

# 2022 Big Lake Aquatic Weed Control Program

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Prepared for  
Big Lake LMD #1  
Skagit County Public Works  
Mount Vernon, Washington



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## **Project Overview**

Fish timing window issues plagued this year's program delaying treatment to August 1, 2022. At the onset of the season a request was made by NWAEE to the Department of Ecology to have the fish timing window changed from July 15 to June 15. During the past few years NWAEE was working under the issuance of the new statewide NPDES permit which nullified the previous observed June 15 treatment window and instituted the original July 15 start date. Prior to the issuance of the new permit, the LMD board and the regional fish biologist had discussions addressing the changing of the treatment window from July 15 to June 15. It appeared that the regional fish habitat manager was in agreement with the change and the LMD began operating under the June 15 date during the 2017 season. When the revised 2021 Big Lake permit was issued NWAEE noted that the fish timing window had been changed back to July 15. The permitted fish timing window for Big Lake was exceptionally confusing for 2022. The original decision by Ecology afforded the Big Lake residents no means to manage the lake for 2022. At the eleventh hour, Ecology changed their position on Big Lake and granted a fish timing window of July 15. Once a workable timing window was issued, treatment notices were mailed out and a treatment was scheduled.

The July 15 treatment window created issues associated with appropriate treatment. By July 15, weeds had historically started forming surface mats and densities that restricted recreational lake use. As our targeted treatment date of Aug 1 approached, lake water levels had started to decline exposing a greater percentage of the muck bottom to wave action and resuspension of sediment. These sediment issues resulted in the increased use of Aquathol K.

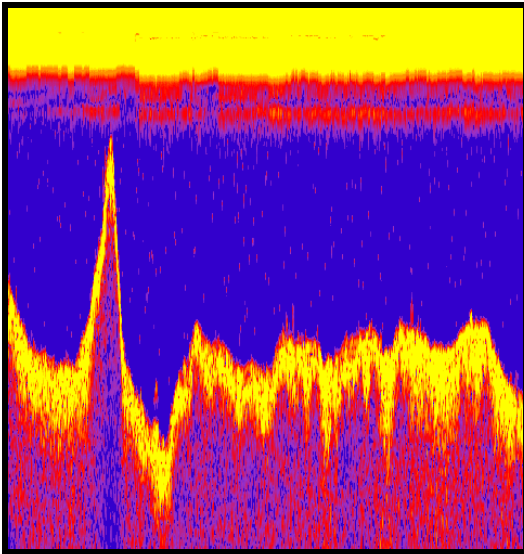
The inability to secure a fish timing window from the Department of Ecology that provided a reasonable approach to aquatic weed control early in the season nearly eliminated any weed control efforts at the lake for the 2022 season. Further discussion of the fish timing window will occur later in the report.

## **Survey Protocol**

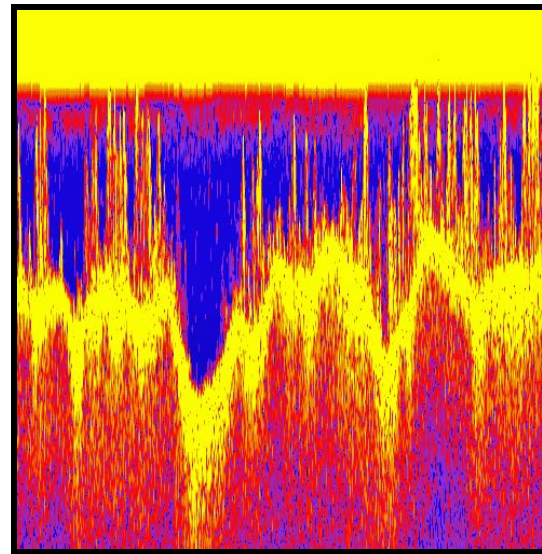
Survey techniques for 2022 once again utilized the sonar mapping technology initiated during the 2013 treatment season and has been utilized every year since. The current mapping protocol is now an industry standard utilized worldwide. Current mapping technology incorporates sonar technology with on board chart recording. Sonar data is collected on board and processed to produce an on-screen map of the lake bottom as the boat transects the lake. When weeds are no longer observed along the lake bottom, the collection of sonar data is terminated. Once collected, the SD card is uploaded via cloud-based technology and the processing of the data is finalized. The resulting product is a color-coded map of the lake bottom identifying weed growth areas and plant densities. Not only is a well-defined map produced but a sonar log of the survey is saved allowing a complete review and evaluation of the survey to occur in-house. This updated protocol encompasses a surface vehicle transecting the lake along the littoral zone. Boat tracks are designed to be approximately 100 feet apart. 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 through the structure scan or visually through the water column. The system automatically calculates and stores the position of every transect data point enabling the mapping of thousands of data points on a daily basis.

When individual milfoil plants were identified from the surface, waypoints were added to the transect line.



Weed Free Lake Bottom



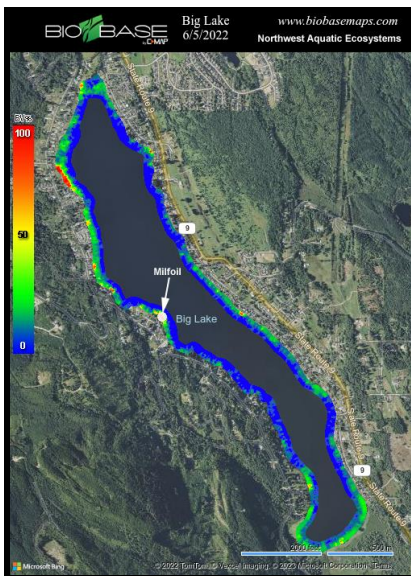
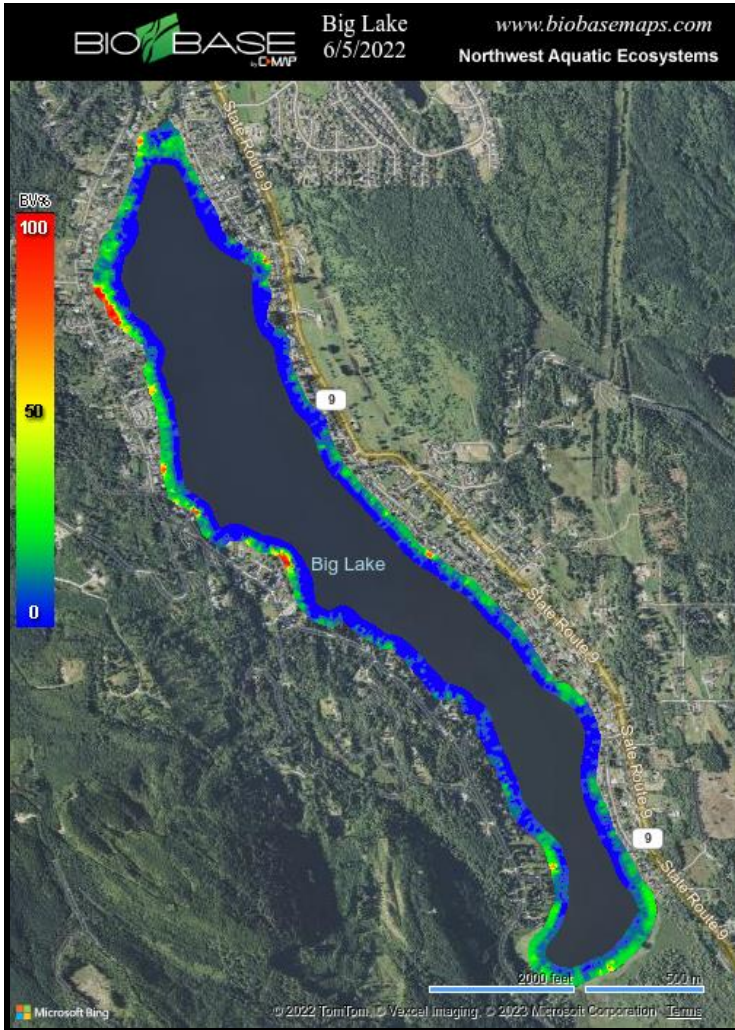
Dense Weed Growth Lake Bottom

## Big Lake Pre-Treatment Survey Results

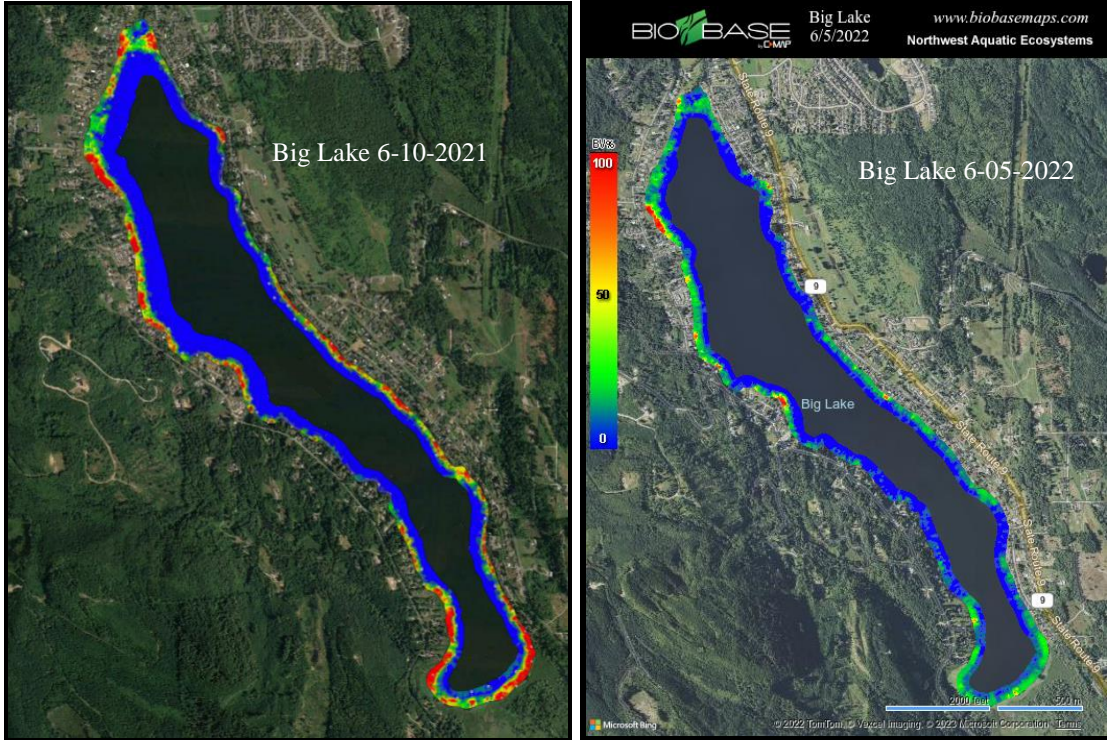
Big Lake was surveyed on June 05, 2022, within the same timeline as the past four spring surveys. Weed growth was less dense than in any years since the current BioBase surveying protocol was utilized. Also noted and likely responsible for the declined densities was the fact that water temperature at this time of the year was also the lowest noted since 2014. Lakes state-wide were typically five to ten degrees lower than normal at the onset of the early June survey. Decreased water temperatures typically delay seed germination and reduce the rate of plant growth. Water clarity was good with no algae related issues present.

Weed species noted during the 2022 survey were similar to those identified in prior surveys. NWAEC has not noted any major changes in plant species lake-wide. Native plants identified during 2014 were still present within the system during 2022. No *B. elodea* was noted in the southeast quadrant of the lake. No new native species were recognized. The lake's littoral zone is dominated by *P. robbinsii*, *P. zosteriformis*, *P. epihydrus*, *P. richardsoni*, *vallisneri* and *elodea*. Different weed species were dominant depending on the shoreline area sampled. In general *P. robbinsii* is dominant lake-wide.

Only one shoreline location lake-wide exhibited milfoil growth.

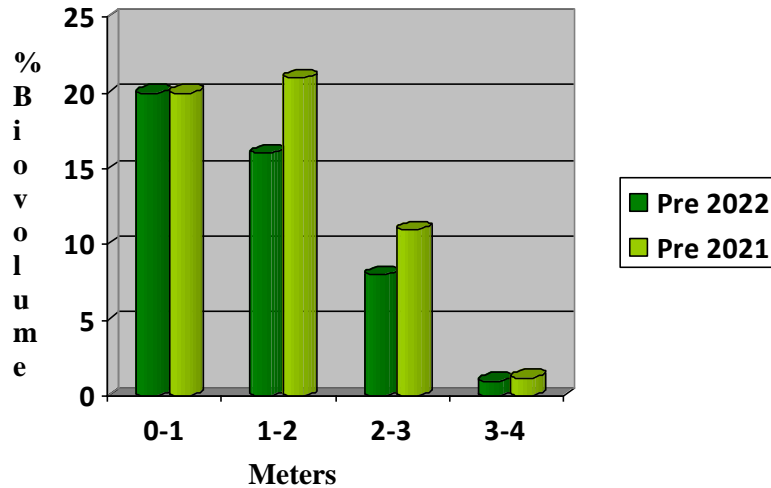


Milfoil Locations



Biovolume (All water): Refers to the average percentage of the water column taken up by vegetation regardless of whether vegetation exists. In areas where no vegetation exists, a zero value is entered into the calculation, thus reducing the overall biovolume of the entire area covered by the survey.

### Biovolume Changes Pre Treatments 2021 -2022



## **August 1, 2022 Treatment**

Our approach during 2022 was to continue to provide maximum coverage under the current NPDES guidelines. The 2022 treatment model was designed similar to the prior models expanding treatment outward from the shoreline with the continued use of Aquathol K liquid, Diquat and Aquathol K/Diquat tank mixes. Triclopyr was replaced with glyphosate for lily pad control. Aquathol K has been found to exhibit systemic herbicide properties related to the ability of the active ingredient to be translocated into the root systems of targeted species. Past use of Aquathol K has increased the efficacy of treatments in those lake areas plagued with shallow rich organic muck bottoms. The use of Diquat/Aquathol K mixtures is now an industry standard supported by the recent manufacturing of this same herbicide composition under the trade name Strike.

The delay in treatment was a direct result of the fish timing window issue. There were no treatments planned for Big Lake for 2022 when the initial timing window restriction was adopted by the Department of Ecology. After the Ecology position changed, treatment notices were formatted and sent out. The timeline required to be within permit compliance established an August first treatment.

Shoreline posting was conducted on Sunday July 31. A two-person crew, comprised of one watercraft, completed the posting task within a 10-hour timeframe. One crew member posted the docks as the boat circumnavigated the shoreline. If dock access was not available, then the crew member was off loaded, and signage was placed along the water's edge. Similar to years past, the local newspaper was contacted addressing the upcoming treatment and notice was published in the newspaper. The public boat launch was posted with a large sign requesting that no boating occur during the treatment. The boat launch signage was in place no less than 24 hours prior to treatment. On the day of treatment new signage was posted at the boat launch displaying the areas of the lake that were targeted for treatment and the water restrictions associated with the treatment.

Material was offloaded from a locked container truck and transferred into two 25-gallon spray tanks mounted on the application boat. Containers were triple rinsed on site and returned into the truck empty. Herbicides, diquat and Aquathol K, were 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 into the on-board lake water, the lake water/herbicide mixture 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 treatment boat utilized the onboard GPS to identify treatment site boundaries. All the targeted sites were treated on August first. Native submersed weeds were treated with both a Diquat/Aquathol K mixture and also a conventional diquat mix. Diquat was applied at a rate of one to two gallons per surface

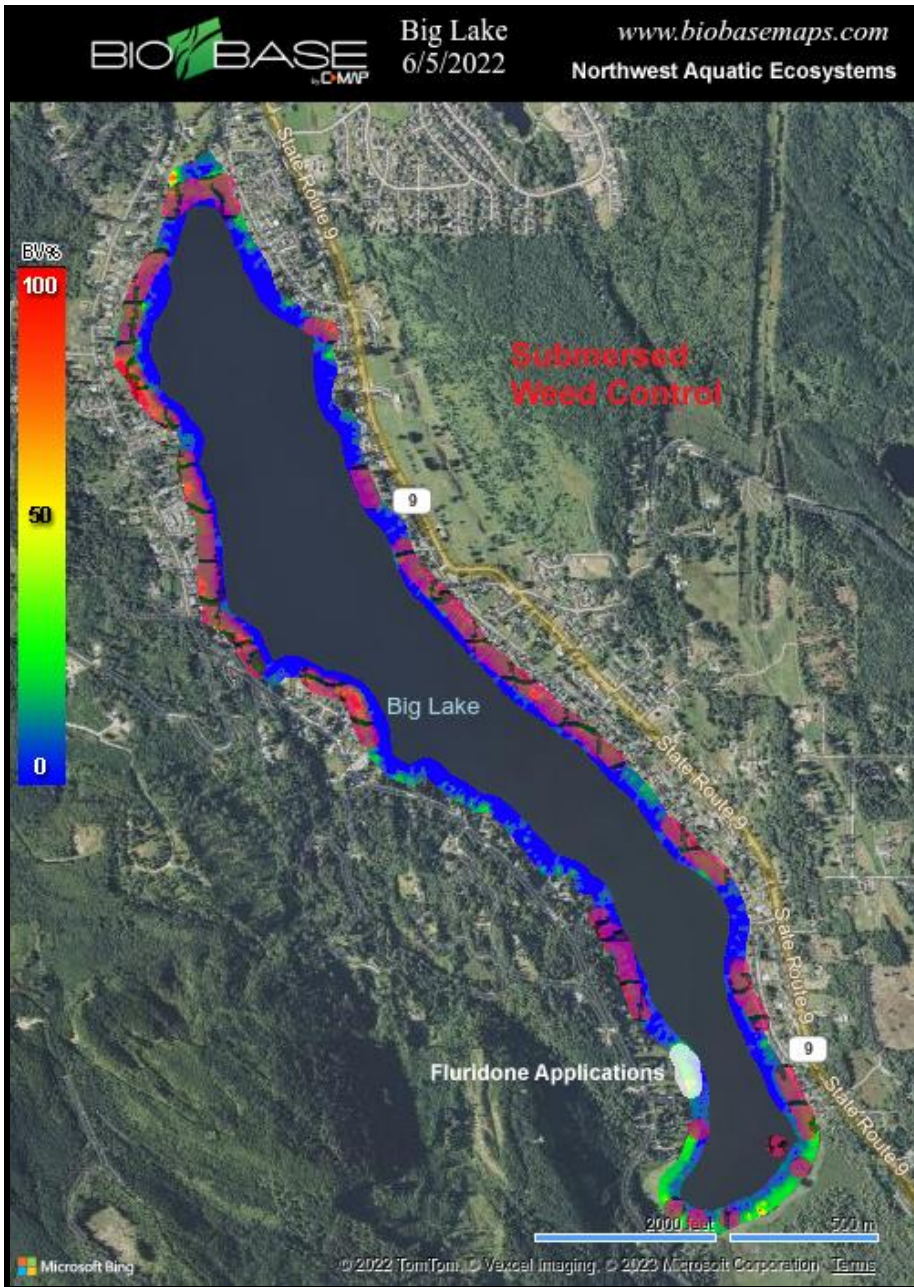
acre while Aquathol K was applied at a five gallon per acre rate in a tank mix consisting of five gallons of Aquathol K and one to two gallons of diquat.

A second application boat equipped with a 25 gallon spray tank was deployed to spray the targeted lily pad sites while the submersed weeds were being sprayed. A 1% tank mix solution of triclopyr and adjuvant were combined and then surface sprayed over the pads using a handheld spray gun. Once the spray tank was emptied the process was duplicated until all the targeted plants lake-wide were treated.

Fluridone was applied utilizing a blower system that ejected the pellets over the water's surface. The pellets then sank to the bottom. A maximum rate of 60 lbs. of SonarOne was dispersed over the 5 acre site.

There are several areas of the lake that are designated no spray zones as required by the NPDES permit. In conjunction with these designated sites, there are a number of private lakefront residents that have also requested that no weed control activities occur within their property lines. The extreme southern area of the lake is heavily infested with native plant growth. Surveying within a close proximity to the shoreline is nearly impossible and problematic. Boat prop entanglement within weed beds in conjunction with associated clogged water intakes render in-depth surveys of this area challenging. This southeast zone of the lake previously identified a small infestation of *B. elodea* present. This site was again treated with a diquat mixture of 2 gallons per surface acre in an effort to ensure control of any *B. elodea* that may have been overlooked.

Drift related control is an important component of the Big Lake treatment script. Some areas of the lake depend on the drift from treatment sites to control plants that do not receive a direct application of herbicide. Many factors contribute into the drift component. On a yearly basis, how treatments respond to drift is unpredictable. However, if the proper conditions exist, drift can prove to be a very reliable and important tool in weed management. At times, expected drift zones do not materialize, resulting in some lake areas remaining untreated or exhibiting varying degrees of control.



## Fluridone Experiment

As a result of the original decision by the Department of Ecology to only allow fluridone use in the lake at any time during 2022, a small scale experiment was conducted. The goal of the experiment was to determine if fluridone concentrations could be maintained at a lethal dosage level capable of controlling weed growth at a reasonable expense. Pelleted fluridone formulations are some of the most expensive products on the market to be considered for use within the Big Lake system. Pelleted fluridone formulations are manufactured and distributed through only one supplier SePRO. Per acre treatment costs



could range between \$1,500.00 and \$2,000.00 per acre. Our treatment scenario was based on label information and past results from other lakes that have utilized this approach.

*Fluridone labeling states that “Sonar One 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. Where dilution of SonarOne 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 to the targeted plants. The application rate and use frequency of SonarOne in a partial lake is highly dependent upon the treatment area. An application rate at the higher end of the specified rate range may be required and frequency of applications will vary depending upon the potential of untreated water diluting the Sonar One concentration in the treatment area. Use a rate at the higher end of the rate range where greater dilution with untreated water is anticipated”.*

All of the historically targeted treatment sites at Big Lake have been narrow shoreline strips extending outward approximately 150 feet. The lake’s shoreline consists of rich organic muck sediment and a gentle slope. The gentle shoreline slope promotes increased water movement within these shorelines resulting from heavy boat traffic and wind action. As a result of the anticipated dilution impacting concentration rates and exposure times, a multi treatment approach was adopted. Our protocol was identical to other SonarOne applications designed for similar small narrow type applications. Big Lake however experiences extreme shoreline wave activity throughout the day. Our treatment script involved the application of the maximum yearly permitted concentration of SonarOne (150ppb) separated into three independent applications evenly spaced over an eight week timeline.

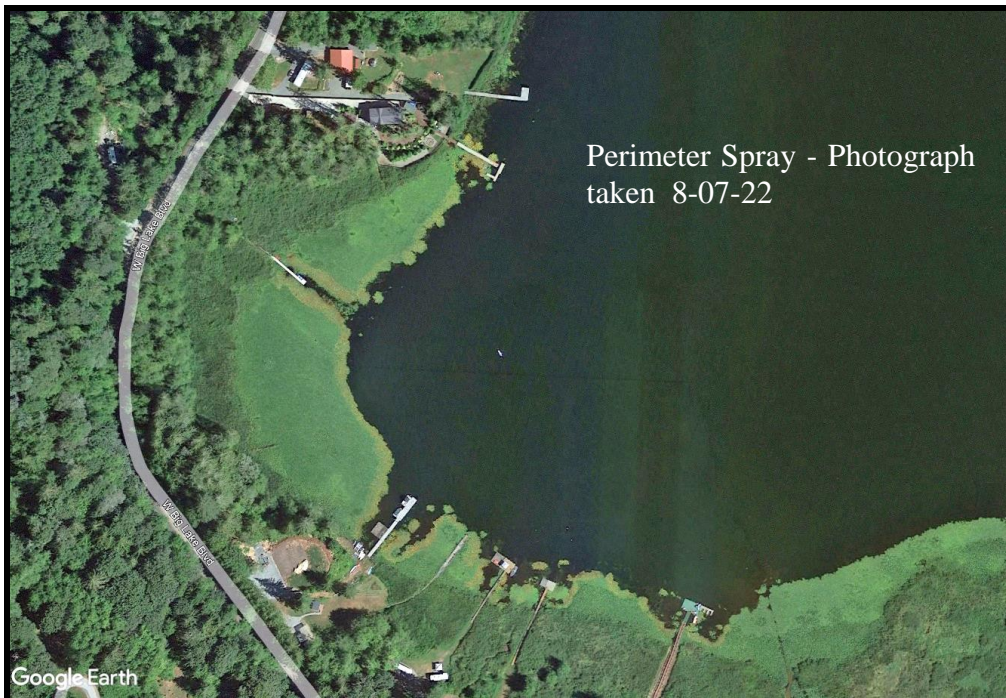
A five acre shoreline sector of the lake was selected to receive three SonarOne applications at approximately two to three week intervals. Following each application, three fluridone samples were collected in an effort to monitor fluridone concentrations within the water column. One sample was taken at both ends of the treatment site and one sample was taken in the middle. Samples were collected two feet from the bottom and overnighted to the SePRO laboratory for analysis.



Fluridone applications were performed within the site boundaries on August 1, Aug 22 and September 8. Fluridone samples were collected on August 9, August 31 and September 23. All of the fluridone sampling results detected fluridone levels less than 1 ppb. The inability to capture meaningful fluridone concentrations capable of producing pondweed or elodea control strongly suggests that fluridone use lake-wide would not be an effective management tool if only narrow shoreline areas of the lake are targeted. During the September 27 sampling date, bottom rake tows were collected and evaluated for fluridone damage. None of the plants collected were experiencing any type of anticipated fluridone response. Surprisingly, lily pads within the treatment site were also not exhibiting any of the typical fluridone response associated with long term exposure. Lily pads are typically one of the first species to express fluridone damage post application.

## Secondary Treatments

No secondary treatments for submersed weeds were performed during 2022. However, additional lily pad treatments were performed within the south and southwestern sections of the lake on 8-22 and 9-08.



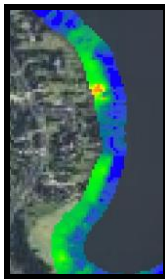
Aerial picture of the southwest and southern shoreline areas one week post the Aug 1, 2022 lily pad spray. Note pads starting to respond to the application.

With an August 1 treatment date, it requires approximately three weeks to have the ability to evaluate the outcome of a prior treatment. The Big Lake LMD had requested that no submersed weed control activities commence after August 1<sup>st</sup>. The initial application was designed to incorporate that requirement into the treatment model by

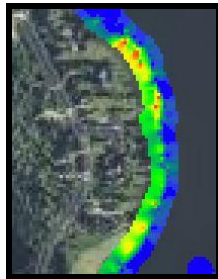
increasing application rates in an effort to clearly provide enough material to impact weeds for the entire season by utilizing only one application. This approach appeared to be successful until the lake level declined; creating new zones for plants to grow while also reducing the depth which then exposed plants that would typically stay submerged.

### Fall Survey 09-22-2022

Our fall survey was performed on September 22, 2022, approximately two weeks earlier than our 2021 campaign. No milfoil or Brazilian elodea was noted during the 2022 fall survey. Surprisingly, although we observed a reduction in the shoreline areas that were noted as red (100% biovolume) during the spring survey, the majority of the survey was similar to the spring campaign with many of the green areas in the 10% to 40% biovolume range. The SonarOne experimental treatment site demonstrated an increase in plant biomass along with other shoreline areas exhibiting the same pattern of growth.

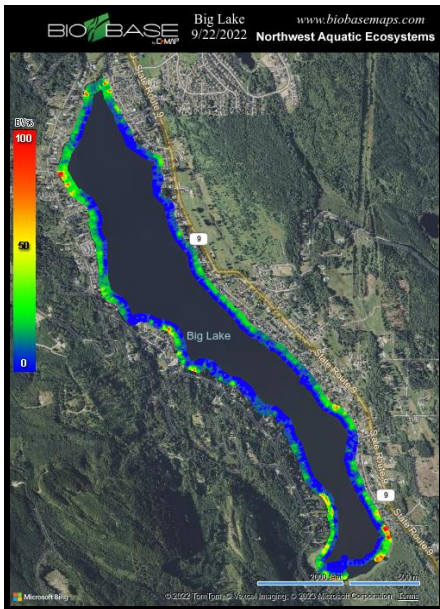


Spring 2022 Survey

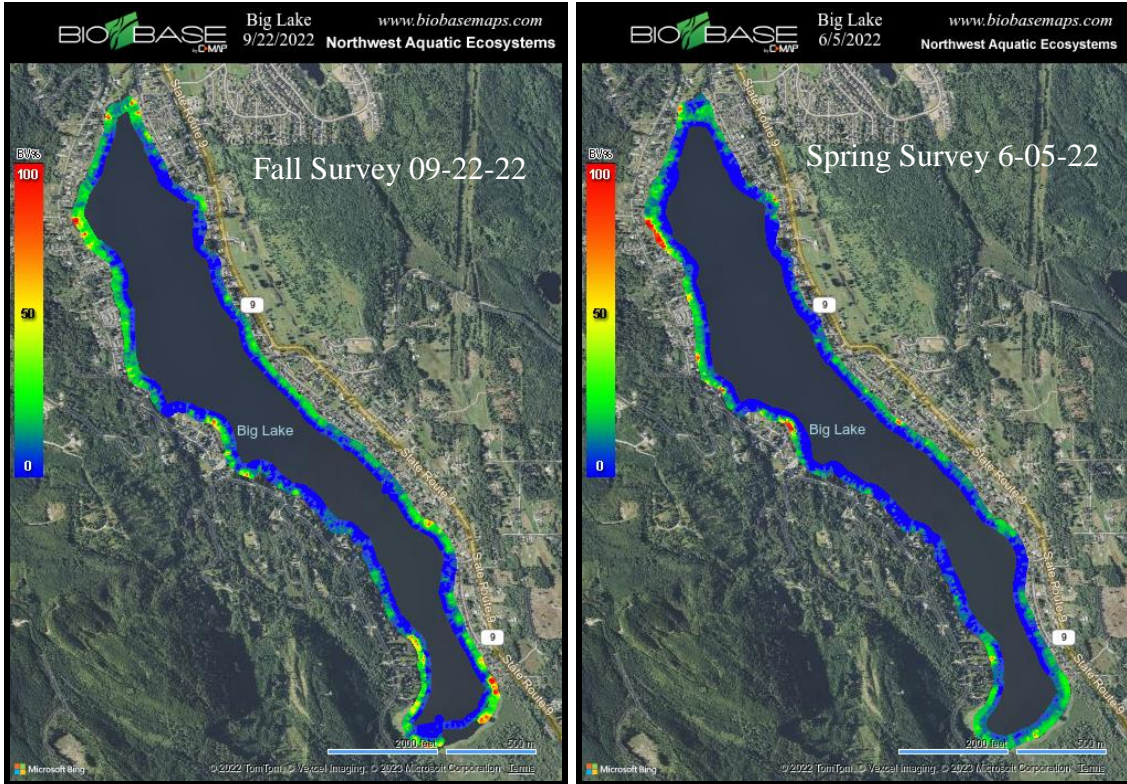


Fall 2022 Survey

Fluridone Experimental Site  
Pre and Post Treatment



Fall Survey 2022



## 2023 BUDGET

|                                     |    |   |            |              |
|-------------------------------------|----|---|------------|--------------|
| Surveys (pre)                       | 1  | @ | \$1,800.00 | \$ 1,800.00  |
| Surveys (post)                      | 2  | @ | \$1,500.00 | \$ 3,000.00  |
| NPDES Permit                        | 1  | @ | \$ 750.00  | \$ 750.00    |
| Noxious Weed Control                | 15 | @ | \$ 250.00  | \$ 3,750.00  |
| Native Weed Control (Diquat)        | 80 | @ | \$ 325.00  | \$ 26,000.00 |
| Native Weed Control Aquathol K      | 40 | @ | \$ 750.00  | \$ 30,000.00 |
| Purple Loosestrife Lily Pad Control | 4  | @ | \$ 400.00  | \$ 1,600.00  |
| Communication                       |    |   |            | \$ 450.00    |
| Mailings                            |    |   |            | \$ 700.00    |

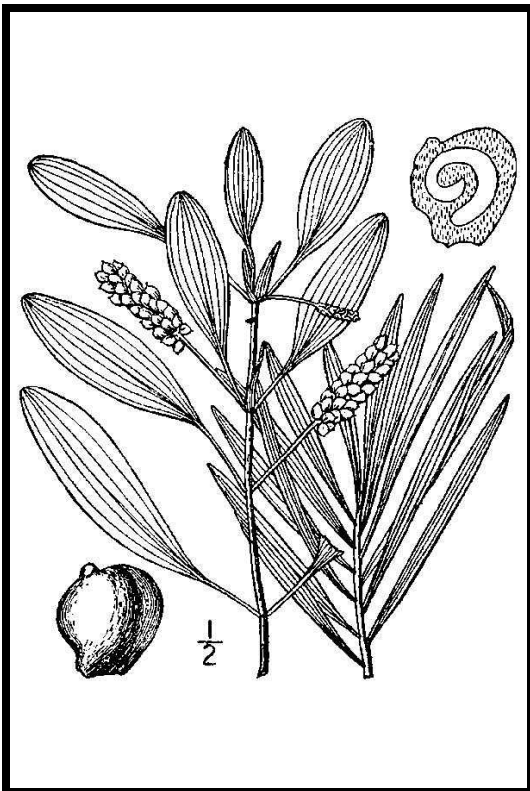
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|-------------------|--------------|
| Newspaper Notice  |              |
| Signs Boat Launch | \$ 550.00    |
| Total             | \$ 69,600.00 |

## Recommendations

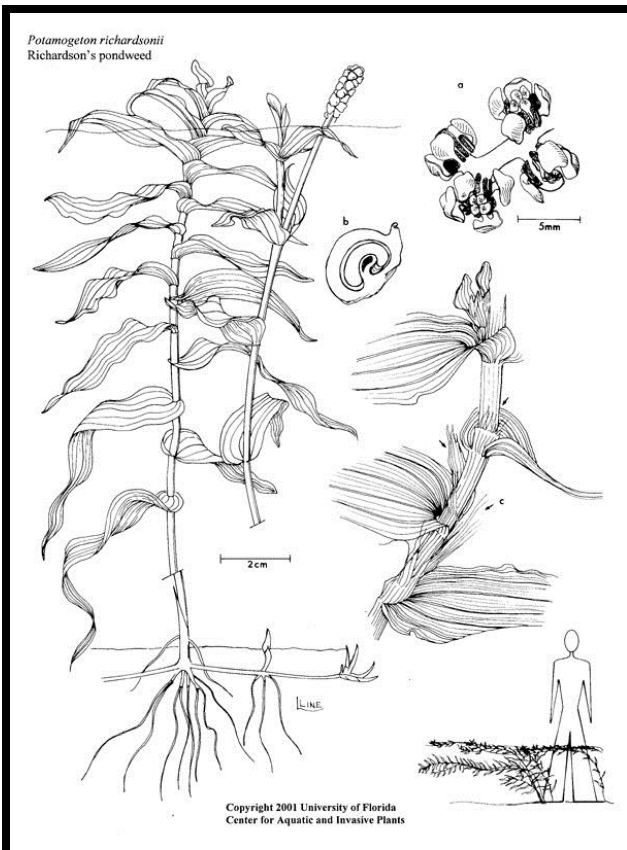
1. Continue efforts to petition the Department of Ecology to change the fish timing window to June 15. This issue currently has a July 15 hearing date if a solution to the current appeal is not resolved. There are a number of fish timing window issues the Department of Ecology is currently trying to resolve. Coho salmon are the only species that may be a concern within the Big Lake system. This species spawns in the Nookachamps Creek during the spring and likely reside in the lake until the following spring when Coho migrate to salt water. The historical timeline of when Coho migrate out of any particular system determines the fish timing window date. Typically, the July 15<sup>th</sup> window is the generic default date established statewide. Many Coho bearing lakes have been able to document that the majority of the fish have already left the system by July 15<sup>th</sup>. Once that can be established, the timing window can be changed and has been changed for many lakes in the region. Treating after July 15<sup>th</sup> alters the seasonal treatment plan for the lake.
2. With the current July 15<sup>th</sup> treatment date, will the LMD restrict secondary submersed weed treatments after August 1<sup>st</sup>?
3. NWAE has dropped our Big Lake appeal dealing with the ability to change the treatment percentage to a more realistic number. There is no science behind the current standard. In past cases the hearings examiner has always agreed with the agency when no science is available to support any position. When no science is available to refute any standard set by an agency then the agency's expertise is used as the standard.
4. Lily pad control operations should only be conducted during those hours when wind conditions are minimal. Patches consisting of only a few plants should be cut and removed by the property owners.
5. Noxious species appear to no longer represent the problematic species lake-wide. The range and location of milfoil plants have stabilized; not much expansion has been detected. Plants currently coexist in mixed stands of native species. Milfoil can now be seasonally controlled with either contact herbicides or specifically targeted with systemic materials. Actions that may or may not be implemented will probably change on a year-to-year basis.
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.

7. Continued use of the contact herbicide Aquathol K, utilizing both the liquid and granular formulations. Use of the material has proved to be successful in controlling some pondweeds not susceptible to diquat. Use should also include tank mixes of both diquat and Aquathol K.
8. Continued use of the new mapping technology. This technology provides an excellent visual evaluation of weed conditions lake-wide. The resulting map can be understood by all users of the lake and requires no in-depth technical background for review. The technology also provides an excellent reference to visually show a property owner if problematic weeds are present at their parcel.
9. Continue to work with the LMD and County personnel on nutrient related issues and assist in providing information when requested.
10. It would appear that the use of fluridone earlier in the season would not provide the control anticipated. Our experiment utilizing the maximum concentration rate did not produce any data that would support such use. During the entire eight weeks, fluridone levels were below 1ppb. Even if fluridone (SonarOne) use produced acceptable control, material costs associated with product use may be outside the scope of the current budget. A five acre site with an average depth of 4 feet would require 162 lbs. of material broken up into three applications. Material costs alone would be \$6,800.00. This does not include the labor and posting costs required for each application. Three events would be necessary.
11. Application of granular material is slow. Any pellets that are mistakenly broadcast onto docks or in boats would need to be removed. Placement of material around docks is difficult.
12. Fluridone use would require an irrigation restriction for seven days following any application throughout the treatment timeline. Residents with water rights could object to non-use of the water for irrigation.

**Dominant Submersed Macrophyte Species Residing Within Big Lake**  
*Potamogeton epihydrus*

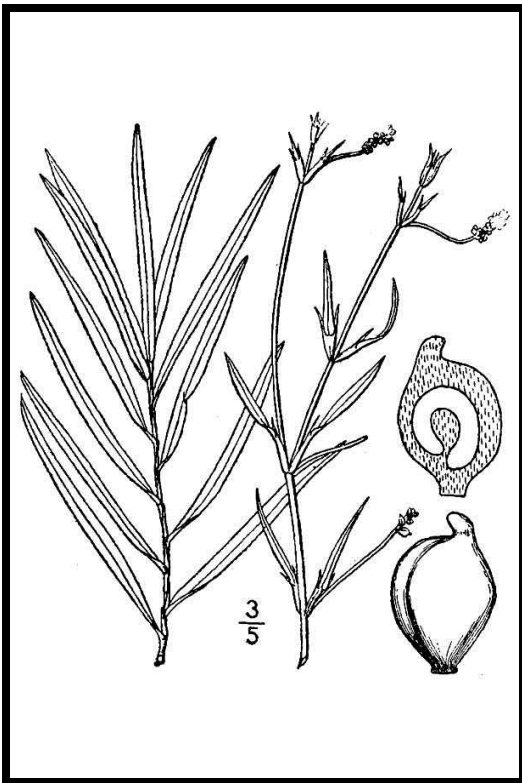
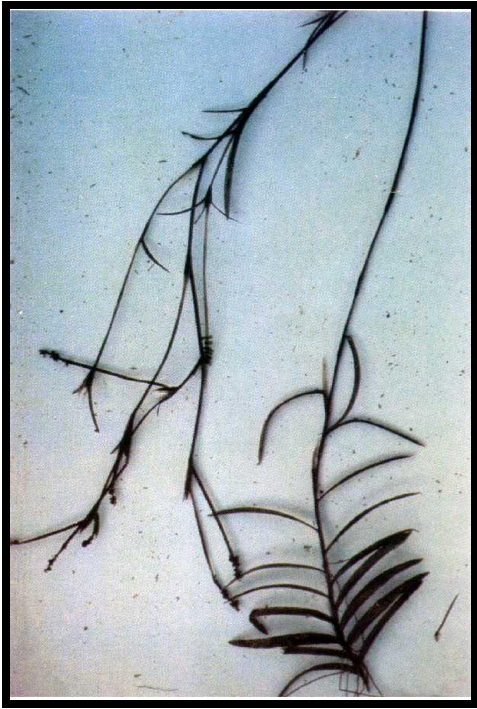


Potamogeton richardsonii

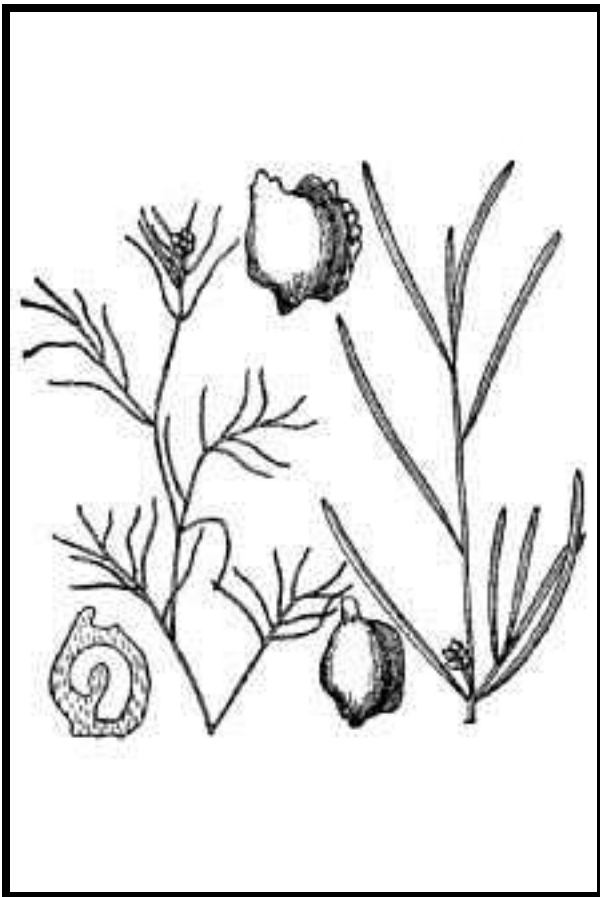




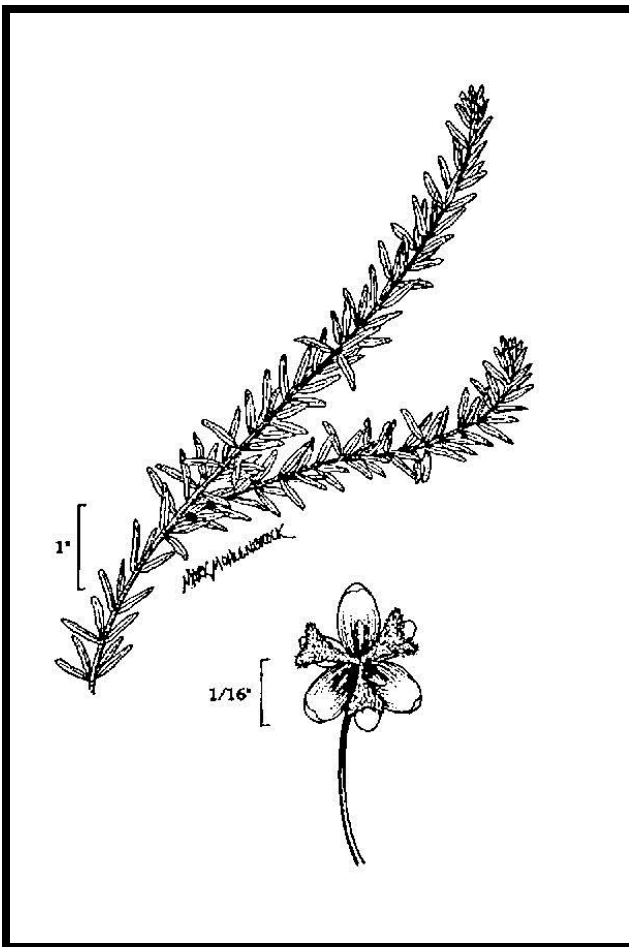
*Potamogeton robbinsii*



Potamogeton foliosus



Elodea canadensis



*Vallisneria americana*

