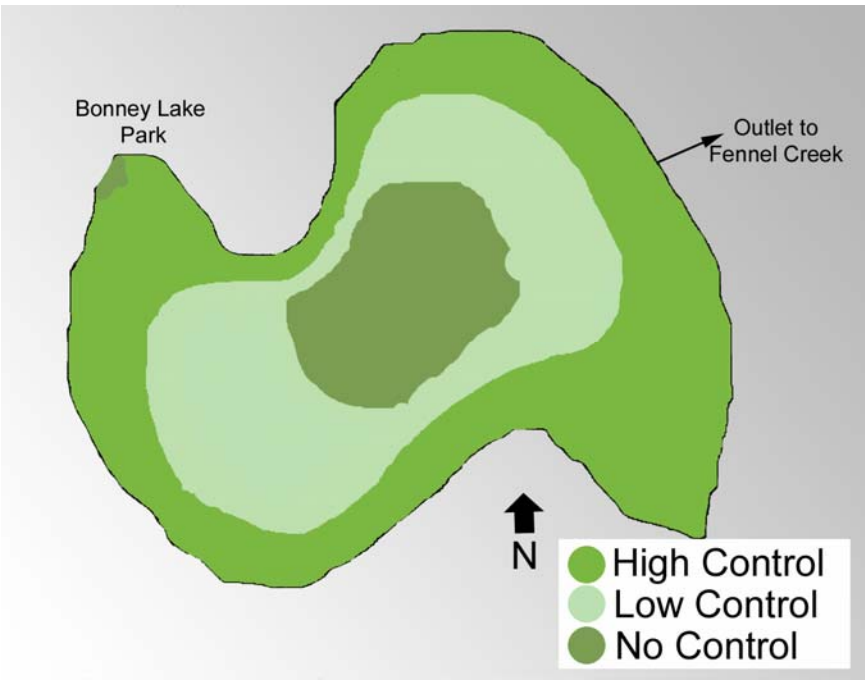
The shallow nature of Bonney Lake exposes all lake areas to potential weed problems resulting in the important necessity to change conservancy zones within the littoral zone of the lake on a year to year basis. This approach allows the lake managers the ability to direct management of the lake from a more environmentally friendly point of view. Yearly scientific evaluation of

lake conditions ensures those responsible for managing the lake the capability to designate and alter conservancy areas in the best interest of the lake. Annual determination of treatment zones promotes and encourages maintaining a robust healthily and productive ecosystem.

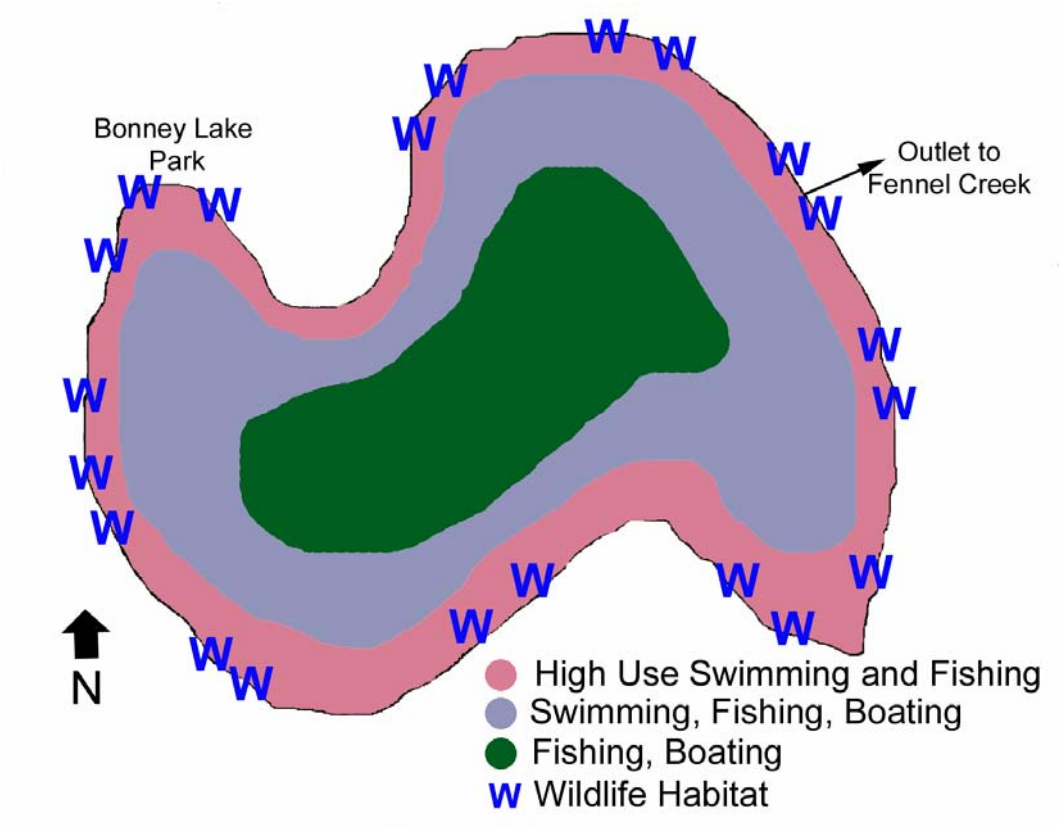
Conservancy areas have also been established along non developed shoreline regions and low use mid basin zones. These conservancy areas provide vital cover for juvenile fish and prime habitat for insects and invertebrates. Nearly 25% of the lake will remain as an undisturbed natural ecosystem. The remaining 75% will be managed to maintain low growing species and sparse pondweed populations. This managed littoral zone consists primarily of the entire residential shoreline.

Over the past 15 years limited management has promoted maintaining invasive nuisance plant and algae growth at acceptable levels in an effort to ensure safe recreational water usage. This area in particular is managed to maintain low growing species while eliminating those plants that reach the waters surface which pose a danger to swimmers and boaters.

Control Zones



BENEFICIAL USE MAP



VI. Aquatic Plants and Algae:

The Aquatic Plant Survey of Bonney Lake during the 2005 season was performed by Northwest Aquatic Eco-Systems. The only other surveys on file were performed during 1998 by RMI (Aqua Technex) and by the Washington State Department of Ecology during 1973 and 2003. The 1973 surveyed identified elodea as the major dominant submersed species with emergent plants scattered along the shoreline in patches, while the 1998 survey by RMI noted Potamogeton gramineus as the dominant plant. The RMI survey clearly identified the shift in weed composition from a plant community once dominated by elodea to one comprised of pondweeds. Current surveys performed by the Department of Ecology and Northwest Aquatic Eco-Systems identifies a monoculture plant community dominated by Najas.

Current surveys in conjunction with past macrophyte surveys were used as the basis for evaluating the distribution of aquatic plants in Bonney Lake . Potamogeton gramineus, and Potamogeton amplifolius are the identified pondweeds present within the system. These plants are sub-dominant and were observed sporadically within 100 feet of the shoreline. Najas guadalupensis and Najas flexilis are the dominant aquatic species identified throughout the entire lake. Following the fluridone treatment these species have aggressively transformed the macrophyte community into a monoculture dominated by Najas. **Najas was not identified during the 1998 survey**. In conjunction with the submersed aquatic native macrophytes the shoreline provides habitat for numerous non-native noxious plants. Fragrant water lily

(Nymphaea ordorata), purple loosestrife (Lythrum salicaria), yellow flag iris (Iris pseudacorus), Japanese knotweed (Polygonum cuspidatum), and Reed Canary Grass (Phalaris arundinacea) frequent the shoreline landscape. Native Brasenia was identified in small isolated shoreline patches. Chara and nitella, low growing algae species were also identified sporadically along the lake bottom.

The plants observed and mapped during 2005, clearly demonstrates a change in plant diversity proceeding the fluridone application. However other plant community shifts have been observed lakewide since 1973 without intervention. The major change noted in macrophyte composition since the treatment has been the establishment of a mono-culture of Najas. Pondweeds once dominant throughout the lake are now observed only sporadically within the submersed macrophyte community.

Latin Name	Common Name	Origin/Threat
Najas guadalupensis	Common Water-Nymph	Native/Non-Invasive
Najas flexilis	Slender Water-Nymph	Native/Non-Invasive
Nitella	Nitella	Native/Non-Invasive
Potamogeton amplfolius	Bigl-leaf pondweed	Native/Non-Invasive
Potamogeton gramineus	Grass Leaved Pondweed	Native/Non-Invasive
Brasenia schreberi	Water-Shield	Native/Non-Invasive
Nymphae odorata	Fragrant Water Lily	Non Native/-Invasive
Chara	Muskgrass	Native/Non-Invasive
Polygonum cuspidatum	Japanese knotweed	Non Native/-Invasive
Phalaris arundinacea	Reed canary grass	Non Native/-Invasive
Iris pseudacorus	Yellow Flag Iris	Non Native/-Invasive
Lythrum salicaria	Purple Loosestrife	Non Native/-Invasive

Species: Potamogeton alpinus Balbis, alpine pondweed
Potamogeton gramineus L, grass-leaved pondweed
Family: Potamogetonaceae

Alpine and grass-leaved pondweed have both floating and underwater leaves. The underwater leaves of both species are long, fairly narrow, and attach directly to the stem. When present, the floating leaves of alpine pondweed are broader, but are similarly shaped to the underwater leaves, and are attached to the stem by short stalks. The floating leaves of grass-leaved pondweed are oval and on stalks that may be longer than the leaf blades. Grass-leaved pondweed is extremely variable in appearance and may look differently depending on whether it is growing in deep or shallow water or stranded along shorelines by receding water.

Leaf: Alpine: submersed leaves: reddish, to 20 cm long and 1 -2 cm wide, have rounded tips, usually 7 veins, and lack stalks. Transitional leaves are often present. Floating leaves: (often absent) to 6 cm long by 2.5 cm wide and on short stalks. Sheaths (stipules) are free from the leaf base, to 4 cm long, and break apart easily. Grass- leaved: submersed leaves: green-to-reddish, to 13 cm long by 1.2 cm wide, have pointed tips, 3-9 veins and no stalks. Floating leaves: 1.5-7 cm long and 1 -3 cm wide and on stalks usually longer than the blades. Sheaths (stipules) to 3 cm long are persistent and free of the leaf base.

Stem: Long, forms rhizomes. Alpine: reddish, few branched. Grass-leaved: many short branches.

Flower: Small, clustered on emergent spikes, each with 4 petal-like lobes. Alpine: spikes to 3.5 cm long on stalks 6-15 cm long. Grass-leaved: spikes to 4 cm long on long stalks to 20 cm.

Fruit: Achene. Alpine: 3.5-4 mm long, sharply ridged back, curved beak. Grass-leaved: 1.5-3 mm, back slightly ridged, straight to slightly curved beak.

Root: Fibrous, from rhizomes. Grass-leaved forms long tubers.

Propagation: Seeds, creeping rhizomes, tubers (grass-leaved only).

Importance of Plant: Seeds, tubers, and vegetation provide important food and cover for aquatic animals and waterfowl.

Distribution: Both occur throughout the temperate Northern Hemisphere.

Habitat: Alpine: shallow cold-water ponds and lakes. Grass-leaved: shallow to deep water; variable appearance depending upon growing conditions.

May be confused with: Other pondweeds with long, narrow underwater leaves. Grass-leaved pondweed is a variable species that hybridizes freely. Much disagreement and confusion exists regarding this plant among taxonomists. Each will hybridize with other pondweeds, forming plants with intermediate characteristics.

Species: Chara spp., muskgrass, stonewort, muskwort
Family: Characeae

Although these common lake inhabitants look similar to many underwater plants, they are actually algae. Muskgrasses are green or gray-green colored algae that grow completely submersed in shallow (4 cm) to deep (20 m) water. Individuals can vary greatly in size, ranging from 5 cm to 1 m in length. The main "stem" of muskgrasses bear whorls of branchlets, clustered at regularly spaced joints. When growing in hard water, muskgrasses sometimes become coated with lime, giving them a rough gritty feel. These algae are identifiable by their strong skunk-like or garlic odor, especially evident when crushed.

Leaf: Algae lack true leaves. Six to 16 leaf-like branchlets of equal length grow in whorls around the stem, and are never divided. These branchlets often bear tiny thorn-like projections, which give the plant a rough or prickly appearance when magnified.

Stem: Algae lack true stems. The round, stem-like structure varies from 5 cm to over 1 m in length.

Flower: Algae do not produce flowers. Instead, microscopic one-celled sex organs called oogonia are formed. These tiny organs and patterns in the cases that surround them are used to distinguish between species.

Fruit: Algae do not produce fruits. Tiny spores are produced in fruiting bodies. In some muskgrass species the fruiting bodies are orange and very conspicuous. Root Muskgrasses may be attached to the bottom by root-like structures called holdfasts.

Propagation: Spores carried by water and waterfowl; plant fragments.

Importance of Plant: An important food source for waterfowl, particularly ducks. Provides valuable protection for young fish and invertebrates. Muskgrasses grow quickly and occasionally cover the entire bottom of ponds, however its low growth rarely causes it to be considered a nuisance in Washington.

Distribution: Worldwide. More than 30 species in the U.S.

Habitat: Fresh to brackish water, inland and coastal, in both shallow and deep water. Some species found in alkaline lakes and slow-moving streams. Muskgrassses will often grow in deeper water than vascular aquatic plants.

May be confused with: Other plant-like algae: Nitella (Nitella spp.), which have symmetrically forked smooth branchlets, do not have lime coatings, and lack the odor of muskgrasses; and Tolypella spp., which have unsymmetrically forked branches. Slender water-nymph and coontail (Ceratophyllum demersum) are vascular plants which have a different leaf structure and do not produce an odor when crushed.

Species: Nitella sp., nitella, brittlewort
Family: Characeae

Nitellas are bright green algae often mistaken for higher plants because they appear to have leaves and stems. These long, slender, delicate, smooth-textured algae lie on the bottom of a lake or pond and are seldom found in the water column. Whorls of forked branches are attached at regularly spaced intervals along the "stems." Nitellas sometime grow together with muskgrasses (Chara spp.), another plant-like algae, to form underwater meadows.

Leaf: No true leaves. 6 to 8 evenly forked branchlets grow in whorls at regularly spaced intervals along the "stem." Unlike the rough branchlets of most muskgrasses (Chara spp.), nitella branchlets have a smooth texture.

Stem: No true stems. Hollow, stem-like structures have whorls of forked branches along their entire length. The largest nitella species have "stems" up to 2 m long.

Flower: Does not bear flowers. Instead nitellas have microscopic spore-producing organs. Male organs grow at the base of the branchlets. Female organs are in a cluster on the sides of the branchlets below the male organs.

Fruit: Produces spores rather than fruits.

Root: Lacks roots. May be attached to the bottom by root-like structures called holdfasts or floating free above the sediment.

Propagation: Spreads by spores transported by wildlife and will also form new plants from vegetative fragments.

Importance of Plant: Provides cover for fish, food for fish and waterfowl, and stabilizes sediment. Because nitellas have no roots, they remove nutrients directly from the water. Nitellas are considered desirable species in Washington.

Distribution: Worldwide. More than 30 species are reported to occur in the U.S.

Habitat: Nitellas grow in shallow to deep waters of soft water or acid lakes and bogs. They often grow in deeper water than flowering plants and frequently form a thick carpet or grow in clumps along the bottom.

May be confused with: Muskgrasses (Chara spp.), which have unforked branches and a distinctive, unpleasant garlic odor, especially when crushed. Another algae, Tolypelfa, has unevenly forked branches in contrast to the evenly forked branches of the nitellas. Nitellas may also be confused with two vascular plants: water-nymphs (Najas spp.), which have opposite leaves, and coontail (Ceratophyllum demersum),which has leaves that fork into several segments.

Species: Potamogeton amplifolius Tuckerman, big-leaf pondweed
Family: Potamogetonaceae

Big-leaf pondweed has two leaf types: large, usually wavy-edged underwater leaves that are curved into a banana shape, and oval, leathery floating leaves that grow on or near the water surface. Underwater leaves often decay late in the growing season, making big-leaf pondweed easy to confuse with other floating-leaved pondweeds.

Leaf: Alternate leaves of two types. Submersed leaves: bright to dark green, translucent, 8-20 cm long and 2-7.5 cm wide, folded along the midrib, curved backwards into a banana-shape, and sometimes with wavy margins. They have short stalks (1-2 cm) and 19-45 lengthwise veins. These leaves often decay in late summer. Floating leaves: often absent. The opaque, leathery, oval leaves taper at both ends and are 5-10 cm long and 2.5-5 cm wide. They have 25-45 veins and 3-10 cm long stalks that are generally longer than the floating leaves. Sheaths (stipules) are up to 10 cm long, whitish, translucent, occur at leaf bases, but are not attached to the leaves. They become stringy with age.

Stem: Few or unbranched stem (to 3 mm thick) to 5 m long

Flower: Small flowers have 4 petal-like lobes. Up to 16 whorls of tightly clustered flowers are arranged into a spike up to 5 cm long on stalks rising above the water. The flower stalks are thicker than the stem and are 5-15 cm long.

Fruit: Seed-like achene is 3-5 mm long, has flattened sides, a 0.5-1 mm beak, and is orange to pinkish when ripe. The back is rounded or keeled when dry.

Root: Fibrous, from creeping underground rhizomes.

Propagation: Seeds, fragments, rhizomes.
Importance of Plant: Plants may show rapid early season growth, with plants over 3m tall observed in early May. Seeds and entire plan tare good wildlife food and habitat.

Distribution: Throughout North America. Particularly common in western and northeastern Washington lakes.

Habitat: Lakes and ponds. Will grow in clear water as deep as 6 m.
May be confused with: Without floating leaves, may be confused with other broad-leaved pondweeds such as Illinois pondweed (P. illinoensis], and white stem pondweed (P. praelongus). However, these do not have as many leaf veins, and white stem pondweed has no leaf stalks. Big-leaf pondweed will hybridize with other pondweeds, forming plants with intermediate characteristics.

Species: *Nymphaea odorata,* fragrant waterlily, white waterlily
Family: Nymphaeaceae

Fragrant waterlily is perhaps the most familiar of all aquatic plants. It commonly grows around lake and pond margins and can be recognized by the fragrant white, pink to purple, many-petaled flowers that float on the water surface. The large, round, floating leaves have a distinctive slit on one side. This nonnative plant has been introduced to many lakes in Washington. It can be invasive in lakes with extensive shallow areas.

Leaf: The round, smooth, green, leathery leaves are up to 30 cm in diameter and have a slit on one side. The underside is often red or purplish with numerous veins. The leaf stalk is attached to the leaf center at the base of the slit.

Stem: No true upright stem is present. Straight, flexible stalks attach leaves and flowers to thick, submerged rhizomes.

Flower: Large, fragrant flowers, 6-12 cm across, are at the ends of long stalks. The flowers have numerous (20-30) white, pink, or purple petals with yellow centers. After fertilization, the flower stalk curls like a corkscrew, drawing the flower underwater. Blooms June through October.

Fruit: Leathery, berry-like capsules, to 3 cm across, with numerous small seeds (2 mm).

Root: Thick rhizomes, 2-3 cm in diameter.

Propagation: Seeds, rhizomes.

Importance of Plant: Rhizomes and leaves were used by Native Americans in eastern North America as remedies for many ailments from colds to ulcers. The leaves and roots are eaten by beavers, muskrats, porcupines, and deer; the seeds are eaten by waterfowl. It can become a nuisance in shallow lakes. A favorite aquatic garden plant, many varieties have been cultivated.

Distribution: Native to eastern North America. Widely introduced in the Pacific Northwest.

Habitat: Shallow ponds, lakes, and slow streams in water 3-6 feet deep.

May be confused with; Spatterdocks (Nuphar spp.), which have heart-shaped leaves and yellow, cup-shaped flowers. Watershed (Brasenia schreberi), which has smaller, slimy-coated leaves and leaf stalks attached to the middle of the leaves. Yellow floating- heart (*Nymphoides* peltata), which has smaller leaves and yellow flowers. Other native and introduced *Nymphaea* species.

Species: Brasenia schreberi Gmel. water-shield, dollar bonnet, water target
Family: Cabombaceae

Water-shield is identified by the thick coating of gelatinous slime covering the young stems, buds, and undersides of young leaves. The long reddish leaf stalks are attached to the centers of the floating oval leaves, giving them an umbrella-like appearance. Water-shield flowers are small, purplish, and rise slightly above the water, but are not particularly showy. Because of the floating leaves, some taxonomists consider water-shield to be in the water-lily family (Nymphaeaceae).

Leaf: Oval leaves (4-12 cm long and 3-8 cm wide) float on the water surface. The leaves have purple undersides with long, centrally attached leaf stalks up to 2 m long. A slimy gelatinous substance usually covers the stalks and underside of young leaves and stems.

Stem: Arise from submersed, branching, reddish creeping rhizomes.

Flower: The 5-20 cm long flower stalks each bear a single purplish flower with 3 sepals and 3 (4) similar-looking petals. Each flower measures up to 2.5 cm across and is elevated slightly above the water surface. Blooms May to September.

Fruit: Each flower produces 4-18 separate narrowly egg-shaped, leathery fruits between 6-8 mm long. Each fruit usually contains 2 seeds. They ripen underwater and decay to release seeds.

Root: Slender, branched, creeping rhizomes.

Propagation: Rhizomes, seeds, winter buds.

Importance of plant: The rhizomes and leaves have been used for food and medicinal purposes by Native Americans. The Japanese use young leaves and stems in salads. Provides habitat for fish and aquatic insects; seeds and vegetation are eaten by waterfowl.

Distribution: Throughout most of the U.S. and southern Canada. Also occurs in Central America, Cuba, Africa, East Asia, and Australia.

Habitat: Shallow ponds, lakes, and slow-moving streams. It grows in water 0.5-3 m deep.

May be confused with: Fragrant water-lily (Nymphaea odorata), or some floating-leaved pondweeds (Potamogeton spp.), but only water-shield is covered by a slimy coating with the stem attached at the center of an oval leaf. Water-lilies have showy white or pink flowers and leaves cleft to the stalk. Floating-leaved pondweeds have the stem attached at the leaf edge.

Species: Lythrum salicaria L., purple loosestrife
Family: Lythraceae

Purple loosestrife has vivid purple-pink flowers and blooms in summer and early fall. This erect, robust, square-stemmed, perennial crowds out native wetland species to form dense stands in shallow water and wet soil throughout Washington. It is important to recognize this invasive, rapidly spreading European species because every effort needs to be taken to control its spread to new areas.

Leaf: The narrow leaves are stalkless, lance-shaped, 3-14 cm long, heart-shaped at the base, and sometimes covered with fine white hairs. They are opposite or whorled, and sometimes alternate on the upper portion of the stem.

Stem: The erect stem is usually square in cross-section, 0.5-2 m tall, and often branched. May be covered with fine whitish hairs.

Flower: Showy purple-pink flowers occur in erect spikes at the stem tops. The stalkless flowers have 5 sepals and 5-7 delicate wrinkled petals (7-14 mm long).

Fruit: Egg-shaped capsule (3-4 mm) has many tiny seeds. A single plant may produce up to 2.7 million seeds a year.

Root: Strong rhizomes.

Propagation: Tiny, lightweight seeds are readily spread by waterfowl and other animals. Vegetative reproduction by shoots and rhizomes.

Importance of Plant: A European species introduced to North America in the mid 1800s. It was distributed as an ornamental, but has become a serious pest plant. It is known as the "purple plague" because it displaces native wetland species. Provides minimal wildlife habitat. Has some medicinal uses in its native range.

Distribution: Native to Eurasia, but introduced nearly worldwide. Patches located throughout Washington and spreading to new locations.

Habitat: Marshes, lake shores, ponds, stream banks, and ditches. Occasionally grows in upland areas.

May be confused with: Fireweed *(Epilobium angustifoliumim), a* perennial herb that inhabits dry, often disturbed sites such as clear-cuts and roadsides. Fireweed flowers have 4 rounded petals. Also confused with hardhack (Spiraea douglasii), which is a native woody shrub rather than a perennial herb. Neither of these species have square stems. The related native plant

hyssop loosestrife *(Lythrum hyssopifolium)* is smaller (to 40 cm) and has smaller, lighter-colored flowers.

Species: *Phalaris arundinacea L,* reed canarygrass
Family: Poaceae

Reed canarygrass is an invasive, tall, coarse looking, perennial grass that commonly forms extensive single-species stands along the margins of lakes and streams and in wet open areas. Stems can reach 2 m in height. Leaf blades are blue-green when fresh and straw-colored when dry. Flowers are borne on the stem high above the leaves and are pinkish at full bloom.

Leaf: Flat, blue-green leaves are rough to the touch, to 30 cm long, and relatively wide (to 17 mm).

Stem: The hollow round stem is covered with a waxy coating and is up to 1 cm in diameter.

Flower: Each flower group (spikelet) has 3 flowers. These spikelets are located in dense clusters that are 2-40 cm long and to 11 cm wide. Blooms June through August.

Fruit: Dry and one-seeded, with a conspicuously glossy tan surface; 1.5-2 mm long and less than 1 mm wide.

Root: Long and fibrous. Emerging from the nodes of long, stout, scaly, pinkish rhizomes.

Propagation: Seeds, rhizomes.

Importance of plant: Invasive in wetlands, where it outcompetes native species. Dense stands cause flooding in streams and ditches. Eaten by only a few wildlife species, it grows too densely to be used as cover for waterfowl. Grown as cattle forage, particularly in eastern Washington. A major pollen contributor during allergy season.

Distribution: Native to Eurasia. Introduced to North America in all but the extreme southeastern U.S. and Mexico.

Habitat: Wet meadows, marshes, pastures, lakes margins, and ditches. Tolerates short-term flooding.

May be confused with: Other shoreline grasses, such as common reed (Phragmites oustralis), which is usually larger (to 4 m tall) and has o more open flower cluster; reed mannagrass (G/ycenia *grandis),* which has less dense and more open diffuse flower clusters; tall fescue *(Festuca arundinacea),* which has narrower leaves (4 to 10 mm wide) and a non-rhizomatous habit; and orchard-grass *(Dactylis glomerata),* which has flower clusters attached to only one side of the flowering stems, is not rhizomatous and usually grows on dryer sites.

Species: Najas *flexilis* (Willd.) Rest & Schmidt, slender water-nymph or naiad
Najas guadalupensis (Sprengel) Magnus, common water-nymph
Family: Najadaceae

Slender water-nymph and common water-nymph are completely submerged annual plants, although they are often found as floating fragments. They have opposite leaves that are often clustered near the tips of the stems. The leaf base is much wider than the rest of the leaf blade, which helps to distinguish the water-nymphs from other underwater plants. These plants have inconspicuous flowers and fruits that are almost completely hidden by the leaf bases. Water-nymph pollination takes place underwater.

Leaf: Glossy, green, and finely toothed leaves are oppositely arranged, but appear to be whorled near ends of the stems. Leaves are long and narrow with broad bases that clasp the stem. Slender: leaves taper to a long point and are 1 -3 cm long and 1 -2 mm wide. Common: the blunt-tipped leaves are generally shorter and narrower (1-2.5 cm long and 0.5-1 mm wide) than slender water-nymph leaves.

Stem: The slender, limp and branched stem is up to 2 m long and easily broken.

Flower: Inconspicuous, tiny (2-3 mm) flowers are located in clusters at the base of the leaves. Male and female flowers occur separately on the same plant. Water-nymph pollen is transported by water currents.

Fruit: The small, oval-shaped fruit is located in the leaf bases. Each fruit contains one seed that is about 3 mm long. The fruit surface is smooth and glossy in slender water-nymph and is dull and pitted in common water-nymph. Fruits are present in late summer.

Root: Fibrous.

Propagation: Seeds, plant fragments.

Importance of Plant: The entire plant is eaten by waterfowl. Water-nymphs are considered to be one of their most important food sources. They also provide shelter for small fish and insects.

Distribution: Slender: northern North America and northern Europe. Common: southern North America, Central and South America. In Washington, slender water-nymph is the more common species, but common water-nymph has been reported.

Habitat: Ponds, lakes, and sluggish streams to depths of 4 m. Slender water-nymph tolerates brackish conditions.

May be confused with: The broad sheathing leaf bases and the opposite leaf arrangement help to distinguish water-nymphs from other submersed species such as nitella *(Nitella* spp.), water-starwort *(Callitriche* spp.), muskgrass (Chara spp.), and thin-leaved pondweeds (Potamogeton spp.). Examination of seed characteristics is the only reliable method of distinguishing between slender and common water-nymph.

Aquatic plants are often misinterpreted as and under-valued part of freshwater lake systems. Generically most lake front property owners consider aquatic plants to be nuisance components of the ecosystem creating unsafe conditions along residential shoreline areas while interfering with fishing activities.

Aquatic plants provide a vital food supply for many animals within most aquatic ecosystems. Ducks and geese eat the seeds, leafy parts, and tubers of many plants. Songbirds utilize the fluff from cattails *(Typha* sp.) as nest material and eat the seeds of many shoreline emergent plants. Humans also utilize aquatic plants as a food source.

Aquatic plants provide important living space for small animals such as aquatic insects, snails, and crustaceans, which in turn supply food for fish and waterfowl. Studies have shown that vegetated areas support a greater quantity and quality of these tiny invertebrates than do un-vegetated areas.

Fish and amphibians use aquatic plants as a source of cover from predatory fish and birds. Fisheries emendated with dense macrophyte growth are often comprised of a stunted fisheries consisting of large populations of small fish. Aquatic plants provide important protection for fingerlings and behave as "nurseries" for baby fish.

Submersed and emergent plants protect shorelines from erosion due to wave action and/ or currents. They also help stabilize bottom sediments which can increase water clarity.

Aquatic plants form a vital part of the complex system of chemical cycling in a waterbody. They can influence the supply of oxygen in the water. Waterbodies plagued with dense weed growth often experience elevated oxygen levels during the day (photosynthesis) and depleted levels during the night when the plants consume oxygen (respiration). Aquatic plants utilize nutrients that would otherwise be used by algae, thereby improving water clarity. Although aquatic plants function as positive nutrient sinks (absorb nutrients) during their growing season, these same plants become nutrient negative sinks when their nutrients are released back into the system during decomposition at the conclusion of the growing season. Healthy lake systems with adequate native weed cover often resist invasion by exotic species. A diverse healthy native plant community is more resistant to invasion by opportunistic exotic plants.

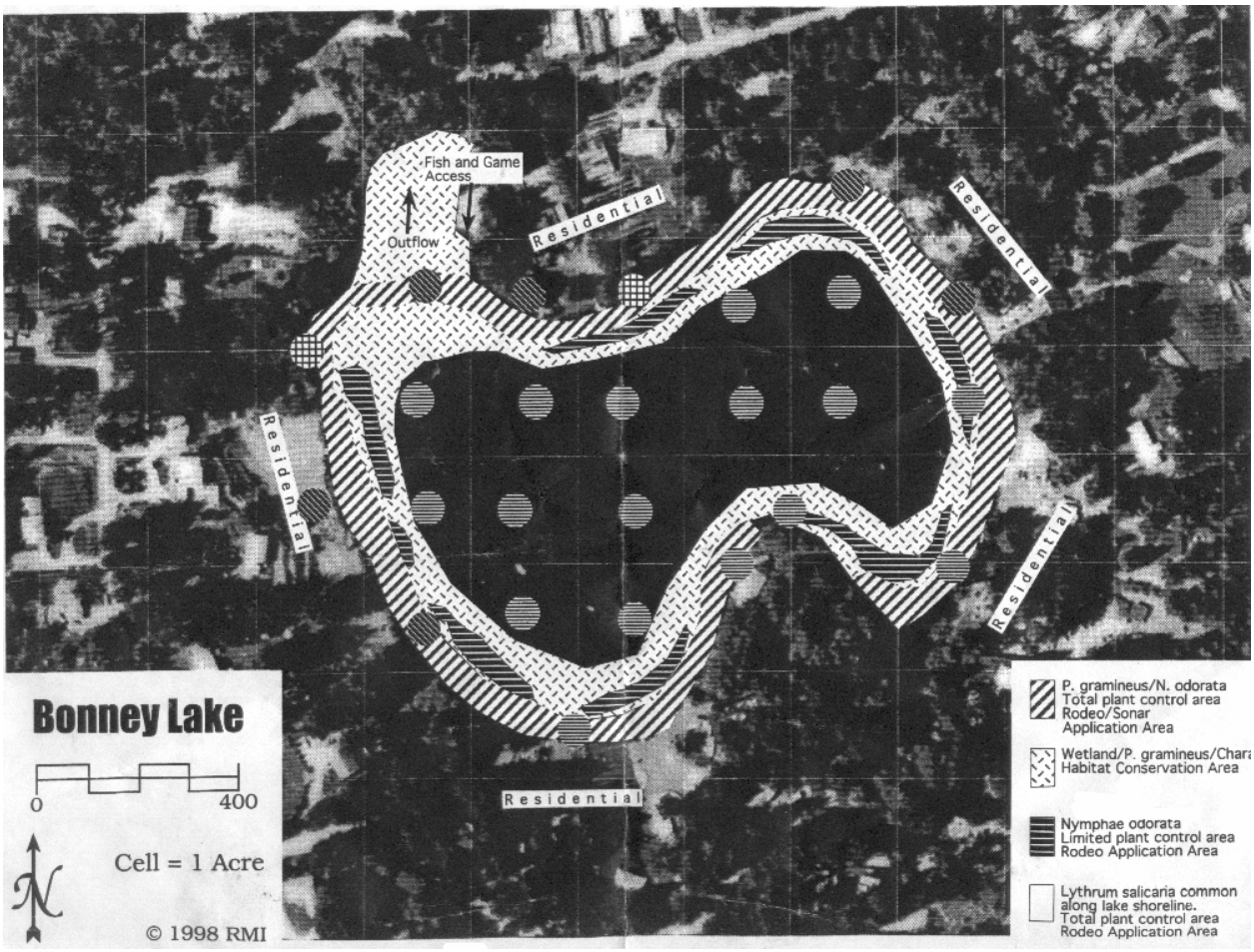
Most of the time, problems associated with noxious native weed growth arise when plants are so numerous they impede recreational activities such as boating and swimming. The greater problem is associated with safety concerns when growth becomes very thick impeding movement and encouraging entanglement. Plants also harm spawning habitat by covering prime shoreline substrate with dense growth. Floating weed masses will absorb sunlight, increasing the water temperature within the immediate area.

The causes of unnaturally high levels of plant growth are complex. Often it is attributed to increased nutrients, which come from around the lake or in the watershed. Contributing problems can include failing septic systems, fertilizer run-off, and or poor surface water management within the watershed. These increased nutrients cause the natural process of lake aging (eutrophication) to proceed at an accelerated rate, and increased plant and algal growth is part of this process.

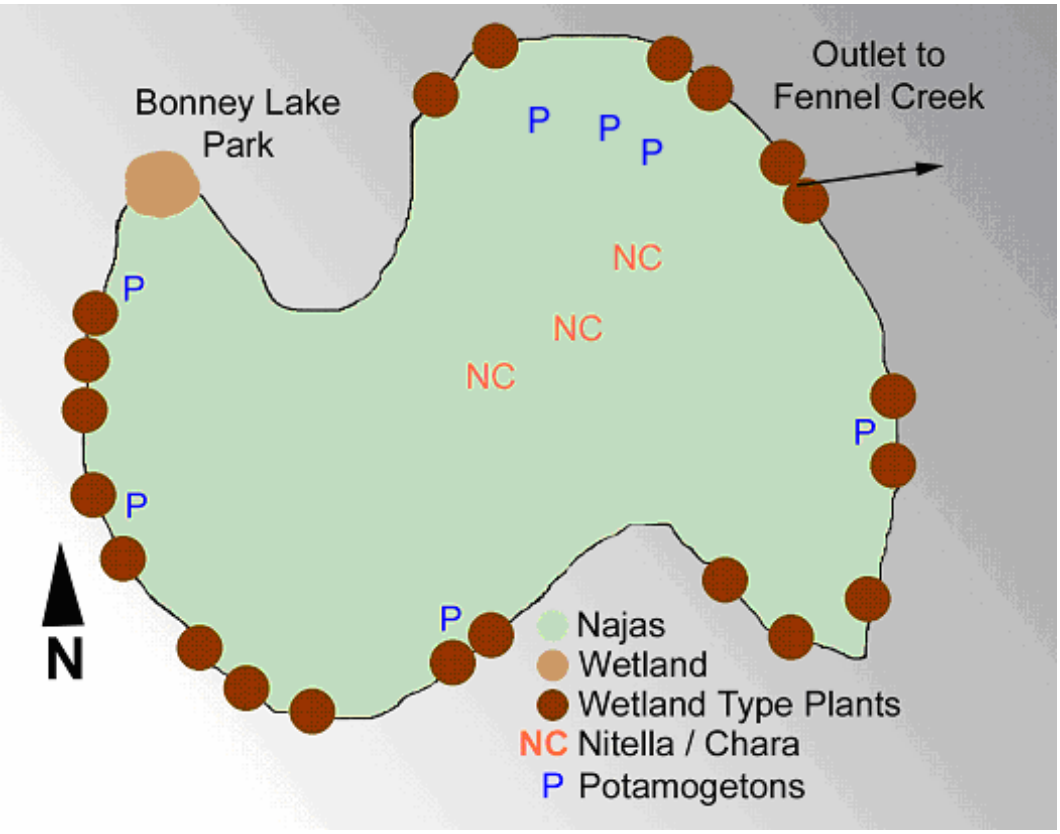
Another problem can arise if a nonnative species is inadvertently introduced to the lake. This often happens when recreational users unknowingly carry plants from one waterbody to another, or when someone discards aquarium plants into a lake. Several exotic species such as Eurasian watermilfoil *{Nyriophyllum spicatum) and* Brazilian elodea (*Egeria densa)* are aggressive and can crowd out more desirable native vegetation. Changes in vegetation may take slowly or quite rapidly. Along with preventing or eliminating pollution, lake associations can monitor plant community changes by identifying aquatic plants on a yearly basis. This is

also a good way to detect changes within the plant community at early stages when control or elimination of the problem is less complicated and cost effective. Monitoring of aquatic plants provide a valuable historic record of what inhabits the littoral zone of the lake.

Bonney Lake Weed Survey RMI 1998



Bonney Lake Weed Survey 2005



Note -Wetland type plants include: Brasenia, Nymphaea odorata, Nuphar

VII. Aquatic Plant Control Alternatives, their Effectiveness, Environmental Impacts, Human Health Risks, and Costs

The following descriptions are in part from A Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plans, 1st Edition, WDOE, January, 1994. These alternatives are commercially available and have known impacts, limitations and results. The reasonableness of application to Bonney Lake is based on the lake's natural environment, budgetary restraints and results of communications between the local community and the City of Bonney Lake. The resulting research has established the communities' preferences.

A. No Action

Specific short and long-term impacts associated with not controlling aquatic plants in the waterbody.

When evaluating management alternatives consideration must be given to the assessment of environmental impacts if unmanaged weed growth is not addressed in a positive nature. One option for managing aquatic weeds in Bonney Lake is to let aquatic weeds continue to grow, and do nothing to control them. This "no action" alternative would acknowledge the presence of the aquatic weeds but would not outline any management plan.

A non action alternative is an unacceptable approach not supported by the homeowners, Lake Bonney Conservation Association and the City of Bonney Lake. Historically the local community has maintained an active role in various lake aquatic weed related problems. Such a non action approach would have a serious impact on the aquatic ecosystem, related human resources and tax base of the area. Current and past lake conditions have been well documented over the years supporting the need for environmentally friendly and economical control measures. Without intervention most likely the lake will continue to degrade producing unsuitable habitat for aquatic organisms, unfriendly lake conditions for boaters and swimmers and an unhealthy aesthetic surrounding. Such conditions would only encourage the devaluation of abutting properties hence reducing the tax base of the area.

Suitability for Bonney Lake

Current nuisance weed infestations are currently moderate to heavy in density. No control and/or limited activities lake wide proceeding the fluridone application has resulted in a lake system now dominated by a mono-culture of Najas. Unless control measures are initiated with appropriate methodologies, growth is likely to increase each growing season in the future until the entire lake is dominated by nuisance plants that reside in the upper and surface of the water column. Neglecting the need to control potential toxic algal blooms would close the lake for swimming during the summer months.

Advantages: Under the no action plan there would be no expenditure of Homeowners Association funds.

Drawbacks: Under the no action alternative the lake beneficial uses would continue to limit swimming and access to those areas where aquatic growth is naturally non-occurring. There would continue to be human safety risks associated with increased aquatic plant populations in swimming and other recreational areas. Boaters would continue to be entangled in the floating weeds. Submersed plants would continue to cause limited visibility for boat operators creating a safety hazard for passengers and swimmers. Sports fishing would continue to be limited to poor quality trolling and to those few areas not covered by dense aquatic growth.

Overall lake water quality would degrade as the density and range of plants increase resulting in increased lake temperatures and decreased oxygen levels. Nutrient levels would increase from the decomposition of increased biomass, and also from lack of programs to limit input from fertilizers and poor management of construction sites. The broadening of the current populations of non-native/invasive aquatic plant species would increase the risk of spreading these species to other water bodies by boats and waterfowl that are not already experiencing problems form that particular species. This may result in a shift of species composition throughout the lake impacting the food chain and fisheries.

Continued sedimentation, increased nutrient input and continually increased plant populations would hasten any tendency towards changing the entire lake into a shallow wetland, and thereby significantly and negatively impacting beneficial human uses and property values. Such changes are slowly occurring at Bonney Lake and without continued and decisive intervention, the process will only accelerate.

B. Environmental Manipulation

Physical methods of aquatic plant control would include:

- Hand-pulling
- Hand cutting
- Raking
- Bottom barrier application (sediment covers)
- Water level draw down
- Implementing watershed controls to reduce nutrient inputs
- Water column dyes
- SolarBee Technology
- Sonic Solution

1. Hand Pulling

Hand-digging and removal of rooted, submerged, and emergent 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 then 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.

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. Some residents at Bonney Lake have found hand-pulling to be acceptable for a relatively small area but must be repeated annually. Complete removal of the root was expressed as very important and it is essential that neighbors also accomplish the same degree of removal.

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 appropriate for small-area, low plant density applications. This method can also be useful for clearing pond weeds or very small patches of water lilies from areas around docks and beaches.

Handpulling without involving commercial divers is typically performed on a volunteer basis providing no financial burden to the community.

Drawbacks: The technique is time-consuming and costly when performed commercially and 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. Some undesirable plants will readily spread from plant segments. Therefore, plant segments not collected can cause short term fish habitat loss. Soft mucky bottom areas may pose a hazard to those activities occurring along shallow shoreline areas. Also lake sediments support the growth of leaches.

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 $500 to $2400/day with area covered dependent on density of plants.

Permits: An HPA, consisting of having a copy of WSFW Publication #APF-1-98 entitled "Aquatic Plants and Fish" in hand, is currently required for small- scale removal of aquatic plants by hand-pulling, and all publication provisions must be followed. For large-scale removal, an individual HPA is required.

Application to Bonney Lake: Intensive manual labor and high costs makes hand-pulling acceptable only for those areas where the property owner may choose to clear a small localized area. Increased lakewide use of manual control is solely dependent on the ability of the local community to sustain volunteer support (labor) on a regular basis throughout the growing season. The local residents in conjunction with the City of Bonney Lake encourage residents to hand pull weeds on an individual bases and recognizes the benefits of this technique.

2. Hand-Cutting

This technique is also a manual method, but differs from hand pulling in that plants are cut below the water surface (roots generally not removed). 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.

Typical Hand Cutter

Control Effectiveness and Duration: Root systems and lower stems are often left intact. As a result, effectiveness is usually short-term as re-growth 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 and floating plant growth. Costs are minimal if volunteer labor is utilized.

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. 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. Plant segments not collected can cause short term fish habitat loss.

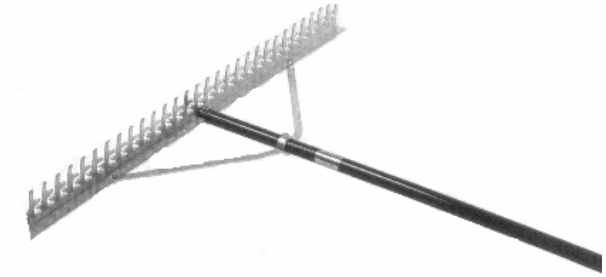
Costs: Where volunteer efforts are employed, costs are mostly limited to purchase of a cutting implement. This can vary from under $100 for the Aqua Weed Cutter ® (Sunrise Corp.) to over $1000 for the mechanized Swordfish ® (Redwing Products).

Permits: An HPA, consisting of having a copy of WSFW Publication #APF-1-98 entitled "Aquatic Plants and Fish" in hand, is required for small-scale removal of aquatic plants by hand-cutting, and all publication provisions must be followed. For large-scale removal, an individual HPA is required. Mechanical (motorized) cutting (including battery-operated equipment) requires hydraulic approval by Department of Fisheries and Wildlife.

Application to Bonney Lake: Short term results, intensive manual labor makes hand-cutting acceptable only for those areas where the property owner may choose to clear a small localized area for a short period of time such as a pathway for boat access, or clearing around a dock or swimming area. Large scale use of manual cutting is dependent on the ability of the local community to maintain a large enough volunteer group throughout the season. Perhaps a more realistic approach to hand cutting would be for the community to purchase several cutting tools and promote use of the tools lake wide on an individual basis.

3. Raking

A rope is attached to a sturdy rake, and the rake is dragged through the water by the rope. This method attempts to remove the plants by pulling the plant from the sediment, though it also results in a considerable amount of shorter, broken weeds with their roots intact.



Control Effectiveness and Duration: As with hand pulling, the success of this removal method depends a great deal on sediment type, plant species, and the ability to remove the entire plant. The duration of control is in excess of one season if the entire plant is removed, but is quite short if part of the plant is merely broken off and the roots are left intact.

Advantages: This technique allows the removal of aquatic plants from some deeper areas of a water body. It also allows the immediate removal of plants, and is site specific.

Drawbacks: This method is quite labor intensive and therefore only suitable for small areas. It is also not species specific. The plant fragments generated by raking can spread the plants' range to other areas of the water body. Raking also increases short-term turbidity, and disturbs bottom dwelling animals. Many of the drawbacks identified with weed cutting are also applicable to weed raking.

Costs: For projects using volunteer labor and for individual property owners, the cost of raking is limited to the cost of equipment. Commercial rakes are available for around $100.

Permits: An HPA, consisting of having a copy of WSFW Publication #APF-1-98 entitled "Aquatic Plants and Fish" in hand, is currently required for small- scale removal of aquatic plants by raking, and all publication provisions must be followed. For large-scale removal, an individual HPA is required.

Application to Bonney Lake: Raking can be a good method of control in small, shallow areas, such as around docks and small swimming beaches. But since it is labor intensive and not conducive to use in deeper waters, it is not a good technique for controlling the weeds in mid-lake swimming and boating areas.

4. Bottom Barrier and Sediment Covers

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 pretreatment of 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 with the least expense material, burlap has been found to provide up to 2-3 years of relief from problematic growth before eventually decomposing. After satisfactory control has been achieved (usually several months), some barrier materials can be relocated to other areas to increase benefits.

Advantages: Usually, bottom barriers can be easily applied by individual property owners to small, confined areas such as around docks, moorages and swimming 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 milfoil 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 re-growth 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. Fabric bottom barriers pose a long-term fish habitat loss.

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 $0.15 to $0.25/sq. ft. for materials only. Costs associated with a one acre bottom screen installation averages between $35,000.00 -$45,000.00

Permits: WSFW Publication #APF-1-98 entitled “Aquatic Plants and Fish” can serve as an HPA for a narrowly defined and limited amount of bottom barrier applications (refer to pages 25-27 of this publication for specifics). The majority of bottom barrier applications require hydraulic approval from Washington Department of Fisheries and Wildlife. In addition, barriers costing more than $2,500 may need a shoreline permit from Pierce County.

Application to Bonney Lake: Bottom barrier application may be a good alternative for relatively small but intensely used areas such as private swimming areas or swimming at the public launch. In areas where the lake is deeper than four feet commercial divers would be required. Installation in shallow areas can be accomplished using community volunteers. Another choice would be to combine a bottom barrier with a sand/gravel mixture cover. Placement of sand/gravel along the lake bottom will require approval through the Department of Fish and Wildlife. The effect would be similar to installing beauty bark. This would serve to improve near shore habitat and macrophytes do not appear to repopulate the substrate in a short time frame. Without grant funding to support large scale use of bottom barriers it is unlikely that the local community and the City could afford this option.

5. Water Level Drawdown

Water level drawdown used for management of aquatic plants involves exposing plants and root systems to prolonged freezing and drying, or hot, dry conditions to kill the plants. It's use has been more common in management of reservoirs and ponds than in natural lakes.

Control Effectiveness and Duration: Aquatic plants vary in terms of susceptibility to drawdown. Some aquatic plants can be permanently damaged after sufficient exposure, while others are unaffected or even enhanced. Therefore, accurate identification of target species is critical before considering this method. The mild, wet winters typical of Western Washington may not provide adequate freezing/drying conditions to kill certain plants. Neither would the short temperate, summer period of low rainfall provide enough drying to accomplish total destruction of certain weeds.

Advantages: In addition to controlling aquatic plant biomass, drawing down the water level makes it possible to use several other management procedures for restoration or improvement. For instance, it can be used for fish management, to repair structures such as docks, to facilitate localized dredging or bottom barrier replacement or to remove stumps or debris. Drawdowns could be used in coordination with hand pulling weeds when lake levels are low. This technique can result in compaction of certain types of sediments, such as mucky substrates and thus improve shoreline use. Decreasing near shore vegetation through drawdown can reduce potential inputs of nutrients into the water from seasonal dying of aquatic plants.

Drawbacks: This technique is not species-selective; removal of beneficial plant species may occur. Wetlands adjacent to the water body can be exposed with possible negative impacts on both plant and associated animal communities. Submerged and floating plants respond variably to drawdown, and stimulate growth in some species. Drawdown can also enhance growth of certain emergent plants such as cattails and bulrushes. Prolonged drying and freezing can decrease bottom-dwelling invertebrates that could be important food sources for fish. Dissolved oxygen levels may decline as a result of lowering the water level with possible negative impacts on fish and other aquatic organism. Recreational use of the water body may be limited or unavailable during the period of drawdown. Drawdown has not proven effective in Western Washington. If summer or winter drawdown is implemented for plant control, sediments must become completely dry for a prolonged period of time to kill plant roots.

Costs: Since there is no structure that controls the lake level mechanical pumping would be required for a full drawdown. Pumping costs have not been estimated.

Permits: Drawdown of Bonney Lake would require hydraulic approval from Washington Department of Fish and Wildlife and may require a SMA permit from Pierce County.

Application to Bonney Lake: Full water level drawdown is not practical as a principle management technique for Bonney Lake. Winter flows into the lake are significantly greater than what can be reasonably pumped. Though summer flows are greatly reduced and typically cease during May through September, the duration of drawdown would require the lake to be closed during the entire summer months. A partial drawdown to assist beach cleaning, hand pulling weeds, bottom barrier placement minor dredging, and herbicide treatment of the exposed broadleaf plants would appear to be a good alternative. This could only be accomplished through pumping and recharging of the lake may take considerable time during the summer months.

Permits: Permits required for a partial drawdown includes a hydraulic approval from Washington Department offish and Wildlife and may require a SMA permit from Pierce County.

Application to Bonney Lake: A partial drawdown would provide for beach cleaning and improved opportunity to install bottom barriers.

6. Watershed Controls

The principle involves reducing sources of external (outside) nutrient and sediment inputs by implementing watershed best management practices (BMPs). Best management practices are

often difficult to implement and enforce on a complete watershed basis simply because the immediate Bonney Lake community has control only over a very small percentage of the entire watershed. The majority of the control over the management practices directly related to most of the lakes recharge water are typically under the control of local government which relies on ordinances and regulations already established to implement and enforce any formal plan. The immediate lake community has shown extreme care and diligence in reducing nutrients (phosphorus and nitrogen) to the water body by using prudent household and yard care practices, as well as employing agricultural, forestry, construction and road maintenance practices that minimize pollutant loadings within property under their ownership.

The ability to implement a complete watershed management plan is not the responsibility of the Bonney Lake Community. This responsibility relies on local government working with concerned property owners to ensure the residents of Bonney Lake that waters entering the lake are clean and free of nutrients. Simply stating that because Bonney Lake is the final collection point of waters within the watershed does not place any additional burden on this particular group to ensure that the water leaving the lake is in any healthier state than when it entered the system. If this were true waters entering the lake would already be below threshold values necessary to sustain weed and algae growth. What can and should be excepted is that the local Bonney Lake residents manage the resource in an appropriate beneficial fashion.

Control Effectiveness and Duration: It has not been demonstrated locally that immediate excessive rooted macrophyte growth is due to siltation, increased external nutrient inputs or to historically-enriched sediments. What has been clearly demonstrated on a large scale basis is that weed and algae growth is directly related to nutrient input and nutrient concentrations. Typically an increase in overall nutrient levels will directly influence both weed and algae populations.

Advantages: Watershed best management practices are easy to perform if those areas wishing to implement management practices are under the direct legal obligation to control those mandating and or requesting control.

Drawbacks: Employing BMPs to correct nuisance aquatic plant growth will not correct the problem in the short term or result in substantial reduction in weed and or algae growth. Changes are often slow and or never experienced relating to nutrient and or weed growth simply because prior actions have already created an environment that can adequately support aquatic plant growth for years and years.

Costs: Initiation of local homeowner BMPs involves little if any expense. Implementation requires only modification of past behaviors associated with poor decisions as to the proper management of daily resources. Other improvements are often made through, conserving water and energy, and composting where possible.

Permits: Permits are not required.

Application to Bonney Lake: BMPs only insure improved and proper stewardship of the watershed. However, it is unlikely that BMP implementation will not significantly alter the macrophyte density.

7. Water Column Dyes

The theory behind this technique is to suppress aquatic plant growth by shading the plants from sunlight needed for photosynthetic growth. Dark-colored dyes are applied to the water, which reduces the amount of light reaching the submersed plants.

Control Effectiveness and Duration: Dyes are commercial products available for applications in closed systems (water bodies with no outflow). According to the manufacturers, dyes are apparently effective against Eurasian watermilfoil, Hydrilla, Elodea, and various pond weeds, as well as macroalgae Chara spp. and filamentous green algae like Spirogyra spp. There are a number of pond dyes on the market that mimic the shading effects. These products are probably more effective in shallower water bodies where dye concentrations can be kept up and the loss of dye through dilution would be less. Best results are obtained when the product is used early in the growth season.

Advantages: Most dyes are reported to be non-toxic to humans, livestock, and aquatic organisms. No special equipment is needed for application: it can be poured into the water by hand from shoreline or boat. It imparts a blue color to the water.

Drawbacks: Its use is limited to shallow water bodies with no outflow. According to the manufactures dyes ares less effective when aquatic plant growth is within 2 feet of the surface. In this case other methods of removal are recommended prior to dye use. This can increase program costs considerably. Repeat dye treatments may be necessary throughout the growth season. Some dyes should not be used in drinking water supplies, in flowing waters, or in chlorinated waters. Water column dyes are also known to impact the food chain of the lake, and may subsequently affect the fishery. Most lake colorants are not permitted in Washington State because they are comprised of formulations that do not comply with food grade standards.

Costs: Costs for most dyes are approximately $50/Gallon, which can be used to treat one acre of water at average depth of 4 feet at the recommended dosage of 1 ppm (part per million).

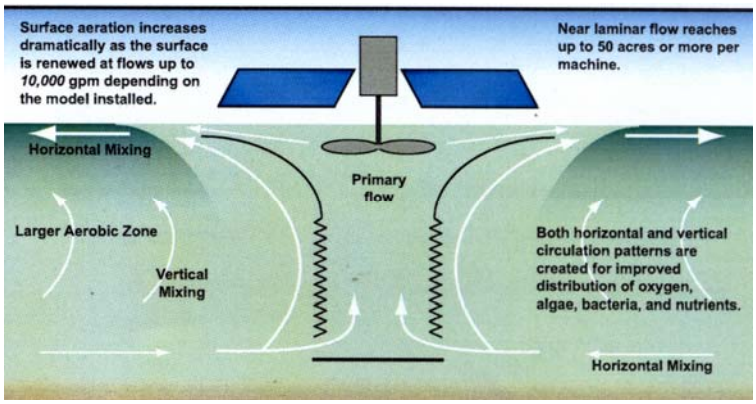
Permits : The use of water column dyes requires application through the NPDES permit process from the Dept. of Ecology prior to treatment. Only the use of food grade dyes is permitted in Washington State. No none grade food dyes have been utilized in Washington State since the adoption of the current NPDES program (2002).

Application to Bonney Lake: This treatment does not appear to have a practical application for Bonney Lake.

8. SolarBee Technology

This technology utilizes proven industry standards to shift the food chain from an environment dominated by blue green algae to one consisting of zooplankton and beneficial green algae. SolarBee is a floating lake circulator with the ability to circulate 10,000 gallons of water per

minute and spread it gently across the top of the lake. The circulatory pattern established by the equipment favors green algae and zooplankton growth.



(taken from SolarBee literature)

Control Effectiveness and Duration: Circulatory movement within a lake system has the ability to improve dissolved oxygen levels and shift the food chain toward more beneficial non problematic organisms. Control of unwanted species usually occurs within a few weeks while weed control timelines have not yet been established. Experimentation directed at weed control activities are currently in progress.

Advantages: SolarBee requires little if any maintenance and the units are solar powered. Once installed and operating properly financial requirements to maintain the units are minimal.

Drawbacks: Equipment has experienced limited peer review however the relatively short time the equipment has been introduced into the market would make such review difficult. Technology requires the ability to manipulate the food chain toward more beneficial aquatic organisms.

Costs: Only one unit would be required **c**osting approximately $45,000.00. Installation, insurance and sales tax are not included. Annual maintenance costs should be less then $500 per year.

Permits : The use of SolarBee would require permitting through various governmental agencies. These permits are easily to obtained and require about 45 days to process.

Application to Bonney Lake: SolarBee Technology should be investigated for use if bluegreen algae problems have occurred historically. Once peer reviewed the equipment should also be considered for weed control activities.

SolarBee Unit

(taken from SolarBee literature)

6. Sonic Solution

This approach requires sonic waves similar to sonar to be transmitted through the water at a specific wave length frequency. As algae cells are exposed to the constant vibration of the sonic waves the cell wall eventually breaks down and the organism dies. For best results equipment should be installed prior to any major bloom preferably at the start of the warm summer season.

Control Effectiveness and Duration: Research indicates that if the equipment is installed prior to bloom conditions control is often obtained within six to eight weeks. The duration of control is variable. Factors such as the timing of the installation and algal concentrations present at the time of installation are suspected to influence duration of control and when control will be obtained.

Advantages: There is no interference with use of water body during these operations.. The cost of operation after purchase is minimal in the range of $3.00 per month.

Drawbacks: If initiated under bloom conditions control may take up to ten weeks to occur. Since this process involves exposing the targeted algal cells to an ultrasonic wave constant bombardment of the cell wall is required.

Costs: Costs are minimal after initial purchase. The cost of operation is in the range of $3.00 per month.

Permits: Use of this equipment requires hydraulic approval from the Department of Fisheries and Wildlife.

Application to Bonney Lake: The use of sonic devises shows promise for controlling algae problems at Bonney Lake Five or six units would be required for complete lake control. The devices will not address submerged weed problems.

C. Mechanical Control Methods.

Mechanical methods for aquatic plant control include:

- Mechanical cutting and harvesting
- Rotovation/cultivation (underwater bottom tillage)
- Weed rolling
- Diver-operated suction dredging

1. Mechanical Cutting and Harvesting

Mechanical cutting and harvesting are considered an interim technique to temporarily remove plants interfering with recreational or aesthetic enjoyment of a water body. Mechanical cutting involves cutting plants below the water surface, with collection of the cut fragments being a separate operation. Mechanical harvesting also cuts the plants below the water surface, but in addition, the harvester collects the plant fragments for offshore disposal. To achieve maximum removal of plant material, these operations are usually performed during summer when submersed and floating-leafed plants have grown to the water's surface. Maximum cutting depths for mechanical cutters and harvesters range from 5 to 8 ft. with swath widths of 6.5 to 12 ft.

Control Effectiveness and Duration: Since cutting and harvesting involve the 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 the operation, water depth, and depth of cut are suspected to influence duration of control.

Advantages: Both cutting and harvesting are most appropriately used for large, open areas with few surface obstructions. There is usually little interference with use of water body during these operations. Cutting, and the accompanying removal of cut weeds, along with harvesting also has the added benefit that removal of in-lake plant biomass 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, cutting and 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. The cost of these operations can be relatively low compared to other physical/mechanical techniques.

Drawbacks: Cut plant material requires collection and removal from the water. While harvesters automatically collect plant fragments, the use of mechanical cutters requires the additional task of collecting these fragments. Both operations can be detrimental to non-target plants and animals (e.g., fish, invertebrates), which may be removed indiscriminately by these processes. Cutting and harvesting can lead to the enhanced growth of opportunistic plant species that may invade harvested areas. Capital costs for machine purchase are high and the equipment requires regular maintenance.

Costs: Cutting and 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 $1,200/acre/cut using paid operators, but is considerably less when volunteer labor is available. Transporting of cut debris off site is an additional expense. Small scale lake harvesting operations where the equipment is not operated on the lake for a long period of time usually also includes mobilization and demobilization fees. Such fees generally range between $500.00 and $1,200.00.

Permits: Mechanical cutting (including battery-operated equipment) requires hydraulic approval from the Department of Fisheries and Wildlife.

Application to Bonney Lake: The use of a mechanical cutter or harvester could be used to remove vegetation in open areas, however, it would not be effective around piers and docks. The public boat launch would need to be designated as the staging area for the harvesting operation. If commercial contractors are utilized the small nature of the project would probably result in the weeds being cut during those times of the year when the equipment is not being operated on larger projects. This usually relates to late season harvesting.

Some residents have raised the possibility of purchasing a harvester and operating the equipment from within the organization. A small harvester typically costs in the neighborhood of $50,000.00 to $75,000.00. Maintenance of the equipment varies depending on the age of the harvester, harvesting skills of the operator and vandalism associated with leaving the equipment onsite unattended. Such costs would range between $5,000.00 - $15,000.00 per year.

2. Rotovation/Cultivation (Bottom Derooting)

Mechanical rotovation/cultivation are bottom tillage methods that remove aquatic plant root systems. This results in reduced stem development and seriously impairs growth of rooted aquatic plants. Derooting methods were developed by aquatic plant experts with the British Columbia Ministry of Environment as a more effective milfoil control alternative to harvesting. Essentially two types of tillage machinery have been developed. Deep water tillage is performed

in water depths of 1.5 to 11.5 ft. using a barge-mounted rototiller equipped with a 6-10 ft. wide rotating head. Cultivation in shallow water depths up to a few meters is accomplished by means of an amphibious tractor or modified WWII DUCW vehicle towing a cultivator. Both methods involve tilling the sediment to a depth of 4-6 in., which dislodges plants including roots. Certain plants like milfoil have roots that are buoyant and float on the surface where they can be collected. Treatments are made in an overlapping swath pattern. Bottom tillage is usually performed in the cold off-season months of winter and spring to reduce plant re-growth potential. Bottom tillage has not been used in Washington State for native weed control and is not considered within the industry as a viable means to control native weeds. Bottom tilling is utilized for milfoil control.

Control Effectiveness and Duration: Bottom tillage has been used effectively for long term control of milfoil where populations are well established and prevention of stem fragments is not critical. Single treatments using a crisscross pattern have resulted in milfoil stem density reductions of 80-97 percent in bottom tillage treatments. Seasonal rototilling in an area is at least as effective as 3 to 4 harvests, and where repeated treatments have occurred at the same site over several years, carryover effectiveness may extend to greater than a year.

Advantages: A high percentage of entire plants (roots and shoots) can be removed by bottom tillage methods. Depending on plant density, carryover effectiveness of rototilling can persist up to 2 to 3 years without re-treatment. Following treatment, rotovated areas in Washington and British Columbia have shown increases in species diversity of native plants, of potential benefit to fisheries. Fish are not removed through rototilling as they are by harvesting operations. Unlike harvesting which is conducted during summertime when plant growth is maximal, rototilling for root removal can be performed during off season months of winter and spring. This results in no interference with peak summer-time recreational activities.

Drawbacks: Bottom tillage is limited to areas with few bottom obstructions and should not be used where water intakes are located. Rototilling does create short term turbidity in the area of operation, but increases are usually temporary with a rapid return to baseline conditions often within 12 hours. Since bottom sediments are disturbed, short term impacts on water quality and the benthic invertebrate community can occur. Rototilling is not advised where bottom sediments have excessive nutrient and/or metals concentrations, because of potential release of contaminants into the overlaying water. Rotovation is not species selective, except by location, and can result in unintentional removal of non-target plants. The method does result in production of plant fragments, and is not recommended for use in water bodies with new or sparse milfoil infestations or where release of fragments is a concern. There are often timing restrictions to avoid interference with fish spawning or juvenile use.

Costs: Bottom tillage costs vary according to treatment scale, density of plants, machinery used and other constraints. Contract costs for rot ovation in the state of Washington range from $1200- $1700/acre depending on treatment size.

Permits: Tillage methods require hydraulic approval from Washington Department of Fish and Wildlife. In addition, a shoreline permit from Pierce County and approval from DNR may be required. A Section 404 permit may be required by the Army Corps of Engineers.

Application to Bonney Lake: Tillage appears not to be a viable alternative natural debris within the lake would make general application difficult and even more expensive. Access to the lake would require the use of one of the public boat launch and typically this technique is not utilized for native plant control. There currently are no active rototilling operations occurring within the Pacific Northwest area.

3. Weed Rolling

Weed rolling is a useful technique for controlling aquatic weeds in a small defined area. Weed rollers consist of a mechanically driven roller that sets on the lakebed and is moved across it at up to a 270 degree arc. The low-voltage power unit is attached to a dock or other in-water structure. The roller is swept or rolled repetitively over the plants and sediment to keep the area free of aquatic plants. Plants are detached from the lakebed or flattened by the roller and attached fin-like projections. After an initial treatment to remove weeds, weed rollers can be used as little as once a week to keep plants from re-establishing.

Control Effectiveness and Duration: Weed rolling has proved effective for controlling aquatic weeds when manufacturers' suggestions are followed concerning site preparation, such as the removal of weeds and debris before use. Weed rollers do not work very well in areas where weed growth has already become established. The roller must be used on a regular basis during and prior to the weed growing season to keep weeds under control.

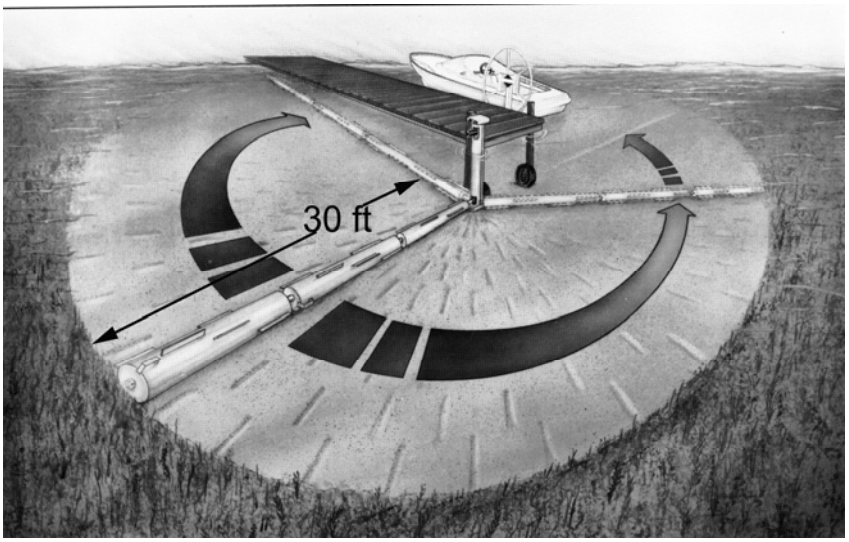
Advantages: Weed rollers agitate the sediment, and therefore effectively suppress weed growth in areas where it is used regularly. By so doing, they are able to maintain weed-free areas around docks and other applicable areas. Some weed rollers are easily relocated, allowing a single setup to be used in multiple areas. The cost of operation is low.

Drawbacks: The act of agitating the sediment will disturb some bottom dwelling animals and may destroy fish spawning areas. The sediments released into the water column can be dispersed to other areas. Weed rollers are not species specific, and resulting plant fragmentation may increase the spread of some species. When areas under treatment are to be used for swimming or wading, the weed roller should be unplugged and the entire unit removed from the water for safety reasons. Possible site vandalism may require addition installation considerations.

Costs: The cost of weed rollers varies among manufacturers, but is generally in the $3,500 range. Costs associated with installation vary from site to site. Operating costs are minimal.

Permits: The installation and operation of weed rollers requires hydraulic approval from the Washington Department of Fish and Wildlife.

Application to Bonney Lake: Weed rollers could be effective for use by individual waterfront property owners for the control of weeds around their docks and in small swimming areas. These devices are not designed for use in large, mid-lake areas. Weed rollers have only a 30 foot radius. Possible vandalism and liability concerns restrict use to private installations only.



4. Diver Operated Suction Dredging
Diver dredging was being used in the late 1970s in British Columbia as an improvement to hand removal of sparse colonies of Eurasian watermilfoil. 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 and 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 offsite for upland disposal. This technique is used specifically for noxious weed control and has not been utilized in Washington State as a native plant control alternative.

Control Effectiveness and Duration: Diver dredging can be highly effective under appropriate conditions. Efficiency of removal is dependent on sediment conditions, density of aquatic plants and underwater visibility. As it is best used for local infestations of low plant density where fragmentation must be minimized, the technique has great potential for milfoil control. Depending on local conditions, milfoil removal efficiencies of 85-95% can be achieved by diver dredging.

Advantages: This method is species selective and site specific. Disruption of sediments is minimized. Plant pieces are collected and retained, and fragmentation spread is minimized (very important for control of milfoil). It can be used to cover areas larger than practical 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 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 laws on certification, safety, and hourly wage payment, which can affect total project cost. Costs run from a minimum of $1,100/day to upwards of $2,000/day with no dredged material being transported off site.

Permits: In the State of Washington, use of suction dredging requires hydraulic approval from Washington Department of Fish and Wildlife. It may also require additional approval from the Department of Ecology related to increased turbidity created within the water column. In addition, a Section 404 permit from the Army Corps of Engineers is required. A Pierce County shoreline management permit and approval from Washington Department of Natural Resources may also be required.

Application to Bonney Lake: Suction dredging would be expensive and likely outside the available funding parameters for this particular project. Historical use of this technique in Washington State is limited to only a few projects in over 15 years. This technique is not typically utilized for native weed control.

D. Biological Control Methods

Interest in using bio-control 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 bio-control agents for aquatic plant management is still in its infancy, potentially useful candidates have been identified such as plant eating fish or insects, pathogenic organisms, and competitive plants. Except for on exotic species infestation, a realistic objective of bio-control of aquatic vegetation is not eradication, but the reduction of target plant species to lower more acceptable levels. More importantly, control of nuisance plants using biological agents will be a gradual process, although the effects should be long lasting.

1. Grass Carp

In the State of Washington, the only biological method currently available for aquatic plant control is the introduction of grass carp (Cteno pharynogodon). The grass carp, also known as the white amur, is a vegetarian fish native to the Amur River in Asia. Because this fish feeds on aquatic plants, it can be used as a biological tool to control nuisance aquatic plant growth. In some situations, sterile (triploid) grass carp may be permitted for introduction into Washington waters.

Permits are most readily obtained if the lake or pond is privately owned, has no inlet or outlet, and is fairly small. The objective of using grass carp to control aquatic plant growth is to end up with a lake that has about 20 to 40 percent plant cover, not a lake devoid of plants. In practice, grass carp often fail to control plants, or in cases of overstocking, all the submerged plants are eliminated from the waterbody.

The Washington Department of Fish and Wildlife determines the appropriate stocking rate for each waterbody when they issue the grass carp-stocking permit. Stocking rates for Washington lakes generally range from 9 to 25 eight- to eleven-inch fish per vegetated acre. The number

will depend on the amount and type of plants in the lake as well as spring and summer water temperatures. To prevent stocked grass carp from migrating out of the lake and into streams and rivers, all inlets and outlets to the pond or lake must be securely screened. For this reason, residents on water bodies that support a salmon or steelhead run are rarely allowed to stock grass carp into these systems.

Once grass carp are stocked in a lake, it may take from two to five years for them to control nuisance plants. Survival rates for the fish will vary depending on factors like presence of otters, birds of prey, or fish disease. A lake will probably need restocking about every ten years.

Success with grass carp in Washington has been varied. Sometimes the same stocking rate results in no control, control, or even complete elimination of all underwater plants. Bonar et Al. found that only 18 percent of 98 Washington lakes stocked with grass carp at a median level of 24 fish per vegetated acre had aquatic plants controlled to an intermediate level. In 39 percent of the lakes, all submersed plant species were eradicated. It has become the consensus among researchers and aquatic plant managers around the country that grass carp are an all or nothing control option. They should be stocked only in waterbodies where complete elimination of all submersed plant species can be tolerated.

Grass carp exhibit definite food preferences and some aquatic plant species will be consumed more readily than others. Pauley and Bonar performed experiments to evaluate the importance of 20 Pacific Northwest aquatic plant species as food items for grass carp. Grass carp did not remove plants in a preferred species-by species sequence in multi-species plant communities. Instead, they grazed simultaneously on palatable plants of similar preference before gradually switching to less preferred groups of plants.

Generally, in Washington grass carp do not consume emergent wetland vegetation or water lilies even when the waterbody is heavily stocked or over stocked. A heavy stocking rate of triploid grass card in Chambers Lake, Pierce County resulted in the loss of most submersed species, whereas the fragrant water lilies, bog bean, and spatterdock remained at pre-stocking levels. A stocking of 83,000 triploid grass carp into Silver Lake, Washington resulted in the total eradication of all submersed species, including Eurasian watermilfoil, Brazilian elodea, and swollen bladderwort. However, the extensive wetlands surrounding Silver Lake have generally remained intact. In southern states, grass carp have been shown to consume some emergent vegetation (Washington State Department of Ecology, 2002).

Grass carp stocked into Washington lakes must be certified disease free and sterile. Sterile fish, called triploids because they have an extra chromosome, are created when the fish eggs are subjected to a temperature or pressure shock.

Fish are verified sterile by collecting and testing a blood sample. Triploid fish have slightly larger blood cells and can be differentiated from diploid (fertile) fish by this characteristic. Grass carp imported into Washington must be tested to ensure that they are sterile. Because Washington does not allow fertile fish within the state, all grass carp are imported into Washington from out of state locations. Most grass carp farms are located in the southern United States where warmer weather allows for fast fish growth rates. Large shipments are transported in special trucks and small ships arrive via air.

Advantages: The introduction of grass carp is relatively inexpensive considering the control duration that can be expected from this method. It requires little labor, and offers a different approach to aquatic weed control.

Drawbacks: All inlets and outlets to the waterbody must be screened to guarantee that no grass carp are allowed to escape the treatment area. Overstocking can result in elimination of all submersed aquatic plants, and at least part of the habitat for the resident animal populations and migrating waterfowl. Under stocking can allow less-favored plants to spread throughout the waterbody, which can also affect the habitat. Control of weeds is not immediate, and may take a number of years to accomplish. Fecal material released form the consumption of aquatic plants may lead to algae problems and increased nutrient levels.

Costs: For quantities in excess of 10,000 fish, the cost is in the neighborhood of $6.00 - $8.00 per fish. Smaller quantities that are shipped by air cost up to $25.00 per fish.

Permits: Washington Department offish and Wildlife requires a game fish planting permit prior to grass carp introduction to a water body. In addition, if outlet screening is necessary, a hydraulic approval is required from the Washington Department of fish and Wildlife. Department of Natural Resources National Heritage Program must be contacted for assessment of threatened or endangered species.

Application to Bonney Lake: Increased nutrient levels associated with the planting of grass carp will only encourage and sustain longer and possible toxic algal blooms that may already hinders lake usage. If sustained blooms occur additional chemicals if permitted would need to be applied in order to maintain the lake at an acceptable level. The employment of grass carp will only maintain the current weed populations at current densities while possibly eliminating beneficial species. The elimination of low growing bottom species may encourage other less desirable plants to inhabit the lake. The cutlet will need to be screened off.

E. Chemical Control Methods.

Aquatic herbicides are chemicals specifically formulated for use in water to eradicate or control aquatic plants. Herbicides approved for aquatic use by the United States Environmental Protection Agency (EPA) have been reviewed and considered compatible with the aquatic environment when used according to label directions. However, individual states may also impose additional constraints on their use.

Aquatic herbicides are sprayed directly onto floating of emergent aquatic plants, or are applied to the water in either liquid or pellet form. Systemic herbicides are capable of killing the entire plant by translocating from foliage or stems and killing the root. Contact herbicides cause the parts of the plant in contact with the herbicide to die back, leaving the roots alive and capable of re-growth (chemical mowing). Non-selective herbicides will generally affect all plants that they come in contact with, both monocots and dicots. Selective herbicides will affect only some plants (usually dicots – broad leafed plants like Eurasian watermilfoil will be affected by selective herbicides whereas monocots like Brazilian elodea and our native pondweeds may not be affected).

Because of environmental risks from improper application, aquatic herbicide use in Washington State waters is regulated and has certain restrictions. The Washington State Department of

Agriculture must license aquatic applicators. In addition, because of a March 2001 court decision (Federal 9th Circuit District Court), coverage under a discharge permit called a National Pollutant Discharge Elimination System (NPDES) permit must be obtained before aquatic herbicides can be applied to some waters of the U.S. This ruling, referred to as the Talent Irrigation District decision, has further defined Section 402 of the Clean Water Act. The Department of Ecology has developed a general NPDES permit which is available for coverage under the Washington Department of Agriculture for the management of noxious weeds growing in an aquatic situation and a separated general permit for nuisance aquatic weeds (native plants) and algae control. For nuisance weeds (native species also referred to as beneficial vegetation) and algae applicators and the local sponsor of the project must obtain an NPDES permit from the Washington Department of Ecology before applying herbicides to Washington water bodies.

Although there are a number of EPA registered herbicides, the Department of Ecology currently issues permits for eight aquatic herbicides (as of 2005 treatment season). Several other herbicides are undergoing review and it is likely that other chemicals may be approved for use in Washington in the future.

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 economic, political, and social implications.

The State of Washington currently permits use of only six aquatic herbicides to control native aquatic weeds. The systemic herbicides include fluridone, glyphosate, triclopyr, and 2,4-D. The contact herbicides permitted for use are Aquathol K and Diquat. Permitted algaecides include Hydrothol and sodium carbonate peroxyhydrate. 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 re-growth. These seven herbicides and two algaecides are reviewed in more detail below.

What materials are allowed through the current NPDES permitting system can change on a yearly basis as new regulations and or court decisions are rendered. These changes are reviewed and evaluated prior to every treatment season.

1. Fluridone

Fluridone, 1-methyl-3phenyl-S-[3-trifluromethyl)phenyl]-4(IH)-pryidinone, 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 SP, SONAR SRP) spread on the water surface. It is also available as AVAST® from Griffin L.L.C. Fluridone is effectively absorbed and translocated by both plant roots and shoots.

Control Effectiveness and Duration: Fluridone demonstrates good control of submersed aquatic plants, but is not effective on emergent plants. In the past it was best used in

applications where there was little water movement, though the newer AVAST® product has proven effective in flowing water situations. Its use is most applicable for lake-wide or isolated bay treatments to control a variety of exotic and native species. Eurasian watermilfoil is particularly susceptible to the effects of fluridone. Typical fluridone injury symptoms include retarded growth, whitened leaves and plant death. Effects of fluridone treatment become noticeably 7-10 days after application, with control of target plants often requiring 60-90 days to become evident. 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 extensive human health risk studies, it has been determined that use of fluridone according to label instruction does not pose any effect to human health. Fluridone also has a very low order of toxicity to zooplankton, benthic invertebrates, fish, and wildlife. Fluridone targets elodea

Drawbacks: Fluridone is a very slow-acting non-selective herbicide, and its effects can sometimes take up to several months. Because of the long uptake time needed for adsorption and herbicidal activity, fluridone generally is not effective inflowing water situations. Because of the potential for drift out of the treatment zone, fluridone is not suitable for treating a defined area within a large lake. The potential exists for the release of nutrients to the water column and consumption of 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 vegetation may be necessary. As fluridone-treated water may result in injury to irrigated vegetation, there are label recommendations regarding irrigation delays following treatment. To protect drinking water sources, it is recommended that no applications be made within 0.25 miles of a water intake.

Costs: Treatment costs (materials and application) by private contractor for any of the formulations range from about $700 to $2000/acre, depending on scale of treatment.

Permits: A NPDES permit is required, and the development of an Integrated Aquatic Vegetation Management Plan (IAVMP) is necessary for continued use. Monitoring of herbicide levels in the treated waterbody may be required.

Application to Bonney Lake: Fluridone has already been utilized at Bonney Lake. Ideally if again incorporated into the program, treatment would be applied in the early summer months as soon as the outlet stops flowing, approximately May- June. The treatment would then have two to three months to fully act on the vegetation. Use of fluridone would impact both targeted and no-targeted species. Fluridone use is not recommended because of the monoculture plant community established lakewide following the past application. Use of fluridone may require replanting native plants in order to establish a diverse macrophytes composition. The small nature of the waterbody and the ability of fluridone to mix throughout the entire lake impacting plants lakewide does not support product use.

2. Glyphosate

Glyphosate [N-(phosphonomethyl)glycine] is a non-selective, broad spectrum herbicide used primarily for control of emergent or floating leaf plants like water lilies and watershield, and is

generally not effective on underwater plants. Glyphosate has been utilized at Bonney Lake twice resulting is short term control and questionable results. Glyphosate was formulated as RODEO® (Dow Agroscience) for aquatic application, though since the patent on Rodeo® has expired, other products with the same glyphosate formulation, such as Aquamaster®, are available. Glyphosate is a systemic herbicide that is applied to the foliage of actively growing plants along with appropriate surfactants to improve product penetration and adherence. The herbicide is rapidly absorbed by foliage and translocated throughout plant tissues, affecting the entire plant, including roots. Though a non-selective herbicide, the application of glyphosate sprays by an experienced applicator can target specific species and avoid killing most non-targeted plants. Glyphosate has a relatively low acute toxicity and is placed in Toxicity Category III, with Toxicity Category IV being the lowest degree of acute toxicity. The EPA has classified it as a Group E oncogen – one that shows evidence of non-carcinogenicity.

Control Effectiveness and Duration: Glyphosate is effective against many emergent and floating leafed plants, such as water lilies (Nuphar spp.), purple loosestrife (Lythrum salicaria), and watershield (Brasenia schreberi). According to the manufacturer, RODEO® is not effective on submerged plants or those with most of the foliage below water. The herbicide binds tightly to soil particles on contact and thus is not available 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 in a few weeks time. Repeat applications are often required for plants that were missed during the initial spray application.

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 and permit instructions. Glyphosate could not be used in Bonney Lake if residents use the lake waters as an active potable water supply.

Costs: Treatment costs (materials and application) by private contractor for any of the formulations average approximately $350/acre, depending on scale of treatment.

Permits: An NPDES permit is required, and the development of an Integrated Aquatic Vegetation Management Plan (IAVMP) is necessary for continued use. Monitoring of herbicide levels in the treated waterbody may be required.

Application to Bonney Lake: Glyphosate treatment would work well to kill the floating lily pads and problematic emergent weeds along the perimeter of the lake. To be effective it should be applied along the entire affected shoreline. However, it can be applied at only those locations where property owners wish to remove vegetation and in areas approved by WDOE.

Endothall: Endothall is a contact-type herbicide that is not readily. translocated in plant tissue. Endothall formulations (active ingredient endothall acid, 7- oxabicyclo [2,2,I]heptane-2,3-dicaboxlic acid) are currently registered for aquatic uses in Washington in either inorganic or amine salts. Aqueous or granular forms of the dipotassium salt of endothall, Aquathol® (Cerexagri) and Hydrothol 191® (Cerexagri), are permitted in state waters with stringent use restrictions on water contact, irrigation and domestic purposes over and above label restrictions. Endothall is a fast-acting and non-selective herbicide that destroys contacted vegetation, but not plant roots. The use of Endothall prior to seed head production eliminates this source of the plants propagation mode. Reduction in the volume of viable seeds produced on a yearly basis will result in a decrease in plant density and range lakewide. Recent research has shown that endothall at low concentrations, can be used selectively against exotic aquatic plants while leaving some native species unaffected.

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.

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 little or no drift impact from proper application of this product. Overall costs of treatment are less than fluridone applications over the same area. At low concentrations, Hydrothol 191® can be used in fish-bearing waters.

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. The rapid die-back and decomposition of large quantities of plant material can cause oxygen depletion in the waterbody. Currently, Washington requires an 24 hour swimming advisory when Aquathol K is used and a 24 hour swimming restriction when Hydrothol 191 is utilized as a control agent during and following treatment. There are also label restrictions on fish consumption and non-food crop irrigation. Endothall does not target elodea

Costs: As with fluridone applications, endothall treatments vary with total area and dosage rates. Average costs run about $500-$1,000/acre.

Permits: An NPDES permit is required, and the development of an Integrated Aquatic Vegetation Management Plan (IAVMP) is necessary for continued use. Monitoring of herbicide levels in the treated waterbody may be required.

Application to Bonney Lake: This material has not been utilized I in the past at Bonney Lake. Najas the dominant plant within the system is controlled with proper Aquathol K use Aquathol K will provide seasonal and partial residual control.

2,4-D: 2,4-D is a relatively fast-acting, systemic, selective herbicide used for the control of broad-leaved species. Its mode of action is primarily as a stimulant of plant stem elongation. The low-volatile butoxyethyl-ester (BEE) formulation of 2,4-D is the active ingredient in

commercial products Navigate® and AquaKleen®. Both products are granular in form, and are effective for spot treatments. DMA*41VM® is a dimethylamine salt of 2,4-D, and comes in liquid form. The 2,4-D DMA (like 2,4-D Bee) is rapidly converted to 2,4-D acid and has proven highly effective in the control of Eurasian watermilfoil, while leaving native aquatic plants mostly unaffected. Basically, it has not been shown to be very effective on other broad-leaved aquatic plants.

Control Effectiveness and Duration: 2,4-D has been shown to be effective in controlling Eurasian watermilfoil in Lake Washington and Loon Lake. 2,4-D has proven to be a fast acting herbicide, needing only a 48 hour contact time with the targeted plant, and has been shown to provide a high kill rate, with a 98% kill on Loon Lake.

Advantages: 2,4-D is a fast acting and systemic herbicide, capable of killing the entire plant. As a selective herbicide, there is reduced risk of unintentional damage to non-targeted species. Eurasian watermilfoil can be treated at concentrations that cause little damage to other aquatic plants.

Drawbacks: 2,4-D has a tendency to accumulate in plants and sediments. It has not been effective on most broad-leaved aquatic plants. Downstream irrigators must be notified to ensure that treated water is not used on 2,4-D sensitive plants. 2,4-D does not target any of the submersed aquatic plants in Bonney Lake

Costs: Treatment costs for 2,4-D (materials and application) can run up to $700 per acre.

Permits: An NPDES permit is required, and the development of an Integrated Aquatic Vegetation Management Plan (IAVPM) is required for continued use. Monitoring of herbicide levels in the treated waterbody may be required.

Application to Bonney Lake: The use of 2,4-D at Bonney Lake is not recommended due to its lack of effectiveness on aquatic plants other than milfoils.

Diquat: Diquat, 6,7-dihydrodipyrido[1,2-a:2',1'-c, is a fast acting and non-selective contact herbicide, trade name Reward®. It is applied as a liquid, and causes injury only to the parts of the plant to which it is applied. As a desiccant, it destroys plant tissue by causing leaves to wilt and the entire plant to quickly dry out. Diquat is rapidly inactivated by clay minerals, and therefore does not reach the roots. Application of this herbicide is used primarily for short-term control of submersed aquatic plants. It is suitable for spot treatment, but is also used on entire waterbodies. Diquat was approved for use in Washington State in 2003.

Control Effectiveness and Duration: Diquat quickly destroys the leaves and stems of plants that it contacts. Effectiveness is similar to other contact herbicides such as Aquathol K noted above. Najas is identified on the label as a plant species controlled by diquat.

Advantages: Diquat controls plant growth immediately upon application, and is rainfast within 1 to 2 hours. The elimination of seasonal growth and decomposition at the end of the year reduces the amount of biomass that is recycled through the system. Diquat is not harmful to most fish at the application rates recommended by the herbicide manufacturer.

Drawbacks: Diquat is non-selective, affecting all plants it comes in contact with. It should not be applied in turbid or muddy water, as it is tightly absorbed onto suspended clay particles and becomes unavailable as a herbicide. Diquat does not kill the roots of plants. Since diquat acts so quickly, large areas of dense vegetation should not be treated at the same time to prevent serious oxygen depletion. Use requires notice and posting of a 24 hour re-entry water advisory, No use within 2 meters of the shoreline.

Costs: Typical treatment costs run between $250 and $600 per acre.

Permits: A NPDES permit is required, and the development of an Integrated Aquatic Vegetation Management Plant (IAVMP) is required for continued use. Monitoring of herbicide levels in the treated waterbody may be required.

Application to Bonney Lake: Treatment of submersed aquatic plants in the lake would bring a quick increase in open water areas. If chemical control is a selected alternative Diquat would be the preferred product of choice. This material has not yet been utilized at Bonney Lake however anticipated results should provide adequate seasonal and marginal long term control. Diquat would also control elodea if identified within the system which is not impacted by the use of Aquathol K.

GreenClean: Active ingredient sodium carbonate peroxyhydrate. GreenClean is a fast-acting non-selective contact algicide. Use in Washington State has been permitted for the 2004 season having most recently receiving labeling through local state government. GreenClean may be applied in a granular or liquid form. However the material is packaged in a granular formulation. Liquid application requires the formation of a slurry mixture. GreenClean is used for short-term (monthly and seasonal) control. Because it is fast acting, GreenClean can be used to treat smaller areas effectively. There is a two hour water entry restriction following application associated with the use of GreenClean in Washington.

Control Effectiveness and Duration: GreenClean quickly destroys the cells of planktonic and filamentous algae. Duration of control is regulated by water temperature, sunlight and reproduction rate of species targeted. It is unclear how often treatment would be required to maintain seasonal control.

Advantages: GreenClean controls algal growth immediately upon application.

Drawbacks: It is uncertain how long treatments would last.

Costs: Typical treatment costs run between $500.00 and $700.00 per acre.

Permits: A NPDES permit is required

Application to Bonney Lake: Treatment of algal blooms would bring a quick increase in open water areas. GreenClean is currently the only approved material for planktonic algae blooms in Washington State. Hydrothol is currently under review and may be available during the 2006 season.

General Herbicide Review

Advantages

- Aquatic herbicide application can be less expensive than other aquatic plant control methods.
- Most aquatic herbicides produce desirable results within 14 days
- Little or no off target drift impacts
- Spot treatment are possible
- No bioaccumulation
- Aquatic herbicides are easily applied around docks and underwater obstructions.

Disadvantages

- Some herbicides have swimming, drinking, fishing, irrigation, and water use restrictions.
- Herbicide use may have unwanted impacts to people who use the water and to the environment.
- Non-targeted plants as well as nuisance plants may be controlled or killed by some herbicides.
- Rapid-acting herbicides may cause low oxygen conditions to develop as plants decompose.
- The most opportunistic time to apply herbicides is early in the growing season when plants are actively growing.
- Expertise in using herbicides is necessary in order to be successful and to avoid unwanted impacts.
- The use of herbicides can prove to be controversial.
- Some cities or counties may have policies forbidding or discouraging the use of aquatic herbicides. Some timing restrictions as to when materials can be applied may also exist.

The following alternatives have been eliminated from further consideration as a result of financial concern and/or feasibility to perform the task:

Sediment Oxidation

Cost prohibitive

Stormwater Treatment

Cost prohibitive and not required if watershed best management practices (BMPs) are instituted and enforced by local government.

Dilution/Flushing

Dilution or flushing may be a feasible restoration measure for some lakes where large volumes of low-nutrient water are plentiful. Such a water supply has not been identified and would require considerably more scientific investigation. Costs associated with any further studies related to this approach have not been budgeted.

Lake Level Regulation

Lake level regulation is usually important with respect to flood control and not water quality. Higher lake levels are sometimes recommended to prevent high-phosphorus groundwater from entering a lake. This is only feasible where near-shore groundwater levels are close to normal lake elevation. The shallow nature of the waterbody precludes any more consideration of this technique. Lake level fluctuations of 12 inches or more would severely impact lake usage and near shore flooding.

Drawdown

Lake drawdown has been used on a limited basis for control of aquatic plant growth through desiccation during summer months or freezing during fall or winter months. Since benefits are typically short-lived and more expensive than alternative plant control techniques, this technique is not recommended for further analysis. Drawdown would require the pumping of lake waters since no gated outlet exists.

Dredging

Dredging has been used on a limited basis for removal of nutrient-rich lake bottom sediments or to deepen shoreline areas to depths were aquatic plant growth becomes light limited. However, dredging is typically much more expensive (at $10 to $20 per cubic yard of material removed) than alternative control measures for internal phosphorus control or aquatic plant control. At such a high cost, dredging is usually limited to maintaining navigational corridors in areas of high sediment deposition and is not commonly performed for eutrophication control. For these reasons, it is not recommended for further analysis.

Hypolimnetic Withdrawal

This technique is a variation of the dilution theme and requires a low-cost supply of high-oxygen, low-nutrient rich water to use in flushing. Since there is no suitable water supply available, this technique is not recommended for further analysis.

VIII. Plant Problems by Specific Locations and an Assessment of the Control Levels in each of the Areas Identified on the Use Map

Lake management alternatives associated with environmental conditions which triggers the initiation of a specific control alternative have been defined within Bonney Lake. Specific established "lake use control zone " criteria are as follows:

No Control – These areas consist of 25% of the lake proper and are located out in the main lake basin and non-residential use areas. Such areas are typically associated with the deeper lake waters however some shoreline areas have been designated. Typically these deep water areas do not support the same density of weeds and or algae growth species that sustain the ability to reach the waters surface creating boating and or swimming hazards. No control areas are designate as conservancy zones on the lake.

Low Level Control – These are lake conservancy areas located along the shoreline that support plant and algae species that may throughout the growing season produce

surface floating nuisance plant and or algae problems. Such areas are not targeted on a yearly basis but are considered only after plants develop that possess the ability to render lake areas unsafe for swimming and or boating activities

High Level Control – Typically consists of residential shoreline areas extending outward towards the 10 foot contour line. These areas have historically produced weed and algae growth patterns that hinder full recreational use of these specific lake shoreline areas by producing surface floating mats and or dense submersed growth.

Control levels have been established in order to manage the community needs associated with lake use. This approach allows for all recreational uses established by the lake community to be maintained and utilized within a healthy balanced ecosystem. Such an approach promotes the present and future system to be managed in a vibrant and healthy fashion which benefits local residential use in conjunction with resident lake flora and fauna.

The long term plan and past management practices is designed to maintain adequate open areas for fishing, and boating. Historically no control levels have been and will be used throughout the central area of the lake. Low levels of control will be associated with mid lake basin areas. High level of control will be used where human safety and property protection are required. These areas include residential swimming areas and all lake waters extending out to the ten foot contour line.

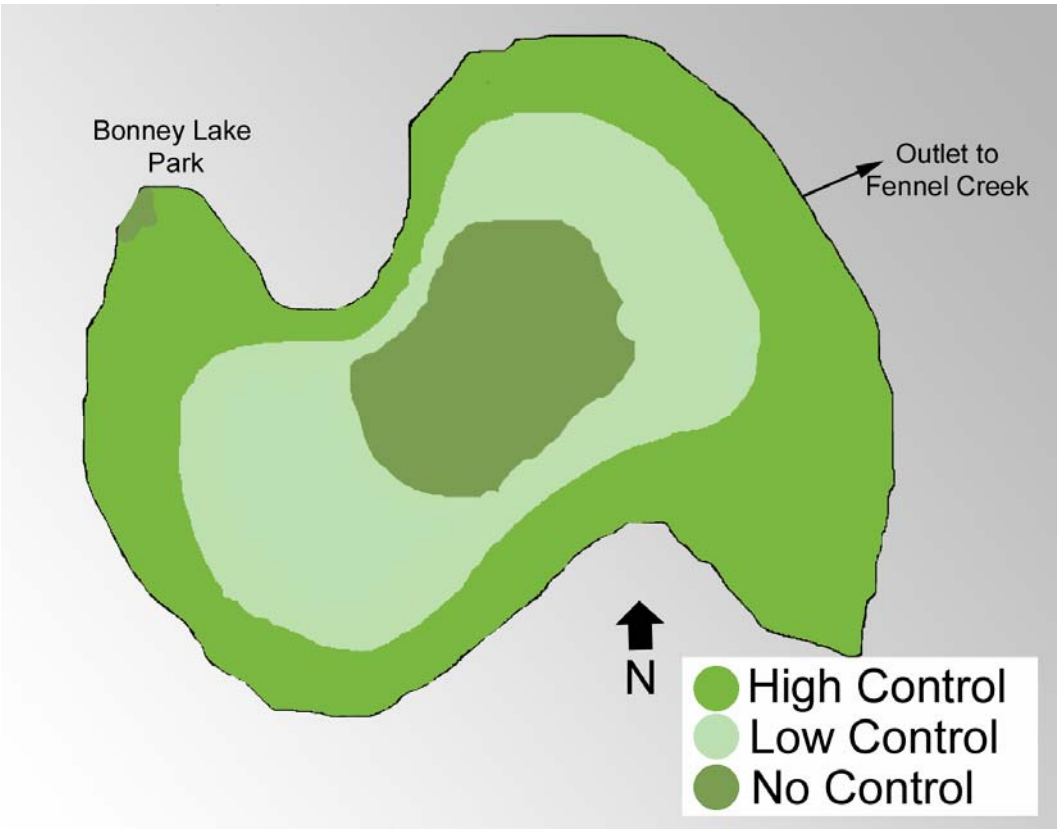
IX. Selected Options of Site Specific Levels of Control

A. Plants targeted for Control

Bonney Lake seasonally has one submersed aquatic plant type, two floating species and numerous emergent species that require control on a yearly and or bi-yearly basis. Najas spp. has been targeted as undesirable nuisance submersed species in conjunction with the floating lily pads, brasenia and emergent shoreline noxious plants. Committee members understand that although the complete eradication of the native plant communities within certain high use residential use areas is advantageous for full recreational use of those particular areas, such an approach would be expensive and could possibly result in the introduction of new less desirable species inhabiting the lakes littoral zones. The ability to maintain low growing species while targeting nuisance plants that often form surface mats forms the basis for all aquatic weed control activities lakewide. The plan stresses the seasonal control of troublesome plants while not targeting eradication of any one particular species.

While it is understood that any control alternative may produce minor short term environmental changes within the immediate areas targeted the foundation of the program is planned to inflict as little disturbance to the lakes natural ecosystem, water chemistry and the human population residing immediately within the surrounding lake area and watershed. It is extremely important to note that every attempt has been made to evaluate all control alternatives. Alternatives that have been shown to produce acceptable results while also proven to be fiscally responsible to the resources of the area are those methods that have been selected as the cornerstone for the IAVMP.

CONTROL ZONES



Past mapping of the aquatic plants in Bonney Lake will prove to be a valuable tool in future years. Basic relationships and or tends can now be established and evaluated as to any results obtained related to the control alternative selected. This hands-on technical approach will provide the association with the means to achieve the projects goals while maintaining a healthy productive ecosystem. Data produced will also provided a historical timeline of methods and results that other lake communities can evaluate and use in relationship to other water bodies experiencing similar problems and budgets.

1. Najas – Control type - High

Yearly control when needed of this plant within the ten foot lake contour line. Control will be obtained with the use of the following techniques:

Chemical Control – With the use of Diquat and/or Aquathol K.
Manual Weed Removal – On a volunteer basis organized by the local community within designated lake shoreline areas to be determined by the lake committee.
Manual Weed Cutting – On a volunteer basis organized by the local community within designated lake shoreline areas to be determined by the lake committee. Manual weed cutting tools to be supplied by the lake committee.

Bottom Screening – On a volunteer basis with the screening material to be installed and maintained at the expense of the property owner. Bottom barriers are to be supplied by the lake committee.
Weed Harvesting – Harvesting outside the immediate docks and shoreline areas.
Grass Carp – Planting of up to ten fish per acre to supplement other control alternatives.
SolarBee – If data and current research supports such use, installation of one unit.

2. White Water Lily – Control type - High
Chemical Control - Yearly control of this plant for two consecutive years is anticipated. After control is achieved strategy will consist of perimeter spraying of selected infestations to ensure this species from spreading lakewide. Control will be obtained with the use of Rodeo.
Manual Weed Removal – On a volunteer basis organized by the local community within designated lake shoreline areas to be determined by the lake committee.
Manual Weed Cutting – On a volunteer basis organized by the local community within designated lake shoreline areas to be determined by the lake committee. Manual weed cutting tools to be supplied by the lake committee.

3. Brasenia - Control Type – High
Chemical Control - Yearly control of this plant for two consecutive years is anticipated. After control is achieved strategy will consist of perimeter spraying of selected infestations to ensure this species from spreading lakewide. Control will be obtained with the use of Rodeo.
Manual Weed Removal – On a volunteer basis organized by the local community within designated lake shoreline areas to be determined by the lake committee.
Manual Weed Cutting – On a volunteer basis organized by the local community within designated lake shoreline areas to be determined by the lake committee. Manual weed cutting tools to be supplied by the lake committee.

4. Japanese Knotweed, Reed Canary Grass, Yellow Flag Iris, Purple Loosestrife – Control Type - High

Chemical Control - Yearly control of these non-native invasive noxious shoreline plants.
Manual Weed Removal – On a volunteer basis organized by the local community.
Manual Weed Cutting – On a volunteer basis organized by the local community.

4. Planktonic Algae – Control type – High
Yearly control when needed of this algae throughout the lake on a seasonal basis. Control will be obtained with the use of GreenClean and Hydrothol (only if approved for such use)
SolarBee – If data and current research supports such use, installation of one unit.
Sonic Solution – If data and research suggests such.

5. Potamogeton gramineus – Control type - Low
Yearly control when needed of this plant along the residential shoreline lake areas extending outward approximately 150 feet. Densities of this plant are low throughout the lake. Current control when necessary can be accomplished manually either by cutting and/or removal.

6. Potamogeton amplifolius - Control type - Low

Yearly control when needed of this plant along the residential shoreline lake areas extending outward approximately 150 feet. Densities of this plant are low throughout the lake. Current control when necessary can be accomplished manually either by cutting and/or removal.

7. Chara, Nitella Algae Control – Control type- Low
Control as needed of these algae types within the ten foot contour line on a seasonal basis when plants are within three feet of the waters surface.
Chemical Control - Control will be obtained with the use of GreenClean and Hydrothol 191.
Manual Weed Removal – On a volunteer basis organized by the local community.
Manual Weed Cutting – On a volunteer basis organized by the local community.

An NPDES permit from the Washington State Department of Ecology is required for the spraying of any herbicide within Bonney Lake This permit requires notification and posting of the lake before spraying. This requirement will be performed by the contractor and has historically been accomplished through direct mailing to all community households, the placement of notices at the residences, postings at the public boat launch and along residential shoreline areas. NPDES permit also requires monitoring of the herbicide level in the lake after treatment if application sites exceed ten acres. If treatment exceeds ten acres samples will be collected and analyzed.

The small nature of Bonney Lake allows for extensive monitoring of the treatment sites by lakeside residents during the summer months, daily inspection and evaluations are also possible. Active members of the lake committee members are residents of the lake. Assessing the success of any type of control alternative utilized has always been and will continue to be the foremost priority of the community. Volunteers evaluating the degree of control obtained during the summer months will be compared with results reported by the consultant. This dual monitoring approach will ensure data credibility while discouraging any conflicts that may arise between the consultant and the association.

The extent and detail of volunteer monitoring is dependent on those interested in participating in the effort. Although it is the goal of the Bonney Lake community to become aggressively involved in any monitoring program the specifics of the program have not been determined simply because the degree of involvement has not been identified.

Monitoring of the site will be consistent with those guidelines established within the NPDES permit issued for this project.

B. Costs and Funding

The following table outlines the basic costs for implementing the Bonney Lake IAVMP for five years. These projected costs are based on a yearly herbicide application. As the Bonney Lake community follows this plan from year to year, it is anticipated that actual costs vary from a year to year basis. Costs due not reflect any expenses incurred by the private property owner in controlling plants within their ownership. The budget is established through the Bonney Lake Community Club.

Table IX-1

Bonney Lake IAVMP Implementation Costs

	2006	2007	2008	2009	2010
Herbicide Application	$6,500.00	$6,500.00	$7,000.00	$5,000.00	$5,000.00
SolarBee	$45,000.00	$0	$0	$0	$0
Sonic Solution	$20,000.00				
Harvester (purchase)	$70,000.00	$0	$0	$0	$0
Harvester Maintenance	$2,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Harvester (contract two cuts)	$30,000.00	$30,000.00			
Education and Outreach	$100	$100	$100	$100	$100
Monitoring	$1,500.00	$1,500.00	$1,500.00	$1,500.00	$1,500.00
Printing	$50.00	$50.00	$50.00	$50.00	$50.00
Miscellaneous	$300.00	$300.00	$300.00	$300.00	$300.00

These costs reflect no volunteer community involvement

C. Sources of Funding

Bonney Lake is a public lake, owned and managed by the City of Bonney Lake and the Lake Bonney Conservation Association. There are state funds and/or grants available to this community however the small nature of the waterbody in comparison to other lakes competing for the same funding complicates the ability or this group to secure such funding. Project funding will be obtained through association dues and the City of Bonney Lake.

D, E, F, G Evaluation, Health Risks

The Bonney Lake Homeowners Association, desire to safeguard and preserve the lake and its surrounding environment by employing the best management practices available and maintain financial responsibility to the City and it's members. As new technologies are developed and become practical the managing partners we will explore those options and try to implement them into the current plan. Through numerous avenues of information while relying a great deal on the Department of Ecology the group intends to keep current on lake associated information. The current plan supports controlling up to 75 percent of the lake area, in the areas that become problematic with nuisance plants and algae growth. The plan stresses the seasonal control of troublesome plants while not targeting eradication of any one particular species. Noxious invasive species will be controlled at a 100 percent level.

The entire shoreline is owned by private property owners and the City of Bonney lake. The threshold for treatment will be determined by joint agreement between the City, Bonney Lake Community Club Board of Directors and any consultant they may retain.

Until improved control methods are developed and affordable the shoreline property owners propose to use approved registered herbicides as the primary method for the control of the weeds and algae in Bonney Lake. These include diquat, glyphosate, endothall, fluridone, GreenClean and Hydrothol 191. The preferred materials would be Diquat and glyphosate. Costs associated with annual l treatment is between $3,000 and $6,000 which will be funded, as it has been in the past, by the membership dues and the City of Bonney Lake.

In addition to contracted out control methods, private property owners on Bonney Lake will be encouraged to implement hand pulling, cutting and raking.

Treatment budgets are a major concern. No formal funding necessary to implement control alternatives has been secured. Options that could not be reasonably afforded were studied and evaluated but, at this time could not be seriously considered simply because of potential funding shortfalls. Alternatives were first reviewed for effectiveness on the targeted species, capacity to accomplish the task within a reasonable timeframe, costs associated with the alternative and the ability of the community to financially support the effort. The Lake Bonney Conservation Association and the City are willing to utilize any management method which will result in weed control lake wide within a strict budget. Many methods are well beyond the communities financial capability and until some state funding is made available to the group they are limited in their options.

Control alternatives are initiated when the Department of Ecology approves permits and Fisheries identifies treatment “windows”. Early intervention, when the plants begin their growth, would enhance the effectiveness of any effort. Weed control alternatives generally last for a season; they provide good control, allowing for safe recreational use, while preserving the aesthetic quality and the enjoyment of the lake by its residents and animals living within and around the lake.

Natural areas are preserved for the nesting of waterfowl, the protection of aquatic animals, fish and beneficial plants. These areas are in the mid portion of the lake and shoreline areas. Plants in these areas include filamentous algae, Najas, floating plants (lily pads) and emergent species.

In conjunction with any control alternative, lake residents will be encouraged to carry on the use of hand pulling along the shore by their homes. Many parts of the lake are not amenable to this type of control because of the soft bottom sediments. This method is far too labor-intensive, and the pulled weeds must be disposed of at least 50 feet from the lake to keep nutrients from reentering the water. Plants that are killed by chemical treatment are left in the lake and decompose as they would in the fall by natural process.

Our investigation into control methods has identified that that harvesting and/or chemical treatment alone is not an adequate long-term solution. It is necessary to control, as best the group can, not only the conditions in the lake, but the in-flowing waters as well. Therefore, the group will continue to work with Pierce County and the City of Bonney Lake on surface water

projects, including swales, ditch maintenance, silt barriers, and natural plantings. The managing group would like to increase monitoring in and around the lake.

The Lake Bonney Conservation Association will endeavor to keep residents informed of new and best practices through meeting minutes and workshops. They will monitor proposed developments in the watershed. If they have concerns about the effect on the lake they will make them known to the County and City Planning Commission so that it may take appropriate action.

The use of the above strategies, we believe, will enhance the safety and enjoyment of the lake, prevent its degradation, and protect the environment for humans, animals and plants for many years to come.

X. Public Involvement

A. Interested Parties

The private nature of Bonney Lake in conjunction with limited seasonal flow at the outlet clearly identifies the stakeholders associated with Bonney Lake. Those interested parties consist of the following groups: Lake residents, City of Bonney Lake, Pierce County, active local community lake groups, Washington State Department of Ecology and the Department of Fisheries. All of the past comments on file with the Department Ecology related to prior weed control operations undertaken at Bonney Lake have been reviewed. Washington State residents have had three prior instances to provide comments on a yearly basis associated with herbicide use policy within the lake. We believe all of those interested parties and comments have been incorporated into this particular plan.

Community Involvement

The Bonney Lake community has always been actively involved in implementing and directing the management practices of the lake. The formation of the committee over 10 years ago recognized the need for the community to take an active role in management of the lake along with keeping up to date on current lake technology issues. Meetings are scheduled throughout the year and community members are encouraged to attend and voice any comments or concerns directed at lake management issues. The committee continues to meet on a regular basis.

The Bonney Lake IAVMP will be available at the local regional library for review and comment by any interested groups or parties upon completion. The plan will be available during the period of time that the program is undergoing review by the state agencies.

The final version of the Bonney Lake IAVMP is also subject to a SEPA review.
Updated status information will be provided to the members of the Bonney Lake Homeowners Association, relevant government agencies, and community groups.

Established Timeline

June, 2005
Meeting discussing the IAVMP process with the City and local community.

July, 2005
Public meeting notices were sent out to property owners and interested parties, Ecology was present. IAVMP process was discussed and a timeline established.

October, 2005
First draft completed and distributed.
Review comments submitted by Margaret Hill (Ecology) with Board member, discuss changes and timeline for SEPA submittal.

November, 2005
Public meeting notices were sent out to property owners and interested parties. Draft IAVMP document was reviewed and comments were received.

December, 2005
Draft document updated and submitted for review.

XI. SEPA Review

WAC 197-11-960

ENVIRONMENTAL CHECKLIST

Purpose of Checklist:

The State Environmental Policy Act (SEPA), Chapter 43.21 RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for Applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring the preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the question from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply". Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. **The agency to which you submit this checklist may ask you to explain your answers or to provide additional information reasonably related to determining if there may be significant adverse impact.**

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (Part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable:
   Bonney Lake Integrated Aquatic Vegetation Management Plan

2. Name of applicant:
   City of Bonney Lake

Lake Bonney Conservation Association

3. Address and phone number of applicant and contact person:
   City of Bonney Lake
   John Woodcock
   P.O. Box 7380
   Bonney Lake, WA 98390-0944
   253-447-4336

4. Date checklist prepared:
   Oct 1, 2005

5. Agency requesting checklist:
   Department of Ecology

6. Proposed timing or schedule (including phasing, if applicable):
   SEPA review needs to be finalized by April 1, 2005 so that treatments if approved can be planned for the summer between June and July.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.
   The IAVMP may require addendums and or changes as plant species and or control philosophies change.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.
   Bonney Lake Integrated Aquatic Management Plan
   Department of Ecology EIS and Supplemental EIS directed at nuisance aquatic weed control in Washington State.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.
   No

10. List any government approvals or permits that will be needed for your proposal, if known.
    NPDES permit and Army Corps approval if SolarBee is utilized.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agency may modify this form to include additional specific information on project description.)

    Document details an aquatic plant management plan for Bonney Lake which is a 16 acre waterbody. Lake is used as a full time public recreational facility.

12. Location of proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographical map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any applications related to this checklist.

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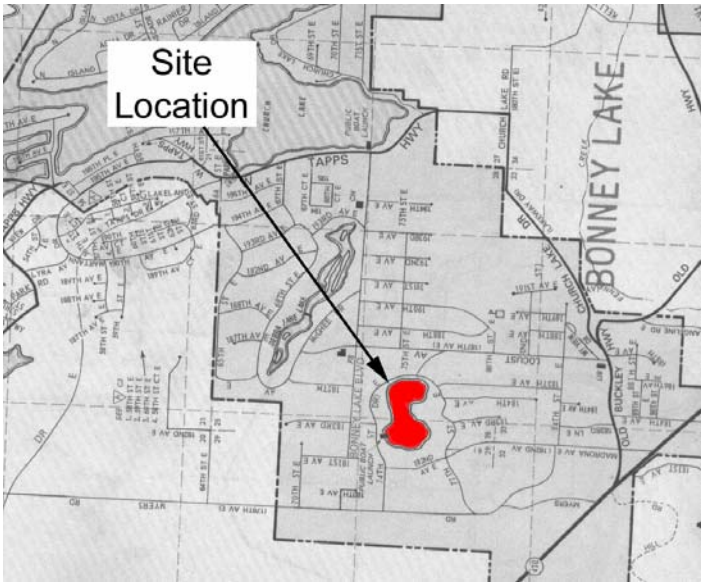

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes or mountains. Other:
Lake

b. What is the steepest slope on the site (approximate percent slope)?
N/A

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.
Lake sediments consist of organic muck,

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.
N/A

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.
None

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.
No

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?
O%

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:
None

2. Air

a. What types of emissions to the air would result from this proposal (i.e. dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.
Gasoline exhaust from outboard motor, vapors and possible dust from herbicides

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.
No

c. Proposed measures to reduce or control emissions or other impacts to air, if any:
None for exhaust, liquid material will be injected into the water.

3. Water

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.
Bonney Lake 16 acres, seasonal outlet that exits to Fennel Creek to the Puyallup River.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.
Work will consist of aquatic weed control activities taking place within the lake proper and shoreline areas..

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of the fill material.
None

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.
No

5) Does the proposal lie within a 100 year floodplain? If so, note location on the site plan.
Lake level has a seasonal high water mark.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.
No waste materials will be discharged into the lake.

b. Ground:

1) Will groundwater be withdrawn, or will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

No

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals . . .; agricultural; etc.). Describe the general size of the system, the number such systems, the number of houses to be served (if applicable), or the number animals or humans the system(s) are expected to serve.

None

c. Water Runoff (including storm water):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities if known). Where will this water flow? Will this water flow into other waters? If so, describe.

N/A

2) Could waste material enter ground or surface waters? If so, generally describe.

No waste materials are being utilized for this project.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

None

4. Plants

a. Check or circle types of vegetation found on the site:

deciduous tree: **alder, maple, dogwoods**
evergreen tree: **fir, cedar, pine**
shrubs: **typical landscaping varieties**
grass: **typical lawn grasses**
wet soil plants: **lily pads and emergents consisting of native and noxious plants**
water plants: **pondweeds, najas nitella, chara, planktonic, lily pads and filamentous algae**

b. What kind and amount of vegetation will be removed or altered?

If approved up to 75% of the lake may be under weed control activities.

c. List threatened or endangered species known to be on or near the site.

None

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

N/A

5. Animals

a. Birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: **hawk**, **heron, songbirds, mallard**, **osprey, Canada goose, great blue heron**
mammals: **deer, raccoon**
fish: **bass, trout, spiny ray**

b. List any threatened or endangered species known to be on or near the site.

None

c. Is the site part of a migration route? If so, explain.
No.

d. Proposed measures to preserve or enhance wildlife, if any:
State agencies have been contacted and are consultants to this project.

6. Energy and Natural Resources

a. What kinds of energy (electrical, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.
N/A

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.
No

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:
N/A

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.
Registered aquatic herbicides may be used. Gasoline may be present at the site.

1) Describe any emergency services that might be required.
Emergency spill response team.

2) Propose measures to reduce or control environmental health hazards, if any:
Label, State and Federal directions will be followed. A NPDES permit will need to be issued for this project.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?
none

2) What types and levels of noise would be created by or associated with the project on a short-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.
None

3) Proposed measures to reduce or control noise impacts, if any:
N/A

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties?
Recreational lake with residential shoreline homes with public access..

b. Has the site been used for agriculture? If so, describe.
No

c. Describe any structures on the site.
Residential homes

d. Will any structures be demolished? if so, what?
No

e. What is the current zoning classification of the site?
Residential

f. What is the current comprehensive plan designation of the site?
Residential development

g. If applicable, what is the current shoreline master program designation of the site?
N/A

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.
Wetlands are present and wetland type plants are present along the shoreline.

i. Approximately how many people would reside or work in the completed project?
No one lives in the lake but numerous homes are present along the shoreline.

j. Approximately how many people would the completed project displace?
None

k. Proposed measures to avoid or reduce displacement impacts, if any:
N/A

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:
State and local agencies have been contacted.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle or low-income housing.
N/A

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.
N/A

c. Proposed measures to reduce or control housing impacts, if any:
N/A

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

N/A

b. What views in the immediate vicinity would be altered or obstructed?

N/A

c. Proposed measures to reduce or control aesthetic impacts, if any:

None

11. Light and Glare

a. What kind of light or glare will the proposal produce? What time of day would it mainly occur?

N/A

b. Could light or glare from the finished project be a safety hazard or interfere with views?

N/A

c. What existing off-site sources of light or glare may affect your proposal?

N/A

d. Proposed measures to reduce or control light and glare impacts, if any:

N/A

12. Recreation

a. What designated and informal recreation opportunities are in the immediate vicinity?

Swimming, boating and fishing

b. Would the proposed project displace any existing recreational uses? If so, describe.

No, recreational opportunities would be increased.

c. Proposed measures to reduce or control impacts on recreation, including recreational opportunities to be provided by the project or applicant, if any:

N/A

13. Historic and Cultural Preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

None

b. Generally describe any landmarks or evidence of historic, archeological, scientific, or cultural importance known to be on or next to the site? If so, generally describe.

None

c. Proposed measures to reduce or control impacts, if any:

None

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans if any.

N/A

b. Is the site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

N/A

c. How many parking spaces would the completed project have? How many would the project eliminate?

N/A

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

No

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

N/A

g. Proposed measures to reduce or control transportation impacts, if any:

None

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

No

b. Proposed measures to reduce or control direct impacts on public services, if any.

None

16. Utilities

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other:

N/A

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

N/A

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: _____

Date Submitted: _____

XII. Action Strategy to Implement the Integrated Aquatic Vegetation Management Plan

The following condensed time line will govern yearly implementation of all required programs, monitoring and control methods required to control the aquatic vegetation within Bonney Lake. As this IAVMP is implemented, the plan if needed will be updated when necessary. Changes would reflect any new technology not available at the time the original plan was drafted.

Throughout the year: Use of the Lake Bonney Conservation Association newsletters to continue to educate community members concerning the necessity of reducing the nutrient level in the lake through proper land use management practices.
Late spring/early summer: Begin surveying and mapping the growth of aquatic plants. Services of professional biologists/botanists will be engaged at this time. Final control locations and costs will be established.
Early/Mid-summer: Implementation of agreed upon control measures that are required to achieve project goals. The application of any herbicide will be followed by an assessment of the results through continued surveying and mapping of plants in the control areas.
The responsibility of implementing this plan falls upon the Lake Bonney Lake Conservation Association Board of Directors and the City of Bonney Lake. Local residents will be informed of all aspects of the implementation of the plan. Community involvement will be strongly encouraged and welcomed.

The Board of Directors of Lake Bonney Conservation Association has been accountable to the club members for the maintenance of Bonney Lake. The basic concept has always been to provide the Bonney Lake Community with a safe usable lake in an effort to maximize their enjoyment of swimming, fishing, boating, wild life habitat and aesthetic values of the lake. Costs are assessed to the members and are then used to pay for the expenses associated with management of the lake.

Lake maintenance has been required for many years. However actual implementation of control techniques has been very limited. Chemical treatment of Bonney Lake if approved will be applied according to high, medium, and low levels of control to those areas designated on the Control Zone levels map. Control of the plant and algae growth lake wide will be determined jointly by the Bonney Lake Board, the City and the consultant based on visual observation and biological surveys.

Problematic plant and algae growth areas within the lake move with the season and control of such areas will only be initiated when and where needed. The current plan does not anticipate control within the lake to exceed 12 acres. If a total lake weed control alternative is required than an addendum to the current IAVMP will be submitted for review and approval. In addition if any of the information submitted in the plan needs to be changed, an addendum will be submitted.

Due to the small size of the lake, it is probably not practical to use multiple methods of mechanical removal.

Our short term plan is to determine in the early spring, the type of nuisance weeds and amount of area that needs to be controlled. Control of the plant and algae growth will be determined jointly by the Bonney Lake Board of Directors, the City and the consultant based on visual and

biological surveys. Control zones will be evaluated by plant densities, plant species, aesthetic values, and if human beneficial uses are negatively impacted.

Bonney Lake's long term goal is to protect the ecological balance of the lake while providing full recreational use to the surrounding property owners and public. As designed the program will be able to keep the lake maintenance cost within established budgets and the usability of Bonney Lake at a maximum for all concerned users. It is the desire of all involved parties to work with others concerned about lake management in an attempt to lower any environmental impact while maintaining the usability of the lake that the local area enjoys.

Any and all costs associated with carrying out this plan will be funded by the Lake Bonney Conservation Association and the City of Bonney Lake. As a small public lake the association is available for State and or Federal grants.

XIII. Monitoring and Evaluation Plan

The success of this plan will be measured by the extent of the actual control of aquatic plants in the lake and the increase or improvement of the beneficial uses while minimizing the impact on other fish, wildlife and plants. To a large extent, monitoring the control of the plants will be carried out by volunteers and the consultant. This will include mapping the location and density of the targeted plant species on a regular basis, and comparing this data to that collected in previous years. By combining the resulting trends of plant growth and proliferation with the applied control methods, the success of the control methods adopted can be judged. Control methods can then be adjusted as indicated. The increase or improvement of the beneficial uses of the lake can be judged from community feedback.

Monitoring of the site will be consistent with those guidelines established within the NPDES permit issued for this project. Specifically the permit requires monitoring of all application sites greater than ten acres in size. For such sites in excess of ten acres the following monitoring will be accomplished. As noted earlier the level of volunteer involvement with the monitoring component of the plan will be dependent on the level pf participation available.

Sampling Schedule

Category	Timing	Units	Sample Point	Sample Type
Receiving water within application site	2,4-D 5 days after initial application Fluridone 90 says after initial application Endothall 5 days after initial application	mg/l	Within boundaries of the treatment site	One areal composite
Receiving water outside the application	Within 24 hours after completion of the application	mg/l	100 feet from boundary of the application site perimeter	One areal composite of the site

At the conclusion of the growing season a post application survey of the lake will be completed. This evaluation will include an estimate of the effectiveness of the application, any dead or dying organisms, algae conditions and may include any other environmental data which may be available.

APPENDIX

Water Use Restrictions

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) AQUATIC NUISANCE PLANT AND ALGAE CONTOL CHEMICAL USE RESTRICTIONS CHART *

Herbicide or Algaecide	Fishery Issues	Use Restrictions
2, 4 - D	Fish Window	No Swimming Restrictions. Do not apply within 400 ft. of an outlet stream if there is an outflow.
Alum	No Fish Window If fish are killed or distressed during application; treatment must cease and the appropriate staff at the Ecology Regional Office and Fish and Wildlife Office must be notified.	No Swimming Restrictions. Whole lake treatments are only allowed if there is an approved IAVMP. Powdered alum must be mixed with water to form a slurry; the pH must remain between 6 and 8.5. Only aluminum compounds suitable for water treatment may be used. Applications shall start as early as possible each morning. A jar test must be completed prior to whole lake treatments; for partial lake treatments, alum concentration cannot exceed 50 µg/L. For whole lake treatments; application shall cease if winds exceed 5 mph. For whole lake treatments; a buffering material shall be available for use.
Calcium Hydroxide	No Fish Window	No Swimming Restrictions. The pH must remain between 6 and 9. A jar test must be completed prior to treatments; pH monitoring is required.
Diquat	Fish Window If state or federal Endangered Species Act listed species may be present no treatments are allowed until all appropriate agencies are	24-hour advisory must be posted at all public entry sites to the treatment area. Buffers are required for treatment in water bodies that do not have an approved IAVMP. In flowing waters do not apply within 1600 feet upstream of operating potable water intakes. In standing water do not apply within 1400 feet of a Potable water intake for rates of 2 gal/acre, or within 700 feet for rates of 1 gal/acre, or 350 feet for rates of ½ gal/ acre. Only treat submersed and floating plants, and filamentous algae. Not allowed for use on emergent plants

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	contacted and a mitigation plan is prepared.	2 meter buffer from shoreline. Limited to one treatment, unless there is an approved IAVMP. Whole lake treatments are only allowed under an approved IAVMP. Pouring Diquat directly into the water is prohibited. The Shoreline posting map shall include a 400 foot buffer strip around the treatment area. Buoys or similar devices shall be used to mark treatment area boundaries on the water.
Endothall (Aquathol ® K)	Fish Window	24-hour reentry advisory for swimming must be posted. Boating advisory in treated area when application methods may result in airborne particles of herbicide. The Shoreline posting map shall include a 400 foot buffer strip around the treatment area. Buoys or similar devices shall be used to mark treatment area boundaries on the water. Do not apply within 400 ft of an outlet stream if there is an outflow. Use is prohibited when the pH is below 6 or above 9.
Endothall (Hydrothol ® 191)	Fish Window	24-hour re-entry restriction must be posted. Boating and non swimming advisory must be posted in treated area where application methods may result in airborne particles of herbicide. The Shoreline posting map shall include a 400 foot buffer strip around the treatment area. Buoys or similar devices shall be used to mark treatment area boundaries on the water. Control of filamentous algae only; concentrations are limited to 0.2-mg a.e./L No treatment if hardness exceeds 275 mg/L as Ca Co_3 Treatment must occur from the shoreline outward.

6/10/05

Fluridone	No Fish Window	No Swimming Restrictions.
Glyphosate	No Fish Window	No Swimming Restrictions. Residential and Business Notices must inform residents and businesses of the ½ mile application restriction for potable water use. Apply only to free-floating, floating leaved and emergent plants.
GreenClean	No Fish Window Consult with Fish and Wildlife Officials before application to sites with Endangered or Threatened Species.	Closed during and 2-hours after treatment. A recreational advisory must be posted prior to treatment, The Shoreline posting map shall include a 400 foot buffer strip around the treatment area. Buoys or similar devices shall be used to mark treatment area boundaries on the water. Algae must be present; treat only in lakes, ponds, and reservoirs. Surrounding shorelands and wetlands cannot be treated.
PAK 27®	No Fish Window Consult with Fish and Wildlife Officials before application to sites with Endangered or Threatened Species.	Closed to recreation activities during treatment and 2 hours after treatment. A recreational advisory must be posted prior to treatment. The Shoreline posting map shall include a 400 foot buffer strip around the treatment area. Buoys or similar devices shall be used to mark treatment area boundaries on the water. Algae must be present; treat only in lakes, ponds, and reservoirs. Surrounding shorelands and wetlands cannot be treated.

6/10/05

Adjuvants	Must adhere to label requirements and restrictions.
R-11	
LI-700	
Agri-Dex ™	
Class Act Next Generation ™	
Competitor ™	
Dyne-Amic ™	
Kinetic ™	

*Refer to the label for drinking water (potable water) use restrictions.

*If there is any information in the Integrated Aquatic Vegetative Management Plan (IAVMP) that is inconsistent with this chart, this chart shall supercede the IAVMP.

*Any discharges of Herbicides, Algaecides or Adjuvants must comply with FIFRA (label requirements), the State of Washington Department of Agriculture directions and any additional requirements specified in a permit from the Department of Ecology. In the event of conflicting requirement, the more stringent shall apply.

REN

®

REWARD

Landscape and Aquatic Herbicide

TO PREVENT ACCIDENTAL POISONING, NEVER PUT INTO FOOD, DRINK, OR OTHER CONTAINERS, AND USE STRICTLY IN ACCORDANCE WITH ENTIRE LABEL.

DO NOT USE THIS PRODUCT FOR REFORMULATION.

Active Ingredient:

Diquat dibromide [6,7-dihydrodipyrido (1,2-a:2',1'-c) pyrazinediium dibromide] 37.3%

Other Ingredients: 62.7%

Total: 100.0% *Contains 2 lbs. diquat cation per gal. as 3.73 lbs. salt per gal.*

KEEP OUT OF REACH OF CHILDREN.

WARNING/AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

See additional precautionary statements and directions for use inside booklet.

EPA Reg. No. 100-1091
EPA Est. 100-TX-001

Product of United Kingdom
Formulated in the USA

SCP 1091A-L2A 0503
131537

2.5 gallons

Net Contents

syngenta

FIRST AID	
If swallowed	• Call a Poison Control Center or doctor immediately for treatment advice. • Immediately give water or milk to drink and induce vomiting by inserting finger in throat. • Do not induce vomiting or give anything by mouth to an unconscious person. • Take person and product container to the nearest hospital or physician fast. • PROMPT TREATMENT IS ESSENTIAL TO COUNTERACT POISONING and should be initiated before signs and symptoms of injury appear.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a Poison Control Center or doctor for treatment advice.
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a Poison Control Center or doctor for treatment advice.
If inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a Poison Control Center or doctor for further treatment advice.

NOTE TO PHYSICIAN

CALL SYNGENTA MEDICAL EMERGENCY ASSISTANCE 1-800-888-8372 at any hour to obtain toxicology information and a diquat analysis. To be effective, treatment for diquat poisoning must begin **IMMEDIATELY.** Treatment consists of binding diquat in the gut with suspensions of activated charcoal or bentonite clay, administration of cathartics to enhance elimination, and removal of diquat from the blood by charcoal hemoperfusion or continuous hemodialysis.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

HOT LINE NUMBER

For 24-Hour Medical Emergency Assistance (Human or Animal) or
Chemical Emergency Assistance (Spill, Leak, Fire, or Accident), Call
1-800-888-8372

PRECAUTIONARY STATEMENTS

Hazards to Humans and Domestic Animals

WARNING/AVISO

May be fatal if absorbed through skin. Harmful if swallowed or inhaled. Causes substantial, but temporary, eye injury. Causes skin irritation. Contact with irritated skin, or a cut, or repeated contact with intact skin may result in poisoning. Do not get in eyes, on skin, or on clothing. Avoid breathing vapor or spray mist. Do not feed forage from treated crops to livestock. Keep livestock and pets out of treated fields and crop areas.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Coveralls over short-sleeved shirt and short pants or coveralls over long-sleeved shirt and long pants
- Waterproof gloves
- Chemical-resistant footwear plus socks
- Protective eyewear
- Chemical-resistant headgear for overhead exposure
- Chemical-resistant apron when cleaning equipment, mixing, or loading

Exception: After this product has been diluted with at least 50 gallons of water, applicators for AQUATIC SURFACE APPLICATIONS must, at a minimum, wear (Note – Mixers and Loaders for this application method must still wear the Personal Protective Equipment (PPE) as described in the above section):

- Long-sleeved shirt and long pants
- Shoes plus socks
- Waterproof gloves
- Protective eyewear

Exception: At a minimum, applicators for AQUATIC SUBSURFACE APPLICATIONS must wear (Note – Mixers and Loaders for this application method must still wear the Personal Protective Equipment (PPE) as described in the above section):

- Short-sleeved shirt and short pants
- Waterproof gloves
- Chemical-resistant footwear plus socks

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/ maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Control Statements

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS. Mixers, loaders, and applicators using closed systems who meet these requirements may wear: long-sleeved shirt and long pants, protective eyewear, waterproof gloves, shoes plus socks, and a chemical-resistant apron when mixing, loading, or cleaning equipment. If handling tasks are performed from inside an enclosed cab or aircraft with enclosed cockpits that meet these requirements may wear: long-sleeved shirt, long pants, shoes and socks for the labeling-specified PPE. All labeling-specified PPE must be immediately available for use in an emergency. All applicable requirements as specified in 40 CFR 170.240(d)(4-6) must be followed.

User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Environmental Hazards (Terrestrial and Aquatic Uses)

This pesticide is toxic to aquatic invertebrates. For **Terrestrial Uses,** do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash waters. For **Aquatic Uses,** do not apply directly to water except as specified on this label. Treatment of dense weed areas may result in oxygen loss from decomposition of dead weeds. This loss of oxygen may cause fish suffocation. Therefore, treat only 1/3 to 1/2 of the water body area at one time, especially if dense areas of weeds and/or algae exist, and wait 14 days between treatments.

Necessary approval and/or permits should be obtained prior to application if required. Consult the responsible State Agencies (i.e., Fish and Game Agencies or Department of Natural Resources) before making applications to public waters.

CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read the entire Directions for Use and Conditions of Sale and Limitation of Warranty and Liability before buying or using this product. If the terms are not acceptable, return the product at once, unopened, and the purchase price will be refunded.

The Directions for Use of this product should be followed carefully. It is impossible to eliminate all risks inherently associated with the use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions, presence of other materials or other influencing factors in the use of the product, which are beyond the control of SYNGENTA CROP PROTECTION, Inc. or Seller. All such risks shall be assumed by Buyer and User, and Buyer and User agree to hold SYNGENTA and Seller harmless for any claims relating to such factors.

SYNGENTA warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated in the Directions for Use, subject to the inherent risks referred to above, when used in accordance with directions under normal use conditions. This warranty does not extend to the use of the product contrary to label instructions, or under abnormal conditions or under conditions not reasonably foreseeable to or beyond the control of Seller or SYNGENTA, and Buyer and User assume the risk of any such use. SYNGENTA MAKES NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

In no event shall SYNGENTA or Seller be liable for any incidental, consequential or special damages resulting from the use or handling of this product. **THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE EXCLUSIVE LIABILITY OF SYNGENTA AND SELLER FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT OR, AT THE ELECTION OF SYNGENTA OR SELLER, THE REPLACEMENT OF THE PRODUCT.**

SYNGENTA and Seller offer this product, and Buyer and User accept it, subject to the foregoing Conditions of Sale and Limitation of Warranty and Liability, which may not be modified except by written agreement signed by a duly authorized representative of SYNGENTA.

DIRECTIONS FOR USE

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

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

READ ENTIRE LABEL. USE STRICTLY IN ACCORDANCE WITH PRECAUTIONARY STATEMENTS AND DIRECTIONS, AND WITH APPLICABLE STATE AND FEDERAL REGULATIONS.

DO NOT APPLY THIS PRODUCT THROUGH ANY TYPE OF IRRIGATION SYSTEM.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 24 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water is:

- Coveralls over short-sleeved shirt and short pants, or coveralls over long-sleeved shirt and long pants
- Waterproof gloves
- Chemical-resistant footwear plus socks
- Protective eyewear
- Chemical-resistant headgear for overhead exposure

NON-AGRICULTURAL USE REQUIREMENTS

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses. **Keep all unprotected persons out of operating areas or vicinity where there may be drift.**

For terrestrial uses, do not enter or allow entry of maintenance workers into treated areas, or allow contact with treated vegetation wet with spray, dew, or rain, without appropriate protective clothing until spray has dried.

For aquatic uses, do not enter treated areas while treatments are in progress.

STORAGE AND DISPOSAL

Prohibitions

Do not contaminate water, food, or feed by storage, disposal, or cleaning of equipment. Open dumping is prohibited.

Storage

Keep pesticide in original container. Do not put concentrate or dilute into food or drink containers. Do not contaminate feed, foodstuffs, or drinking water. Do not store or transport near feed or food. Store at temperatures above 32°F. For help with any spill, leak, fire, or exposure involving this material, call **1-800-888-8372.**

Pesticide Disposal

Pesticide wastes are toxic. 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

Do not reuse container. 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.

CONTAINER IS NOT SAFE FOR FOOD, FEED, OR DRINKING WATER!

SPECIFIC USE DIRECTIONS

Reward Landscape and Aquatic Herbicide is a nonvolatile herbicidal chemical for use as a general herbicide to control weeds in noncrop and aquatic areas. Absorption and herbicidal action is usually quite rapid with effects visible in a few days. Reward Landscape and Aquatic Herbicide controls weeds by interfering with photosynthesis within green plant tissue. Weed plants should be succulent and actively growing for best results. Rinse all spray equipment thoroughly with water after use. Avoid Spray Drift to crops, ornamentals, and other desirable plants during application, as injury may result. Application to muddy water may result in reduced control. Minimize creating muddy water during application. Use of dirty or muddy water for Reward Landscape and Aquatic Herbicide dilution may result in reduced herbicidal activity. Avoid applying under conditions of high wind, water flow, or wave action.

SPRAY DRIFT MANAGEMENT

Avoiding spray drift at the application site is the responsibility of the applicator and the grower.

The interaction of many equipment- and weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.

The following drift management requirements must be followed to avoid off-target movement from aerial applications to agricultural field crops. These requirements do not apply to forestry applications, public health uses, or to applications using dry formulations.

- The distance of the outermost nozzles on the boom must not exceed 3/4 the length of the wingspan or rotor.
- Nozzles must always point backward parallel with the air stream and never be pointed downward more than 45 degrees.

Where states have more stringent regulations, they should be observed.

Droplet Size

The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (See **Wind, Temperature and Humidity,** and **Temperature Inversions**).

Controlling Droplet Size

- **Volume** – Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- **Pressure** – Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types, lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- **Number of Nozzles** – Use the minimum number of nozzles that provide uniform coverage.
- **Nozzle Orientation** – Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is the recommended practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.
- **Nozzle Type** – Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

Boom Length

For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

Application Height

Applications should not be made at a height greater than 10 ft. above the top of the target plants, unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

Swath Adjustment

When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase with increasing drift potential (higher wind, smaller drops, etc.).

Wind

Drift potential is lowest between wind speeds of 2-10 mph. However, many factors, including droplet size and equipment type, determine drift potential at any given speed. Application should be avoided below 2 mph due to variable wind direction and high inversion potential.

Note: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

Temperature and Humidity

When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

Temperature Inversions

Applications should not occur during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

Sensitive Areas

The pesticide should only be applied when the wind is blowing away from adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops).

COMMERCIAL GREENHOUSES AND NURSERIES

For general weed control in commercial greenhouses (beneath benches), (field grown and container stock), and other similar areas, Reward Landscape and Aquatic Herbicide may be applied preplant or postplant preemergence in field grown ornamental nursery plantings or postemergence as a directed spray. Reward Landscape and Aquatic Herbicide may also be applied preemergence in ornamental seed crops (U.S., except CA). Avoid contact with desirable foliage as injury may occur. Do not use on food or feed crops.

Spot spray: 1-2 qts. Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 100 gals. of water, or 0.75 oz. (22 mls.) Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 1 gal. of water. **Broadcast:** 1-2 pts. Reward Landscape and Aquatic Herbicide in a minimum of 15 gals. of water per acre. Add the labeled rate of a 75% or greater nonionic surfactant per 100 gals. of spray mixture. Use an adequate spray volume to insure good coverage.

ORNAMENTAL SEED CROPS (FLOWERS, BULBS, ETC.) U.S., EXCEPT CA

For preharvest desiccation of ornamental seed crops. NOT FOR FOOD OR FIBER CROPS.

Broadcast (Air or Ground): 1.5-2 pts. Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per acre in sufficient water (minimum of 5 gals. by air; 15 gals. by ground) for desiccation and weed burndown. Repeat as needed at no less than 5-day intervals up to three applications. Do not use seed, screenings, or waste as feed or for consumption. **DIRECTIONS FOR LANDSCAPE, INDUSTRIAL, RECREATIONAL, COMMERCIAL, RESIDENTIAL, AND PUBLIC AREAS**

Reward Landscape and Aquatic Herbicide provides fast control of broadleaf and grassy weeds in industrial, recreational, golf course, commercial, residential, and public areas.

Reward Landscape and Aquatic Herbicide is a nonselective herbicide that rapidly kills undesirable above ground weed growth in 24-36 hours. Avoid application of Reward Landscape and Aquatic Herbicide to desirable plants.

Reward Landscape and Aquatic Herbicide is a contact/desiccant herbicide; it is essential to obtain complete coverage of the target weeds to get good control. Improper application technique and/or application to stressed weeds may result in unacceptable weed control. For best results, apply to actively growing, young weeds.

Difficult weeds (such as perennial or deeply-rooted weeds) can often be controlled by tank mixing Reward Landscape and Aquatic Herbicide with other systemic-type herbicides. Refer to other product labels for specific application directions.

For residual weed control, tank mix Reward Landscape and Aquatic Herbicide with a pre-emergent herbicide labeled for the intended use site. When mixing Reward Landscape and Aquatic Herbicide with another herbicide, it is recommended to mix just a small amount first to determine if the mixture is physically compatible before proceeding with larger volumes.

Syngenta has not tested all possible tank mixtures with other herbicides for compatibility, efficacy or other adverse effects. Before mixing with other herbicides Syngenta recommends you first consult your state experimental station, state university or extension agent.

Grounds maintenance weed control: Reward Landscape and Aquatic Herbicide can be used as a spot or broadcast spray to control weeds in public, commercial and residential landscapes, including landscape beds, lawns, golf courses and roadsides. Reward Landscape and Aquatic Herbicide can also be used for weed control around the edges and nonflooded portions of ponds, lakes and ditches.

Trim and edge weed control: Reward Landscape and Aquatic Herbicide can be used to eliminate undesired grass and broadleaf plant growth in a narrow band along driveways, walkways, patios, cart paths, fence lines, and around trees, ornamental gardens, buildings, other structures, and beneath noncommercial greenhouse benches. Vegetation control with Reward Landscape and Aquatic Herbicide is limited to the spray application width. Do not exceed the labeled rate of Reward Landscape and Aquatic Herbicide as excessive rates may result in staining of concrete-based materials. Reward Landscape and Aquatic Herbicide, since it does not translocate systemically, can be used as an edging or pruning tool when precisely applied to select areas of grass or to undesirable growth on desirable ornamental bedding plants, ground covers, etc.

Industrial weed control: Reward Landscape and Aquatic Herbicide can be used as a spot or broadcast spray either alone or in combination with other herbicides as a fast burndown or control weeds in rights-of-ways, railroad beds/yards, highways, roads, dividers and medians, parking lots, pipelines, pumping stations, public utility lines, transformer stations and substations, electric utilities, storage yards, and other noncrop areas.

Spot spray: 1-2 qts. of Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 100 gals. of water, or 0.75 oz. (22 mls) Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 1 gal. of water. **Broadcast:** 1-2 pts. Reward Landscape and Aquatic Herbicide in a minimum of 15 gals. of water per acre. Add the labeled rate of 75% or greater nonionic surfactant per 100 gals. spray mixture. Use an adequate spray volume to insure good coverage. Greater water volumes are necessary if the target plants are tall and/or dense. It is recommended that 60 gals. or greater water volume be used to obtain good coverage of dense weeds.

Turf Renovation (All Turf Areas Except Commercial Sod Farms)

To desiccate golf course turf and other turf areas prior to renovation, apply 1-2 pts. of Reward Landscape and Aquatic Herbicide per acre plus the labeled rate of a 75% or greater nonionic surfactant in 20-100 gals. of water (4 teaspoons of Reward Landscape and Aquatic Herbicide plus the labeled rate of a 75% or greater nonionic surfactant per 1 gal. of water) using ground spray equipment. Apply for full coverage and thorough contact with the turfgrass. Apply only when the turf is dry, free from dew and incidental moisture. For enhanced turf desiccation, especially in the case of thick turfgrass, water volumes should approach 100 gals. of water per acre.

For **suppression** of regrowth and quick desiccation of treated turfgrass, Reward Landscape and Aquatic Herbicide may be mixed with other systemic nonselective or systemic postemergence grassy weed herbicides. Refer to other product labels for specific application directions and restrictions. Avoid spray contact with, or spray drift to, foliage of ornamental plants or food crops.

Do not graze livestock on treated turf or feed treated thatch to livestock.

DORMANT ESTABLISHED TURFGRASS (BERMUDAGRASS, ZOYSIAGRASS), NONFOOD OR FEED CROP

For control of emerged annual broadleaf and grass weeds, including little barley*, annual bluegrass, Bromes including rescuegrass, sixweeks fescue, henbit, buttercup, and Carolina geranium in established dormant bermudagrass lawns, parks, golf courses, etc.

Apply 1-2 pts. Reward Landscape and Aquatic Herbicide per acre in 20-100 gals. of spray mix by ground as a broadcast application. Add the labeled rate of a 75% or greater nonionic surfactant per 100 gals. of spray mixture.

Bermudagrass must be dormant at application. Application to actively growing bermudagrass may cause delay or permanent injury. Users in the extreme Southern areas should be attentive to the extent of dormancy at the time of application.

*For control of little barley, apply Reward Landscape and Aquatic Herbicide prior to the mid-boot stage.

AQUATIC USE DIRECTIONS

New York – Not for Sale or Use in New York State without Supplemental Special Local Needs Labeling.

Necessary approval and/or permits should be obtained prior to application if required. Consult the responsible State Agencies (i.e., Fish and Game Agencies or Department of Natural Resources). Treatment of dense weed areas may result in oxygen loss from decomposition of dead weeds. This loss of oxygen may cause fish suffocation. Therefore, treat only 1/3 to 1/2 of the water body area at one time and wait 14 days between treatments.

For application only to **still water** (i.e. ponds, lakes, and drainage ditches) where there is minimal or no outflow to public waters.

and/or

For applications to **public waters** in ponds, lakes, reservoirs, marshes, bayous, drainage ditches, canals, streams, rivers, and other slow-moving or quiescent bodies of water for control of aquatic weeds. For use by:

- Corps of Engineers; or
- Federal or State Public Agencies (i.e., Water Management District personnel, municipal officials); or
- Applicators and/or Licensees (certified for aquatic pest control) that are authorized by the State or Local government.

Treated water may be used according to the following table or until such time as an approved assay (example: PAM II Spectromatic Method) shows that the water does not contain more than the designated maximum contaminant level goal (MCLG) of 0.02 mg./l. (ppm) of diquat dibromide (calculated as the cation):

Water Use Restrictions Following Applications With Reward Landscape And Aquatic Herbicide (Days)

Application Rate	Drinking	Fishing and Swimming	Livestock Consumption	Spray Tank Applications** and Irrigation to Turf and Ornamentals	Spray Tank Applications** and Irrigation to Food Crops
2 gals./surface acre	3 days	0	1 day	3 days	5 days
1 gal./surface acre	2 days	0	1 day	2 days	5 days
0.75 gal./surface acre	2 days	0	1 day	2 days	5 days
0.50 gal./surface acre	1 day	0	1 day	1 day	5 days
Spot Spray* (< 0.5 gal./surface acre)	1 day	0	1 day	1 day	5 days

*Rates refer to total surface area.

**For preparing agricultural sprays for food crops, turf or ornamentals (to prevent phytotoxicity), do not use water treated with Reward Landscape and Aquatic Herbicide before the specified time period.

When the contents of more than one spray tank is necessary to complete a single aquatic application, no water holding restrictions apply between the consecutive spray tanks.

No applications are to be made in areas where commercial processing of fish, resulting in the production of fish protein concentrate or fish meal, is practiced. Before application, coordination and approval of local and/or State authorities must be obtained.

Apply Reward Landscape and Aquatic Herbicide in Accordance With the Following Table

Weed Species	Subsurface or Bottom Placement Gals./Surface Acre*	Surface Gals./Surface Acre*
Bladderwort (*Utricularia* spp.)	1-2	2
Coontail (*Ceratophyllum demersum*)	2	2
Elodea (*Elodea* spp.)	2	2
Naiad (*Najas* spp.)	1-2	2
Pondweeds[1] (*Potamogeton* spp.)	2	2
Watermilfoils (*Myriophyllum* spp.)	1-2	2
Hydrilla (*Hydrilla verticillata*)	2	2
Waterlettuce[2] (*Pistia stratiotes*)	NA	0.5 - 0.75
Waterhyacinth[2] (*Eichhornia crassipes*)	NA	0.5 - 0.75
Pennywort[3] (*Hydrocotyle* spp.)	NA	0.5 - 0.75
Frog's Bit[6] (*Limnobium spongia*)	NA	0.5 - 0.75
Salvinia[2] (*Salvinia* spp.)	NA	0.5 - 0.75
Duckweed[4] (*Lemna* spp.)	NA	1
Cattails[3] (*Typha* spp.)	NA	1-2
Algae[5] (*Spirogyra* spp. & *Pithophora* spp.)	1-2	2

*For water less than or equal to 2 ft. in average depth of treatment area, use a maximum of 1 gal. Reward Landscape and Aquatic Herbicide per surface acre. Lowest rates should be used in shallow areas where the water depth is considerably less than the average depth of the entire treatment area, for example, shallow shoreline areas. At water temperatures below 50°-60°F, efficacy and immediacy of results may be reduced.

[1]Reward Landscape and Aquatic Herbicide controls *Potamogetan* species except Richardson's pondweed (*P. richardsonii*). For control of *P. robbinsii,* applications must be made when the plants are in the early stages of growth such as in Spring and early Summer.

[2]For salvinia, waterlettuce, and water hyacinth, use the labeled rate of Reward Landscape and Aquatic Herbicide in 75-200 gals. water plus the labeled rate of a 75% or greater nonionic surfactant per acre for surface sprays, and for aerial application for waterlettuce and water hyacinth control, apply the labeled rate of Reward Landscape and Aquatic Herbicide in 10-24 gals. of water plus the labeled rate of a 75% or greater nonionic surfactant per acre.

[3]For pennywort and cattail control, apply in 50-150 gals. of water plus the labeled rate of a 75% or greater nonionic surfactant per acre for full coverage and thorough weed contact. Repeat treatments may be necessary to control regrowth. For best results, apply before flowering (cattail).

[4]For duckweed control, apply as an overall spray in 50-150 gals. of water plus the labeled rate of a 75% or greater nonionic surfactant per acre. Retreatment may be necessary for plants missed in previous applications and regrowth.
[5]For suppression of certain filamentous algae species including *Spirogyra* and *Pithophora,* apply according to the submersed use directions.
[6]Not for use in California.

Application: In mixed weed populations, use the high rate of application as indicated by weeds present.

Subsurface Applications: Where the submersed weed growth, especially hydrilla, has reached the water surface, apply either in a water carrier or an invert emulsion through boom trailing hoses carrying nozzle tips to apply the dilute spray below the water surface to insure adequate coverage. **Bottom Placement:** Where the submersed weeds, especially hydrilla, bladderwort, and coontail growth, have reached the water surface or where water is slowly moving through the submersed weed growth that has reached the water surface, especially hydrilla, bladderwort, and coontail, con- trol may be enhanced when applied in an invert emulsion carrier injecting diluted Reward Landscape and Aquatic Herbicide near the bottom with weighted hoses. The addition of a copper-based algae- cide will improve control. Where algae are present along with the submersed weeds, pretreatment with copper-based algaecide at recommended rates is advised for best results.

Surface Application: For submerged aquatic weeds, apply Reward Landscape and Aquatic Herbicide either as concentrate slowly poured directly from the container in strips or as a spray in sufficient carrier. Applications should be made to ensure complete coverage of the weed areas. In mixed weed populations, use the high rate of application as indicated by weeds present.

If posting is required by your state or tribe – consult the agency responsible for pesticide regulations for specific details.

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For non-emergency (e.g., current product information), call
Syngenta Crop Protection at 1-800-334-9481.

Product of United Kingdom
Formulated in the USA
Syngenta Crop Protection, Inc.
Greensboro, North Carolina 27409
www.syngenta-us.com

SCP 1091A-L2A 0503
131537

GreenClean™ Granular Algaecide

- For use in Ponds, Lakes, Water Gardens, Fountains, Irrigation Systems, Golf Course Ponds, Bilge Water, Non-Potable Water Reservoirs, Conveyance Ditches, Canals, Laterals, Fire Ponds, Watering Tanks (Non-Potable Water) and Storage Tanks

- For use on Floors, Walkways, Storage Areas, Ground Cover Mats, Weed Control Mats, Nursery Yards, Shorelines, Gravel, Dirt Floors, and Other Non-Painted Surfaces

- For indoor or outdoor horticultural, agricultural and commercial uses.

ACTIVE INGREDIENT:
Sodium Carbonate Peroxyhydrate* . . . 50%
OTHER INGREDIENTS 50%
TOTAL 100%
* Contains 27.6% Hydrogen Dioxide by weight.

KEEP OUT OF REACH OF CHILDREN DANGER – PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand this label, find someone to explain it to you in detail.)

EPA Registration No.: 70299-4
EPA Establishment No.: 68660-TX-001

FIRST AID

If in eyes
- Hold eye open and rinse slowly and gently with water for 15 – 20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

If on skin or clothing
- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15 – 20 minutes.
- Call a poison control center or doctor for treatment advice.

If swallowed
- Call poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to do so by the poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

If inhaled
- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible.
- Call a poison control center or doctor for treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-858-7378 for emergency medical treatment information. **NOTE TO PHYSICIAN**
Probable mucosal damage may contraindicate the use of gastric lavage.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMAN AND DOMESTIC ANIMALS – DANGER: Corrosive. Causes irreversible eye damage. Harmful if swallowed, inhaled or absorbed through skin. Do not get in eyes, on skin or on clothing.

PERSONAL PROTECTIVE EQUIPMENT (PPE) When handling wear protective eyewear (goggles or face shield) and chemical resistant gloves. Applicators and handlers must wear coveralls over long-sleeved shirt, long pants, and chemical resistant footwear plus socks. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions exist for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

Users should wash hands thoroughly with soap and water before eating, drinking, chewing gum, using tobacco or using the toilet. Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to birds. Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Do not apply to treated, finished drinking water reservoirs or drinking water receptacles. This product is highly toxic to bees and other beneficial insects exposed to direct contact on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the

treatment area. Do not apply this product or allow it to drift to crops where beneficials are part of an integrated pest management strategy.

PHYSICAL AND CHEMICAL HAZARDS

Strong oxidizing agent. **Corrosive**. Do not bring in contact with other pesticides, cleaners or oxidative agents.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This standard contains requirements for the protection of agricultural workers on farms, forests, nurseries and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), notification to workers, and restricted entry intervals (REI). The requirements in this box apply to uses of this product that are covered by the Worker Protection Standard.

For enclosed environments:

There is a restricted entry of one (1) hour for this product when applied via spraying or foaming on hard surfaces in enclosed environments. PPE requirement for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil or water, is coveralls, waterproof gloves and shoes plus socks.

There is a restricted entry of zero (0) hours for spreading, broadcasting, spot treatment, injection or other non-spraying or non-foaming application methods when used in enclosed environments.

For water treatment and applications in non-enclosed environments:

Keep unprotected persons out of treated areas until sprays have dried or dusts have settled.

Non-Agricultural Use Requirements

The requirements in this box apply to uses of this product that are not within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries or greenhouses.

Keep unprotected persons out of treated areas until sprays have dried or dusts have settled.

WATER APPLICATION RATES

Application	Heavy Algae Growth	Low Algae Growth/Maintenance
Large Volume – Granular: Lakes, ponds, lagoons, etc.	**90-500 lbs** of GreenClean Granular Algaecide per million gallons of water. - OR - **30-170 lbs** of GreenClean Granular Algaecide per acre-foot of water.	**9-50 lbs** of GreenClean Granular Algaecide per million gallons of water. - OR - **3-17 lbs** of GreenClean Granular Algaecide per acre-foot of water.
Small Volume – Granular: Indoor and outdoor water gardens, fountains, ornamental waterfalls, etc.	**3-16 Tbs** of GreenClean Granular Algaecide per 1000 gallons of water. (16 Tbs = 1 Cup, 2 Cups = 1 lb)	**1-5 tsp** of GreenClean Granular Algaecide per 1000 gallons of water. (3 tsp = 1 Tbs)
Liquid Applications: Use for suspended algae and free-floating algae mats.	**Solution Preparation:** Due to solubility limitations, use at least 1 gallon of water to fully dissolve each 0.5 lbs of GreenClean Granular Algaecide. Dissolution of GreenClean Granular Algaecide in cold water takes approximately 5 minutes. **Treatment Rates:** Use same rates as the granular application above.	

Apply GreenClean Granular Algaecide to any water or surface sites except treated, finished drinking water reservoirs or drinking water receptacles.

Some application sites include:

AGRICULTURAL
Farms, Sod Farms, and Irrigation Systems.
HORTICULTURAL & COMMERCIAL Greenhouses, Nurseries, Golf Courses, Amusement Parks, Water Parks, Aquariums, Zoos, Botanical Gardens, Parks and Recreational Areas, Non- Chlorinated Swimming Areas, Raceways, Sports Facilities, Business Parks, Residential Developments, Indoor/Interiors, Malls, Hotels, Kennels, Cemeteries, Carwashes, Marinas, Boats, Docks, Garden Centers, Power Washing, Water Gardens, Landscapes, Municipalities, Waterways, Storm Waters, Drainage Systems, Impounded Waters, Wastewater, and Irrigation Systems.

WATER TREATMENT

Use GreenClean Granular Algaecide to treat, control, and prevent a broad spectrum of algae. Effects of treatment are immediately apparent (bubbling, bleaching/discoloration of algae, floating of dead organic matter). Waters treated with GreenClean Granular Algaecide are permissible to be used without interruption.

DETERMINING WATER VOLUME

Measure length (L), width (W), and average depth (D) in feet (ft) and calculate volume using one of the following formulas:

Square/Rectangular:
L(ft) x W(ft) x D(ft) x 7.5 = Gallons

Circular/Elliptical:
L(ft) x W(ft) x D(ft) x 5.9 = Gallons

1 acre-foot of water =
208.7 ft long x 208.7 ft wide x 1 ft deep
43,560 ft^3 = 325,851 gal = 2,780,000 lbs

$$\frac{\text{Avg. L (ft) x Avg. W (ft) x Avg. D (ft)}}{43{,}560} = \textbf{acre-feet of water}$$

GENERAL TREATMENT NOTES

- Control is most easily achieved when algae are not yet well established. Treat when growth first begins to appear. This is especially important in the prevention of clogged irrigation systems, pumps, filters, etc.
- Apply early in the day under calm, sunny conditions, and when water temperatures are warm. Sunlight and higher temperatures both enhance GreenClean Granular Algaecide activity.
- Apply in a manner that will insure even distribution of GreenClean Granular Algaecide within the treatment area.
- Break up any heavy floating algae mats before or during application.
- Skim any dead algae and organic matter that rises to the water's surface after treatment. Allowing dead organics to sink and decay will provide a food source and additional nutrients that stimulate algae re-growth and further blooms.
- Use GreenClean Granular Algaecide as an integral part of your water management system. If using in conjunction with other water additives (such as bacteria or enzymes), always apply GreenClean Granular Algaecide first and wait several hours before adding any other products.
  - Re-treat areas if re-growth begins to appear. Allow 48 hours between consecutive treatments.
- Maintain an algae free pond with GreenClean Granular Algaecide maintenance rates at a frequency appropriate for your environmental conditions.
  - In regions where water freezes in the winter, treatment with GreenClean Granular Algaecide (including skimming) 6-8 weeks before expected freeze will help prevent masses of decaying algae under the ice cover.
- After application, do not allow undiluted granules to remain in an area where humans or animals are exposed.
- Non-target plants will suffer contact burn if undiluted granules are accidentally spilled on them. Do not apply in such a way that the concentrated product comes in contact with grass, ornamentals and other foliage.
- Do not tank mix with aquatic herbicides or algaecides containing copper or bromides. Always apply GreenClean Granular Algaecide at least one day prior to the application of these

products.

- 100 pounds of GreenClean Granular Algaecide per million gallons of water = 4ppm of sodium.

EFFECTIVENESS FACTORS

- Effects of GreenClean Granular Algaecide treatment are immediately apparent (bubbling, bleaching/discoloration of algae, floating dead organic matter).
- GreenClean Granular Algaecide treatments are successful when contact of the pesticide is made with the algae.
- Liquid applications will not sink through the water column as readily as a granular application.
- When treating surface mats and blooms, it is possible that GreenClean Granular Algaecide will not penetrate the water column below the infested area, and a second application is then required for treating any bottom growing algae.
- Apply more frequently during the summer months when water consumption and temperatures are high.

APPLICATION METHODS

SPREADING / BROADCASTING: Broadcast GreenClean Granular Algaecide with a mechanical spreader or by hand, directly on the water surface, from shore or from a properly equipped boat.

SPOT TREATMENT: Apply GreenClean Granular Algaecide directly over the infested area. Re-treatment is required when heavy growth occurs.

LIQUID: Make a solution with GreenClean Granular Algaecide (refer to liquid application rates). Spray this solution on the water surface from shore or a properly equipped boat. When using this method, the wind direction is important as well as the operation of the boat. If using a slurry, agitate constantly.

INJECTION: Make a solution with GreenClean Granular Algaecide (refer to liquid application rates). Inject this solution into the water via a piping system.

SUBSURFACE: Place GreenClean Granular Algaecide in burlap bags and drag through the water by means of a boat. Use granular application rates. Begin treatment along the shoreline, and proceed outward. The path of the boat shall insure an even distribution. Continue dragging until all GreenClean Granular Algaecide is dissolved.

GROUND/SURFACE APPLICATION RATES

Application	Heavy Algae Growth	Low Algae Growth/Maintenance
Granular Applications	**2-3 lbs** of GreenClean Granular Algaecide per 1000 sq ft of area. Make granular applications over a wet surface or activate with water immediately following application. (1 lb = 2 Cups)	**1-2 lbs** of GreenClean Granular Algaecide per 1000 sq ft of area. Make granular applications over a wet surface or activate with water immediately following application. (1 lb = 2 Cups)
Liquid Applications	**Solution Preparation:** Due to solubility limitations, use at least 1 gallon of water to fully dissolve each 0.5 lbs of GreenClean Granular Algaecide. Dissolution of GreenClean Granular Algaecide in cold water takes approximately 5 minutes. **Treatment Rates:** Use same rates as the granular application above.	
Foam Applications	**Solution Preparation:** Follow the Liquid Application instructions shown above. Add 2-5 fl oz of an alkaline-based foam, such as BioSafe Systems' "Alk-A-Foam," per gallon of finished solution. **Treatment Rates:** Use the same rates as the granular/ liquid application given above.	

SURFACE TREATMENT

Use GreenClean Granular Algaecide on all non-painted surfaces, to prevent and control algae, moss, slime molds and their spores, and the odors and conditions that these organisms cause (such as the breeding grounds for pests such as shore flies and fungus gnats).

GENERAL TREATMENT NOTES

- Control is most easily achieved when growth is not yet well established. Treat when growth first begins to appear.
- Apply in a manner that will insure even distribution of GreenClean Granular Algaecide within the treatment area.
- GreenClean Granular Algaecide is water activated. Watering before application is preferred over misting after application because it prevents over watering leading to a reduced effectiveness.
- Use GreenClean Granular Algaecide in conjunction with ZeroTol Broad Spectrum Algaecide/Fungicide and TerraCyte, as part of a comprehensive cleanliness/treatment program.
- When applying GreenClean Granular Algaecide to soil, gravel or other similar media, incorporate the application of GreenClean Granular Algaecide into the first inch of substrate for optimum effectiveness.
- To maintain clean surfaces, apply GreenClean Granular Algaecide at maintenance rates every 5-7 days or as needed to control new or established conditions.
- After application, do not allow undiluted granules to remain in an area where humans or animals are exposed.
- Non-target plants will suffer contact burn if undiluted granules are accidentally spilled on them. Do not apply in such a way that the concentrated product comes in contact with grass, ornamentals and other foliage.
- Do not tank mix with aquatic herbicides or algaecides containing copper or bromides. Always apply GreenClean Granular Algaecide at least one day prior to the application of these products.

APPLICATION METHODS

SPREADING / BROADCASTING: Broadcast GreenClean Granular Algaecide with a mechanical spreader or by hand. A lawn spreader or any other applicator that will insure uniform coverage is acceptable.

SPOT TREATMENT: Apply GreenClean Granular Algaecide directly over the infested area. Re-treatment is required when heavy growth occurs.

LIQUID: Make a solution with GreenClean Granular Algaecide (refer to liquid application rates). Spray this solution on the desired treatment surface.

FOAM: Make a solution with GreenClean Granular Algaecide (refer to foam application rates). Spray this solution on the desired treatment surface. Use a foamer, such as the BioSafe BioFoamer, to apply.

STORAGE AND DISPOSAL

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

PESTICIDE STORAGE: Store in original containers in a cool, well-vented area, away from direct sunlight. Do not allow product to become overheated in storage. This may cause increased degradation of the product, which will decrease product effectiveness. In case of spill, flood area with large quantities of water. Do not store in a manner where cross-contamination with other pesticides or fertilizers could occur.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. Open dumping is prohibited. If wastes cannot be disposed of according to label directions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

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

WARRANTY

This material conforms to the description on the label and is reasonably fit for the purposes referred to in the directions for use. Timing, unfavorable temperatures, water conditions, presence of other materials, method of application, weather, watering practices, nature of soil, disease problem, condition of crop, incompatibility with other chemicals, pre-existing conditions and other conditions influencing the use of this product are beyond the control of the seller. Buyer assumes all risks associated with the use, storage, or handling of this material not in strict accordance with directions given herewith. NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTIBILITY IS MADE.

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AQUATHOL® K

AQUATIC HERBICIDE

ACTIVE INGREDIENT:

Dipotassium salt of endothall*	40.3%
OTHER 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

KEEP OUT OF REACH OF CHILDREN

DANGER

FIRST AID:

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes then continue rinsing.
- Call a poison control center or doctor for treatment advice.

IF ON SKIN:

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

IF INHALED:

- Move person to fresh air. If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a poison control center or doctor for treatment advice.

IF SWALLOWED:

- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow. Do not induce vomiting unless told by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

HOT LINE NUMBER: Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact (303) 623-5716 for emergency medical treatment information.

NOTE TO PHYSICIAN: Measures against circulatory shock, respiratory depression, and convulsion may be needed.

EPA Registration No. 4581-204 EPA Establishment No. 62171-MS-003

Net Contents _____

cerexagri

Cerexagri, Inc.
630 Freedom Business Center
Suite 402
King of Prussia, PA 19406
1 800-438-6071 • www.cerexagri.com

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.

HOW TO APPLY:
AQUATHOL K is a contact herbicide; consequently, do not apply before weeds are present. Application as early as possible after weeds appear and are actively growing is recommended for best results.

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.

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 a concentrate or diluted with water depending on the equipment. Some dilution will give better distribution. For best results apply when water is quiescent and/or flows are minimal.

In instances where the weed(s) to be controlled is an exposed surface problem (i.e., some of the broad-leaved pond weeds) coverage is important. For best results apply the concentrate or with the least amount of water compatible with the application equipment.

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

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 treated area, 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.

Aquatic Weed	RATES: Entire Pond/Lake or Large Area Treatment	Gallons per Acre Ft.	Spot or Lake Margin Treatment	Gallons per Acre Ft.
Bur Reed, Sparganium spp.	3.0-4.0 ppm	1.9-2.6 gal.	4.0-5.0 ppm	2.6-3.2 gal.
Coontail, Ceratophyllum spp.	1.0-2.0 ppm	0.6-1.3 gal.	2.0-3.0 ppm	1.3-1.9 gal.
Horned Pondweed, Zannichellia palustris	1.0-2.0 ppm	0.6-1.3 gal.	2.0-3.0 ppm	1.3-1.9 gal.
Hydrilla, Hydrilla verticillata	2.0-3.0 ppm	1.3-1.9 gal.	3.0-4.0 ppm	1.9-2.6 gal.
Hygrophila, Hygrophila polysperma	4.0-5.0 ppm	2.6-3.2 gal.	5.0 ppm	3.2 gal.
Milfoil, Myriophyllum spp.	2.0-3.0 ppm	1.3-1.9 gal.	3.0-4.0 ppm	1.9-2.6 gal.
Naiad, Najas spp.	1.0-3.0 ppm	0.6-1.9 gal.	2.0-4.0 ppm	1.3-2.6 gal.
Pondweed, Potamogeton spp.	0.5-3.0 ppm	0.3-1.9 gal.	1.5-4.0 ppm	1.0-2.6 gal.
Including:				
American, P. nodosus	2.0-3.0 ppm	1.3-1.9 gal.	3.0-4.0 ppm	1.9-2.6 gal.
Largeleaf (Bass Weed), P. amplifolius	2.0-3.0 ppm	1.3-1.9 gal.	3.0-4.0 ppm	1.9-2.6 gal.
Curlyleaf, P. crispus	0.5-1.5 ppm	0.3-1.0 gal.	1.5-3.0 ppm	1.0-1.9 gal.
Flatstem, P. zosteriformis	2.0-3.0 ppm	1.3-1.9 gal.	3.0-4.0 ppm	1.9-2.6 gal.
Floating-leaf, P. natans	1.0-2.0 ppm	0.6-1.3 gal.	2.0-3.0 ppm	1.3-1.9 gal.
Illinois, P. Illinoensis	1.5-2.5 ppm	1.0-1.6 gal.	2.5-3.5 ppm	1.6-2.3 gal.
Narrowleaf, P. pusillus	1.0-2.0 ppm	0.6-1.3 gal.	2.0-3.0 ppm	1.3-1.9 gal.
Threadleaf, P. filiformis	2.0-3.0 ppm	1.3-1.9 gal.	3.0-4.0 ppm	1.9-2.6 gal.
Sago, P. pectinatus	1.0-2.0 ppm	0.6-1.3 gal.	2.0-3.0 ppm	1.3-1.9 gal.
Variable Leaf, P. diversifolius	1.0-2.0 ppm	0.6-1.3 gal.	2.0-3.0 ppm	1.3-1.9 gal.
Parrot Feather, Myriophyllum aquaticum	2.0-3.0 ppm	1.3-1.9 gal.	3.0-4.0 ppm	1.9-2.6 gal.
Water Stargrass, Heteranthera spp.	2.0-3.0 ppm	1.3-1.9 gal.	3.0-4.0 ppm	1.9-2.6 gal.

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 OF CANAL 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.

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS (AND DOMESTIC ANIMALS)

DANGER

CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING. AVOID BREATHING VAPORS OR SPRAY MIST.

Applicators and other handlers must wear:
- Long-sleeved shirt and long pants
- Waterproof gloves
- Shoes plus socks
- Protective eyewear

USER SAFETY RECOMMENDATIONS:

Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove protective clothing and equipment immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

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 — 7 days after application

Up to 4.25 ppm dipotassium salt — 14 days after application

Up to 5.0 ppm dipotassium salt — 25 days after application

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 crystallizing. 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.

EMERGENCY TELEPHONE NUMBERS:

CHEMTREC: (800) 424-9300

MEDICAL: (303) 623-5716 Rocky Mountain Poison Control Center

WARRANTY AND DISCLAIMER

Cerexagri, Inc. 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. CEREXAGRI MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. IN NO CASE SHALL CEREXAGRI 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.

Cerexagri 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 Cerexagri.

Cerexagri, Inc. is a wholly-owned subsidiary of Arkema Inc.
Aquathol is a registered trademark of Cerexagri, Inc.

4581-204(100504-1166) Made and Printed in U.S.A.

Avast!®

AQUATIC HERBICIDE

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 of Fluridone Per Gallon

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

KEEP OUT OF REACH OF CHILDREN

CAUTION – PRECAUCION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID	
IF IN EYES	• Hold eye open and rinse slowly and gently with water for 15 to 20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a posion control center or doctor for treatment advice.
IF ON SKIN OR CLOTHING	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15 to 20 minutes. • Call a posion control center or doctor for treatment advice.
IF SWALLOWED	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by the poison control center or doctor. • Do not giove anything by mouth to an unconscious person.
IF INHALED	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible. • Call a posion control center or doctor for further treatment advice.
Have product container or label with you when calling a posion control center or doctor, or going for treatment. **For medical emergencies involving this product, call toll free 1-888-324-7598.**	
See Label for Additional Precautions and Directions for Use	

GCN 090403 CPC 060660

GRIFFIN L.L.C.
VALDOSTA, GEORGIA 31601

Specimen Label

EPA REG. NO. 1812-435

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION

Harmful if swallowed, absorbed through skin or inhaled. Causes moderate eye irritation. Avoid breathing spray mist. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash clothing before reuse.

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 untreated water when disposing of equipment washwaters. Trees and shrubs growing in water treated with Avast! 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 by incineration, or if allowed by State and local authorities, by burning. If burned, stay out of smoke.

GENERAL INSTRUCTIONS

Avast! is a selective systemic aquatic herbicide for management of aquatic vegetation in fresh water ponds, lakes, reservoirs, drainage canals and irrigation canals. Avast! 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 Avast! in contact with the target plants for a minimum of 45 days. Rapid water movement or any condition that results in rapid dilution of Avast! in treated water will reduce its effectiveness.

In susceptible plants, Avast! inhibits the formation of carotene. In the absence of carotene, chlorophyll is rapidly degraded by sunlight. Herbicidal symptoms of Avast! appear in 7 to 10 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 Avast!. Species susceptibility to Avast! may vary, depending on time of year, stage of growth, and water movement. For best results, apply Avast! prior to initiation of weed growth or when weeds begin active growth. Mature target plants may require higher application rates and take longer to control.

Avast! is not corrosive to application equipment.

The label provides recommendations on the use of chemical analysis for the active ingredient. Griffin recommends the use of an Enzyme-Linked Immunoassay (ELISA Test) for the determination of the concentration of the active ingredient in treated water. Contact Griffin for the utilization of this test, know as the AvasTest™, for the incorporation of this analysis into your treatment program. Other proven chemical analyses for the active ingredient may also be used. The chemical analysis, AvasTest, is referenced in this label as the preferred method for the rapid determination of the active ingredient concentration in treated water.

Application rates are provided in fluid ounces or quarts of Avast! to achieve a desired concentration of the active ingredient in parts per billion (ppb). The maximum application rate or sum of all application rates is 90 ppb in ponds and 150 ppb in lakes and reservoirs per annual growth cycle. This maximum concentration is the amount of product calculated as the target application rate, NOT determined by testing the residues of the active ingredient in the treated water.

SPECIAL PRECAUTIONS

- **Obtain required permits:** Permits may be required by state or local agencies. Consult with appropriate state or local water authorities before applying this product.
- **Chemigation:** Do not apply this product through any type of irrigation system.
- **Hydroponic Farming:** Do not use water treated with Avast! for hydroponic farming.
- **Greenhouse and Nursery Plants:** Do not use water treated with Avast! for irrigating greenhouse or nursery plants unless use of an approved assay, such as AvastTest, confirms that residues are less than 1 ppb.
- **Water Use Restrictions Following Application of Avast! (Days)**

Application Rate	Drinking[1]	Fishing	Swimming	Livestock/Pet Consumption	Irrigation[2]
Maximum Rate (150 ppb) or less	0	0	0	0	See irrigation instructions below

[1] Note below, under Potable Water Intakes, the information for application fo Avast! within ¼ mile (1320 feet) of a functional potable water intake.

[2] Note below, under Irrigation, the specific time frames or fluridone residues that provide the widest margin of safety for irrigating with water treated with Avast!.

- **Potable Water Intakes:** In lakes and reservoirs or other sources of potable water, DO NOT apply Avast! at application rates greater than 20 ppb within ¼ mile (1320 feet) of any functioning potable water intake. At application rates of 6 to 20 ppb, Avast! may be applied where functioning potable water intakes are present.

  NOTE: Existing potable water intakes that are no longer in use, such as those that have been 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 Avast! may result in injury to the irrigated vegetation. Those who irrigate from areas treated with Avast! should be informed of the irrigation time frames or water assay requirements presented in the table below. These time frames and assay recommendations are suggestions that should be followed to reduce the potential for injury to vegetation irrigated with water treated with Avast!. There is a greater potential for crop injury when water treated with Avast! is applied to crops grown in low organic and sandy soils.

Recommended Waiting Periods Before Irrigating with Water Treated with Avast! (Days After Application)			
Application Site	**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[1]	7	30	Assay required
Canals	7	14	Assay required
Lakes and Reservoirs[2]	7	14	Assay required

[1] For purposes of Avast! 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.

[2] In lakes and reservoirs where one-half or greater of the body of water is treated, use the pond and static canal irrigation precautions.

Where the use of Avast! treated water is desired for irrigating crops prior to the time frames established above, the use of AvasTest is recommended to measure the concentration in the treated water. Where AvasTest has determined that concentrations are less than ten parts per billion (ppb), there are no irrigation precautions for irrigating established tree crops, established row crops or turf. For tobacco, tomatoes, peppers or other plants within the Solanaceae family and for newly seeded crops or newly seeded grasses, such as overseeded golf course greens, do not use Avast! SRP treated water if concentrations are greater than five parts per billion. Furthermore, when rotating crops, do not plant members of the Solanaceae family in land that had been previously irrigated with fluridone concentrations in excess of 5 ppb. It is recommended that an aquatic specialist be consulted prior to commencing irrigation to these sites.

WEED CONTROL INFORMATION

Avast! selectivity is dependent upon dosage, time of year, stage of growth, method of application and water movement. The following categories, Controlled, Partially Controlled and Not Controlled, are provided to describe expected efficacy under ideal treatment conditions, using higher to maximum application rates. Use of lower rates will increase selectivity of some species listed as Controlled or Partially Controlled. Additional aquatic plants may be controlled, partially controlled or tolerant to Avast!. Consult an aquatic specialist prior to application to determine a plant's susceptibility to Avast!.

Vascular Aquatic Plants Controlled by Avast!

Floating Plants:
Duckweed, Common *(Lemna minor)*
Emersed Plants:
Spatterdock *(Nuphar luteum)*
Waterlily *(Nymphaea* spp.*)*
Submersed Plants:
Bladderwort *(Utricularia* spp.*)*
Coontail, Common *(Ceratophyllum demersum)*
Egeria, Brazilian Elodea *(Egeria densa)*
Elodea, Common *(Elodea canadensis)*
Fanwort, Cabomba *(Cabomba caroliniana)*
Hydrilla *(Hydrilla verticillata)*
Naiad *(Najas* spp.*)*
Pondweed *(Potamogeton* spp.*)*, except Illinois pondweed
Watermilfoil *(Myriophyllum* spp.*)*, except Variable-Leaf Milfoil
Shoreline Grasses:
Paragrass *(Urochloa mutica)*

Vascular Aquatic Plants Partially Controlled by Avast!

Floating Plants:
Salvinia *(Salvinia* spp.*)*
Watermeal, Common *(Wolffia columbiana)*[1]
[1] Partial control only with Avast! applied at the maximum labeled rate.
Emersed Plants:
Alligatorweed *(Alternathera philoxeroides)*
Cattail *(Typha* spp.*)*
Lotus, American *(Nelumbo lutea)*
Parrotfeather *(Myriophyllum aquaticum)*
Smartweed *(Polygonum* spp.*)*
Spikerush *(Eleocharis* spp.*)*
Waterprimrose, Creeping *(Ludwigia peploides)*
Waterpurslane *(Ludwigia palustris)*
Watershield *(Brasenia schreberi)*
Submersed Plants:
Limnophila *(Limnophila sessiliflora)*
Pondweed, Illinois *(Potamogeton illinoensis)*
Tapegrass; American Eelgrass *(Vallisneria americana)*
Watermilfoil, Variable-Leaf *(Myriophyllum heterophyllum)*
Shoreline Grasses:
Barnyardgrass *(Echinochloa crusgalli)*
Canarygrass, Reed *(Philaris arundinaceae)*
Cutgrass, Giant *(Zizaniopsis miliacea)*
Torpedograss *(Panicum repens)*
Watergrass, Southern *(Hydrochloa caroliniensis)*

Vascular Aquatic Plants Not Controlled by Avast!

Floating Plants:
Water Lettuce *(Pistia stratiotes)*
Emersed Plants:
Arrowhead *(Sagittaria* spp.*)*
Bacopa *(Bacopa* spp.*)*
Big Floatingheart; Banana Lily *(Nymphoides aquatica)*
Bulrush *(Scirpus* spp.*)*
Frogbit, American *(Limnobium spongia)*
Pickerelweed; Lanceleaf *(Pontederia* spp.*)*
Rush *(Juncus* spp.*)*
Waterhyacinth, Floating *(Eichornia crassipes)*
Water Pennywort *(Hydrocotyle umbellata)*
Shoreline Grasses:
Maidencane *(Panicum hemitomon)*

NOTE: Algae (*Chara, Nitella* and filimentous species) are not controlled by Avast!.

MIXING AND APPLICATION DIRECTIONS

The aquatic plants present in the treatment site should be identified prior to application to determine their susceptibility to Avast!. It is also 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 Avast! well before using. Add the recommended amount of Avast! 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. Avast! 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. Avast! may also be diluted with water and the concentrated mix metered into the pumping system.

Tank Mix Recommendations

Avast! may be tank mixed with other aquatic herbicides and algaecides to enhance efficacy and plant selectivity. Refer to the label of the companion herbicide or algaecide for use directions, precautions and restrictions.

Application to Ponds

Avast! may be applied to the entire surface area of a pond. For single applications, rates may be selected to provide 45 to 90 ppb in the treated water. Use the higher rate within the rate range where there is a dense weed mass, when treating more difficult to control species, and for ponds that are less than 5 acres in size with an average depth of less than 4 feet. Application rates necessary to obtain these active ingredient concentrations in treated water are shown in the following table. For additional application rate calculations, refer to the section of this label entitled Application Rate Calculation - Ponds, Lakes and Reservoirs. Split or multiple applications are recommended where dilution of treated water is anticipated; however, the sum of all applications must not exceed a total of 90 ppb per annual growth cycle.

Average Water Depth of Treatment Site (feet)	Quts. of Avast! per Treated Surface Acre 45 ppb to 90 ppb		Fluid Ozs. of Avast! per Treated Surface Acre 45 ppb to 90 ppb	
1	0.12	0.24	3.8	7.7
2	0.24	0.49	7.7	15.7
3	0.37	0.73	11.8	23.4
4	0.49	0.98	15.7	31.4
5	0.61	1.22	19.5	39.0
6	0.73	1.46	23.4	46.7
7	0.85	1.70	27.2	54.4
8	0.98	1.95	31.4	62.4
9	1.10	2.19	35.2	70.1
10	1.22	2.44	39.0	78.1

Application to Lakes and Reservoirs

The following treatments are recommended for treating both whole lakes or reservoirs and partial areas of lakes or reservoirs (bays, etc.). For best results in treating partial lakes and reservoirs, Avast! 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. Rate ranges are provided as a guide to include a wide range of environmental factors, such as target species, plant susceptibility, selectivity and other aquatic plant management objectives. Application rates and methods should be selected to meet the specific lake/reservoir aquatic plant management goals.

Whole Lake or Reservoir Treatments (Limited or No Water Discharge)

Single Application to Whole Lakes or Reservoirs: Where single applications to whole lakes or reservoirs are desired, apply Avast! at an application rate of 10 to 90 ppb. Application rates necessary to obtain these concentrations in treated water are shown in the following table. For additional application rate calculations, refer to the section of this label entitled Application Rate Calculation - Ponds, Lakes and Reservoirs. Choose an application rate to meet the aquatic plant management objective. Where greater plant selectivity is desired, such as when controlling Eurasian watermilfoil and curlyleaf pondweed, choose an application rate lower in the rate range. For other plant species, an aquatic specialist should be contacted to determine when to choose application rates lower in the rate range to meet specific plant management goals. Use the higher rate within the rate range where there is a dense weed mass or when treating more difficult to control plant species. Retreatments may be required to control more difficult to control species or in the event of a heavy rainfall event where dilution of the treatment concentration has occurred. In these cases, a second application or more may be required; however, the sum of all applications cannot exceed 150 ppb per annual growth cycle. Refer to the following section, Split or multiple Applications to Whole Lakes or Reservoirs, for guidelines and maximum rate allowed.

Average Water Depth of Treatment Site (feet)	Quts. of Avast! per Treated Surface Acre 10 ppb to 90 ppb		Fluid Ozs. of Avast! per Treated Surface Acre 10 ppb to 90 ppb	
1	0.03	0.24	1.0	7.7
2	0.05	0.49	1.6	15.7
3	0.08	0.73	2.6	23.4
4	0.11	0.98	3.2	31.4
5	0.14	1.22	4.5	39.0
6	0.16	1.46	5.1	46.7
7	0.19	1.70	6.1	54.4
8	0.22	1.95	7.0	62.4
9	0.24	2.19	7.6	70.1
10	0.27	2.44	8.6	78.1
11	0.30	2.68	9.6	86.0
12	0.32	2.93	10.2	93.8
13	0.35	3.17	11.2	101.4
14	0.38	3.42	12.1	109.4
15	0.41	3.66	13.1	117.1
16	0.43	3.90	13.8	124.8
17	0.46	4.15	14.7	132.2
18	0.49	4.39	15.7	140.5
19	0.51	4.63	16.3	148.2
20	0.54	4.88	17.3	156.2

Split or Multiple Applications to Whole Lakes or Reservoirs: To meet certain plant management objectives, split or multiple applications may be desired in making whole lake treatments. Split or multiple application programs are desirable when the objective is to use the minimum effective dose and, through the use of water analysis, e.g. AvasTest, add additional Avast! to maintain this lower dose for sufficient time to ensure efficacy and enhance selectivity. Water may be treated with an initial application of 6 to 50 ppb. Additional split applications should be made to maintain a sufficient concentration for a minimum of 45 days. In controlling Eurasian watermilfoil and curlyleaf pondweed and where greater plant selectivity is desired, choose an application rate lower in the rate range. For other plant species, an aquatic specialist should be contacted to determine when to choose application rates lower in the rate range to meet specific plant management goals. When utilizing split or multiple applications of Avast!, the utilization of AvasTest is strongly recommended to determine the actual concentration in the water over time. For split or multiple applications, the sum of all applications must not exceed 150 ppb per annual growth cycle.

NOTE: In treating lakes or reservoirs that contain functional potable water intakes and the application requires treating within ¼ mile of potable water intake, no single application can exceed 20 ppb. Additionally, the sum of all applications cannot exceed 150 ppb per annual growth cycle.

Partial Lake or Reservoir Treatments

Where dilution of Avast! with untreated water is anticipated, such as in partial lake or reservoir treatments, split or multiple applications may be used to extend the contact time with the target plants. The application rate and use frequency of Avast! in a partial lake is highly dependent upon the treatment area. Higher application rates may be required and frequency of applications will vary depending upon the potential for untreated water to dilute the Avast! concentration in the treatment area. Use higher rates where greater dilution with untreated water is anticipated.

Treatment Areas Greater than ¼ Mile from a Functional Potable Water Intake: For single applications, apply Avast! at application rates from 30 to 150 ppb. Split or multiple applications may be made, however, the sum of all applications cannot exceed 150 ppb per annual growth cycle. Split applications should be made to maintain a sufficient concentration in the target area for a period of 45 days or longer. The use of AvasTest is recommended to maintain the desired concentration in the target area over time.

Treatment Areas Within ¼ Mile of a Functional Potable Water Intake: In treatment areas that are within ¼ mile of a potable water intake, no single application can exceed 20 ppb. When utilizing split or multiple applications of Avast! for sites that contain a potable water intake, AvasTest is required to determine the actual concentration in the water. Additionally, the sum of all applications cannot exceed 150 ppb per annual growth cycle.

Application Rate Calculation – Ponds, Lakes and Reservoirs

The amount of Avast! to be applied to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:

Quarts of Avast! required per treated surface acre	=	Average water depth of treatment site (feet)	x	Desired ppb concentration of active ingredient	x	0.0027

For example, the quarts per acre of Avast! required to provide a concentration of 25 ppb of active ingredient in water with an average depth of 5 feet is calculated as follows:

5 x 25 x 0.0027 = 0.33 quart per treated surface acre

When measuring quantities of Avast!, quarts may be converted to fluid ounces by multiplying quarts to be measured by 32.
For example, 0.33 quarts x 32 = 10.5 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

Static Canals: In static drainage and irrigiation canals, Avast! should be applied at the rate of 1 to 2 quarts per treated surface area.

Moving Water Canals: The performance of Avast! will be enhanced by restricting or reducing water flow. In slow moving bodies of water, use an application technique that maintains a concentration of 15 to 40 ppb in the target area for a minimum of 45 days. Avast! can be applied by split or multiple broadcast applications or by metering in the product to provide a uniform concentration of the herbicide based upon the flow pattern. The use of AvasTest is recommended to maintain the desired concentration in the target area over time.

Static or Moving Water Canals Containing a Functional Potable Water Intake: In treating a static or moving water canal that contains a functional potable water intake, DO NOT apply Avast! at application rates greater than 20 ppb within ¼ mile (1320 feet) of any functional potable water intake. Applications of less than 20 ppb may be applied within ¼ mile from a functioning potable water intake; however, if applications of Avast! are made within ¼ mile from a potable water intake, the AvasTest must be utilized to demonstrate that concentrations do not exceed 150 ppb at the potable water intake.

Application Rate Calculation – Moving Water Drainage Canals and Irrigation Canals

The amount of Avast! to be applied through a metering system to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:

1. Average flow rate (feet per second) x Average canal width (feet) x Average water depth (feet) x 0.9 = Cubic feet per second (CFS)
2. CFS x 1.98 = acre-feet per day (water movement)
3. Acre-feet per day x desired ppb x 0.0027 = Quarts of Avast! required per day

WARRANTY STATEMENT

GRIFFIN warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. It is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials or the manner of use or application, all of which are beyond the control of GRIFFIN. In no case shall GRIFFIN be liable for consequential, special or indirect damages resulting from the use or handling of this product. All such risks shall be assumed by the Buyer. The exclusive remedy of any buyer or user of this product for any and all losses, injuries, or damages resulting from or in any way arising from the use, handling, or application of this product, whether in contract, warranty, tort, negligence, strict liability, or otherwise, shall not exceed the purchase price paid for this product or at GRIFFIN'S election, the replacement of this product. GRIFFIN MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

Avast! is a registered trademark of Griffin L.L.C.
AvasTest is a trademark of Griffin L.L.C.
Griffin and Design are a registered trademark of Griffin Corporation.

PUBLIC COMMENTS

Doug,

I have receipts from the treatment done on Lake Bonney using Sonar.

The first date is 5/18/87 at the cost of $2.50 per foot. The contractor was Aquatics Unlimited Northwest Inc, 22647 88 Ave South, Kent WA 98031

The second date is 7/9/1993 and was done by Resource Management 2900-B 29th Ave SW, Tumwater WA 98502 206-754-3460

The third treatment was in 1997 and was also done with Sonar/Rodeo by Terry McNab.

If you would like copies of these receipts let me know I will be glad to bring them on the 3rd. **I would like my name listed on page 8 of the IAVMP under personal communication for treatment history of Lake Bonney since this information will also be listed on the IAVMP.**

I will be bringing pictures of Lake Bonney for you to review for our cover of the IAVMP.

Thank you again for all your effort and hard work Doug.

Sue Elsey
18212 77th St East
Bonney Lake,WA 98391

Doug,

I have contacted the folks living around Lake Bonney that do not have computer access and asked if they would like their voices to be heard during this comment period. I volunteered to send their comments on my computer to you in this email. I will send you the original hard copies from these three individuals or deliver them to you at the November 3rd meeting so you can keep them for your records.

Sue Elsey

October 23,2005

To whom it may concern,

I have been a resident on Lake Bonney since 1956, and it was a pristine lake at that time. However, as the area became more populated, and trees were removed, lawns were fertilized and had chemical weed control applied, the lake began to change for the worse.

We hoped that sewers would help, the problem continued to grow.

At this time, with the all the weed growth and the algae problems, I would like to see chemicals used. Whatever it takes.

Helen Bodine
18311 77th St E
Bonney Lake, WA 98391

To Doug Dorling
Re: IAVMP

My husband and I bought our home on Bonney Lake in 1991. It was clear, clean, blue and so beautiful when the sun was out it looked like a thousand diamonds shimmering at us. No more!

It is now a lake that the children can't swim in and even going out in our boats is not enjoyable. For some years the owners on the lake paid (per lake footage) to have the lake treated. This did help, but was discontinued some years ago.

Many people on the lake have spent many hours doing a "Lake Rake" but as quoted in the paper "It's us against the algae and the algae is winning."

We are grateful that we now have the attention and support of the city council to help preserve this priceless jewel in Bonney Lake.

Please-Please use the chemicals that are compatible with our lake in Spring 2006 so we don't have another summer like the last two.

Kay Bressler

October 23, 2005

Doug
Northwest Aquatic Eco-Systems

After receiving a draft of the IAVMP we'd like to share our strong feelings about Bonney Lake and it's future.

Our goal: To have a healthy aquatic environment for the welfare of people, fish and wildlife.

We feel it will take chemical treatment for non-native, noxious and nuisance plants that have taken over our lake. Chemical treatment we feel is also warranted to control the algae.

We are very interested in having the "Solar Bee" installed to see what advantages it may produce. To us it just can't hurt anything, so why not.

We have tried harvesting weeds and cutting the water iris and pods but the cuttings that accidentaly drop into the water can float and reattach elsewhere. Scooping the globs of algae is endless and really nonproductive because of the wind and water movements. The globs just float to another yard.

We are very proud of our lake group, Lake Bonney Conservation Association, because we all care very much about the well being of Lake Bonney now and in the future.

Bob and Sherry Leistiko
18209 74th St E
Bonney Lake, WA 98391

Thanks for your impressive effort so far, Doug!

2. I suggest the following for improvement of this document:

a. Section VI. on pages 23 thru 34:

* Rank the plants, listed in the table on p. 24, in priority order for start of management efforts. The most important species to start control efforts, before others, would be listed first.

* I don't see information about the most vulnerable stage, for control efforts, in the life cycle of each species listed. This knowledge is essential to reverse population increase.

* Bluegreen algae isn't named here. Why not?

b. Section VII. on pages 35 thru 61:

* Above the normal waterline what site-specific actions in the past 50 years have contributed the most to the present weed probems in the lake? What remediation actions are possible now?

* Watershed Controls, pp. 42-43: Instead of lame generalities and so much use of "not" and "unlikely", why not give specific examples of applicable BMPs? What plants in association with other plants to function as an organic sponge, as in an area forest? What curbing and surface run-off collection devices, and where to be placed, including the fishing access from 74th Street? What would make the shoreline less attractive and usable for Giant Canadas? Who has "success stories" in the Pacific Northwest?

Doug,

I have been a resident on Lake Bonney for 20 years, and have seen many changes relating to the lake and its surrounding area. I have spent many summers floating on and swimming in this beautiful lake, but have been dismayed at its seemingly quick deterioration. I realize there are many reasons for this deterioration, but am heartened to know that there is community and municipal interst in addressing the issue.

We have heard pros and cons about past and future use of chemicals to treat specific problems. We have also recently tried manual harvesting and have heard information about the "Solar Bee". I am in favor of using the "Solar Bee" for eradicating any blue green algae that we may have, and feel that continued use of this circulator can effect a slow but positive change in the overall quality of the water in this lake. Eradicating the blue green algae with this product will help promote a natural process of positive change over a long period of time.

At the same time, I am in favor of using the appropriate chemicals to specifically target noxious, non native and nusiance vegetation. In a perfect world, we would have a good sized volunteer base to manually harvest, but that is not the case here. About half the homeowners on the lake are not members of the Association that has been formed, and of those that are members, I know of only 2 that have volunteered to do the work of manually harvesting their water frontage. That said, I am not in favor of the manual removal (raking) of the naja that has flourished. Page 39 of the Draft indicates that one of the drawbacks of this process is that it can actually spread the plants. After taking part in the first "Lake Rake" in Sept 2004, I feel any effort to continue this process would be like "spinning our wheels" and would not be the best solution to that specific problem.

Thank you Doug, for your hard work on this project and for the opportunity to express my personal views.

Sharon Steele

EarthLink Revolves Around You.

Doug,

Which herbicide do you recommend?
Is data available for its long term
affect on the lake? see pages 23-24

The lake has been monitored for 2 yrs.
Stream Team & John Woodcock can supply
you with the appropriate data which will
help you in assessing our DO and
stratification etc. and help determine if
the Solarbee could be a viable option for us.

I enjoyed reading the draft (sidenotes
we are the Lake Bonney Conservation Association)
and think it will be a valuable tool for us.

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