Aquatic Plants Growing to the Surface on June 18, 2019 on Prior Lake

Curlyleaf Pondweed Delineation and Assessment Surveys for Upper and Lower Prior Lake, Scott County, 2019

Curlyleaf Pondweed Delineation: April 29, 2019
Herbicide Treatment: 14.3 ac treated with diquat: May 20 2019
Curlyleaf Pondweed Assessment Date: June 18, 2019

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Curlyleaf Pondweed Delineation and Assessment Surveys for Upper and Lower Prior Lake, Scott County, 2019

Summary

Early Season Curlyleaf Pondweed Delineation: Curlyleaf pondweed (CLP) distribution and abundance were delineated on April 29, 2019. 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 14.94 acres were delineated for a herbicide treatment.

The curlyleaf pondweed treatment was conducted on May 20, 2019 using diquat at 2 gallons per acre and a total of 14.3 acres were treated in the Prior lakes (Figure S3).

Post Treatment Assessment: A follow-up curlyleaf assessment was conducted on June 18, 2019. The June 18 curlyleaf assessment found curlyleaf in the treatment areas was mostly well controlled. Outside o the treatment areas, there were a few spots where heavy curlyleaf pondweed growth was present, however most heavy growth was patchy (Figure S4).

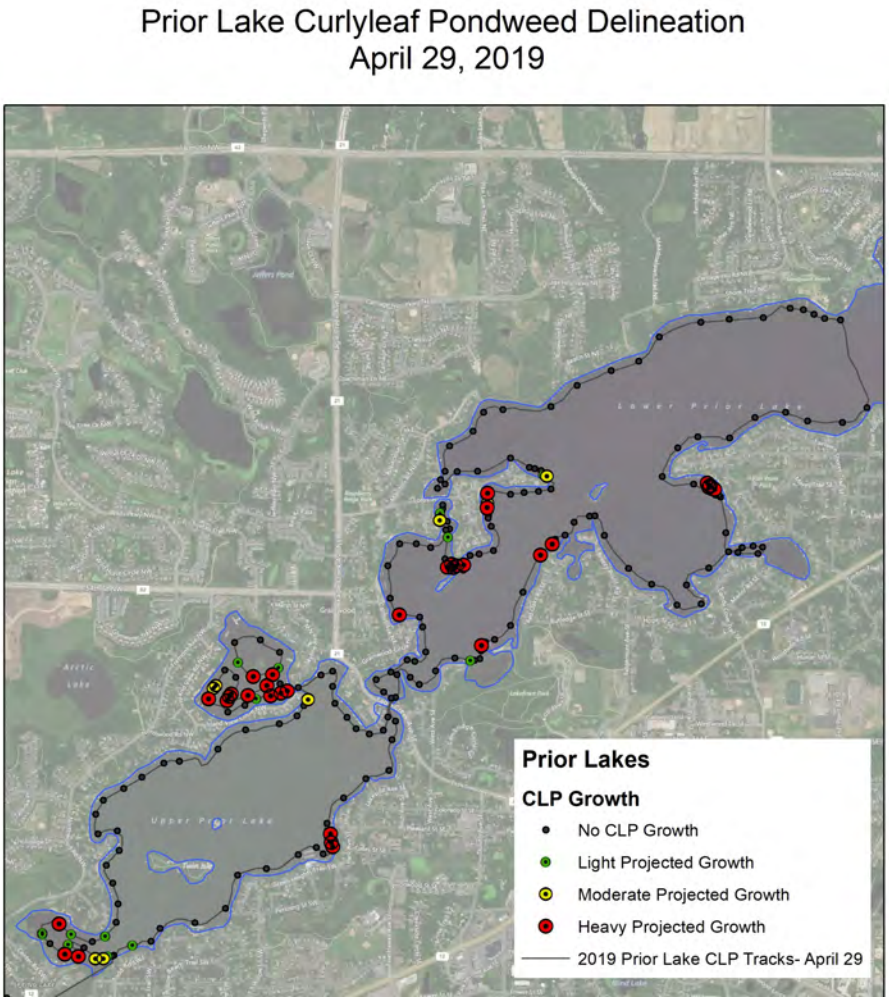


Figure S1. Curlyleaf pondweed was sampled in Prior Lake on April 29, 2019.

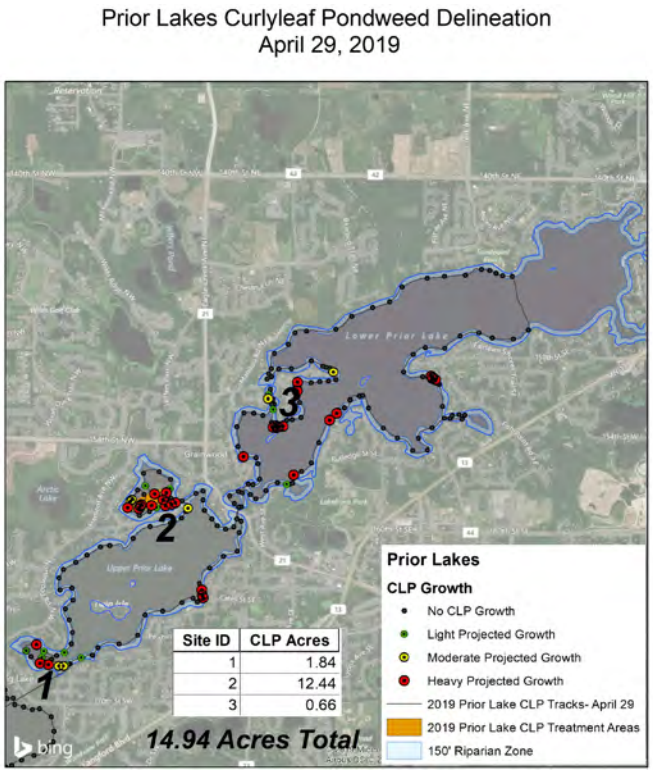


Figure S2. DELINEATION: Map of curlyleaf pondweed delineation sites for April 29, 2019.

Key: Green dots = light growth, yellow dots = moderate growth, and red dots = heavy growth. Blue shading = 150 foot contour around the lake.

Figure S3. TREATMENT: Prior Lakes curlyleaf pondweed was treated on 14.3 acres on May 20, 2019 using diquat.

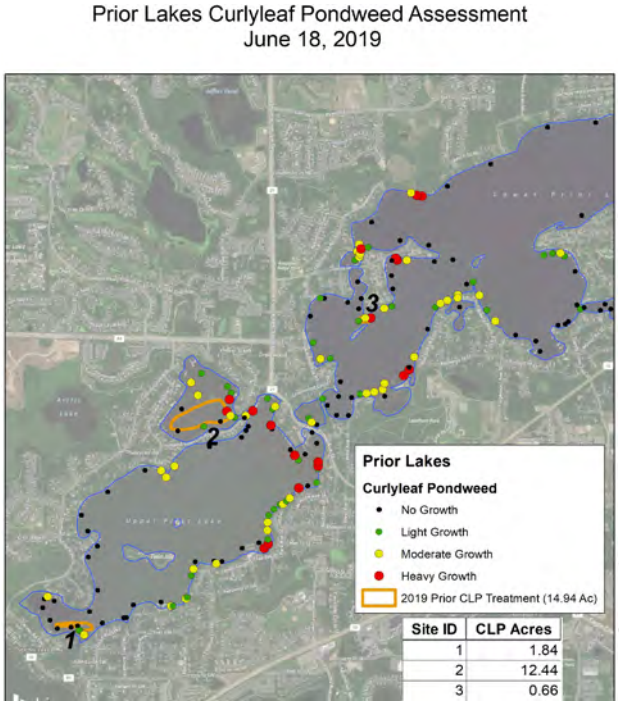


Figure S4. ASSESSMENT: Map of curlyleaf pondweed assessment sites for June 18, 2019. Colored dots indicate the growth of curlyleaf pondweed in June, 2019. Key: Green = light growth, yellow = moderate growth and red = heavy growth. Black = no CLP.

Curlyleaf Planning for 2020: 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 (Figure S5) 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 2020.

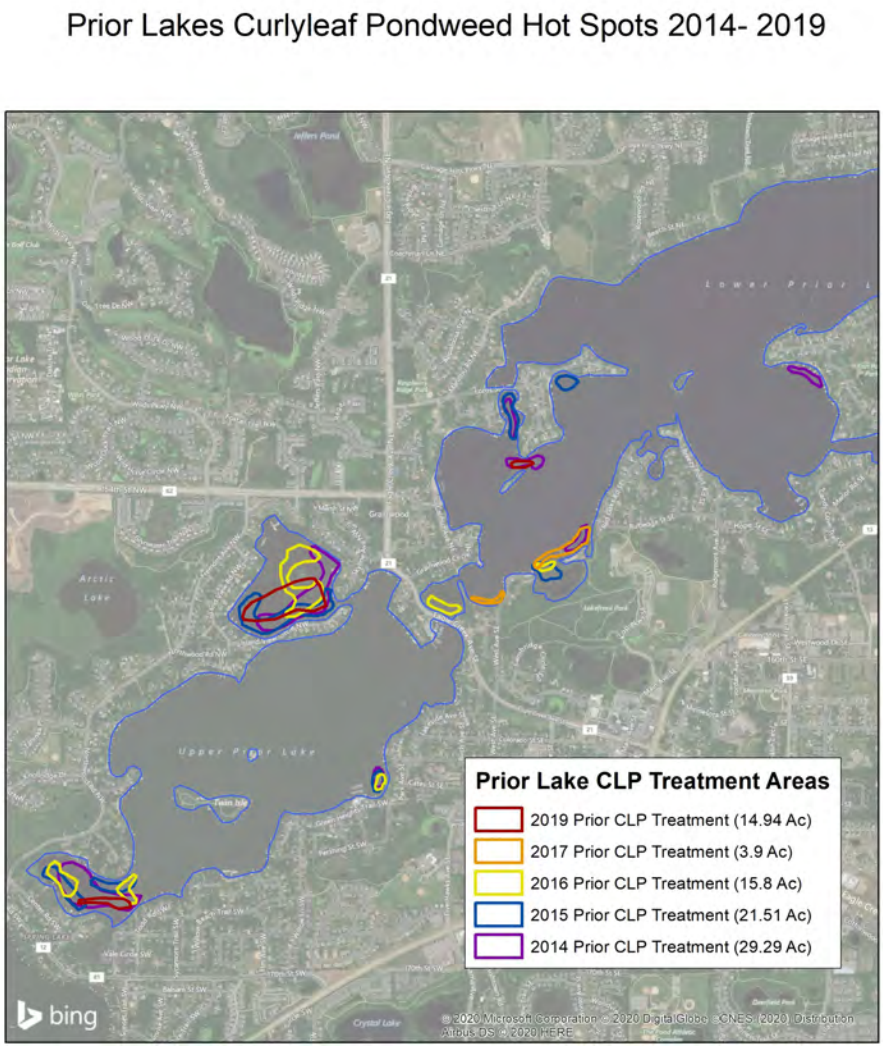


Figure S5. Prior Lake hot spot map for curlyleaf pondweed treatment areas from 2014-2019.

Curlyleaf Pondweed Delineation and Assessment Surveys for Upper and Lower Prior Lake, Scott County, 2019

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 29, 2019. Curlyleaf was treated on May 20, 2019 and a follow-up curlyleaf pondweed assessment was conducted on June 18, 2019 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.

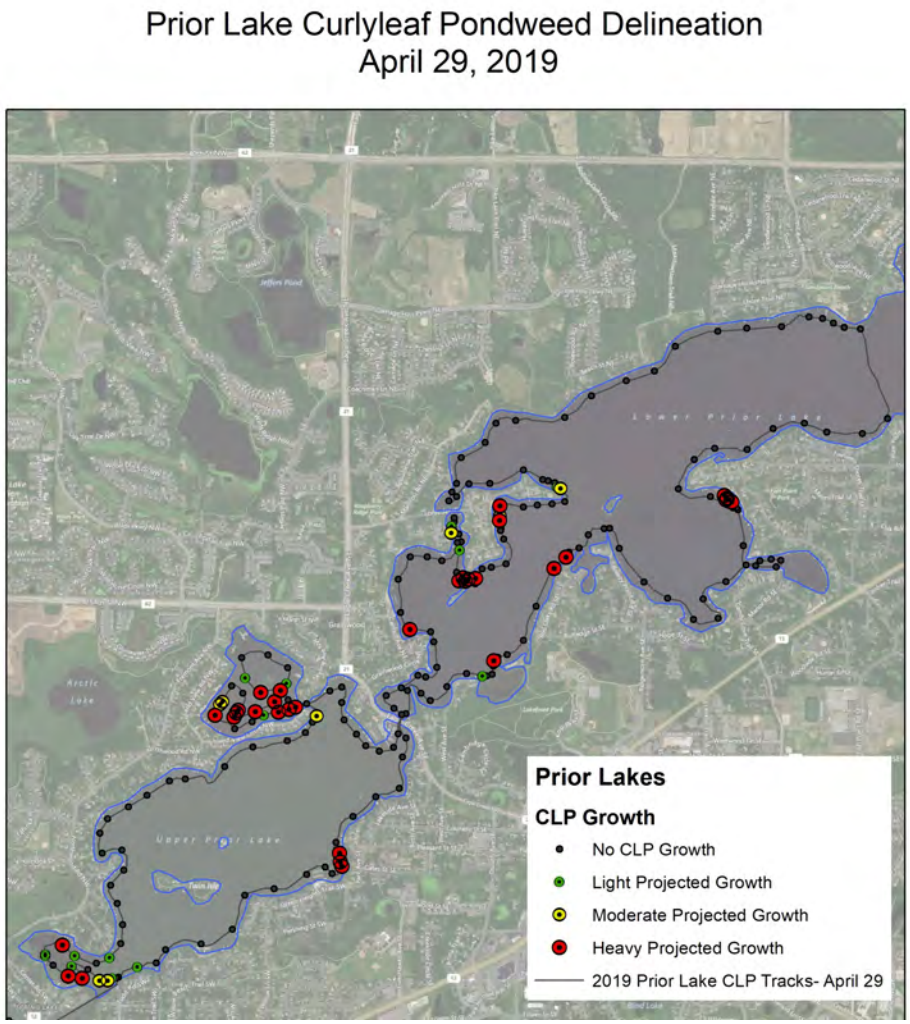


Figure 1. Sites of curlyleaf sampling for a delineation on April 29, 2019.

Methods

Curlyleaf Pondweed Delineation: At the time of the spring CLP delineations, only a fraction of the peak curlyleaf biomass is present. For spot treatments, the areas to be treated should be delineated prior to curlyleaf developing peak biomass. Curlyleaf stem counts on a rake sampler were used to identify areas that had a potential to produce dense curlyleaf. After a short sweep of about 1-foot (30 cm), 4 curlyleaf stems or more per rake sample generally indicated some CLP plants had developed runners and would likely produce heavy growth in the next few weeks. Alternatively, sites where 3 stems or less were collected per rake sample were not predicted to produce dense growth at the peak growing period. These areas were not targeted for treatment. This delineation method was used for spot lake treatments in Gleason Lake and has worked for other lakes as well (McComas et al, 2015*).

Curlyleaf Pondweed Assessment: A CLP assessment was conducted by Blue Water Science on June 17, 2019. The assessment involved surveying the entire lake nearshore area, observing CLP growth, and sampling aquatic plants with rakes. 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 were from 1 to 3 with 1 being sparse and 3 being a nuisance. Plant density chart is shown on the next page (Figure 2). Based on these sample sites, plant distribution maps were constructed.

McComas, S.R., Y.E. Christianson, and U. Singh. 2015. Effects of curlyleaf pondweed control on water quality and coontail abundance in Gleason Lake, Minnesota. Lake and Reservoir Management. 31:109-114.

Curlyleaf Pondweed Growth Characteristics

(source: Steve McComas, Blue Water Science)

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.

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 - 100 g-dry wt/m^2
Estimated TP loading: 2.2 - 3.8 lbs/ac

MnDNR rake sample density equivalent for moderate growth conditions: 2.

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: 280+ stems/m^2
Biomass: >100 g-dry wt/m^2
Estimated TP loading: >6.7 lbs/ac

MnDNR rake sample density = 3.

Figure 2. CLP plant density ratings.

Curlyleaf Pondweed Delineation on April 29, 2019 and Assessment on June 18, 2019 in Upper and Lower Prior Lake

A delineation survey on April 29, 2019, sampled a total of 229 sites around Upper and Lower Prior Lake with rake sampling. Curlyleaf was found at 58 out of 229 sample sites including 32 sites with curlyleaf growth projected to be abundant in June. A total of 14.95 acres in Lower Prior Lake areas were delineated as having the potential to develop moderate to heavy growth conditions by June (Figure 2).

A total area of 14.94 acres of CLP in Prior Lake was permitted for treatment based on criteria where treatment was either 150 feet or more from shore or treatment was in front of public property. However, only Areas 1 and 2 were treated. The small Area 3 (0.66 acres) was not treated. A total of 14.3 acres were treated. The herbicide diquat was used for curlyleaf control at 2 gallons per acre using an average depth of 7 feet.

On June 18, 2019, a curlyleaf assessment was conducted. A total of 185 sites were sampled (Figure 3). Control was very good in the treated areas. A few spots of moderate to heavy growth were observed in untreated areas (Figure 3). Aquatic plant conditions are shown in Figure 4.

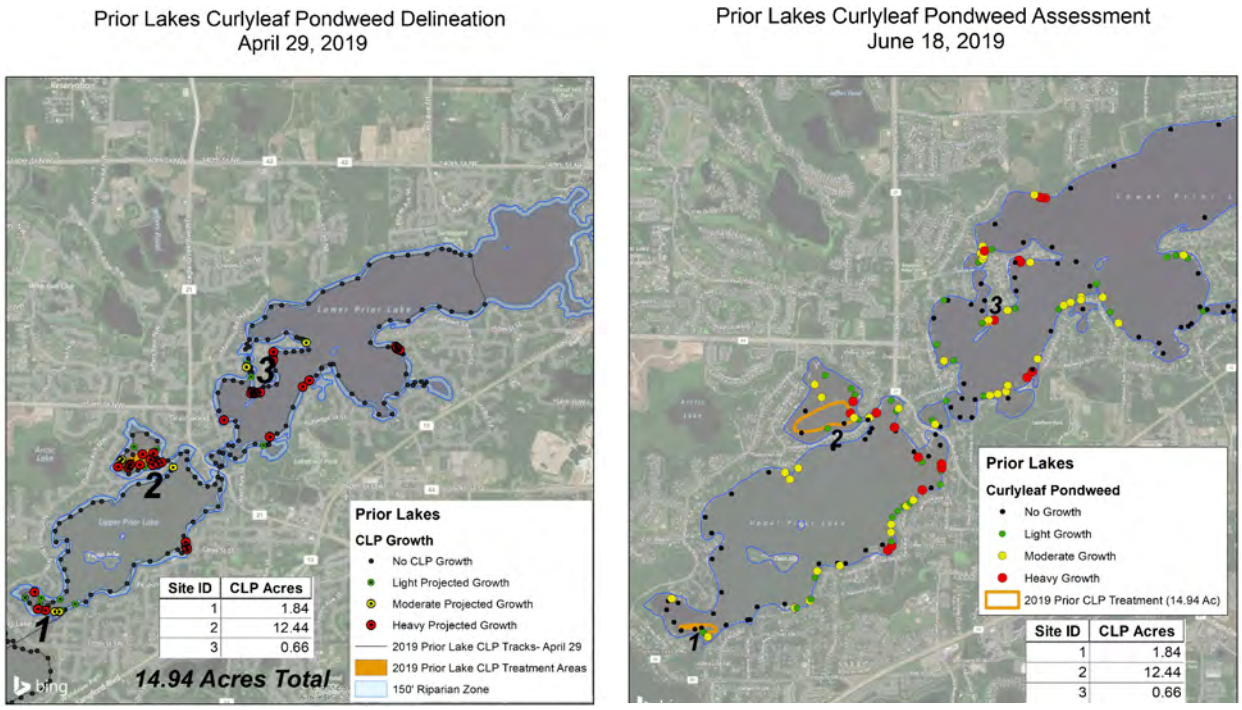
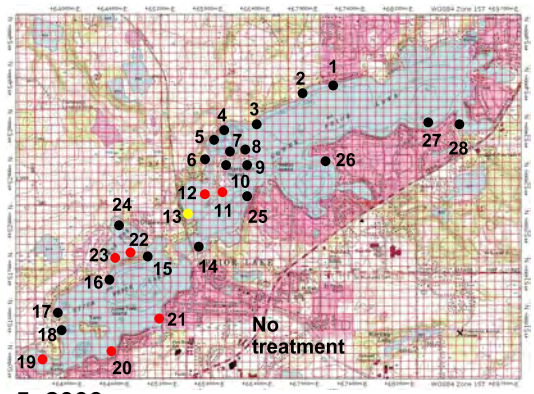


Figure 3. Map of curlyleaf pondweed delineation is shown on the left (April 29, 2019) and the curlyleaf assessment is shown on the right (June 18, 2019).

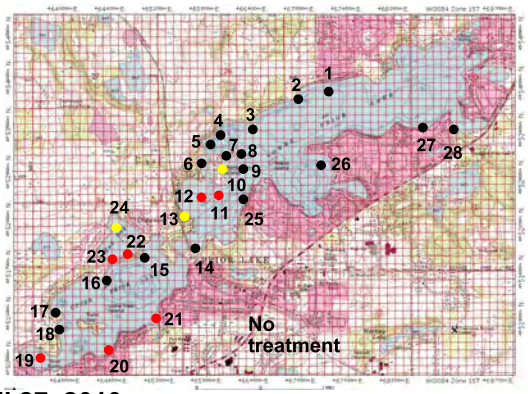
June 18, 2019 Representative Curlyleaf Conditions

Figure 4. Curlyleaf growth in Prior Lake.

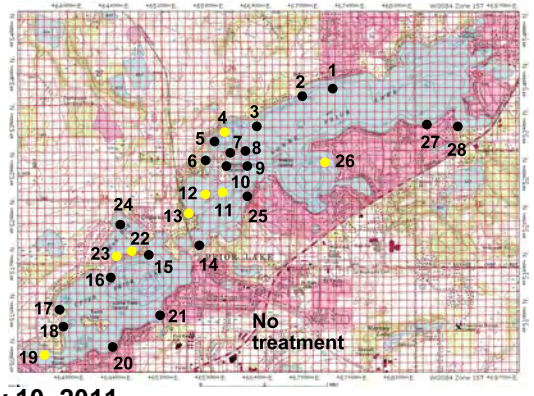
Previous Herbicide Treatments from 2009 - 2019



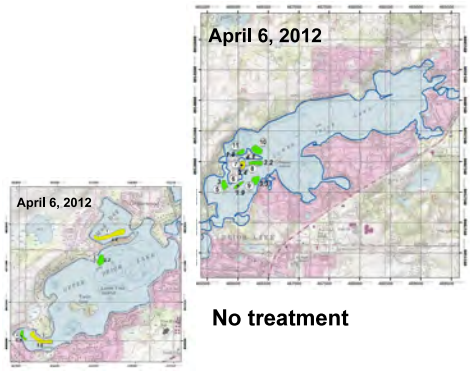
May 5, 2009



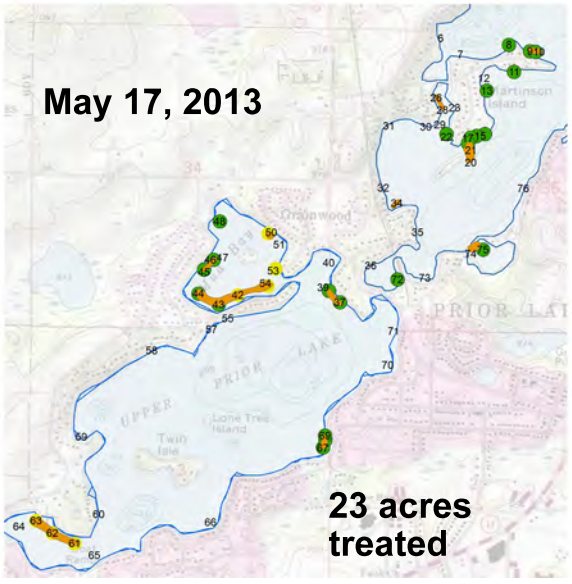
April 27, 2010



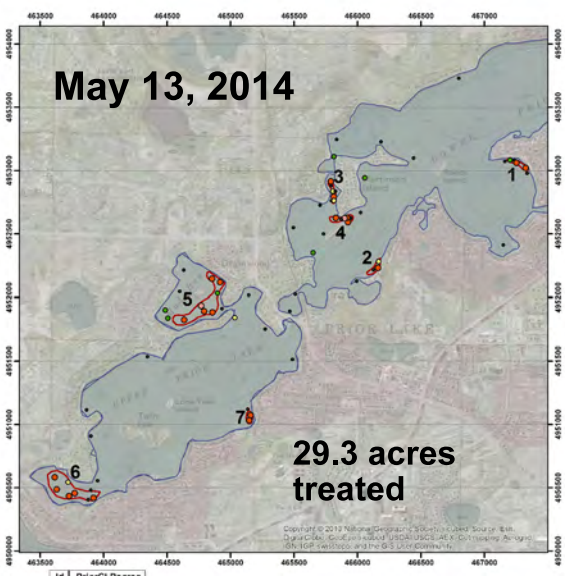
May 10, 2011



April 6, 2012

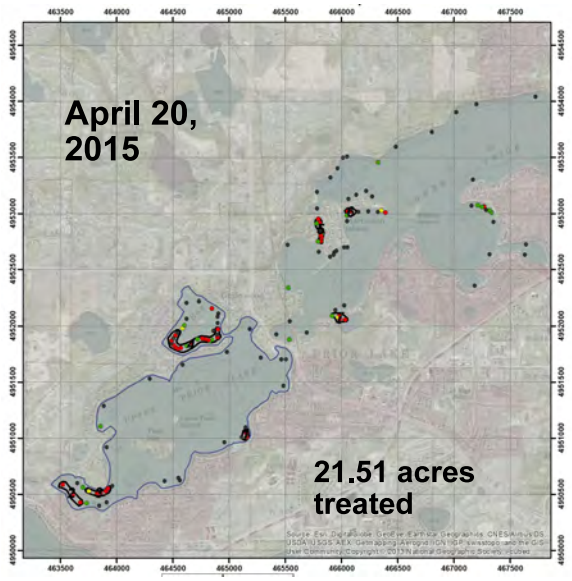


May 17, 2013

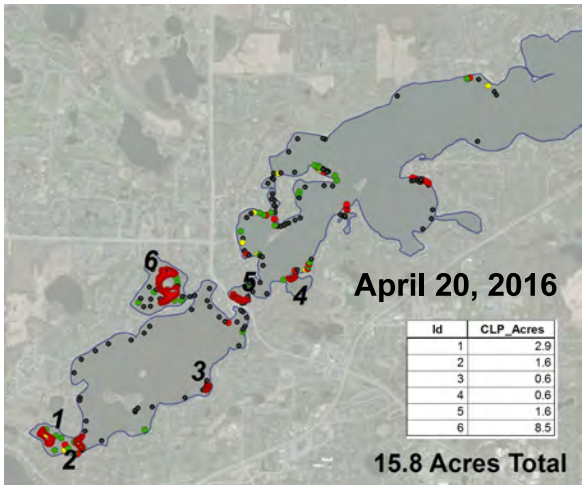


May 13, 2014

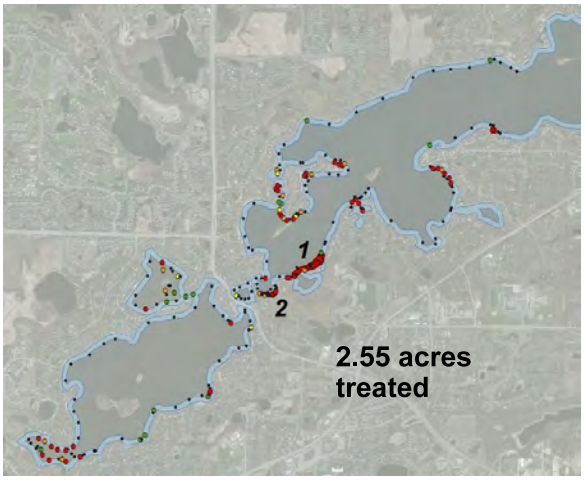
Figure 5. Previous herbicide applications locations from 2009 to 2019 on Upper and Lower Prior Lakes.



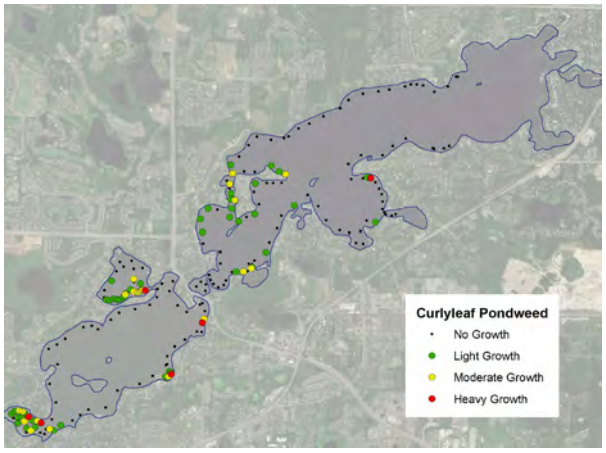
April 20, 2015



April 20, 2016



April 14, 2017



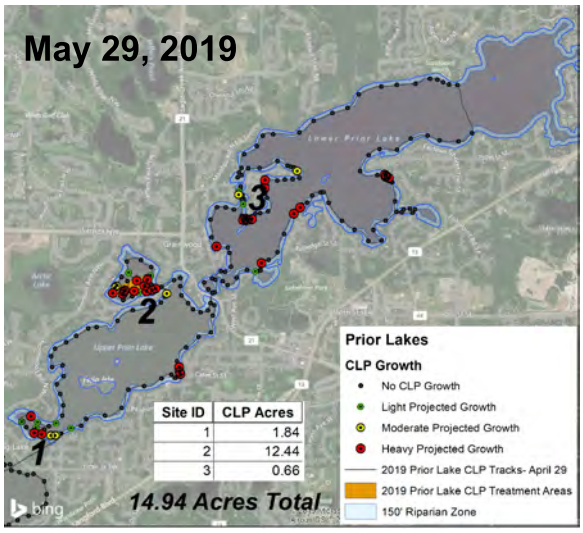


Table 2. Treatment summary from 2009-2019.

Year	Treatment
2009	No treatment
2010	No treatment
2011	No treatment
2012	No treatment
2013	23 acres
2014	29.3 acres
2015	21.5 acres
2016	15.8 acres
2017	2.55 acres
2018	No treatment
2019	14.9 acres

Figure 5. Previous herbicide applications locations from 2009 to 2019 on Upper and Lower Prior Lakes.

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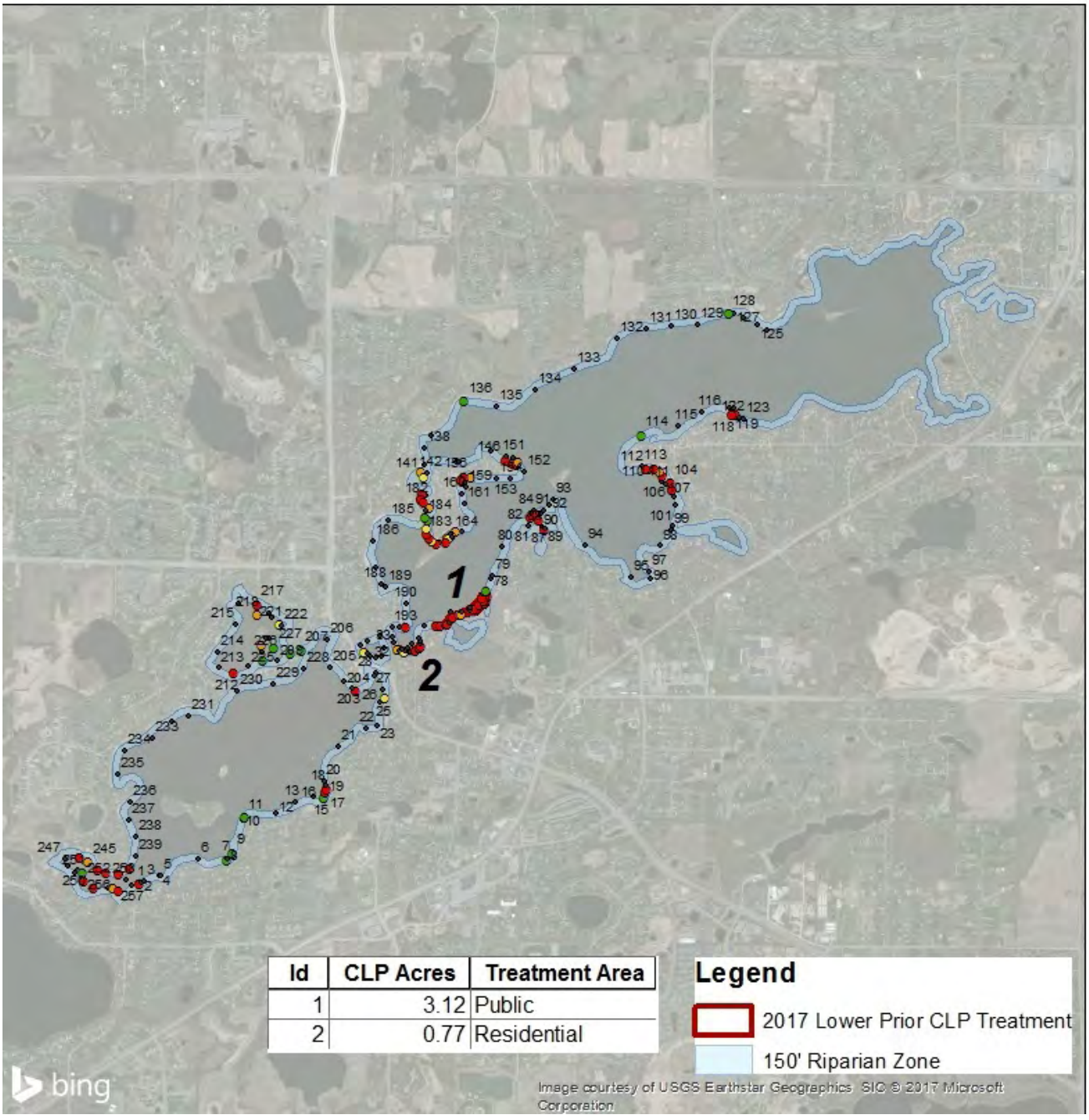
Currently, for Upper and Lower Prior Lake, the method has been to use past CLP growth history combined with early season scouting. Then if curlyleaf growth has indications of producing potential heavy growth, those areas are delineated and treatment is considered. That is the approach to be considered for 2020.

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.

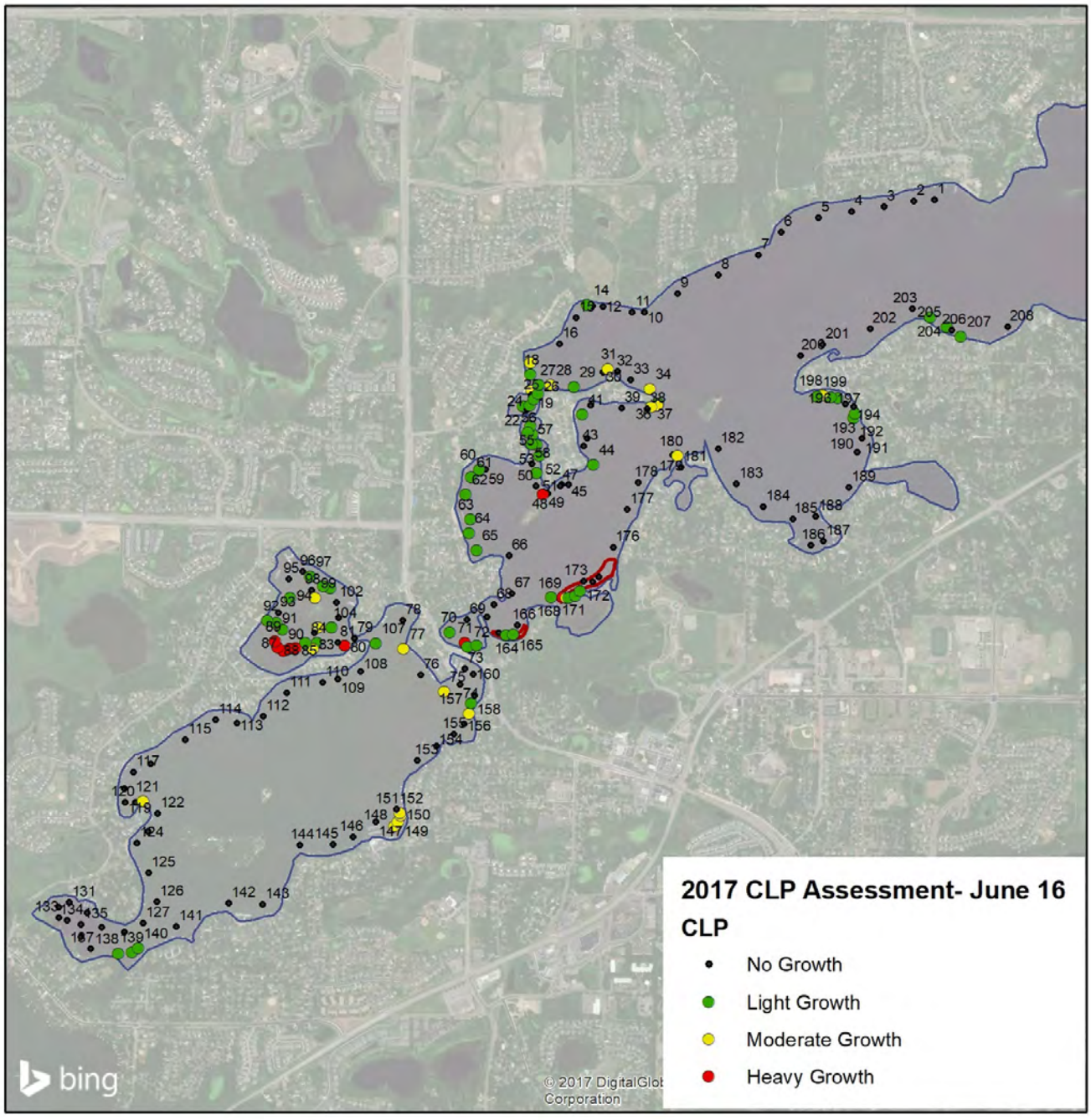
Example of heavy growth of curlyleaf pondweed in Prior Lake on June 1, 2016.

Appendix A - 2017 Delineation and Assessment



Sample sites numbered for the April 14, 2017 delineation.

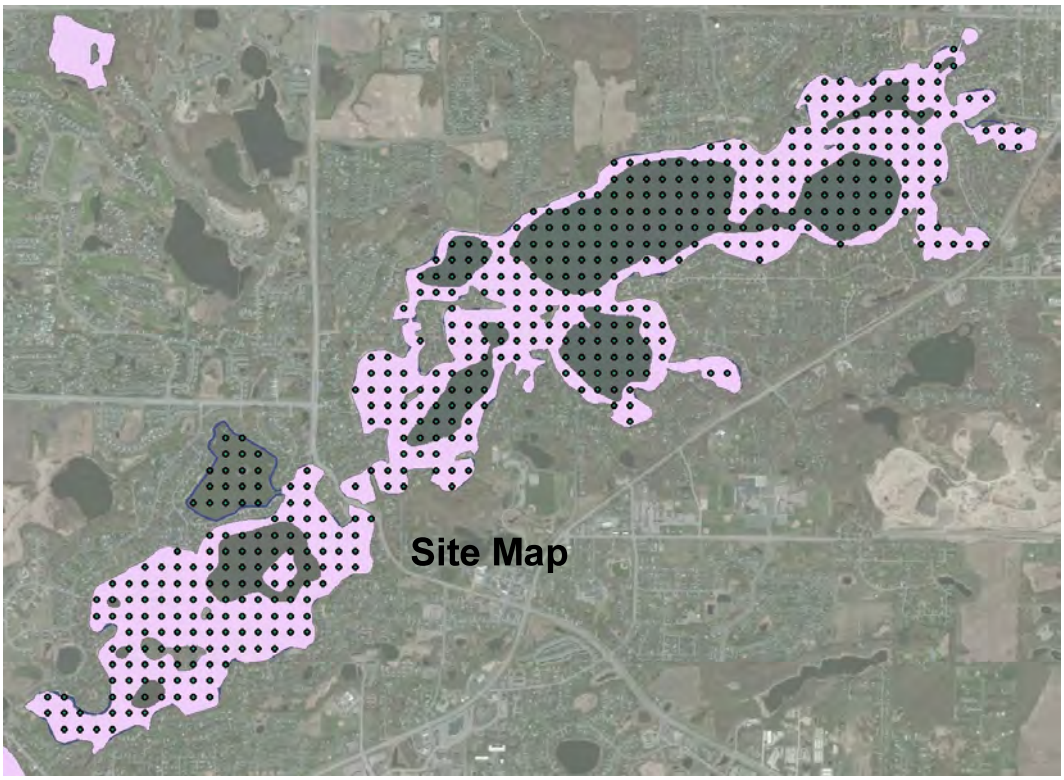
Prior Lake Curlyleaf Pondweed Assessment June 16, 2017



Sample sites numbered for the June 16, 2017 assessment.

Appendix B - 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. 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. Based on these sample sites, several plant distribution maps were constructed.

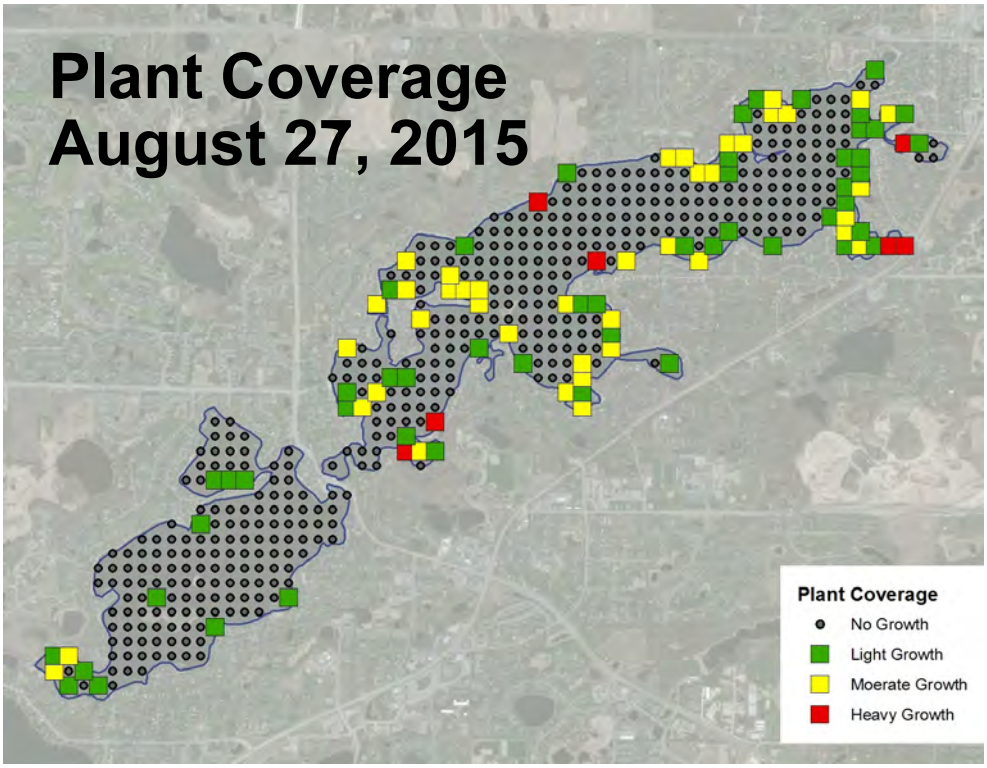


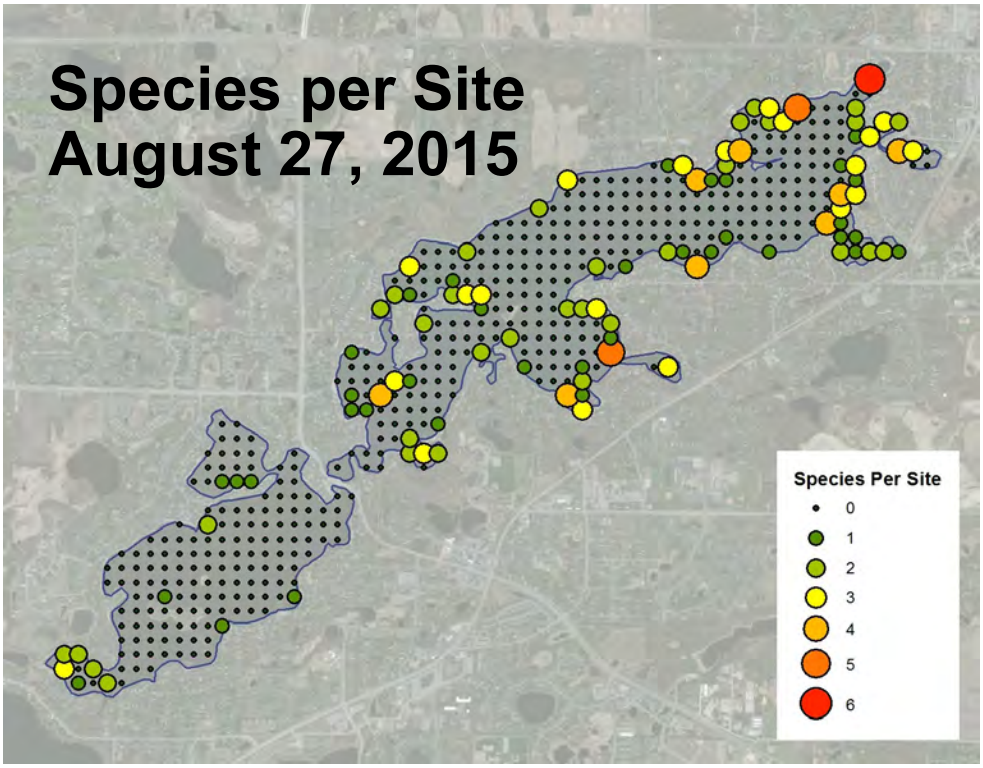
Point-intercept sample site map for Upper and Lower Prior Lakes for 2015. Pink shading represents the littoral zone. Mud Bay (north of Upper Prior Lake) is less than 15 feet and should be shaded pink.

Chart of Aquatic Plant Density Ratings

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.

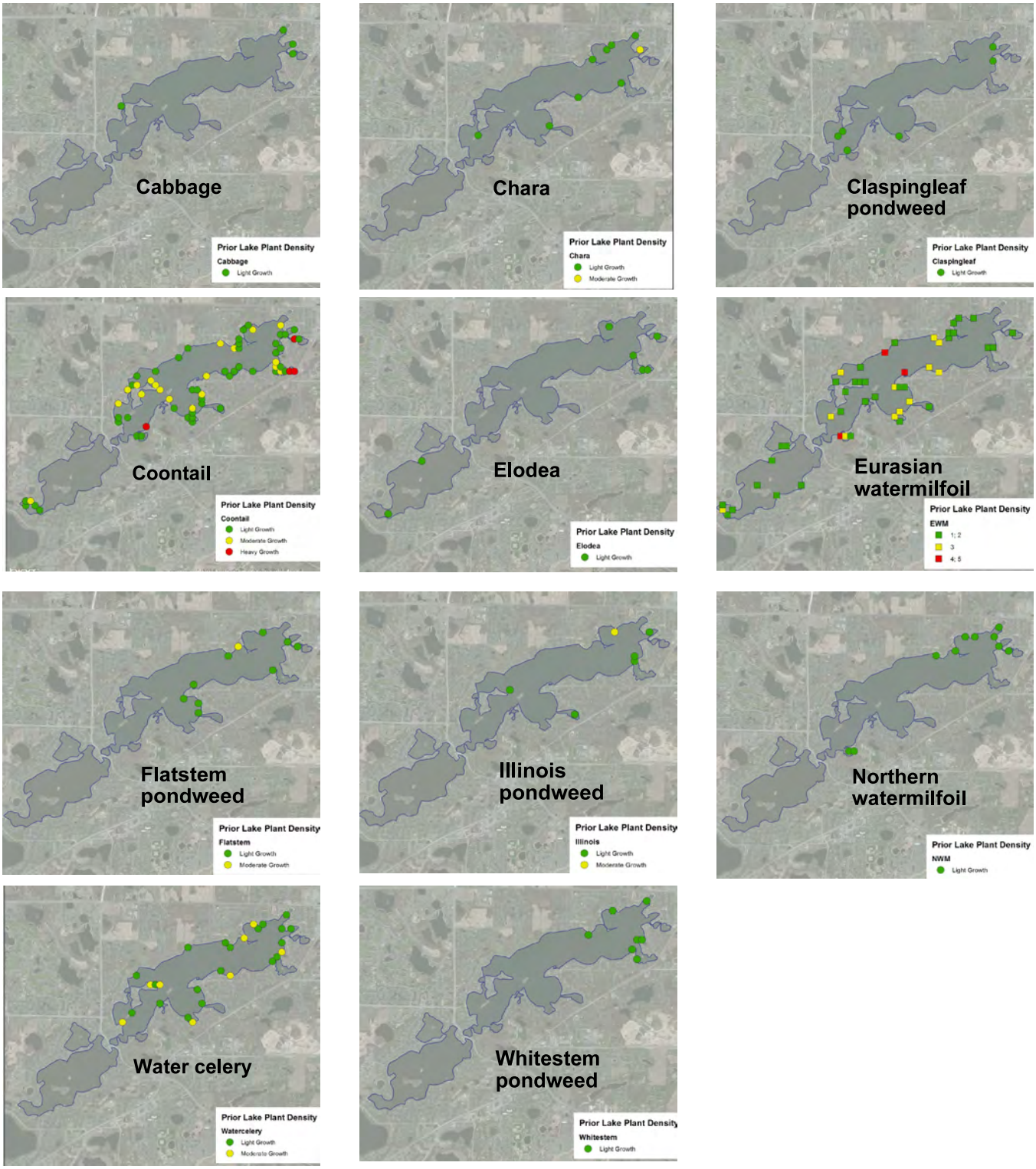
Results: A point-intercept aquatic plant survey was conducted on Upper and Lower Prior Lakes on August 27, 2015. Plant distribution and species richness were greater in Lower Prior compared to Upper Prior. Aquatic plants grew to a water depth of 15 feet in Lower Prior and to 6 feet in Upper Prior. Aquatic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





[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 below.



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.

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. A total of 12 species were observed. In Upper Prior, Eurasian watermilfoil was the dominant species. A total of 4 species were found.

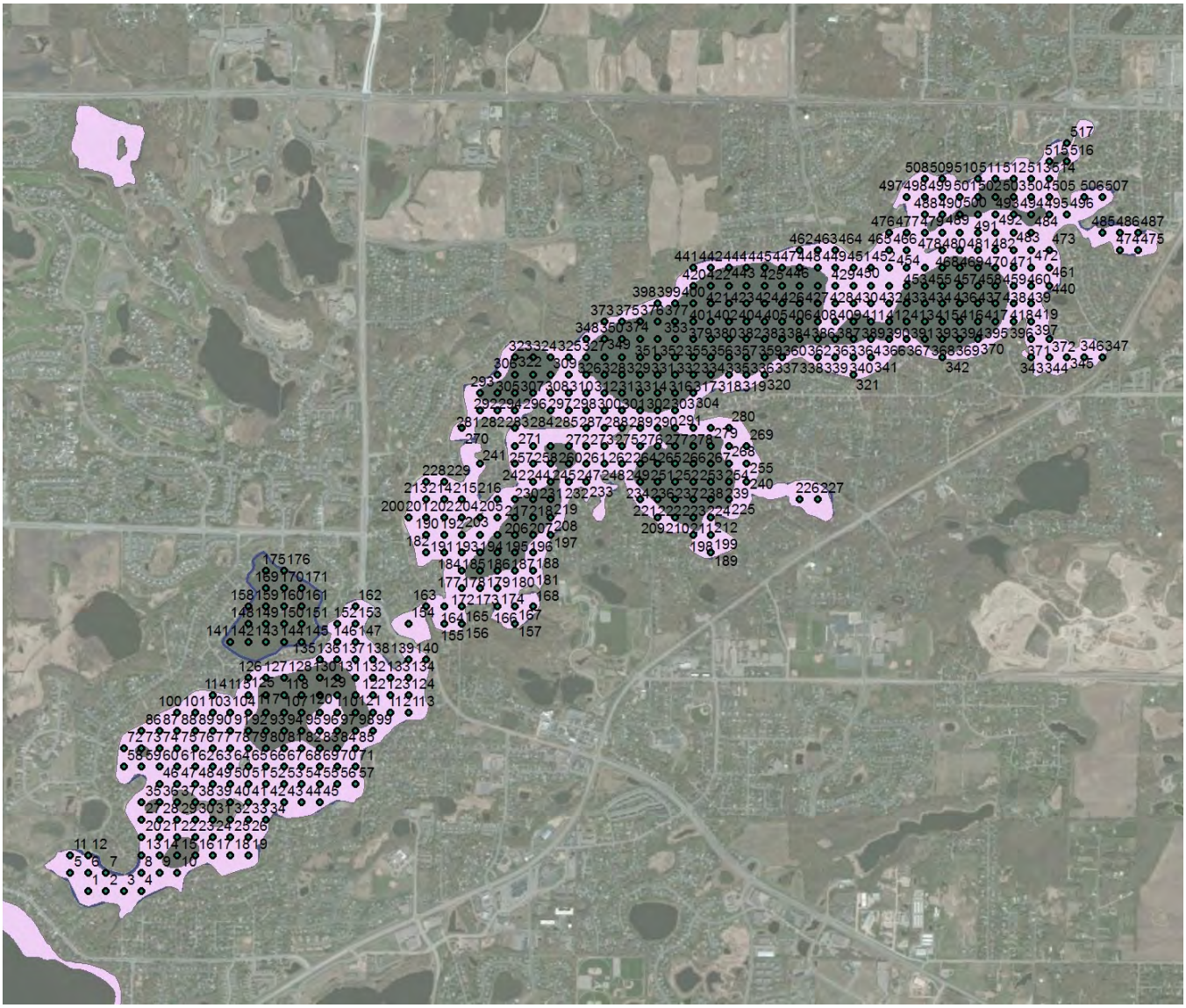
Aquatic plant species found at each sample site are listed below.

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

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



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.