Curlyleaf Pondweed on a Sample Rake Pole, Forest Lake on June 13, 2023

Curlyleaf Pondweed and Eurasian Watermilfoil Delineation, Treatment, and Assessment for Forest Lake, Washington County, 2023

	Delineation	Treatment	Assessment
CLP	May 9, 2023	May 22, 2023 (61.55 acres)	June 13, 2023
EWM	June 13, August 8, 2023	August 18, 2023 (8.41 acres)	September 20, 2023

Prepared for:
Comfort Lake-Forest Lake Watershed District
Forest Lake, Minnesota

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December 27, 2023

Curlyleaf Pondweed and Eurasian Watermilfoil Delineation, Treatment, and Assessment for Forest Lake, Washington County, 2023

Summary

Curlyleaf Pondweed (CLP) Delineation, Treatment, and Assessment: Forest Lake (MnDNR ID#82-015900) is a 2,271 acre lake in Washington County, Minnesota. Early season curlyleaf pondweed distribution and abundance were evaluated May 9, 2023.

In the delineation survey, heaviest potential curlyleaf growth was found in the Second Lake and potential early summer heavy growth was estimated at 61.55 acres for all 3 basins (Figure 1). A total of 61.55 acres of curlyleaf areas were treated on May 22, 2023.

A post treatment curlyleaf assessment was conducted on June 13, 2023. The June curlyleaf assessment found excellent control in the treated areas although there was some new curlyleaf pondweed sprouting in 3rd lake (Figure 1).

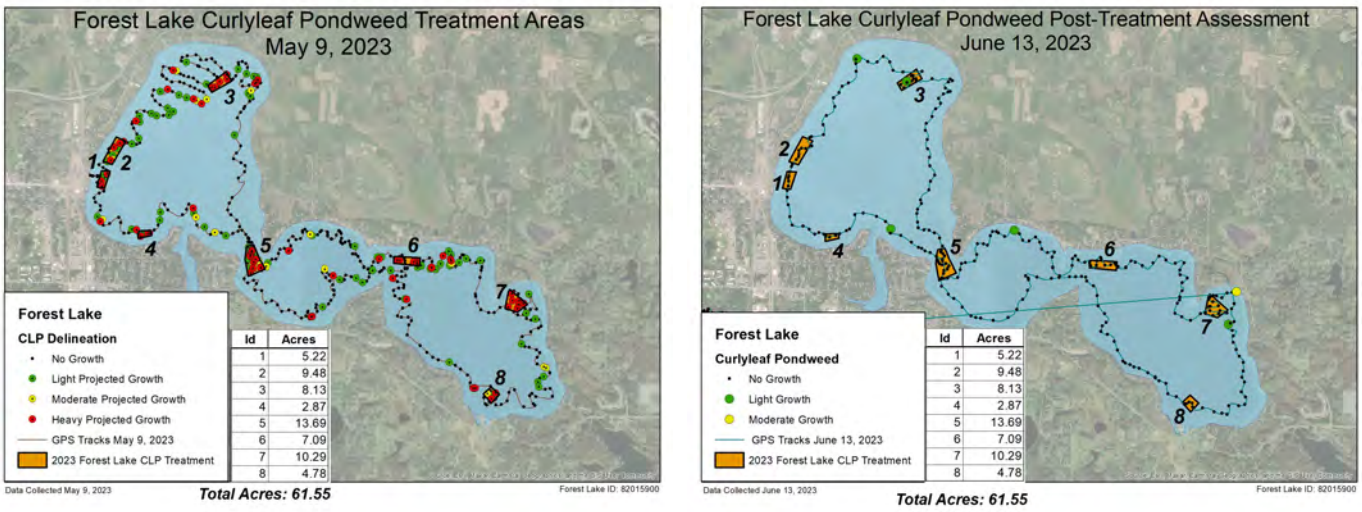


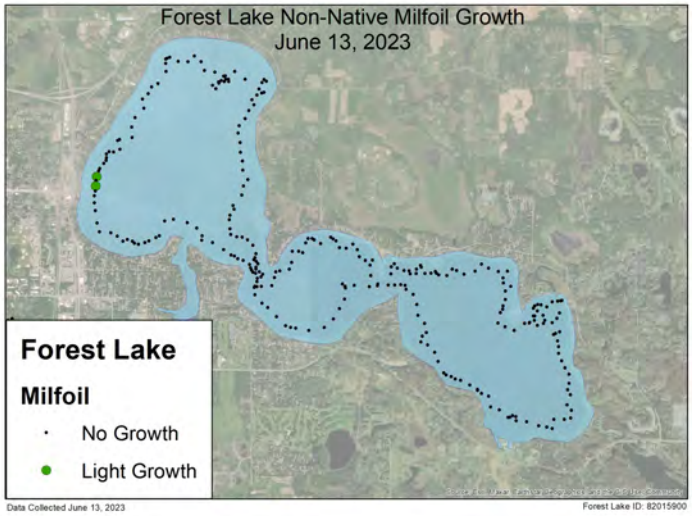
Figure 1. [left] DELINEATION: Map of curlyleaf pondweed distribution from the May 9, 2023 survey. Approximately 61.55 acres were delineated for CLP treatment.
[right] ASSESSMENT: Map of curlyleaf pondweed assessment sites for June 13, 2023.
Key: green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, and black dots = no curlyleaf growth. Orange shaded areas indicates treatment areas.

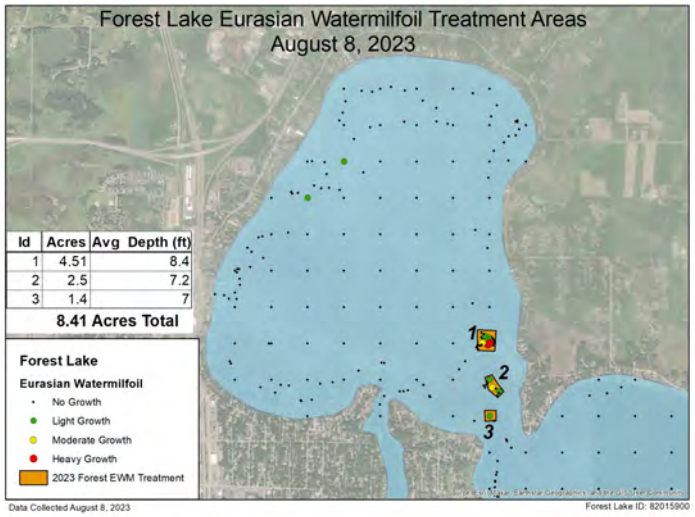
Eurasian Watermilfoil (EWM) Delineation, Treatment, and Assessment: EWM distribution and abundance were evaluated June 13, 2023. EWM growth was light and based on that delineation, no treatment was recommended at that time (Figure 2).

Later in the summer, another EWM delineation was conducted on August 8, 2023 and a few EWM locations were found that could be treated. Based on this delineation, a treatment area of 8.41 acres was constructed.

Treatment of 8.41 acres occurred on August 18, 2023 using ProcellaCor herbicide.

On September 20, 2023, after the EWM treatment, an EWM assessment found good control in the treated areas. Only a few scattered plants were observed outside of the treatment polygons. Northern watermilfoil was abundant in much of Forest Lake in water depths of 3 to 6 feet.





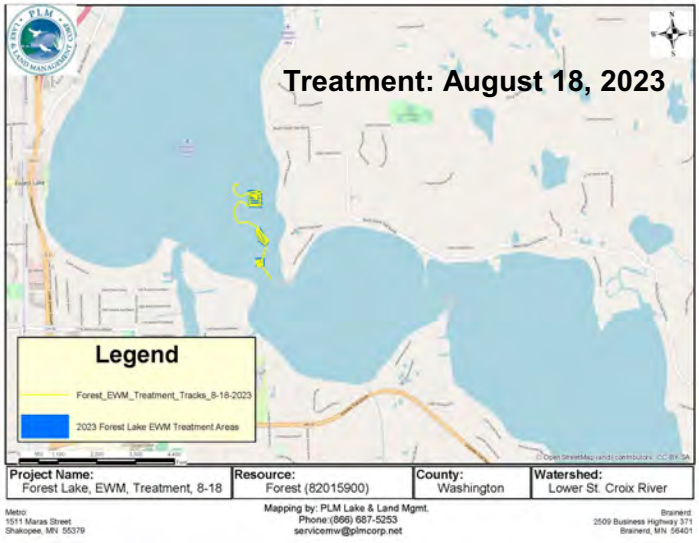


Figure 2. [top-left] DELINEATION: Map of EWM distribution from the June 13, 2023 survey. [top-right] Proposed treatment map, based on the August 8, 2023 EWM delineation. [bottom-left] Treatment map on August 18, 2023.

Summary of CLP and EWM Treatments from 2009-2023: Historically two non-native submerged aquatic plants were treated with herbicides and again in 2023 both curlyleaf pondweed and Eurasian watermilfoil were treated (Table 1 and Figure 3). Curlyleaf pondweed treatments have ranged from 16 to 169 acres from 2009 through 2023 with variability from year to year.

Eurasian watermilfoil was discovered in Forest Lake in 2015 and 30 acres were treated in the first year. From 2016 through 2023, EWM treatments have ranged from 5.86 acres to 53.83 acres (Table 1 and Figure 3). Eurasian watermilfoil has been confined mostly to the first lake but there is some growth in the second lake at the end of 2023. The greatest number of acres treated were in 2020 (Figure 3).

Table 1. Acres of non-native plants treated from 2009 through 2023.

	CLP (acres)	EWM (acres)
2009	98	
2010	155	
2011	168	
2012	155	
2013	60	
2014	101	
2015	88	30
2016	114	13.9
2017	169	33.35
2018	16.59	40.74
2019	99.11	49.34
2020	59.29	53.83
2021	120.33	5.86
2022	103.96	22.3
2023	61.55	8.41

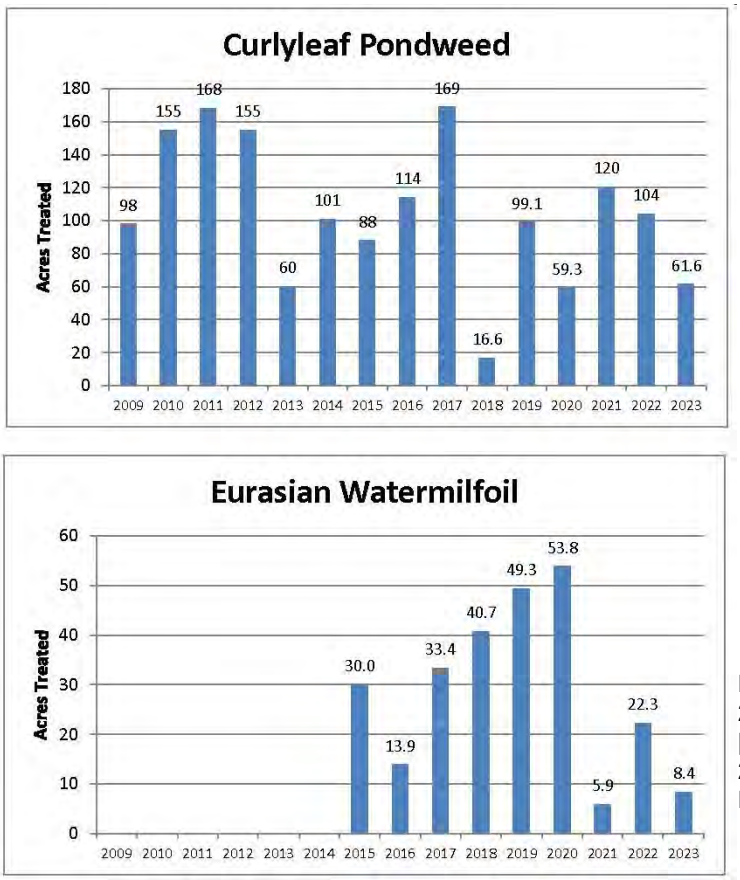


Figure 3. [top] Curlyleaf pondweed treated from 2009-2023.
[bottom] Eurasian watermilfoil treated from 2015-2023. Eurasian watermilfoil was first found in Forest Lake in 2015.

A hotspot map of curlyleaf pondweed treatment areas over the last 10 years is shown in Figure 4. There appears to be about 100 acres of persistent curlyleaf in the 3 basins. The actual acreage of curlyleaf treated varies from year to year based on climatic factors. A hotspot map of EWM areas that have been treated from 2015 to 2023 is shown in Figure 4. EWM is found primarily in the 1st lake.

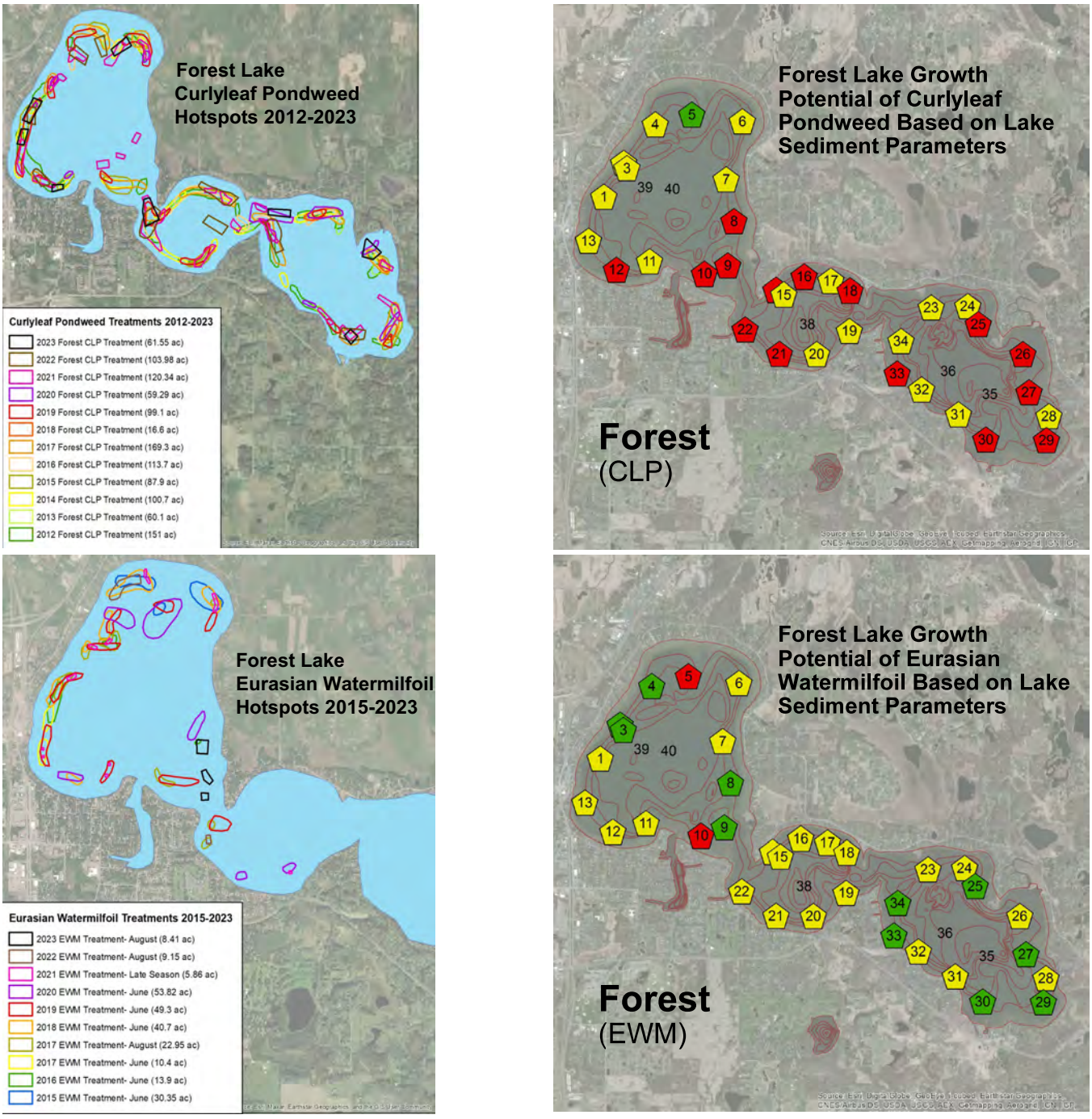


Figure 4. [top-left] Map of historical treatment of curlyleaf pondweed in Forest Lake, 2012-2023. [top-right] Curlyleaf potential growth based on lake sediment analyses for Forest Lake. Key: green = light growth, yellow = moderate growth, and red = heavy growth. [bottom-left] Map of historical treatment of Eurasian watermilfoil in Forest Lake, 2015-2023. [bottom-right] Eurasian watermilfoil potential growth based on lake sediment analyses for Forest Lake. Key: green = light growth, yellow = moderate growth, and red = heavy growth.

ADDITIONAL INFORMATION

Curlyleaf Pondweed and Eurasian Watermilfoil Delineation, Treatment, and Assessment for Forest Lake, Washington County, 2023

Size: 2,271 acres
Littoral area: 1,531 acres
Maximum depth: 37 feet

Overview

Forest Lake is located within Washington County. A meandering survey in 2023 was used to characterize the status of curlyleaf pondweed. A total of 520 sites were sampled. Curlyleaf pondweed was sampled at 153 sites out of 520 sites on the May 9, 2023 delineation survey. Eight areas of projected heavy growth totaling about 61.55 acres were delineated for treatment.

An initial curlyleaf pondweed delineation was conducted on May 9, 2023. A total of 61.55 acres of curlyleaf pondweed were treated on May 22, 2023. A follow-up curlyleaf pondweed assessment was conducted on June 13, 2023 to characterize the status of CLP at its peak growing period. Eurasian watermilfoil distribution and abundance were delineated on June 13 and August 8, 2023 and 8.41 acres were treated in 2023. An EWM assessment for all treatment areas occurred on September 20, 2023. EWM was sparse.

Figure 5. After treatment, curlyleaf pondweed growth was light to moderate on June 13, 2023 and was sampled at 6 sample sites.

Methods

Curlyleaf Pondweed: 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 treated. This delineation method was used for spot lake treatments in Gleason Lake and has worked for other lakes as well (McComas et al, 2015*).

Eurasian Watermilfoil: A Eurasian watermilfoil delineation was conducted by Blue Water Science on June 13 (284 sample sites) and August 8 (99 sample sites). The delineation involved surveying the entire lake nearshore area, observing milfoil growth, and sampling aquatic plants with rakes. Areas to be treated were selected based on the growth status of milfoil in mid June, the known previous occurrence of EWM and the importance for navigation and/or recreation in the area.

A herbicide application was conducted in 2023 on 8.41 acres for EWM control. A follow-up EWM assessment was conducted by Steve McComas, Blue Water Science, on September 20, 2023 to evaluate the EWM growth. EWM density ratings used in the June delineation and August assessment are shown in the chart below.

Chart of Density Ratings for Plant Growth

Aquatic plant density ratings from 1 to 3.

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 Delineation on May 9, 2023

In the delineation survey, heaviest potential curlyleaf growth was found in many locations around the full lake, summer heavy growth was estimated at 61.55 acres for all 3 basins (Figure 6). A total of 61.55 acres of curlyleaf areas were treated on May 22, 2023.

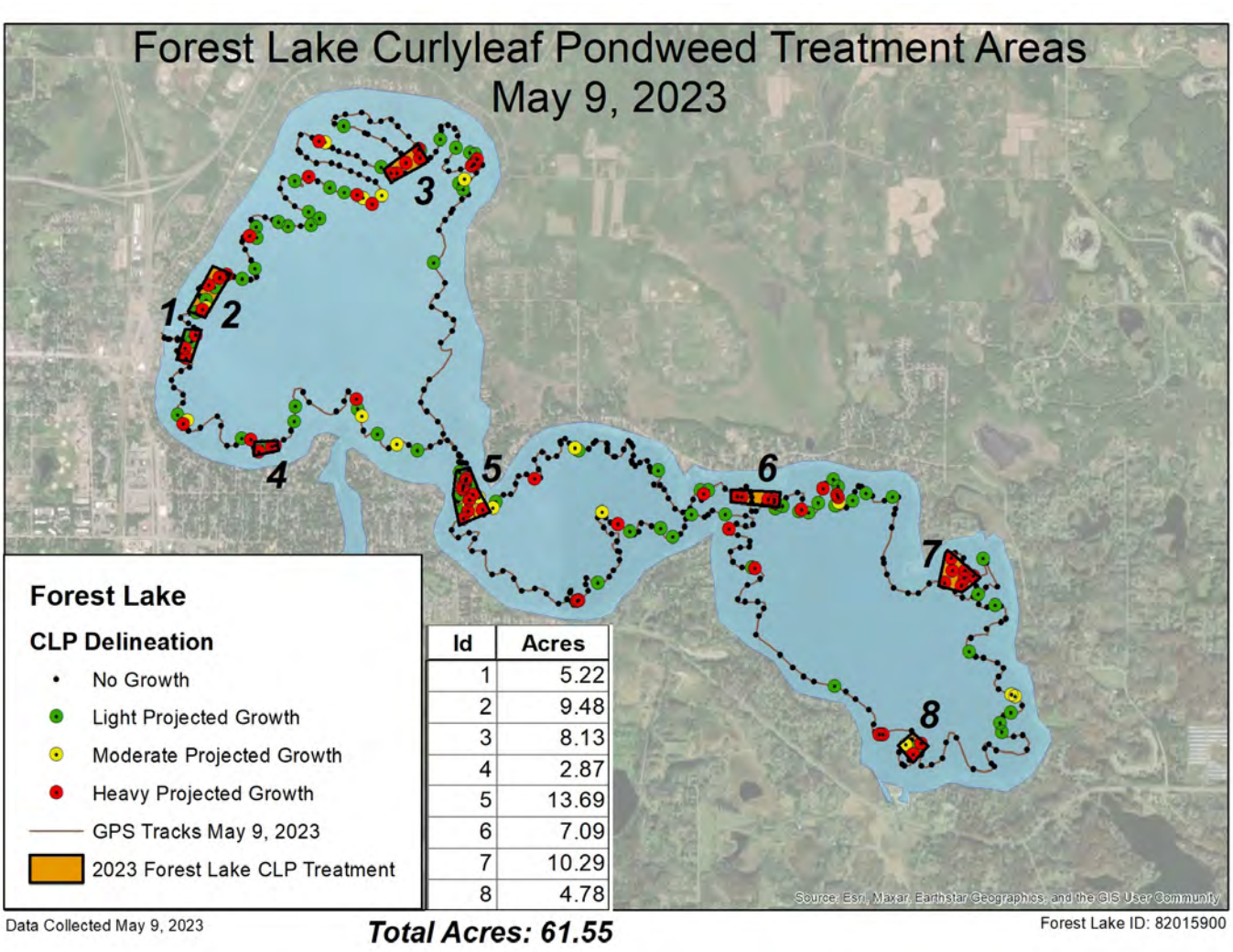


Figure 6. DELINEATION: Map of curlyleaf pondweed distribution from the May 9, 2023 survey. Approximately 61.55 acres were delineated for CLP treatment.

Curlyleaf Pondweed Assessment on June 13, 2023

A total of 61.55 acres of curlyleaf areas were treated on May 22, 2023. A post treatment curlyleaf assessment was conducted on June 13, 2023. The June curlyleaf assessment found excellent control in the treated areas although there was some new curlyleaf pondweed sprouting in a few locations in each lake (Figure 7).

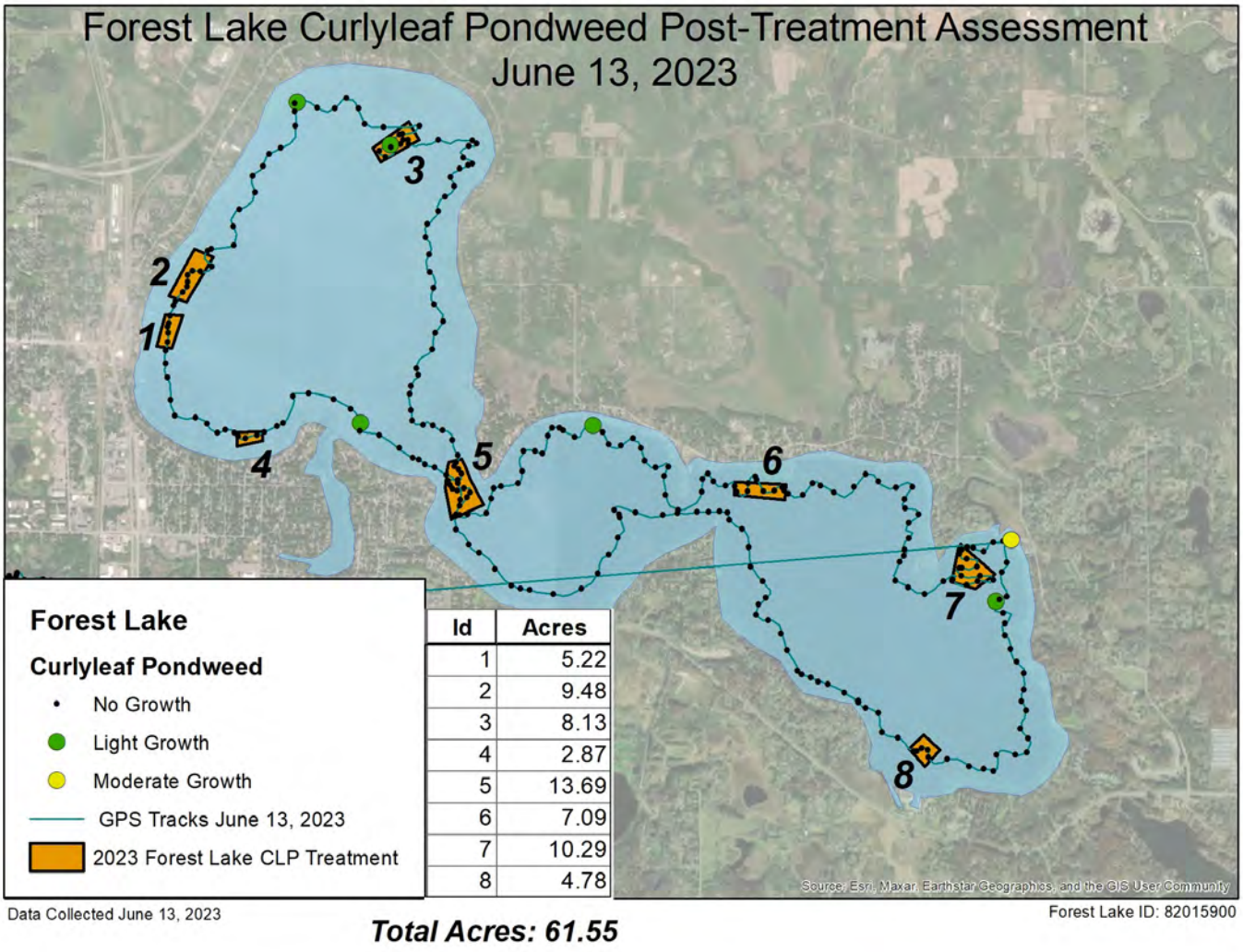


Figure 7. ASSESSMENT: Map of curlyleaf pondweed assessment sites for June 13, 2023.
Key: green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, black dots = no curlyleaf growth, and brown dots = dead curlyleaf.

Compilation of Curlyleaf Treatment Areas from 2012 through 2023

Curlyleaf pondweed growth patterns are somewhat established in Forest Lake. All treatment areas from 2012 through 2023 are compiled in Figure 8. These “hotspot” areas represent about 100 acres of curlyleaf growth. The curlyleaf growth pattern varies from year to year. Some years there will be more than 100 acres and other years there will be less than 100 acres to treat (Table 2). Variables to growth include previous treatments, snow cover, ice off, sunny days, and water temperatures.

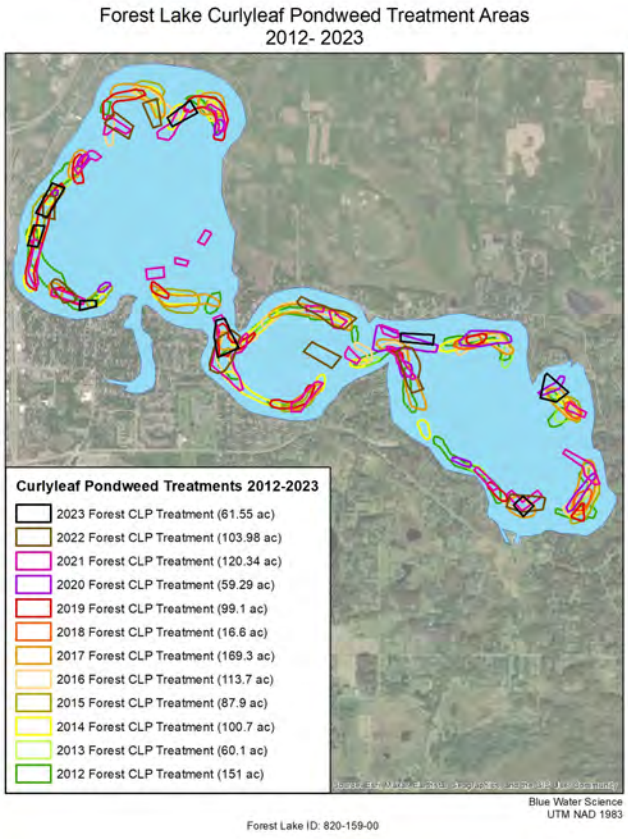


Figure 8. Map of historical treatment of curlyleaf pondweed in Forest Lake, 2012-2023, with hotspot areas shaded black.

Table 2. Acres of non-native plants treated from 2009 through 2023.

	CLP (acres)	EWM (acres)
2009	98	
2010	155	
2011	168	
2012	155	
2013	60	
2014	101	
2015	88	30
2016	114	13.9
2017	169	33.35
2018	16.59	40.74
2019	99.11	49.34
2020	59.29	53.83
2021	120.33	5.86
2022	103.96	22.3
2023	61.55	8.41

Eurasian Watermilfoil Delineation on June 13, 2023

EWM distribution and abundance were evaluated June 13, 2023. EWM growth was light and based on that delineation, no treatment was recommended at that time (Figure 9).

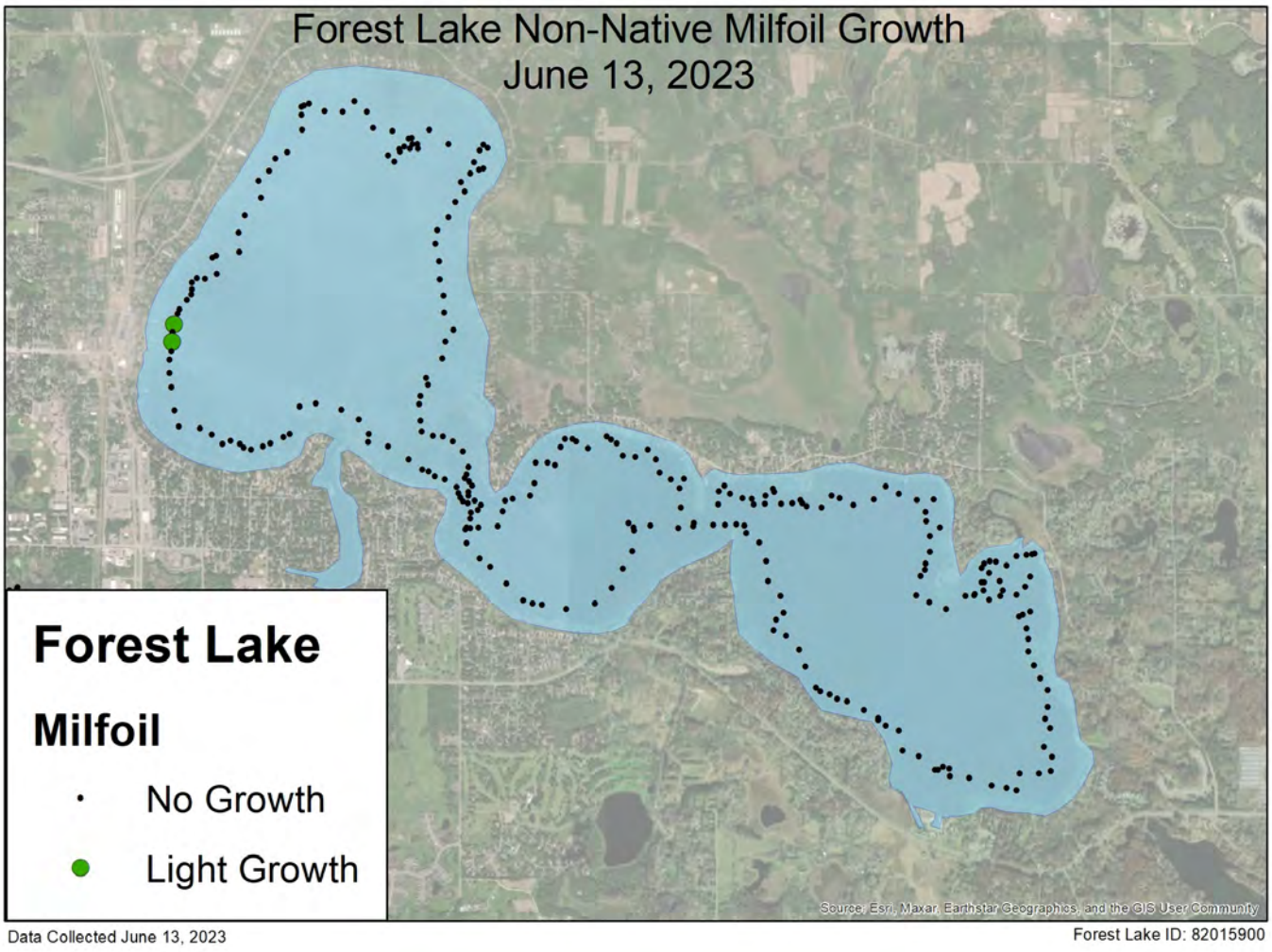


Figure 9. DELINEATION: Map of EWM distribution from the June 13, 2023 survey, no areas were delineated for EWM treatment.

Eurasian Watermilfoil Delineation on August 8, 2023

A second EWM delineation was conducted on August 8, 2023. Based on this delineation, three treatment area of 8.41 acres were delineated. Treatment of EWM was conducted on 8.41 acres on August 18, 2023.

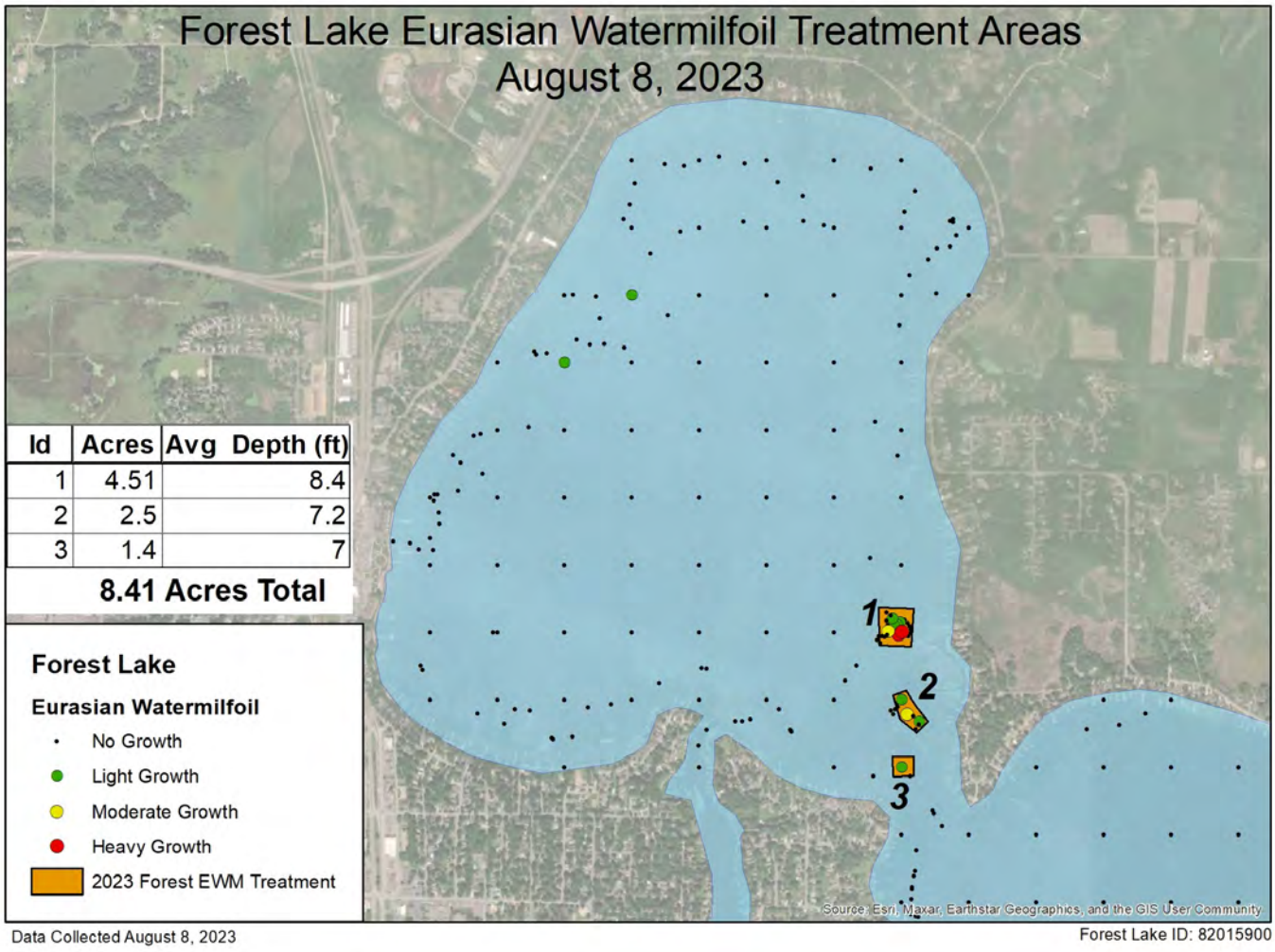


Figure 10. DELINEATION: Map of EWM distribution from the August 8, 2023 survey, 8.41 acres were delineated for EWM treatment.

Eurasian Watermilfoil Treatment 2023

A total of 8.41 acres were treated in 2023 using ProcellaCOR at 5.97 ounces per acre-foot (total of 417 units) and Tribune at 1.25 gallons per acre (total of 10.5 gallons)(Figure 11).

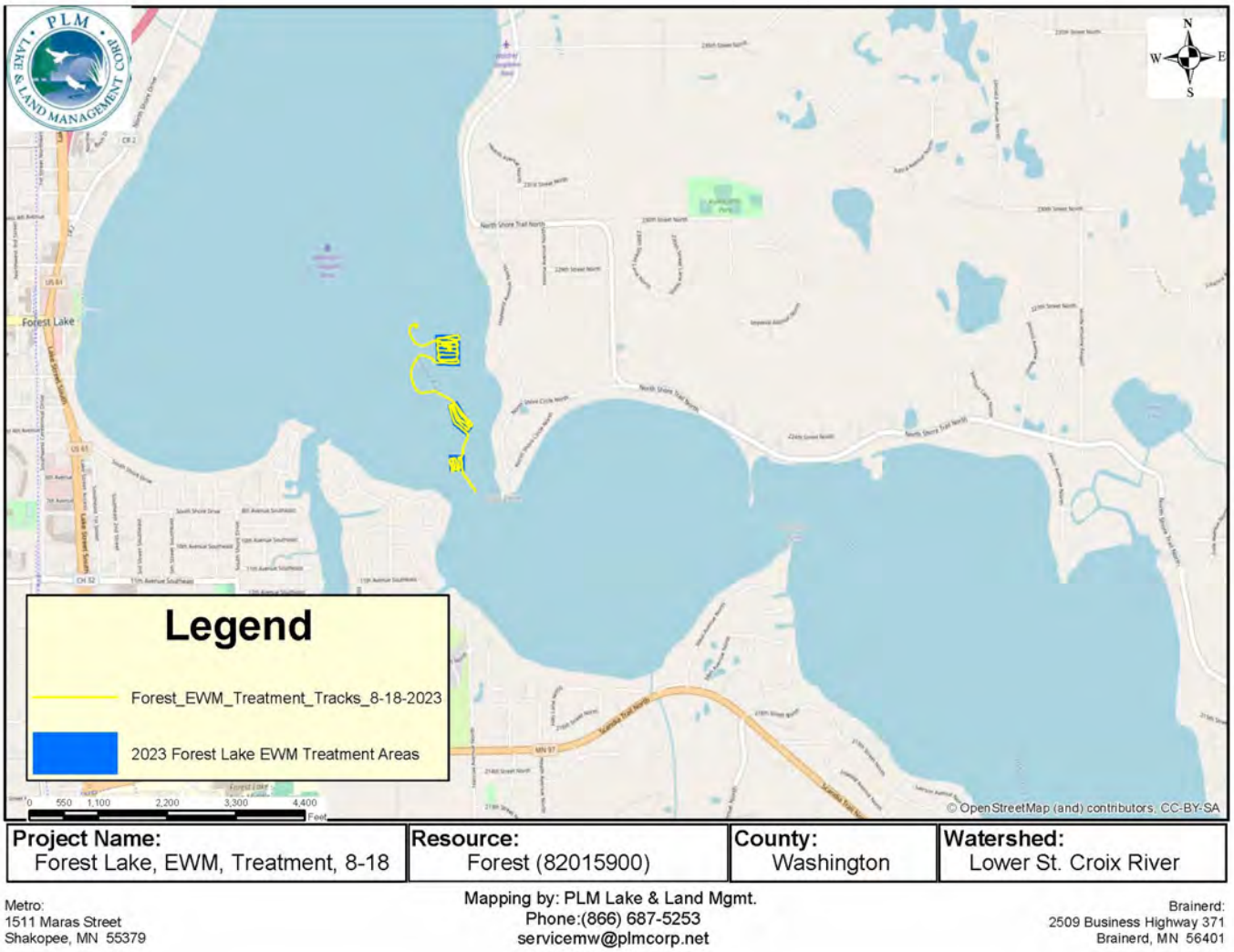


Figure 11. EWM treatment areas in 2023.

Eurasian Watermilfoil Assessment on September 20, 2023

After the EWM treatment on August 18, 2023, an EWM assessment on September 20, 2023 was conducted using a combination of visual inspections and rake sampling. No EWM growth was observed in the treated areas or any other sites in Forest Lake. Survey sites at the public accesses is shown in Figure 12.

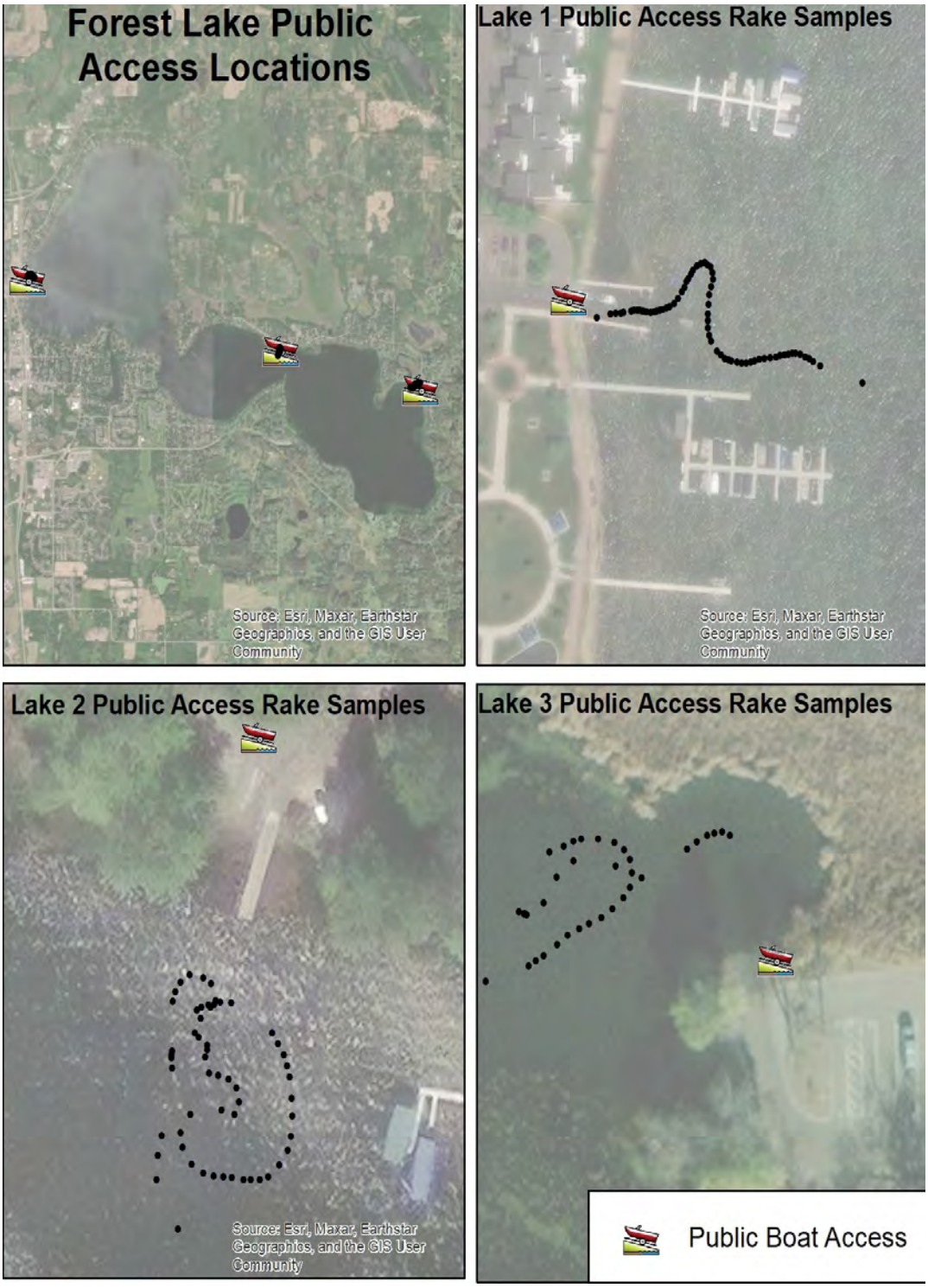


Figure 12. ASSESSMENT: Map of some of the EWM survey sites on September 20, 2023.

Eurasian Watermilfoil Treatments from 2015-2023

Eurasian watermilfoil was first observed in Forest Lake in 2015. EWM treatments have occurred in 2015 through 2023. All areas that have been treated are shown in Figure 13. EWM growth is primarily in the first lake however some EWM has been found into second lake in previous years at the end of 2023.

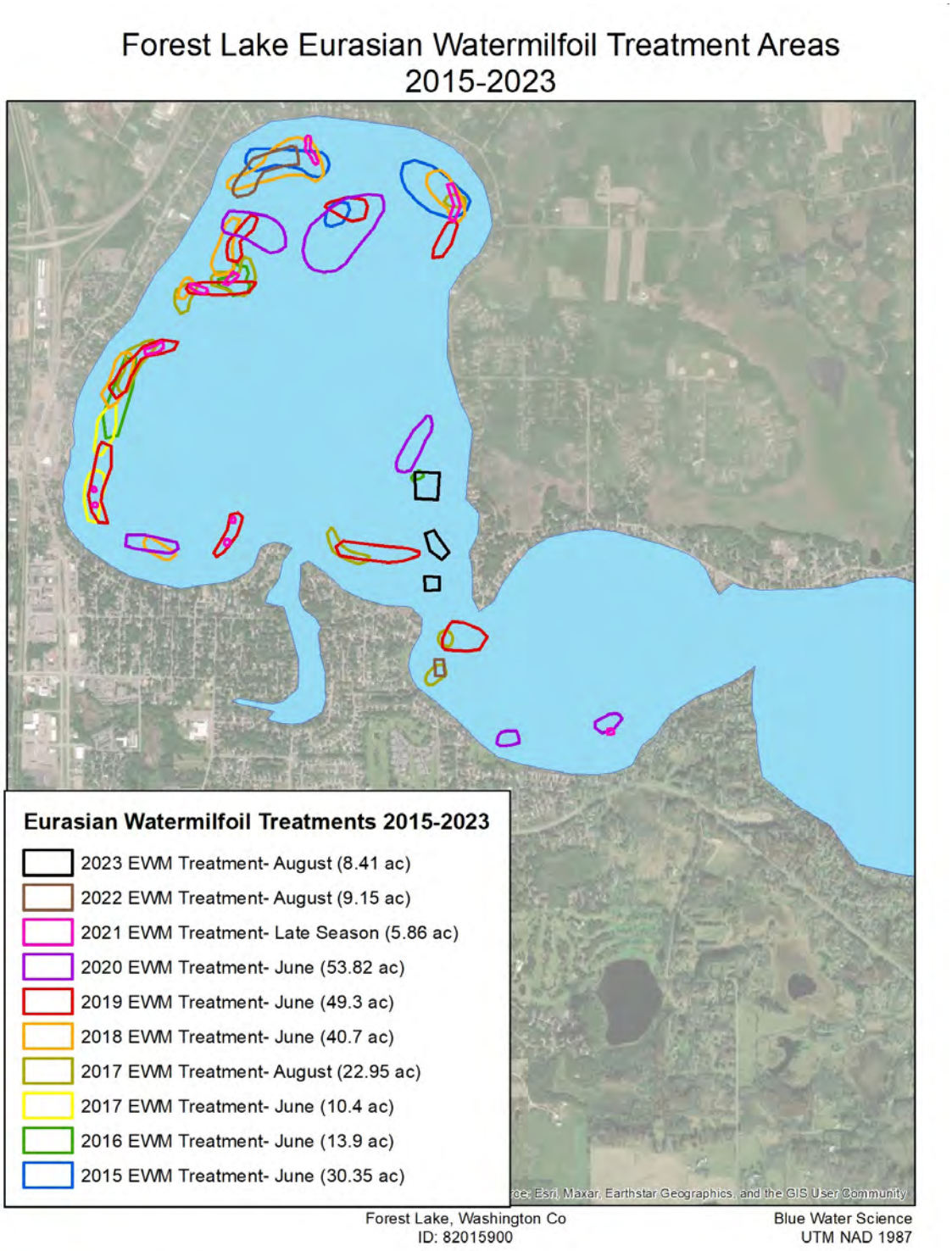


Figure 13. Map of Eurasian watermilfoil treatment areas in Forest Lake, 2015-2023.

What's Next for 2024?

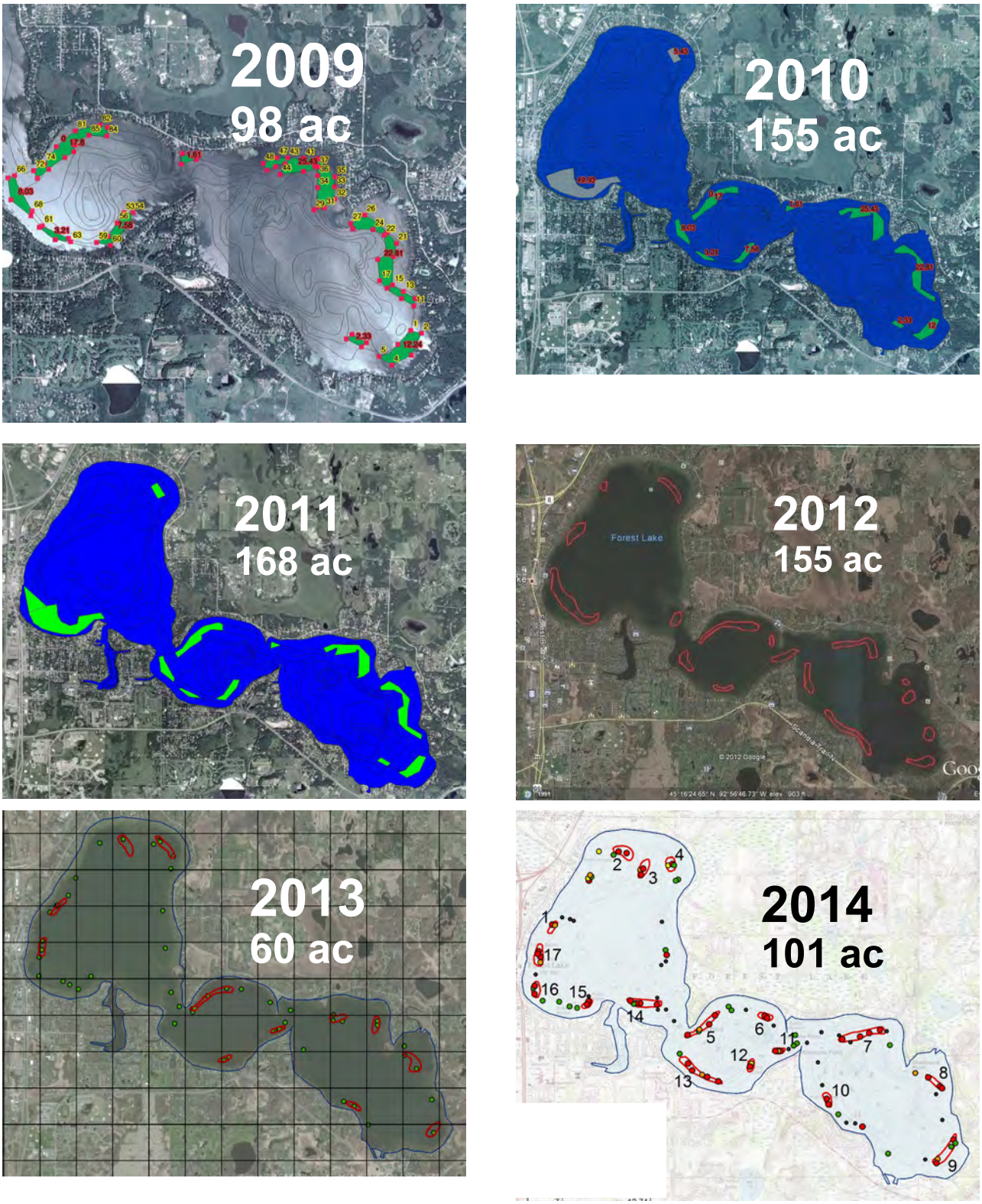
Curlyleaf Pondweed: Treating heavy growth of curlyleaf pondweed based on early season curlyleaf distribution is a challenge. Curlyleaf in late April or early May has just started to go into a rapid growth phase. However, not all early season curlyleaf growth will result in heavy curlyleaf growth in June. 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 Forest Lake, the method has been to use past treatment history combined with early season scouting and then a recheck after treatment to evaluate treatment effectiveness and see if curlyleaf areas were missed. Using this technique, most of the potential heavy growth of curlyleaf pondweed was controlled in 2023.

For 2024, it is proposed to delineate CLP later in April or early May to capture late sprouting CLP. Also the herbicide diquat could be considered for CLP treatments as well.

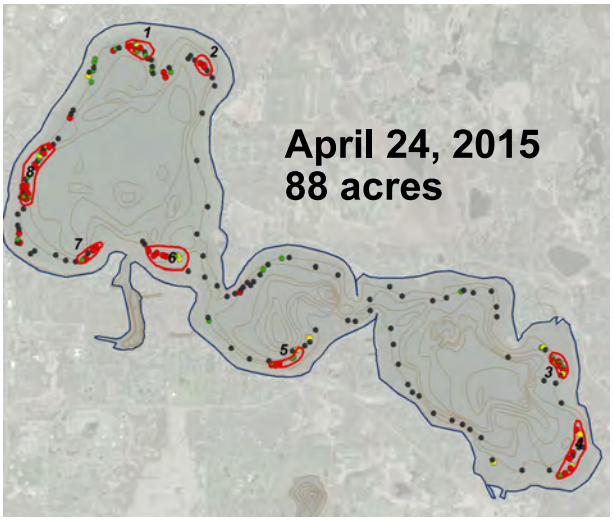
Eurasian Watermilfoil: Two passes with a liquid 2,4-D herbicide for EWM control prevented the occurrence of heavy EWM growth in 2016. The first pass treated half the area and the second pass treated the other half of the area. The same basic approach for EWM control was used in 2017 through 2019. In 2020 through 2023, a combination of 2 herbicides (diquat and ProcellaCPR) were applied and control was very good. This treatment approach could be considered by 2024, if treatment is needed.

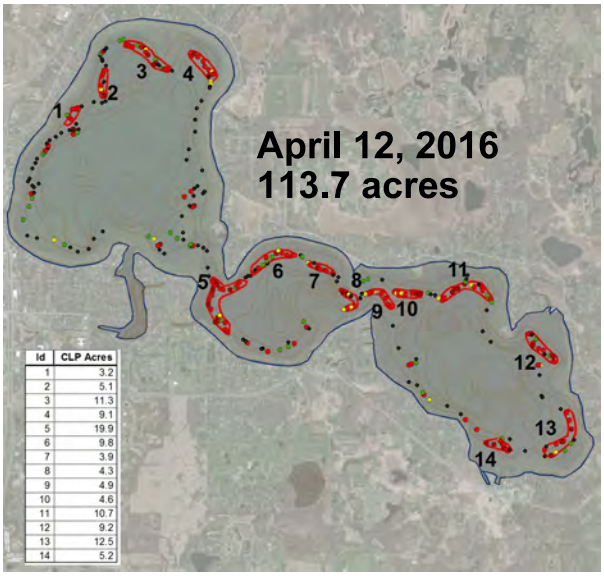
APPENDIX

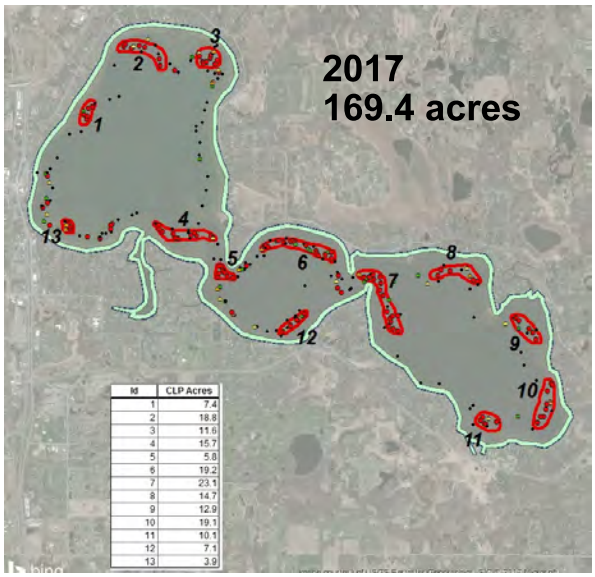
Forest Lake Curlyleaf Treatment Areas for 2009-2023

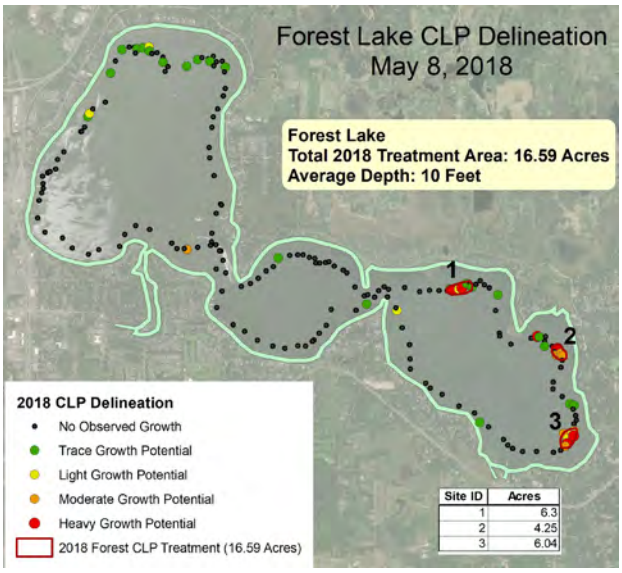


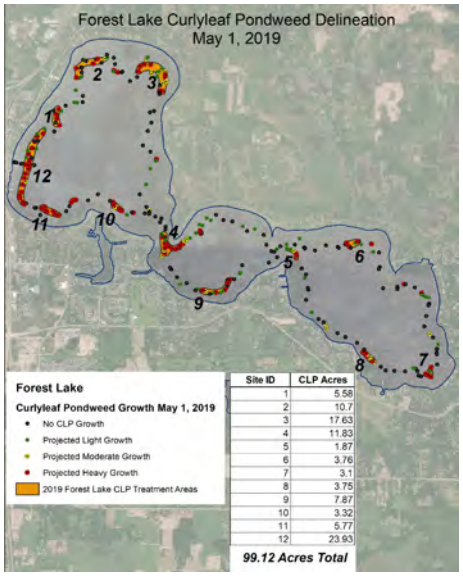
Curlyleaf treatment areas in 2009 through 2014.

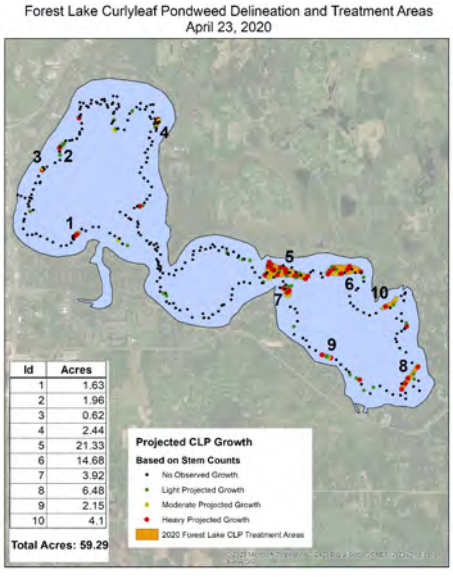




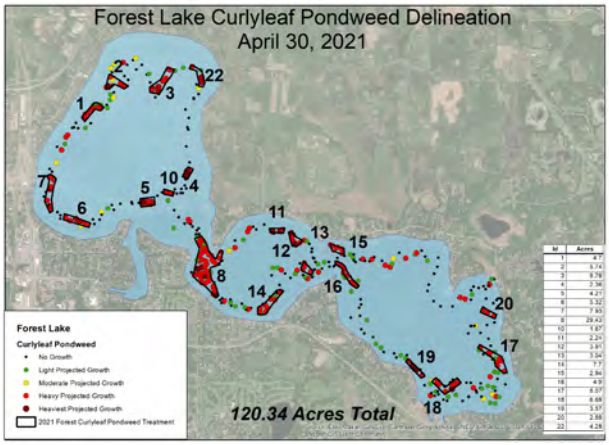


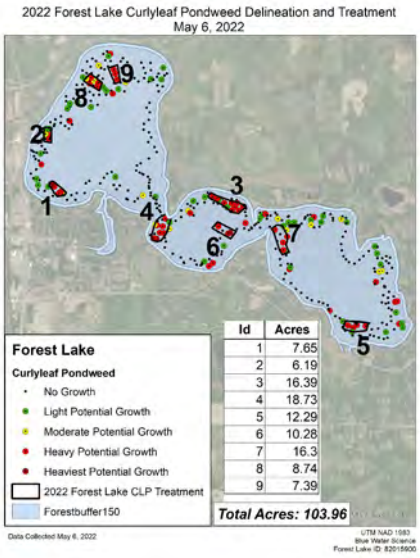


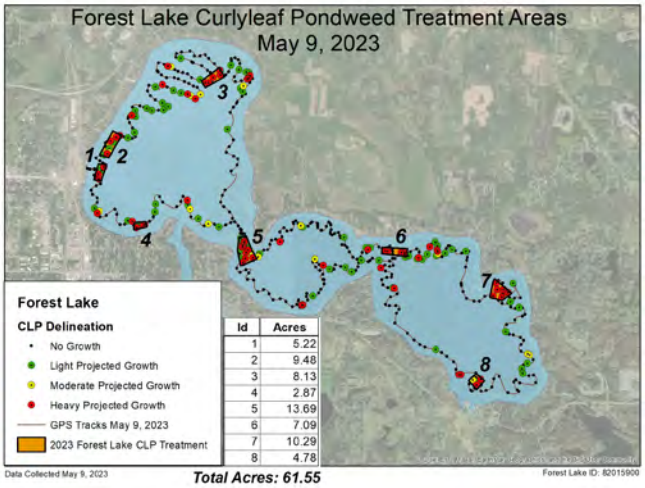




Curlyleaf treatment areas in 2015 through 2020.

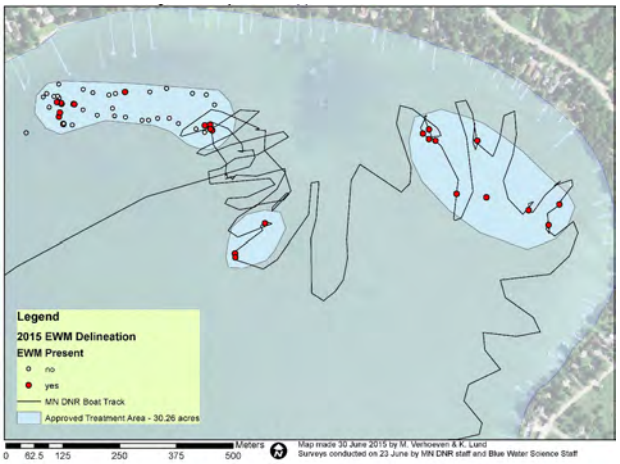


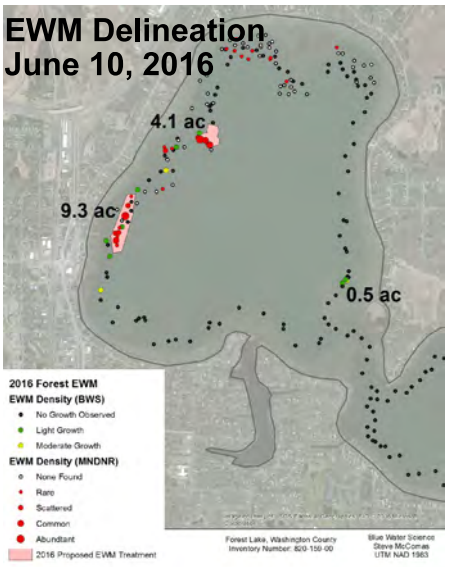


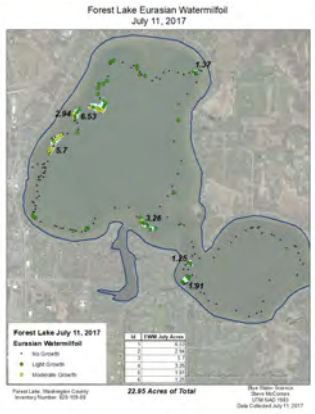


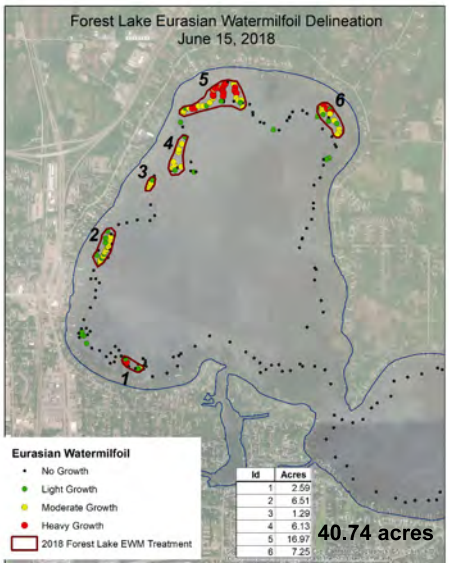
Curlyleaf treatment areas in 2021 through 2023.

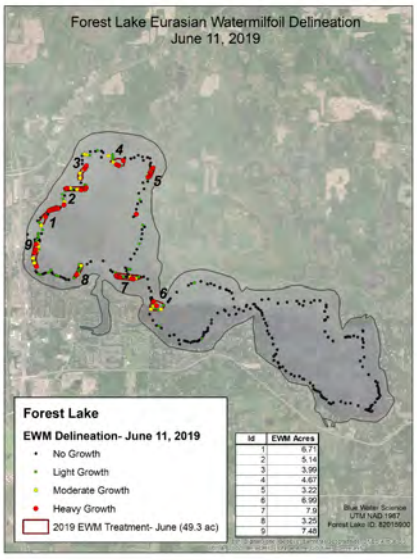
Forest Lake EWM Treatment Areas for 2015-2023

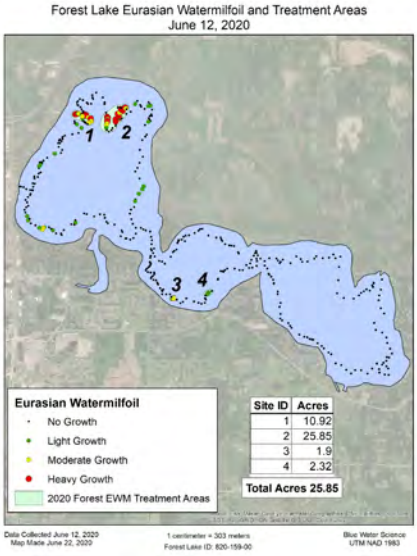






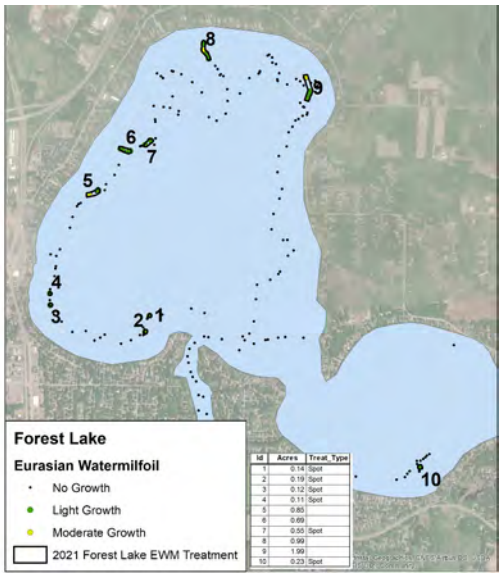






Eurasian watermilfoil treatment areas in 2015 through 2020.

2021



2022

2023

Eurasian watermilfoil treatment areas in 2021 through 2023.