2014 Lake Blass Aquatic Macrophyte Survey & Plan

Performed by Aquatic Engineering, Inc.

2014 Lake Blass Aquatic Macrophyte Survey & Plan

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In cooperation with the Wisconsin Department of Natural Resources (SPL-341-14), the Village of Lake Delton, Camp Chi and the residents of Blass Lake.

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Introduction

A whole lake aquatic plant survey of Lake Blass was conducted during the summer of 2014 by the staff of Aquatic Engineering, Inc. This was the first formal survey conducted on Lake Blass.

A technical survey of aquatic plant density and distribution is essential for understanding the lake ecosystem due to the major ecological role they play and the sensitivity to water quality parameters that plants require (Dennison et al, 1993). The quantitative survey performed in 2014 will provide some useful information toward future management of Blass Lake, including fish habitat improvement, sensitive species protection, aquatic plant management, and water resource related issues.

Ecological Role

Aquatic macrophytes (aquatic plants) provide the source of the food web in a lake and a foundation for sustaining all other biota within the lake. Plants and algae within a lake provide food and oxygen for fish and wildlife. The plants provide food, habitat and cover for the animals and invertebrates that many other aquatic macro organisms depend on. Plants improve water quality, protect shorelines and lake bottoms, and add aesthetics to a lake; however, they also may impact recreation.

Water Quality

Plants within the aquatic ecosystem can serve as indicators of water quality because of their sensitivity to water quality parameters, such as clarity and nutrient levels (Dennison et al, 1993).

Analysis performed within Lake Blass showed a pH range between 7.5-8.5. The range is indicative of "hard" waters as found in Blass Lake. Hard water lakes tend to produce better fisheries and aquatic plants than soft water lakes (Shaw et al, 2004).

Background and History

Blass Lake is located within the Village of Lake Delton in Sauk County, Wisconsin. Blass Lake is a man-made impoundment created in 1929 when Springbrook Creek was dammed. The lake is known to be hyper-eutrophic with poor water quality which contributes to excessive aquatic plant growth since at least 1958 (Ball et al, 1971). There has be no known formal aquatic plant survey on Blass Lake prior to 2014. Historic management has occurred in high use recreational areas around riparian docks and beach areas of Camp Chi over the past decade with herbicides.

Methods

Field Methods

The technical survey study performed was based on the rake-sampling method by Hauxwell et al. (2010) using a point-intercept sampling design, with sites located on a geo-referenced sampling grid placed over the entire lake. From this method, the Wisconsin Department of Natural Resources (WI DNR) created 149 sampling points throughout the entirety of Lake Blass (Fig. 1). Application of this methodology allows: 1) assessment of frequencies of occurrence of different plant species, as well as estimates of species richness, abundance, and maximum depth of colonization; and 2) comparisons of aquatic plant variables over time and among lakes.

To begin the study, a qualitative survey is visually completed and specimens are collected. The quantitative survey is carried out by visiting each of the 149 pre-established GPS survey locations, and dropping a rake to determine depth, sediment type by texture, rake fullness, and species present on the rake sample. Technicians also visually examined and species present within 6 feet of the sampling point and would record the data as visually observed. The rake fullness parameter is determined by the relative amount of vegetation hanging on the rake head when it is retrieved and a value of 1-3 is assigned (Fig. 2). From the vegetation hanging on the rake, a relative distribution of species collected is also determined and the same rating is assigned, with 3 being the dominant species on the rake, 2 being a moderate abundance, and 1 being the species is very minimal in the rake sample. The data is recorded by hand in the field and later entered into a database for further statistical analysis.

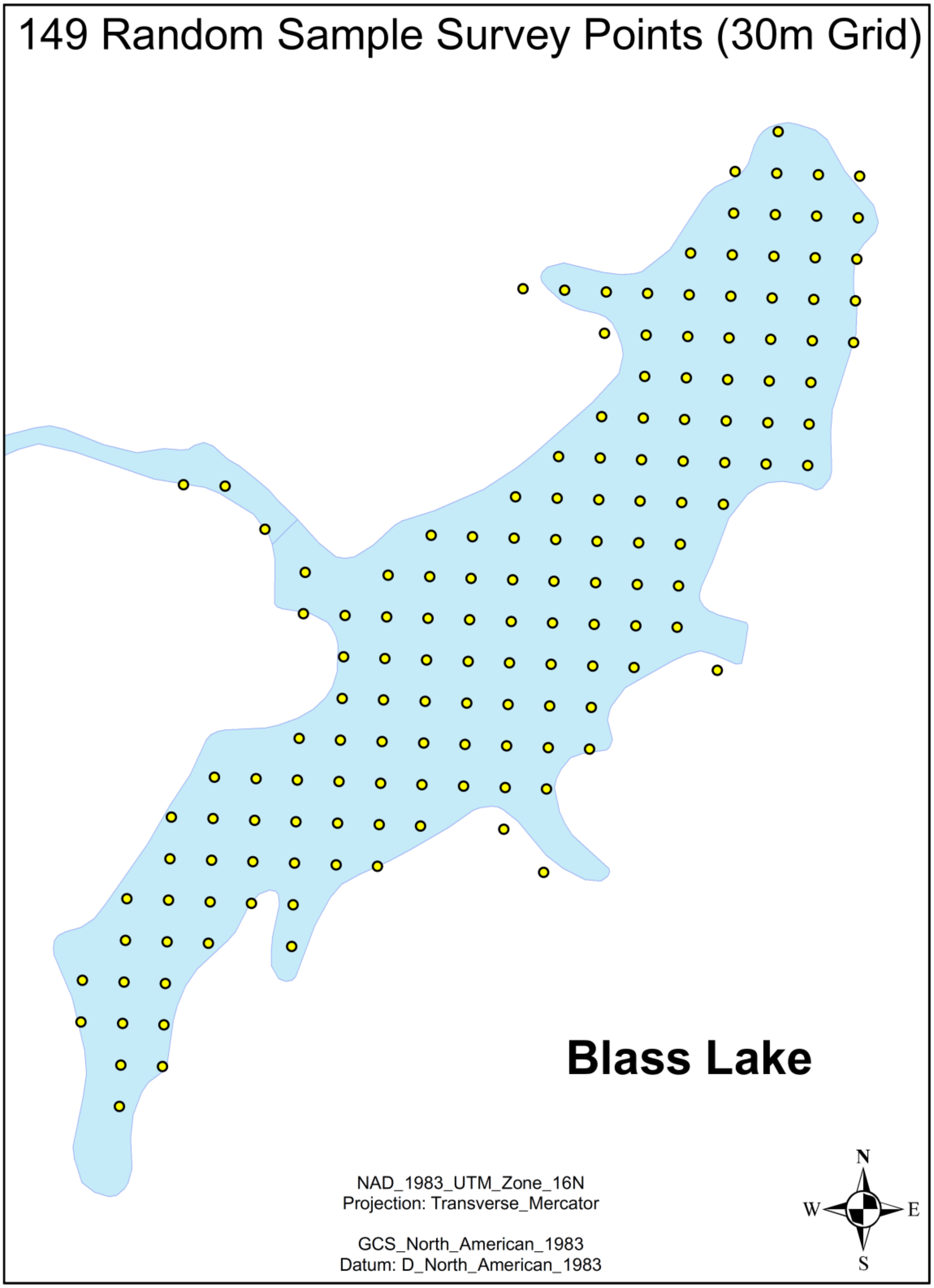

Figure 1. The 149 sampling point grid generated by the Wisconsin DNR for the Lake Blass aquatic macrophyte survey.

Fullness Rating	Coverage	Description
1		Only few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover the tines.
3		The rake is completely covered and tines are not visible.

Figure 2. Illustration of rake fullness ratings used during the survey.

Data Analysis

All data from the field sampling was entered into the raw APM data spreadsheet (Appendix B) (Hauxwell et al, 2010). With the data entered, the following was calculated:

Individual Species Statistics

<u>Frequency of occurrence within vegetated areas (%)</u>: Number of sites at which a species was observed divided by the total number of vegetated sites. Frequency of occurrence is sensitive to the number of sample sites included. Including non-vegetated sites will lower the frequency of occurrence.

<u>Frequency of occurrence at sites shallower than maximum depth of plants</u>: Number of sites a species was observed at divided by the total number of sites shallower than maximum depth of plants.

<u>Relative frequency (%)</u>: This is proportional value that reflects the degree to which an individual species contributes to the sum total of all species observations. The sum of the relative frequencies of all species is 100%. Relative frequency is not sensitive to whether all sampled sites, including non-vegetated sites, are included. Relative frequency does not take into account aquatic moss, freshwater sponges, filamentous algae, or liverworts.

<u>Relative frequency (squared)</u>: This value is only part of a calculation and is not used directly.

<u>Number of sites where a species was found</u>: This is the sum of the number of sites at which a species was recorded on the rake.

Average rake fullness: Mean rake fullness rating, ranges from 1-3.

Number of visual sightings: This is the total number of times a plant was seen within 6 feet of the boat, but not collected on the rake.

Summary Statistics

Total number of sites visited: Total number of sites where depth was recorded, even if a rake sample was not taken. There were a few sites on sampling grid that ended up being on shore, or was near impossible to navigate, and therefore, not all of the 149 sampling sites the WI DNR had created were sampled.

Total number of sites with vegetation: Total number of sites where at least one plant was found on the rake. If no plants were found on the rake, yet a visual of a plant was recorded right next to the sampling point, the number would still be zero due to no vegetation actually being collected.

Total number of sites shallower than the maximum depth of plants: Total number of sites where the depth was less than or equal to the maximum depth at which plants were found. This value is used for frequency of occurrence calculations at sites shallower than the maximum depth of plants.

Frequency of occurrence at sites shallower than maximum depth of plants: Number of times plants were recorded at a site divided by the total number of sites sampled that were shallower than the maximum depth of plants.

Simpson's Diversity Index: A nonparametric estimator of community heterogeneity. It is based on relative frequency and thus is not sensitive to whether all sampled sites (including non-vegetated sites) are included. The closer the Simpson Diversity Index is to 1, the more diverse the community. Although many natural variables like lake size, depth, dissolved minerals, water clarity, mean temperature, etc. can affect diversity, in general, a more diverse lake indicates a healthier ecosystem. Perhaps most importantly, plant communities with high diversity also tend to be more resistant to invasion by exotic species.

Maximum depth of plants: This is the depth of the deepest site sampled at which vegetation was present. Please note that his value does not take into account aquatic moss, freshwater sponges, filamentous algae, or liverworts.

Number of sites sampled using rake pole/rope: This indicates which rake type was used to take a sample. Protocol suggests a 15ft pole rake, and a 25ft rope rake for sampling.

Average number of all species per site (shallower than max depth): Mean number of species found at sample sites which were less than or equal to the maximum depth of plant colonization.

Average number of species per site (vegetated sites only): Mean number of species found at sample sites where vegetation was present.

Average number of native species per site (shallower than max depth): This does not include Eurasion water milfoil, Curly-leaf pondweed, Purple loosestrife, Spiny naiad, or Reed canary grass.

Average number of native per site (vegetated sites only): This does not include Eurasian water milfoil, Curly-leaf pondweed, Purple loosestrife, Spiny naiad, or Reed canary grass.

Species richness: Total number of species observed not including visual sightings. Please note that this value does not include aquatic moss, freshwater sponges, filamentous algae, or liverworts.

Species richness (including visuals): Total number of species observed including visual sightings recorded within 6 feet of the sample site (but does not include additional species found during the qualitative boat survey).

Floristic Quality Index (FQI): This index measures the impact of human development on a lake's aquatic plants. Species in the index are assigned a Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each species found in the lake and multiplying it by the square root of the total number of plant species (N) in the lake ($FQI = \Sigma(c1+c2+c3+\ldots cn)/\sqrt{N}$). Statistically speaking, the higher the index value, the healthier the lake's macrophyte community is assumed to be. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Lake Blass is within the Northern Central Hardwood Forests Ecoregion.

NHI Species Review

The Wisconsin Natural Heritage Inventory (NHI) lists of species and natural communities that are known or suspected to be rare in Wisconsin. The species are legally designated into different categories varying from endangered (END) or threatened (THR) to advisory capacity of special concern (SC). The regions of Blass Lake are in Section 17, township 13N and Range 6E.

The NHI list is below with all the circumstantial species in this area (Table 1).

Scientific Name	Common Names	WI Status	Federal Status	Group
Alder thicket	Alder thicket	NA		Community~
Ameletus lineatus	A Mayfly	SC/N		Mayfly~
Artemisia frigida	Prairie Sagebrush	SC		Plant
Asplenium trichomanes	Maidenhair Spleenwort	SC		Plant
Atrytonopsis hianna	Dusted Skipper	SC/N		Butterfly
Bombus affinis	Rusty-patched Bumble Bee	SC/N		Bee
Buteo lineatus	*Red-shouldered Hawk*	THR		Bird~
Carex festucacea	Fescue Sedge	SC		Plant~
Chlosyne gorgone	Gorgone Checker Spot	SC/N		Butterfly
Cycleptus elongatus	Blue Sucker	THR		Fish~
Dry cliff	Dry Cliff	NA		Community
Dry prairie	Dry Prairie	NA		Community
Emergent marsh	Emergent Marsh	NA		Community~
Emydoidea blandingii	Blanding’s Turtle	SC/P		Turtle~
Floodplain forest	Floodplain Forest	NA		Community~
Fusconaia ebena	Ebonyshell	END		Mussel~
Gymnocarpium jessoense ssp. parvulum	Northern Oak Fern	SC		Plant
Hemlock relict	Hemlock Relict	NA		Community
Hesperia metea	Cobweb Skipper	SC/N		Butterfly
Houstonia caerulea	Azure Bluets	SC		Plant
Macrhybopsis hyostoma	Shoal Chub	THR		Fish~
Moist cliff	Moist Cliff	NA		Community

Moist sandy meadow	Moist Sandy Meadow	NA		Community
Myosotis laxa	Small Forget-me-not	SC		Plant~
Northern dry forest	Northern Dry Forest	NA		Community
Northern dry-mesic forest	Northern Dry-Mesic Forest	NA		Community
Ophisaurus attenuatus	Slender Glass Lizard	END		Lizard
Phemeranthus rugospermus	Prairie Fame-flower	SC		Plant
Pine relict	Pine Relict	NA		Community
Platanthera flava var. herbiola	Pale Green Orchid	THR		Plant~
Platanthera hookeri	Hooker's Orchid	SC		Plant
Plethobasus cyphyus	Sheepnose	END	LE	Mussel~
Polyodon spathula	Paddlefish	THR		Fish~
Primula mistassinica	Bird's-eye Primrose	SC		Plant~
Pseudognaphalium saxicola	Cliff Cudweed	THR		Plant
Rhondodendron lapponicum	Lapland Azalea	END		Plant~
Sand barrens	Sand Barrens	NA		Community
Scleria triglomerata	Whip Nutrush	SC		Plant~
Setophaga cerulea	Cerulean Warbler	THR		Bird
Simpsonaias ambigua	Salamander Mussel	THR	SOC	Mussel~
Southern dry forest	Southern Dry Forest	NA		Community
Southern dry-mesic forest	Southern Dry Mesic Forest	NA		Community
Southern sedge meadow	Southern Sedge Meadow	NA		Community~
Springs and springs run, hard	Springs and Springs Runs, Hard	NA		Community~
Stream--fast,hard,cold	Stream--Fast, Hard, Cold	NA		Community~
Tritogonia verrucosa	Buckhorn	THR		Mussel~
Vaccinium cespitosum	Dwarf Bilberry	END		Plant
Vireo bellii	Bell's Vireo	THR		Bird
White pine-red maple swamp	White Pine-Red Maple Swamp	NA		Community

Information retrieved from http://dnr.wi.gov/topic/NHI/data February 3, *2017.*

Table 1. Natural Heritage Inventory (NHI) for Blass Lake region.

The water quality is considered moderately clear which could increase the organism diversity. Although at times it is considered hypereutrophic due to the surrounding watershed during droughts and other similar events. The NHI lists many species but it is not limited to those that are defined, as this lake is a stable and diverse ecosystem for the region.

Results

Physical Data

The methods for an aquatic plant survey called for a dropping of a rake sampling device to the bottom and recording the depth, sediment composition by feel, and subsequent vegetation pulled. The rake can either be placed on a pole (ideally a long telescopic pole), or on the end of a rope for the deeper areas. For this survey, AEI technicians were able to use a graduated 20 foot telescopic pole. This pole was used at all sampling locations, and a rope was never needed.

The sediment composition in Lake Blass was primarily muck (Fig. 3). However, there were 4 sites around the lake that did contain sand as the primary sediment type. When determining the depths at each sample site, it was determined that the average depth in Lake Blass is 6.6 feet (Fig. 4). The maximum depth found in Lake Blass was 13.5 feet, while the median depth was 6.5 feet.

Vegetation Data

During the Lake Blass aquatic macrophyte survey, there were 148 out of the 149 points sampled. The summary statistics are displayed in Table 1. Out of the 148 locations sampled, 72 of these points resulted in a positive sample for vegetation. The locations that resulted in a positive sample were within the littoral zone. A littoral zone is an area within a lake that receives enough sunlight penetration to produce vegetation.

It was calculated from the survey that the littoral zone was anywhere with a water depth of 8.0 feet or less (Fig. 5). Any location within the lake that had a depth greater than 8.0 feet did not allow for plant colonization. The survey resulted in 85 points within the lake that were less than the maximum depth of colonization and could have allowed for plant colonization. However, only 72 of these points produced a vegetation sample, resulting in a frequency of 84.71% occurrence of vegetation at sites shallower than the maximum depth of plants.

The Lake Blass aquatic macrophyte survey produced results showing a relatively diverse population of plants. This was determined by the Simpson's Diversity Index of 0.84. The closer the Simpson's Diversity Index is to 1.00, the more diverse a community.

Out of the 85 locations less than the maximum depth of colonization, there was an average of 3.93 species collected. However, this number jumps to an average of 4.64 species per site when looking at the 72 sites less than the maximum depth of colonization that produced a vegetation sample. There was only one exotic invasive species found within the lake, curly-leaf pondweed (CLP, *Potamogeton crispus*). This plant was only visualized at one location and never collected during a rake sample. Due to this, the calculations for average number of native species per site shallower than the max depth and vegetated sites only stay the same at 3.93 and 4.64, respectively.

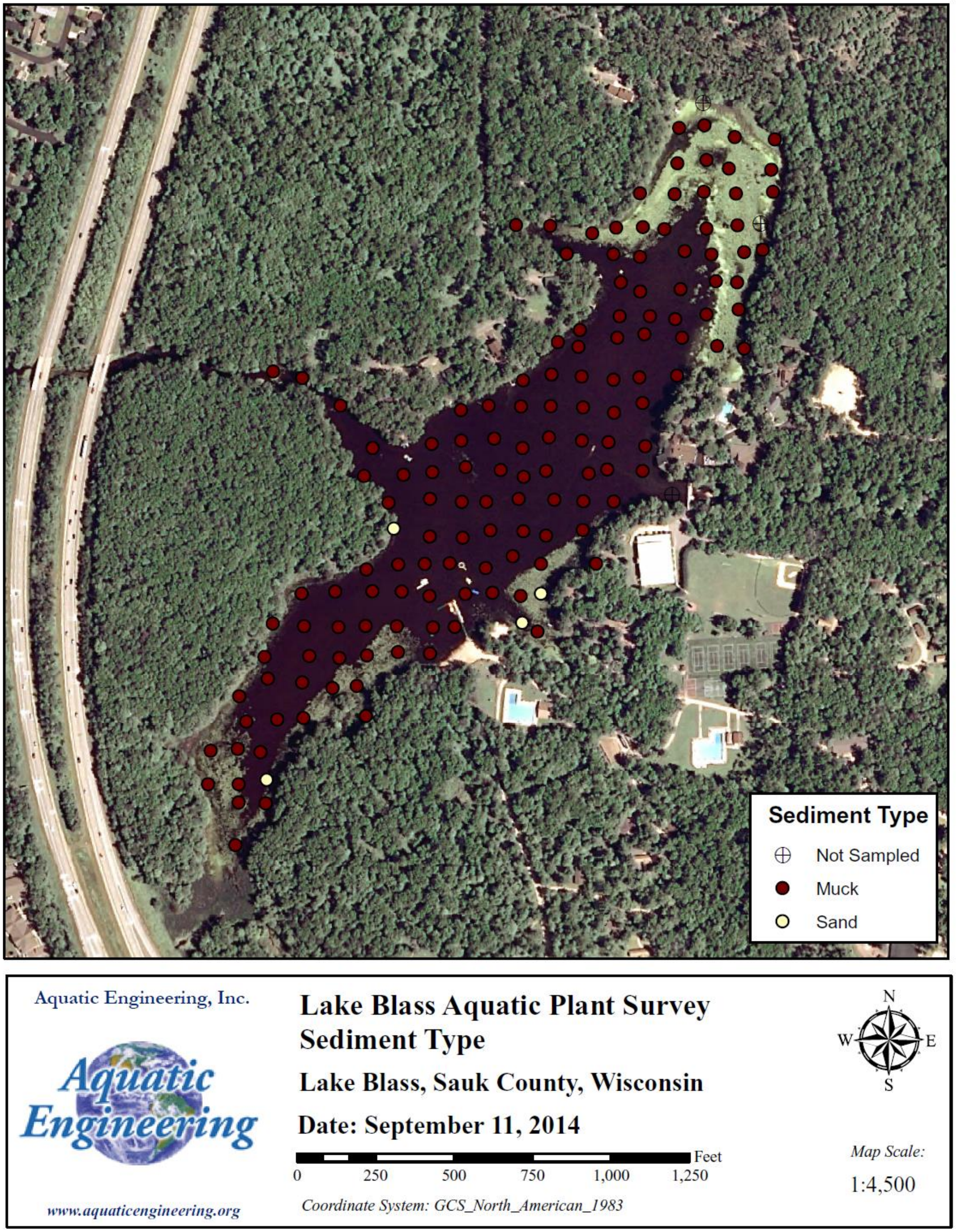

Figure 3. Sediment composition at each sampling point of the Lake Blass aquatic macrophyte survey.

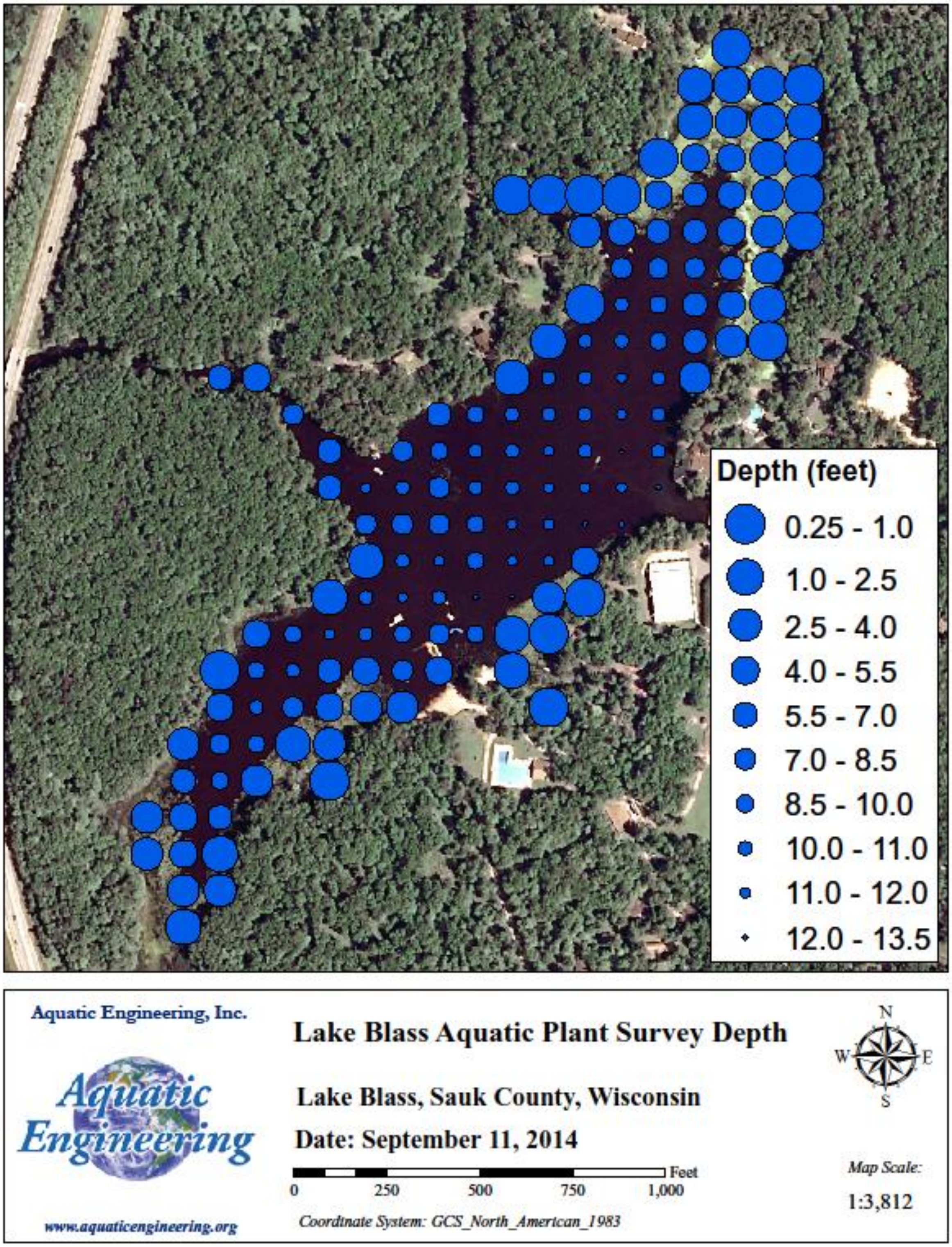

Figure 4. Approximate depths of each sample point of the Lake Blass aquatic macrophyte survey.

Lake Blass had a relatively large species richness, with a value of 13 species collected with a rake, and 16 species collected with a rake and visual sightings. During the sampling, there was a maximum of six species encountered at one single sample location (Fig. 6). This number does not include filamentous algae, freshwater sponges, aquatic moss, or liverworts. However, only filamentous algae was the only other organism witnessed and was not included in the species richness calculations.

Table 2. Summary statistics for the Lake Blass aquatic macrophyte survey.

Total number of sites visited	**148**
Total number of sites with vegetation	**72**
Total number of sites shallower than maximum depth of plants	**85**
Frequency of occurrence at sites shallower than maximum depth of plants	**84.71**
Simpson Diversity Index	**0.84**
Maximum depth of plants (ft)**	**8.00**
Number of sites sampled using rake on Rope (R)	**0**
Number of sites sampled using rake on Pole (P)	**148**
Average number of all species per site (shallower than max depth)	**3.93**
Average number of all species per site (veg. sites only)	**4.64**
Average number of native species per site (shallower than max depth)	**3.93**
Average number of native species per site (veg. sites only)	**4.64**
Species Richness	**13**
Species Richness (including visuals)	**16**

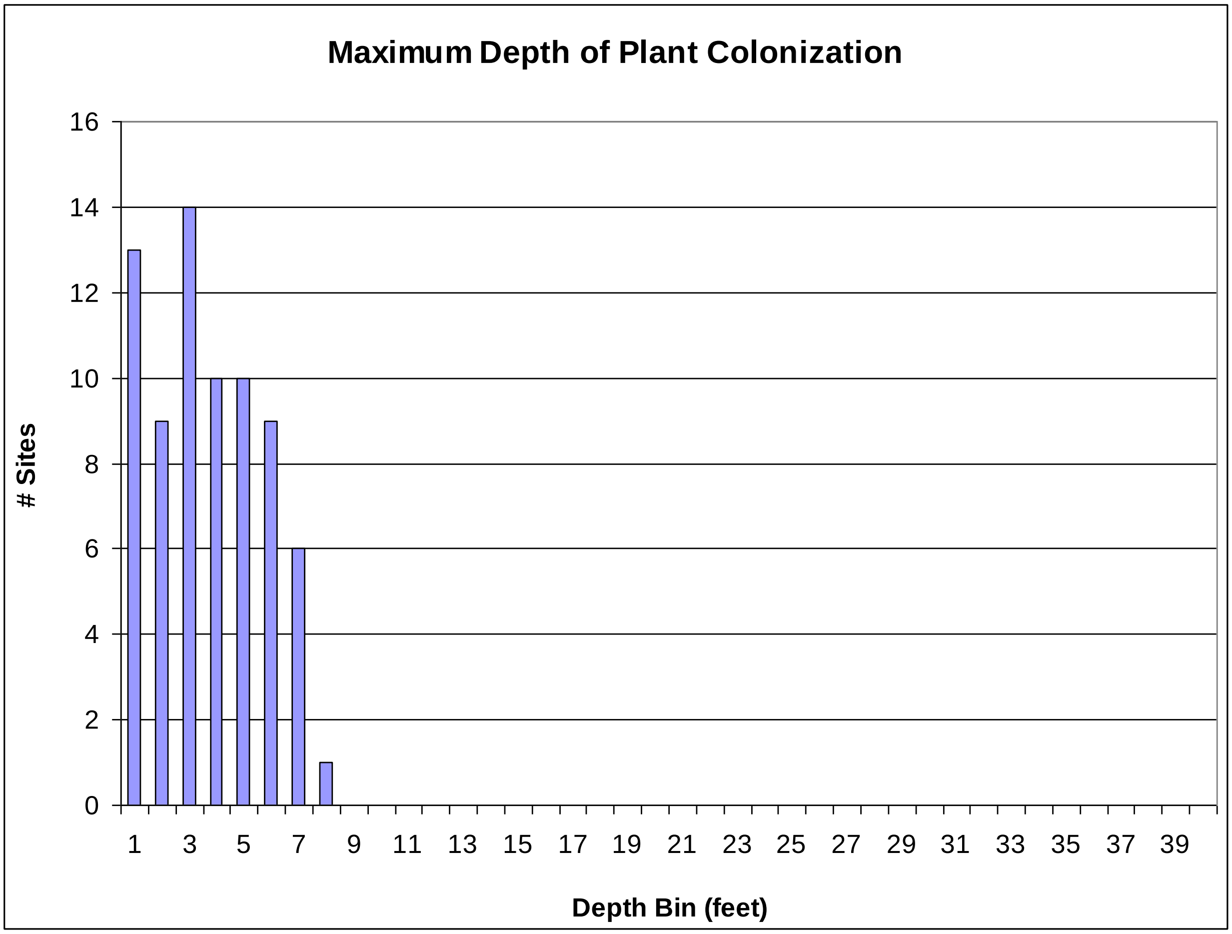

Figure 5. Maximum depth of plant colonization graph for Lake Blass calculated from the aquatic macrophyte survey.

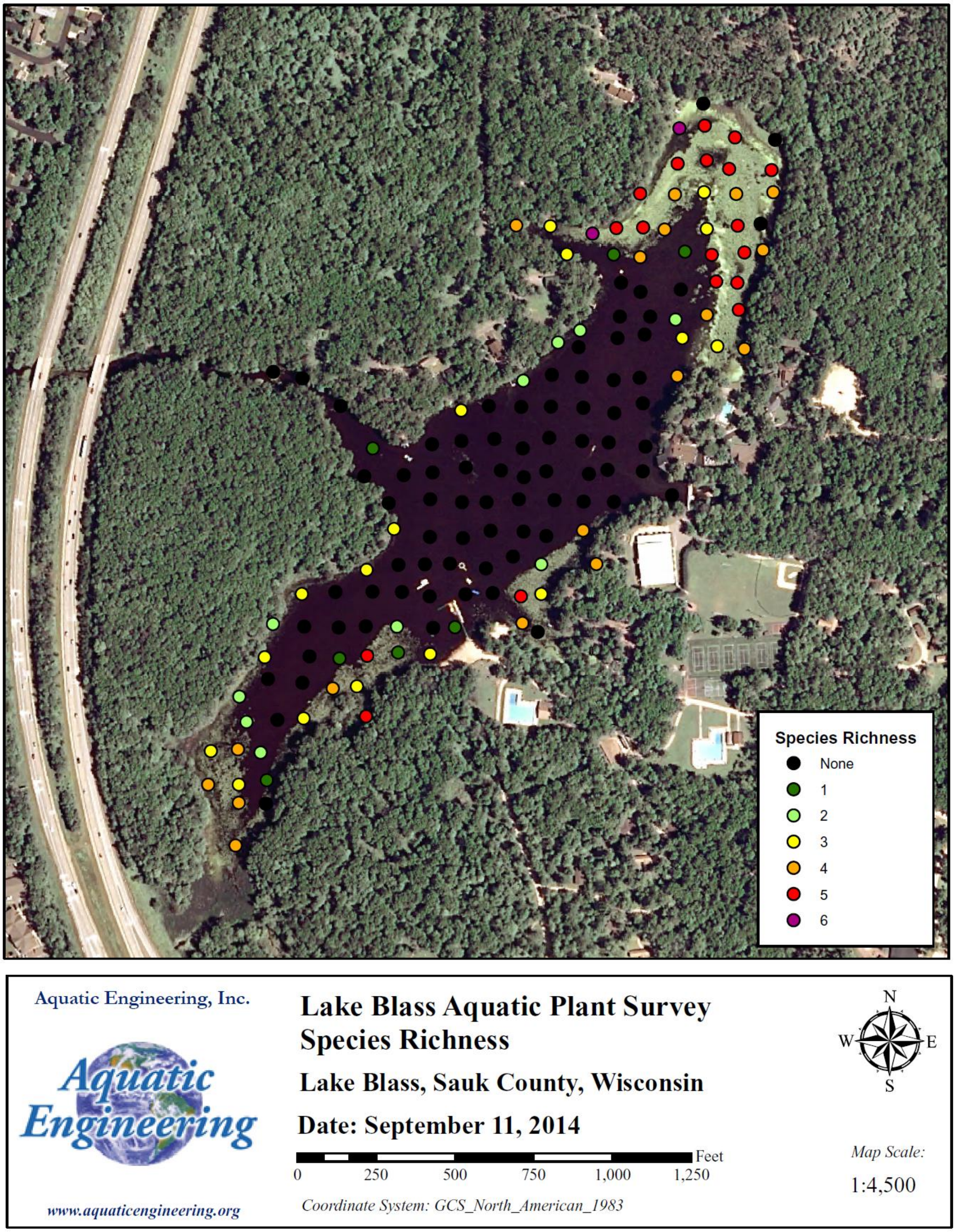

Figure 6. Map of species richness for each single sample location during the Lake Blass aquatic macrophyte survey.

The calculation of the Floristic Quality Index (FQI) for Wisconsin lakes is based on vigorous calculations made by Stanley Nichols (1999). This method applies to specific eco-regions found in Wisconsin. Lake Blass is located within the Northern Central Hardwood Forest eco-region, and calculations from the aquatic macrophyte survey are compared to averages within the eco-region. Nichols reported Average Mean C for the Northern Central Hardwood Forests Region of 5.6, putting Lake Blass below average for this part of the state with a Mean C of 5.15 (Table 2). The FQI also falls below the average of the region of 20.9, with Lake Blass registering 18.6. These numbers indicate the lake had few species that can tolerate disturbance or pollution, and a lower number of species overall.

Table 3. Calculation of Floristic Quality Index from species found during the Lake Blass aquatic macrophyte survey.

Species	Common Name	C	species present=1	
Ceratophyllum demersum	Coontail	3	1	3
Eleocharis erythropoda	Bald spikerush	3	1	3
Elodea nuttallii	Nuttall's waterweed	3	1	3
Lemna minor	Small duckweed	4	1	4
Lemna trisulca	Forked duckweed	6	1	6
Najas flexilis	Nodding waternymph	8	1	8
Nymphaea odorata	White water lily	6	1	6
Pontederia cordata	Pickerelweed	8	1	8
Potamogeton amplifolius	Large-leaf pondweed	7	1	7
Potamogeton zosteriformis	Flat-stem pondweed	6	1	6
Typha latifolia	Broad-leaved cattail	1	1	1
Utricularia vulgaris	Common bladderwort	7	1	7
Wolffia columbiana	Common watermeal	5	1	5
N			13	
mean C				5.1538462
FQI				18.582457

The total vegetation sampled during the Lake Blass survey, when found, was very dense (Table 3). When a rake sample was pulled during the sampling in vegetated areas, there was an average rake fullness rating of 2.22 (Fig. 7). This means that the vegetation encountered was primarily large plants with thick or dense vegetative structures. When looking at each individual species found during the survey, it is clear that coontail (*Ceratophyllum demersum*) was the dominant species within the lake. Coontail was found at 91.67% of the sites where vegetation was collected. When coontail was encountered, the vegetation was very dense and resulted in an average rake fullness of 2.44, the highest among all species.

White water lily (*Nymphaea odorata*) and common watermeal (*Wolffia Columbiana*) were the next highest species encountered at 61.11% of vegetated areas. Both of these species had lower average rake fullness ratings, however, both of these values may be inaccurate and predict a low density of plant material. The white water lily can cover a large area on the surface of the water due to the large shield portion of the plant, but when pulled by a rake, the stem portion of the plant does not fill the rake as much as a densely feathered species like coontail would.

Common watermeal can also be found with very large densities, but the tiny size of the plant makes it disproportional on the rake compared to large macrophytes. The same can be said about lesser duckweed (*Lemna minor*), which was found at 44.44% of vegetated areas. Forked (starred) duckweed (*Lemna trisulca*), which was found at 41.67% of vegetated areas, contains much more vegetation material than lesser duckweed, and accounts for the higher rake fullness rating of 1.57. Large-leaf pondweed (*Potamogeton amplifolius*), Flat stem pondweed (*Potamogeton zosteriformis*), and Grassleaf mudplantain (*Heteranthera dubia*.), where all found at moderate frequencies in vegetated areas (12.5%). The only difference between these three pondweeds was that large-leaf pondweed had a higher average rake fullness rating of 1.89 compared to the 1.11 rating that the remaining two pondweed species. Large-leaf pondweed is a much larger species with large, thick vegetated structures which accounts for the higher average rake fullness rating.

The remaining species found within the survey were sparse throughout the lake. The exotic invasive species of Curly-leaf pondweed (*Potamogeton crispus*) was never found on a rake sample, and was only caught as a visual sighting in one location on the lake. The emergent vegetation species of broad-leaved cattail (*Typha latifolia*) and pickerelweed (*Pontederia cordata*) were the only emergent's that were collected on a rake sample. The broad-leaved cattail was encountered more often at a frequency of 4.17%, compared to pickerelweed which was encountered at 2.78% of vegetated sites. The remaining emergent species of nodding beggartick (*Bidens cernua*) and bald spikerush (*Eleocharis erythropoda*) were only recorded as a visual sighting and never was pulled with a rake sample. Nuttall's waterweed (Elodea nuttallii), Nodding waternymph (Najas flexilis), and common bladderwort (Utricularia vulgaris) were all found at very low numbers throughout the lake, but encountered nonetheless. Filamentous algae was collected at 31.94% of the sites with vegetation, and had a high number of visual sightings. The specific species distribution and density maps are located in Appendix A.

Table 4. Individual statistics for vegetation species found during the Lake Blass aquatic macrophyte survey.

	Frequency of occurrence within vegetated areas (%)	Frequency of occurrence at sites shallower than maximum depth of plants	Relative Frequency (%)	Number of sites where species found	Average Rake Fullness	Visual sightings
Total vegetation					2.22	
Potamogeton crispus Curly-leaf pondweed						1
Bidens cernua Nodding beggartick						2
Ceratophyllum demersum Coontail	91.67	77.65	26.1	66	2.44	7
Eleocharis erythropoda Bald spikerush						1
Elodea nuttallii Nuttall's waterweed	2.78	2.35	0.8	2	1.00	1
Lemna minor Small duckweed	44.44	37.65	12.6	32	1.06	20
Lemna trisulca Forked duckweed	41.67	35.29	11.9	30	1.57	9
Najas flexilis Nodding waternymph	1.39	1.18	0.4	1	1.00	
Nymphaea odorata White water lily	61.11	51.76	17.4	44	1.43	21
Pontederia cordata Pickerelweed	2.78	2.35	0.8	2	2.00	
Potamogeton amplifolius Large-leaf pondweed	12.50	10.59	3.6	9	1.89	8
Potamogeton zosteriformis Flat-stem pondweed	12.50	10.59	3.6	9	1.11	10
Heteranthera dubia Grassleaf mudplantain	12.50	10.59	3.6	9	1.11	4
Typha latifolia Broad-leaved cattail	4.17	3.53	1.2	3	2.33	9
Utricularia vulgaris Common bladderwort	2.78	2.35	0.8	2	1.50	1
Wolffia columbiana Common watermeal	61.11	51.76	17.4	44	1.61	18
Filamentous algae	31.94	27.06		23	1.26	10

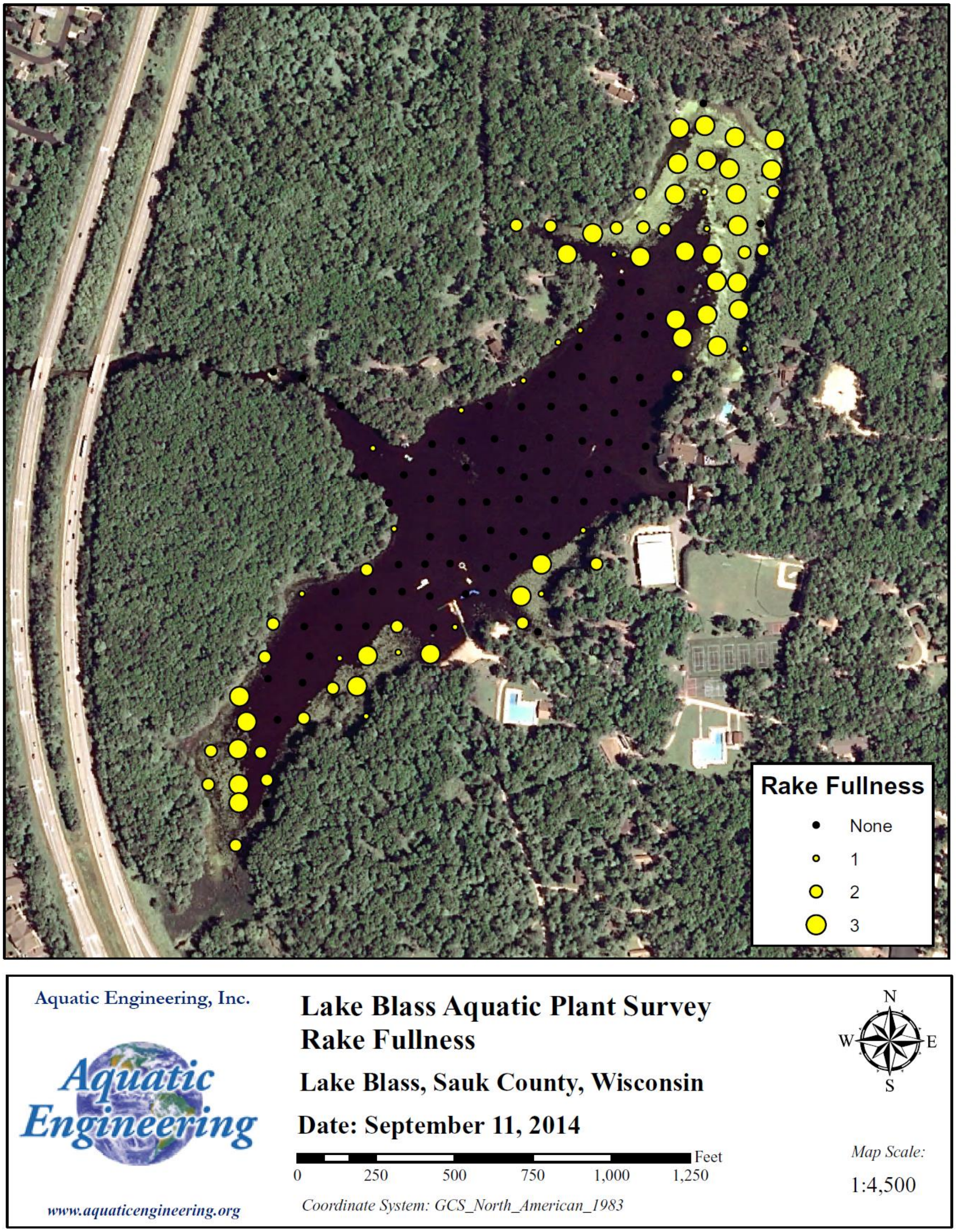

Figure 7. Rake fullness rating for all sample points of the Lake Blass aquatic macrophyte survey.

Discussion and Conclusion

It is important that a lake have a healthy and diverse aquatic plant material because of the vital roles that they play within a lake ecosystem. Plants can help to improve lakes by utilizing nutrients, trapping pollutants, stabilizing shorelines and lake bottoms, and providing habitat or food to the fish and wildlife. The plants of a lake provide the base of the food chain that provides the energy to maintain the lake ecosystem. A well-established native plant community can also help to defend the lake against invasive species. It is important to closely monitor the distribution and density of aquatic macrophyte species, and the data from this survey should provide assistance toward future management decisions of Blass Lake.

After the Lake Blass aquatic macrophyte survey, it can be concluded that 49% of the lake has sufficient habitat and growing conditions to hold vegetation. This number, however, may be slightly less than the actual amount of vegetation inhabiting the lake. This is presumed because, although there were 72 sites of the 148 sampled that produced vegetation, 85 of the 148 sites were within the littoral zone of the lake. A reason for the 13 sites that were within the littoral zone but did not produce vegetation sample may have been a slight miss of the rake on any plant present. This is, however, the reason for the random sampling, which functions to decrease any error as much as possible. Due to the lake being primarily muck, it can be assumed that Lake Blass has had a history of high nutrient levels, large amounts of vegetation, and the subsequent decomposition of that plant material at the bottom. This mucky bottom has allowed for plants to efficiently take root in the sediment and efficiently absorb nutrients. This has no doubt played a factor in the successful establishment of diverse and densely populated macrophytes. The vegetation found and FQI within Lake Blass is well established with a high biodiversity for a man-made impoundment.

A major concern within Lake Blass is the presence of exotic invasive species, specifically; Eurasian water milfoil and curly-leaf pondweed. It was great to see that there was not a single plant of Eurasian water milfoil encountered in the lake. Eurasian water milfoil is a species that can quickly become established and dominate a lake and it's a concern because it's a common problem in nearby area lakes. There was only a single plant of curly-leaf pondweed found during the Lake Blass survey. This plant was very small and in a very shallow part of the lake. Even though there was only one small plant found during the survey, curly-leaf pondweed is another species that can quickly establish itself and take over a lake. Both of these species, although they are not an issue in Lake Blass at the moment, they need to closely be monitored in the future. A spring aquatic vegetation survey should be performed to formally document the CLP presence within Blass Lake. Most plants found during the survey were beneficial species. The presence of southern naiad, pickerelweed, large-leaf pondweed, and common bladderwort are all very good signs. This can be speculated by their high "C" value in the FQI calculation. The high "C" values says that these species are more sensitive and gives a hint to the lack of human disturbance within Blass Lake. Although there are high value species present within the lake, some properties on the lake experience nuisance levels of vegetation which impedes recreational boating and swimming.Most vegetation occurred at the northern quarter of the lake. There was a large amount of vegetation also present at the south corner of the lake. These two locations held the thickest amounts of vegetation. The shallow waters and lack of water movement make these areas prone to buildup of vegetation, which on the north impedes recreational activities for a few residences. The southern end is undeveloped and therefore plant growth does not hamper recreational activities. This formal aquatic macrophyte survey should be used to help determine future management decisions based on the density and distribution of vegetation.

Blass Lake Management Plans

Goal Statement

The Village of Lake Delton, along with the residents of Blass Lake and the Camp Chi community (stakeholders) wish to maintain a healthy and balanced aquatic plant community through periodic monitoring and management while constantly being on-guard for invasive species and nuisance conditions on Blass Lake.

- Monitor for invasive plants and animals
- Reduce invasive nuisance plant growth in high recreational use areas
- Maintain the healthy aquatic plant community
- Educate lake residents and users about APM goals and activities

Background Information

Blass Lake is located within the Village of Lake Delton in Sauk County, Wisconsin. Blass Lake is a man-made impoundment created in 1929 when Springbrook Creek was dammed. The lake is known to be hyper-eutrophic with poor water quality which contributes to excessive algae and aquatic plant growth (Ball et al, 1971). There has been no known formal aquatic plant survey on Blass Lake prior to 2014. Historic management has occurred in high use recreational areas around docks and beach areas of Camp Chi over the past decade using herbicides. Since 2004, Aquatic Engineering, Inc. (AEI) annually does a qualitative (visual) survey of the entire lake occur prior to and after (two times) any management occurs looking for invasive plants and nuisance conditions while evaluating any management actions as well.

In 2014, Blass Lake's aquatic plant community was formally surveyed and Blass Lake was found to have a healthy and diverse aquatic plant community as illustrated within this report. Currently, it has a well established native plant community which is helping to defend the lake against invasive species. It is important to use the distribution and density of aquatic macrophyte species, and the data from the survey documented within this report to provide assistance toward future management decisions of Blass Lake. To date, only sparse populations of Curlyleaf Pondweed (CLP) have been found. No Eurasian Water Milfoil (EWM) has been found in Blass Lake. The survey and findings were shared with the stakeholders on May 11th, 2015.

The stakeholders current view is that the basic management with herbicides use in high recreational areas and annually monitoring is working well to preserve and maintain the plant community while meeting the recreational demands for the lake. Blass Lake has limited and no improved access points to launch any craft other than a small boat so, with the annual plant management actions being limited using a weed harvester is cumbersome and hand removal is too laborious. In turn, limited herbicide treatments work well with little to no use restrictions while controlling targeted plants in the high use areas.

Analysis and Alternative Treatments

Blass Lake is in great condition and a thorough review of the Chapter 7: Table 5 & 8 - Management Techniques Within Lake or Reservoirs (North American Lake Management

Society, Terrene Institute, Third Edition 2001) was reviewed at a public meeting with the Blass Lake residents and Village of Lake Delton Board on May 11th, 2015 and with the Camp Chi community on August 4th, 2015. Handouts of the Chapter 7: Table 5 & 8 were provided to every participant and each topic was reviewed which included: benthic barriers, dredging, dyes, mechanical & hand harvesting, water level controls, herbicide options and biological options and estimated costs. The discussion summary as follows:

- Benthic Barriers – not a practical and not permissible option in Wisconsin;
- Dredging – very costly and seeing the problems are small and the lake is in good shape it would be more damaging to the lake then helpful;
- Dyes – won't deter aquatic vegetation growth effectively, especially in the small areas needing management;
- Mechanical Harvesting – Hard to launch, hard to maneuver around docks and swim rafts and really more aggressive management than what's needed;
- Hand Harvesting – Not practical;
- Water level control – Too aggressive for limited management needed;
- Herbicides – selective use of non-selective contact herbicides specifically targeting susceptible species in specific areas is what has been used historically to manage high recreational use concerns well. Currently, there are no other herbicides that will work efficiently or effectively better than those currently being used;
- Biological – with the current vegetation there is not a permissible biological control available or warranted. If EWM ever shows this option may change. Grass carp are illegal in Wisconsin.

As discussed, the stakeholders current view is that the basic management using herbicides in high recreational areas and annually monitoring is working well to preserve and maintain the plant community while still meeting the recreational demands for the lake stakeholders. Blass Lake has limited and no improved access points to launch a weed harvester and hand removal is too laborious. The stakeholders currently use limited herbicide treatments to manage targeted plants in the high use dock and swimming areas.

Recommended Plans

Blass Lake is in great condition currently and the stakeholders wish to keep up its maintenance and stop invasive specie(s) infestations and any outbreak. Currently, CLP is a concern and will be monitored specifically annually each and every spring. As needed, the stakeholders wish to enroll individually to manage specific high recreational use areas and the Village of Lake Delton oversees these actions and make certain pre – post monitoring continues to ensure proper vegetative control is received and the lake is monitored annually for EWM. Riparian land owners will be informed of the annual plans through a public meeting each spring and mailings as necessary. Volunteers can also be provided training to look for EWM and monitor qualitatively the CLP in the lake.

The south and north ends of the lake have limited to no development and will be preserved as when possible to conserve the sensitive habitats they each serve to Blass Lake. The lake's current development and non-improved access limits the lake's use and risk to invasive species. Therefore, there isn't a need to suggest further lake use regulation's or monitoring at this time. The immediate watershed upstream and downstream is under the Village of Lake Delton's jurisdiction and remains critical to the Village's interests and the Village is committed to continuing the thorough management of these delicate resources and monitoring of invasive concerns and actions within the Village and Blass Lake.

The Blass Lake residents and Village of Lake Delton Board adopted the plans on May 11th, 2015 and the Camp Chi community adopted the plan on August 4th, 2015. This report and subsequent plans serve to fulfill SPL-341-14 planning grant deliverables and we would to thank the Wisconsin Department of Natural Resources for their involvement, participation and continued support for the Village of Lake Delton's interests and Blass Lake.

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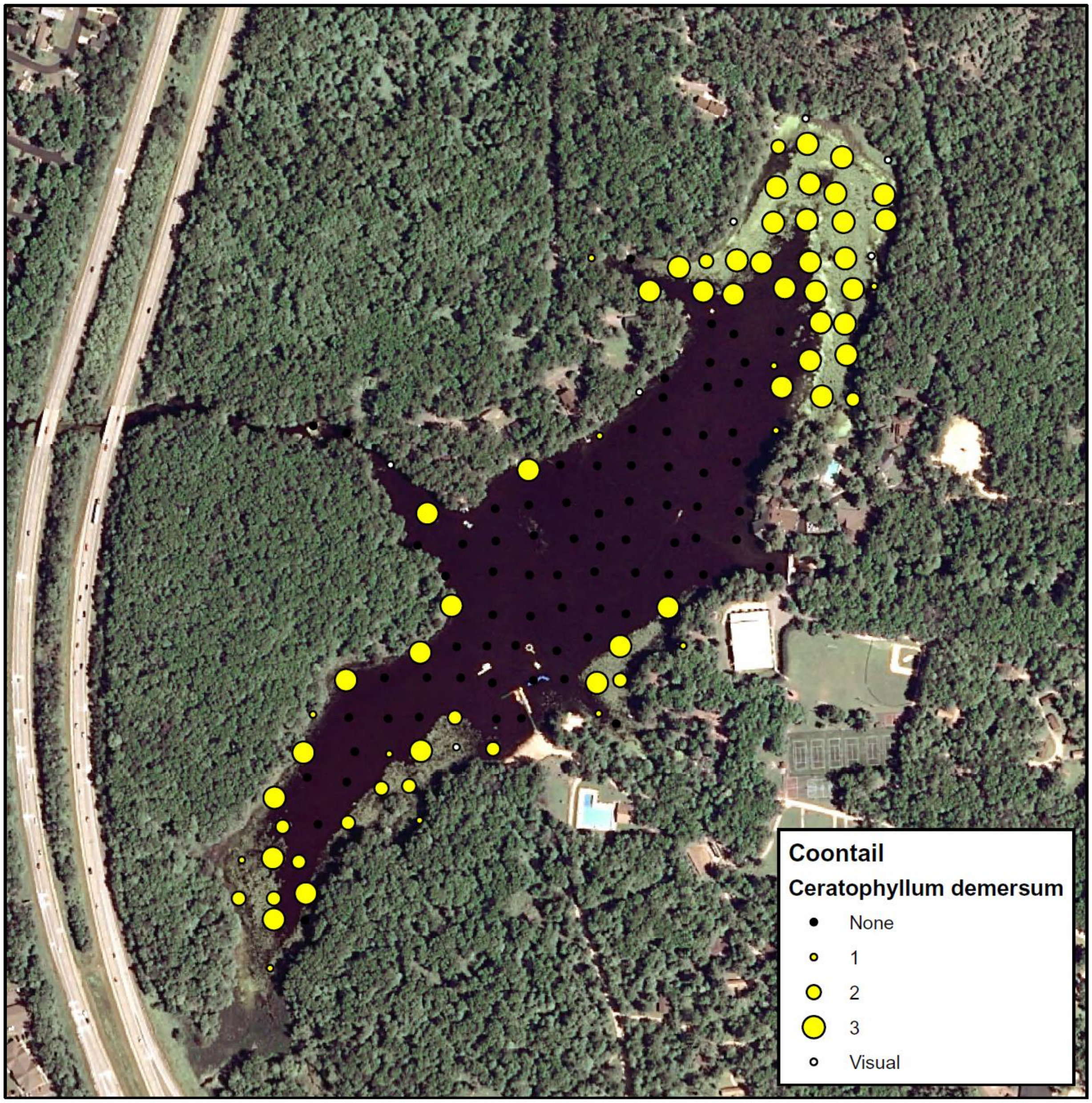
Appendix A



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Aquatic Engineering

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Lake Blass Aquatic Plant Survey
Coontail

Lake Blass, Sauk County, Wisconsin

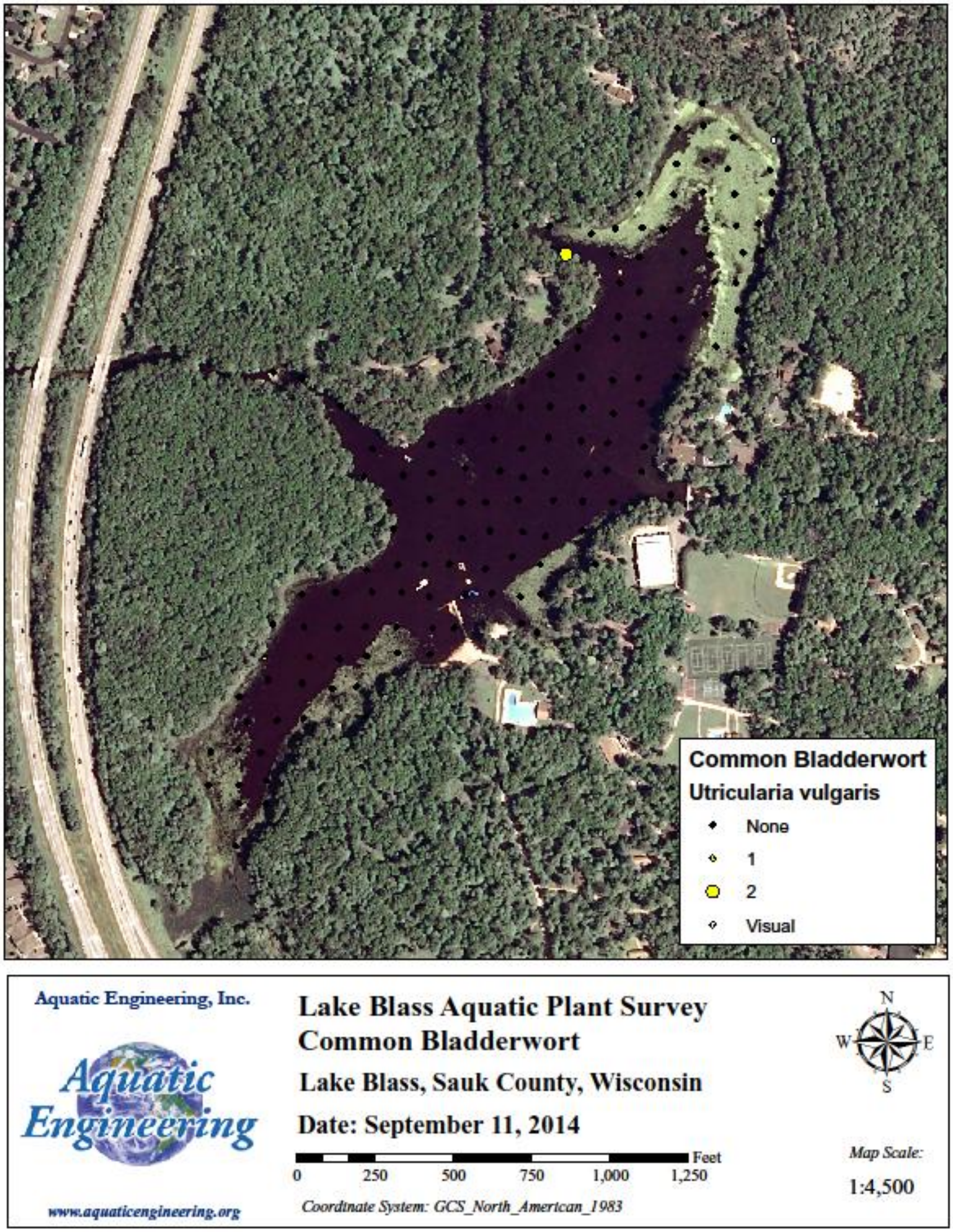
Date: September 11, 2014

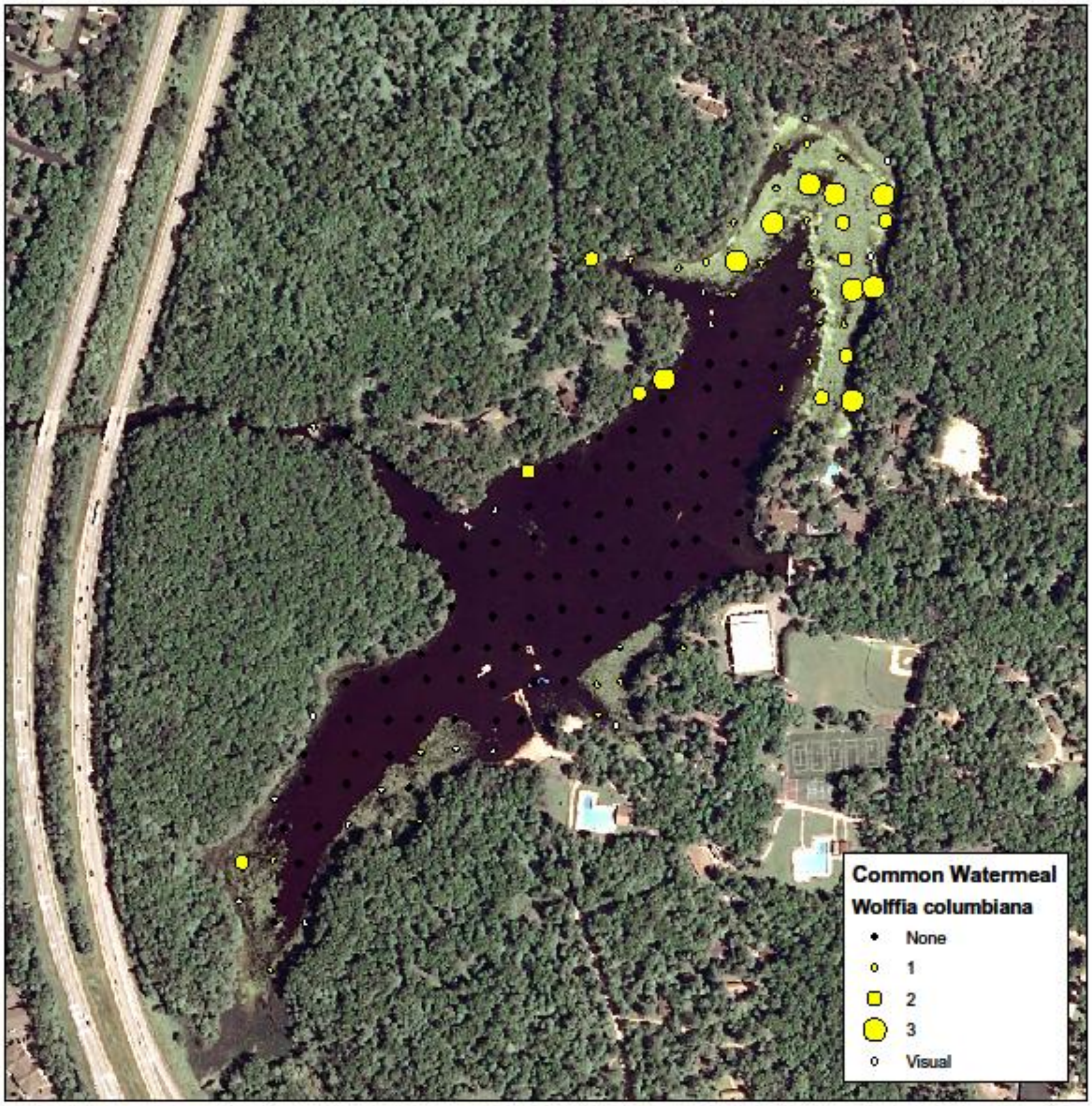
0 250 500 750 1,000 1,250 Feet

Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
1:4,500


Common Bladderwort
Utricularia vulgaris
None
1
2
Visual
Aquatic Engineering, Inc.
Aquatic Engineering
www.aquaticengineering.org
Lake Blass Aquatic Plant Survey
Common Bladderwort
Lake Blass, Sauk County, Wisconsin
Date: September 11, 2014
Feet
0 250 500 750 1,000 1,250
Coordinate System: GCS_North_American_1983
N
W
E
S
Map Scale:
1:4,500



Aquatic Engineering, Inc.

Aquatic Engineering

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Lake Blass Aquatic Plant Survey
Common Watermeal

Lake Blass, Sauk County, Wisconsin

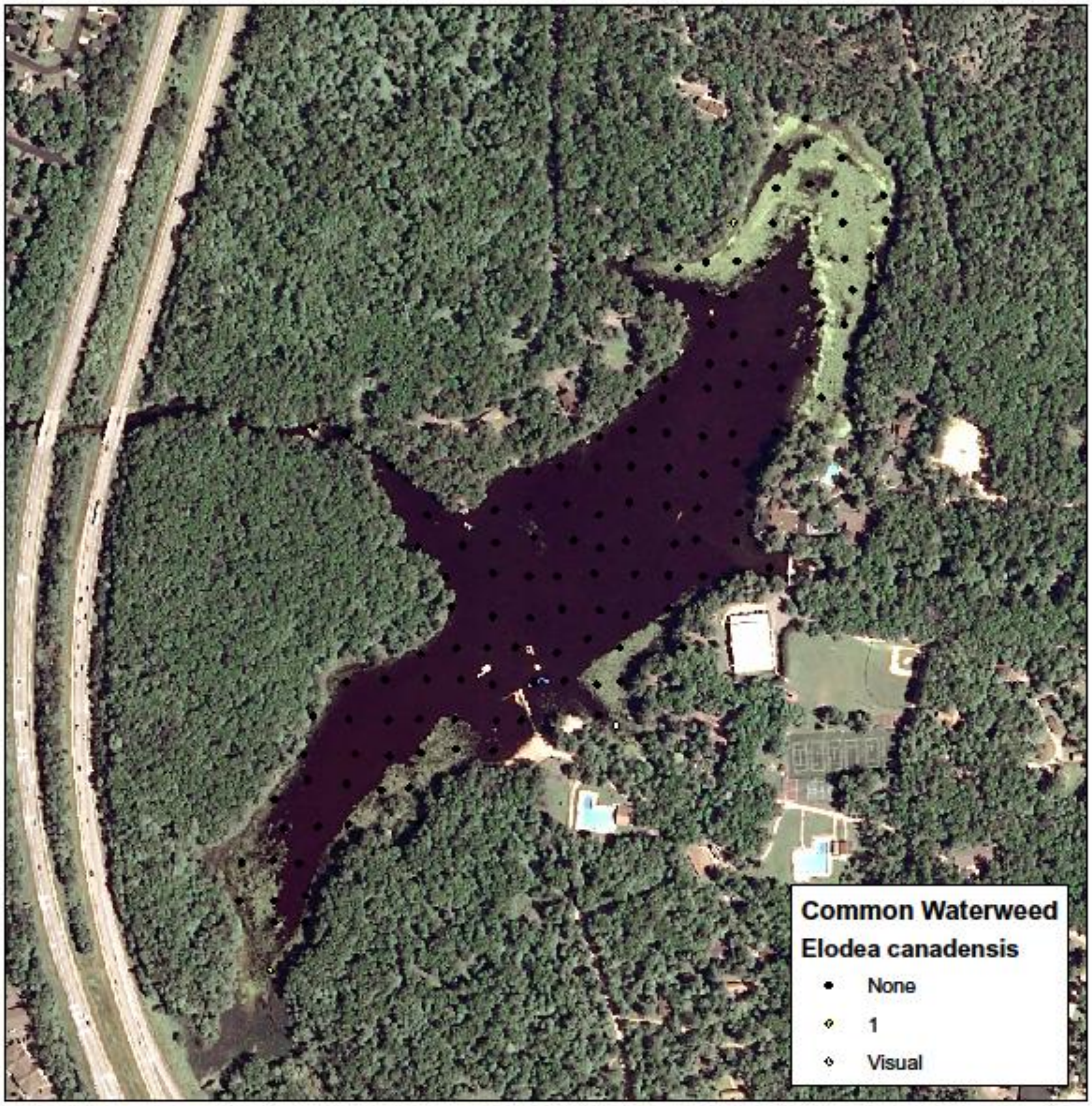
Date: September 11, 2014

Feet
0 250 500 750 1,000 1,250

Coordinate System: GCS_North_American_1983

N
W E
S

Map Scale:
1:4,500



Aquatic Engineering, Inc.

Lake Blass Aquatic Plant Survey
Common Waterweed

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

Feet 0 250 500 750 1,000 1,250

Coordinate System: GCS_North_American_1983

Map Scale: 1:4,500

N W E S

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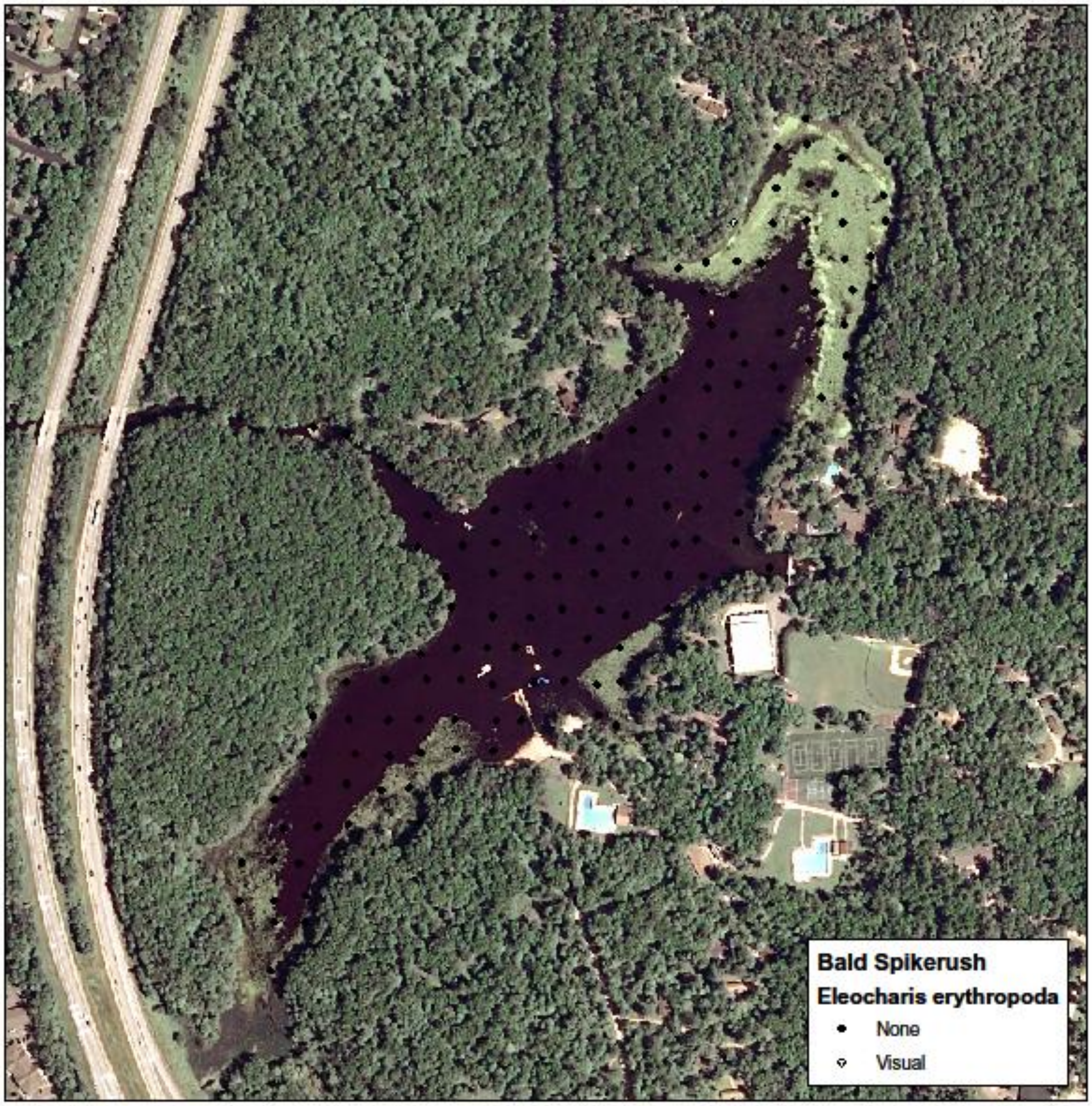

Aquatic Engineering, Inc.

Lake Blass Aquatic Plant Survey
Bald Spikerush

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

Feet
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Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
1:4,500

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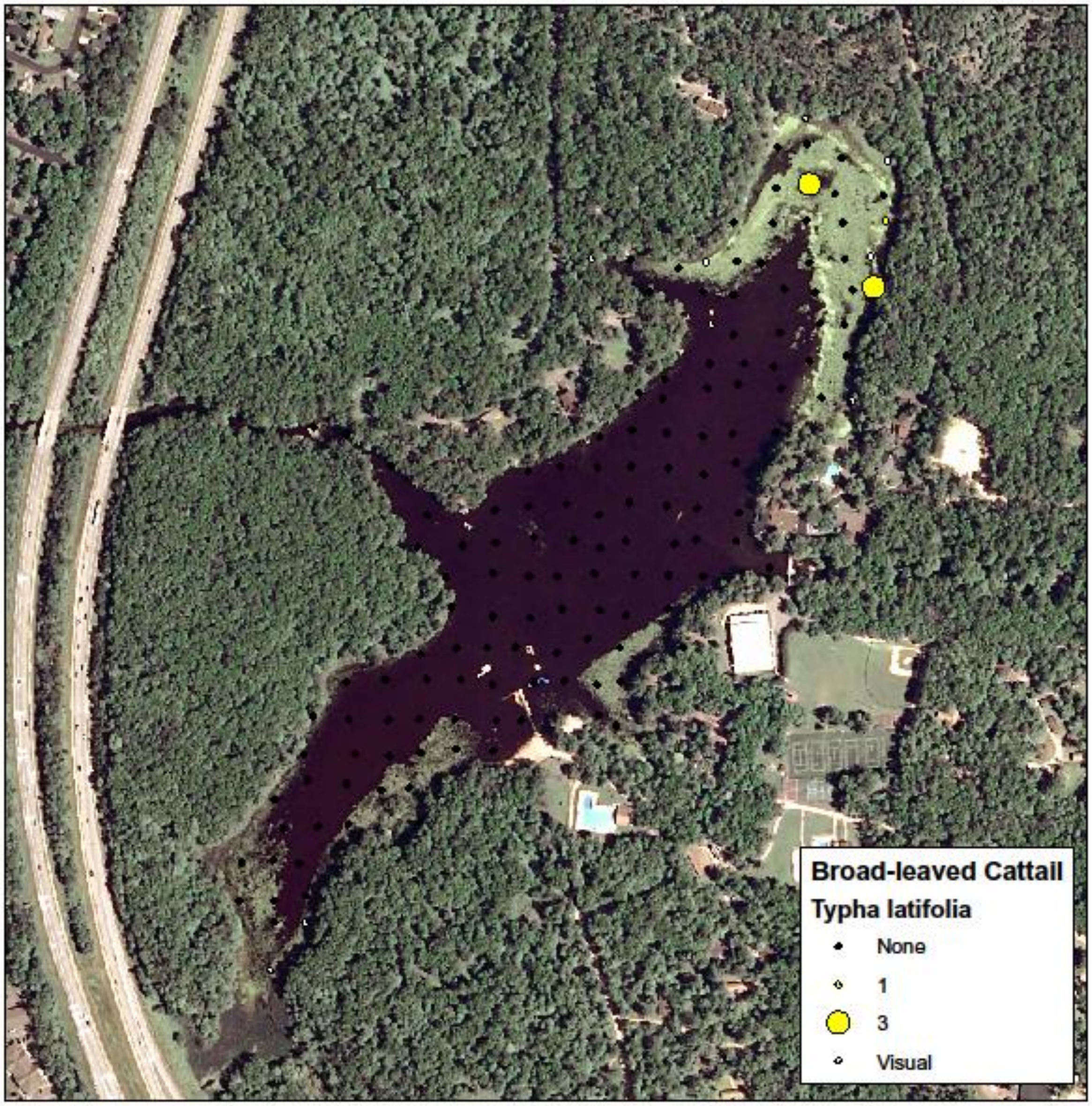

Aquatic Engineering, Inc.

Lake Blass Aquatic Plant Survey
Broad-leaved Cattail

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

Feet
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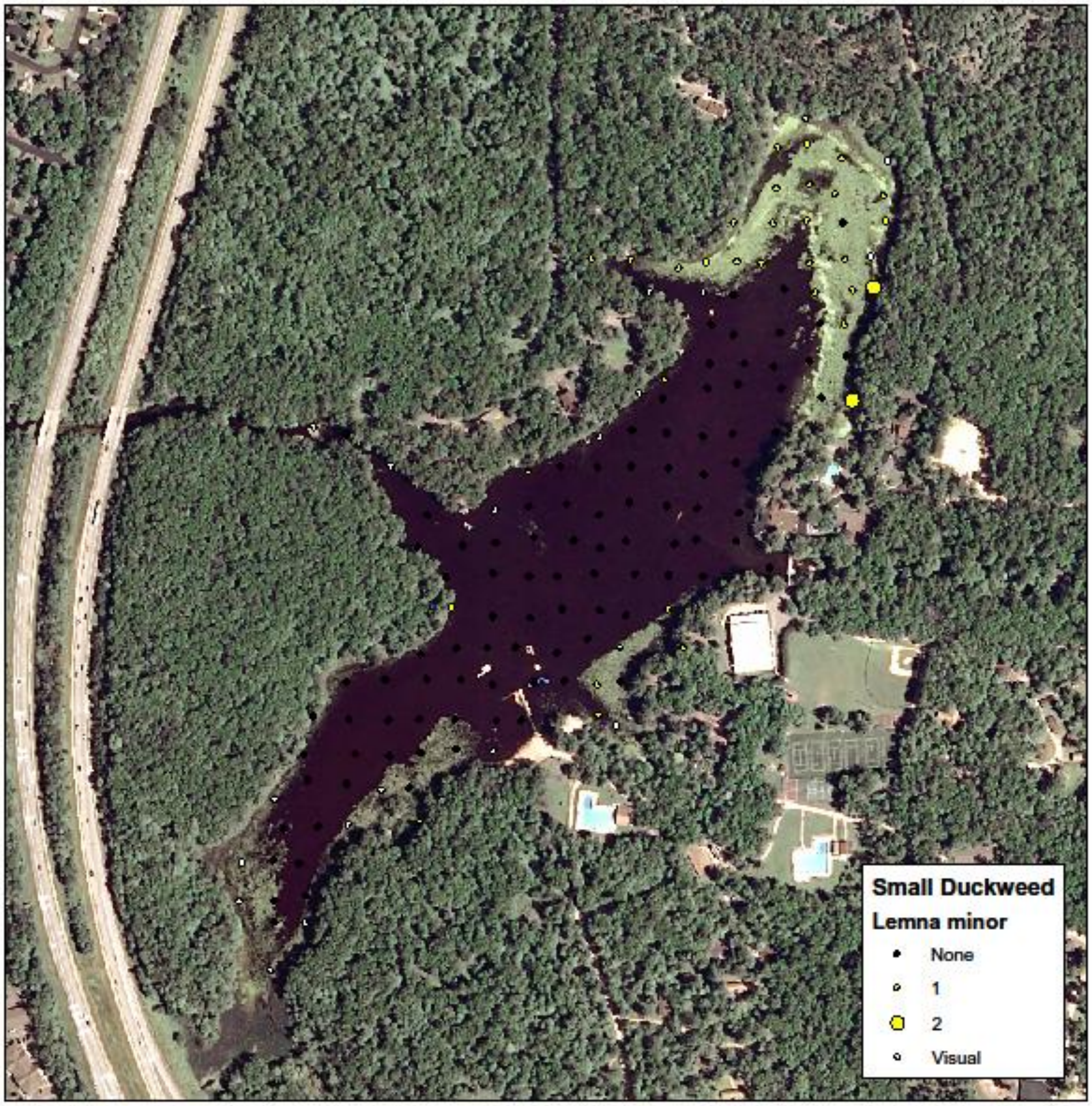
Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
1:4,500

www.aquaticengineering.org



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Lake Blass Aquatic Plant Survey
Small Duckweed

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

0 250 500 750 1,000 1,250 Feet

Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
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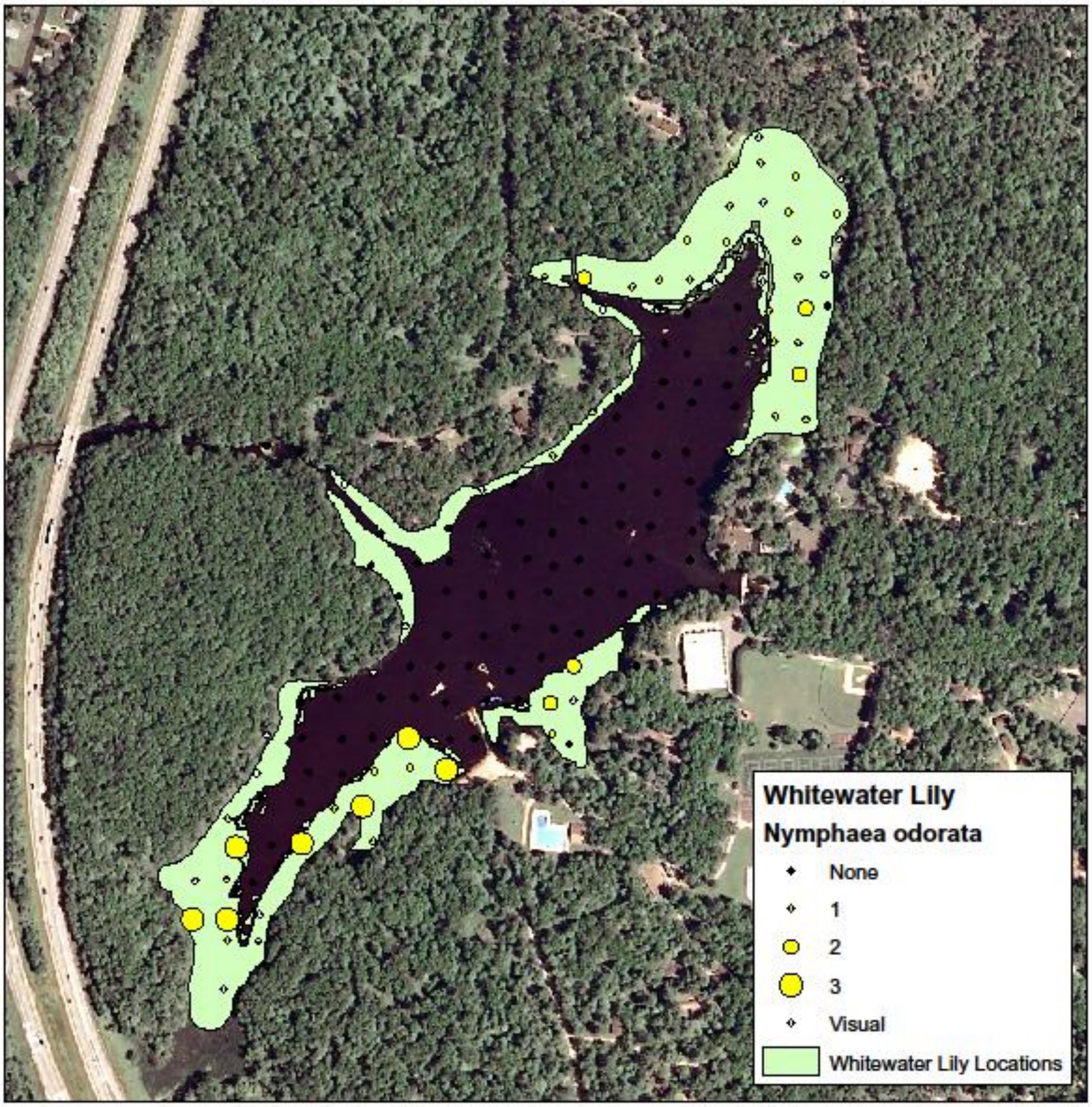

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Lake Blass Aquatic Plant Survey
Whitewater Lily

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

0 250 500 750 1,000 Feet

Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
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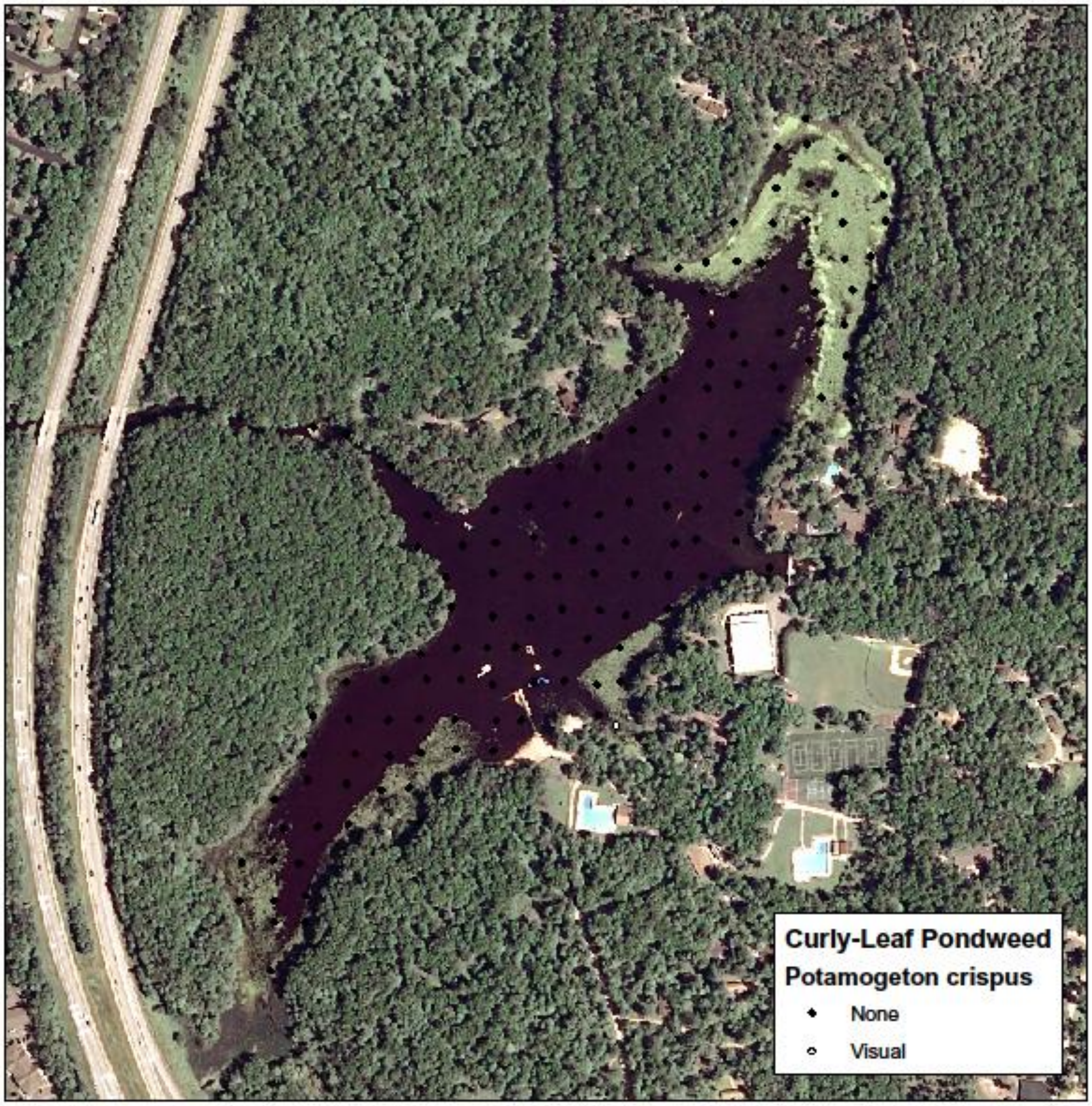

Aquatic Engineering, Inc.

Lake Blass Aquatic Plant Survey
Curly-Leaf Pondweed
Lake Blass, Sauk County, Wisconsin
Date: September 11, 2014

Feet
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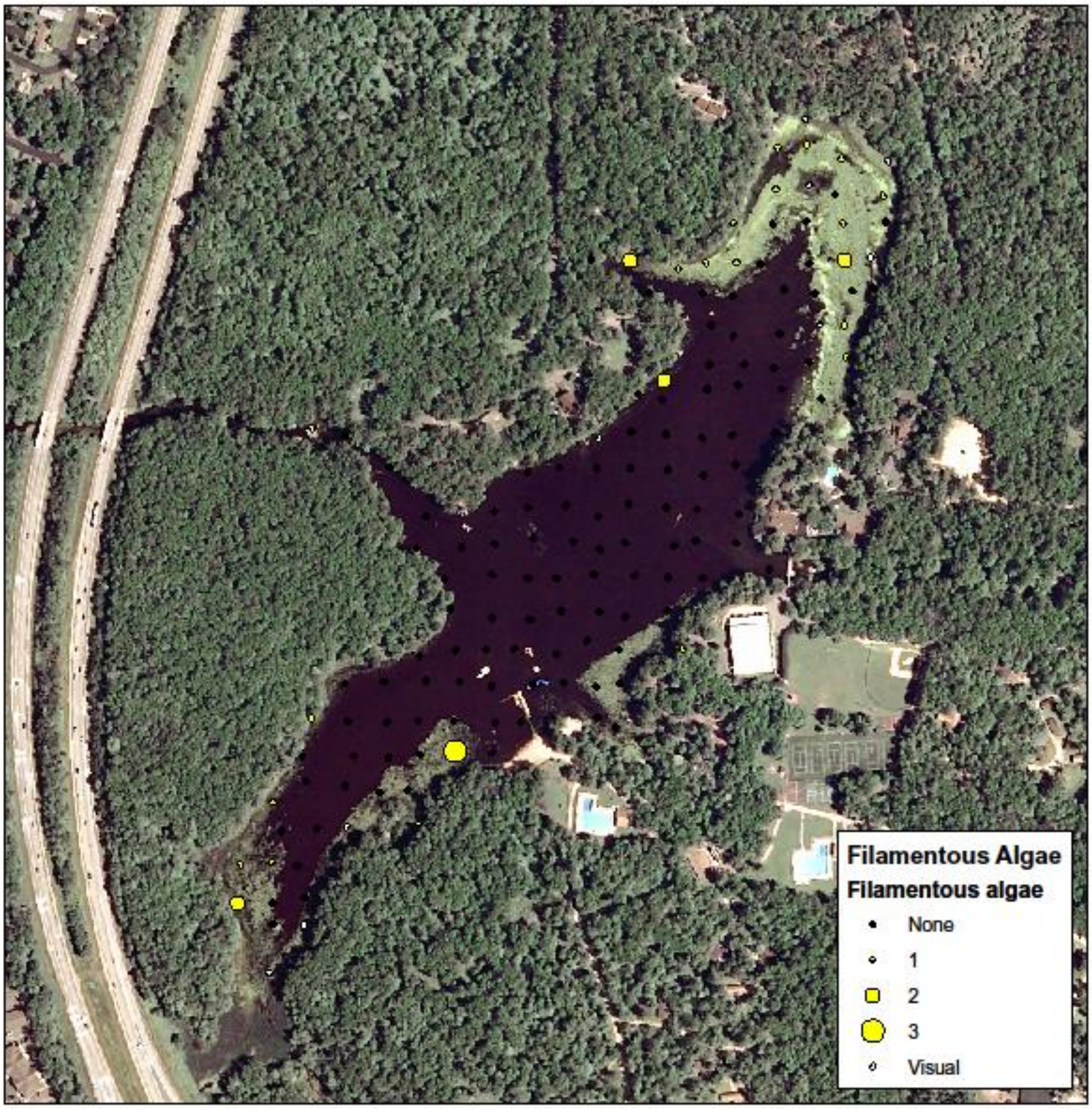
Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
1:4,500

www.aquaticengineering.org



Aquatic Engineering, Inc.

Lake Blass Aquatic Plant Survey
Filamentous Algae

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

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Coordinate System: GCS_North_American_1983

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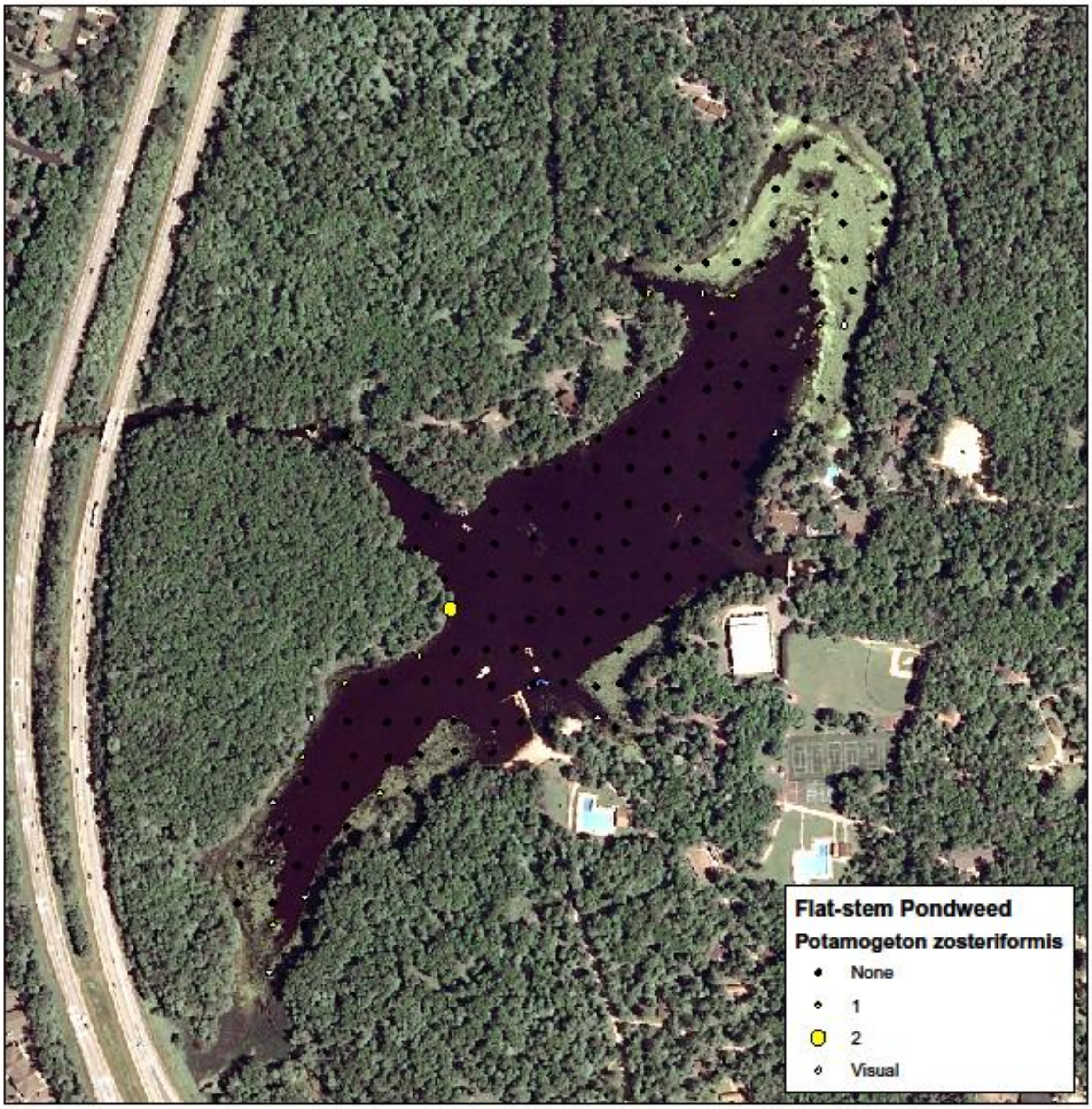
Map Scale:
1:4,500

www.aquaticengineering.org



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Lake Blass Aquatic Plant Survey
Flat-Stem Pondweed

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

Feet
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Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
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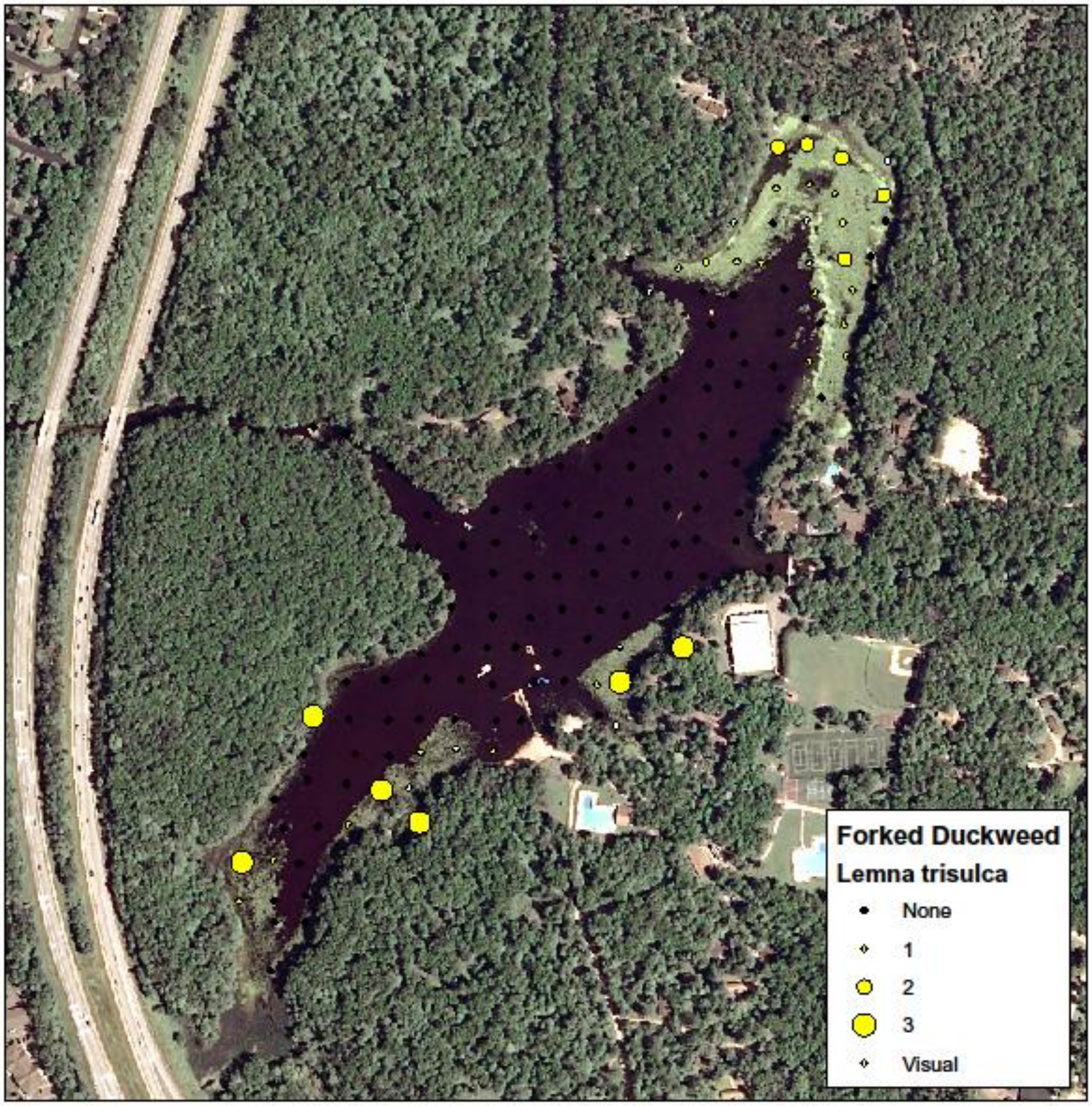

Aquatic Engineering, Inc.

Lake Blass Aquatic Plant Survey
Forked Duckweed

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

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Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
1:4,500

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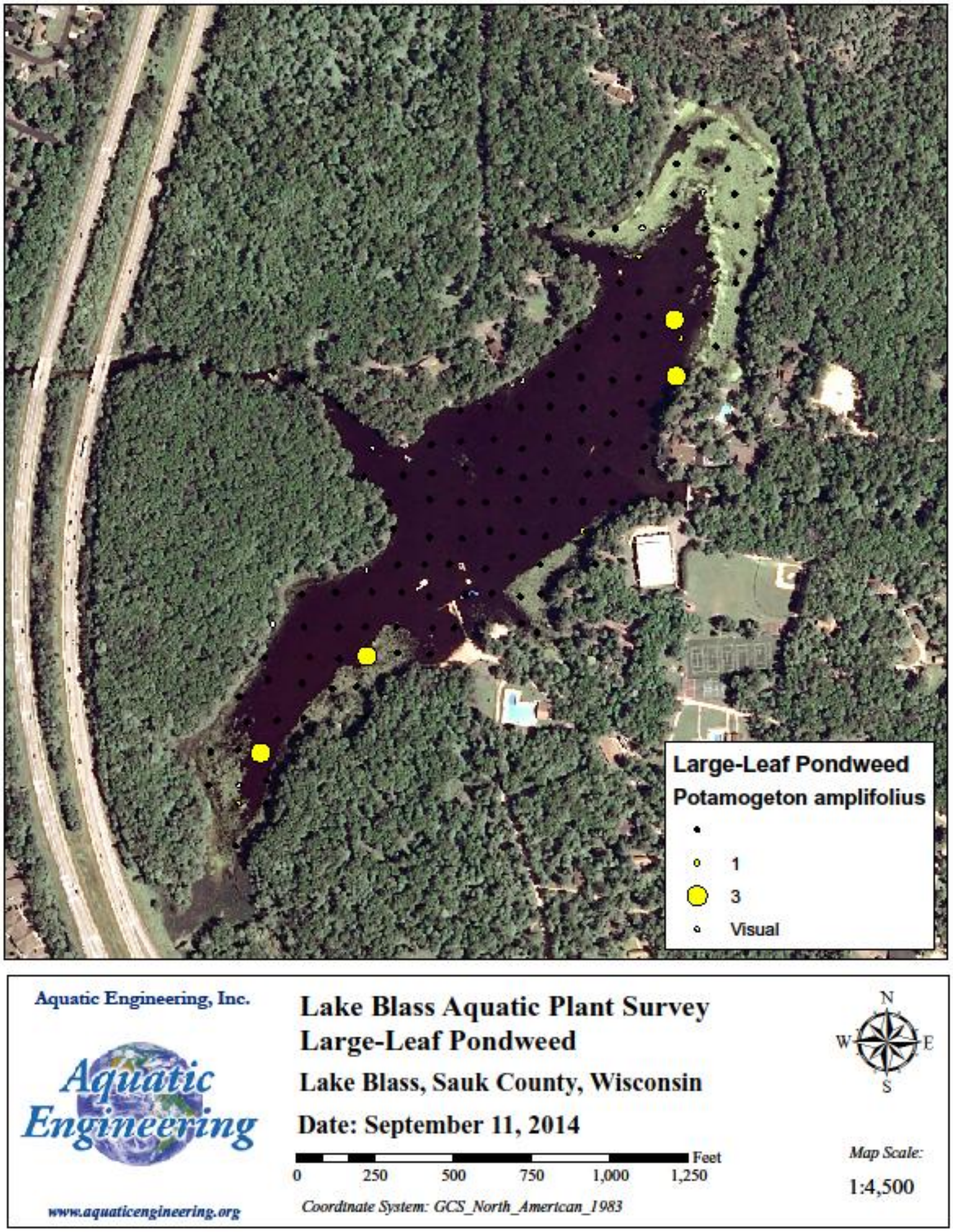

Large-Leaf Pondweed
Potamogeton amplifolius
1
3
Visual
Aquatic Engineering, Inc.
Aquatic Engineering
www.aquaticengineering.org
Lake Blass Aquatic Plant Survey
Large-Leaf Pondweed
Lake Blass, Sauk County, Wisconsin
Date: September 11, 2014
0 250 500 750 1,000 1,250 Feet
Coordinate System: GCS_North_American_1983
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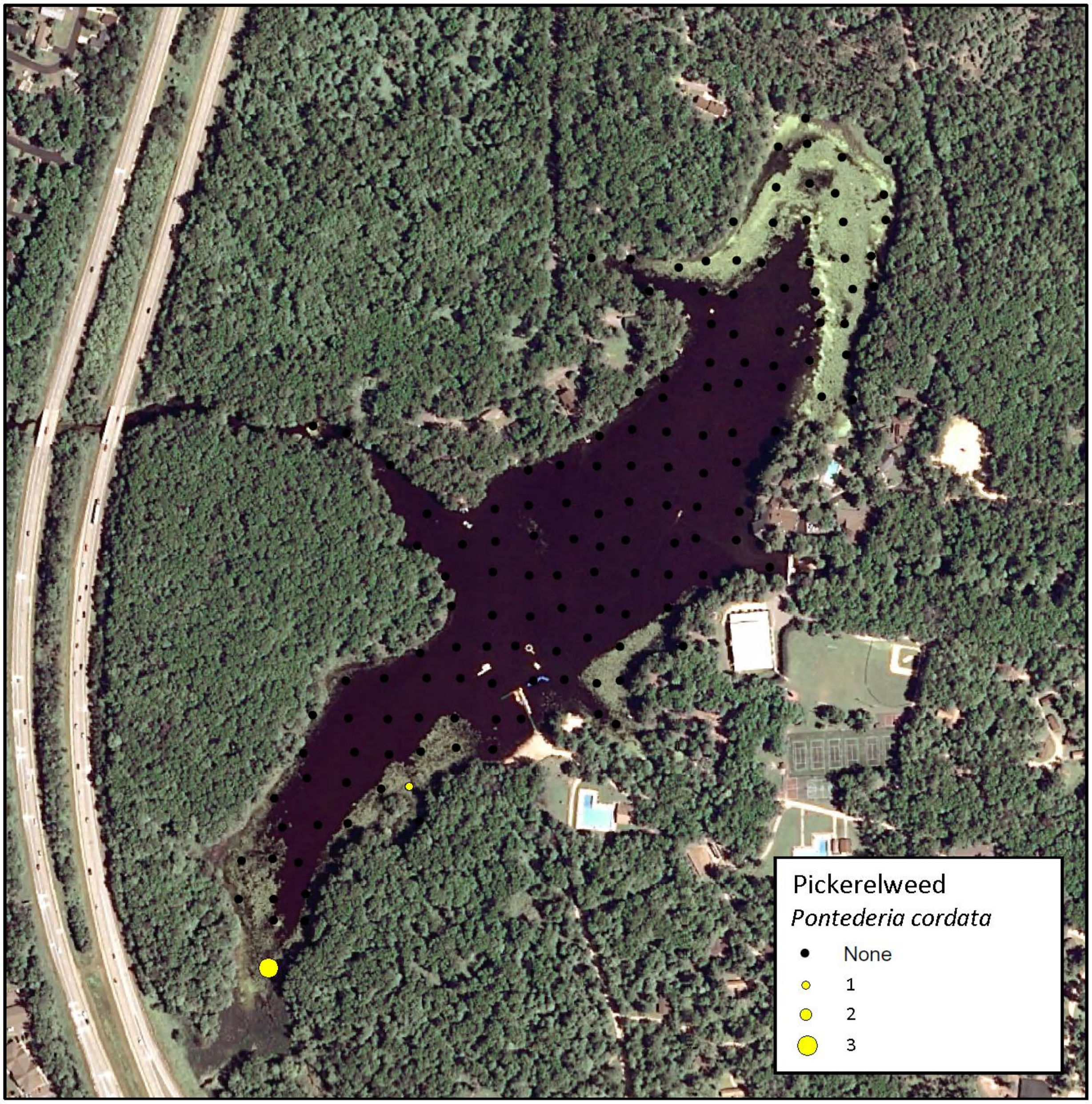
Map Scale:
1:4,500



Aquatic Engineering, Inc.

Lake Blass Aquatic Plant Survey
Pickerelweed

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

Feet
0 250 500 750 1,000 1,250

Coordinate System: GCS_North_American_1983

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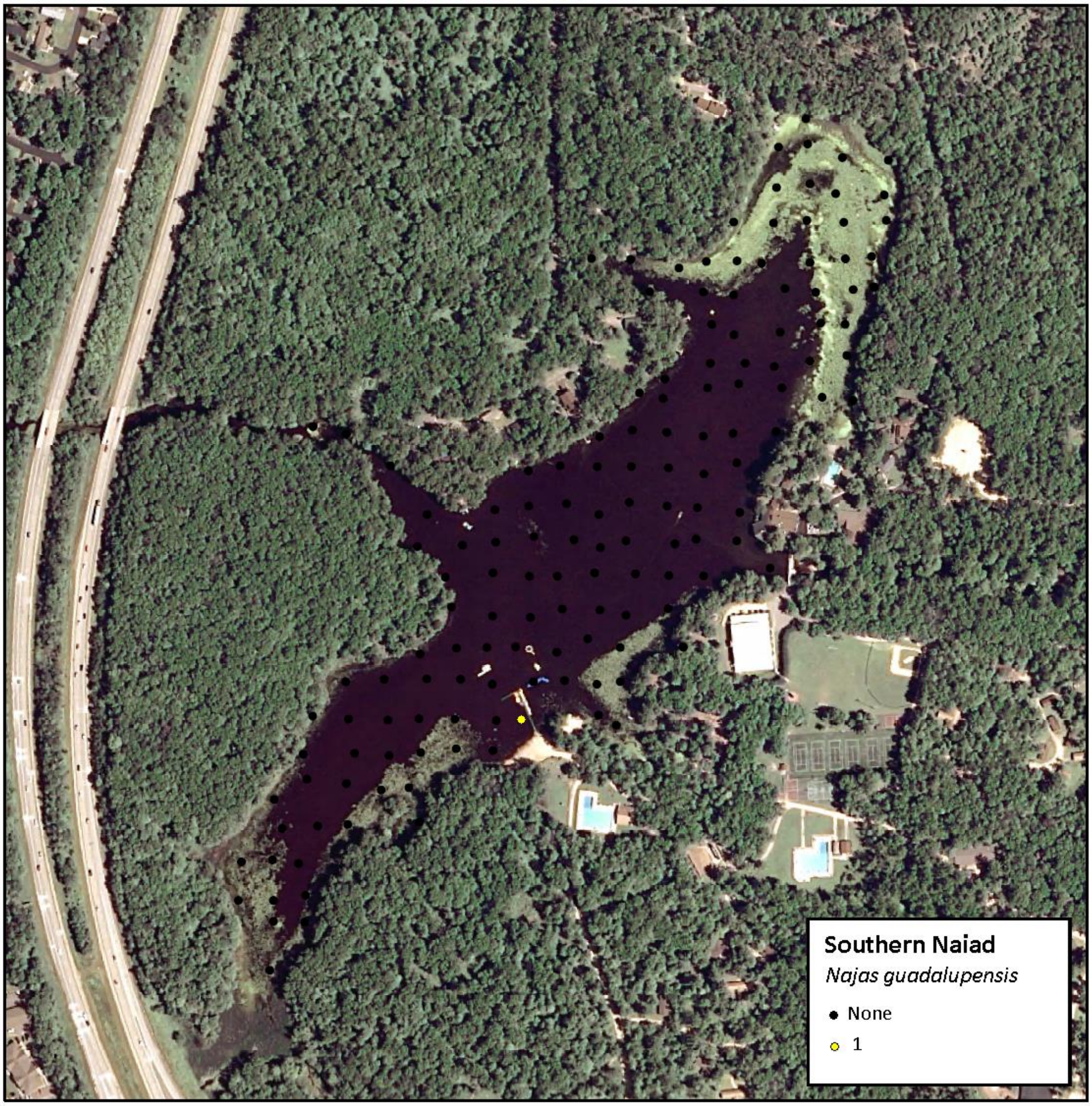
N W E S

Map Scale:
1:4,500



Aquatic Engineering, Inc.

Lake Blass Aquatic Plant Survey
Southern Naiad

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

Feet
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Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
1:4,500

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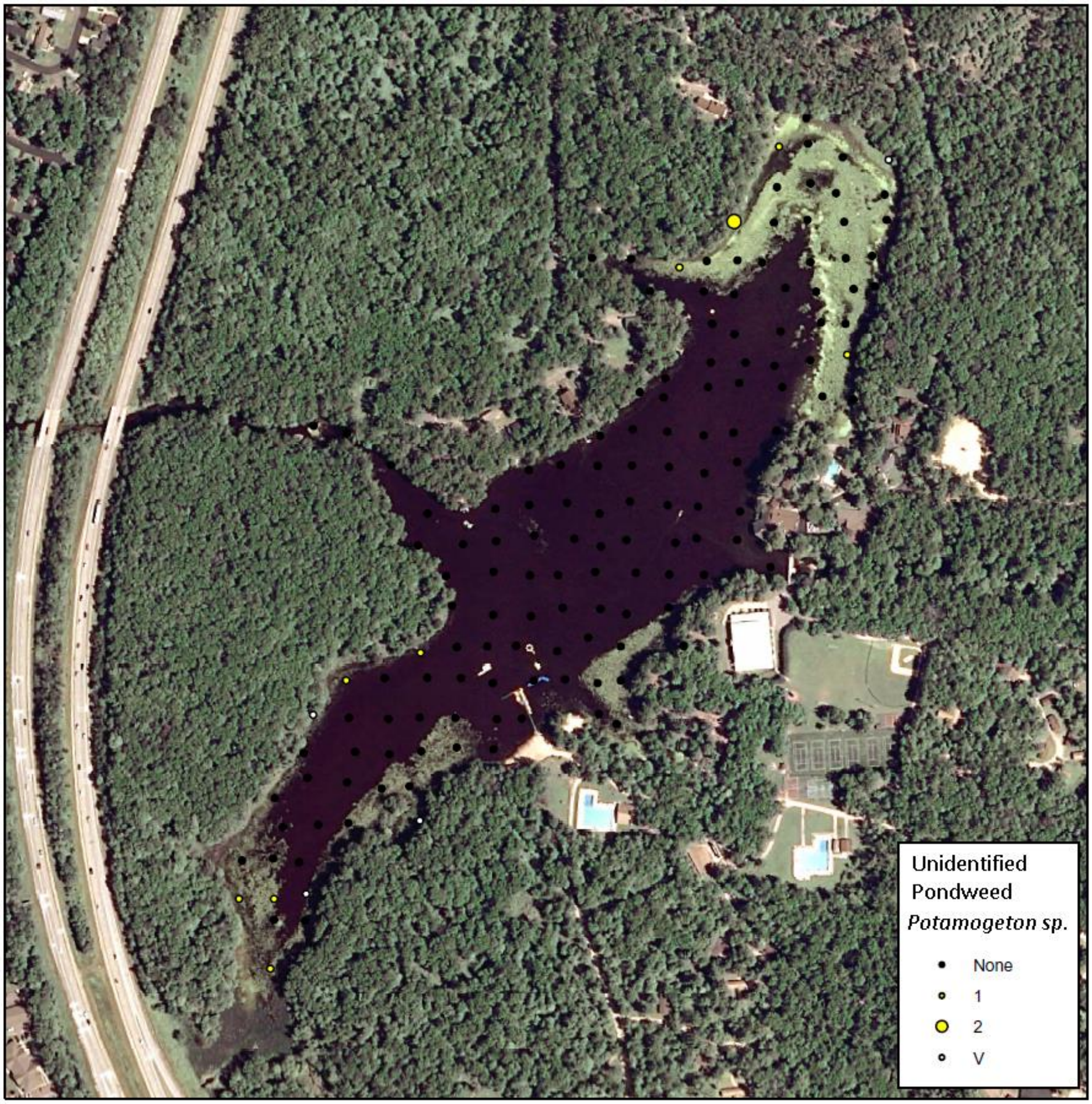

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Lake Blass Aquatic Plant Survey
Potamogeton sp.

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

Feet
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Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
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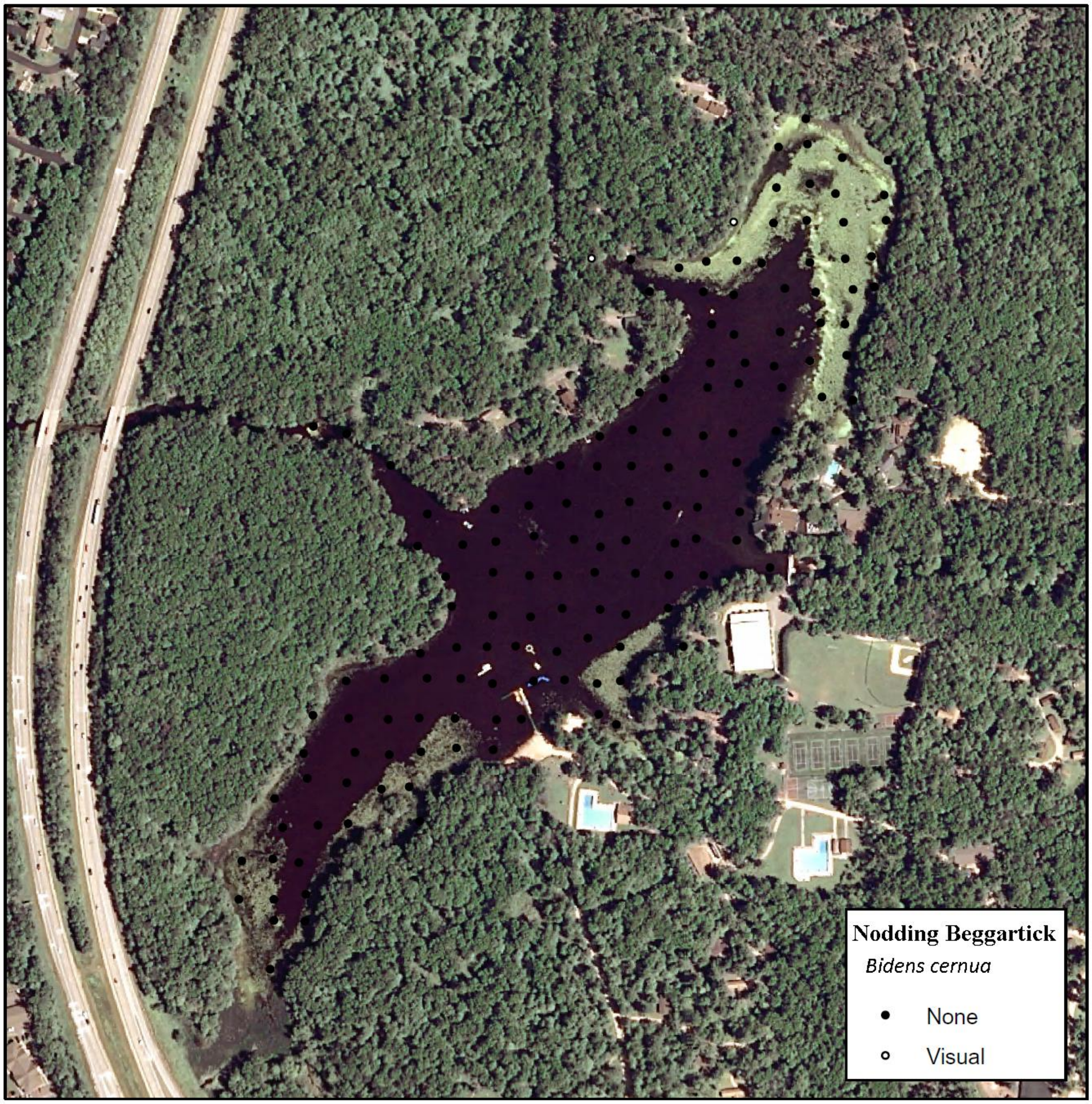
www.aquaticengineering.org



Aquatic Engineering, Inc.

Lake Blass Aquatic Plant Survey
Nodding Beggartick

Lake Blass, Sauk County, Wisconsin

Date: September 11, 2014

Feet
0 250 500 750 1,000 1,250

Coordinate System: GCS_North_American_1983

N W E S

Map Scale:
1:4,500

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Appendix B