Barnes Lake

2021 Aquatic Macrophyte Control Program

Prepared By
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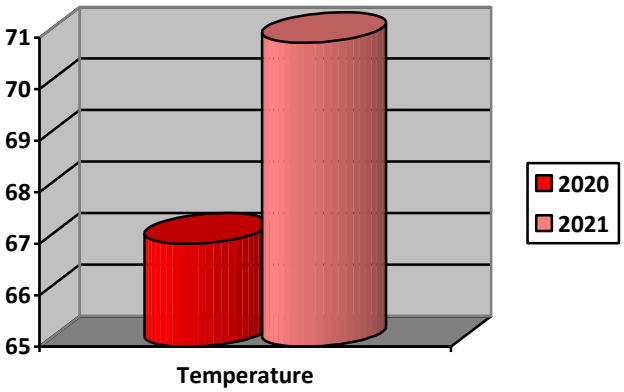
Project Overview

Program components were substantially reduced during 2021 as a result of the whole lake 2020 fluridone treatment. No submersed weed control activities were conducted under the LMD sponsored protocol. Floating plant control directed at lily pad growth was performed once during the season before water level issues restricted access. The major event that had previously occurred within the Barnes Lake system was the treatment of the lake with fluridone to control (eradicate) non-native bladderwort during the 2020 season. The 2020 fluridone application was initiated later in the year than the 2017 campaign and resulted in bladderwort control, fragrant water lily control and brasenia control. Fluridone use during 2020 was anticipated to mimic past protocol by eliminating large yearly treatment expenses during post treatment years. 2021 was the first post treatment year resulting from the 2020 application. The success of the treatment eliminated but did not eradicate the bladderwort infestation from Barnes Lake. Low water level and the late treatment start date required the second fluridone booster application to be applied earlier than anticipated. Water level issues likely created bladderwort plants that may have become landlocked within the floating islands resulting in a reduced exposure interval for these plants. High winter water levels may have dislodged untreated bladderwort into the main lake basin. Not only may low water levels have impacted bladderwort control, lily pads once floating on the water's surface may have also become victims of low water, remaining viable in the soft bottom sediment muck but without access to fluridone infused lake water. Anticipated reduced expenditures for the years 2021, 2022, 2023 and possibly 2024 were incorporated into the future planning model.

The main component for 2021 was to observe the lake's response related to past efforts and provide timely minimal shoreline control activities for lily pads and spot applications for submersed weeds when deemed appropriate.

Survey 5-15-21

The initial and only survey performed during 2021 was undertaken on May 15. This survey date was within a few days of the 2020 campaign. Water level was adequate to access all the lake areas. Noted was the elevated lake temperature from the 2020 survey. Lake temperature had increased from 67 degrees to 71 degrees.



Survey Protocol

A macrophyte survey map is produced each year and incorporated into the baseline IAVMP for Barnes Lake. The surveys are then utilized to monitor yearly weed growth and assist in establishing potential management sites. Electronic bottom surveys have been conducted since 2015.

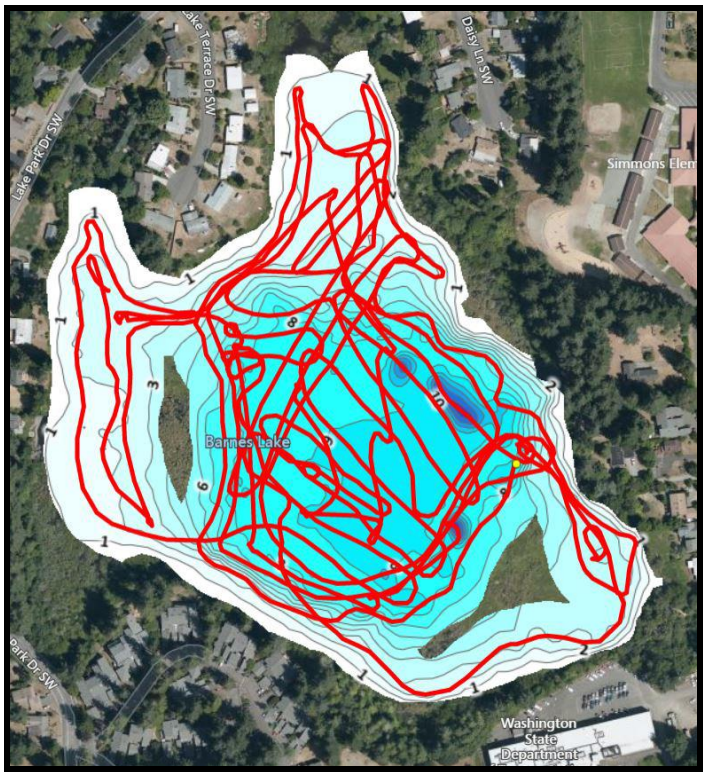
The NWAE mapping protocol utilizes state of the art Bio Base mapping technology. This system produces three map types consisting of a bathymetric contour, a sediment composition profile and a macrophyte density map. All maps are GIS friendly and can be exported into any GIS program. Maps are color coded so they can be easily evaluated by any viewer.

Mapping technology utilizes specialized transducers that electronically collect thousands of data points as the survey boat transects the lake's littoral zone. Data is recorded and viewed onboard. Each file contains one hour of survey data. A completed survey may be comprised of one or more files. Upon completion, all the program files are downloaded and processed. The survey and sonar log produces a stored electronic file of the lake bottom that can be viewed in house at any time and allows the ability to view plant growth along the boat's survey track.

Our protocol encompasses a surface vehicle transecting the lake along the entire littoral zone. Boat tracks are designed to be approximately 150 feet apart. Sonar beam data collection extends approximately 150 feet from all directions surrounding the boat. 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 noted through the water column. This sampling point is then incorporated into the file data log as a single point reference, noting the species captured during the rake tow. These points are then added to the final project map.

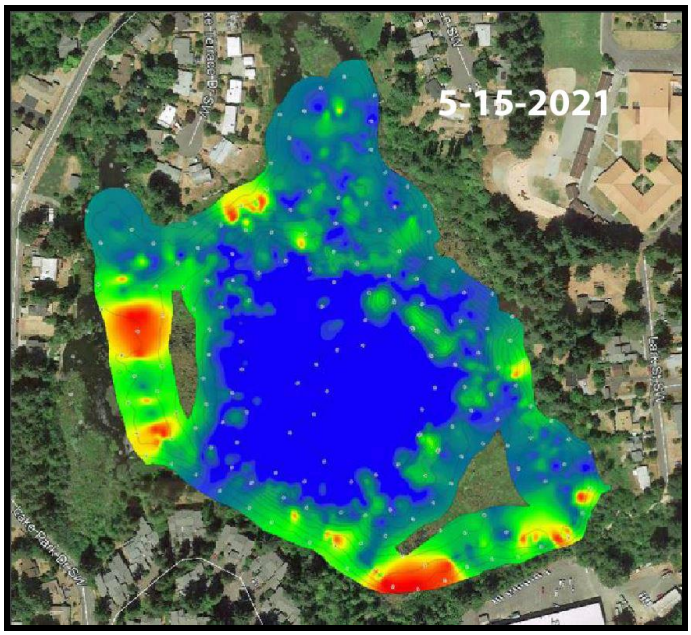
BioBase survey technology provides accuracy in water depths of greater than 2.5 feet. Data collected below the three foot threshold may be skewed because of signal related issues from the reflected bottom transducer readings from the shallow depths. These

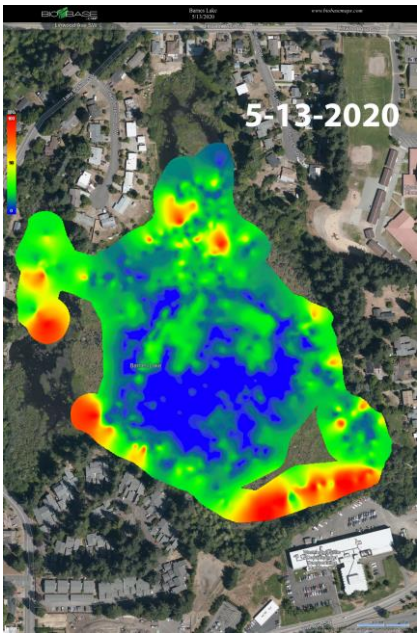
depth issues and data acquisition distributions are typical for the Branes Lake shallow canal and island associated segments of the lake. In general, the surveys efficacy was limited to the main lake basin.



May 2021 Survey Tracks

NWAE had only one successful drone survey of the lake performed on Oct 3, 2021. Although an earlier spring survey was performed, the data was processed later in the year and the file was found to be corrupt. These drone surveys establish a clear visual interpretation of lake conditions at the time of the aerial survey. Pre-treatment pictures/video are typically evaluated against post treatment aerials taken at the end of the season.





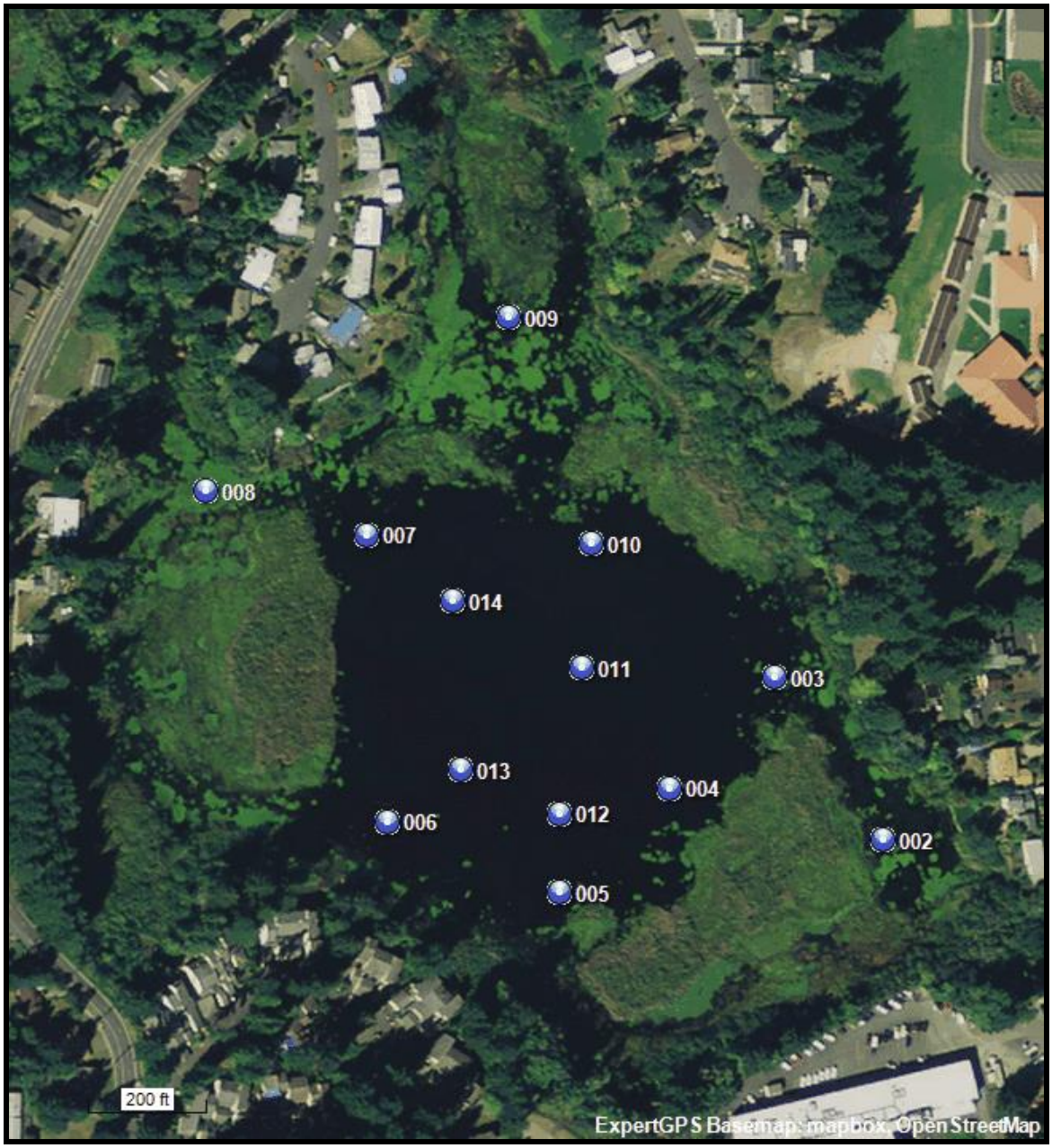
All of the dark blue areas represent biomass densities within the water column of 0 %. The remaining green areas represent densities of less than 40%. While the red areas constitute densities of 100%.

A majority of the green shaded areas were experiencing a filamentous algae growth, nitella. This plant looks similar to aquatic macrophytes but is an algae species. When trying to identify aquatic plants many residents misidentify this species as a plant simply because of the its physical and growth characteristics. Nitella seldom creates water related recreational issues.

Nitella

GPS Grab Sample GPS Coordinates

During the survey, 13 sampling data points were collected. Additional sites can be incorporated into the file at any time if warranted. Only one site (003) identified bladderwort while the remaining sites exhibited no weed growth. Four sites exhibited the presence of nitella. These sampling points can now be used yearly to monitor changes in weed species at each site. Although only four sites identified nitella within the rake tows, visual observations as the boat conducted the survey noted a much greater range.

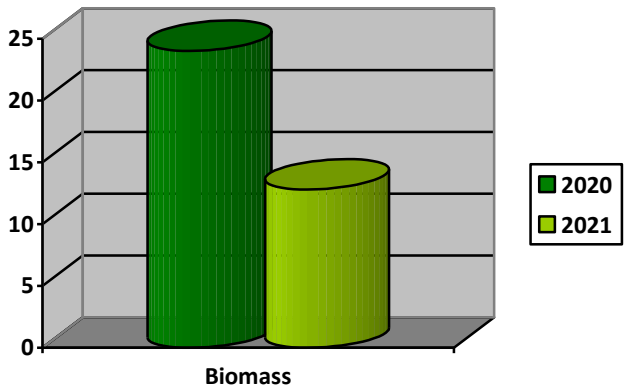


Data Point	Lat	Long	Species	Depth
002	N47 00.185’	W122 54.814’	NO	4.08
003	N47 00.230’	W122 54.858’	BLAD, NI	8.65
004	N47 00.199’	W122 54.900’	NO, NI	14.86
005	N47 00.171’	W122 54.945’	NO	8.65
006	N47 00.190’	W122 54.014’	NO, NI	8.20
007	N47 00.269’	W122 54.023’	NO, NI	6.95
008	N47 00.282’	W122 54.088’	NO	2.66
009	N47 00.330’	W122 54.965’	NO	2.54
010	N47 00.267’	W122 54.932’	NO	8.50
011	N47 00.233’	W122 54.936’	NO	9.71
012	N47 00.192’	W122 54.945’	NO	9.74
013	N47 00.205	W122 54.984’	NO	9.16
014	N47 00.251	W122 54.987’	NO	8.90

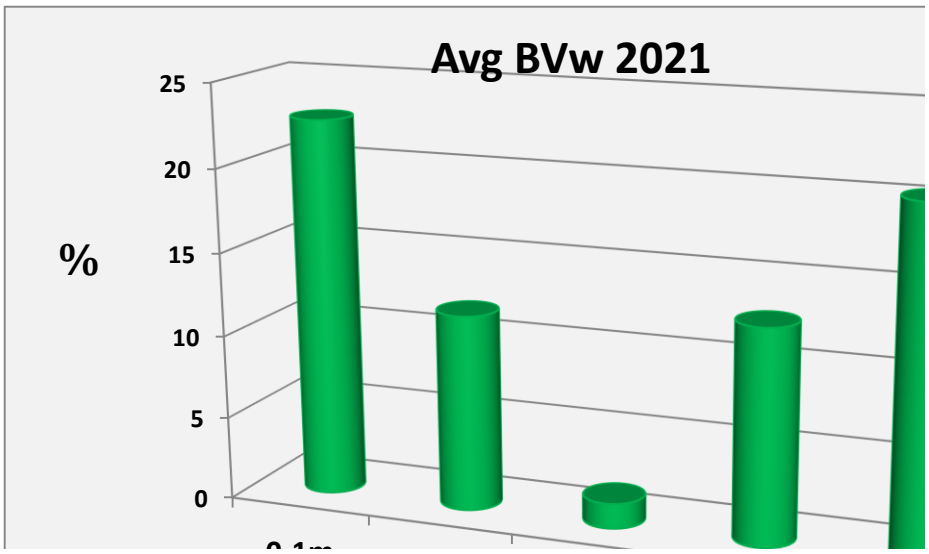
Grab Sample Point Dictionary

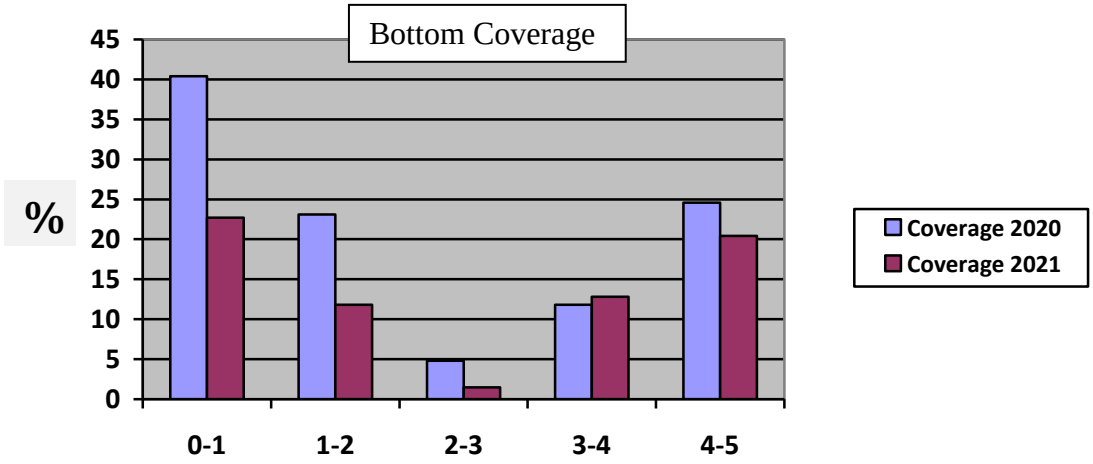
NO - No Macrophytes present, algae not included
BLAD – Bladderwort
NI - Nitella

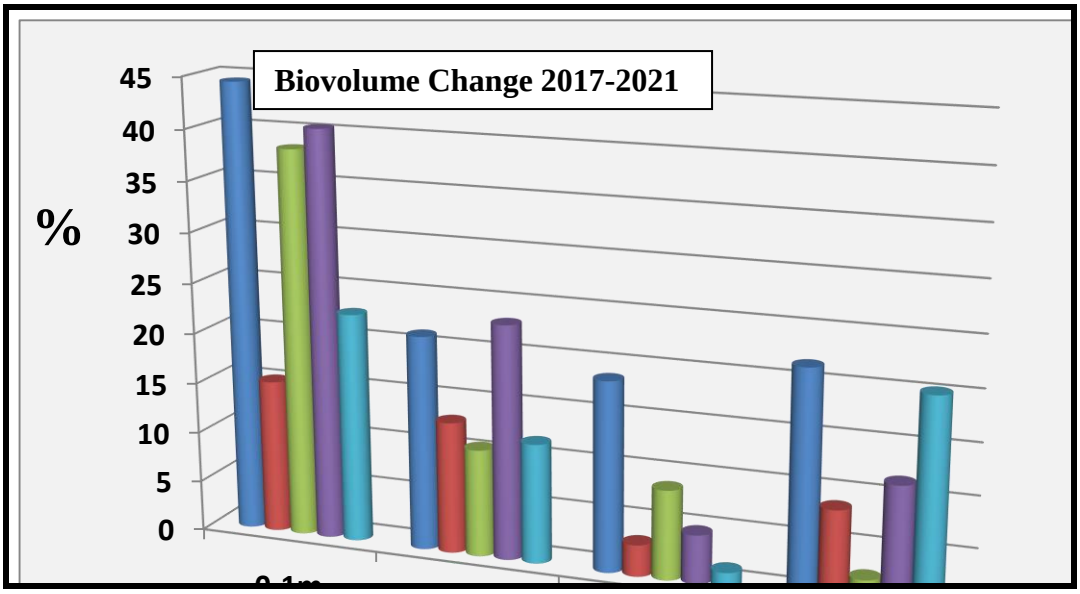
In evaluating all of the data utilizing a grid format (considered within the industry to be the most accurate summary of a surveyed area) and a plant bio volume matrix, the following volumes were noted. Plant biovolume is the percentage of plant biomass taken up in the water column by vegetation when plants exist. When no plants are noted a zero is added into the calculations. The complete 2021survey identified that only 12.8% of the surveyed water volume supported plant growth in comparison to 24% in 2020.



One can further fine tune the analysis and determine bio volumes at one meter intervals.


Avg BVw 2021
%
25
20
15
10
5
0


Bottom Coverage
%
45
40
35
30
25
20
15
10
5
0
0-1
1-2
2-3
3-4
4-5
Coverage 2020
Coverage 2021


Biovolume Change 2017-2021
%
45
40
35
30
25
20
15
10
5
0

Limited historical change was noted. Much of the shallow lake areas that are exposed during the late summer typically support varying densities of emergent, floating and submerged species. Mid basin growth through the years will increase and likely trigger the next fluridone treatment. Bladderwort is a free floating plant that resides dormant on the lake bottom in small ball like configurations. These free floating masses drift along the lake bottom eventually reaching the shoreline.

Pre-Treatment Residential Notice

Notices were mailed to all of the property owners within the lake management district from a mailing list provided by the City of Tumwater. The notice identified the materials to be used and the approximate time-frame when spraying would occur. Mailings were delivered on or about May 1, 2021.

6-03-2021 Treatment

Only one application was administered during the 2021 season. This application targeted floating lily pads, brasenia and yellow flag iris. Prior to treatment, shoreline residents were notified of the pending treatment. Notices were hand delivered to each parcel abutting the lake.

Imazapyr and triclopyr based herbicides were applied to the lake shoreline at a 1% tank solution. In addition to the herbicide, a spray adjuvant was added to the mixture. Spray adjuvants are wetting agent activators that allow for better penetration of the herbicide into the plants' leaf structures. Spraying was accomplished using a 16 foot Airgator airboat. The application boat was equipped with two 25-gallon spray tanks. Once the herbicide, adjuvant and water were mixed, the boat traveled along the shoreline spraying all infestations noted and that were within range of the application equipment.

Drone Survey 10-03-2021

An aerial survey of Barnes Lake was conducted on October 3, 2021. Imagery was collected from two shoreline locations. Although the water level was low, the data collected clearly identifies late seasonal Brasenia growth along a number of the shallow shoreline areas. Both an early and August spraying should be considered. Typically by August our ability to utilize the current launch site leaves few options to complete the August spraying. On other projects we have been able to hand carry and launch a smaller boat with the spraying operation being conducted utilizing a gas powered back pack sprayer.

Recommendations for 2022

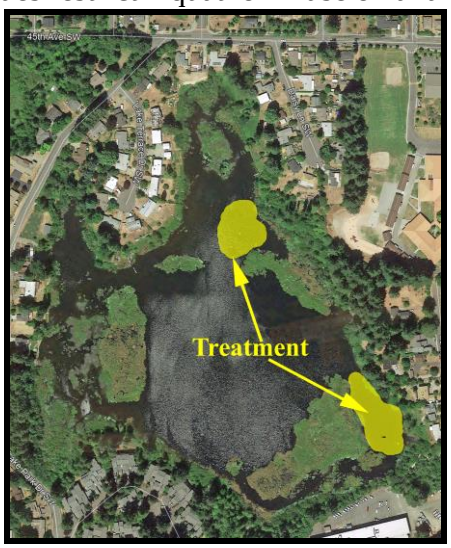
2022 will be the second year after the total lake fluridone application of 2020. We anticipate no bladderwort issues that would warrant spot treatments. Minor lily pad and pondweed control will, however, likely be required. Most all residential lily pad infestations lake wide have been reduced or eliminated. None restrict recreational lake use.

Our program on the lake continues to evolve as new issues may develop. Pondweed control, if necessary, will be accomplished with the use of Aquathol K. There are no label restrictions associated with swimming, fishing or irrigation. Herbicide costs have increased considerably over the last six months with some materials experiencing a 200% increase while other materials may not be available until late second quarter of 2022.

1. Continue early and late seasonal drone surveys of the lake. One early (late May) seasonal electronic and bottom sampling lake event. If water level provides access,

an additional electronic survey and bottom sampling event will be conducted. A late seasonal survey was not available for 2021. Now that survey data points have been established, these sites will be visited each year in an effort to document macrophyte changes on a per site basis. This will provide for an historical timeline, noting yearly changes at each site. These sampling stations will assist in determining the threshold for future fluridone treatments.

2. During 2019 two areas of the lake were identified as potential pondweed control candidates. Both these areas maintain water throughout the summer months and if inundated with submersed pondweed growth may restrict small craft access to the main water body. We have estimated both sites totaling no more than two acres. Control will be performed utilizing Aquathol K in either the liquid or granular formulations. Costs would range between $910.00 and $1,200.00 per treated acre. Budgetary issues restrict Aquathol K use on a large scale basis.



Potential Problematic Weed Growth Areas.

3. Continue use of triclopyr and imazapyr in the control of lily pads and yellow flag iris. Spring and possible late summer applications will be scheduled.

4. Program essentials consist of planned fluridone applications when bladderwort densities impede lake use. Threshold levels that determine treatment are under the discretion of the LMD with recommendations being provided by the consultant. It is anticipated that such treatments will be required on a three to five year basis. Efficacy of fluridone applications is largely dependent on the water level allowing fluridone to reach infestations lodged within the floating islands. Untreated bladderwort, as water levels decline, will potentially refloat during the winter months as once exposed muck bogs are now submerged.

2018 Water levels

5. Modification to the current launch site will again be attempted. Failed attempts to correct the launch shortfalls during 2021 resulted in no changes to the site. Targeted changes would include removal of stumps and placement of large rock along the launch site shoreline.

6. Barnes Lake is currently in a maintenance mode requiring limited treatment.

Budget 2022

Funding for the 2022 program will require increases in associated labor related services as a result of the current available workforce. Material costs and transportation have skyrocketed with some products not being available until the second quarter of 2022. Some products will not be available at all. Pricing continues to change monthly with some materials already experiencing a 125% increase from 2021 levels.

2022 NPDES permit fee		$ 725.00
Insurance		$ 675.00
Spring Electronic Bottom Survey		$ 2,000.00
Fall Electronic Bottom Survey		$ 2,000.00
Aerial Survey (2)		$ 1,000.00
Pre Treatment Mailing		$ 175.00
Shoreline Posting Day of Treatment		$ 210.00
Mobilization		$ 500.00
Imazapyr 1 gal	@	$ 175.00
Triclopyr 1 gal	@	$ 150.00
Aquathol K 1 gal	@	$ 95.00
Airboat Operator		$ 100.00/hr.
Technician		$ 75.00/hr.
Year End Report @ $90.00/hr.		$ 630.00

COSTS ASSOCIATED WITH ONE DAY ON THE LAKE

Mobilization		$ 500.00
Airboat Operator	8 @ $100.00	$ 800.00
Technician	8 @ $75.00	$ 600.00

State of Washington
Department of Agriculture
Olympia, Washington 98504

PESTICIDE APPLICATION RECORD (Version 3)
NOTE: This form must be completed same day as the application and it must be retained for 7 years. (Ref. RCW 17.21)

3. Date of Application-Year: 2021 **Month:** June **Date:** 03 **Time:** 10:00

2. Name of person for whom the pesticide was applied: Barnes Lake Improvement District, City of Tumwater
Firm Name (if applicable):
Street Address: 555 Israel Road **City:** Tumwater 98512

3. Licensed Applicator's Name (if different from #2 above): Douglas Dorling
Firm Name): Northwest Aquatic Eco-Systems
4426 Bush Mountain Drive SW.
Olympia, WA. 98512
360-357-3285
License # 375

4. Name of person who applied the pesticide (if different than #3 above):

License No(s). if applicable:

5. Application Crop or Site: Barnes Lake

6. Total Area Treated (acre, sq. ft., etc.): 1 acre

7. Was this application made as a result of a WSDA Permit ? No

8. Pesticide information (please list all information for each pesticide in the tank mix):

a) Product Name Pesticide Applied	b) EPA Reg. No.	c) Total Amount of Pesticide Applied in Area Treated	d) Pesticide Applied/Acre or other measure)	e) Concentration Applied ppm
Imazapyr	81927-24	.25 gal		1.0%
Triclopyr	70506-176	1 gal		1.0 %

9. Address or exact location of application NOTE: If the application made to one acre or more of Agricultural land, the field location must also be shown on the map on page two of this form. Barnes :Lake Tumwater, WA. 98512, WA 98512

10. Date: 6-03-21 **11. Name of person making application:** Douglas Dorling

12. License No: 375 **13. Apparatus License. Plate No.:** G424

14. Start: 10:00 **Stop:** 2:30

15. Acres completed : 1

16. Wind Direction: SW **Wind Velocity:** 0-5

17. Temperature: 76

Location of Application (If the application covers more than one township or range, please indicate the township & range for the top left section of the map only):
Township: T18N
Range: E OR W (please indicate) 02W

Section(s): 34
County: Thurston

PLEASE NOTE:
The map is divided into 4 sections with each section divided into quarter-quarter sections. Please complete it by marking the appropriate section number(s) on the map and indicate as accurately as possible the location of the area treated.

Northwest Aquatic Eco-Systems

855 Trosper Road SW #108-313
Tumwater, Washington 98512
Telephone: (360) 357-3285

E-MAIL: PONDWEEDS @ COMCAST.NET

Herbicide Treatment
Business and Residential Notice

Distribution Date: 05-01-21 Barnes Lake will be treated with herbocides to control non native pondweeds, lily pads and shoreline emergent vegetation from May 20 through July 30 as required. Treatment dates are dependent on lake water levels and the ability to access the lake. Targeted treatment dates will be May 25 through June 25 . A secondary application may be applied later in the season depending on our ability to access the lake. Notices of applications will be hand delivered to each property owner no longer than 48 hours prior to treatment. Notices will state any water use restrictions or advisories.

Product(s) planned for use:

Diquat—diquat dibromide
Imazapyr (shoreline plant & iris control)
Aquathol K- dipotassium salt of endothall
Triclopyr—triclopyr

Location of Treatment(s): Lily pad control will take place anywhere throughout the lake. Shoreline emergent plant control will only occur at residential properties abutting the lake who have agreed to the treatment. Pondweed control will be limited if required to a few acres. The lake proper is adjacent to Daisy Lane SW. Tumwater. If you are withdrawing water for potable or domestic water use, livestock watering, or irrigation, and have no alternate water source, please contact the applicator Northwest Aquatic Eco-Systems at 360-357-3285 or pondweeds@comcast.net to arrange an alternate water supply.

If you would like to request additional notification prior to treatment, or have further questions, please contact Northwest Aquatic EcoSystems using the information above.

This herbicide treatment is regulated under a permit (NPDES) issued by the Washington State Department of Ecology. **Permit # WAG 994137**

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