2016 Clear Lake
Aquatic Weed Control Program

Prepared for

Clear Lake LMD #4
Skagit County Public Works
Mount Vernon, Washington

Prepared by

Northwest Aquatic Eco-Systems, Inc.
855 Trosper Road SW #108-313
Tumwater, Washington 98512
Pondweeds@comcast.net
Telephone: (360) 357-3285

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Project Overview

This was Northwest Aquatic Eco-Systems (NWAE) fifth year providing aquatic weed control services for the Clear Lake LMD #4 district. Clear Lake has been actively involved with an intense program to eradicate noxious aquatic macrophytes from the system for a number of years. The Local Management District was formed to specifically address these issues. Targeted species include Eurasian watermilfoil and Nymphaea odorata. Densities of Eurasian water-milfoil plants have been reduced considerably and are now contained mainly to an area located by the public swimming area. Lily pad sites have been responding positively to years of prior treatment and this slow process will continue. Some residents living along the shoreline have requested that no herbicides be applied to their lakefront. Such requests have been respected. The entire lake's littoral zone currently supports a wide range of native plant species. This growth extends outward beyond the 15 foot contour line and consumes much of the entire lake shoreline. These native plant stands also support sporadic single plant milfoil growth.

Resident native species now pose the same recreational problems often associated with the milfoil noxious species. Management practices of the lake have evolved over the past few years to incorporate the control of native species at acceptable levels while also monitoring and controlling single milfoil plants that may always remain within the system. The 2016 effort once again utilized the use Aquathol K along troublesome shoreline areas and diquat within other shoreline sites. The use of both products as either individual applications or as a tank mix has resulted in far superior control during the 2015 & 2016 campaigns.

This 2016 report contains information identified in earlier reports in an effort for reviewers to understand most all the activities undertaken at Clear Lake without requiring the review of each yearly report. Similar to 2014 & 2015 during the 2016 submersed weed control component of the project, the public swimming beach was closed down prior to and for 24 hours following the submersed weed operation.

Survey Protocol

As has been utilized in the past, NWAE continued to incorporate the new state of the art electronic surveying equipment in an effort to produce a survey that could easily be understood by all reviewers. Typically, past sampling consisted of manually retrieving weed samples from numerous locations lake-wide while observing growth through the water column. Although effective, individual bottom sampling can only identify plants within the immediate area sampled. Visual observations when water clarity permits is a far superior method for plant inventory since it allows for inspection of the entire lake bottom wherever the survey boat operates. This avoids the possibility of missing plants between bottom surveying data points. The old survey protocol employed a surface vehicle shadowing the weed bed borders and collecting data points corresponding to small or large occurrences of plants. To ensure the efficacy of the survey, a bottom

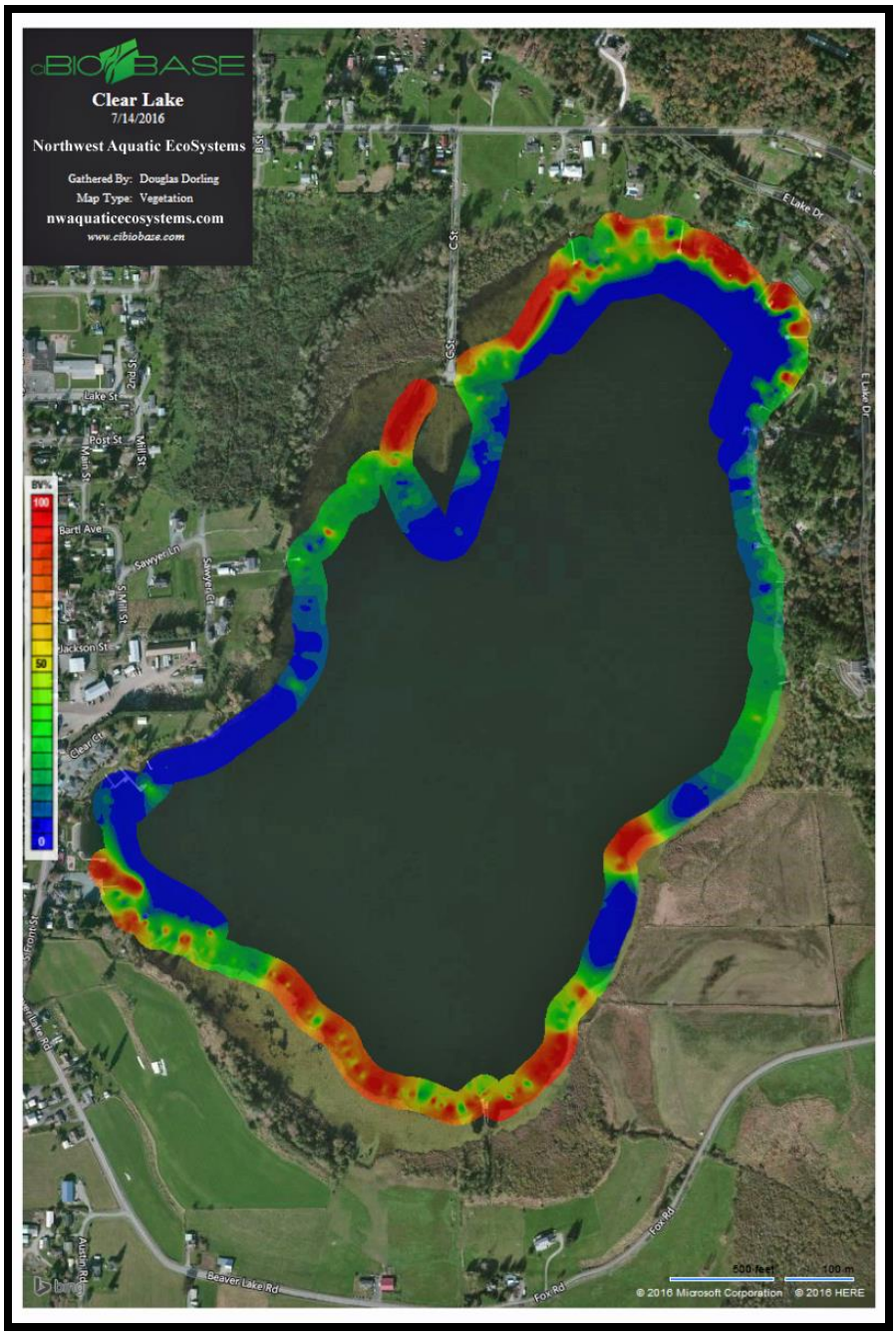
sampling rake is thrown from the boat at various locations lake-wide. The rake is then drawn across the lake bottom, brought to the surface and into the boat. Plants attached to the rake are identified and confirmed as being the same species as noted visually through the water column. If the lake bottom is void of plants, no data is stored. The survey boat typically spends the entire survey within the lakes littoral zone while completing the task. This older system produced sub meter accuracy, automatically identified and stored the position of every sampling data point. Data points are then assembled as a map layer, which are then incorporated into the project file.

During 2014, 2015 & 2016 the survey collected sonar data utilizing specific transducers and bottom scanning equipment. The survey boat traveled along pre-determined transect lines that were spaced approximately 100 feet apart. Once the entire lake's littoral zone had been traveled and no vegetation appeared on the chart recorder, the survey was terminated. Data collected on the SD card was then uploaded via cloud based technology and the processing of the data was finalized. The resulting work product is a color coded map of the lake bottom identifying weed growth areas and plant densities. Not only was a well-defined map produced but a sonar log of the survey was saved allowing a complete review and evaluation of the survey to occur in house. The sonar log allows you the ability to view all plant growth along the boats survey tracks. When nonnative milfoil species were identified, a milfoil specific data point was added to the transect line to ensure that the integrity of the survey bottom sampling was conducted at various locations along the transect lines.

Clear Lake Pre Treatment Survey Results

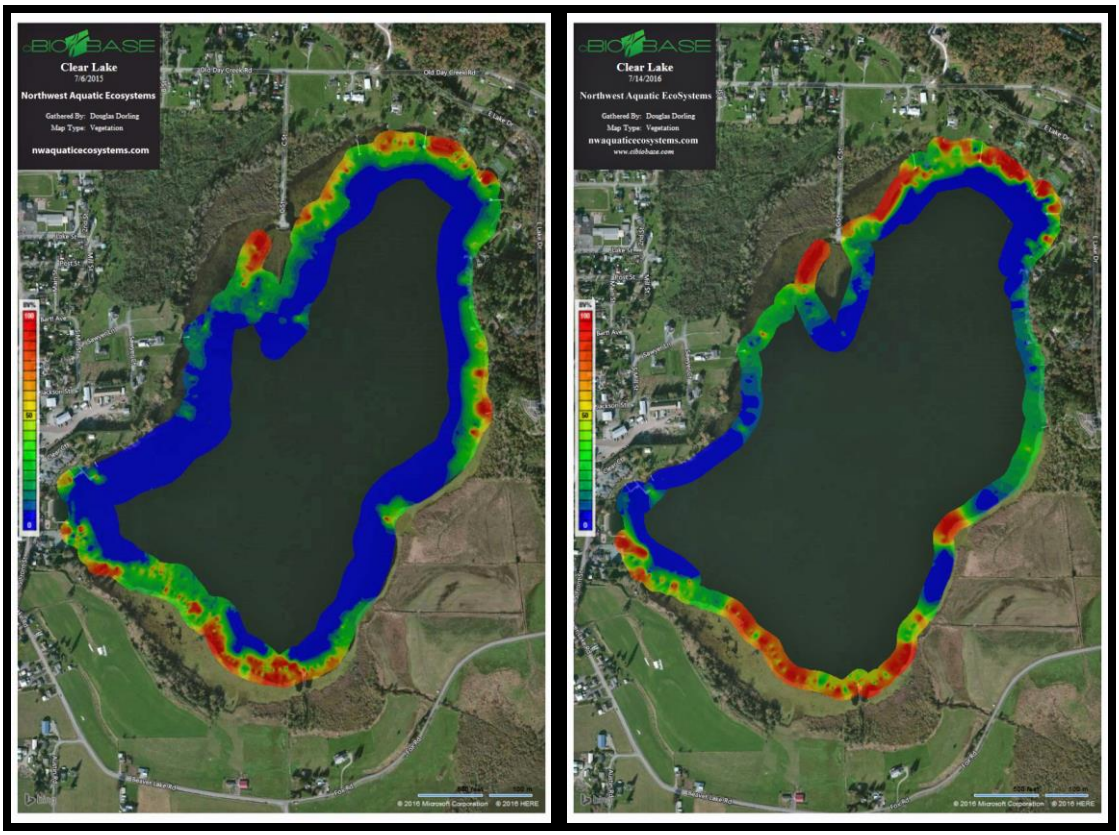
Clear Lake was surveyed on July 14, 2016. Water clarity was good with visibility reaching nearly to the bottom throughout most of the lake's littoral zone. Milfoil was identified once again within those lake areas that have historically experienced limited single plant growth. Plants were sporadic in nature posing no potential recreational hazards. Much of the lake's shoreline was experiencing various degrees of native plant growth. Some lake shorelines were already experiencing growth up to the water's surface. There were no extended lake shoreline areas that were not experiencing some form of native plant growth. This survey produced similar results as were noted during past surveys. The 2016 survey identified the same native species present that have historically been observed lake wide. Weed densities appeared similar to those noted in the past. Although some lake shoreline areas were experiencing decreased weed growth other regions exhibited accelerated growth. Species identified would include Potamogeton amplifolius, P. robbinsii, P. natans, P. gramineus, Vallisineria americana, Elodea canadensis and Utricularia vulgaris. The most prolific pondweed was P. zosteriformis while there were other thin leafed pondweeds that could not be identified in the field. Similar to other lakes in the area, different shoreline sections of the lake were dominated by dissimilar submersed species.

Since a large segment of the shoreline is absent of residential dwellings these shoreline areas are targeted to receive no native macrophyte treatment. Unfortunately, these untreated areas typically are those sites that produce seed heads and are the source of sustained yearly seed production. Such seed production is eventually deposited lake wide through the waterfowl population and wind.



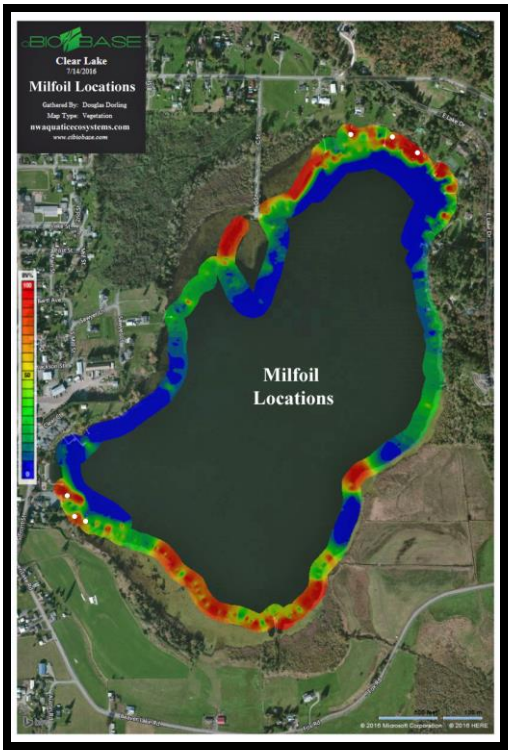
Spring Survey 2016

Red areas indicate 100 percent coverage
Blue areas indicate 0 percent coverage



7-06-2015 7-14-2016

Red areas indicate maximum plant biomass occupying the entire water column.
Blue areas indicate no plant biomass, green - 50% coverage



July 21 Treatment

Under current NPDES guidelines, native macrophyte control is limited to no more than 50% of the shoreline or approximately 6,300 feet. The permit also mandates that "the geographic area where the Permittee intentionally applies chemicals must remain the same for the entire length of the permit coverage up to the maximum percentage of the littoral zone allowed by the water body". In essence, once native plant treatment sites within Clear Lake reach the 50% threshold level, no further expansion of the treatment areas are permitted. The new cycle period for the next permit began during 2016. With the establishment of the new permit cycle, changes in the treatment areas can be evaluated and altered, if necessary, to conform to the fluctuating environmental conditions lake wide.

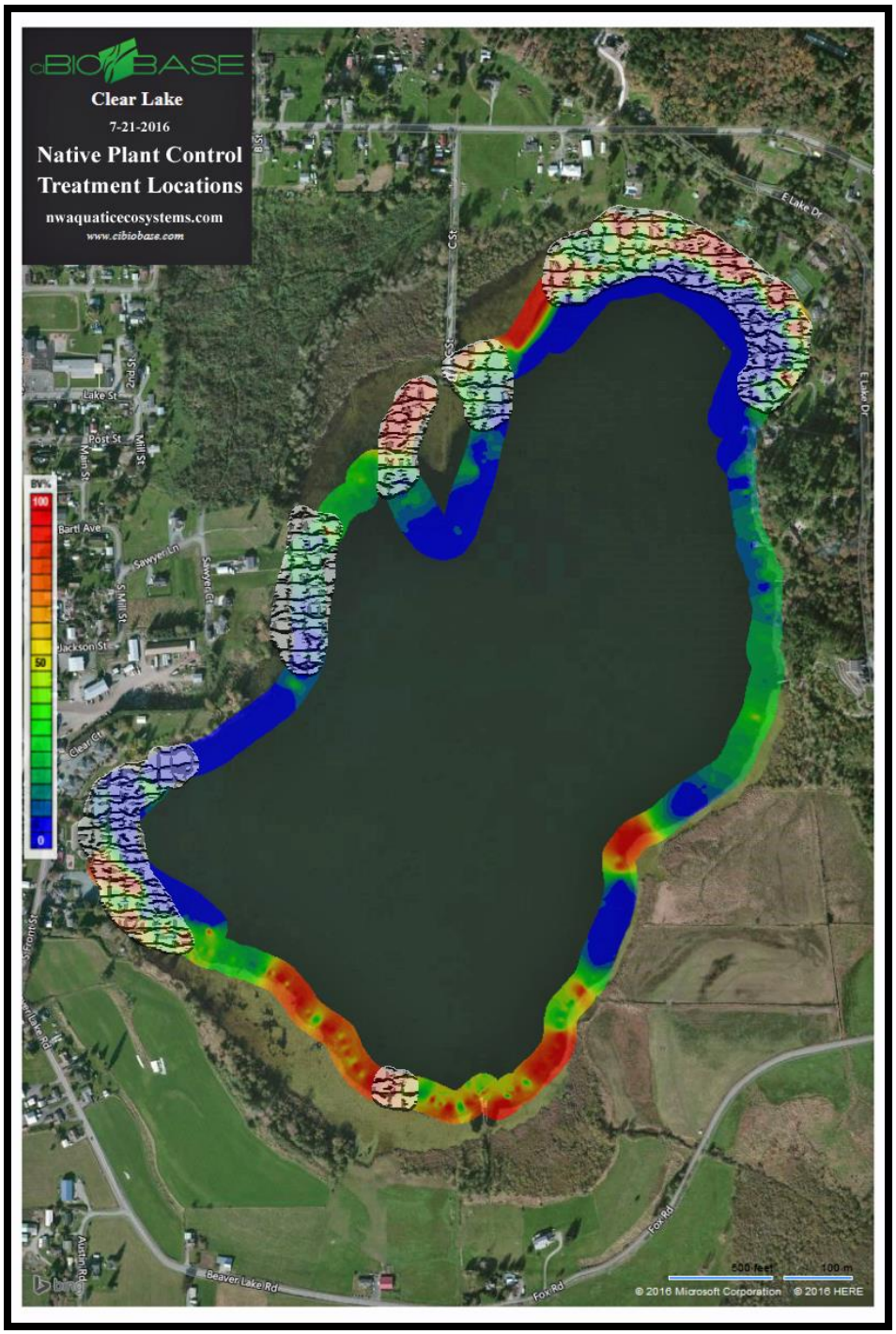
Our approach during 2016 was similar to 2014 and 2015. Provide lake property owners with an acceptable degree of native plant control while continuing the project goals of attacking milfoil infestations when identified.

Shoreline posting was conducted on the day of treatment. A two person crew initiated posting and treatment of the lake upon arrival in the early morning. Early site arrival was necessary in order to ensure that no public beach participants had arrived for daily site use. One small boat posted the lake and swim area while the treatment boat proceeded to treat those areas already posted. Signage posted on the swim beach indicated that lake water use was closed during the treatment and for 24 hours post application. Material was offloaded from a locked truck container and transferred into two 25 gallon spray tanks mounted on the application boat. Containers were triple rinsed on site and returned empty, back into the truck. Material was applied utilizing an 18 foot Airgator airboat. Lake water was drawn into the boat through intake ports located in the hull of the boat. Herbicide was then metered into the lake water via an injection manifold. Once the herbicide was injected, the water was then discharged back into the lake. Weighted hoses were used to place the material at the appropriate depth in the water column. Prior to treatment, a lake treatment map, identifying treatment plots was downloaded into the onboard GPS system. The boat utilized the onboard GPS to identify treatment site boundaries. Tanks were refilled and dispensed as needed. Submersed weeds were treated with Diquat at a rate of two gallons per surface acre in waters over three feet deep and one gallon per acre in waters less than 3 feet in depth. All of the targeted submersed weeds were treated on July 21.

NWAE utilized both Aquathol K and diquat in the northern shoreline areas of the lake. The mixture was applied as a tank mix.

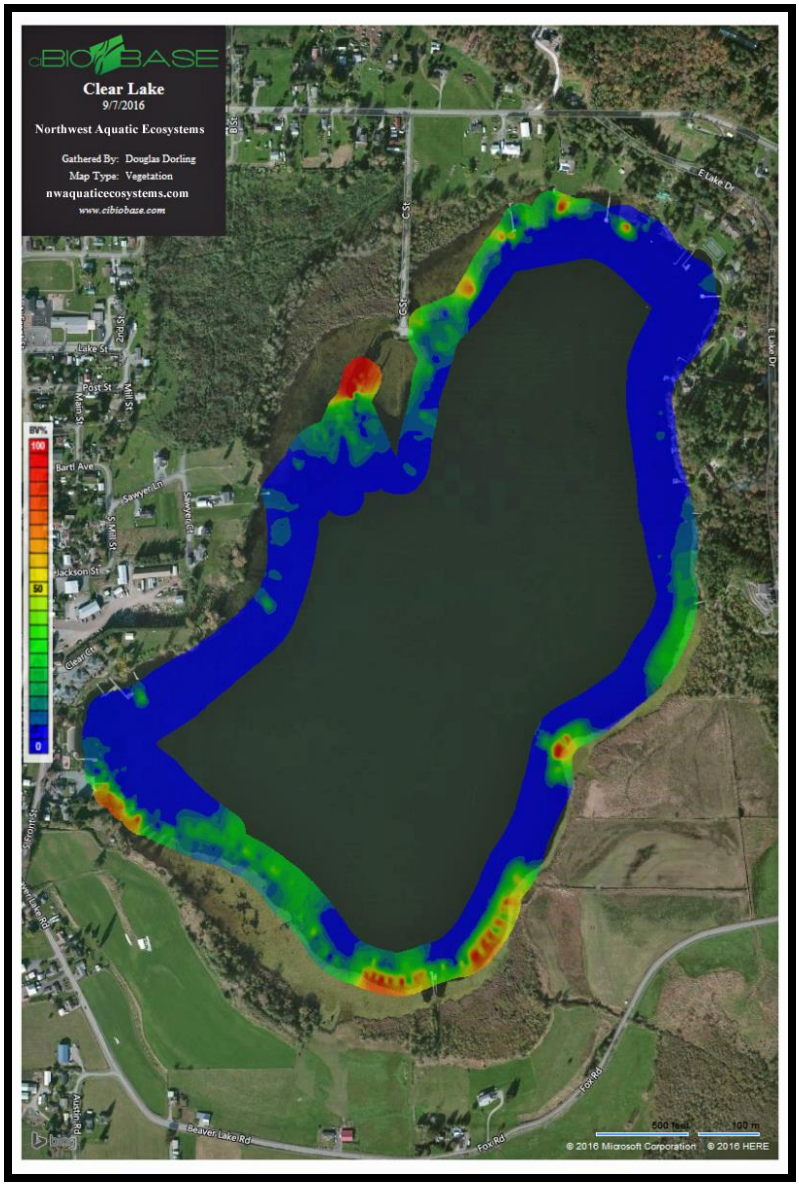
An 18 foot aluminum boat equipped with one 25 gallon spray tank and the airboat were both utilized during the spraying of the lily pads. The 25 gallon tanks aboard each vessel were filled with lake water and herbicide, and then surfactant was added directly into the tank. Once mixed, the application boats drove along the shoreline identifying targeted floating plants and the spray mixture was then discharged using a spray gun. When emptied, the tank was refilled and dispensed as needed. Lily pads received a 1.0%

solution of glyphosate sprayed directly onto the floating leaves. The airboat proceeded counterclockwise along the shoreline from the boat launch while the smaller vessel traveled clockwise. Similar areas treated during 2015 received treatment again during 2016.

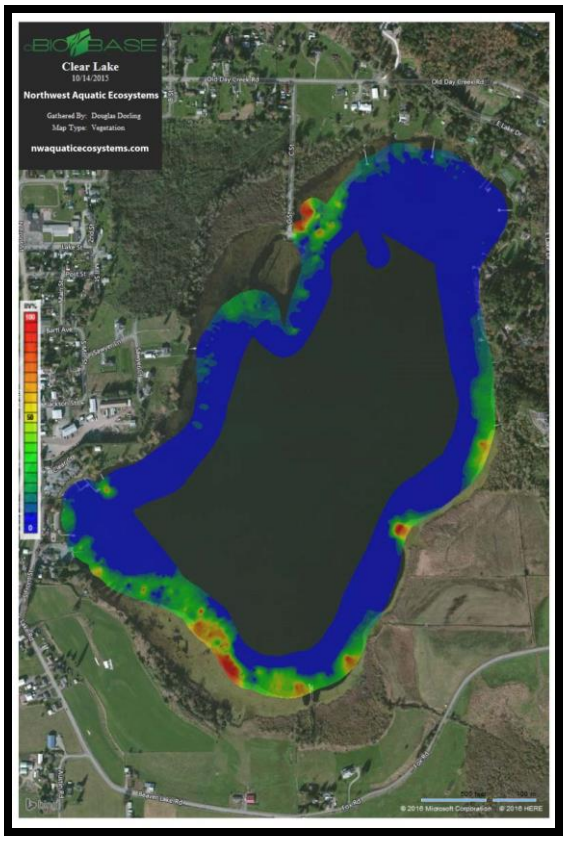


Fall Survey

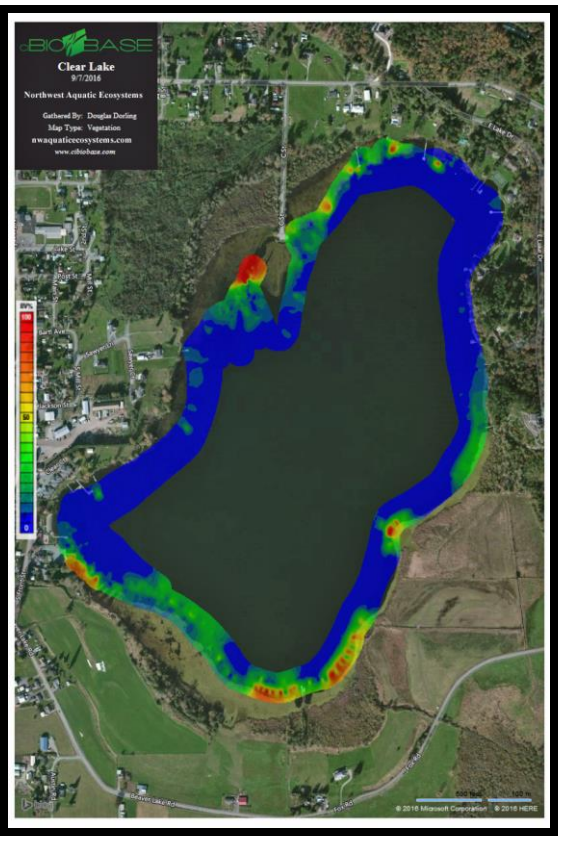
The fall survey was performed on September 7, 2016. No milfoil plants were identified throughout the littoral zone of the lake. Areas that had received treatment earlier in the season were noted consisting of macrophyte growth that was considerably reduced in density from those lake sections not treated. Many of the pondweeds had already decomposed with some of the treated bottom sediments void of macrophyte growth. The larger thick stemmed species were void of leaf structures. However, main stem components were still lying along the bottom decomposing. Re-occurring weed growth was similar to regrowth noted during 2015 but reduced from earlier treatment years.



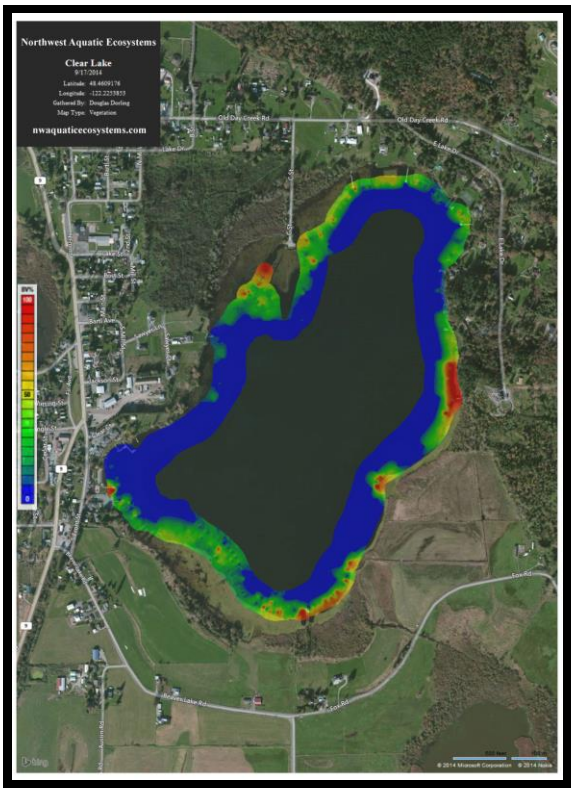
Fall Survey 2016



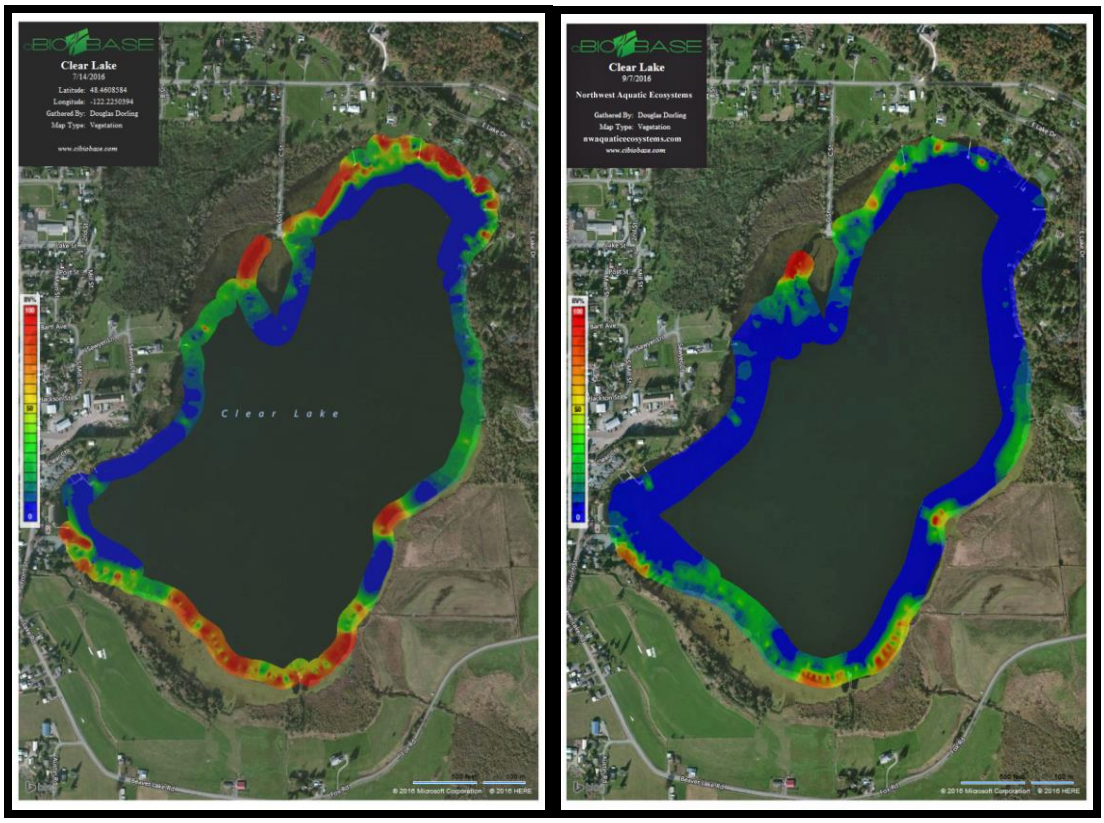
Fall 2015



Fall 2016



Fall 2014

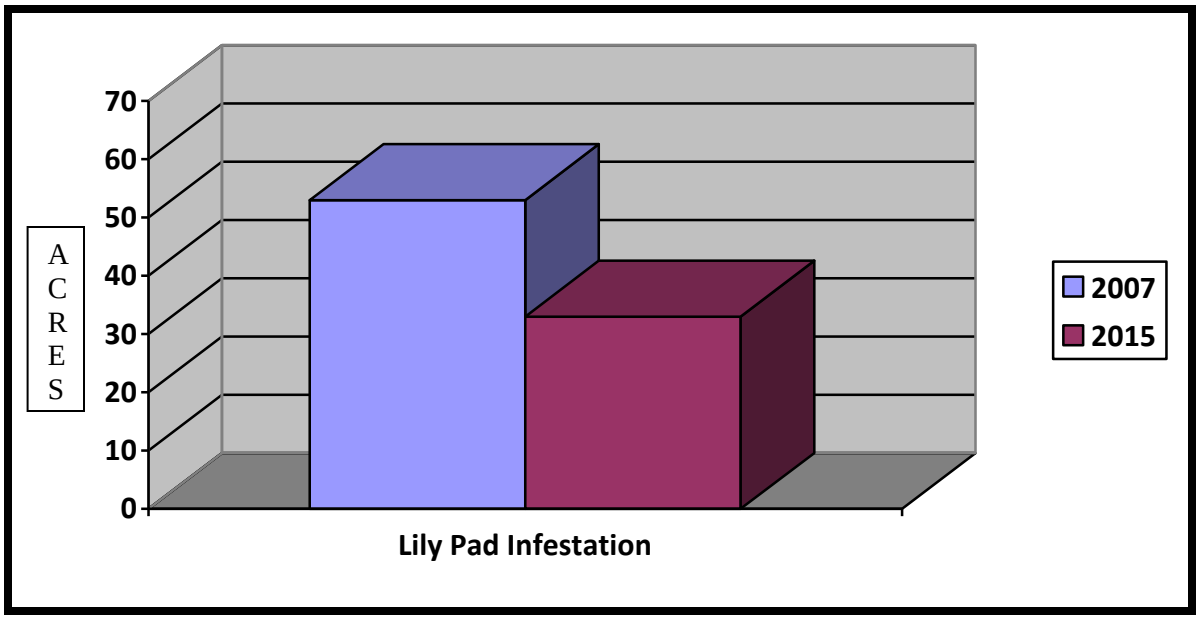


Spring 2016 Fall 2016

Lily Pad Control Update

The Clear Lake LMD started treatments during 2007. At the time of the LMD formation approximately 53 acres (personal communication LMD) of the lake was infested with the fragrant water lily, a Washington State noxious species. Since inception, the LMD has been actively targeting this species on a yearly basis by applying state registered herbicides according to the manufactures recommendation and label specifications.

In an effort to document the progress of the control activities, a June 2015 satellite image of the lake was digitized and evaluated to obtain the current acreage of the fragrant lily pad population lake wide. The resulting effort resulted in a determination that the current infestation consists of approximately 33 acres.


70
60
50
40
30
20
10
0
ACRES
Lily Pad Infestation
2007
2015

2007 **2015**

2007 **2015**

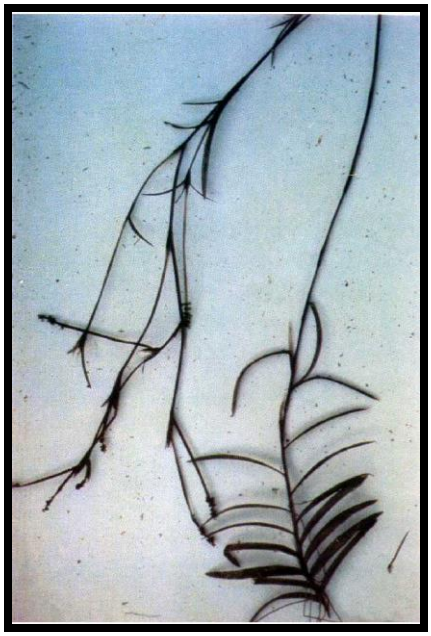
2007 **2015**

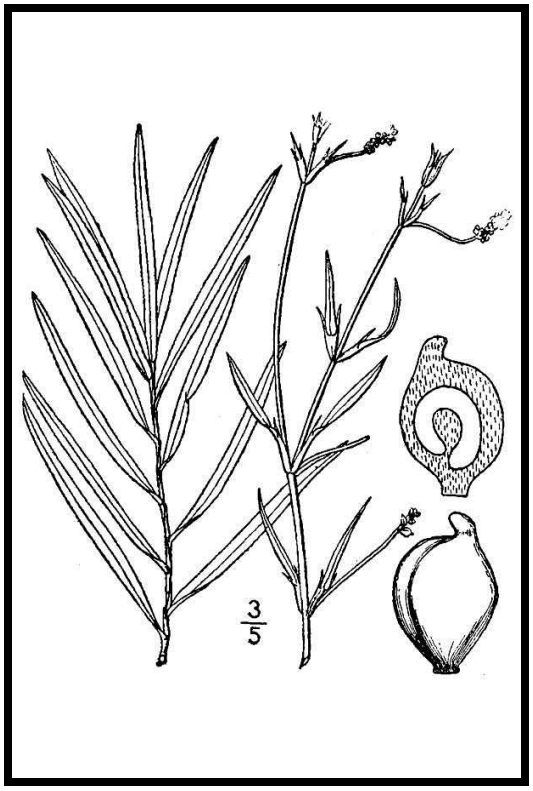
Recommendations

1. The new 2016 treatment format still allows for additional native shoreline treatment if necessary. Clear Lake supports ample nonresidential shoreline areas that will adequately provide the required buffer without impacting residential recreational use.
2. There is only one native weed species that will prove to be difficult to control when necessary. Vallisneria americana (tape grass). Presently this species is not one of the dominant weeds lake-wide but is noted sporadically throughout the lake.
3. Use of Aquathol K and diquat should be continued into the 2017 season. Use of Aquathol K has produced similar results within Clear Lake as observed with other waterbodies statewide. Although Aquathol K is a more expensive product it's use with diquat has resulted in better control in those areas susceptible to soft, light organic soils.
4. Continued communication between residents and the consultant in an effort to keep property owners informed of the current weed growth conditions, what species are native and noxious species, what plants are targeted for control and what plants cannot be controlled. More dialogue between the consultant and the homeowners may result in a better understanding as to the homeowners concerns. This approach would probably result in a more effective treatment format.
5. Noxious species appear to no longer represent the problematic species lake-wide. The range and location of milfoil plants have stabilized and not much expansion has been detected over the years. Plants currently coexist in mixed stands of native species. Low density milfoil growth can now seasonally be controlled with either contact herbicides or specifically targeted with systemic materials. How these species are controlled and what materials should be applied requires evaluation following the spring survey. Actions that may or may not be implemented will probably change on a year to year basis. One year native and noxious weeds may be targeted with a contact herbicide while during other years only milfoil may be targeted with systemic products.
6. The spring survey should be considered the more important of the two scheduled surveys. This survey will determine what plants are targeted and what materials will be used during any treatment year. The late summer survey is performed too late in the season to direct any further native weed control operations. In general, this survey will identify where successful control operations occurred and the need for any additional late season milfoil treatments.

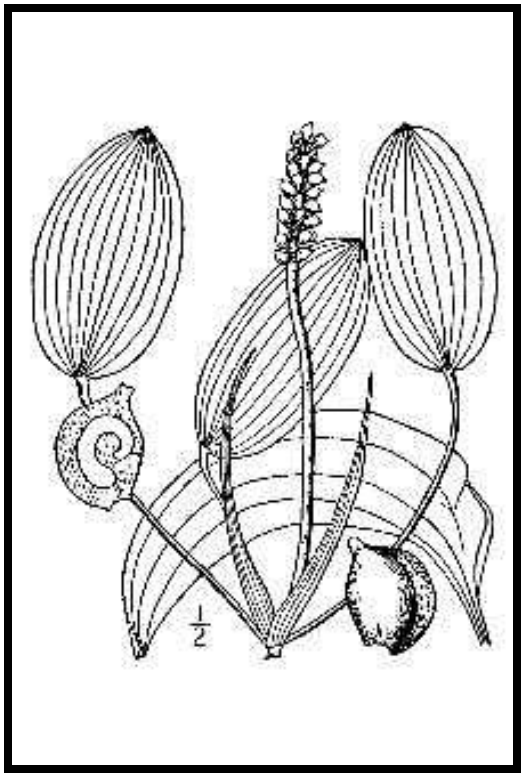
Dominant Submersed Macrophyte Species

Potamogeton robbinsii

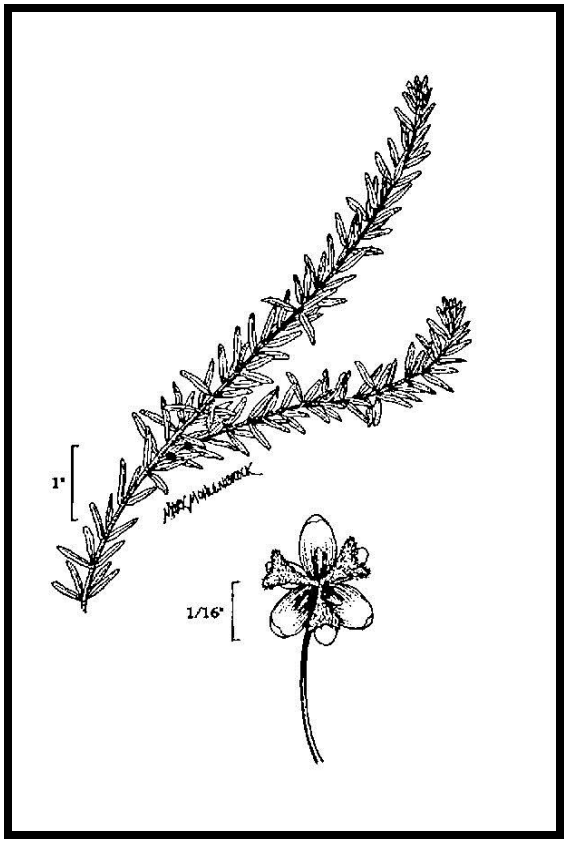




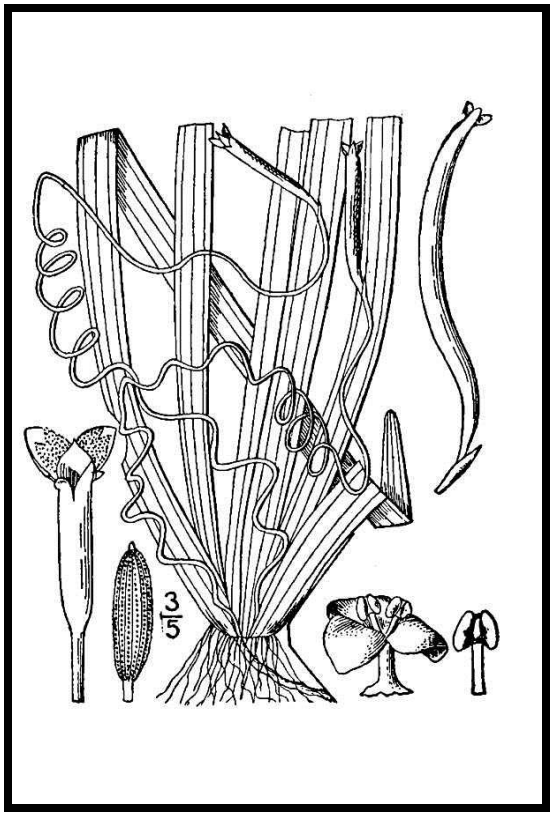
Potamogeton amplifolius



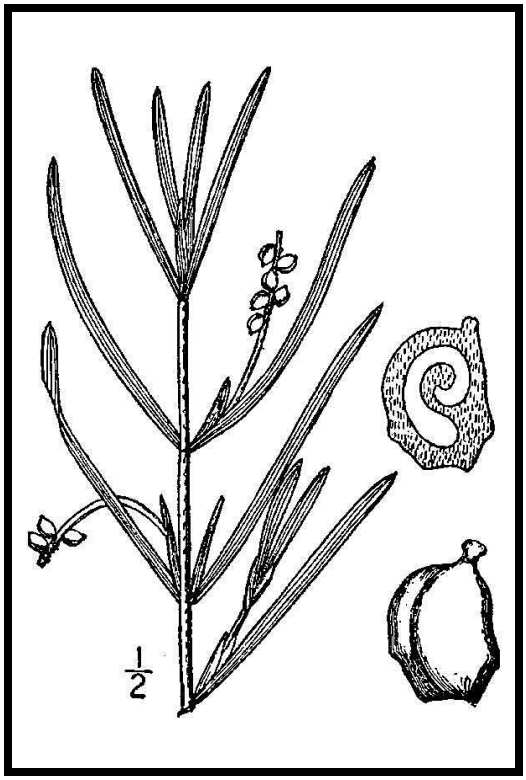
Elodea canadensis



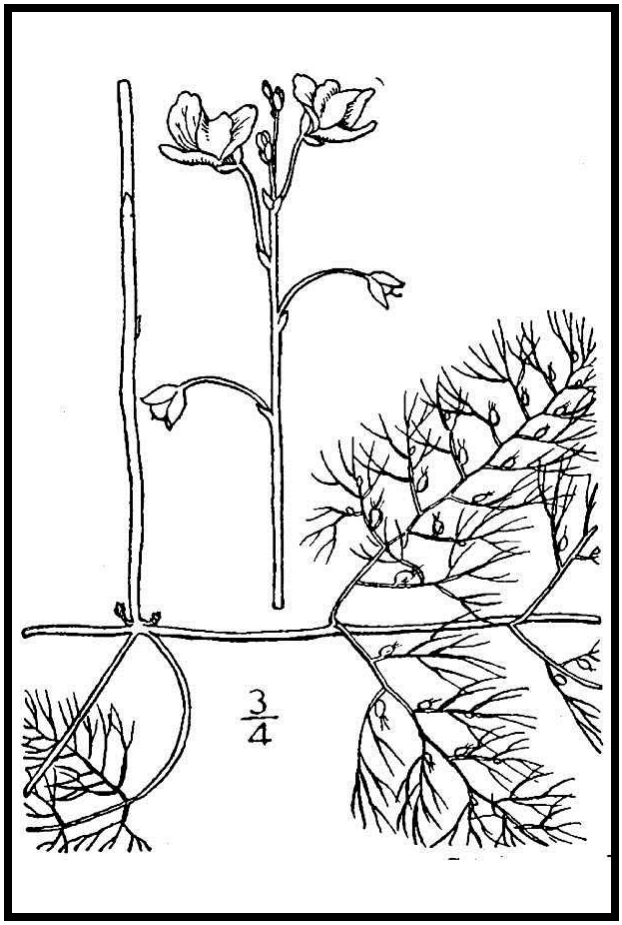
Vallisneria americana



Potamogeton zosteriformis



Utricularia vulgaris



Potamogeton gramineus