Curlyleaf Pondweed Growth on April 20, 2016 on Prior Lake

Curlyleaf Pondweed Delineation and Assessment Surveys for Upper and Lower Prior Lake, Scott County, 2016

Curlyleaf Pondweed Delineation: April 20, 2016
Herbicide Treatment: May 2, 2016 (15.8 ac, 88.47 gallons)
Curlyleaf Pondweed Assessment Date: June 1, 2016

Prepared for:
Prior Lake/Spring Lake Watershed District
Prior Lake, Minnesota

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April 2017

Curlyleaf Pondweed Delineation and Assessment Surveys for Upper and Lower Prior Lake, Scott County, 2016

Summary

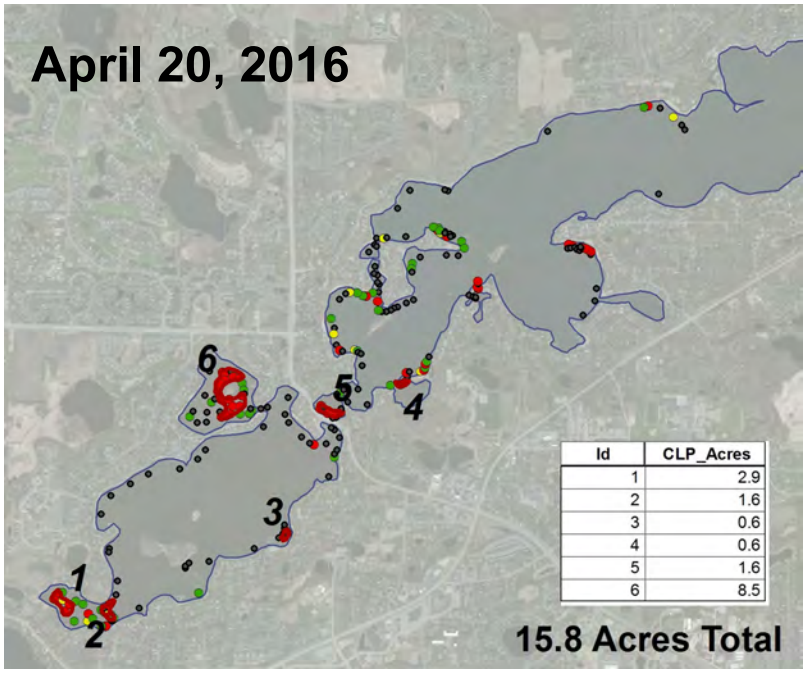
Curlyleaf pondweed (CLP) distribution and abundance were delineated on April 20, 2016. Based on the curlyleaf pondweed densities on both Upper and Lower Prior, several areas were delineated as having the potential for heavy curlyleaf growth by June (Figure S1).

Curlyleaf density was mostly light in April but there was the potential for heavy curlyleaf growth in some areas and 15.8 acres were delineated for a herbicide treatment.

The curlyleaf pondweed treatment was conducted on May 2, 2016 and a total of 15.8 acres were treated including 13.6 acres in Upper Prior and 2.2 acres in Lower Prior (Figure S3). PLM conducted the treatment.

A follow-up curlyleaf assessment was conducted on June 1, 2016. The June 1 curlyleaf assessment found, in the treated areas, the distribution and abundance of CLP was mostly controlled (Figure S4).

Figure S1. Curlyleaf pondweed was sampled in Prior Lake on April 20, 2016. Here curlyleaf pondweed growth was light but with 8 stems on the rake it had significant potential for heavy growth in June. This site was marked for treatment.



Id	CLP_Acres
1	2.9
2	1.6
3	0.6
4	0.6
5	1.6
6	8.5

Figure S2. DELINEATION: Map of curlyleaf pondweed delineation sites for April 20, 2016 totaling about 15.8 acres. Key: Green dots = light growth, yellow dots = moderate growth, and red dots = heavy growth. Black outlined area = proposed CLP treatment areas. (Treatment acreages are shown below).

Figure S3. TREATMENT: Prior Lake curlyleaf pondweed treatment areas May 2, 2016. A total of 15.8 acres were treated using 88.47 gallons of Aquathol K.

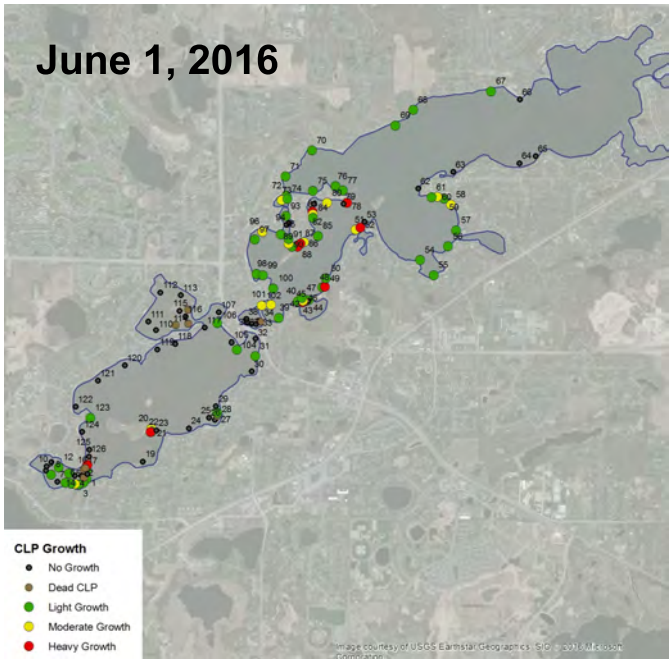


Figure S4. ASSESSMENT: Map of curlyleaf pondweed assessment sites for June 1, 2016. Colored sample areas indicate the treatment areas and the colored dots indicate the growth of curlyleaf pondweed in June, 2016. Key: Green = light growth, yellow = moderate growth and red = heavy growth. Black = no CLP.

Curlyleaf Planning for 2017: Treating heavy growth of curlyleaf pondweed based on early season curlyleaf distribution is a challenge. Curlyleaf in April and May has just started to go into a rapid growth phase. However, not all early season curlyleaf growth will result in heavy curlyleaf growth in late May and June. It appears there are factors that limit curlyleaf growth and significant variables are associated with sediment conditions. The question is how to best delineate areas to treat what could be heavy growth in June but not overtreat areas where growth wouldn't be a nuisance for the season.

Currently, for Upper and Lower Prior Lake, the method has been to use past CLP growth history combined with early season scouting. Then if curlyleaf growth has indications of producing potential heavy growth, those areas are delineated and treatment is considered. That is the approach to be considered for 2017.

Example of heavy growth of curlyleaf pondweed in Prior Lake on April 20, 2016.

Example of heavy growth of curlyleaf pondweed in Prior Lake on June 1, 2016.

Curlyleaf Pondweed Delineation and Assessment Surveys for Upper and Lower Prior Lake, Scott County, 2016

Introduction

Upper and Lower Prior Lakes combined have an area of 1,343 acres with a total littoral area of 732 acres (MnDNR). An initial curlyleaf pondweed delineation was conducted on April 20, 2016. Curlyleaf was treated on May 2, 2016 and a follow-up curlyleaf pondweed assessment was conducted on June 1, 2016 to characterize the status of curlyleaf pondweed at it's peak growing period. Sample sites in the delineation survey are shown in Figure 1. Sample sites were selected based on areas where curlyleaf had been found over the years. A chart showing examples of curlyleaf growth conditions at peak biomass in June are shown on the next page.

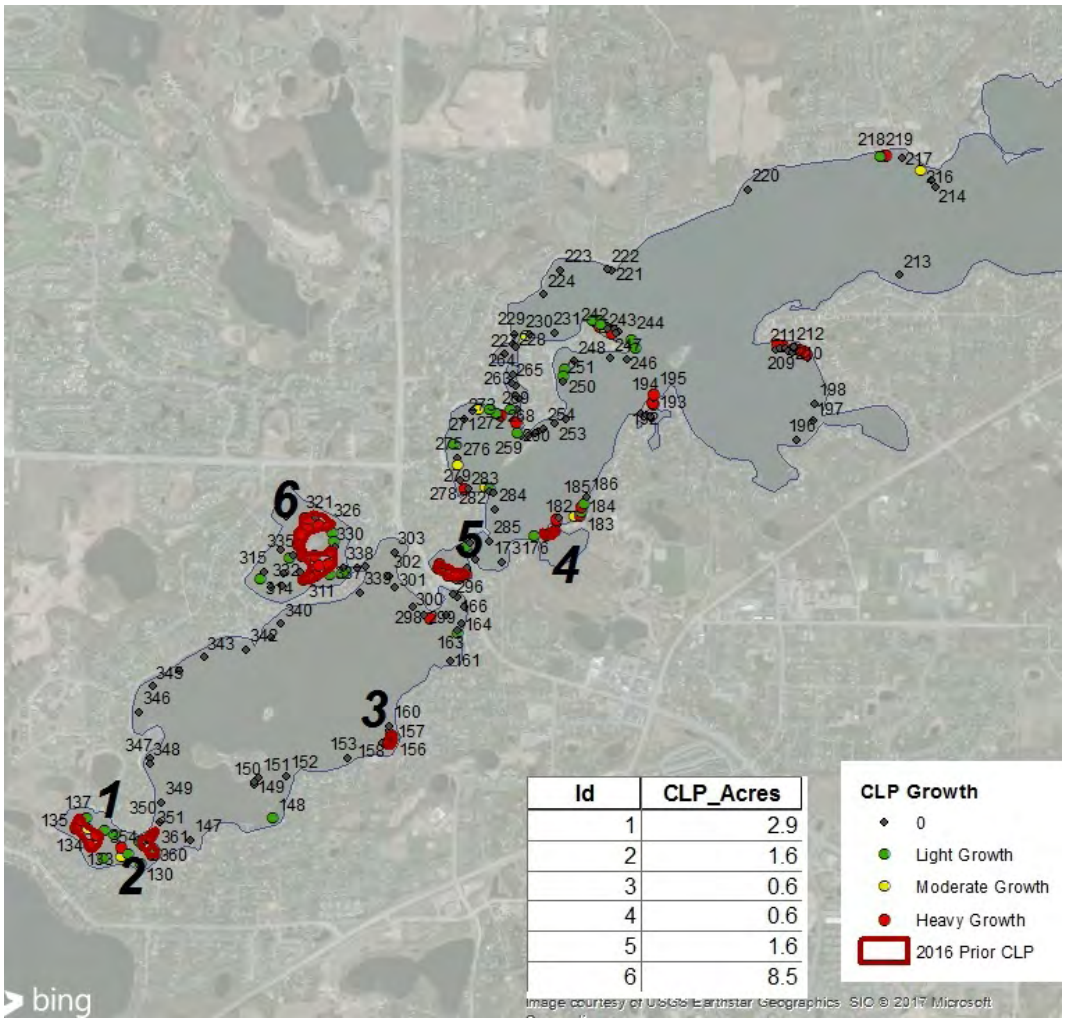
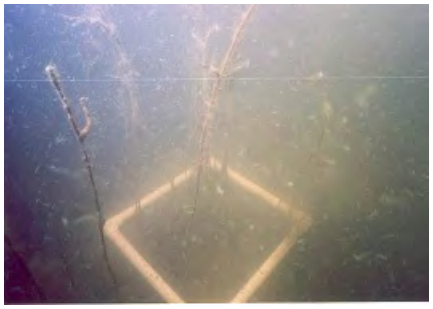


Figure 1. Sites of curlyleaf sampling for a delineation on April 20, 2016.

Methods: Curlyleaf pondweed densities in June are represented on a scale of 1 to 5 with 5 being densest.

Light Growth Conditions



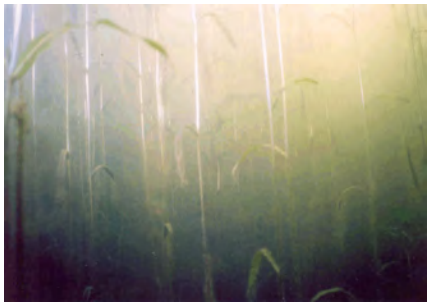
Plants rarely reach the surface.

Navigation and recreational activities are not generally hindered.

Stem density: 0 - 160 stems/m^2
Biomass: 0 - 50 g-dry wt/m^2
Estimated TP loading: <1.7 lbs/ac

MnDNR rake sample density equivalent for light growth conditions: 1, 2, or 3.

Moderate Growth Conditions



Broken surface canopy conditions.

Navigation and recreational activities may be hindered.

Lake users may opt for control.

Stem density: 100 - 280 stems/m^2
Biomass: 50 - 85 g-dry wt/m^2
Estimated TP loading: 2.2 - 3.8 lbs/ac

MnDNR rake sample density equivalent for moderate growth conditions: 2, 3 or sometimes, 4.

Heavy Growth Conditions

Solid or near solid surface canopy conditions.

Navigation and recreational activities are severely limited.

Control is necessary for navigation and/or recreation.

Stem density: 400+ stems/m^2
Biomass: >300 g-dry wt/m^2
Estimated TP loading: >6.7 lbs/ac

MnDNR rake sample density has a scale from 1 to 4. For certain growth conditions where plants top out at the surface, the scale has been extended: 4.5 is equivalent to a near solid surface canopy and a 5 is equivalent to a solid surface canopy. Heavy growth conditions have rake densities of a 4 (early to mid-season with the potential to reach the surface), 4.5, or 5.

Curlyleaf Pondweed Delineation on April 20, 2016 in Upper and Lower Prior Lake

A total of 233 sample sites around Upper and Lower Prior Lake were monitored with rake sampling on April 20, 2016. Curlyleaf was found at low to moderate densities at 106 out of 233 sample sites. A total of 15.8 acres of curlyleaf at 6 treatment areas were delineated as having the potential to develop moderate to heavy growth conditions by June (Table 1 and Figure 2).

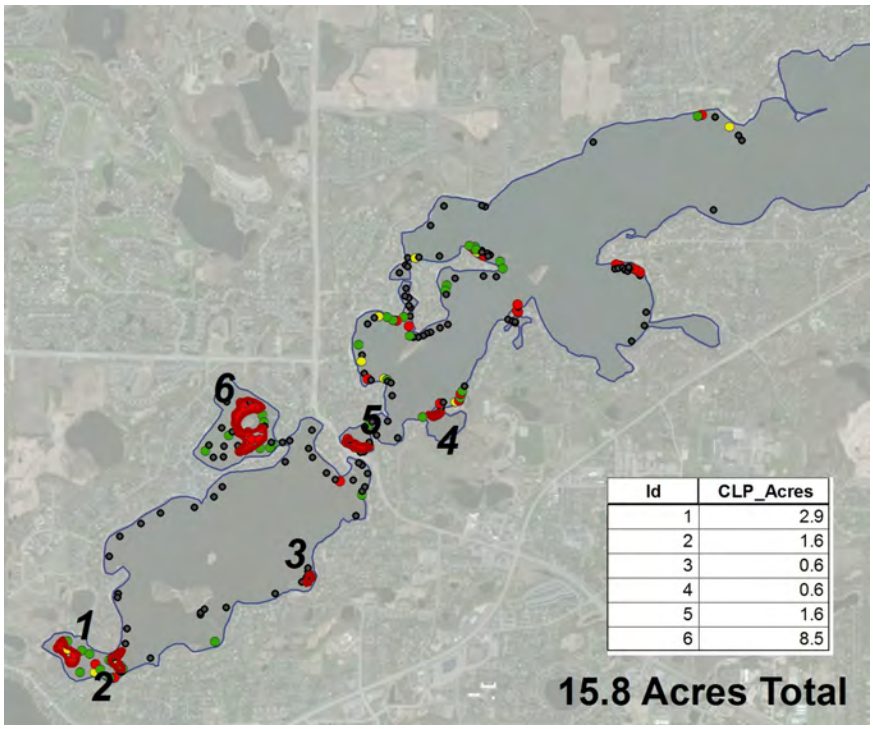


Figure 2. Curlyleaf delineation in Lower and Upper Prior Lake on April 20, 2016. Green circles = light density, yellow circles = moderate density, and red circles = heavy density. Black lines = proposed treatment areas. For Upper Prior: total CLP acres: 13.6 acres. For Lower Prior: total CLP acres: 2.2 acres.

Curlyleaf pondweed density on April 20, 2016 that was high enough to be treated.

Curlyleaf pondweed density on April 20, 2016 at another site that was high enough to be treated.

Table 1. Aquatic plant densities based on rake sampling for April 20, 2016. Curlyleaf stems per rake sample were noted. Areas with green shading have light growth, areas with yellow shading have moderate growth, and areas with red shading have heavy growth. Treatment was generally considered for a site when a site had 4 or more CLP stems.

Treatment Area	Site	Depth (ft)	CLP stems	Coontail
1	129	5	5	
	130	4	2	
	131	6	3	
	132	5	1	
	133	6	4	
	134	5	4	
	135	5	8	
	136	5	10	
	137	5	1	
	138	6	3	
	139	7	6	
	140	7	1	
	141	7	2	
	142	7	10	
	143	5	1	
	144	7	1	
	145	7	7	
	146	7	1	
	147	9	0	
	148	9	2	
	149	11	0	
	150	10	0	
	151	8	0	
	152	11	0	
	153	12	0	
	154	10	0	
3	155	8	8	
	156	7	1	
	157	9	10	
	158	10	0	
	159	9	0	
	160	10	0	
	161	10	0	
	162	8	2	
	163	11	0	
	164	12	0	
	165	11	0	
	166	12	0	
	167	10	0	
	168	9	4	
	169	8	0	
	170	8	0	
	171	9	2	
	172	12	0	
	173	13	0	
4	174	7	2	
	175	6	16	
	176	6	8	
	177	5	7	
	178	3	0	
	179	11	5	
	180	12	0	
	181	10	3	
	182	6	9	
	183	6	1	
	184	10	4	
	185	11	1	
	186	12	0	
	187	2	0	
	188	5	0	
	189	5	0	
	190	5	0	

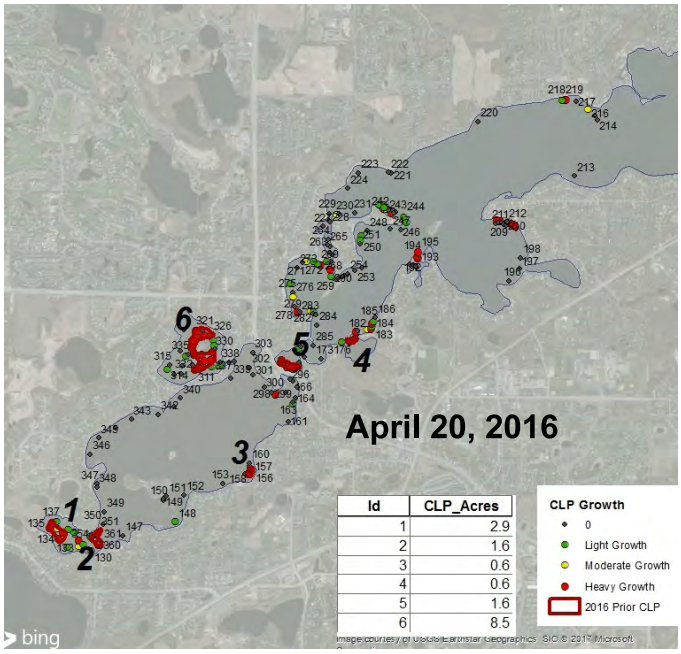


Table 1. Aquatic plant densities based on rake sampling for April 20, 2016. Curlyleaf stems per rake sample were noted. Areas with green shading have light growth, areas with yellow shading have moderate growth, and areas with red shading have heavy growth. Treatment was generally considered for a site when a site had 4 or more CLP stems.

Treatment Area	Site	Depth (ft)	CLP stems	Coontail
	191	6	0	
	192	5	8	
	193	5	9	
	194	9	0	
	195	13	6	
	196	14	0	
	197	14	0	
	198	14	0	
	199	11	0	
	200	8	6	
	201	8	6	
	202	8	5	
	203	10	4	
	204	11	10	
	205	9	15	
	206	13	0	
	207	14	0	
	208	13	0	
	209	16	0	
	210	16	0	
	211	12	0	
	212	10	0	
	213	13	0	
	214	9	0	
	215	9	0	
	216	9	3	
	217	14	0	
	218	10	4	
	219	11	1	
	220	18	0	
	221	7	0	
	222	7	0	
	223	22	0	
	224	22	0	
	225	5	0	
	226	8	0	
	227	8	0	
	228	8	0	
	229	8	3	
	230	11	0	
	231	16	0	
	232	9	2	
	233	9	10	
	234	10	3	
	235	11	4	
	236	13	0	
	237	15	0	
	238	15	0	
	239	12	1	
	240	10	2	
	241	11	1	
	242	14	0	
	243	13	0	
	244	6	2	
	245	5	1	
	246	13	0	
	247	16	0	
	248	11	0	1
	249	8	1	1
	250	10	1	
	251	13	0	
	252	14	0	

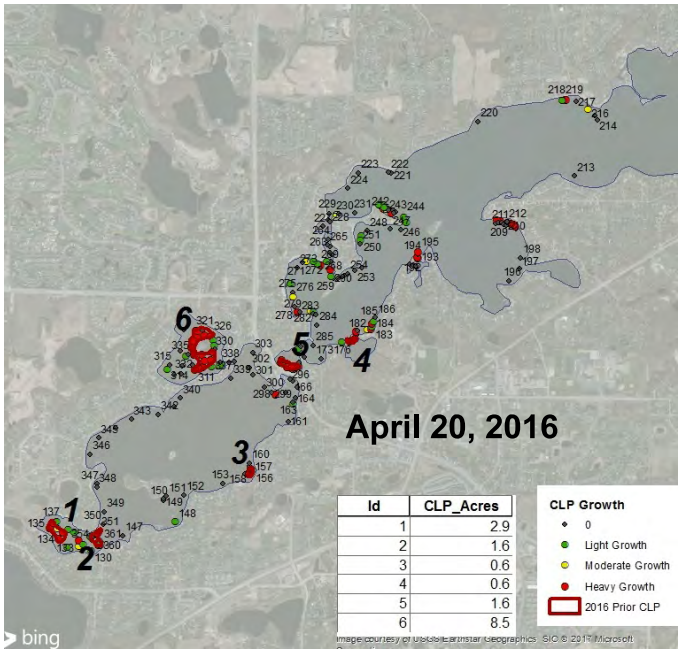


Table 1. Aquatic plant densities based on rake sampling for April 20, 2016. Curlyleaf stems per rake sample were noted. Areas with green shading have light growth, areas with yellow shading have moderate growth, and areas with red shading have heavy growth. Treatment was generally considered for a site when a site had 4 or more CLP stems.

Treatment Area	Site	Depth (ft)	CLP stems	Coontail
	253	16	0	
	254	12	0	
	255	8	0	
	256	6	0	
	257	4	0	
	258	6	0	
	259	8	1	
	260	11	7	
	261	11	0	
	262	9	0	
	263	7	0	
	264	8	0	
	265	8	0	
	266	8	0	
	267	8	2	
	268	12	4	
	269	12	1	
	270	12	2	
	271	13	3	1
	272	14	0	
	273	14	0	
	274	10	1	
	275	13	0	
	276	14	3	
	277	13	0	
	278	12	4	
	279	12	0	
	280	8	3	
	281	7	2	
	282	7	0	
	283	14	0	
	284	18	0	
	285	14	0	
	286	12	0	
	287	8	0	
5	288	11	9	
	289	10	8	
	290	11	0	
	291	12	0	1
	292	9	0	1
	293	8	9	1
	294	6	4	
	295	6	0	
	296	12	0	
	297	13	0	
	298	5	10	
	299	9	0	
	300	15	0	
	301	14	0	
	302	6	0	
	303	9	0	
	304	7	0	
	305	7	0	
6	306	6	1	
	307	6	2	
	308	6	1	
	309	6	7	
	310	6	8	
	311	6	10	
	312	6	0	
	313	6	0	
	314	6	2	

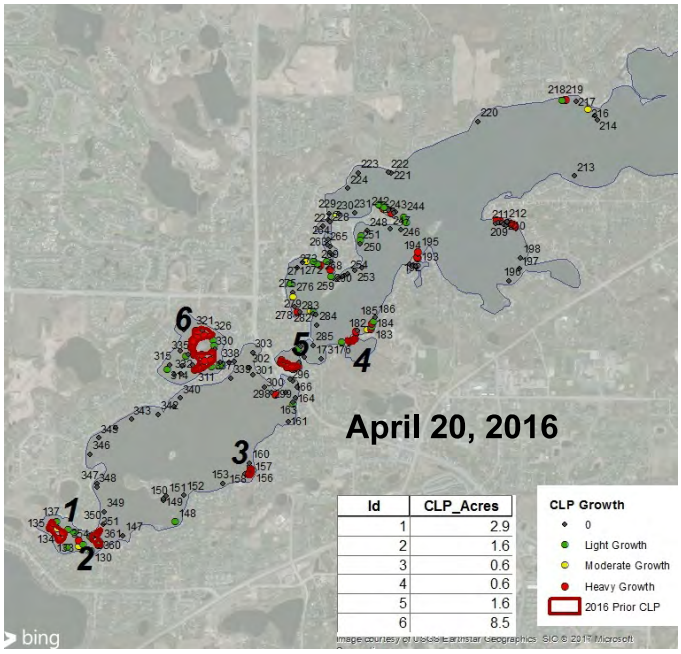
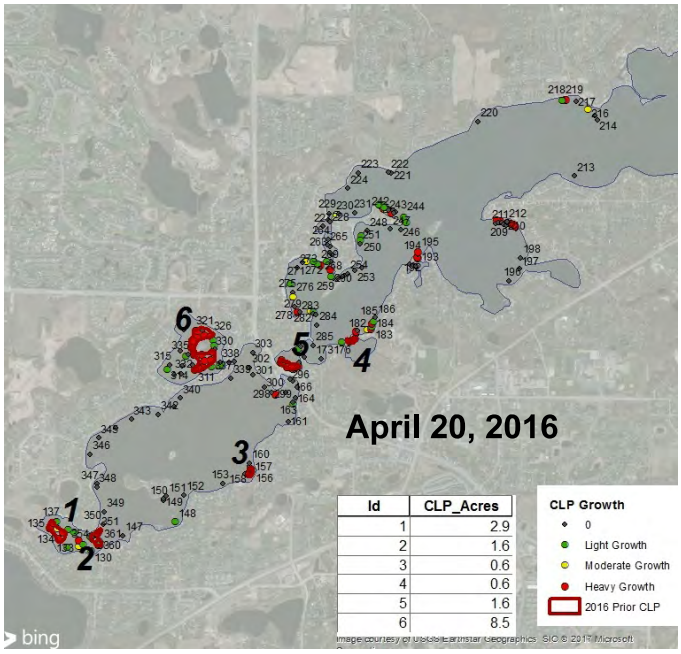


Table 1. Aquatic plant densities based on rake sampling for April 20, 2016. Curlyleaf stems per rake sample were noted. Areas with green shading have light growth, areas with yellow shading have moderate growth, and areas with red shading have heavy growth. Treatment was generally considered for a site when a site had 4 or more CLP stems.

Treatment Area	Site	Depth (ft)	CLP stems	Coontail
6	315	6	0	
	316	5	0	
	317	6	0	
	318	6	1	
	319	6	0	
	320	6	0	
	321	6	9	
	322	6	5	
	323	6	0	
	324	6	10	
	325	6	5	
	326	6	15	
	327	6	1	
	328	6	2	
	329	5	0	
	330	6	4	
	331	4	15	
	332	5	8	
	333	5	10	
	334	5	12	
	335	6	0	
	336	6	8	
	337	6	6	
	338	6	0	
	339	13	0	
	340	16	0	
	341	16	0	
	342	11	0	
	343	13	0	
	344	13	0	
	345	13	0	
	346	11	0	
	347	11	0	
	348	11	0	
	349	11	0	
2	350	8	0	
	351	7	6	
	352	7	10	
	353	7	1	
	354	7	1	
	355	7	0	
	356	7	3	
	357	6	6	
	358	6	4	
	359	6	0	
	360	7	0	
	361	7	2	
Average			3.5	1.0
Occurrence (233 sites)			106	6
% occur			45	3



Curlyleaf Pondweed Treatment Areas on May 2, 2016

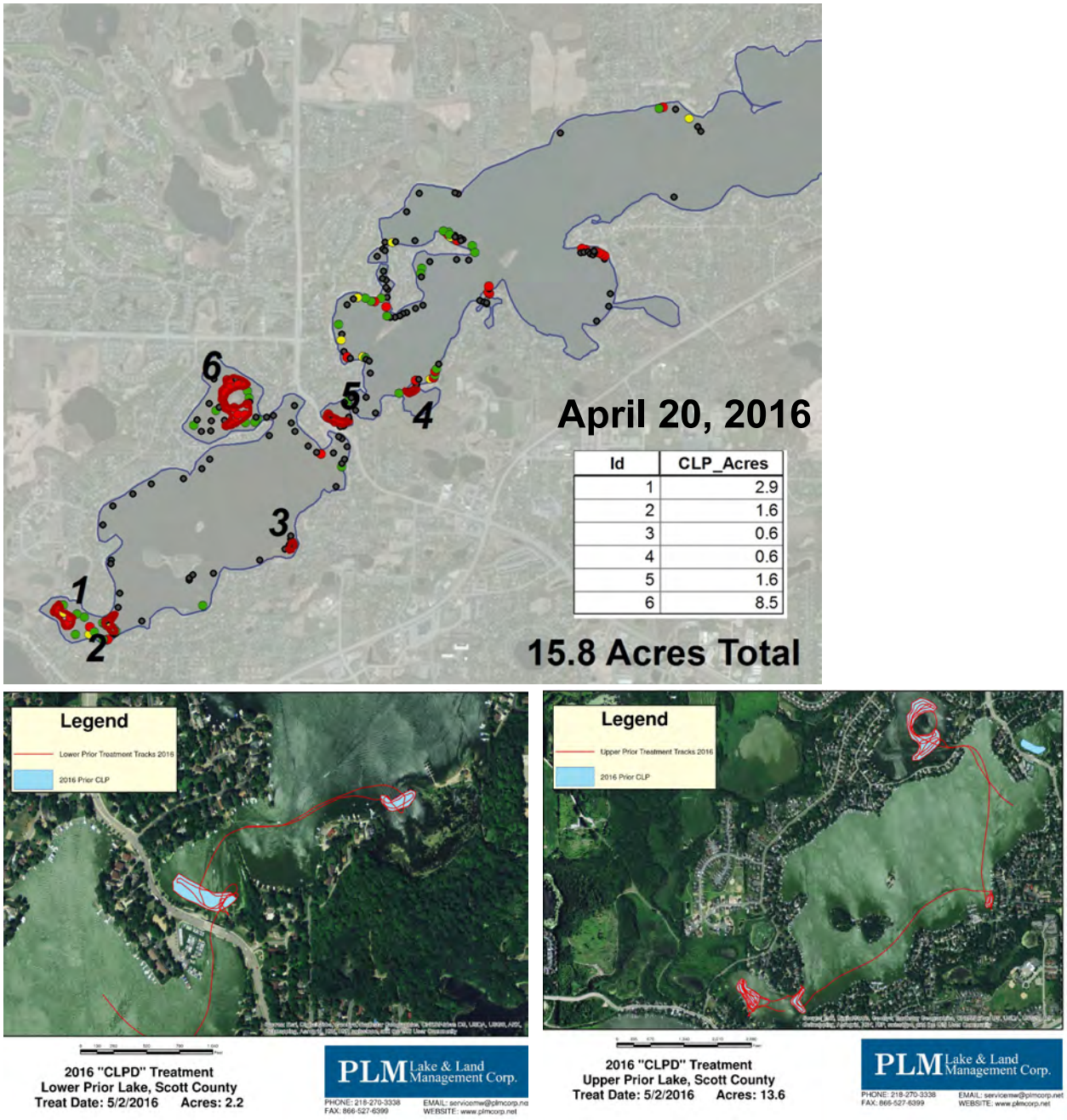


Figure 3. [top] Curlyleaf pondweed delineation and recommended treatment areas totaling 13.6 acres; 16.06 ac in Upper Prior and 2.2 acres in Lower Prior.
[bottom-left and bottom-right] Curlyleaf pondweed treatment areas for May 2, 2016 (source: PLM).

Curlyleaf Pondweed Assessment on June 1, 2016 in Upper and Lower Prior Lake

A total of 15.8 acres of curlyleaf was treated on May 2, 2016 (Table 2 and Figure 4). A total of 129 sites around Upper and Lower Prior Lake were resampled with rake sampling on June 1, 2016 to assess curlyleaf treatment areas and other untreated areas. Curlyleaf was found at light to moderate densities in Treatment areas 1, 2, 3, 5, and 6. Treatment area 4 had relatively poor control.

The overall curlyleaf treatment was good, and overall curlyleaf growth at other untreated sites was mostly light to moderate.

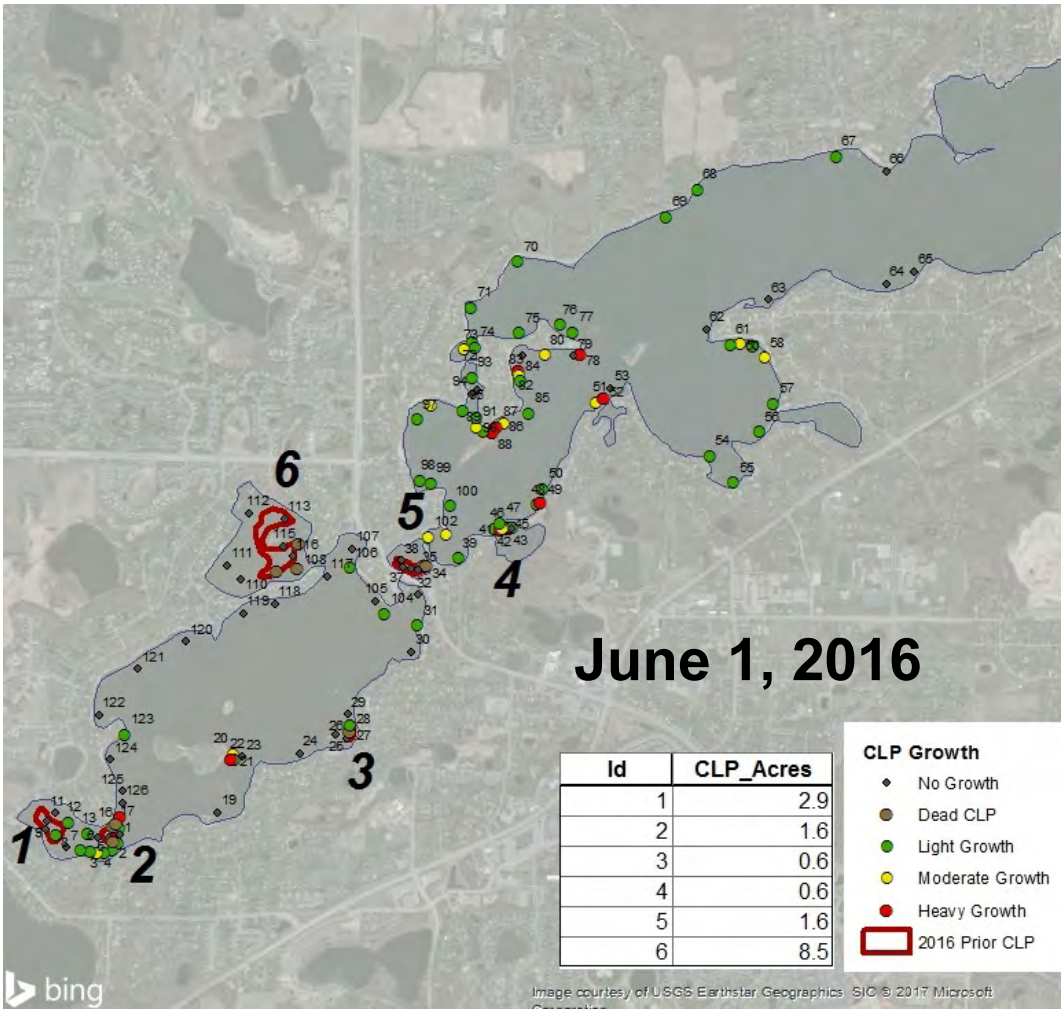


Figure 4. Curlyleaf density on June 1, 2016. Light green shaded areas represent the treatment areas. Key: Green dot = light growth, yellow dot = moderate growth, red dot = heavy growth, and black = no growth.

Table 2. Aquatic plant densities based on rake sampling for June 1, 2016. Densities are based on a scale from 1 to 5 with 5 being the densest.

Treatment Area	Site	Depth (ft)	CLP	CLP - dead	Cabbage	Claspingleaf	Coontail	Elodea	EWM	Flatstem	Stringy	No plants
	1	7	1									
	2	5	1					4				
2	3	4	1					4				
	4	4	3					4	1			
	5	5	2					3	2			
	6	5	1					3	1			
	7	6						3	1			
	8	7	1					1	2			
1	9	5						4				
	10	6						3	1			
	11	6					1	3				
	12	6	2				1					
	13	7	2				1	2				
	14	7					1					
	15	7					1					
	16	8	2									
	17	7		1				1				
	18	7		1			1		1			
	19	10										1
	20	8	3						4			
	21	10	1									
	22	8	4									
	23	12										1
	24	11										1
	25	12										1
	26	7							1			
3	27	8		1								1
	28	9	2									
	29	11										1
	30	12										1
	31	9	2						3			
	32	12										1
	33	9		1								1
	34	11		1								1
	35	12										1
5	36	11										1
	37	12										1
	38	13										1
	39	11	2									
	40	10	2						2			
	41	7	4						1			
	42	6	2						3			
4	43	6	4						3			
	44	5	1						3			
	45	7							3			
	46	5	3									
	47	11	2									
	48	9	2				1		1			
	49	8	5									
	50	14	1									
	51	11	3				1		1			
	52	6	4									
	53	14										1
	54	12	1						1			
	55	8	1			1					1	
	56	12	1						1			
	57	10	2						2			
	58	9	3						1			
	59	9	2						2			
	60	10	3				2					
	61	10	2						2			
	62	12					1		1			
	63	15					1					
	64	14					1					
	65	14										1
	66	4				1						
	67	12	1						1			
	68	6	1						1			
	69	12	1						1			
	70	12	1									

Table 2. Aquatic plant densities based on rake sampling for June 1, 2016. Densities are based on a scale from 1 to 5 with 5 being the densest.

Treatment Area	Site	Depth (ft)	CLP	CLP - dead	Cabbage	Claspingleaf	Coontail	Elodea	EWM	Flatstem	Stringy	No plants
	71	11	2									
	72	8	1		1				1			
	73	9	3		1				1			
	74	9	2		1		1			1		
	75	13	2									
	76	11	1						1			
	77	11	1									
	78	10	4									
	79	16										1
	80	13	3				3					
	81	11										1
	82	8	4									
	83	9	3						1			
	84	14	1				1		1			
	85	13	2									
	86	13	3									
	87	9	4									
	88	5	4									
	89	5	2			3						
	90	9	3									
	91	11	2						1			
	92	7							3			
	93	7	1				3					
	94	6					2		2			
	95	9	1				3		1			
	96	13	3									
	97	14	1									
	98	12	2									
	99	12	1									
	100	16	1									
	101	6	3									
	102	12	3									
	103	14										1
	104	9	2									
	105	10										1
	106	9	1									
	107	9										1
6	108	4		1								1
	109	4		1								1
	110	5										1
	111	6										1
	112	5										1
	113	6										1
	114	6		1								1
	115	4										1
	116	6										1
	117	11										1
	118	15										1
	119	15										1
	120	12										1
	121	12										1
	122	10										1
	123	11	1									
	124	10										1
	125	10										1
	126	10										1
	127	8	4									
	128	8		1								1
	129	8						1				
	Average		2.1		1.0	1.7	1.4	2.8	1.6	1.0	1.0	--
	Occurrence (129 sites)		72		3	3	18	13	37	1	1	40

June 1, 2016 Representative Curlyleaf Conditions

Figure 5. Curlyleaf growth in Prior Lake ranged from light growth [upper left], to moderate growth [upper right], to heavy growth [lower left].

Comparison of Early Season to Late Season Curlyleaf Growth

Mostly light growth of curlyleaf pondweed with the potential for future heavy growth was found in the April 20 delineation and 6 treatment areas were delineated (Table 3). A curlyleaf assessment on June 5, 2015 found curlyleaf to be growing at a range of densities, from light to heavy. In areas where herbicides were applied, control was generally good except for Treatment areas 4 (Figure 6).

Table 3. Comparison of curlyleaf pondweed stem densities based on rake sampling for April 20 and June 1, 2016. Densities are based on a scale from 1 to 5 with 5 being the densest.

Treatment Area	Acres	April 20, 2016 - Delineation		June 1, 2016 - Assessment		CLP Treatment Effectiveness
		Sample Sites	Range of stem densities (stems/0.1 m^2)	Sample Sites	Average CLP density at maximum growth potential (range is 0 - 5)	
1	2.9	129-146	1-10	7-12	0-1	Good
2	1.6	350-361	0-10	1-6	1-3	Fair
3	0.6	155-157	1-10	25-29	0-2	Good
4	0.6	174-185	0-16	41-46	0-4	Poor
5	1.6	288-294	0-9	34-38	0	Excellent
6	8.5	306-337	0-15	108-116	0	Excellent

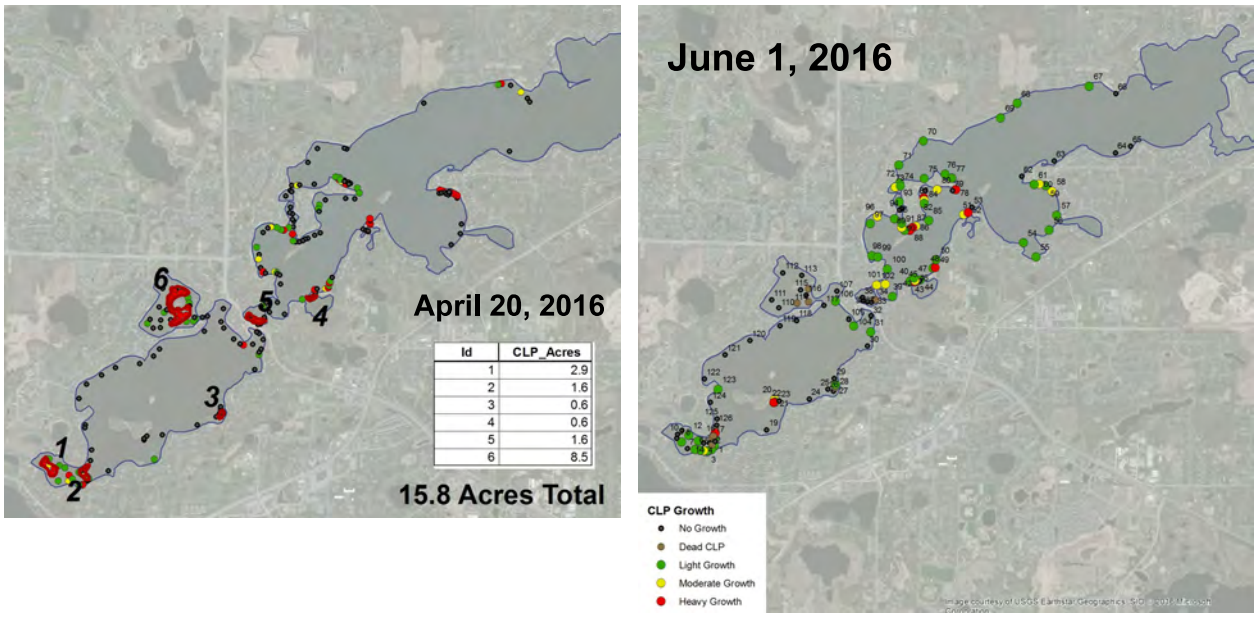


Figure 6. Map of curlyleaf pondweed delineation is shown on the left (April 20, 2016) and the curlyleaf assessment is shown on the right (June 1, 2016).

Curlyleaf Planning for 2017: Treating heavy growth of curlyleaf pondweed based on early season curlyleaf distribution is a challenge. Curlyleaf in April and May has just started to go into a rapid growth phase. However, not all early season curlyleaf growth will result in heavy curlyleaf growth in late May and June. It appears there are factors that limit curlyleaf growth and significant variables are associated with sediment conditions. The question is how to best delineate areas to treat what could be heavy growth in June but not overtreat areas where growth wouldn't be a nuisance for the season.

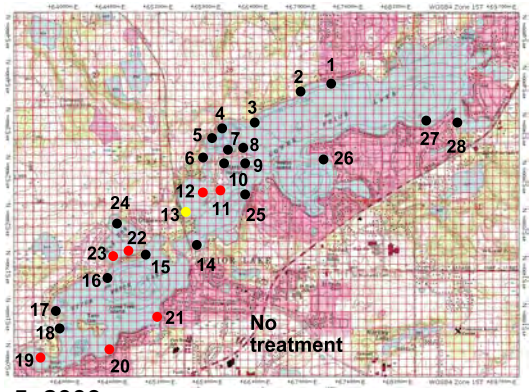
Currently, for Upper and Lower Prior Lake, the method has been to use past CLP growth history combined with early season scouting. Then if curlyleaf growth has indications of producing potential heavy growth, those areas are delineated and treatment is considered. That is the approach to be considered for 2017.

Example of moderate growth of curlyleaf pondweed in Prior Lake on June 5, 2014.

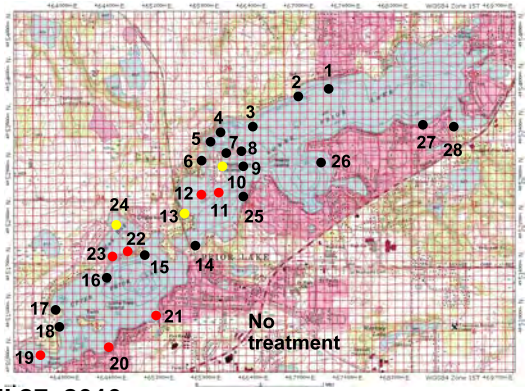
Example of heavy growth of curlyleaf pondweed in Prior Lake on June 5, 2015.

Example of heavy growth of curlyleaf pondweed in Prior Lake on June 1, 2016.

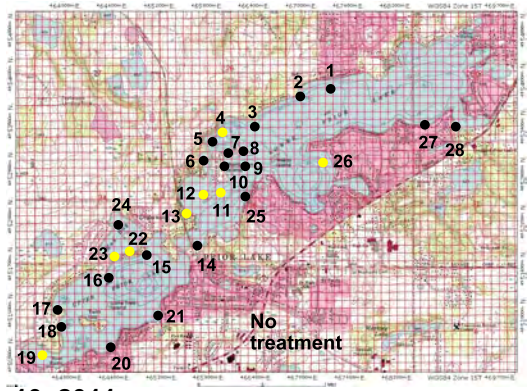
Previous Herbicide Treatments from 2009 - 2016



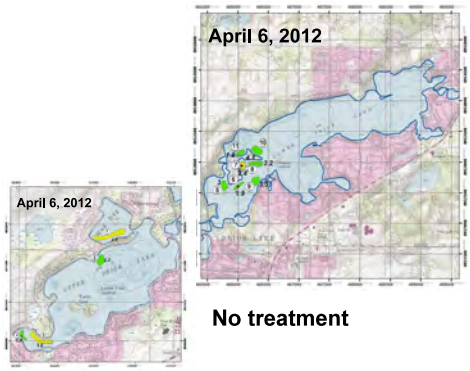
May 5, 2009



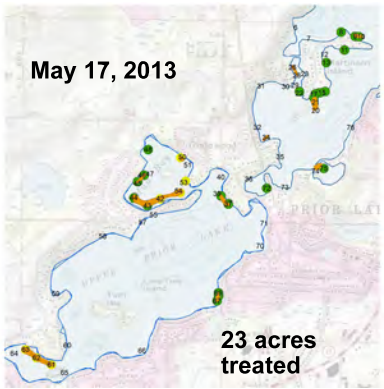
April 27, 2010



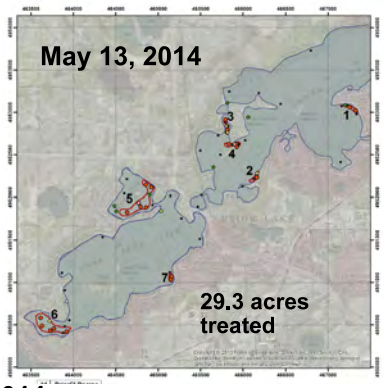
May 10, 2011



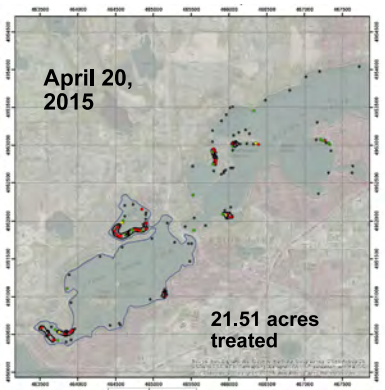
April 6, 2012



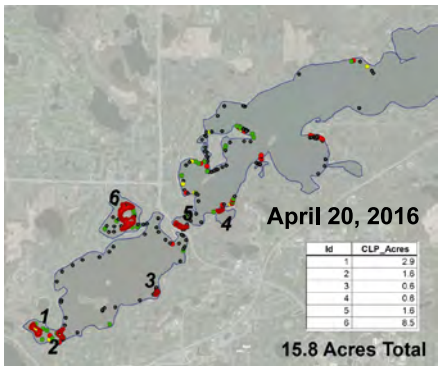
May 17, 2013



May 13, 2014



April 20, 2015



April 20, 2016

Figure 7. Previous herbicide applications locations from 2009 to 2016 on Upper and Lower Prior Lakes.

Appendix A - Point-Intercept Aquatic Plant Survey - 2015

Methods: An aquatic plant point-intercept survey of Upper and Lower Prior Lake was conducted by Blue Water Science. A 100 meter grid was placed on the lake to create 516 points total, of those 516 points, 265 littoral zone points were sampled for plants (Figure A1). At each sample point, a sampling rake was lowered into the water and a plant sample was taken. The plant species were recorded and the density of each species was assigned. Densities were based on the coverage on the teeth of the rake. Density ratings ranged from 1 to 5 with 1 being sparse and 5 being heavy growth (Figure A2). Based on these sample sites, several plant distribution maps were constructed.

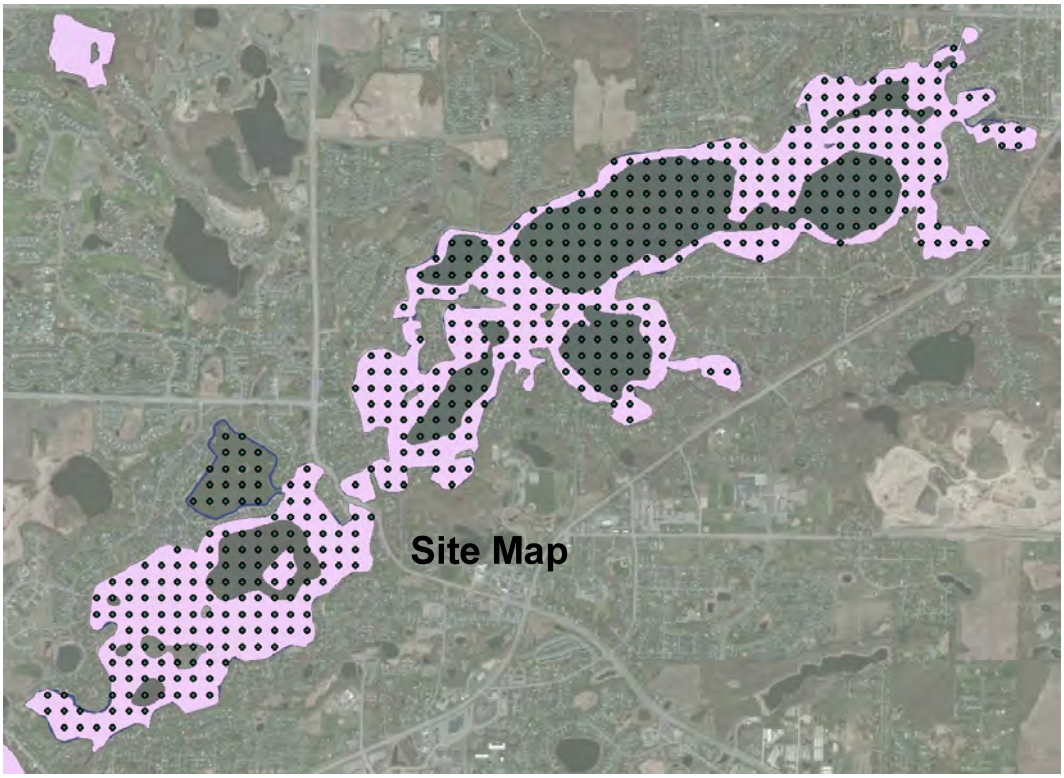
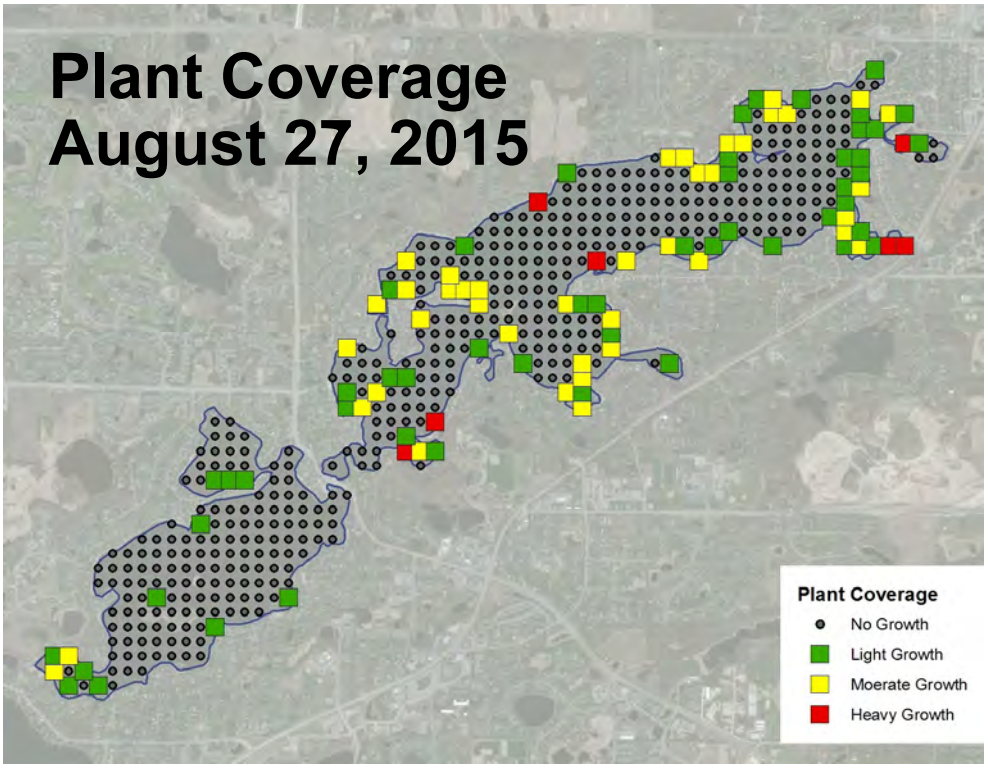


Figure A1. Point-intercept sample site map for Upper and Lower Prior Lakes for 2015. Pink shading represents the littoral zone. Mud Bay (north of Upper Prior Lake) is less than 15 feet and should be shaded pink.

Chart of Aquatic Plant Density Ratings

Figure A2. Aquatic plant density ratings from 1 to 5. A density rating of 4.5 or 5 is used for plants topping out at the surface.

Results: A point-intercept aquatic plant survey was conducted on Upper and Lower Prior Lakes on August 27, 2015. Plant distribution and species richness were greater in Lower Prior compared to Upper Prior (Figure A3). Aquatic plants grew to a water depth of 15 feet in Lower Prior and to 6 feet in Upper Prior. Aquatic plants covered approximately 33 acres in Upper Prior and 220 acres in Lower Prior Lake.



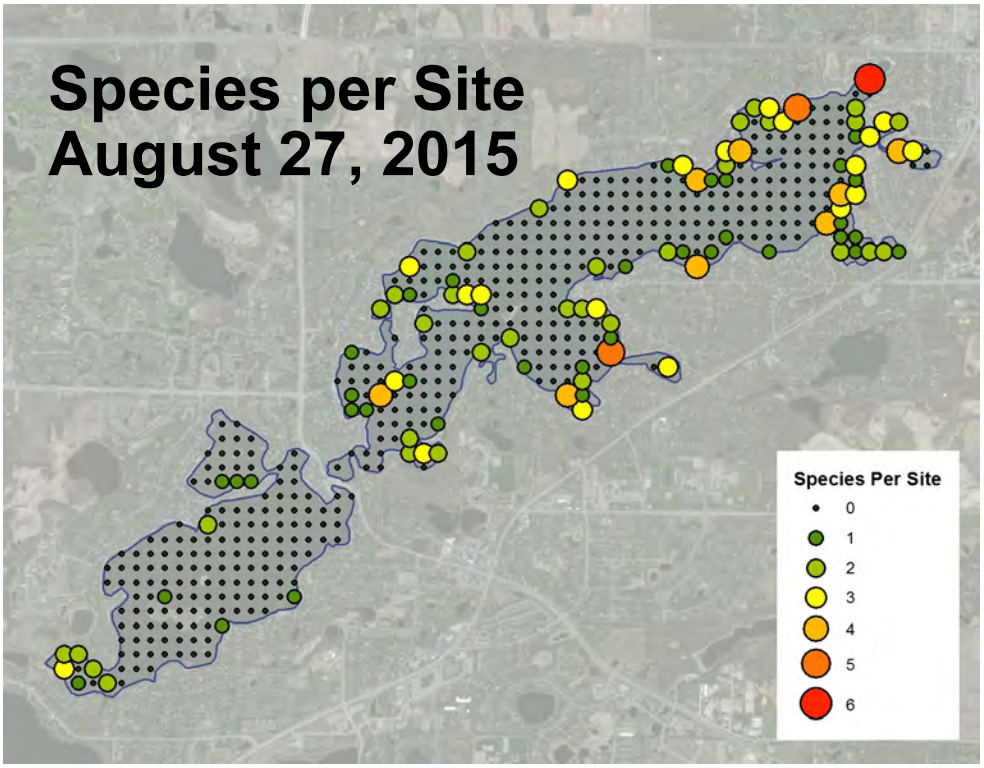


Figure A3. [top] Plant coverage map for August 27, 2015.
[left] Species per site map for August 27, 2015.

Individual aquatic plant species distribution and abundance in Prior Lake are shown in Figure A4.

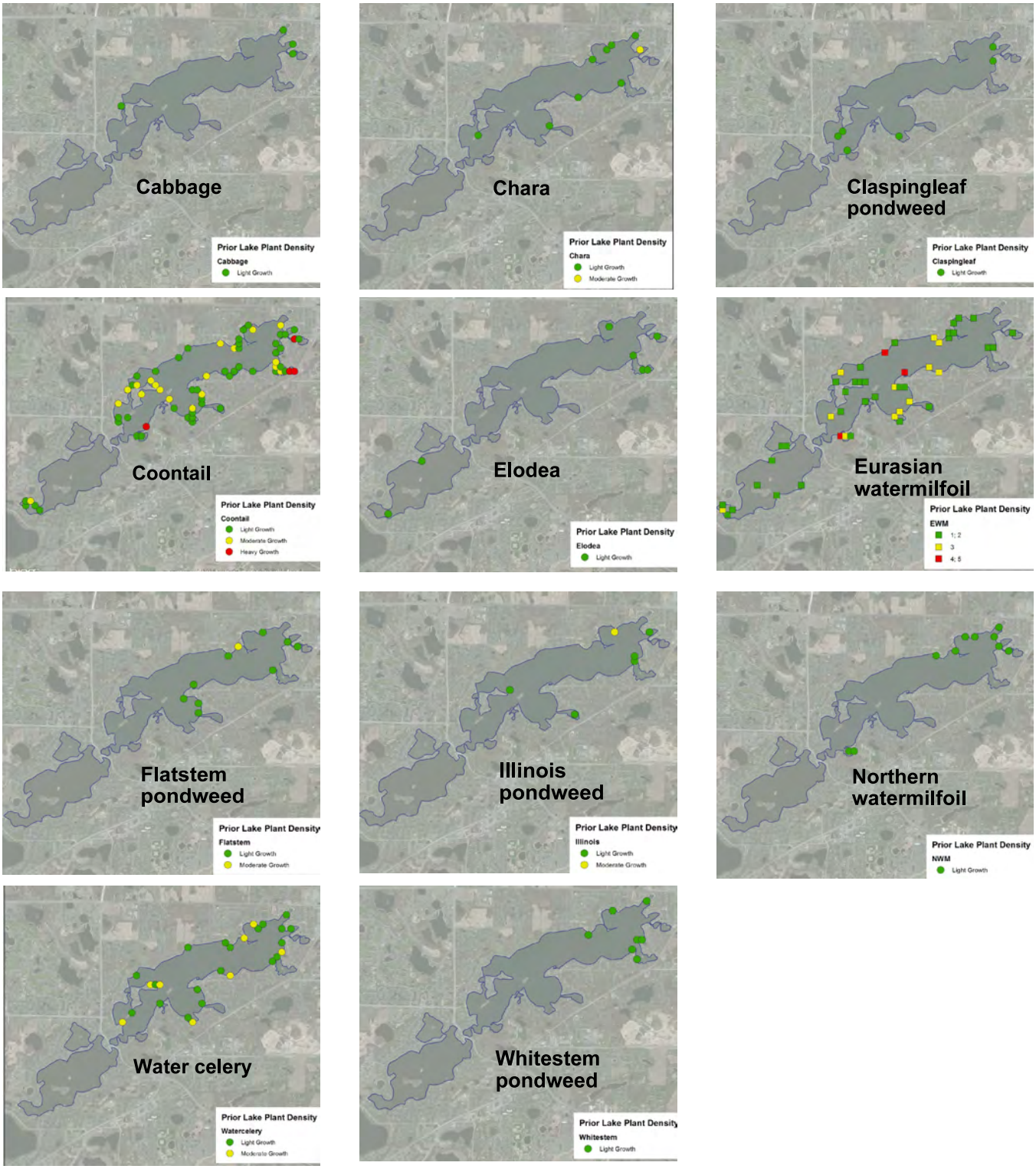


Figure A4. Aquatic plant coverage maps for selected plant species found in Upper and Lower Prior Lakes.

In Upper and Lower Prior Lakes, coontail was the dominant plant followed by Eurasian watermilfoil and water celery (Table A1).

Table A1. Upper and Lower Prior aquatic plant occurrence and density for the August 27, 2015 survey based on 265 sites. Density ratings are 1-5 with 1 being low and 5 being most dense.

Upper and Lower Prior	All Stations (n=265)		
	Occurrence	% Occurrence	Average Density
Coontail (*Ceratophyllum demersum*)	67	25	2.1
Chara (*Chara sp*)	9	3	1
Elodea *(Elodea canadensis)*	7	3	1
Northern watermilfoil *(Myriophyllum sibiricum)*	10	4	1.2
Eurasian watermilfoil (*M. spicatum*)	49	18	2.0
Cabbage (*Potamogeton amplifolius*)	4	2	1
Curlyleaf pondweed *(P. crispus)*	0	0	0
Illinois pondweed *(P. illinoensis)*	6	2	1.7
Whitestem pondweed *(P. praelongus)*	7	3	1.1
Claspingleaf pondweed (*P. Richardsonii*)	6	2	1.2
Flatstem pondweed *(P. zosteriformis)*	10	4	1.4
Sago pondweed *(Stuckenia pectinata)*	2	1	1.5
Water celery *(Vallisneria americana)*	27	10	1.0
Water stargrass *(Zosterella dubia)*	3	1	1.0

In Lower Prior, coontail was the dominant plant (Table A2). A total of 12 species were observed. In Upper Prior, Eurasian watermilfoil was the dominant species (Table A3). A total of 4 species were found.

Aquatic plant species found at each sample site are listed in Table A4. A numbered site map is shown in Figure A5.

Table A2. Lower Prior aquatic plant occurrence and density for the August 27, 2015 survey based on 172 sites. Density ratings are 1-5 with 1 being low and 5 being most dense.

Lower Prior	All Stations (n=172)		
	Occurrence	% Occurrence	Average Density
Coontail (*Ceratophyllum demersum*)	62	36	2.2
Chara (*Chara sp*)	9	5.2	1.7
Elodea (*Elodea canadensis*)	5	3	1.0
Northern watermilfoil *(Myriophyllum sibiricum)*	10	6	1.2
Eurasian watermilfoil (*M. spicatum*)	38	22	2.1
Cabbage (*Potamogeton amplifolius*)	4	2.3	1
Illinois Pondweed *(P. illinoensis)*	6	4	1.7
Whitestem pondweed (*P. praelongus*)	7	4	1.1
Claspingleaf (*P. Richarsonii*)	6	4	1.2
Flatstem pondweed (*P. zosteriformis*)	10	6	1.4
Water celery (*Vallisneria americana*)	27	16	2.0
Water stargrass (*Zosterella dubia*)	3	2	1.0

Table A3. Upper Prior aquatic plant occurrence and density for the August 27, 2015 survey based on 93 sites. Density ratings are 1-5 with 1 being low and 5 being most dense.

Upper Prior	All Stations (n=93)		
	Occurrence	% Occurrence	Average Density
Coontail (*Ceratophyllum demersum*)	5	5	1.6
Elodea *(Elodea canadensis)*	2	2	1
Eurasian watermilfoil (*Myriophyllum spicatum*)	11	12	1.4
Sago pondweed *(Stuckenia pectinata)*	2	2	1.5

Table A4. Point intercept sample sites and aquatic plant abundance for August 27, 2015. UP = Upper Prior and LP = Lower Prior.

Site	Lake	Depth (ft)	White lilies	Cab-bage	Chara	Clasp-ingleaf	Coon-tail	Elodea	EWM	Flat-stem	Hybrid milfoil	Illinois	NWM	Sago	Water celery	Water stargrass	White-stem	No plants
1	UP	7							1									
2	UP	6																1
3	UP	5					2	1										
5	UP	5	1				1		3									
6	UP	7																1
7	UP	6					1		1									
9	UP	11																1
10	UP	9																1
11	UP	5					1		1									
12	UP	4					3							1				
13	UP	9																1
14	UP	20																1
15	UP	35																1
16	UP	14																1
17	UP	11																1
18	UP	11																1
19	UP	10																1
20	UP	10																1
21	UP	14																1
22	UP	48																1
23	UP	16																1
24	UP	12																1
25	UP	11																1
26	UP	11																1
27	UP	10																1
28	UP	14																1
29	UP	12																1
32	UP	10																1
33	UP	11																1
34	UP	9							1									
35	UP	13																1
36	UP	29																1
37	UP	4							2									
42	UP	13																1
43	UP	12																1
44	UP	12																1
45	UP	10																1
46	UP	14																1
47	UP	12																1
48	UP	5							1									
56	UP	10																1
57	UP	8							1									
58	UP	12																1
59	UP	12																1
60	UP	14																1
61	UP	14																1
62	UP	12																1
71	UP	9																1
72	UP	11																1
73	UP	12																1
74	UP	13																1
75	UP	13																1
76	UP	14																1
85	UP	15																1
86	UP	11																1
87	UP	12																1
99	UP	15																1
100	UP	11																1
101	UP	12																1
112	UP	10																1
113	UP	11																1
114	UP	12																1
115	UP	7						1	2									
124	UP	8																1
125	UP	12																1
126	UP	16																1
127	UP	19																1
128	UP	22																1
133	UP	13																1

Table A4. Point intercept sample sites and aquatic plant abundance for August 27, 2015. UP = Upper Prior and LP = Lower Prior.

Site	Lake	Depth (ft)	White lilies	Cab-bage	Chara	Clasp-ingleaf	Coon-tail	Elodea	EWM	Flat-stem	Hybrid milfoil	Illinois	NWM	Sago	Water celery	Water stargrass	White-stem	No plants
134	UP	13																1
135	UP	17																1
138	UP	16																1
139	UP	13																1
140	UP	13																1
141	UP	5																1
142	UP	5																1
143	UP	5												2				
144	UP	5							1									
145	UP	5							1									
146	UP	13																1
147	UP	13																1
148	UP	5																1
151	UP	6																1
152	UP	9																1
153	UP	9																1
154	LP	12																1
157	LP	land																1
158	UP	6																1
161	UP	6																1
162	UP	9																1
163	LP	13																1
164	LP	15																1
165	LP	15																1
166	LP	7					1		5									
167	LP	8					2		3				1					
168	LP	6							2				1					
169	UP	5																1
171	UP	6																1
172	LP	16																1
173	LP	17																1
174	LP	6				1										1		
175	LP	6																1
176	LP	7																1
177	LP	17																1
180	LP	16																1
181	LP	8					4											
182	LP	12					2											
183	LP	8													3			
184	LP	17																1
188	LP	d																1
189	LP	12					2		2						3			
190	LP	14					1											
192	LP	6				1	2		3		1							
193	LP	14																1
197	LP	d																1
198	LP	9				1	2		3						2			
199	LP	15					2											
200	LP	land																1
201	LP	16																1
203	LP	14																1
204	LP	4			1	1									2			
205	LP	11							1									
208	LP	d																1
209	LP	20																1
210	LP	18																1
212	LP	13					1		3									
213	LP	15																1
214	LP	15																1
215	LP	14																1
216	LP	11																1
217	LP	19																1
218	LP	22																1
219	LP	d																1
220	LP	12					1											
224	LP	13					3											
225	LP	16																1
226	LP	22																1
227	LP	14					1		2			1						

Table A4. Point intercept sample sites and aquatic plant abundance for August 27, 2015. UP = Upper Prior and LP = Lower Prior.

Site	Lake	Depth (ft)	White lilies	Cab-bage	Chara	Clasp-ingleaf	Coon-tail	Elodea	EWM	Flat-stem	Hybrid milfoil	Illinois	NWM	Sago	Water celery	Water stargrass	White-stem	No plants
228	LP	11					3											
229	LP	13																1
230	LP	16																1
231	LP	d																1
232	LP	d																1
233	LP	6							2						1			
234	LP	19																1
238	LP	23																1
240	LP	11			1		1		3	2					2			
242	LP	17																1
246	LP	15																1
247	LP	12																1
248	LP	12					3		1									
255	LP	14					2											
256	LP	8					3		1									
257	LP	22																1
259	LP	D																1
266	LP	22																1
269	LP	14					3			1								
270	LP	9		1			3											
272	LP	10					3											
273	LP	d																1
278	LP	8							3	2								
279	LP	13					2		1									
280	LP	11					2		2						1			
281	LP	11					2		1									
282	LP	13					3											
283	LP	d																1
284	LP	10							1						3			
285	LP	13					3		2						1			
286	LP	6							2			2			3			
293	LP	d																1
294	LP	d																1
295	LP	15																1
296	LP	14					3											1
304	LP	17																1
305	LP	11					1		3						1			
317	LP	17																1
318	LP	8							4	1								
319	LP	19																1
320	LP	15					3											
321	LP	9			1		1		3						3			
322	LP	20																1
323	LP	d																1
324	LP	20																1
325	LP	7					1		2									
326	LP	d																1
337	LP	21																1
338	LP	8							3						1			
339	LP	17					1											
340	LP	d																1
341	LP	14					1											
342	LP	15					2											
343	LP	7					2										2	
344	LP	7					3											
345	LP	8					2	1										
346	LP	8					4	1										
347	LP	8					4											
348	LP	19																1
360	LP	27																1
361	LP	23																1
364	LP	19																1
365	LP	14					1											
367	LP	24																1
369	LP	24																1
370	LP	21																1
371	LP	9					3											
372	LP	7					1											
374	LP	d																1

Table A4. Point intercept sample sites and aquatic plant abundance for August 27, 2015.
UP = Upper Prior and LP = Lower Prior.

Site	Lake	Depth (ft)	White lilies	Cab-bage	Chara	Clasp-ingleaf	Coon-tail	Elodea	EWM	Flat-stem	Hybrid milfoil	Illinois	NWM	Sago	Water celery	Water stargrass	White-stem	No plants
375	LP	d																1
376	LP	d																1
395	LP	20																1
396	LP	7			2					1					2		1	
397	LP	9					3											
398	LP	9					2		4									
399	LP	16																1
418	LP	d																1
419	LP	7						1				1			2			
420	LP	d																1
439	LP	11					2		2			1					1	
440	LP	6							1						3		1	
441	LP	12					2		1						2			
442	LP	15																1
443	LP	16																1
444	LP	d																1
445	LP	d																1
446	LP	d																1
449	LP	21																1
450	LP	9							3	1					1		1	
451	LP	14					3											
452	LP	13					2											
460	LP	18																1
461	LP	14					2											
462	LP	16																1
463	LP	13					3											
464	LP	11							3				1		1			
465	LP	13					1		2									
472	LP	14					2											1
473	LP	9				1									2	1		
476	LP	14					1		1	3								
477	LP	9			2				1				1		3			
478	LP	18																1
484	LP	18																1
485	LP	6		1			4			1			1					1
486	LP	3					2	1	2									
488	LP	16																1
495	LP	12					2											1
496	LP	11					2			1			1					1
497	LP	15					2		1									
498	LP	20																1
499	LP	14					3	1										
500	LP	4			2							3			2			
501	LP	21																1
505	LP	10				2									2			
506	LP	12			3							2			1			
507	LP	12		1			2											1
508	LP	14					2		1									
509	LP	7											1		3		1	
510	LP	7			1				1	1			2		1			
511	LP	17																1
512	LP	20																1
513	LP	21																1
514	LP	13					3						1					1
515	LP	34																1
516	LP	28																1
517	LP	6		1	2								2		2	1	1	
Average			1.0	1.0	1.7	1.2	2.1	1.0	2.0	1.4	1.0	1.7	1.2	1.5	2.0	1.0	1.1	
Occur (254 sites)			1	4	9	6	67	7	49	10	1	6	10	2	27	3	7	171
% occur			0	2	3	2	25	3	19	4	0	2	4	1	10	1	3	

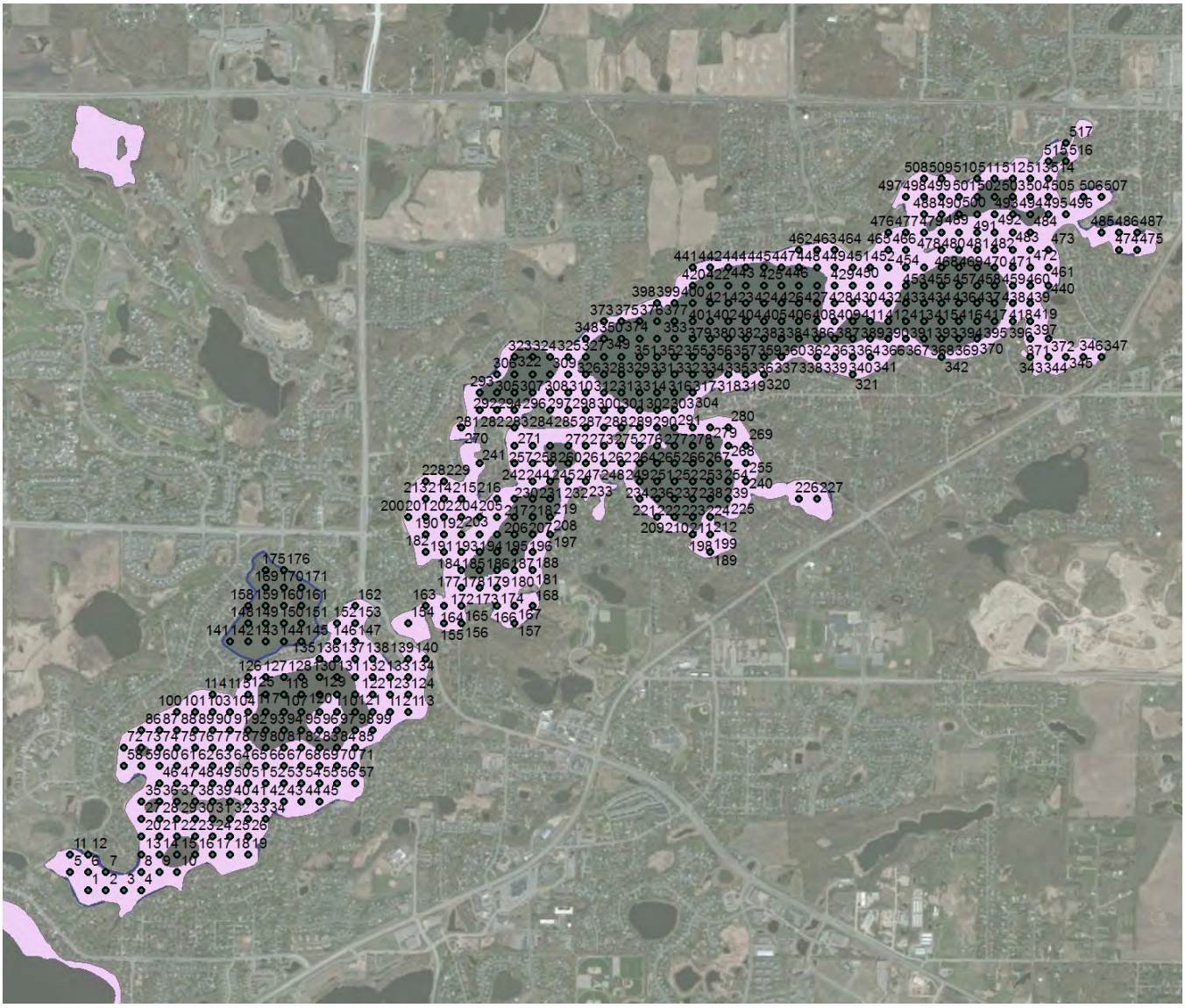


Figure A5. Point-intercept sample site map for Upper and Lower Prior Lakes for 2015. Pink shading represents the littoral zone. Mud Bay (north of Upper Prior Lake) is less than 15 feet and should be shaded pink.