

**Lake Campbell and Lake Erie
2019 Aquatic Plant
Control Program
LMD #3**

Prepared for:

Lake Erie & Campbell LMD #3
Skagit County Public Works
Mount Vernon, Washington

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Project Overview

This will be Northwest Aquatic Ecosystems' tenth consecutive year providing services to the Lake Erie and Campbell waterways. Components of the prior year reports have been incorporated into the 2018 report. Some of the past historical data is necessary in providing the reviewer adequate project baseline references. Our 2019-2020 contract encompassed many of the same objectives and components as the earlier agreements. Management objectives have always focused on noxious weed activities as such species have been managed to reduce their appearance lake-wide. Native plants (pondweeds & niad) currently pose similar recreational hazards as the noxious macrophytes within the Lake Erie system resulting in yearly partial control of these species. Such native species are not yet prevalent within Lake Campbell. However, in recent years native species have begun to exhibit encouraging signs of expansion lake-wide. Northwest Aquatic Ecosystems (NWAE) has learned over the years that Lake Erie requires at times only one early submersed weed treatment and during some years an additional late season application is required. More importantly, if a late season Lake Erie treatment is necessary but not performed, dense growth is present during the following spring. Lake Campbell during the past year has shown an increase in the native plant community component of the lake's ecosystem but unfortunately the lake also exhibited a late seasonal expansion of milfoil that was not present during the spring survey or treatment.

Lake Campbell milfoil colonies still reside hiding in the dense floating plant cover and germination of established seed beds are still actively producing plants. As a result of the increased past milfoil activity noted within Lake Campbell, additional efforts during 2017 & 2018 appeared to have reduced milfoil populations lake-wide. Milfoil efforts directed at Lake Campbell throughout 2018 resulted in low single sporadic plant densities in areas that had historically supported milfoil growth. At the close of 2018 milfoil appeared to be extremely limited lake-wide. Our late seasonal 2019 survey strongly contradicted the spring survey as milfoil was evident along major sections of the shoreline.

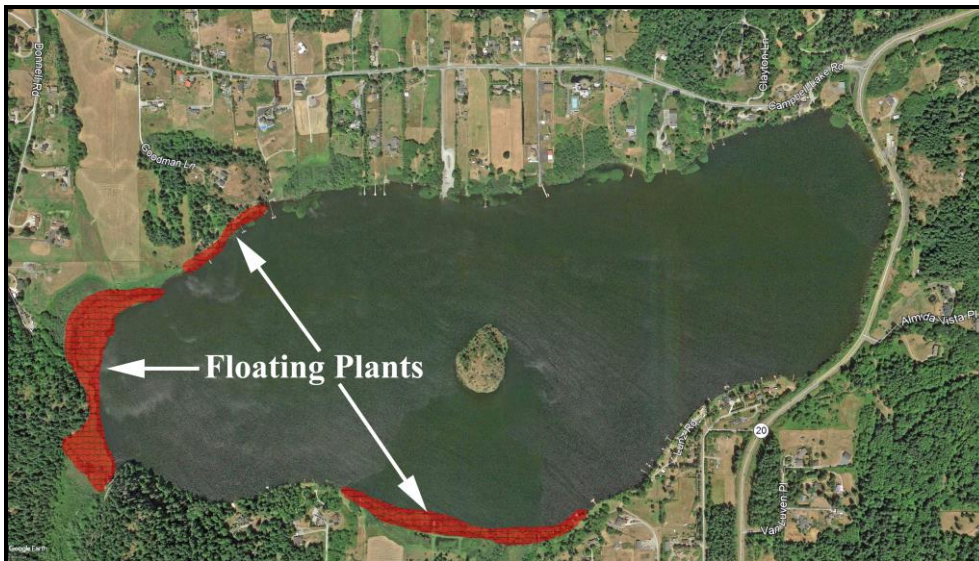
Survey Protocol

Survey techniques for 2019 were identical to those utilized during prior surveys. The methodology is now an industry standard. Macrophyte data was collected utilizing wavelength specific transducers and bottom scanning equipment. Once collected, the SD card was uploaded via cloud based technology and the processing of the data was finalized. During the survey when milfoil plants were identified, their locations were noted along the transect line and their GPS coordinates were recorded. Each milfoil data point was identified by a red dot. The result is a color-coded map of the lake bottom identifying weed growth areas, plant densities and milfoil locations. 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. The sonar log affords you the ability to view all plant growth along the boat's survey track. This new protocol avoids the possibility of missing plants between bottom survey data points.

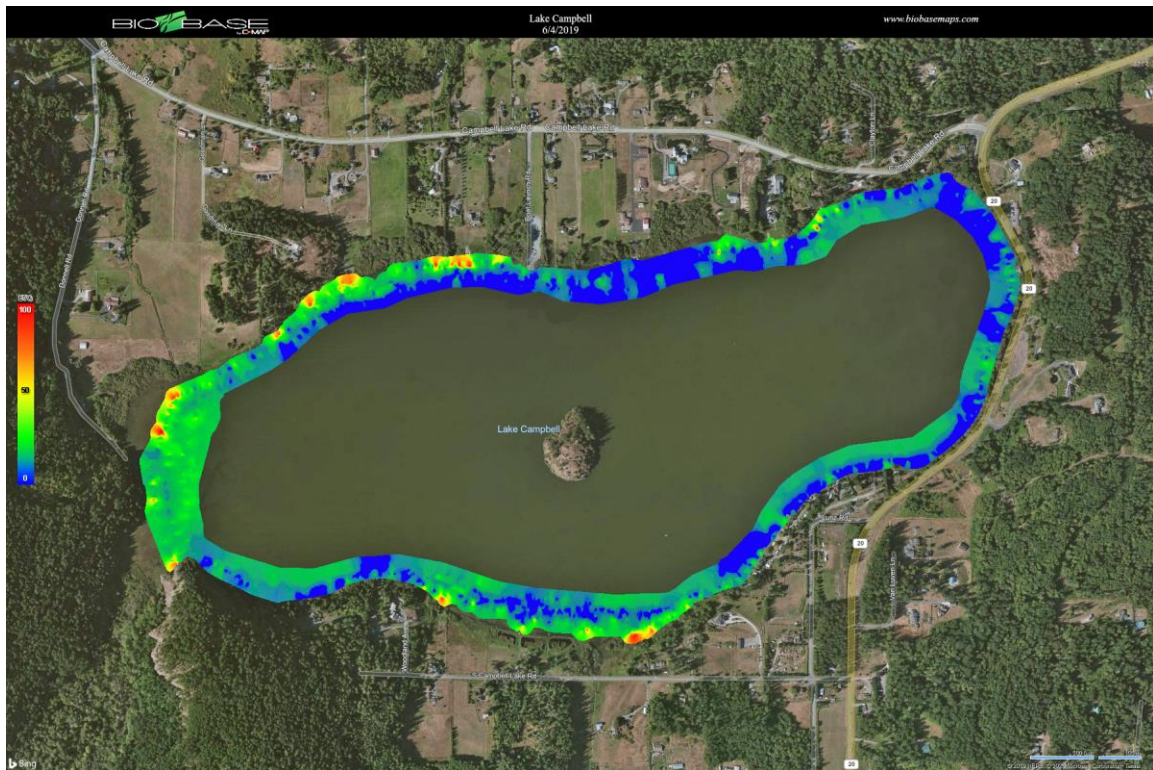
Data is collected by a survey vehicle transecting the lake along the littoral zone. Boat tracks are designed to be approximately 100 feet apart. To ensure the efficacy of the survey, a bottom sampling rake was thrown from the boat at various locations lake-wide. The rake was then drawn across the lake bottom, brought to the surface and into the boat. Plants attached to the rake were identified and confirmed as being the same species as noted through the structure scan or visually through the water column. The system automatically calculates maps and stores the position of every data point.

Lake Campbell Pre-Treatment Survey Results

Lake Campbell was surveyed on June 04, 2019, approximately during the same time as last year's survey (06-09-18). Similar to 2018, the main goal of the spring survey was to determine the effectiveness of our increased milfoil applications implemented during the 2018 season and assess the need for additional site specific milfoil control. Water clarity was very good exhibiting some of the best water clarity we have observed on the lake. One noted exception was the thick filamentous algae growth along most of the lake bottom with growth patterns up to three feet in depth. Limited milfoil was noted; approximately 6 plants. Milfoil growth within the 2018 targeted sites had decreased substantially. The northwestern, western and southwestern shorelines that contain dense native spatterdock are difficult lake sections to survey because of the dense floating plant growth. Milfoil plants and/or fragments can remain undetected beneath the pads. Later in the season due to water movement and a reduction in spatterdock and filamentous algae growth undetected early season milfoil plants may exhibit noticeable growth. Specifically, milfoil plants lying dormant under the thick early seasonal algae growth may potentially germinate as filamentous algae declines.



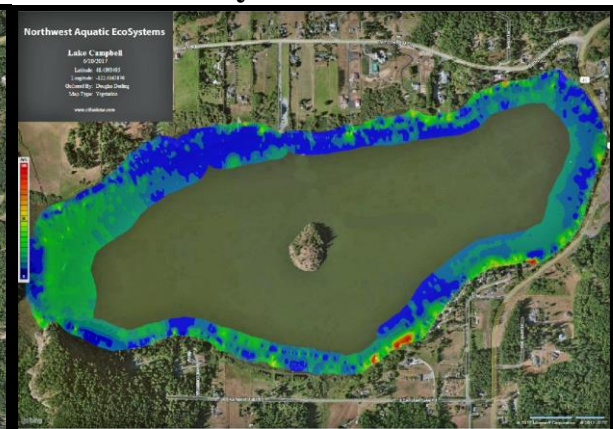
Macrophyte Survey 6-04-2019



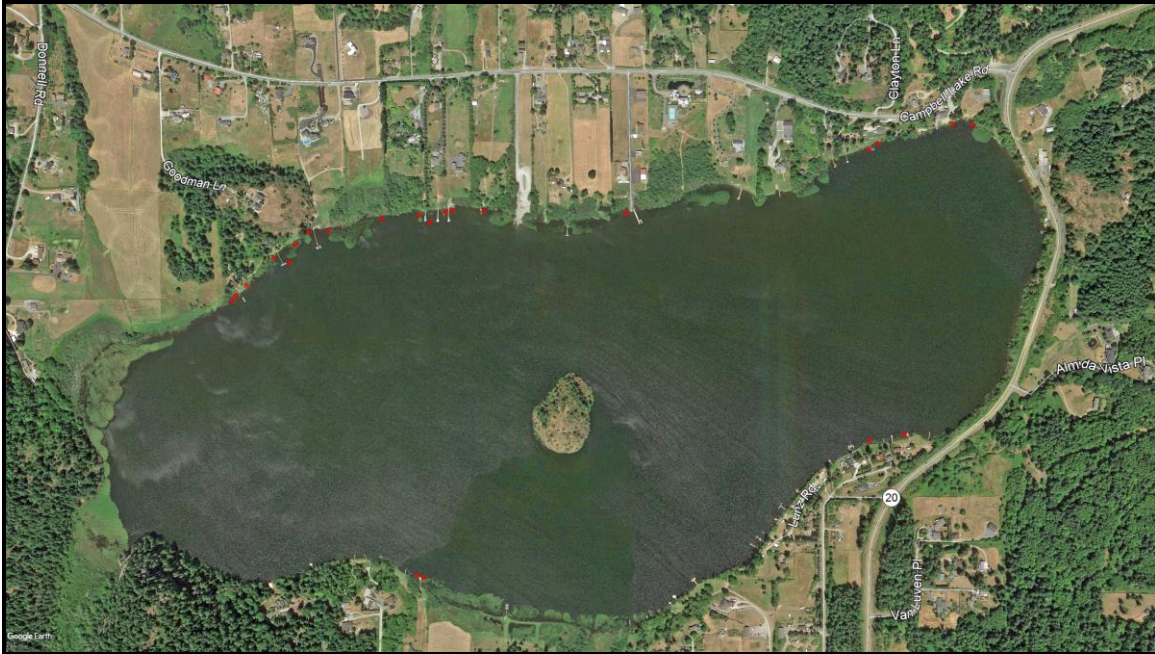
6-09 2018 Survey



6-10-2017 Survey



Milfoil Locations June 2019



Residential Lake Campbell Milfoil Pond Inspection

During the main lake survey two private properties that had been identified as milfoil sources were also inspected. The pond located adjacent to the northern shoreline east of the boat launch contained no milfoil. Only one of the three ponds abutting the southern shoreline supported three milfoil plants.

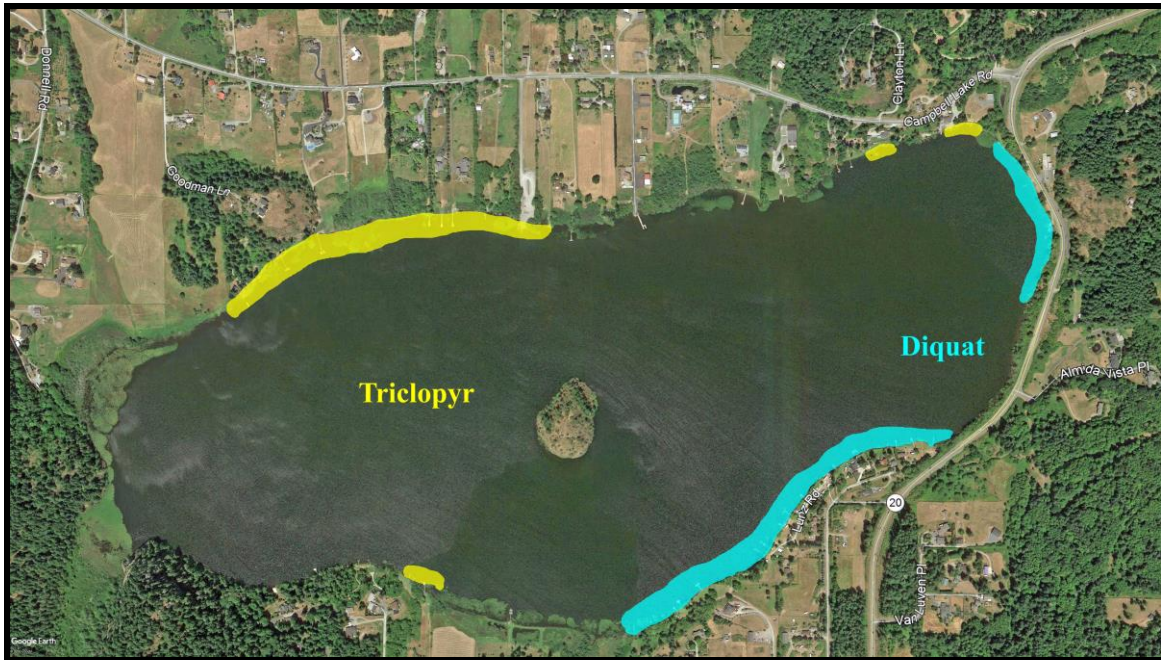


Lake Campbell Treatment

Lake Campbell was treated on 8-07-19. Treatment was scheduled later than in years past in an effort to detect and treat any late seasonal emerging milfoil. Past years have shown that early seasonal surveys typically do not represent the true degree of lake-wide milfoil growth. Late seasonal growth has shown to be problematic. The site was posted on the day of treatment. In conjunction with the shoreline posting, the public boat launch was posted with two large signs. All postings stated the materials that were planned for use and their water use restrictions. A private staging area just north of the public boat launch was employed during treatment. This is the same staging area NWAEC has utilized since our involvement with the project several years ago. The site provides easy, safe unobstructed access to the lake. Three herbicides were applied during the application phase of the project. Submersed weeds were treated with triclopyr and diquat while lily pads, spatterdock, purple loosestrife and yellow flag iris were treated with a 1% solution of imazapyr. At the time of the application the Swinomish nation was sampling and surveying the lake.

Material was off loaded from a locked cargo truck and emptied into two 25 gallon spray tanks secured within the application boat. As the boat discharged the material, it was refilled at the staging area. The process continued until all the targeted milfoil sites were treated. Once completed, the boats tanks were rinsed and filled with a 1% solution of imazapyr. This imazapyr mixture was then discharged targeting purple loosestrife, lily pads, and yellow flag iris infestations. Most of the loosestrife and iris treatment occurred along the northwest shoreline of the lake just west of the public boat launch similar to 2018. Additional minor individual patches were addressed lake-wide. These patches were very small in square footage consisting of limited plant growth on a per lot basis.

Lake Campbell Milfoil Treatment Sites



At the time of the treatment, seven acres of milfoil were treated with triclopyr. Additional acreage (12) of newly identified sporadic milfoil plants were also treated with diquat. At the close of the day the wind and wave action had increased considerably from earlier in the day.

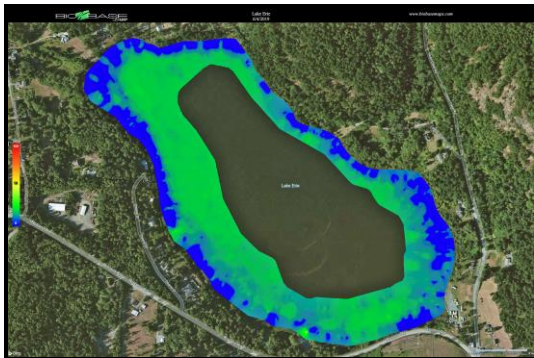
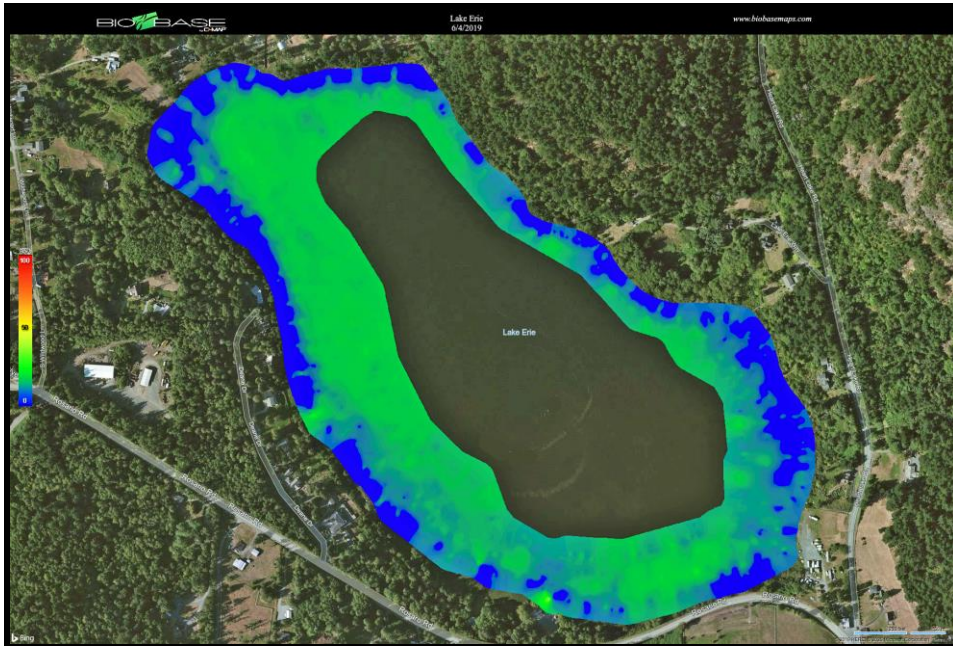
Lake Campbell Main Shoreline Emergent Plant Treatment Sites



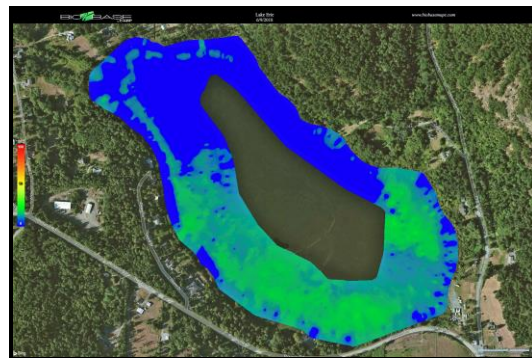
Lake Erie Pre-Treatment Survey Results

Lake Erie was surveyed on June 03, 2019. Water clarity was excellent with no noted scum observed lake-wide. Clarity was some of the best we have noted on the lake. No milfoil plants were identified in the lake. Native plant growth consisting of thin stemmed pondweeds and najas was light but still occupied most of the lake bottom, particularly areas that supported growth in prior years. Najas is still the dominant low growing species while thin leaf pondweed occupied the upper regions of the water column. No species had yet reached the water's surface.

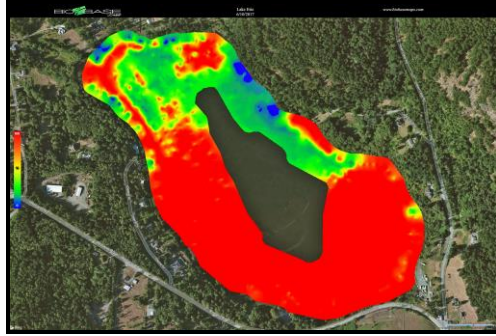
Macrophyte Survey 6-03-19 *Note – Green areas represent 20-40% plant cover red areas 100% plant cover*



6-03-19



6-09-18



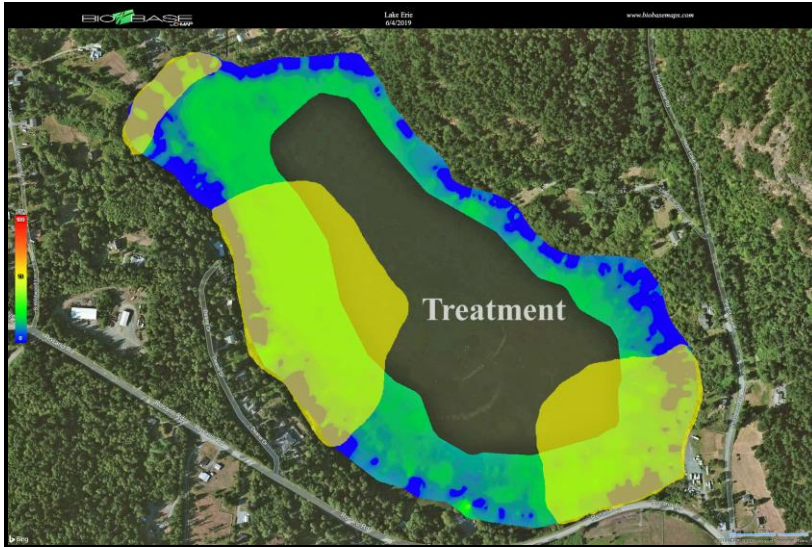
6-10-17

Lake Erie Treatment July 02, 2019

Lake Erie was treated on July 02, 2019 a few weeks earlier than our 2018 application. Targeted sites were almost identical to 2017 & 2018. Only residential and trailer park shorelines were targeted. The large residential shoreline located mid basin along the western shoreline was treated to nearly the mid basin line. The public boat launch was posted with two large signs and the residential shorelines received smaller signs on the day of treatment. Postings noted the materials used and water use restrictions. The larger public access signs identified where the material was applied and what material was used. NWAE utilized the public boat launch during treatment as their staging area. Materials were injected directly over the targeted weed beds via a boom system designed to disperse the mixture vertically throughout the macrophyte column. The treatment boat was equipped with a GPS system that ensured the application vehicle remained within the boundaries of the treatment zone. Lake treatment consisted of the application of diquat at a one/two gallon per surface acre rate. All of the properties on the lake were targeted this year similar to 2018. During 2017 the one parcel that had requested no spraying was sold.



Limited spatterdock and lily pads were treated with a 1% solution of imazapyr. Applications necessary to control both spatterdock and lily pads are now considered maintenance type applications. No large scale targeting of these species is now required.



**Lake Erie
Treatment
2019**

Lake Erie & Campbell Secondary Treatments

No secondary treatment was required at Lake Erie during 2019. Our initial treatment provided acceptable recreational weed growth throughout the season. Lake Campbell, however, experienced substantial late seasonal milfoil growth that was not supported by the established budget.

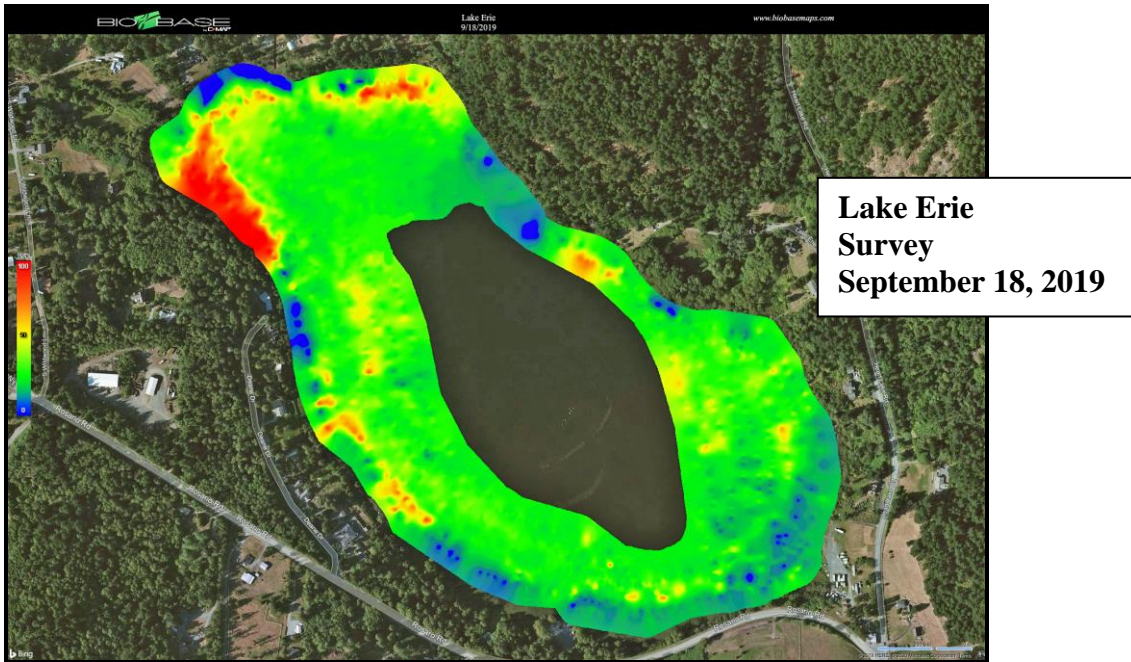
Lake Erie & Campbell Surveys September 18, 2019

Lake Erie and Campbell were both surveyed on September 18, 2019. Both systems were experiencing algae blooms. Surface scum was noted on Lake Campbell but none was observed on Lake Erie. No milfoil plants were identified during the Lake Erie survey but Lake Campbell was experiencing a considerable amount of late season milfoil growth. Growth was significantly greater than what had been observed in prior years. Plants in some areas had surfaced and were easily visible on the water's surface. While no shoreline milfoil fragments were observed at Lake Erie, fragmented plants were noted in Lake Campbell.

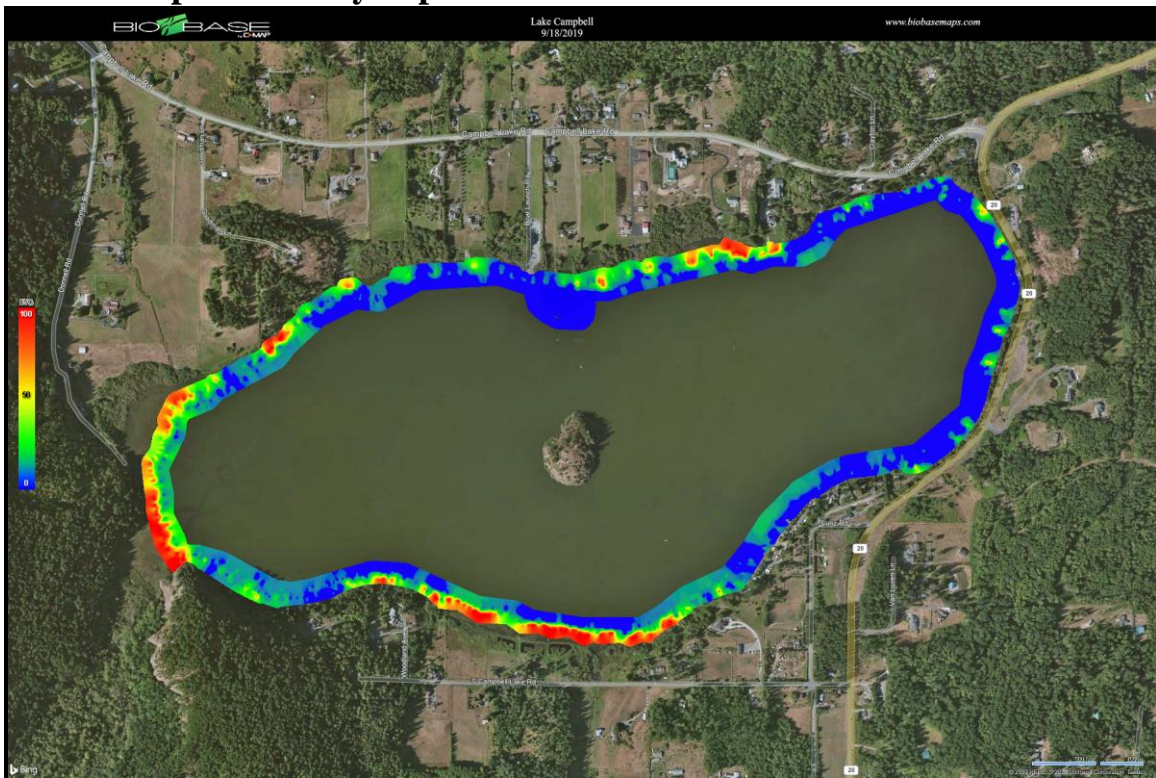
Lake Erie native plant growth was not problematic and no secondary treatment was necessary. Small patches of floating plants consisting of tiny leaved plants were noted. Once again, as noted during 2018, most of the native vegetation seen on both surveys consisted of the macro algae nitella growing along most of the lakes bottom.

Lake Campbell's unexpected late seasonal milfoil growth was probably a result of plants or seeds lying dormant under the early spring thick filamentous algae growth. As the season progressed and the range and density of the algae declined, milfoil emerged as water clarity deteriorated. Plans were initiated to return to Lake Campbell to treat the milfoil in those areas that supported the heaviest growth. After budget issues were reviewed it became apparent that funding for further 2019 treatments at Lake Campbell were not possible. A better approach would be to save the limited funding left in the 2019

budget and apply it toward the 2020 effort. No plants were observed in the private ponds adjacent to the lake.



Lake Campbell Survey September 2019

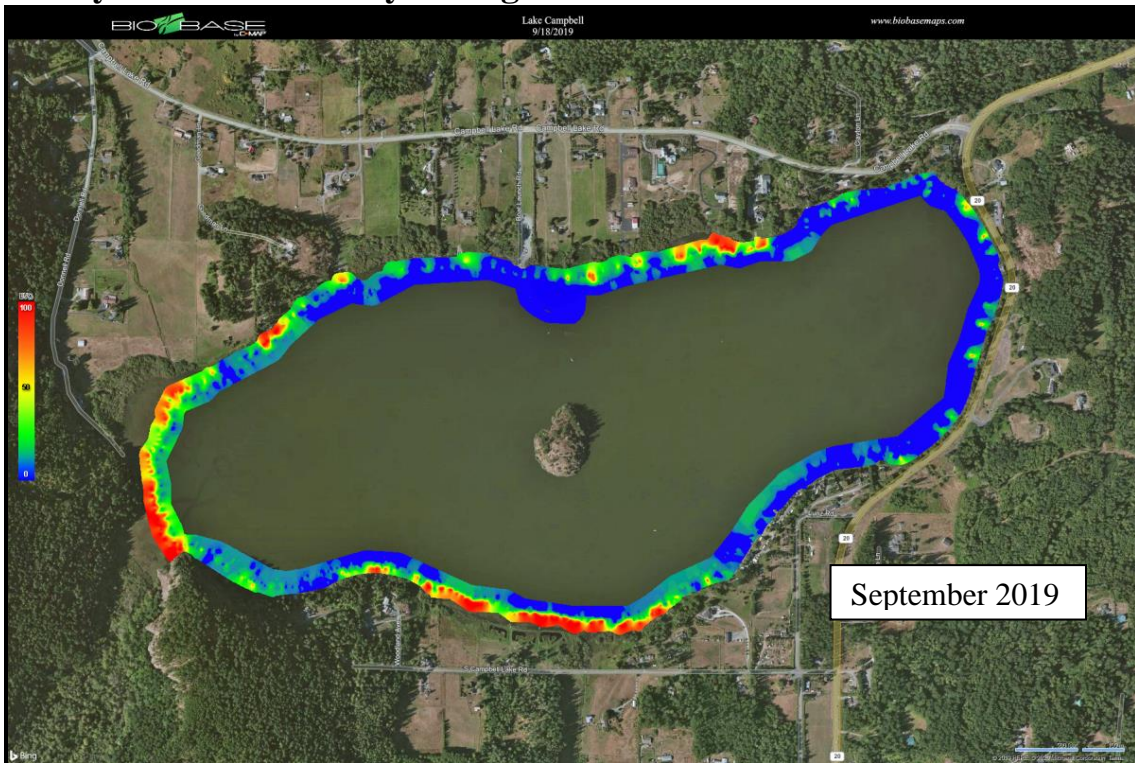




Lake Campbell Milfoil Locations September 2019

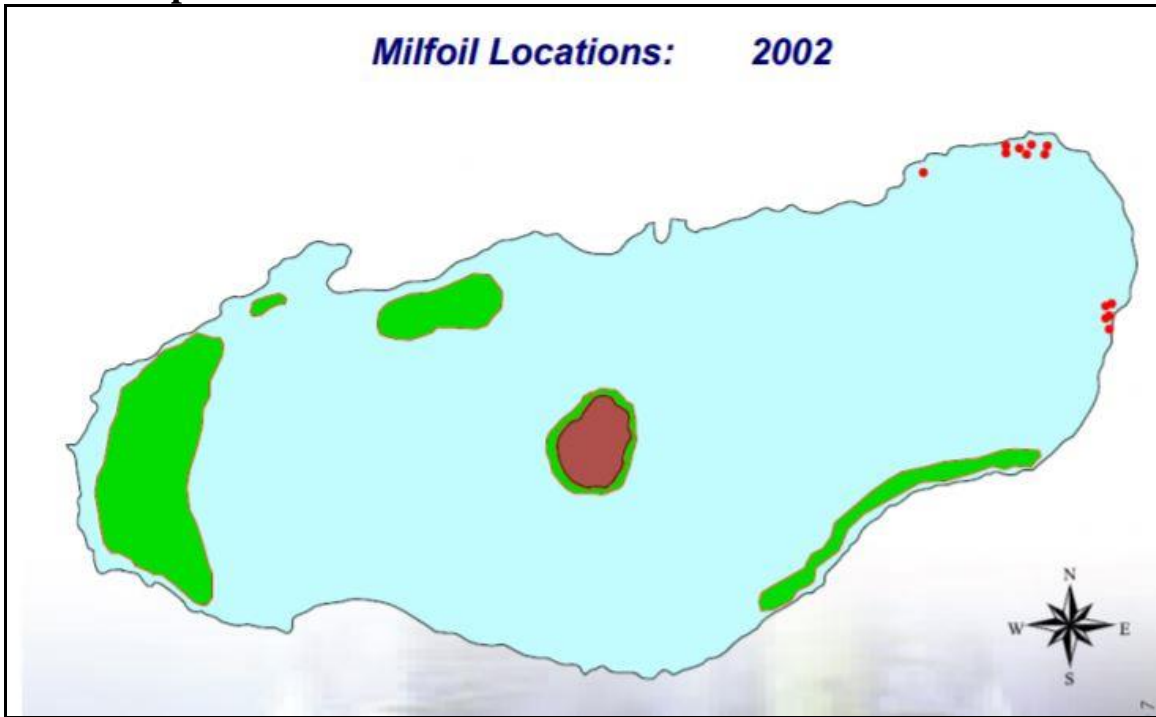
Note: Data points are not complete. Second memory card was corrupt upon downloading.

Yearly Observed Density Changes





Lake Campbell 2002



Alum

Over the past few years both Lake Erie and Campbell have experienced various degrees of algae blooms. Both have sustained rather extensive blooms that created thick scums along the surface waters. These blooms are associated with high nutrient levels that exceed the threshold concentrations necessary to produce bloom conditions. In an effort to reduce nutrient levels within these water columns and sediments, a cost evaluation was made utilizing alum as the product of choice. Alum is widely recognized throughout the industry as the most effective and economical approach at reducing elevated nutrient loads. Alum had been applied to both lakes previously and reduced nutrient levels were maintained below threshold levels for approximately 7 years. NWAEE has extrapolated cost estimates from similar projects that have required approximately the same amount of material to complete the task (10.9 mg AL/L).

Project costs would be: Lake Erie \$290,000.00, Lake Campbell \$865,000.00 at 2018 pricing.

Recommendations For 2020

Milfoil growth within Lake Campbell during 2019 has increased considerably from 2018 densities. Plants are sporadic through most of the shoreline with some shorelines experiencing elevated densities, not just single stemmed plants as noted in previous years. Program resources will likely need to focus more on milfoil control within Lake Campbell and reduced native weed control on Lake Erie. This surprising late season milfoil growth associated with Lake Campbell could not be anticipated considering densities noted at the close of 2018. No milfoil was noted within Lake Erie and late season native plant growth was not required. Untreated areas of Lake Erie will continue to provide a seed source for future problematic native weed outbreaks. It is safe to assume that Lake Erie will require some degree of native weed control on a year to year basis.

Lake Campbell will likely not require any degree of native plant control over the next 3-5 years. Milfoil efforts will need to be increased during 2020 in order to bring the milfoil densities back to manageable levels.

Northwest Aquatic Eco-Systems recommendations for the 2020 season:

1. Aggressive approach to the noted increase in milfoil identified along the Lake Campbell shoreline. Acreages targeted will be increased considerably from years past. Acreages to be determined utilizing the 2019 late summer and 2020 spring surveys.
2. Continue surveys of the two individual private shoreline residential parcels containing small ponds exhibiting milfoil growth and respond accordingly.

3. Minor targeted control of spatterdock at both lake sites to manage the encroachment of this species into the main basin and along residential shorelines. Control of the noxious species fragrant waterlily, purple loosestrife and yellow iris should continue lake-wide as the budget permits. Progress has been made in controlling both purple loosestrife and yellow flag iris as can be noted along the shoreline areas targeted now exhibiting brown dead vegetation.
4. Treatment of the problematic Lake Erie native weeds will likely need to be reduced in an effort to ensure adequate budget resources to address the current Lake Campbell unexpected milfoil issues.
5. Continue use of the new survey technology. This technology and mapping has proven to provide a broad-based evaluation of the macrophyte communities. Yearly surveys are now capable of providing simple color coded maps reflecting yearly changes in plant densities. Current mapping technology is the industry standard.
6. Current budget reflects a reduced native weed control program at Lake Erie and no secondary treatments. Costs associated with providing those additional services would exceed the current budget.
7. If possible the current budget should provide funding to address the worst case scenario (an additional \$6,000.00 - \$10,000.00)

2020 BUDGET

Surveys	4	@	\$1,600.00	\$ 6,400.00
Native Weed Control Erie	30	@	\$ 300.00	\$ 9,000.00
Noxious Weed Control Campbell	43	@	\$ 500.00	\$ 21,500.00
Purple Loosestrife Lily Pad Control	3	@	\$ 230.00	\$ 690.00
Communication				\$ 450.00
Mailings				\$ 325.00
Total				\$ 38,365.00
2020 Budget				\$ 38,000.00
Unused Budget 2019				\$ 1,900.00