2014 Progress Report for Black Otter Lake, Outagamie County, Wisconsin

Prepared by:

Cason & ASSOCIATES, LLC
LAKE & POND MANAGERS

P.O. Box 230 Berlin, WI 54923 920-361-4088

Prepared for:

Black Otter Lake District
c/o Matthew Schroeder
206 Lakeshore Dr.
Hortonville, WI 54944

March 27, 2015

Introduction

For more than a decade, the members of the Black Otter Lake District have actively managed the aquatic invasive species Eurasian watermilfoil (*Myriophyllum spicatum*) (EWM) and curly-leaf pondweed (*Potamogeton crispus*) (CLP). Both species have dominated the lake at various times over this period. Treatments for exotic species date back to 2003. Annual surveys have taken place on Black Otter Lake in the spring and fall to monitor the extent of CLP and EWM, respectively, and to provide information to develop management approaches.

During the winter of 2008/2009, a drawdown of Black Otter Lake took place. The lake was drained in September 2008 and refilled in May 2009. The goals of the drawdown were to improve water quality, reduce sediment volumes and control nuisance aquatic plant growth, including native and exotic species. In 2009, following the drawdown, surveys found little EWM present but nearly lake-wide CLP. The abundance of CLP was unexpected as it was hoped the freezing conditions would impact both exotic species equally. The District had hoped to chemically treat the abundant CLP. However due to the timing of the end of the drawdown and the extent of native plant growth, the treatment was denied by the Wisconsin DNR (WDNR).

In April 2010, post-drawdown treatments of CLP and EWM began. Treatments of CLP utilized liquid and granular formulations of endothall herbicides, while EWM treatments utilized liquid and granular formulations of 2,4-D. Within two years, EWM treatments were successful to the point that further treatments were not warranted until 2014. Whole-lake CLP treatments continued annually through 2013 to reduce the extent of this species. Repeated treatments are needed due to the life-cycle of CLP. CLP produces vegetative reproductive structures called turions. These turions fall to the bottom of the lake when the plants die in the summer. Over the winter and into the spring, turions begin to sprout. Turions can survive chemical treatment and can remain viable in the sediment for a number of years.

The most recent whole-lake treatment for CLP on Black Otter Lake took place on May 16, 2013. A combination of Aquathol K® (liquid endothall) and Aquathol Super K® (granular endothall) were used to treat the lake with a target, lake-wide concentration of 1.0 ppm endothall.

In the fall of 2013, a survey of Black Otter Lake identified approximately 6.5 acres of EWM.

Methods

Exotic Plant Distribution Mapping

On May 27, 2014, a survey for exotic species was conducted on Black Otter Lake by Cason & Associates' staff. This survey was used to determine the area and location of CLP. It utilized the point-intercept aquatic plant survey map as a guide. Surface observations and rake tows were used to determine the abundance of CLP at each location. The ratings used follow the guidelines established by the Wisconsin DNR for point-intercept plant surveys. The results of this survey were used to develop a treatment plan for 2014

A similar survey was conducted on October 15, 2014. This survey focused on EWM. It also utilized the point-intercept aquatic plant survey map. However, areas of EWM growth between sampling locations were also recorded. GPS coordinates for all locations were recorded and used to develop a distribution map. This data was used develop a treatment plan for 2015.

Submergent Aquatic Plant Survey

On September 3, 2104, Cason & Associates staff conducted a point intercept survey of the entire aquatic plant community in Black Otter Lake. At each location, aquatic plant samples were collected from a boat with a single rake tow. All plant samples collected were identified to *genus* and *species* whenever possible, and the information was recorded. An abundance rating was also given for each species. In addition to the plant data, water depth was recorded for each location. Data collected were used to determine species composition, percent frequency and relative abundance. Results of this survey and the survey conducted in 2013 were compared to assess changes in the plant community as a result of the recent aquatic plant management practices, namely whole-lake treatments.

Results and Discussion

Exotic Plant Distribution Mapping

Results of the May 27, 2014 survey for CLP in Black Otter Lake are shown in **Figure 2**. As expected CLP was found lake-wide, however the density and distribution of plants were significantly lower than in prior years. For example, **Figure 1** shows the results of the May 2013 survey. These results suggest the annual spring treatments for this species that have taken place since the drawdown during the 2008-2009 winter have been successful at reducing the abundance of CLP in the lake over time. The winter of 2013-2014 was particularly cold and long. Ice out did not occur on many lakes in Wisconsin until May; weeks later than normal. Water temperatures and aquatic plant growth were monitored to establish the ideal treatment timing. During this time, a period of particularly warm weather cause the lake water temperatures in Black Otter Lake to

quickly increase. By May 31′ 2014, surface water temperatures had reached 74° F. CLP treatments typically take place colder temperatures (less than 65°F). A spring CLP treatment was anticipated to take place utilizing Aquathol K® (liquid endothall) and Aquathol Super K® (granular endothall) applied at a target whole-lake rate of 1.0 ppm. Unfortunately, the Wisconsin DNR did not permit this treatment in 2014. The reasons for not permitting this treatment were threefold. First, the Wisconsin DNR had not received all permitting application materials; specifically proof of public notice. Second, there was a concern that the use of endothall would negatively impact the native aquatic plants which were actively growing by the end of May. Last, it was suspected a late-spring endothall treatment may impact bluegill spawning.

During the October 15, 2014, approximately 19.2 acres of scattered EWM were identified on Black Otter Lake (**Figure 4**). The treatment that had been planned for the spring of 2014 was to include treatment of EWM in addition to CLP. It appears, with a lack of treatment, the EWM in Black Otter Lake expanded in 2014. This is evident by the survey results from October 2013 when 6.5 acres of EWM was identified (**Figure 3**).

Figure 1. Locations of curly-leaf pondweed (*Potamogeton crispus*) found on May 8, 2013 on Black Otter Lake, Outagamie County, WI.

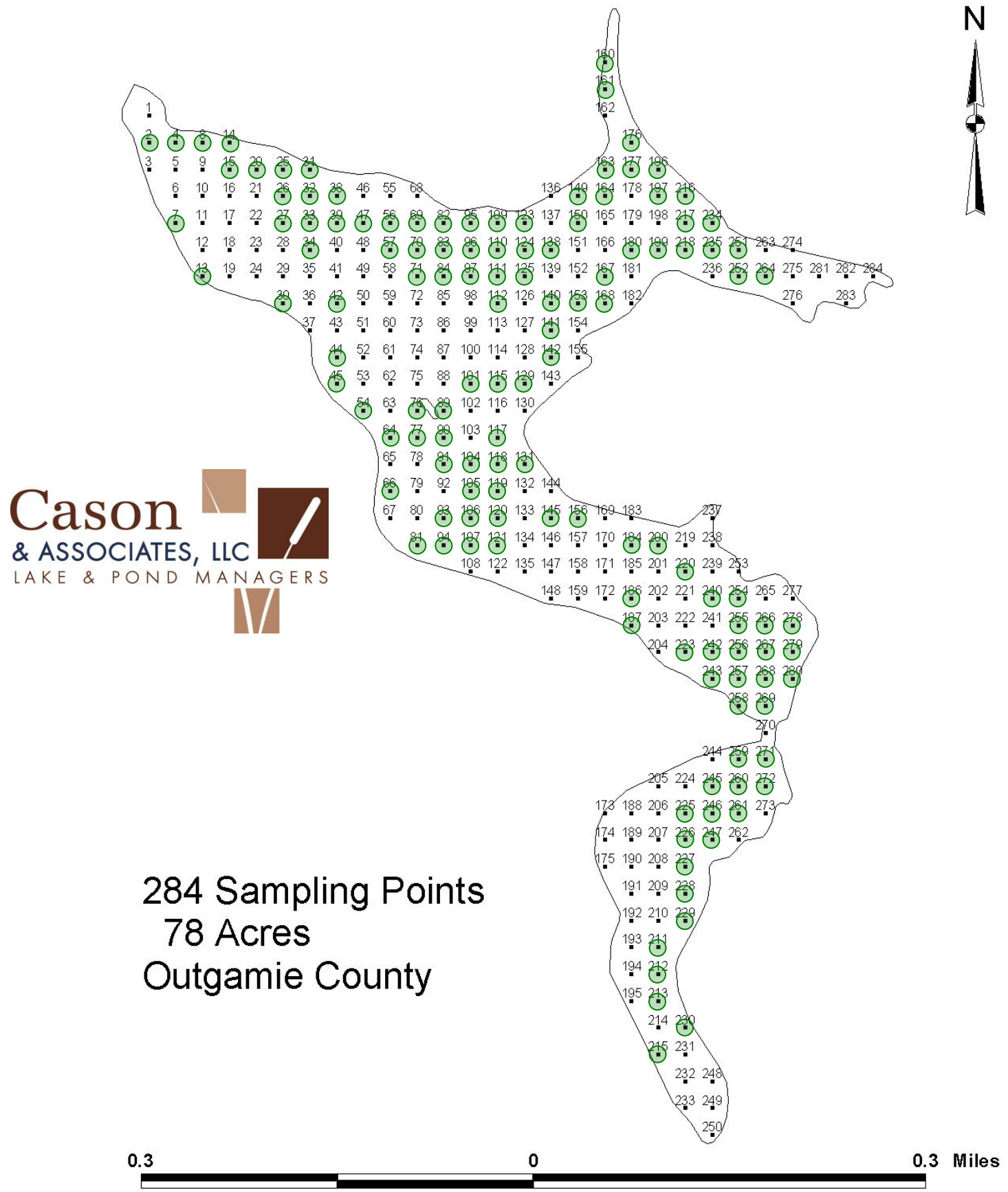


Figure 2. Locations of curly-leaf pondweed (*Potamogeton crispus*) found on May 27, 2014 on Black Otter Lake, Outagamie County, WI.

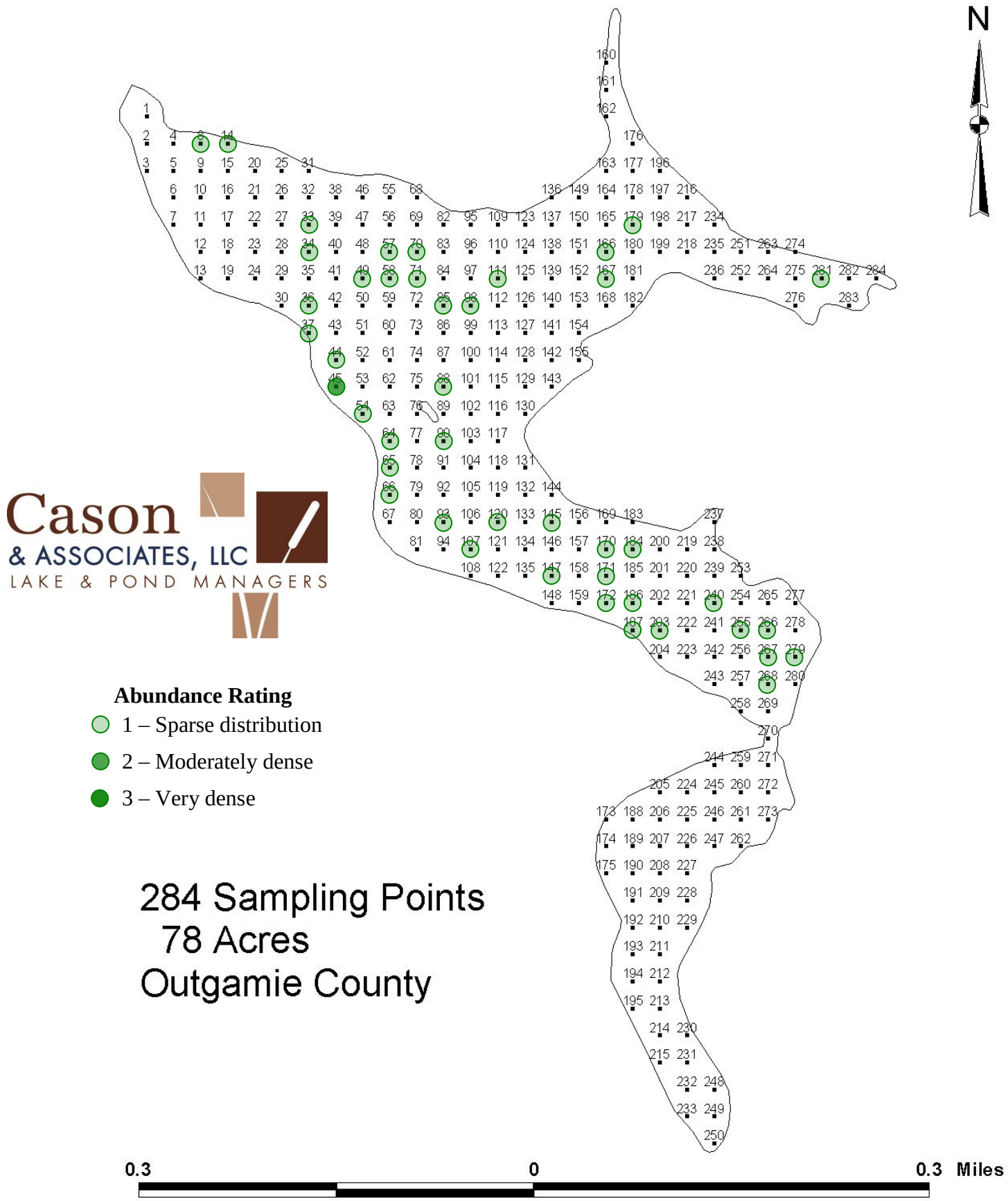


Figure 5. Locations of Eurasian watermilfoil (*Myriophyllum spicatum*) found on October 24, 2013 on Black Otter Lake, Outagamie County, WI (6.5 acres total).

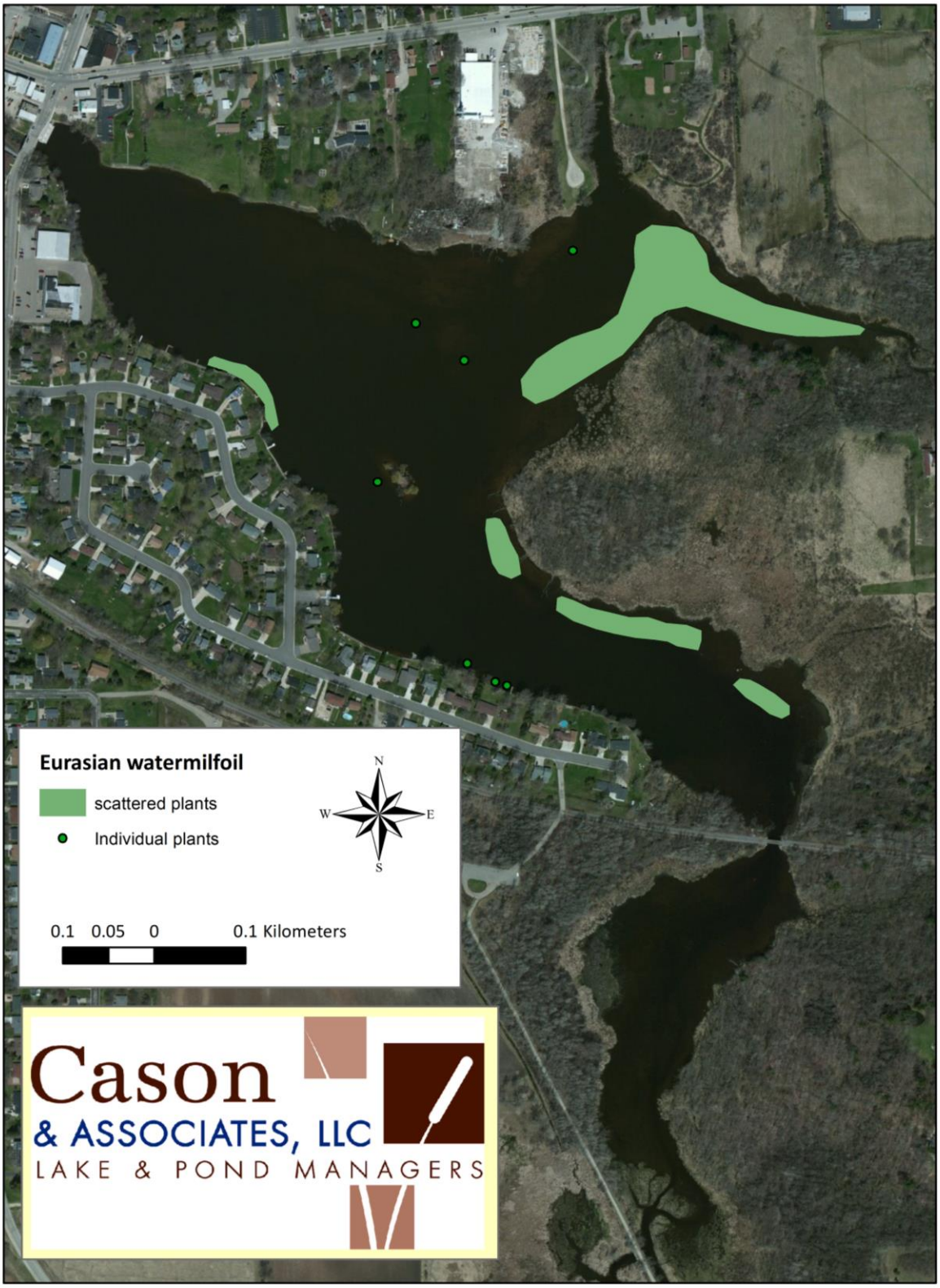
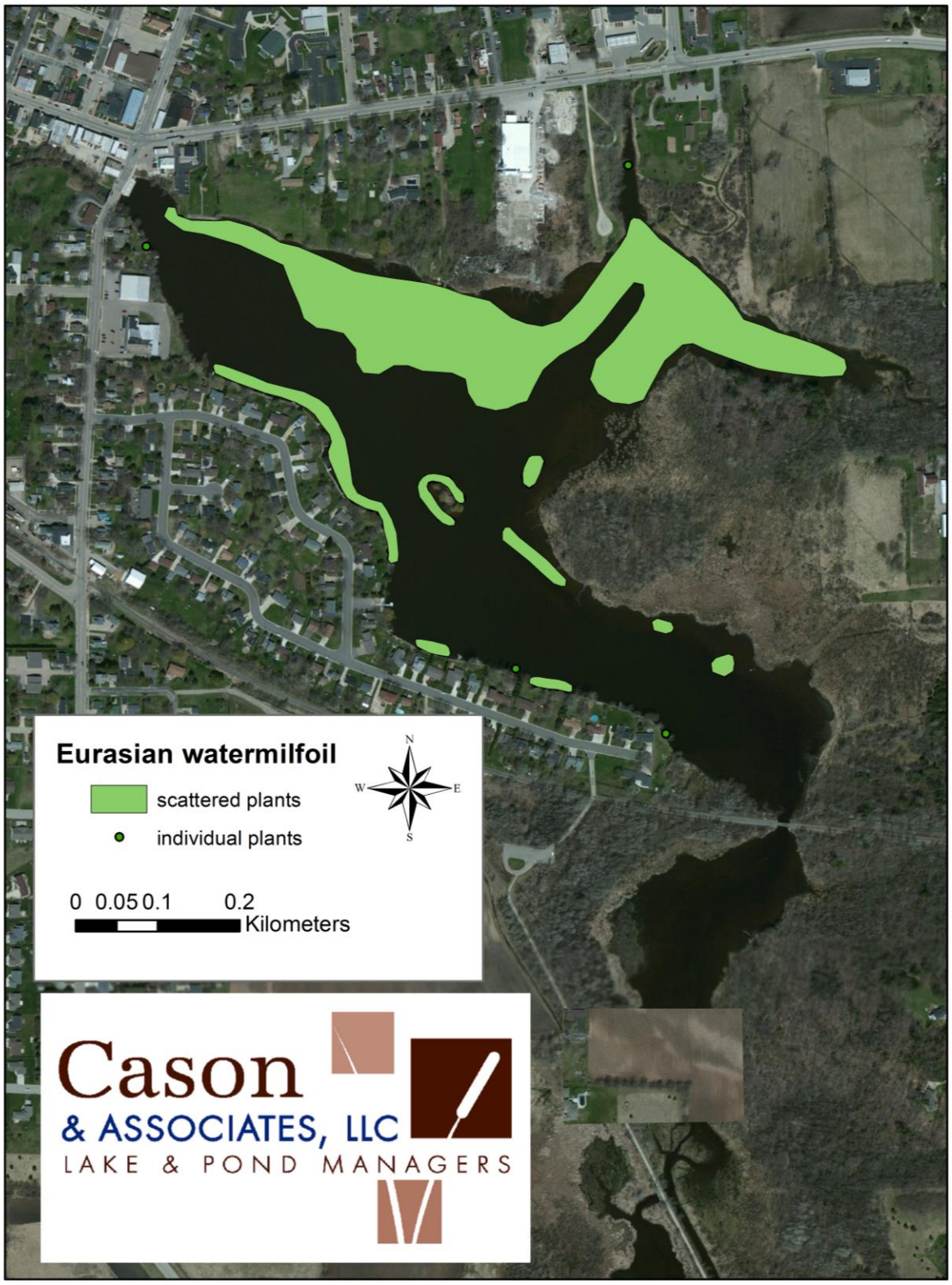


Figure 4. Locations of Eurasian watermilfoil (*Myriophyllum spicatum*) found on October 15, 2014 on Black Otter Lake, Outagamie County, WI (19.2 acres total).



Point-Intercept survey

Although 284 points were mapped across Black Otter Lake, it was only possible to reach 231 locations at the time of the September 3, 2014 survey. The remaining locations were not navigable due to extremely dense growth and/or shallow water. A total of 17 submergent, floating-leafed and emergent aquatic plant species were found during this survey (**Table 1**). This is above the state-wide average of 13 species. Black Otter Lake lies within the Northern Central Hardwood Forests region of Wisconsin. The average number of species found in lakes in this region is 14 species. The percent frequency values listed in **Table 1** reflect the relationship between the number of locations where a particular species was found versus the total number of locations sampled. Percent composition values reflect the abundance of a particular species in relation to all other species found. The most abundant plant species encountered in Black Otter Lake in 2014 were coontail (*Ceratophyllum demersum)*, small duckweed (*Lemna minor*), watermeal (*Wolffia columbiana*), and filamentous algae. Each of these species occurred at greater than 20% frequency and are found in **Figures 5 – 8**, respectively. Coontail, the most abundant plant was found at approximately 95% of the locations sampled.

The data in **Table 1** also show some fluctuations in the levels of native and exotic plant species dating back to 2011. Previous reports include data collected annually since before the drawdown in 2008. These fluctuations are most apparent with coontail and common waterweed (*Elodea canadensis*). In 2011 and 2012, common waterweed reached an abundance of nearly 90%. In the past two years, this species has declined to approximately 13% frequency of occurrence. In comparison, coontail had a frequency of occurrence of 32.4% in 2011 and has increased to over 90% in 2014. The sheer quantity of native aquatic plants in Black Otter Lake was very concerning to riparian property owners and other lake users for a number of years. It appears the lake is prone to dense plant growth. The data show when one overly abundant species begins to decline, another is there to fill the void and becomes the new nuisance. The raw data for the 2014 submergent aquatic plant survey can be found in **Appendix A**.

Table 1. Results of the submergent aquatic plant surveys conducted on Black Otter Lake on August 1, 2011, July 5, 2012, August 21, 2013 and September 3, 2014.

		2014		2013		2012		2011	
Species common name	**scientific name**	**Percent Frequency**	**Relative Frequency**	**Percent Frequency**	**Relative Frequency**	**Percent Frequency**	**Relative Frequency**	**Percent Frequency**	**Relative Frequency**
Coontail	*Ceratophyllum demersum*	90.95	33.2	83.80	31.3	56.80	22.0	32.43	19.8
Small duckweed	*Lemna minor*	52.16	19.0	23.61	8.8	24.85	9.6	3.38	2.1
Watermeal	*Wolffia columbiana*	41.38	15.1	30.56	11.4	23.67	9.2	4.73	2.9
Filamentous algae	--	20.69	7.5	39.35	14.7	55.03	21.3	4.05	2.5
Water stargrass	*Heteranthera dubia*	15.52	5.7	2.31	0.9	visual	--	2.03	1.2
Common waterweed	*Elodea canadensis*	13.36	4.9	54.17	20.2	89.94	34.9	88.51	54.1
Common bladderwort	*Utricularia vulgaris*	9.91	3.6	5.56	2.1	1.78	0.7	0.68	0.4
Muskgrass	*Chara* sp.	8.62	3.1	1.85	0.7	--	--	--	--
Bushy pondweed	*Najas flexilis*	6.90	2.5	0.46	0.2	--	--	1.35	0.8
Sago pondweed	*Stuckenia pectinata*	6.03	2.2	25.93	9.7	2.37	0.9	21.62	13.2
Eurasian watermilfoil	*Myriophyllum spicatum*	3.88	1.4	visual	--	--	--	--	--
Curly-leaf pondweed	*Potamogeton crispus*	1.29	0.5	0.46	0.2	0.59	0.2	2.03	1.2
Spatterdock	*Nuphar variegata*	0.86	0.3	visual	--	visual	--	visual	--
Small pondweed	*Potamogeton pusillus*	0.86	0.3	--	--	0.59	0.2	2.03	1.2
Floating-leaf pondweed	*Potamogeton natans*	0.86	0.3	--	--	--	--	--	--
Water marigold	*Megalodonta beckii*	0.43	0.2						
Forked duckweed	*Lemna trisulca*	0.43	0.2	--	--	--	--	--	--
Cattails	*Typha* sp.	visual	--	visual	--	visual	--	visual	--
White water lily	*Nymphaea odorata*	visual	--	visual	--	visual	--	visual	--
Softstem bulrush	*Schoenoplectus tabernaemontani*	visual	--	visual	--	visual	--	visual	--
Stiff water crowfoot	*Ranunculus aquatilis*	--	--	--	--	visual	--		
Stonewort	*Nitella* sp.	--	--	--	--	1.78	0.7	0.68	0.4
Northern watermilfoil	*Myriophyllum sibiricum*	--		--	--	0.59	0.2	--	--
	Simpson Diversity Index	0.82		0.81		0.77		0.65	
	Coefficient of Conservatism	5.5		5.2		5.1		4.9	
	Floristic Quality Index	20.6		17.2		19.9		18.4	
	(WI ave. 22.2, Region ave. 20.9)								

Figure 5. Locations of coontail (*Ceratophyllum demersum*) identified on September 3, 2014 on Black Otter Lake, Outagamie County, WI.

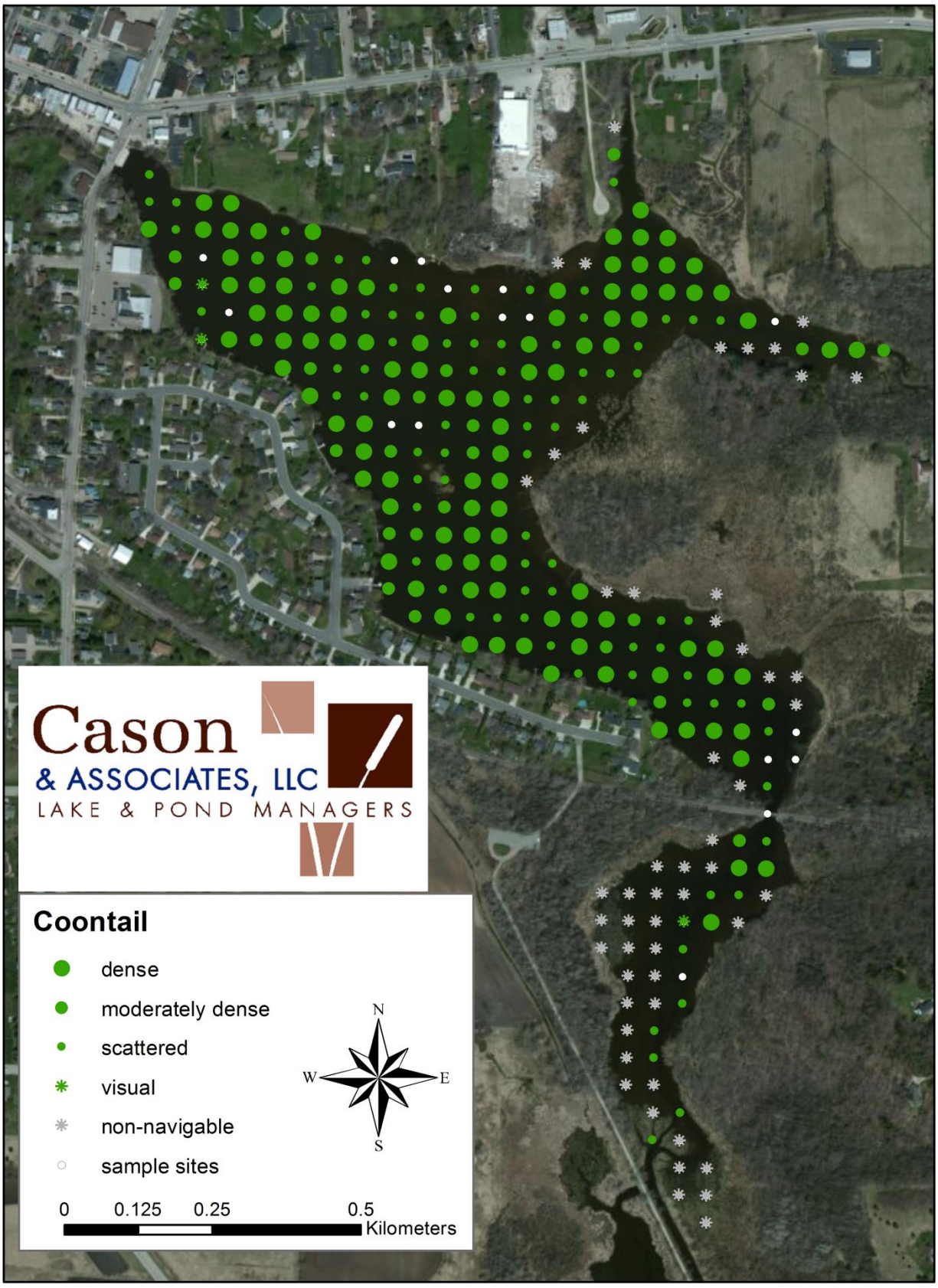


Figure 6. Locations of small duckweed (*Lemna minor*) identified on September 3, 2014 on Black Otter Lake, Outagamie County, WI.

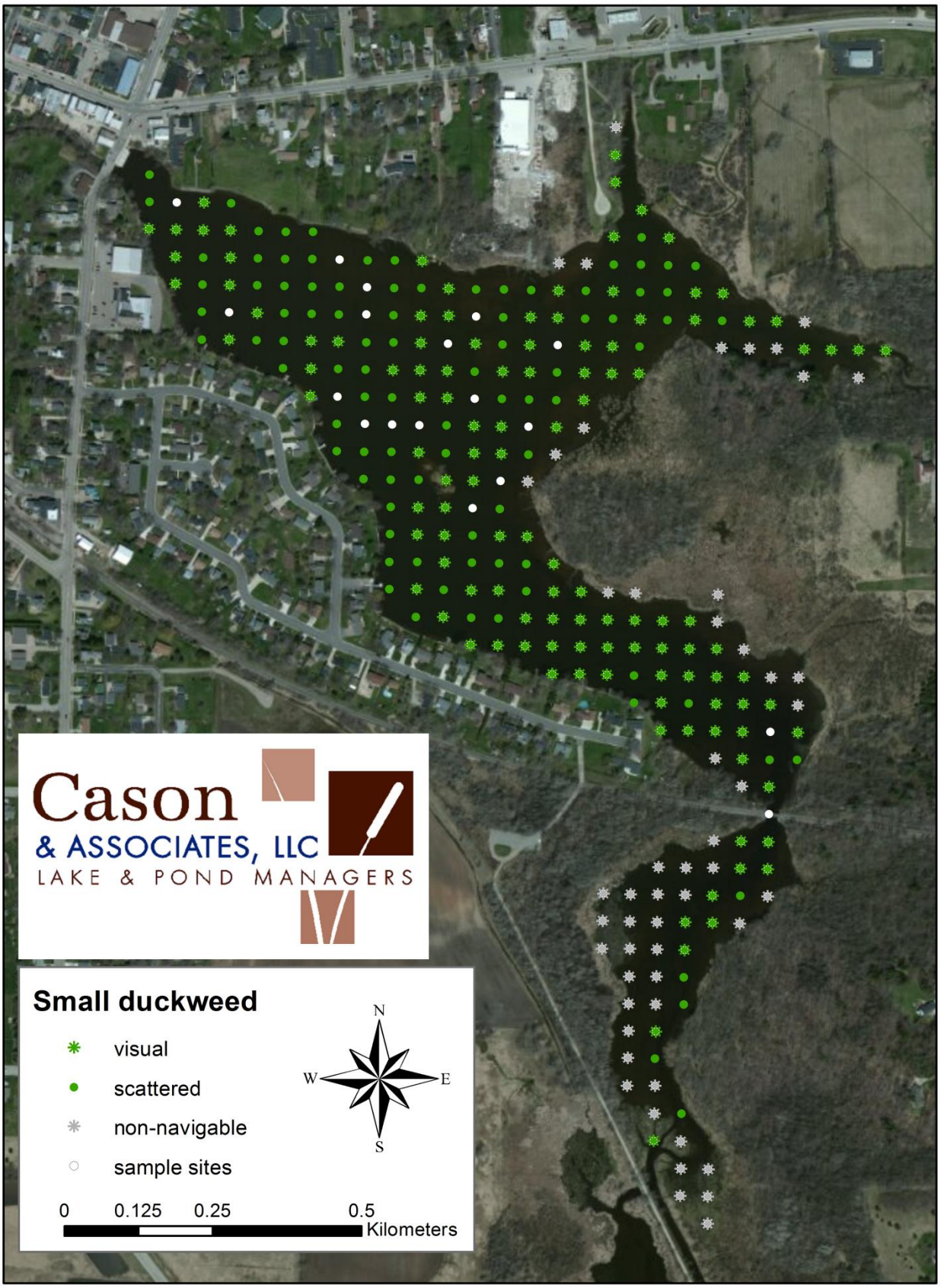
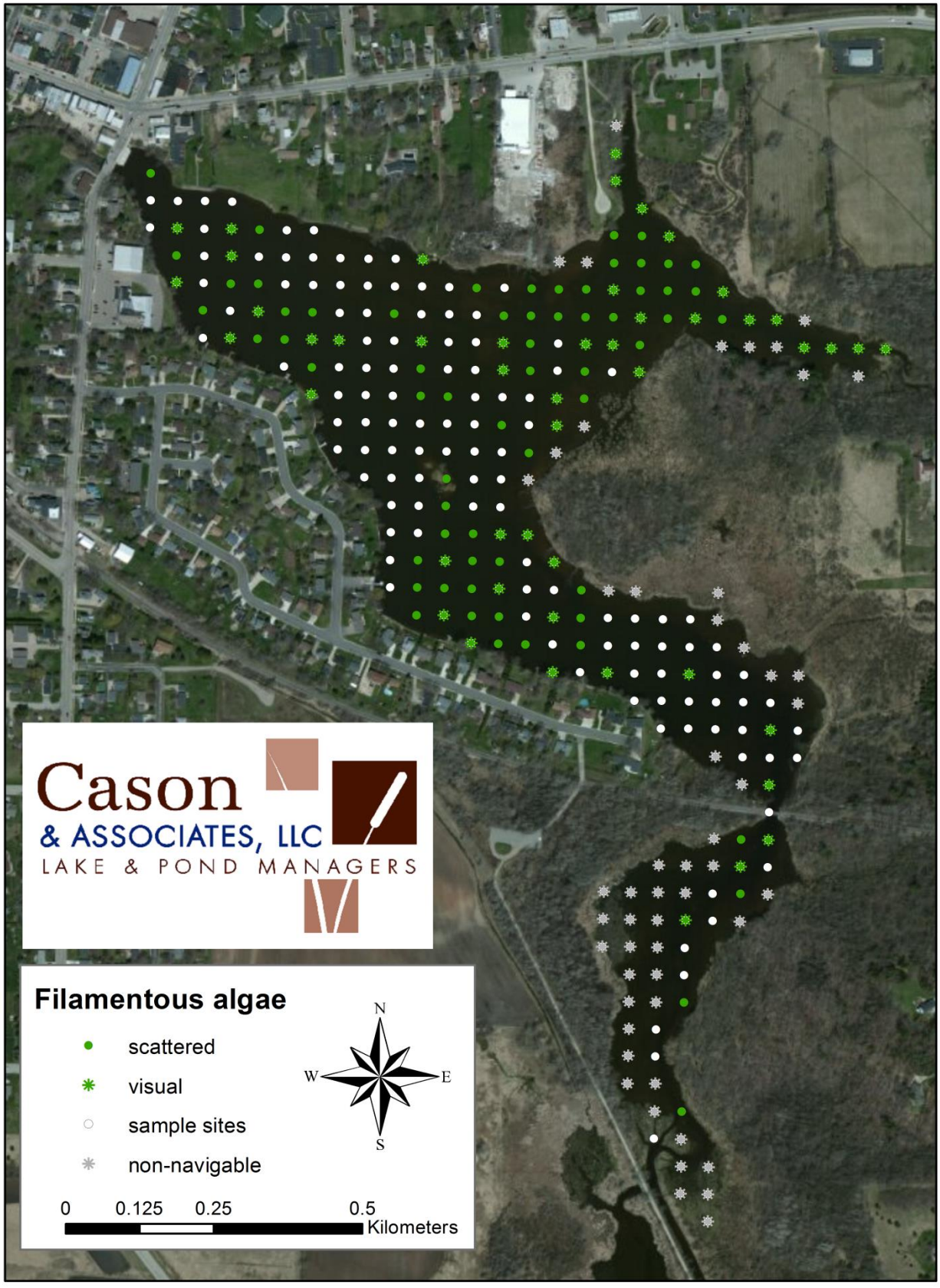


Figure 7. Locations of watermeal (*Wolffia columbiana*) identified on September 3, 2014 on Black Otter Lake, Outagamie County, WI.

Figure 8. Locations of filamentous algae identified on September 3, 2014 on Black Otter Lake, Outagamie County, WI.



Simpson Diversity Index

In order to estimate the diversity of the aquatic plant community, the Simpson Diversity Index takes into account both the number of species identified (richness) and the distribution or relative abundance of each species. With the Simpson Diversity Index (D), 1 represents infinite diversity and 0, no diversity. That is, the bigger the value of D, the higher the diversity. The value of D calculated for Black Otter Lake based on the 2014 data was 0.82. This value has slowly increased since 2011 when it was 0.65. Although State-wide or regional averages for D are not available, data from lakes surveyed in neighboring counties have yielded values of 0.75 or greater with many lakes with values above 0.85.

Assessment of Floristic Quality

The plant data collected for Black Otter Lake were used to assess the *floristic quality* of the lake. The method used assigns a value to each native plant species called a *Coefficient of Conservatism*. Coefficient values range from 0-10 and reflect a particular species' likelihood of occurring in a relatively undisturbed landscape. Species with low coefficient values, such as coontail (C=3), are likely to be found in a variety of habitat types and can tolerate high levels of human disturbance. On the other hand, species with higher coefficient values, such as water marigold (C=8), are much more likely to be restricted to high quality natural areas. By averaging the coefficient values available for the submergent and emergent species found in Black Otter Lake, a lake-wide value of 5.5 was calculated. Values since 2011 have gradually increased from 4.9. The average value for lakes in Wisconsin is 6.0 while the average in the Northern Central Hardwood Forests region of Wisconsin, which includes Outagamie County, is 5.6.

By utilizing the *Coefficients of Conservatism* for the plant species of Black Otter Lake, further assessment of floristic quality can be made. By multiplying the average coefficient values for Black Otter Lake by the square root of the number of plant species found, a *Floristic Quality Index* (FQI) was calculated to be 20.6. Values since 2011 have gradually increased from 18.4. In general, higher FQI values reflect higher lake quality. The average for Wisconsin lakes is 22.2. The average for lakes in the Northern Central Hardwood Forests region is 20.9.

The *Simpson Diversity Index*, the *Coefficient of Conservatism* and the *Floristic Quality Index* values suggest the quality of Black Otter Lake, specifically in terms of the plant community, is below average. This is not surprising for an artificial waterbody such as Black Otter Lake.

Statistical Analysis

The summer point-intercept data from August 2013 and September 2014 on Black Otter Lake were statistically analyzed using a Chi-square test to determine if significant changes to the plant community had occurred between the two surveys. The result of this analysis is found in **Table 2**. The asterisks in the *Significant Change* column indicate where statistically significant changes were found. The more asterisks present a particular plant species, the more significant the change was. Overall, five plant species, including EWM, significantly increased from 2013 to 2014 while three species, including filamentous algae, decreased.

Table 2. Chi-square statistical analysis of aquatic plant data collected in August 2013 and September 2014 on Black Otter Lake, Outagamie County, WI.

		Aug. 2013	Sept. 2014		
Common Name	**Scientific Name**	**Percent Frequency**	**Percent Frequency**	**Significant Change**	**Increase (I) or Decrease (D)**
Eurasian watermilfoil	*Myriophyllum spicatum*	--	3.88	**	I
Curly-leaf pondweed	*Potamogeton crispus*	0.46	1.29		
Coontail	*Ceratophyllum demersum*	83.8	90.95	**	I
Common duckweed	*Lemna minor*	23.61	52.16	***	I
Common watermeal	*Wolffia columbiana*	30.56	41.38		
Filamentous algae	--	39.35	20.69	***	D
Water star-grass	*Heteranthera dubia*	2.31	15.52	***	I
Common waterweed	*Elodea canadensis*	54.17	13.36	***	D
Common bladderwort	*Utricularia vulgaris*	5.56	9.91		
Muskgrasses	*Chara* spp.	1.85	8.62	**	I
Bushy pondweed	*Najas flexilis*	0.46	6.90	***	I
Sago pondweed	*Stuckenia pectinata*	25.93	6.03	***	D
Spatterdock	*Nuphar variegata*	--	0.86		
Floating-leaf pondweed	*Potamogeton natans*	--	0.86		
Small pondweed	*Potamogeton pusillus*	--	0.86		
Star duckweed	*Lemna trisulca*	--	0.43		
Water marigold	*Megalodonta beckii*	--	0.43		

* significant change (a = 0.05), ** more significant change (a = 0.01), *** most significant change (a = 0.001)

Conclusions and Recommendations

Black Otter Lake had been actively managed for EWM and CLP for a number of years leading up to the 2008-2009 drawdown. A survey conducted in July 2008 found approximately 19 acres of EWM and 29 acres of CLP. Both species were found scattered in multiple locations throughout the lake. At the recommendation of the WDNR, the Black Otter Lake District chose to conduct the winter drawdown. Following the drawdown, changes were observed. Water quality improved initially, sediment testing indicated decomposition and desiccation occurred, and the diversity of the native aquatic plant community improved. Plant survey data since 2009 indicate the increased diversity of native plants was short lived.

Immediately following the drawdown, it was apparent that CLP had persisted. Because the lake was refilled in May 2009, treatment of CLP was not permitted that year. Unfortunately, a new crop of turions were produced and, as a result, the first post-drawdown treatment of CLP was postponed until 2010. Annual treatments took place from 2010 to 2013. Unfortunately in 2014 again a whole-lake treatment did not take place. It is likely whole-lake treatments will again be needed starting in 2015 to manage CLP. The untreated CLP plants in 2014 likely produced a new crop of viable turions similar to the spring of 2009 when treatment was denied following the drawdown. After four, annual spring treatments from 2010 to 2013, CLP was still found at 41 locations during the spring 2014 survey. It is likely a new round of annual treatments will be needed for the next four to five years to treat CLP plants sprouting from the bank of turions in the sediments of Black Otter Lake.

Continued aquatic plant management should result in eventual declines in CLP. Research and experience has shown that a multi-year treatment strategy is required to effectively manage CLP. This is due to the persistence of viable turions in the sediment of a lake. These vegetative reproductive structures are produced by mature CLP plants. As the plants die back in the summer, the turions fall to the bottom of the lake and can remain dormant for a number of years. Each year many turions sprout and can grow into mature, turion-producing plants.

It is recommended that CLP and EWM be actively managed as they have been in the past. Early season treatments with endothall and 2,4-D should again be used to target both species. For greatest effectiveness, treatments should target all known locations of these species and take place when the plants are actively growing. CLP is expected to be found growing throughout the lake in the spring of 2015. In addition, it is expected annual whole-lake treatment utilizing Aquathol K® and Aquathol Super K® at a rate of 1.0 ppm endothall will again be needed starting again in 2015.

A whole-lake treatment for EWM will also be wise given the distribution of this species found in October 2014. A low-dose (0.4 ppm) treatment with DMA4 IVM® (liquid 2,4-D)

will target EWM throughout the lake. The cost to treat both CLP and EWM in 2015 will be approximately $33,405. This cost includes setup, material, labor and permit fees.

It is expected if native plant species such as coontail or common waterweed continue to be a nuisance, the mechanical harvester will be used to open predetermined lanes for navigation.

It will be critical to continue to monitor plant growth in Black Otter Lake particularly in relation to chemical treatments. While active management of EWM and CLP continues, it is recommended pre- and post-treatment mapping surveys of the lake be conducted annually to determine the efficacy of treatment and further treatment needs. A pre-treatment survey should again take place in the early spring. The first post-treatment survey should take place in the summer, approximately eight weeks following treatment. This survey can also serve as the full point-intercept survey. As exotic species are actively managed, it will be important to continue to monitor the native plant community to assess possible impacts from the treatments. A third and final survey should be scheduled for the fall. This survey, in particular, will help determine future treatment needs for EWM. The cost for the spring and fall invasive species mapping surveys will be $750 each. The cost for the summer point-intercept survey will be $2,000.

Clean Boats Clean Waters

District volunteers have conducted boat launch monitoring to discourage the movement of exotic species into or out of Black Otter Lake. Although fishing pressure on the lake has been relatively low in recent years, this monitoring program should continue. The District should increase the pool of volunteers participating in this program. However, with such low boating pressure on the lake, it has been a challenge to convince potential volunteers of its importance.

Water quality assessment

Dissolved oxygen, temperature, phosphorus, chlorophyll and Secchi depth data for Black Otter Lake were traditionally collected by volunteers for a number of years. This monitoring has been conducted through the WDNR's Citizen Lake Monitoring Network. The data collected can be downloaded online. However, no data for 2014 are available. Because water quality can be affected by management activities on the lake, continued water quality monitoring is recommended. The frequency to which volunteer monitoring took place in the past should continue in 2015 and beyond. These data will be valuable in determining what impact the management of exotics, in particular, has on the water quality of the lake.

Appendix C

Aquatic plant survey data on September 3, 2014 from Black Otter Lake, Outagamie County, WI.