



Cason & Associates, LLC

Professional Resources for Management of Lakes, Ponds, Rivers and Wetlands

Results of the Aquatic Plant Survey Conducted on Maiden Lake, August 4 - 5, 2009

Recent Management

Eurasian watermilfoil was first identified in Maiden Lake during the summer of 2008. It totaled approximately one acre near the boat launch in Mosquito Bay. The Maiden Lake Association was able to obtain an Early Detection & Rapid Response Grant from the Wisconsin Department of Natural Resources (WDNR). A WDNR permit was then obtained to treat the milfoil in the identified location (**Figure 1**).

On June 2, 2009 the area was treated with Navigate[®], a granular 2,4-D herbicide. However, during the course of the treatment, additional locations of Eurasian watermilfoil were noted in Mosquito Bay. Permission from the WDNR to treat these new locations was quickly obtained, and they were treated on June 9, 2009. In all, approximately 1.5 acres of Eurasian watermilfoil were treated.

On June 25, 2009, an exotic species mapping survey was conducted by visually inspecting the entire shoreline for the presence of Eurasian watermilfoil and other exotics. No Eurasian watermilfoil or other exotic species were found during the survey. A complete submergent aquatic plant survey was requested by the WDNR to search for Eurasian watermilfoil in deeper locations on the lake, and to create baseline data for the aquatic plant community. With the help of Lake Association volunteers, the survey took place on August 4 and 5, 2009.

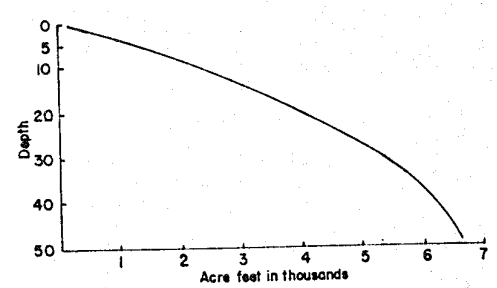
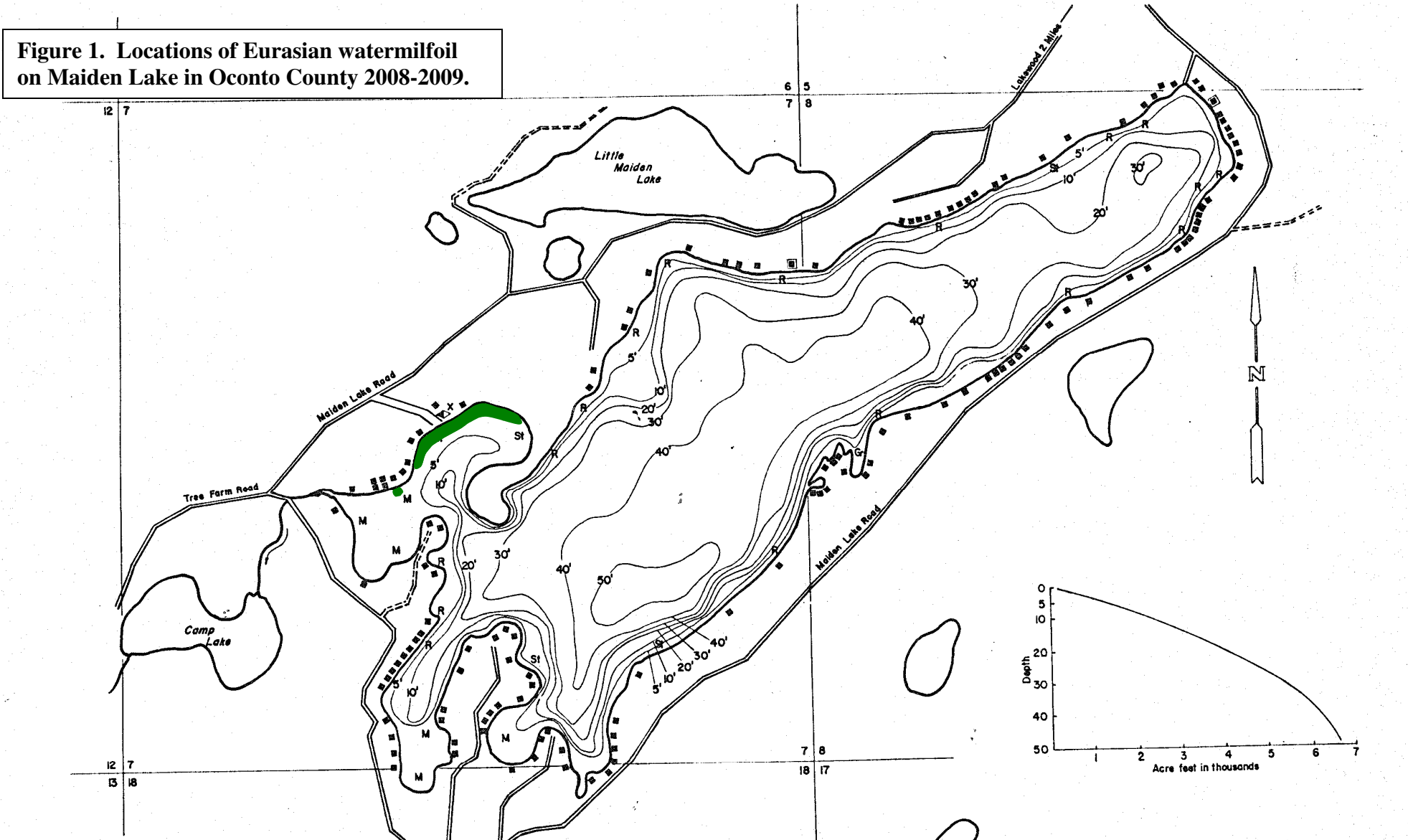
Methods

A plant survey map for Maiden Lake was provided by the WDNR (**Figure 2**). A series of 639 grid points were mapped across the lake. These points were loaded onto a GPS to locate them from a boat. At each of these locations, aquatic plant samples were collected with a single rake tow. The rake used consisted of two short-toothed garden rake heads welded together and attached to a rope. All plant samples collected were identified to genus and species whenever possible, and the information was recorded. An abundance rating of 1, 2 or 3 (sparse, moderate or dense) was also given for each species. Any species that were sighted but did not show up on the rake tow were recorded as having been visually observed (V). In addition to the plant data, depth and bottom substrate composition were recorded for each location. Data collected has been used to determine species composition, percent frequency and relative abundance.

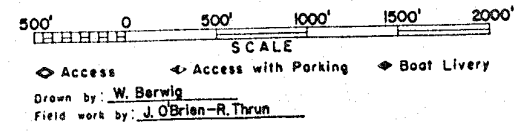
LAKE SURVEY MAP

MAIDEN LAKE
OCONTO COUNTY
SEC. 5-7-8-18 T. 32 N. R. 16 E.W.

Figure 1. Locations of Eurasian watermilfoil on Maiden Lake in Oconto County 2008-2009.



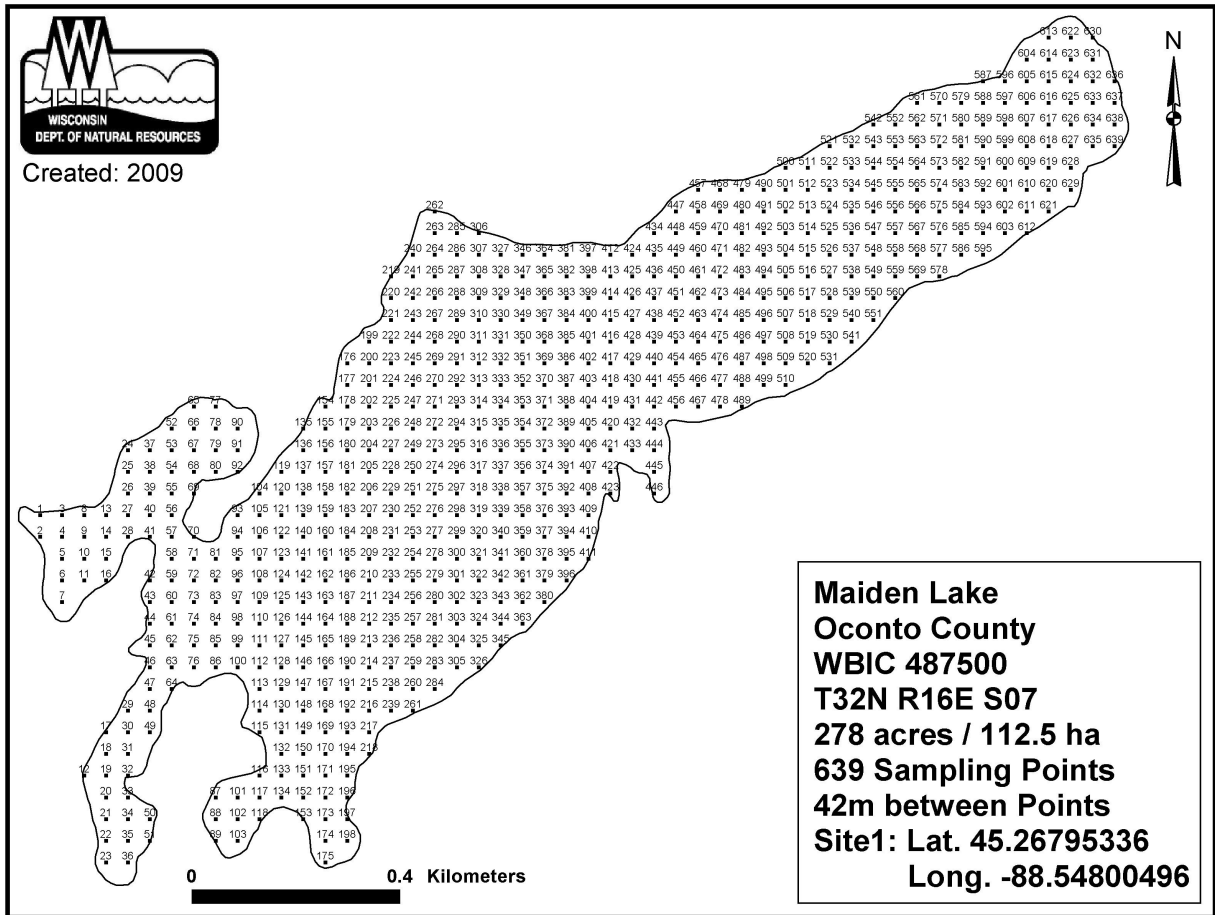
EQUIPMENT	RECORDING SONAR	MAPPED	JUNE	1978
		MONTH	YEAR	
		LAKE	BOTTOM	SYMBOLS
TOPOGRAPHIC SYMBOLS				
(B) Brush	Steep slope	P. Peat	B Boulders
(PW) Partially wooded	-----	Indefinite shoreline	Mk. Muck	⊗ Stumps & Snags
(W) Wooded	-----	Marsh	C. Clay	⊙ Rock danger to navigation
(C) Cleared	-----	Spring	M. Marl	T Submergent vegetation
(P) Pastured	-----	Intermittent stream	Sd. Sand	⊥ Emergent vegetation
(A) Agricultural	-----	Permanent inlet	Sl. Silt	⊕ Floating vegetation
B.M. Bench Mark	-----	Permanent outlet	Gr. Gravel	⊖ Brush shelters
• Dwelling	-----	Dam	R. Rubble	
⊠ Resort	-----	D.N.R. State owned land	Bc Bedrock	
⊡ Camp	-----			



SPECIES OF FISH	ABUNDANCE	
	Abundant	Present
Muskie		
N. Pike		
Wallace	X	
L. M. Bass	X	
S. M. Bass	X	
Panfish	X	
Trotl		

WATER AREA	269	ACRES
UNDER 5 FT.	19	%
OVER 20 FT.	39	%
MAX. DEPTH	52	FEET.
TOTAL ALK.	90.3	P.P.M.
VOLUME	6545.5	ACRE FT.
MAIN SHORELINE	5.6	MI.
ISLAND SHORELINE		MI.

Figure 2. Plant survey map developed by the WDNR for the August 4-5, 2009 survey



Results

Aquatic Plant Community

Although 639 points were mapped across Maiden Lake, vegetation was found at only 316 locations at the time of the survey. The maximum depth that plants were found was 34.5 feet. Half of the points sampled on Maiden Lake were too deep to sustain vegetation. A total of 15 aquatic plant species were found during the survey (**Table 1**). This is above the state-wide average of 13 species. Maiden Lake lies within the Northern Lakes and Forests region of Wisconsin (Nichols 1999). The average number of species found in lakes in this region is also 13 species. The most abundant plant species encountered in Maiden Lake were muskgrass (*Chara* sp.), and nitella (*Nitella* sp.). Muskgrass was by far the most abundant species found, being identified at 85.1% of the points sampled that contained vegetation. Nitella was found at 16.8% of the vegetated points sampled. Percent frequency values reflect the relationship between the number of locations where a particular species was found versus the total number of locations sampled. Relative

frequency values reflect the abundance of a particular species in relation to all other species found (Table 1).

Figure 3 presents the relative abundance of aquatic plant species found in Maiden Lake at the time of the 2009 survey. The raw data for the 2009 aquatic plant survey can be found in Appendix A.

Figure 3. Aquatic plant community composition for Maiden Lake, Oconto County, WI, on August 4-5, 2009

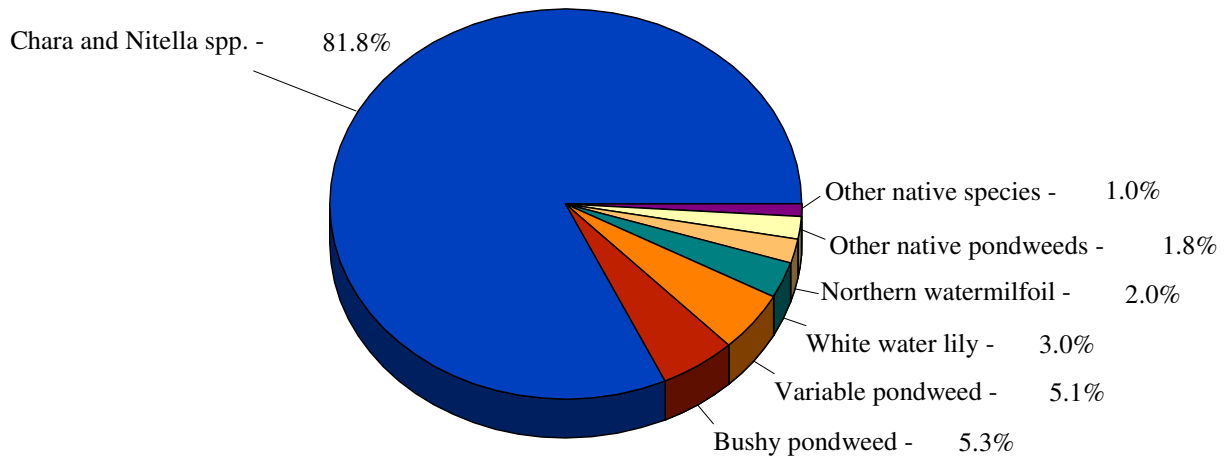


Table 1. Results of the aquatic plant survey conducted on Maiden Lake on August 4-5, 2009.

Species Scientific Name	Common Name	Percent Frequency	Relative Frequency
<i>Chara spp.</i>	Muskgrasses	85.13	68.3
<i>Nitella spp.</i>	Nitella	16.77	13.5
<i>Najas flexilis</i>	Bushy pondweed	6.65	5.3
<i>Potamogeton gramineus</i>	Variable pondweed	6.33	5.1
<i>Nymphaea odorata</i>	White water lily	3.8	3
<i>Myriophyllum sibiricum</i>	Northern watermilfoil	2.53	2
<i>Elodea canadensis</i>	Common waterweed	0.63	0.5
<i>Potamogeton natans</i>	Floating-leaf	0.63	0.5
<i>Potamogeton pusillus</i>	Small pondweed	0.63	0.5
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	0.63	0.5
<i>Schoenoplectus acutus</i>	Hardstem bulrush	0.63	0.5
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	0.32	0.3
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	visual	--
<i>Nuphar variegata</i>	Spatterdock	visual	--
<i>Polygonum amphibium</i>	Water smartweed	visual	--

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 Maiden Lake based on the 2009 data was 0.51. That means that the aquatic plant community has average diversity in Maiden Lake. This is not surprising given the fact that most of the lake's littoral zone (zone sustaining plant growth) contains muskgrass (*Chara* spp.).

Assessment of Floristic Quality

The plant data collected for Maiden 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 common waterweed, 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 nitella, 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 Maiden Lake, a lake-wide value of 6.0 was calculated (**Table 2**). The average value for lakes in Wisconsin is 6.0 while the combined average for lakes in the Northern Lakes and Forests region of Wisconsin which includes northern Oconto County is 6.7 (Nichols 1999).

Table 2. Maiden Lake Floristic Quality Index (FQI) analysis table

Scientific Name	Common Name	C
<i>Chara</i> spp.	Muskgrasses	7
<i>Elodea Canadensis</i>	Common waterweed	3
<i>Myriophyllum sibiricum</i>	Northern water-milfoil	7
<i>Najas flexilis</i>	Bushy pondweed	6
<i>Nitella</i> spp.	Nitella	7
<i>Nuphar variegata</i>	Spatterdock	6
<i>Nymphaea odorata</i>	White water lily	6
<i>Polygonum amphibium</i>	Water smartweed	5
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	7
<i>Potamogeton gramineus</i>	Variable pondweed	7
<i>Potamogeton natans</i>	Floating-leaf pondweed	5
<i>Potamogeton pusillus</i>	Small pondweed	7
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	6
<i>Schoenoplectus acutus</i>	Hardstem bulrush	5
	N	14
	mean C	6.0
	FQI	22.4
	Simpson Diversity Index	0.51

By utilizing the *Coefficients of Conservatism* for the plant species of Maiden Lake, further assessment of floristic quality can be made. By multiplying the average coefficient values for Maiden Lake by the square root of the number of plant species found, a *Floristic Quality Index* (FQI) was calculated to be 22.4 (**Table 2**). In general, higher FQI values reflect higher lake quality. The average for Wisconsin lakes is 22.2. The average for lakes in the Northern Lakes and Forests region is 24.3 (Nichols 1999). Both the *Coefficient of Conservatism* and the *Floristic Quality Index* values suggest the quality of Maiden Lake, specifically in terms of the plant community, is slightly below average.

Exotic Plant Distribution Mapping

Eurasian watermilfoil was sighted at only one sample point in Mosquito Bay, in an area that had been previously treated. One other Eurasian watermilfoil plant was located in the northeast corner of the lake near the private boat landing. This plant was growing in shallow enough water that it was hand-pulled by a Cason & Associates, LLC staff member at the time it was discovered. No other Eurasian watermilfoil plants could be found around the area. Also, no other exotic species were identified in Maiden Lake during the August 2009 survey.

Conclusions and Recommendations

Members of the Maiden Lake Association have done an excellent job at staying ahead of the Eurasian watermilfoil threat to the lake. The plant was identified early, and was successfully treated. This survey found only a small amount remaining in a recently treated area, and a single plant in a new area which was hand-pulled at the time of the survey. With exotic plant species present in nearby lakes, re-infestation of Eurasian watermilfoil could take place and should be anticipated. That is why it is important to continue monitoring for years to come.

At least one formal exotic species mapping survey should be conducted each year, preferably in fall at the end of the aquatic plant growing season. Lake volunteers should also be on the lookout for Eurasian watermilfoil and other exotic plants throughout the season. Along with annual monitoring, a full point-intercept survey, like the one completed in August, should be performed at least every five years. This survey will provide baseline data on the lake's aquatic plant community so that future changes can be accurately assessed. It will also provide data on aquatic plants in areas that are too deep to be observed from a boat.

Fragmentation is the primary mode of spread for Eurasian watermilfoil, and lake users should remove any floating fragments as well as hand-pull individual plants whenever possible. Because of the small amount of Eurasian watermilfoil growing in Maiden Lake, these efforts should not be too labor-intensive for the time being. Locations of hand-pulled plants should be recorded so that they can be inspected during a fall survey. For hand-pulling to be successful care must be taken to remove the entire root mass, along with the plant, or else it will quickly regenerate. If Eurasian watermilfoil is too abundant or too deep to hand-pull, it should again be treated with Navigate[®]. Herbicide

treatments should be conducted in spring or fall when water temperatures are cooler and Eurasian watermilfoil is most actively growing.

Education and prevention will be the most important means of protecting Maiden Lake. Education of lake users about the threats of exotic invasive species and methods for preventing their introduction should continue to be a priority for the Association. Lake volunteers should be encouraged to continue with the *Clean Boats – Clean Waters* program as well. Along with the public boat landing, attention should also be focused on the private boat landing in the northeast corner of the lake where the single Eurasian watermilfoil plant was found, as this could be another point of re-introduction.

Budgets

When considering a budget for the 2010 season, Association members should expect a similar amount to the 2009 budget, minus the full point-intercept survey. At least one visual boat survey (two surveys are recommended) and one treatment should be expected for the 2010 season. The cost to treat two acres would be approximately \$1,850. In addition, the cost of each survey including report preparation would be \$750.

Works Cited

Nichols, S. (1999). Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications. *Journal of Lake and Reservoir Management*, 15 (2), 133-141.

Appendix A

Raw data for the aquatic plant survey, Maiden Lake, August 4-5, 2009.

sampling point	Depth (ft)	comments	<i>Chara</i> ,Muskgrasses	<i>Elodea canadensis</i> ,Common waterweed	<i>Myriophyllum sibiricum</i> ,Northern water milfoil	<i>Myriophyllum spicatum</i> ,Eurasian water-milfoil	<i>Najas flexilis</i> ,Bushy pondweed	<i>Nitella</i> sp.,Nitella	<i>Nuphar variegata</i> ,Spatterdock	<i>Nymphaea odorata</i> ,White water lily	<i>Polygonum amphibium</i> ,Water smartweed	<i>Potamogeton amplifolius</i> ,Large-leaf pondweed	<i>Potamogeton gramineus</i> ,Variable pondweed	<i>Potamogeton natans</i> ,Floating-leaf pondweed	<i>Potamogeton pusillus</i> ,Small pondweed	<i>Potamogeton zosteriformis</i> ,Flat-stem pondweed	<i>Schoenoplectus acutus</i> ,Hardstem bulrush
526	23.7		2														
527	21.1		3														
528	18.6		2														
529	18.9		1														
530	17.5		1														
531	14		1														
532	9.2		1														
533	13.1		1														
534	19.5		1														
535	25.7	No Plants															
536	27.8							1									
537	24.5		3														
538	18.2		1														
539	15.4		1														
540	13.3		1														
541	13.4		1														
542	8		1										1				
543	11.9																
544	4.5	No Plants															
545	15.1																
546	26																
547	27.8	No Plants															
548	20.9		2														
549	8.7		1														
550	8.2		1														
551	9.5		1														
552	7.6																
553	11		1		1												
554	13.5		1														
555	13.8		1														
556	22.2	No Plants															
557	27.9	No Plants															
558	24		1						1								
559	10.5		1														
560	5.6		1										1				

