INTRODUCTION

Lake Mohawksin is an approximate 1,910-acre flowage on the Wisconsin River system. The lake has an average depth of 9 feet and a maximum depth of approximately 25 feet. The water levels are controlled by a dam operated by the Wisconsin Public Service.

In 2001 the presence of Eurasian water milfoil (EWM) was verified by the Wisconsin Department of Natural Resources (WDNR). In the early summer of 2006, Eurasian water milfoil was believed to cover approximately 10-15 surface acres within the confines of the flowage. Surveys completed during August and September 2006 proved that the original estimate was drastically low and in fact, nearly 103 acres of the lake was discovered to have EWM colonies exhibiting aerial coverages of 50% or greater. Furthermore, many other areas of the lake contained scattered levels of the exotic plant. A more elaborate explanation of these findings were provided to the Friends of Lake Mohawksin (FOLM) in *Preliminary Eurasian Water Milfoil Assessment Results* (September 2006).

Although lake stakeholders understand that eradication of EWM from Lake Mohawksin is impossible they would like to start treating the densest colonies and the colonies that occur in high traffic areas in the hope of reducing sources of spread and impacts to open water access by riparian landowners. Because this is the first treatment to be completed on Lake Mohawksin, FOLM, the group financing the treatments, thought it was of utmost importance to keep the Lake Mohawksin stakeholders informed concerning the project and provide concrete evidence that the treatments performed as intended. In addition to a qualitative and quantitative assessment of the treatment areas, FOLM also monitored dissolved oxygen concentrations within the treatment areas to ensure localized anoxia was not an unwanted affect associated with treating the extremely dense areas of EWM.

A preliminary treatment area of approximately 7.1 acres (Map 1), consisting of a few dense areas of EWM within heavy traffic corridors, was used to obtain a conditional chemical application permit from the WDNR. During May, these areas were surveyed and modified slightly to avoid navigational hazards such as stumps and shallow bars (Map 1). The necessary data was supplied to the applicator, Schmidt's Aquatic Plant Control (SAPC), and an application of Navigate® (2,4-D) was completed on May 16, 2007 at 100 lbs/acre. At the time of the treatment, Cliff Schmidt (SAPC) met with A.J. Theiler, founder of FOLM, and coordinated the adjustment of a section of the navigation lane (Site A) to a position more familiar amongst riparians (Map 2). Due to this adjustment, the total treated acreage was slightly increased to 7.4 acres. The winds were light (0-5 mph) and the water temperature was 14.4°C (58°F). To aid in our understanding of the treatment, the applicator provided the approximate application path which is generated by his onboard Global Positioning System (GPS) (Map 2).

TREATMENT MONITORING

Determining the success or failure of chemical treatments on EWM is often a difficult task because the criteria used in determining success or failure is ambiguous. Most people involved with EWM management, whether professionals or laypersons, understand that the eradication of EWM from a lake, or even a specific area of a lake, is nearly, if not totally, impossible. Most understand that achieving control is the best criteria for success. During the surveys reported on here, two different methods of evaluation were used to understand the level of control that was



achieved by the chemical treatment. A qualitative assessment was determined for each treatment site by comparing detailed notes of pre- and post treatment observations and spatial data were collected with the a sub-meter GPS data collector. A quantitative assessment of the treatment was also made by collecting data at 44 point-intercept sample locations on Lake Mohawksin (Appendix A). At these locations, EWM presence and rake fullness was documented as well as water depth and substrate type. Native plant abundances were also determined at each plot during the pre- and post treatment surveys; however, these data are only discussed lightly here because comparisons between early spring samples and summer samples are not fully valid due to the lifecycles of these species. The monitoring of dissolved oxygen levels within the treatment areas is explained separately.

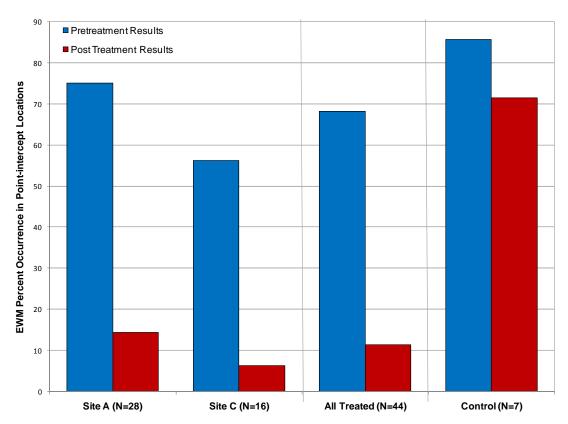


Figure 1. EWM percent occurrence in point-intercept locations displayed based on treatment site. Please note the vertical axis maximum value is 90%.

Pretreatment Survey – May 1 & 2, 2007

The purpose of this survey was to verify the locations of the treatment areas used in the conditional permit. The weather conditions were sunny and windy but had almost no affect on the ability to locate the dense EWM in these isolated areas of Lake Mohawksin. EWM was already at the surface in almost all areas where the treatment was to take place.

Site A Extremely dense EWM was observed in all areas of this treatment site. Two modifications were made to the proposed navigation lane: (1) the western-most lane was adjusted to avoid several submerged stumps and (2) the east-west orientated, shoreward lane was moved to avoid a shallow bar (Map 1). As stated above, an adjustment of the eastern navigation

lane (Map 2) was made based on the coordination of A.J. Theiler and Cliff Schmidt. Of the 28 point-intercept locations within this treatment site, 21 (75%) contained EWM (Figure 1).

Site C Slightly less EWM was observed in this site compared with Site A. EWM was actually growing denser outside of this treatment area within the extents of the floating-leaf species community that had not yet emerged (Map 2). Nine of the 16 (56.3%) sub-sample locations contained EWM.

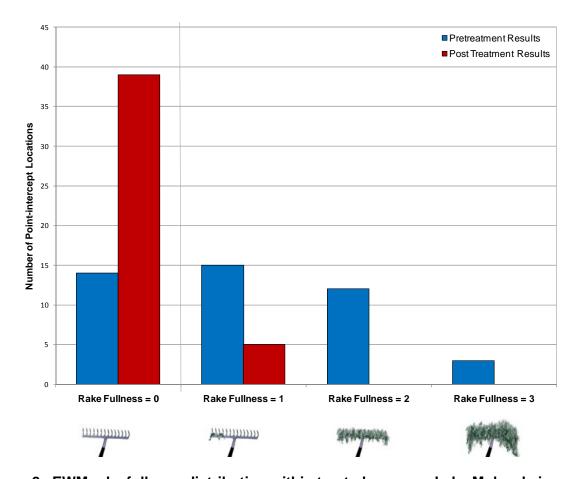


Figure 2. EWM rake fullness distribution within treated areas on Lake Mohawksin.

Post Treatment Survey – July 27, 2007

During this survey, all treatment areas were visited to determine the efficacy of the chemical application. The conditions were sunny and windy with EWM growth matted at the surface. All point-intercept sample locations were re-visited and data were collected in the same manner as during the pretreatment survey.

Site A-07 Considering the entire bay, the EWM appeared slightly less dense than in July 2006. However, it was still matted at the surface ceasing all forms of navigation in these areas. It is interesting to note that within the confines of the 40-foot treatment lane, almost no EWM was observed, but within roughly 10 feet on either side of this lane, there was a continuum of EWM density which increased as the distance from the treatment area got larger. In other words, EWM was affected, but not killed, within a small distance from the treatment area. Only 4 of the 28

(11.4%) point-intercept locations contained EWM after the treatment (Figure 1). Many native species were observed within this treatment area including Vasey's pondweed, a species of special concern. Actually, amounts of native plants, especially coontail, within the treatment lane made navigation a challenge. However, it was significantly easier to boat through than the surrounding mat of EWM.

Site C-07 Almost no EWM was observed within this treatment area. Presumably due to the high boat traffic that this area endures, native plants were not causing the navigational difficulties observed in Site A. Only 1 of the 16 (6.3%) point-intercept locations contained EWM after the treatment (Figure 1).

Dissolved Oxygen Monitoring

All of the proposed treatment areas contained very dense infestations of EWM and as a result, it is plausible that the chemical treatments could lead to localized anoxia as treated plants decay. All treatment areas were relatively small, so the risk of large scale anoxia leading to a fishkill was very small. However, by understanding the affects of the small-scale treatment on dissolved oxygen levels, considerations for future management of this and other waterbodies can be made.

Using a dissolved oxygen probe (Hach® Model HQ30d), readings were collected at 4 locations throughout the treatment areas including 1 control site (Map 2). Monitoring started 5 days prior to treatment and occurred each day leading to treatment, the day of treatment, 1, 2, 3, and 5 days following the treatment and then continued every 5 days until 30 days post treatment (12 samples).

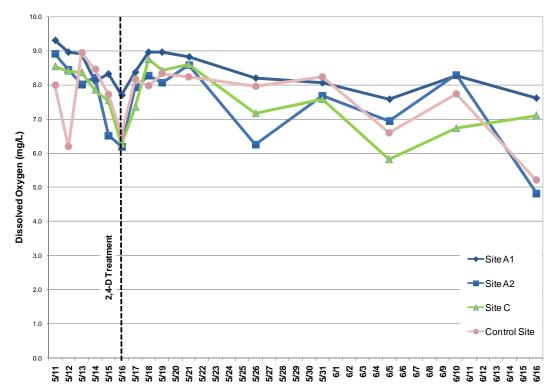


Figure 3. Dissolved oxygen levels observed within 4 sites in Lake Mohawksin.

CONCLUSIONS AND RECOMMENDATIONS

Differing from many herbicide treatments of EWM, the goal of this treatment was not to eliminate or reduce a colony's density, but to provide relief in a few high traffic areas of Lake Mohawksin. With much uncertainty related to the efficacy of 2,4-D treatments on area lakes, the fledgling lake association also wanted evidence that the treatments were going to be successful before large-scale treatments were considered.

Before the treatment on Lake Mohawksin, 68.2% of the point-intercept locations contained EWM and 11.4% contained EWM after the treatment (Figure 1). A rake fullness rating of 1-3 was used to determine abundance of the EWM at each location. Figure 2 displays the number of point-intercept locations exhibiting each of the rake fullness ratings within the areas treated on Lake Mohawksin. Of the 5 point-intercept locations that contained EWM after the treatment (Figure 1), they all exhibited a rake fullness rating of 1 (Figure 2).

Because of the alteration of the treatment lane (Map 2, Site A) after the pretreatment point-intercept sub-sampling monitoring data had been collected, these locations served as an unintentional *control group*. By collecting data at these same locations after the treatment, this allowed predictions to be made about untreated EWM. Of these 7 locations, 6 contained EWM before the treatment and 5 contained EWM after the treatment (Figure 1) showing that there was a negligible difference in occurrence of EWM within the control site. There was also a small increase in the average rake fullness when comparing the pretreatment survey data o the post treatment survey data, which is to be expected as plants increase their biomass as the growing season progresses.

Table 1. Percent occurrence of native dicots from the point-intercept survey.

	% Oc	currence
Species	Pretreatment Results	Post Treatment Results
Coontail	31.0	40.5
Watershield	4.8	9.5
Water marigold	0.0	4.8
White water lily	0.0	4.8
Spatterdock	0.0	2.4
Northern water milfoil	0.0	2.4
Common bladderwort	0.0	2.4

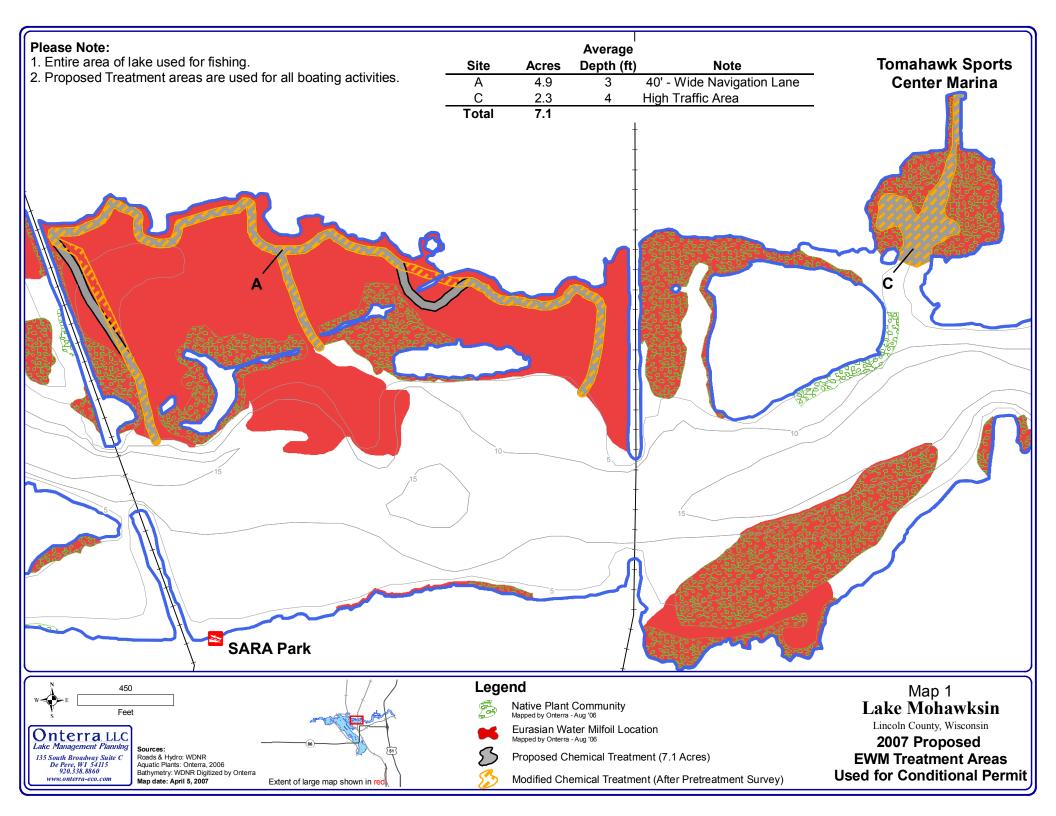
Conclusions made from comparing quantitative pretreatment survey data to post treatment survey data need to be understood in the context that the plants are at different phases of their lifecycle during each of the surveys. Most native plants should be at very low biomass (or not even started growing yet) during the spring survey and at their peak growth during the August survey. However, it is important to understand the effects of the dicot-specific herbicide on some of the broad-leaved natives. Table 1 show that there was an increase in occurrence of all broad-leaved natives within the treatment area. Elodea, a monocot, did decrease slightly in percent occurrence from 57% before the treatment to 43% after the treatment. It is unclear what caused this reduction since the herbicide does not cause mortality to monocot plants. Because this plant is not rooted and is largely influenced by water movement, the observed reduction is

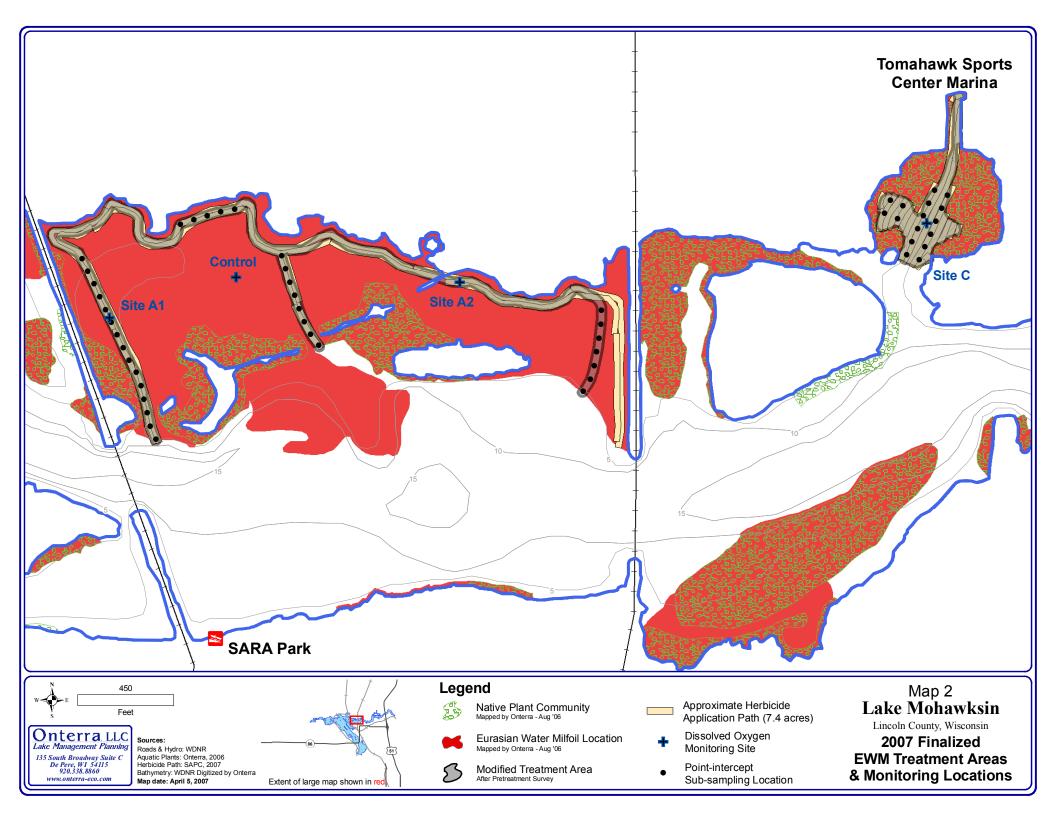
not of a concern, especially in light of its highly common status in this and many regional waterbodies.

The data displayed in Figure 3 clearly show that dissolved oxygen levels did not reach anoxia. There was a reduction in dissolved oxygen levels on the date of the treatment and it remains unknown if this was a result of natural variations or if it can be attributed to the herbicide application. 2,4-D is biodegraded and it is possible that microbial activity could lead to minor changes in dissolved oxygen within a treatment site. However, the control site's readings mimicked the levels found within the treatment sites, causing doubt on the hypothesis that the herbicide application caused this reduction. Perhaps since the control site was only 51 meters (170 feet) away from the navigation lane, a wider range of the herbicide's influence on dissolved oxygen may have been detected. It is important to note the following three points: (1) there was a trend of decreasing dissolved oxygen levels even before the date of application in all monitoring locations; (2) the degree of change (approximately 1 mg/L) is quite small and the values remained above 6 mg/L (significantly greater than levels considered harmful to aquatic life); and (3) the day after the treatment, when one would expect to see the levels decrease if significant biodegradation was occurring, the levels rebounded to what was observed a few days before the treatment.

It is obvious that there was a significant reduction in the occurrence of EWM caused by the 2007 chemical treatments conducted on Lake Mohawksin. The factors that most likely contributed to the success of this treatment include EWM growing in shallow water within isolated bays where water movement had little effect on the dilution of the herbicide concentration. Reports from riparians, especially those near Site A (Map 1, 2) state that navigation was greatly improved compared to 2006 and the native plants that "filled in" after the treatment did not become problematic until late in the growing season. It is perceived that long-term reduction of EWM in these areas will not be observed and continual maintenance of these lanes will be needed on an annual or semi-annual basis to achieve continual control. If FOLM decides to target larger colonies of EWM on Lake Mohawksin, attention will need to be paid to factors that influence chemical concentrations, such as water depth and vulnerability to dilution, if similar successes are to be achieved.







				Sand, R=Rock)										
Number	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Myriophyllum spicatum	Elodea canadensis	Ceratophyllum demersum	Potamogeton robbinsii	Potamogeton amplifolius	Potamogeton zosteriformis	Brasenia schreberi	Potamogeton natans	Note
1	-89.744668	45.477217	9	-	Р						ļ			
2	-89.744767	45.477383	2	S	Р		1							
3	-89.744816	45.477560	2	s	Р	1								
4	-89.744877	45.477735	2	s	Р									
5	-89.744935	45.477910	3	S	Р				2					
6	-89.745021	45.478080	3	М	Р	1	1		1		1			
7	-89.745152	45.478234	3	М	Р		2	1	1	1				
8	-89.745257	45.478398	3	М	Р	1	1	1						
9	-89.745365	45.478562	5	М	Р	1	1							
10	-89.745469	45.478726	5	М	Р	3	1							
11	-89.745580	45.478888	4	М	Р	1	1	1						
12	-89.745681	45.479054	4	М	Р	3	1				1			
13	-89.745789	45.479217	5	М	Р	2	1				1			
14	-89.745901	45.479379	5	М	Р	2	1	1	1	1			1	
15	-89.746005	45.479543	5	М	Р	2	1	1		1	1			
16	-89.744199	45.479983	2	s	Р	1			1			1		
17	-89.743955	45.480037	2	М	Р	2	1	1						
18	-89.743712	45.480093	4	М	Р		1	1	1			<u> </u>		
19	-89.743465	45.480140	3	М	Р		2		1		1			
20	-89.743213	45.480170	2	М	Р	1		1	2			1		
21	-89.736853	45.477818	6	М	Р									Not Treated
22	-89.736720	45.477972	4	М	Р	1	1							Not Treated
23	-89.736651	45.478145	3	М	Р	1	1							Not Treated
24	-89.736602	45.478322	2	М	Р	1	1		<u> </u>					Not Treated
25	-89.736565	45.478500	2	М	Р	1			ò		ò	1		Not Treated
26	-89.736527	45.478678	3	М	Р	2	1			1				Not Treated
27	-89.736517	45.478858	3	М	Р	1		3			1	1		Not Treated
28	-89.730421	45.480389	4	М	Р									
29	-89.730523	45.480224	4	М	Р	2								
30	-89.730626	45.480059	5	М	Р	1								

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Number	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Myriophyllum spicatum	Elodea canadensis	Ceratophyllum demersum	Potamogeton robbinsii	Potamogeton amplifolius	Potamogeton zosteriformis	Brasenia schreberi	Potamogeton natans	Note
31	-89.730729	45.479894	6	М	Р	1								
32	-89.730832	45.479729	5	М	Р									
33	-89.730935	45.479565	4	М	Р					ļ				
34	-89.730186	45.480317	4	М	Р	1								
35	-89.730289	45.480152	5	М	Р	2				1				
36	-89.730392	45.479987	6	М	Р					1				
37	-89.730495	45.479822	5	М	Р		1							
38	-89.730597	45.479657	5	М	Р									
39	-89.730700	45.479492	4	R	Р									
40	-89.731231	45.480261	4	М	Р	1	1							
41	-89.731334	45.480097	4	М	Р	2	1							
42	-89.730996	45.480189	4	М	Р	1								
43	-89.731099	45.480024	4	М	Р	1	1							
44	-89.741681	45.478418	5	М	Р	1		1						
45	-89.741834	45.478562	3	М	Р	1		1						
46	-89.741948	45.478724	3	М	Р	2	1	1						
47	-89.742043	45.478891	2	М	Р	2	1	1						
48	-89.742121	45.479062	3	М	Р	2	1							
49	-89.742209	45.479231	3	М	Р	2	1							
50	-89.742286	45.479403	4	М	Р	3	1							
51	-89.742354	45.479576	4	М	Р	2	2	1						

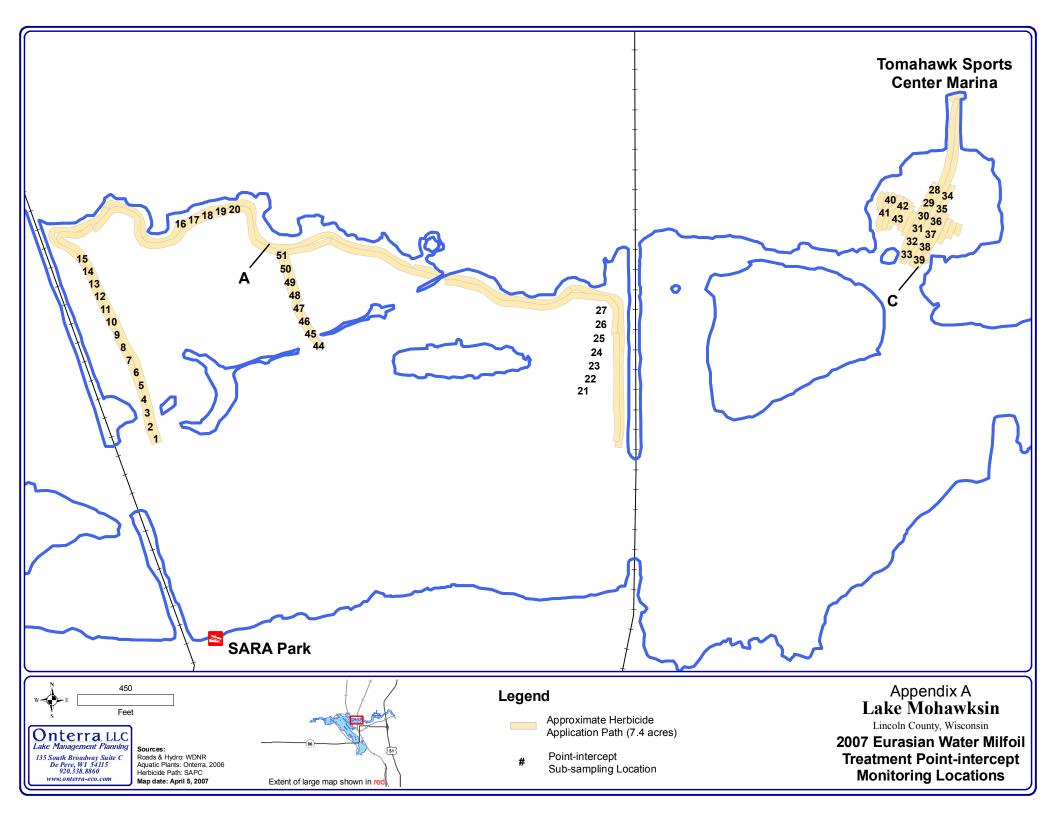
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1	-89.744668	45.477217	9	М	Р																				
2	-89.744767	45.477383	3	М	P				1													1			
3	-89.744816	45.477560	3	М	Р				1	1															
4	-89.744877	45.477735	2	М	Р		1		1																
5	-89.744935	45.477910	3	М	P		2	1																	
6	-89.745021	45.478080	3	M	P		1	_	1												1		1		
7	-89.745152	45.478234	3	М	P			2	1						1					1					
8	-89.745257	45.478398	5	M	Р		1	1					1												
9	-89.745365	45.478562	5	M	Р		1	1		_	4														
10	-89.745469	45.478726	5	M	P P		4	1		1	1			4											
11	-89.745580 -89.745681	45.478888 45.479054	4	M	P		1	3		1				1											
13	-89.745789	45.479217	4	M	Р		1	3		1								1							
14	-89.745901	45.479379	5	M	Р		1			1								'							
15	-89.746005	45.479543	5	M	P		1	1		'			1	1				1							
16	-89.744199	45.479983	2	M	P		1		1		1	1						•							
17	-89.743955	45.480037	2	М	Р		1	1	-		2	-													
18	-89.743712	45.480093	4	М	Р		2				1														
19	-89.743465	45.480140	3	М	Р						2	1					1								
20	-89.743213	45.480170	2	М	Р		2				2														
21	-89.736853	45.477818		М	Р																				Not Treated
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23	-89.736651	45.478145	3	М	Р	2			1																Not Treated
24	-89.736602	45.478322	2	М	Р	1	1		1																Not Treated
25	-89.736565	45.478500	2	М	Р	1	1		1			1				1									Not Treated
26	-89.736527	45.478678	2	М	Р	2				1				1											Not Treated
27	-89.736517	45.478858	2	М	Р			1						1											Not Treated
28	-89.730421	45.480389	4	М	Р																				
29	-89.730523	45.480224	4	М	Р																				
30	-89.730626	45.480059	5	М	Р					1															
31	-89.730729	45.479894	6	М	Р																				
32	-89.730832	45.479729	5	М	Р																				

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Post	Treatment Point-I	ntercept Survey	/																						Appendix A
Number	Longitude (Decimal Degrees)	Latitude (Decimal Degrees)	Depth (ft)	Sediment type (M=muck, S=Sand, R=Rock)	Rope (R); Pole (P); Visual (V)	Myriophyllum spicatum	Elodea canadensis	Ceratophyllum demersum	Vallisneria americana	Potamogeton amplifolius	Potamogeton robbinsii	Brasenia schreberi	Potamogeton foliosus	Potamogeton zosteriformis	Megalodonta beckii	Nuphar variegata	Nymphaea odorata	Potamogeton praelongus	Potamogeton richardsonii	Myriophyllum sibiricum	Nitella sp.	Potamogeton epihydrus	Potamogeton pusillus	Utricularia vulgaris	Note
33	-89.730935	45.479565	4	М	Р			1																1	
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37	-89.730495	45.479822	5	М	Р																				
38	-89.730597	45.479657	5	М	Р																				
39	-89.730700	45.479492	4	R	Р																				
40	-89.731231	45.480261	4	М	Р	1	1									1									
41	-89.731334	45.480097	4	М	Р		1	1					1												
42	-89.730996	45.480189	4	М	Р			1																	
43	-89.731099	45.480024	4	М	Р		1	1		1			1												
44	-89.741681	45.478418	5	М	Р			2				1													
45	-89.741834	45.478562	3	М	Р	1		2																	
46	-89.741948	45.478724	3	М	Р	1		2	1																
47	-89.742043	45.478891	2	М	Р			1	1	1	2														
48	-89.742121	45.479062	3	М	Р	1				2	1						1								
49	-89.742209	45.479231	3	М	Р				1		1	1			1				1						
50	-89.742286	45.479403	3	М	Р	1	1		1		1								1						
51	-89.742354	45.479576	4	М	Р		1	2																	

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			Conti	ol Sit	е		Site	e A1			Sit	te C		Site A2					
		Latit	ude		28'45.48	Latit	ude	N 45 28		Latit	ude		8'47.86	Latit	ude	N 45 28	3'45.19		
		Longi	tude	W 89	44 35.49	Long	tude	W 89 4	4 43.82	Longi	tude	W 89 4	3'50.01	Longi	tude	W 89 44 20.78			
Date		Time	DO	Т	%	Time	DO	Т	%	Time	DO	T	%	Time	DO	Temp	%		
5/11	-5	3:47	7.98	63.6	88.0	3:52	9.31	65.6	104.8	3:29	8.54	64	94.4	3:36	8.91	65.7	100.5		
5/12	-4	10:19	6.18	62.0	66.5	10:25	8.97	62.7	97.4	9:53	8.39	62.6	90.9	10:06	8.44	59.1	87.8		
5/13	-3	2:15	8.94	59.5	93.7	2:19	8.92	60.7	94.9	2:31	8.37	59.9	88.2	2:42	8.02	59.0	83.6		
5/14	-2	12:10	8.44	61.2	91.7	12:17	8.11	63.1	90.0	12:32	7.84	63.7	87.7	12:46	8.21	62.3	90.3		
5/15	-1	2:58	7.71	64.7	86.8	3:03	8.32	62.9	91.7	3:14	7.53	62.4	82.5	3:25	6.52	63.8	72.5		
5/16	0	10:39	6.54	58.3	67.9	10:46	7.7	58.9	80.5	11:00	6.25	58.7	65.3	11:13	6.19	58.7	64.7		
5/17	1	12:04	8.15	59.3	84.8	12:09	8.38	59.3	87.2	12:21	7.34	59.9	77	12:34	7.93	61.8	85.1		
5/18	2	12:04	7.96	60.6	84.7	12:11	8.97	59.8	94.5	12:23	8.75	62.2	94.9	12:34	8.27	61.8	89.2		
5/19	3	9:09	8.32	62.1	90.7	9:16	8.97	60.6	96.1	9:27	8.42	62.7	92.3	9:36	8.06	62.9	88.7		
5/21	5	4:24	8.23	62.1	89.6	4:33	8.82	61.6	95.3	4:49	8.59	63	94.5	5:00	8.58	64.8	96.3		
5/26	10	8:20	7.95	63.4	87.4	8:29	8.21	63.2	90.1	8:42	7.16	63.1	78.5	9:13	6.25	63.5	68.9		
5/31	15	2:50	8.23	71.2	99.2	2:59	8.06	69.9	95.9	3:13	7.57	69.7	89.8	3:29	7.69	73.6	95.2		
6/5	20	3:27	6.59	65.3	74.8	3:36	7.58	66.1	86.9	3:52	5.82	64.9	65.9	4:06	6.94	81.6	81.6		
6/10	25	3:07	7.73	69.4	91.2	11:24	8.27	69.3	97.4	11:38	6.73	69.1	79.2	11:57	8.3	70.6	99.2		
6/16	31	10:19	5.2	77.7	67.1	10:29	7.62	76.8	97.4	10:51	7.1	75.1	89.1	11:00	4.83	77.4	62.2		

Notes:

- 1 All readings taken with Hach Meter Model HQ30d
- 2 Time shown is AM for values 7:00 to 11:59 and PM for values 0:00 to 6:59
- 3 All readings taken at depth of 3 feet except for Bliss Street where the reading depth was 2 feet (24 inches) and the water depth is 2.5 feet (30 inches)
- 4 Prepared by A.J. Theiler, (715) 453-0010, ajtheiler@charter.net
- 5 Data collected and documented under WDNR Aquatic Invasive Species Grant AEPP-087-07, Project activities number 6) DO monitoring in treatment areas.

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