

The logo for AquaTechnex features the company name in a bold, sans-serif font. 'Aqua' is in blue and 'Technex' is in black. A thick, curved orange line arches over the text from the left side.

AquaTechnex

*"Advancing the Science
of Lake Management"*

The background of the cover is a scenic landscape photograph. It shows a large, snow-capped mountain peak in the distance under a clear blue sky. In the middle ground, there is a dense forest of tall, dark evergreen trees. In the foreground, a calm body of water reflects the surrounding scenery, including the trees and the sky. A patch of bright green grass is visible on the left side of the water's edge.

**Lake Erie and Campbell
Lake Management District
2006 Year End
Report**

Introduction and Project Overview

Both Erie and Campbell lakes are located in the western portion of Washington States Skagit County. Lake Erie is a 110 acre water body with a mean depth of 6 feet and a maximum depth of 14 feet. The lake has a relatively small watershed of only 1.62 square miles. The shoreline is a mixture of both residential and commercial real estate with large areas still undeveloped. Lake Erie drains into Lake Campbell, which is located approximately one mile bearing southeast. Lake Campbell is 370 acres consisting of a mean depth of 8 feet and a maximum depth of 16 feet. Campbell has a watershed of 5.68 square miles.

Both of these lakes have been negatively impacted by aquatic plants and algae for a number of years. This is primarily due to their expansive littoral zones and significant internal/external nutrient loading capabilities. In the early 80's a Phase One Lake Restoration Study was performed on these lakes using grant funds provided by Washington States Department of Ecology. This extensive study resulted in the acquisition of additional funds to kick start a Phase Two Lake Restoration effort. An Alum (Aluminum Sulfate lake wide) treatment was performed on both Erie and Campbell in addition to an aquatic weed harvester purchased by the county for submersed weed suppression. Over time, the harvester work was abandoned due to high inputs and relatively low amounts of success for successfully diminishing plant populations. By the early 2000's weed and algae growth were back up to nuisance levels, impairing residents and visitors at the public boat launches. Eurasian Water milfoil is thought to have been introduced around this time frame as well.

The citizens of both lakes began working with Skagit County's Public Works Department to actively mitigate the impact of these weeds on their use and enjoyment of the lakes. They formed a working group, educating each other on all current problems and working on a solution for the best management of these problems. A number of public meetings were held to discuss this issue and get consensus from the community on all of the best management options available. The County Lakes staff assisted the community shortly after by developing an Integrated Aquatic Vegetation Management Plan (IAVMP). This report focused primarily on preparation for workable solutions to all current lake issues. At that time, this report was also a pre-requisite for funding from Ecology to go towards best management practices for both lakes.

During this multi year time frame the citizens of both lakes also formed a Lake Management District (LMD) to fund the implementation of the plan and raise levels of awareness. This type of special local district is set up after landowners, who benefit from the improvements to the lake, vote to create the district. The LMD has been active for approximately 5 years. Through the county, the LMD has contracted with Aquatechnex, LLC to provide aquatic plant management services. Services started with both lakes in

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2002. (Prior year end reports provide additional information on specific tasks and accomplishments for previous years; these are on file with the county.)

Management Efforts Summer 2005 and 2006 Season

Two treatments took place in the summer of 2005 for management of both Eurasian milfoil and Fragrant water lily on Lake Campbell. The shoreline was sporadically infested with both Milfoil and Lilies. For the milfoil, a selective broadleaf herbicide DMA-4, IVM (active 2,4-D) was used for control of all infestations. The Fragrant water lily was sprayed with the translocating herbicide AquaPro (active glyphosate). Both treatments were on a two treatment program once in the first week of August with a follow-up the third week of August. In all, approximately one acre of shoreline lilies was sprayed and 35 acres of submersed milfoil were targeted. Judging by the 2006 survey displayed in the following maps, both treatments were extremely successful. Sample points in 2006 show a control of > 95% for targeted treatments when comparing to survey sampling prior to the 2005 survey. This concluded management activities for 2005. Lake Erie did not have any treatment in 2005 following a survey that brought up no noxious weed populations warranting a treatment.

Though there was no herbicidal treatment in 2006 on either lake, a significant triploid grass carp stocking took place in early May. 600 8-12 inch carp were introduced into Lake Campbell and 200 into Lake Erie. Survey results from this year show a significant change in native submersed weeds, leading our group to believe the grass carp actively removing natives. A hostile take-over of Northern and Hybrid milfoil has erupted as a result in Lake Campbell, both plants being at the bottom of the carp food preference list. Lake Erie remains fairly native weed dominant with really only widgeon grass as the dominant species in that lake as of now.

The Erie/ Campbell LMD hired Aquatechnex to implement a monitoring program of these lakes to characterize the aquatic plant communities and help determine the need for additional aquatic plant management activities over the life of the LMD. This report summarizes all monitoring performed during the fall survey of 2006, and will illustrate impacts of grass carp populations on native weed populations. It will also present protocols for ongoing monitoring and suggest aquatic plant management objectives for 2007.

Survey Methods and Implementation

The objectives of the field aquatic plant survey efforts for 2005 were as follows:

- To monitor the changes in the aquatic plant communities over time.
- Insure that the maps and data contain the information necessary to support aquatic plant management permit applications in future years.
- To characterize the conditions present in the lakes during the summer of 2006 and make recommendations to the community regarding additional control efforts.

Our first step was to review past years survey results so as to have an awareness of all past plant locations for reference during the survey. Planning and assembly of equipment was the next step. Boats, sampling equipment and data collection equipment were mobilized to the lake for the 2006 survey.

The survey team had some hardships during this survey as it was implementing a new technology into the field. Aquatechnex has acquired a Trimble Pro XT GPS unit that consists of the Trimble receiver and a Bluetooth wireless transmission to a Panasonic tough book with touch screen capabilities. Survey technique remained the same, with the primary change being that this new technology allows surveyors to put sample points right into a map on ArcView 9.1 in the field! This is a fine feature for referencing and doing a compare and contrast with print-offs of year prior maps.

An effort was put forth this fall to attain a high resolution image for the survey maps. The western portion of Skagit County is not yet available from the GIS department of Skagit County. As a result, all sample points taken this year are being displayed in Arc view 3.2 on a pre-existing black and white sat image provided by TerraServer USA. Communications reveal images available as soon as January of 2007. At this time, the images can be implemented into the updated Arc view 9.1 which boasts extremely significant upgrades in the displaying of data.

For this years survey a new data dictionary was created for the new Trimble device. Four features were chosen for the two lakes as follows;

- ~ Fragrant water lily points/areas
- ~ Purple loosestrife points. Offshore referencing
- ~ Eurasian milfoil points/areas
- ~ Native Plants (with dropdown menu for all native species)

Default feature settings were established for each feature on the Trimble Pro XT. The logging interval was set for one second intervals. The accuracy default was set for 'code'. The default minimum number of positions collected for each feature was set for 10. Display symbols and colors for the symbols were also selected and set.

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The following maps illustrate what was found in both lakes this fall of 2006. Each illustration will have a descriptive section in the appendix. As there are 14 maps, descriptions will be numbered 1-14 in the appendix and relate to corresponding maps. There are 13 maps for Lake Campbell and one map for Lake Erie. Two additional maps from 2005 are beside maps of 2006 for compare and contrast to the 2006 survey of Campbell.

Survey Results

Based on the results from the 2006 fall survey, a lot can be said about both the 2005 treatments and the stocking of grass carp. Detail for each map will be displayed in the appendix as mentioned, so this section will cover major issues.

Campbell;

35 acres were initially treated in August of 2005. Of those 35 acres, less than one remains of Eurasian. Today, double the initial 35 exists in the form of hybrids and northern milfoils. Two reasons this may be happening. One, even though DMA-4 is a selective broadleaf, its fate in the mortality of northern and hybrid milfoils is undetermined. Believed to have some resistance, we will need to watch these populations and determine a viable solution to management of the two species. From a whole lake standpoint, the switch from native submersed to non-native and nuisance aquatic weeds is very obvious. Clearly, the grass carp have gotten off to a speedy start and is already thinning out the native mats enabling the exotics more room to grow. Triploid carp will eat Milfoil's though not usually until all other food sources are consumed. Small native populations remain around the lake which is a good sign that a food source is still evident.

The Fragrant water lily populations are worth noting as well. Last year approximately one acre of shoreline lily coverage was treated in August. The survey shown displays locations in 2005 vs. 2006. Though still at most of the 2005 locations, the lilies we found this year were one to two pads per sample point. This will require maintenance to continue efforts of eradication for this noxious weed.

Erie;

Lake Erie has seen some drastic changes as well. Ever since the lake wide Sonar treatment back in 2000 Milfoil has been sparse in the lake system. The 2005 survey turned up no milfoil. This fall one plant was mapped and will require hand removal early in the 2007 growing season. As for native species, it seems as though the grass carp are actively eating up what populations of Leafy and Slender-leafed pondweed remain. Macro algae Chara and Filamentous Algae remain in small population though were not

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noted in the 2006 transects. Straight line transects in 2006 found a lake wide trend of dominant widgeon grass. As the stands were thinned out in some areas, we believe that the grass carp will continue to attack the widgeon grass and the lake will sustain its current health for several years.

Recommendations

There are a couple of things that need to be addressed for a successful 2007 season on both Erie and Campbell. Though noxious weed levels are down, remaining plants need to be controlled for spread prevention. Below are recommendations for both lakes starting in the spring of 2007.

Campbell;

It is suggested that another survey take place in the spring time as soon as the submersed weed populations show active signs of growth. Any noxious weeds found should be mapped and presented for treatment. Fragrant lily and Purple Loosestrife populations should be actively removed next year as well as any shoreline Yellow flag Iris that may be visible. Continued research and pending results of a spring survey will guide our group to establishing the best management tool for the ever growing Northern/Hybrid Milfoil populations.

Erie;

First priority would be to do a spring survey of this zone. The survey should be extensive, as one milfoil plant usually indicates the chance of other single plants in other locations. Post survey, a dive crew should hand remove the one plant found this fall and any other plants that may be found during the spring survey. Seeing as most of Lake Erie is littoral zone, a spread of milfoil could be disastrous.

Questions or Comments;

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Appendix A

Maps 1-16

1; 2005 milfoil coverage. All polygons represented areas that contained Eurasian water milfoil plants. Many of these sites are now fully infested with Northern and Hybrid milfoils as shown in maps 2 and 3. It is thought that Eurasian milfoil does still exist in this system, though an extensive spring survey will need to occur as this fall had too dense of a variety milfoil canopy for proper survey techniques to occur.

2-3; Northern and Hybrid milfoil zones that have clearly taken over the lake in a mere season. Populations of both species have more than tripled in size over the 2006 growing season. This phenomenon will need to be closely monitored as soon as spring growth begins.

4-5; Fragrant water lily comparison between 2005 and 2006. As there was a treatment in 2005 for the lilies, a comparison is needed for monitoring results. As seen in the maps, locations of this plant have not changed over the past year. Some lilies did not get controlled in the 2005 application as illustrated. The 2006 points are mere single and double plants with one or two points having more than two plants. Overall, the 2005 treatment did an excellent job at keeping the lily populations at bay. It is suggested that another treatment take place in 2007 to further eliminate this noxious from the Campbell system.

6; Purple Loosestrife stands. These points are referencing stands of purple loosestrife that are on shore. These plants have been mapped out over the past few years with no real control projects in place. It is suggested and was discussed with Michael See this fall that an effort for future control of this noxious weed take place. As it stands, the plant is fairly contained to the northeast portion of the lake. If left alone it will likely spread throughout the shoreline as it is more dominant than most of the grasses and broad leafs that border the lake.

7-14; Native submersed weed maps. Similar to past years are illustrations of the native plant coverage throughout the lake. It is clear that native stands have significantly been reduced over the 2005 survey. This is a majority due to the dominant native Northern Milfoil and Hybrid. These two species are extremely competitive and will starve out native pondweeds in their search for more nutrients. The milfoils will also form a dense canopy, providing light to only themselves. The milfoil populations will need to be controlled to ensure native stands are able to re-habilitate to densities they once were.

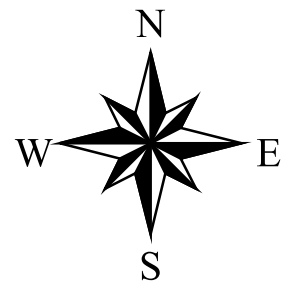
15; This map simply shows were the littoral zones of the lake give way to deeper, 'no growth', zones.

16; A map illustrating the overall consistency of native widgeon grass in Lake Erie. As shown, one Milfoil plant was found and needs to be removed in the spring.

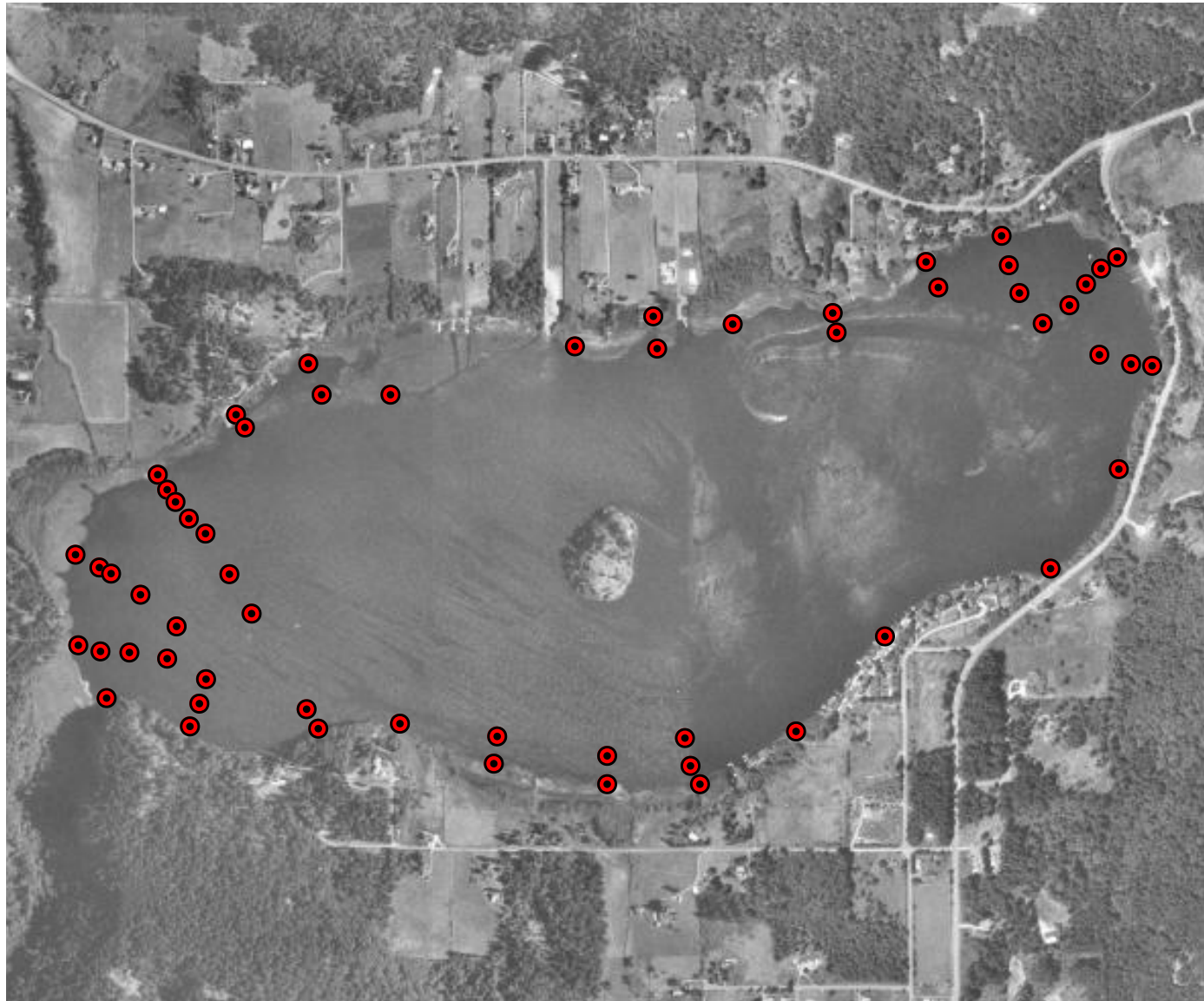
Lake Campbell 2005 Survey Milfoil Coverage



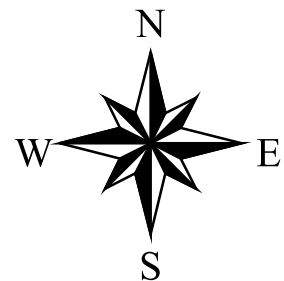
-  Sparse milfoil
-  Sparse milfoil
-  Sparse milfoil
-  Sparse eurasian points
-  Mod sparse eurasian
-  Moderate eurasian
-  Mod dense eurasian
-  Dense moderate eurasian
-  Dense mod eurasian



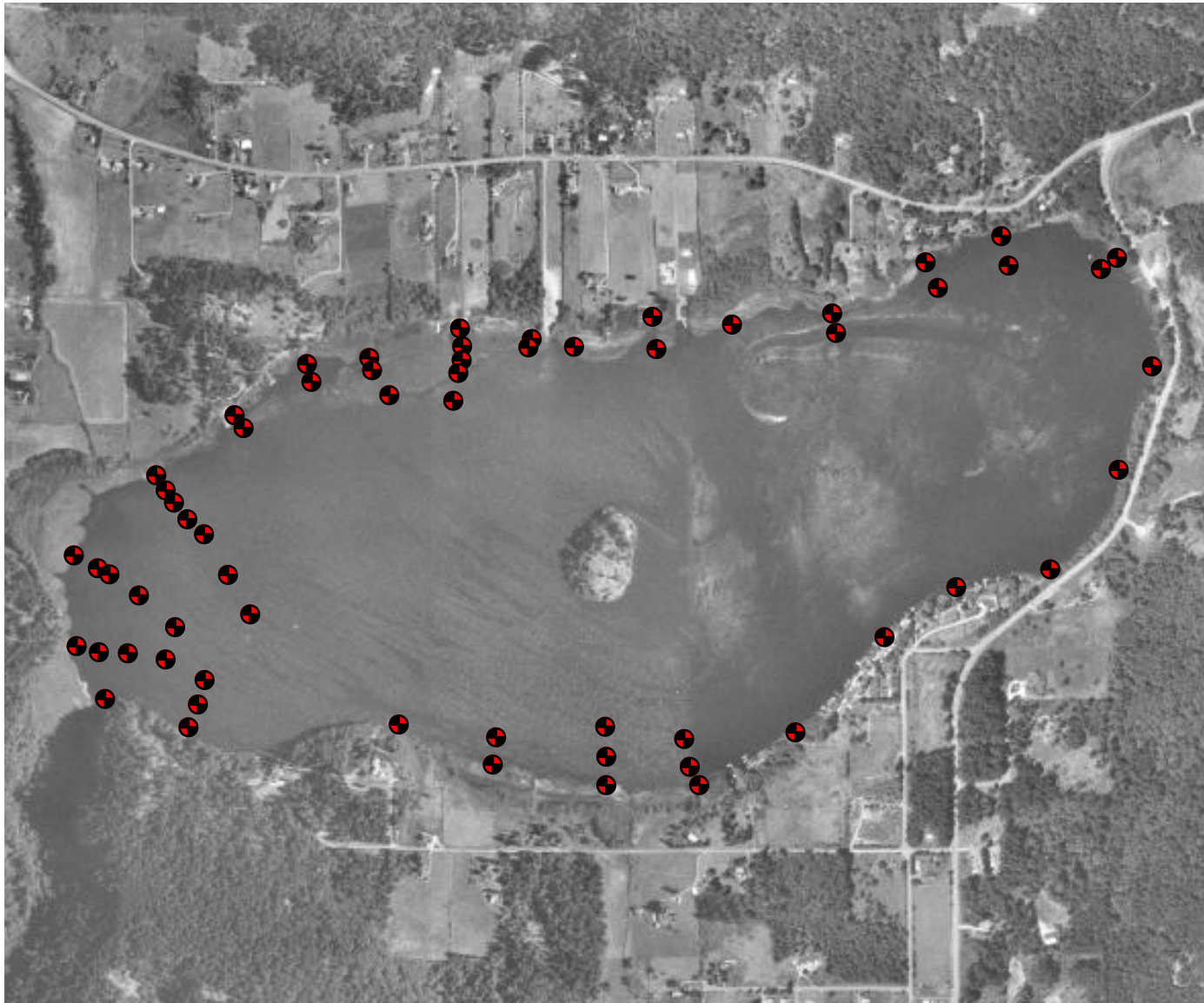
Lake Campbell 2006 Fall Survey



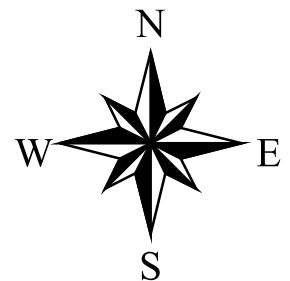
- Hybrid milfoil2
- Hybrid milfoil



Lake Campbell 2006 Fall Survey



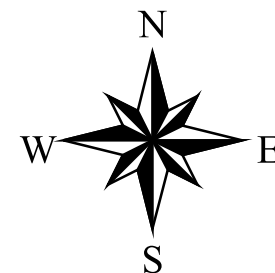
- Northern milfoil3
- Northern milfoil2
- Northern milfoil



Lake Campbell 2005 Fragrant Lily sites



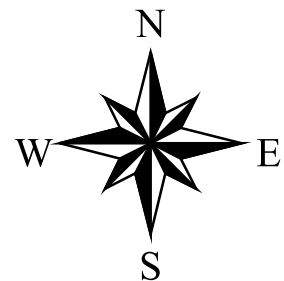
- Fragrant water lily points
- Fragrant water lily areas



Lake Campbell 2006 Fall Survey



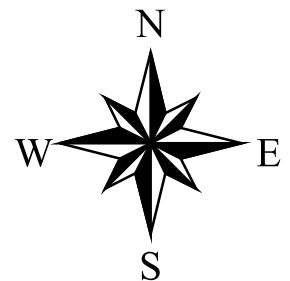
● White water lily



Lake Campbell 2006 Fall Survey



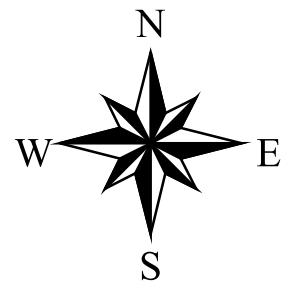
● Purple Loosestrife



Lake Campbell 2006 Fall Survey



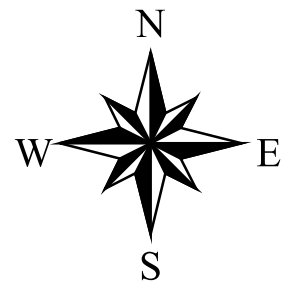
 American pondweed



Lake Campbell 2006 Fall Survey



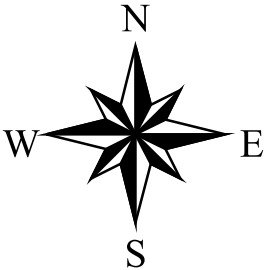
- Chara3
- Chara2
- Chara1



Lake Campbell 2006 Fall Survey



- Curly leaf3
- Curly leaf2
- Curly leaf

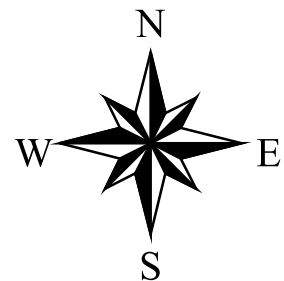


Lake Campbell 2006 Fall Survey



- ⊕ Elodea
- ⊕ Elodea2

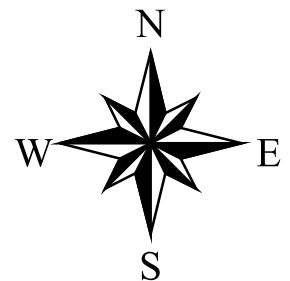
0.4 0 0.4 0.8 Miles

A horizontal scale bar with four segments. The first segment is labeled '0.4', the second '0', the third '0.4', and the fourth '0.8 Miles'.

Lake Campbell 2006 Fall Survey



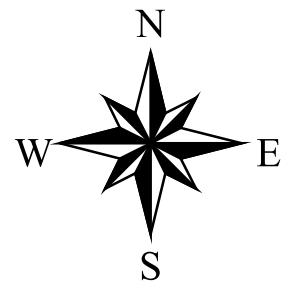
- ⊕ Naiad4
- ⊕ Naiad3
- ⊕ Naiad2
- ⊕ Naiad



Lake Campbell 2006 Fall Survey



- ⊕ Richardson pondweed3
- ⊕ Richardson pondweed2
- ⊕ Richardson pondweed

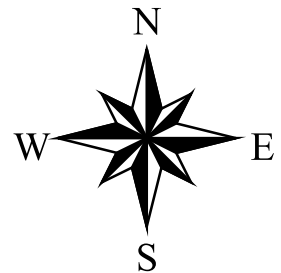


Lake Campbell 2006 Fall Survey



- ⊕ Thin-leaf pondweed2
- ⊕ Thin-leaf pondweed

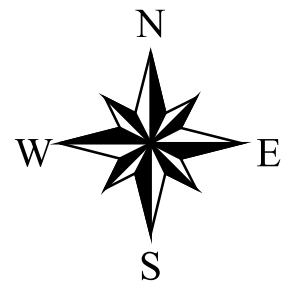
0.4 0 0.4 0.8 Miles

A horizontal scale bar with four segments. The first segment is labeled '0.4', the second '0', the third '0.4', and the fourth '0.8 Miles'.

Lake Campbell 2006 Fall Survey



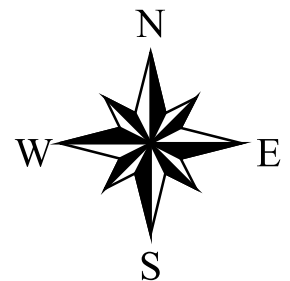
- ⊕ Widgeon grass4
- ⊕ Widgeon grass3
- ⊕ Widgeon grass2
- ⊕ Widgeon grass



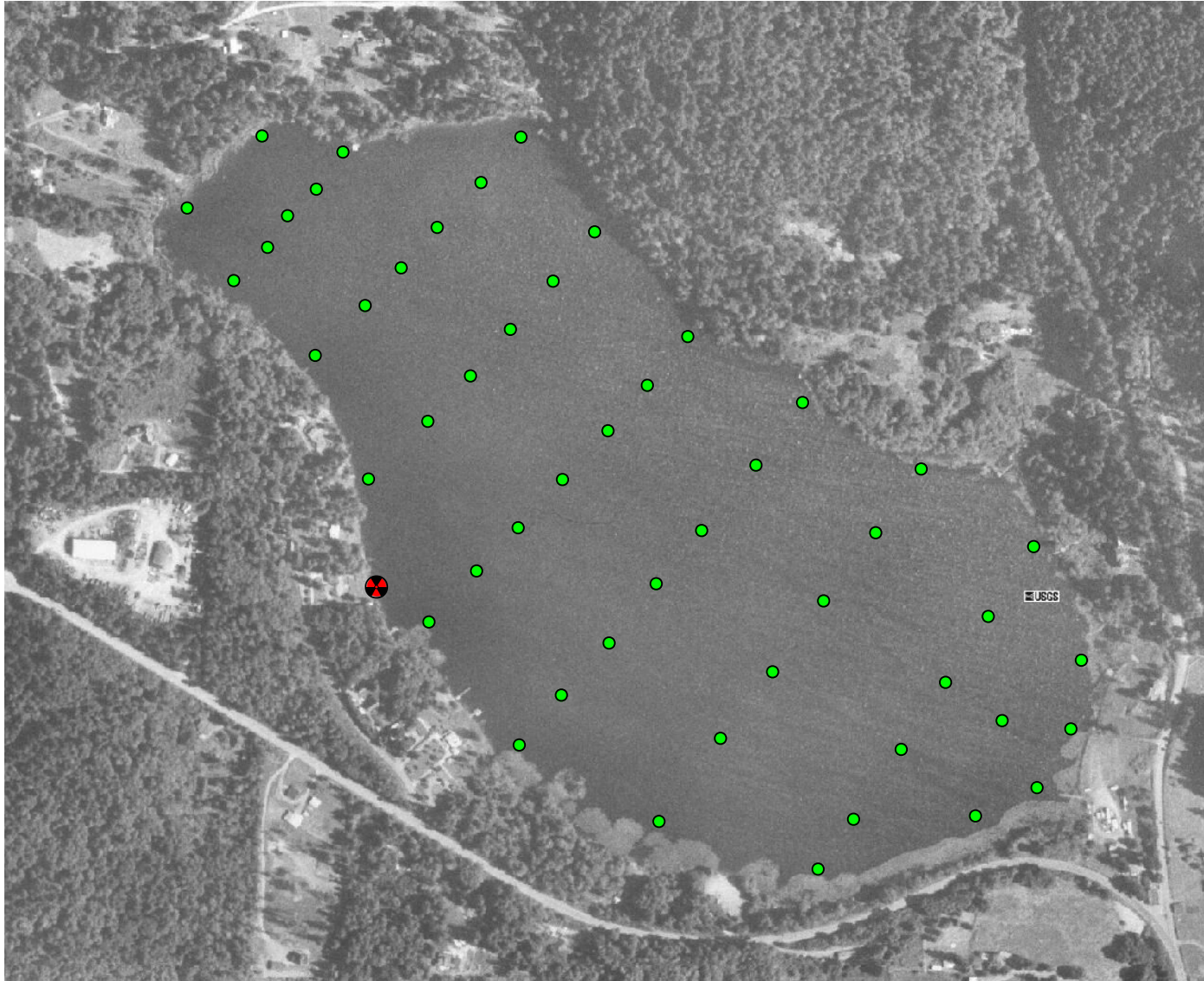
Lake Campbell 2006 Fall Survey



- ▲ No plants 2
- ▲ No plants



Lake Erie 2006 Fall Survey



-  Eurasian watermilfoil
-  Widgeon grass

