Curlyleaf Pondweed in Forest Lake, April 23, 2025

Curlyleaf Pondweed and Eurasian/Hybrid Watermilfoil Delineation, Treatment, and Assessment for Forest Lake, Washington County, 2025

	Delineation	Treatment	Assessment
CLP	April 23, 2025	2025 (167.44 acres)	June 20, 2025
EWM	June 20, 2025	2025 (47.37 acres)	September 15, and October 24, 2025

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

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Summary

Curlyleaf Pondweed (CLP) Delineation, Treatment, and Assessment: Forest Lake (MnDNR ID#82-015900) is a 2,271 acre lake in Washington County, Minnesota. On April 23, 2025 a curlyleaf pondweed delineation survey sampled 674 sites (Figure 1). Curlyleaf pondweed was growing most frequently in 5-12 feet of water and was found at 344 out of 674 sample sites. Eleven areas of projected heavy growth totaling about 167.44 acres were delineated for treatment. Eurasian watermilfoil was found at 23 sites on this April 23, 2025 survey as well.

A total of 167.44 acres of curlyleaf areas were treated in May 2025.

A post treatment curlyleaf assessment was conducted on June 20, 2025. The curlyleaf pondweed assessment survey sampled 384 sites (Figure 1). Curlyleaf pondweed was growing most frequently in 5-13 feet of water and was found at 90 out of 384 sample sites. The June curlyleaf assessment found excellent control in the treated areas however new curlyleaf pondweed sprouting was observed in 3rd lake due to sprouting after the April 23, 2025 delineation (Figure 1).

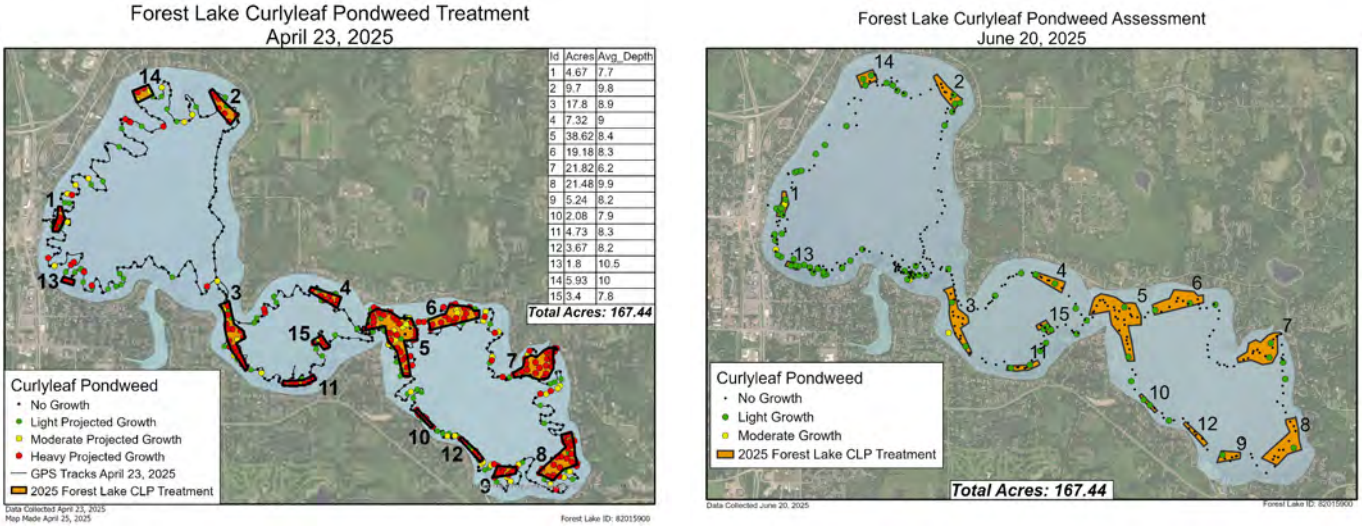

Figure 1. [left] DELINEATION: Map of curlyleaf pondweed distribution from the April 23, 2025 survey. Approximately 167.44 acres were delineated for CLP treatment.
[right] ASSESSMENT: Map of curlyleaf pondweed assessment sites for June 20, 2025.
Key: green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, and black dots = no curlyleaf growth.

Eurasian Watermilfoil (EWM) Delineation, Treatment, and Assessment: EWM distribution and abundance were evaluated June 20, 2025. Somewhat surprisingly, the delineation found no milfoil growth in 2nd lake and a treatment area of 47.37 acres was outlined for the entire lake (Figure 2).

Treatment of 47.37 acres occurred in July 2025 using ProcellaCor/Diquat herbicides in 6 areas (1, 6, 7, 8, 9, 10) and 2,4-D in 4 areas (2, 3, 4, 5).

An assessment conducted on September 15, 2025, after the EWM treatment, found excellent control in the treated areas and a follow-up assessment was conducted on October 24, 2025 found very little EWM (Figure 3).

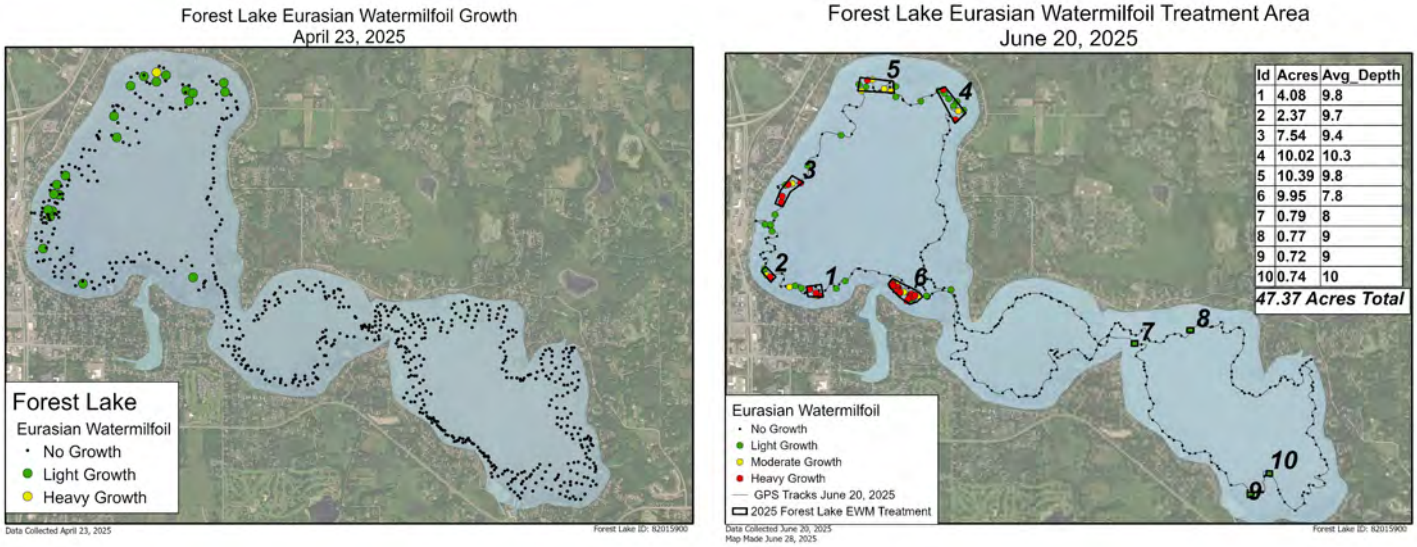

Figure 2. [left] DELINEATION: Map of EWM distribution from the April 23, 2025 survey. [right] DELINEATION: Map of EWM distribution from the June 20, 2025 survey. A proposed treatment area of 47.37 acres was based on the June 20, 2025 EWM delineation. TREATMENT: Occurred in July 2025.

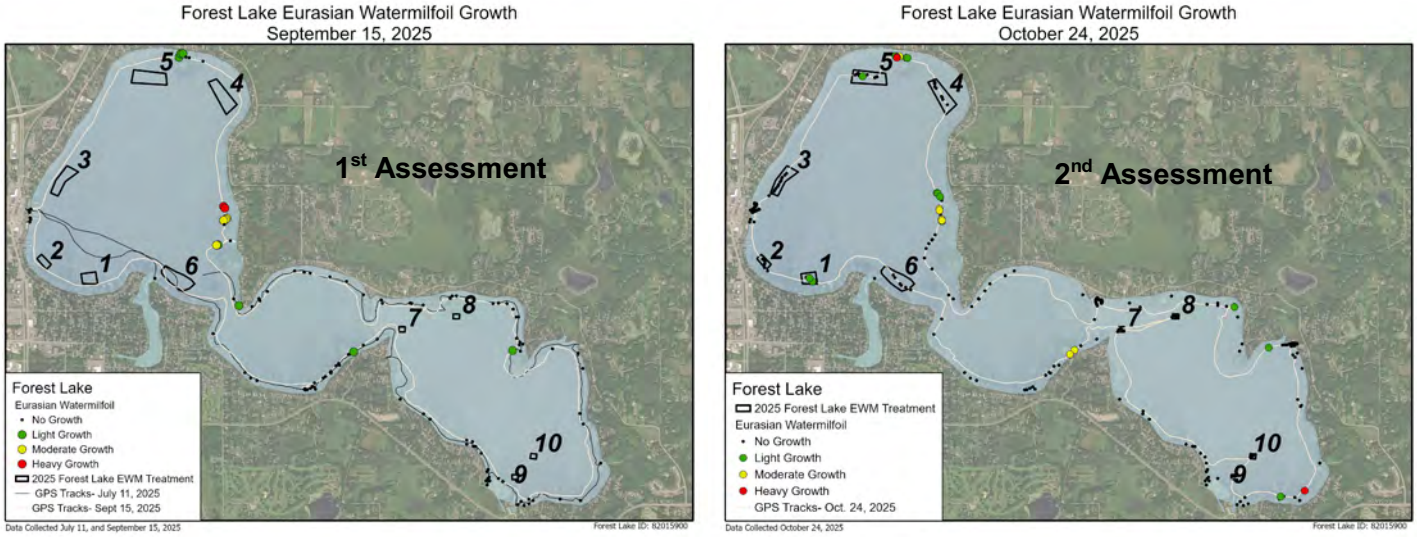

Figure 3. [left] ASSESSMENT: Map of EWM distribution in Forest Lake and in the treatment areas on September 15, 2025. [right] ASSESSMENT: Map of EWM distribution in Forest Lake and the treatment areas on October 24, 2025.

Summary of CLP and EWM Treatments from 2009-2025: Historically two non-native submerged aquatic plants have been treated with herbicides and curlyleaf pondweed and Eurasian watermilfoil were treated again in 2025 (Table 1 and Figure 4). Curlyleaf pondweed treatments have ranged from 16 to 168 acres from 2009 through 2025 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 2025, EWM treatments have ranged from 5.86 acres to 53.83 acres (Table 1 and Figure 4). Eurasian watermilfoil has been confined mostly to the first lake but there is some growth in second and third lakes at the end of 2025. The greatest number of acres treated were in 2020 (Figure 4).

Table 1. Acres of non-native plants treated from 2009 through 2025.

	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
2024	15.79	47.94
2025	167.44	47.37

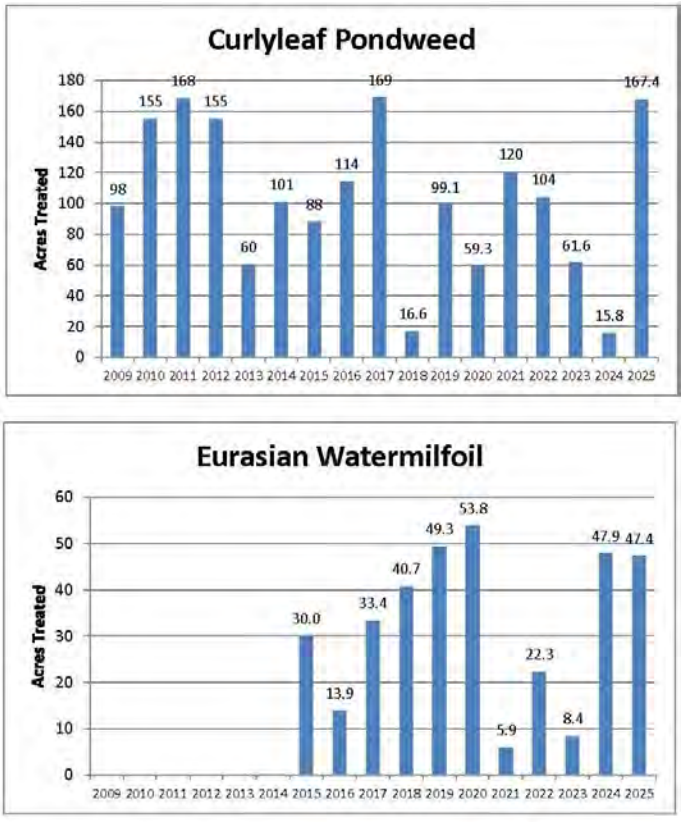

Figure 4. [top] Curlyleaf pondweed treated from 2009-2025.
[bottom] Eurasian watermilfoil treated from 2015-2025. Eurasian watermilfoil was first found in Forest Lake in 2015.

ADDITIONAL INFORMATION

Curlyleaf Pondweed and Eurasian Watermilfoil Delineation, Treatment, and Assessment for Forest Lake, Washington County, 2025

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

Overview

Forest Lake is located within Washington County. A meander survey in 2025 was used to characterize the status of curlyleaf pondweed. Curlyleaf pondweed was sampled at 344 sites out of 674 sites on the April 23, 2025 delineation survey. Eleven areas of projected heavy growth totaling about 167.44 acres were delineated for treatment and curlyleaf pondweed was treated in May 2025. A follow-up curlyleaf pondweed assessment was conducted on June 20, 2025 to characterize the status of CLP at its peak growing period. Curlyleaf pondweed was observed at 90 sites out of 384 sites sampled.

Eurasian watermilfoil distribution and abundance were delineated on June 20, 2025 and 47.37 acres were treated in July 2025. An EWM assessment for all treatment areas occurred on September 15 and October 24, 2025.

Figure 5. After treatment, curlyleaf pondweed growth was light to moderate on June 20, 2025.

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 20 (384 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 2025 on 47.37 acres for EWM control. A follow-up EWM assessment was conducted by Steve McComas, Blue Water Science, on September 15 and on October 24, 2025 to evaluate the EWM growth. EWM density ratings used in the June delineation and the assessments are shown in the chart below.

Chart for Curlyleaf Projected Growth on the Early Delineations, April 24

Rake Sample	Early Season Density (stems/m^2)	Potential Future Growth	Map Color Code
1-2 stems	10-20 stems/m^2	Light	Green
3 stems	30 stems/m^2	Moderate	Yellow
4+ stems	40+ stems/m^2	Heavy	Red

Chart of Density Ratings for Mature 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 April 23, 2025

In the delineation survey, potential curlyleaf growth was found in a number of locations around the full lake with mostly light to moderate projected growth (Figure 6). The projected summer heavy growth was estimated at 167.44 acres and a total of 167.44 acres of curlyleaf areas were treated in May 2025 with the herbicide flumioxazin.

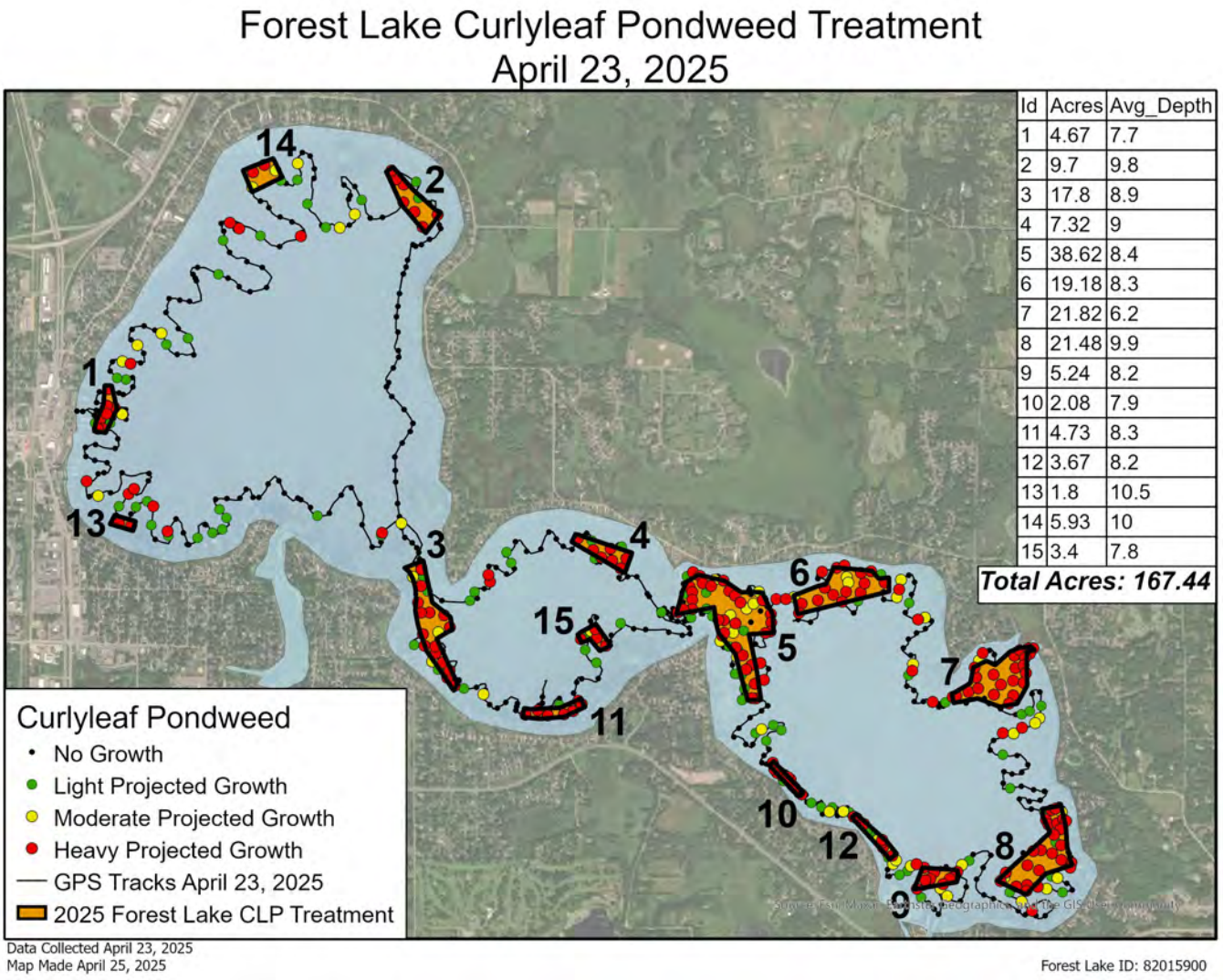

Figure 6. DELINEATION: Map of curlyleaf pondweed distribution from the April 23, 2025 survey. Approximately 167.44 acres were delineated for CLP treatment.

Curlyleaf Pondweed Assessment on June 20, 2025

A total of 167.44 acres of curlyleaf areas were treated in May 2025. A post treatment curlyleaf assessment was conducted on June 20, 2025. The June curlyleaf assessment found excellent control in the treated areas that used the flumioxazin herbicide although there was some new curlyleaf pondweed sprouting after the April 23, 2025 delineation in a number locations in each lake (Figure 7). Some of the regrowth may have occurred in the treatment areas.

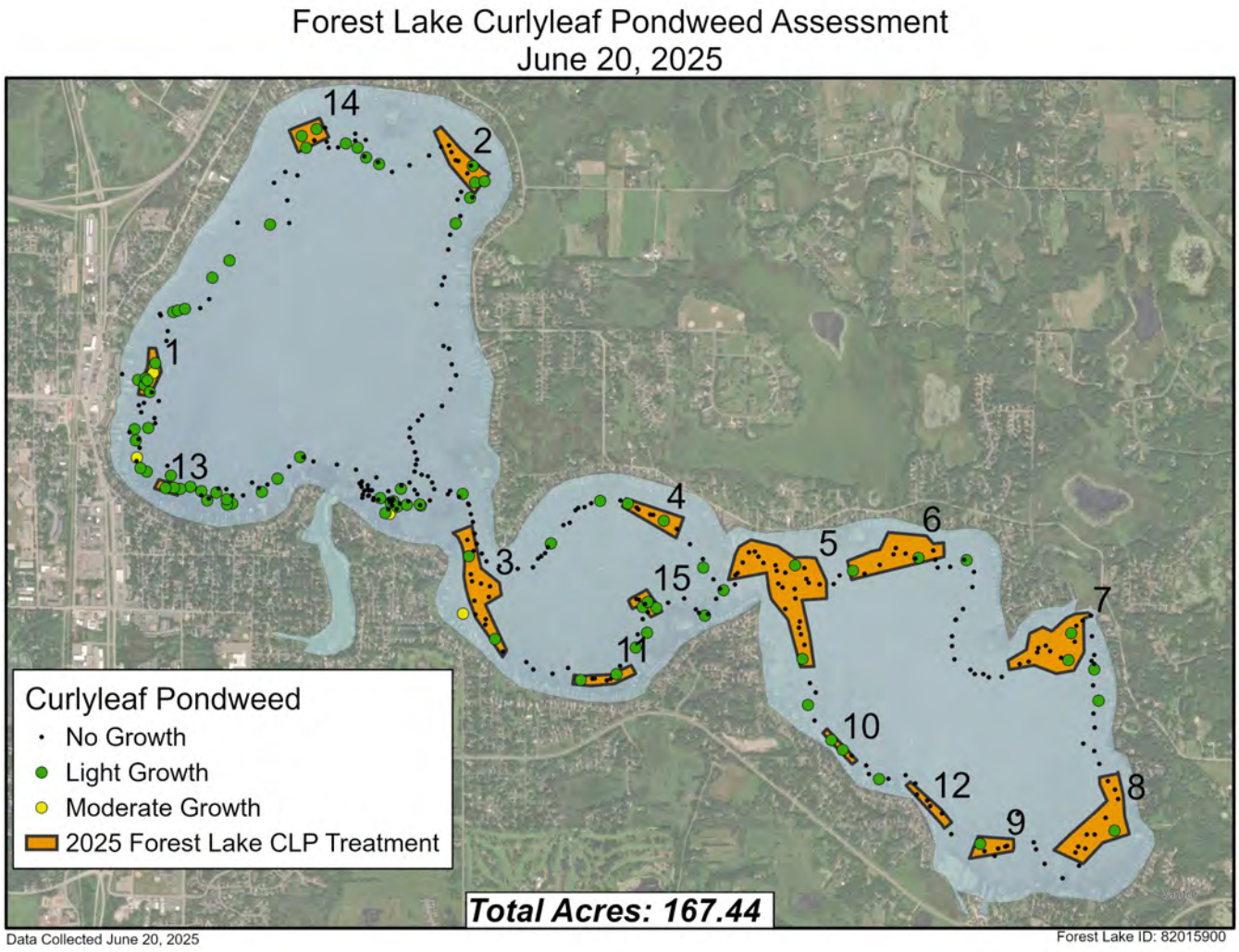

Figure 7. ASSESSMENT: Map of curlyleaf pondweed assessment sites for June 20, 2025.
Key: green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, and black dots = no curlyleaf growth.

Compilation of Curlyleaf Treatment Areas from 2012 through 2025

Curlyleaf pondweed growth patterns are somewhat established in Forest Lake. All treatment areas from 2012 through 2025 are compiled in Figure 8. These “hotspot” areas have covered much of the nearshore area, but not every 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.

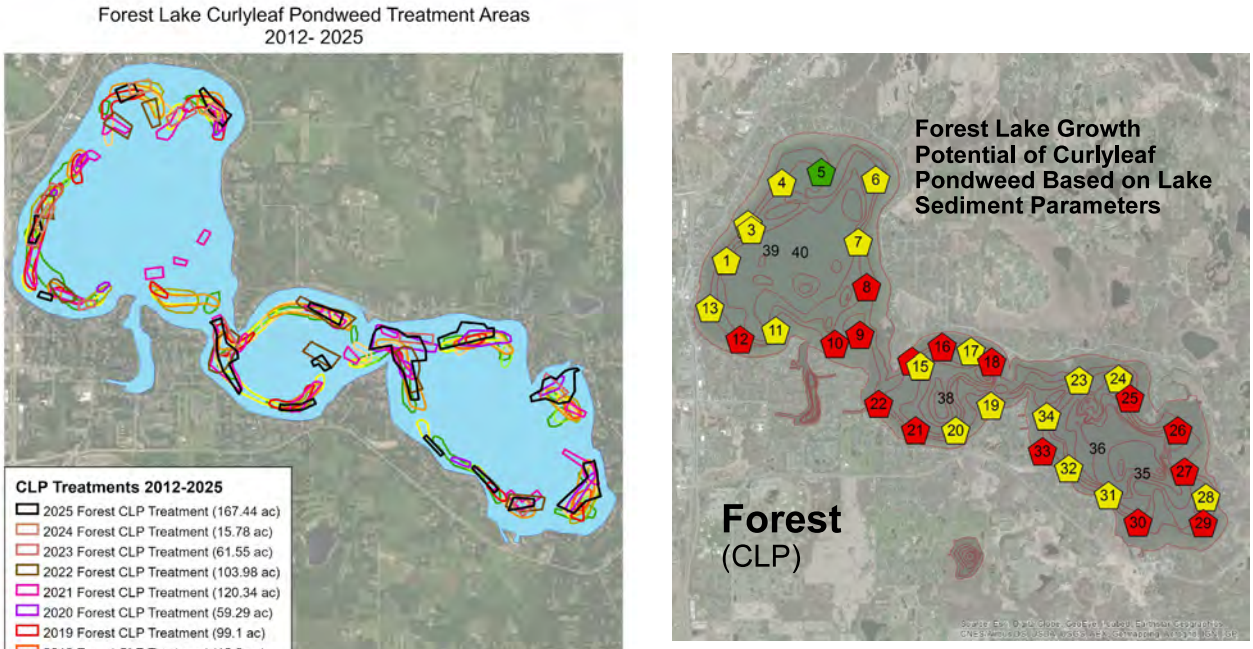

Figure 8. [left] Map of historical treatment of curlyleaf pondweed in Forest Lake, 2012-2023.
[right] Curlyleaf potential growth based on lake sediment analyses for Forest Lake.
Key: green = light growth, yellow = moderate growth, and red = heavy growth.

Table 2. Acres of non-native plants treated from 2009 through 2025.

	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
2024	15.79	47.94
2025	167.44	47.37

Eurasian Watermilfoil Delineation on April 23 and June 20, 2025

An early EWM delineation was conducted on April 23, 2025 and the next EWM delineation was conducted on June 20, 2025 (Figure 9). Based on this delineation, eleven treatment areas of 47.37 acres were delineated (Figure 10). Treatment of EWM was conducted on 47.37 acres in July 2025 using 2,4-D in areas 2, 3, 4, and 5 and a combination of diquat and ProcellaCOR in areas 1, and 6-10.

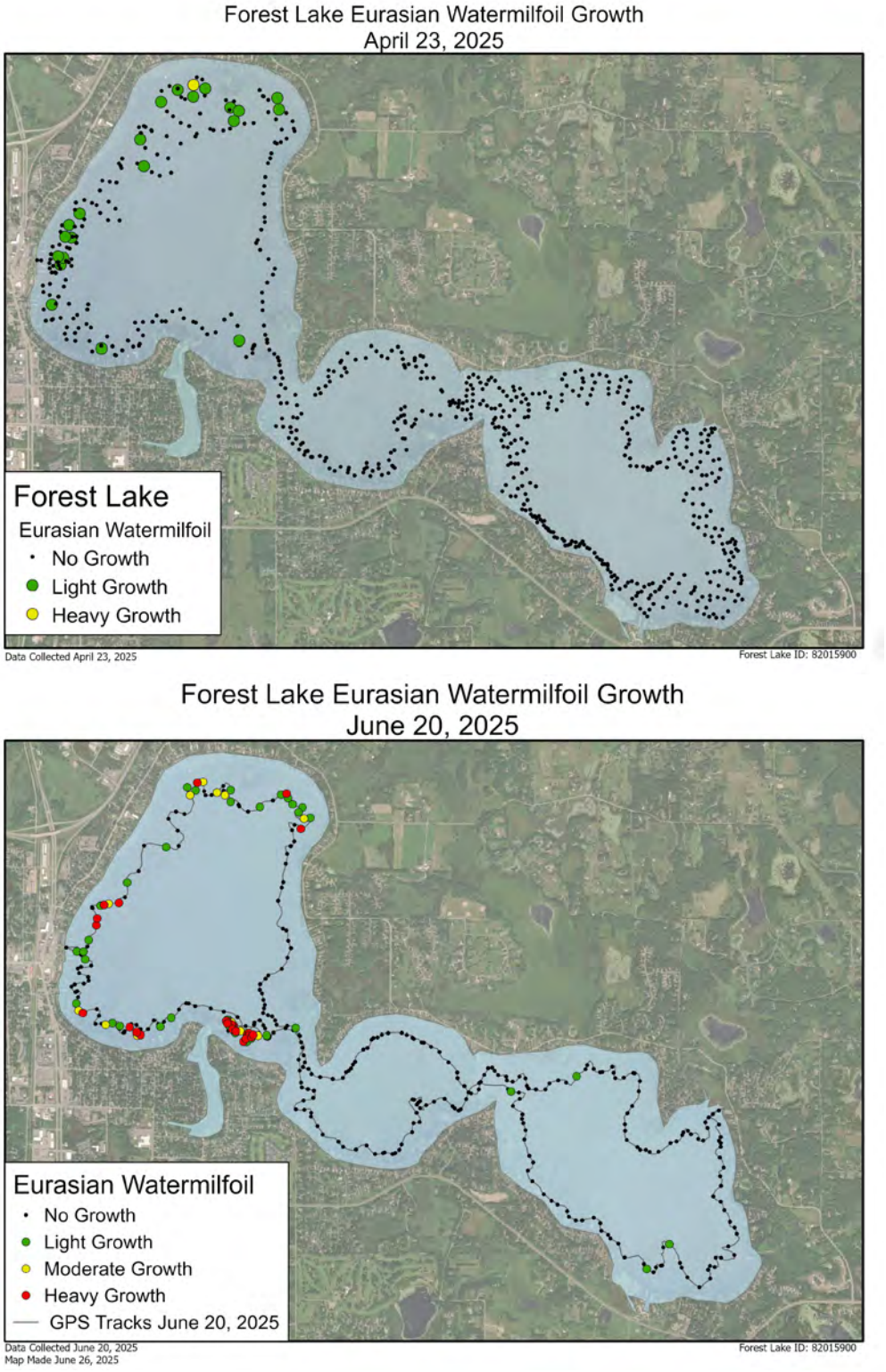

Figure 9. DELINEATION: Map of EWM distribution from the April 23 (top) and June 20, 2025 (bottom) surveys, 47.37 acres were delineated for EWM treatment.

Eurasian Watermilfoil Treatment 2025

A total of 47.37 acres were treated in 2025 using 2,4-D (Alligare) and a mixture of diquat and ProcellaCOR (Table 3 and Figure 10).

Table 3. Treatment on July 2, 2024.

Treatment Area	Size (ac)	Herbicide
1	4.08	Diquat (Tribune) and florpyrauxifen-benzyl (ProcellaCOR)
2	2.37	2,4-D Amine (Alligare)
3	7.54	2,4-D Amine (Alligare)
4	10.02	2,4-D Amine (Alligare)
5	10.39	2,4-D Amine (Alligare)
6	9.95	Diquat (Tribune) and florpyrauxifen-benzyl (ProcellaCOR)
7	0.79	Diquat (Tribune) and florpyrauxifen-benzyl (ProcellaCOR)
8	0.77	Diquat (Tribune) and florpyrauxifen-benzyl (ProcellaCOR)
9	0.72	Diquat (Tribune) and florpyrauxifen-benzyl (ProcellaCOR)
10	0.74	Diquat (Tribune) and florpyrauxifen-benzyl (ProcellaCOR)
Total	**47.94**	

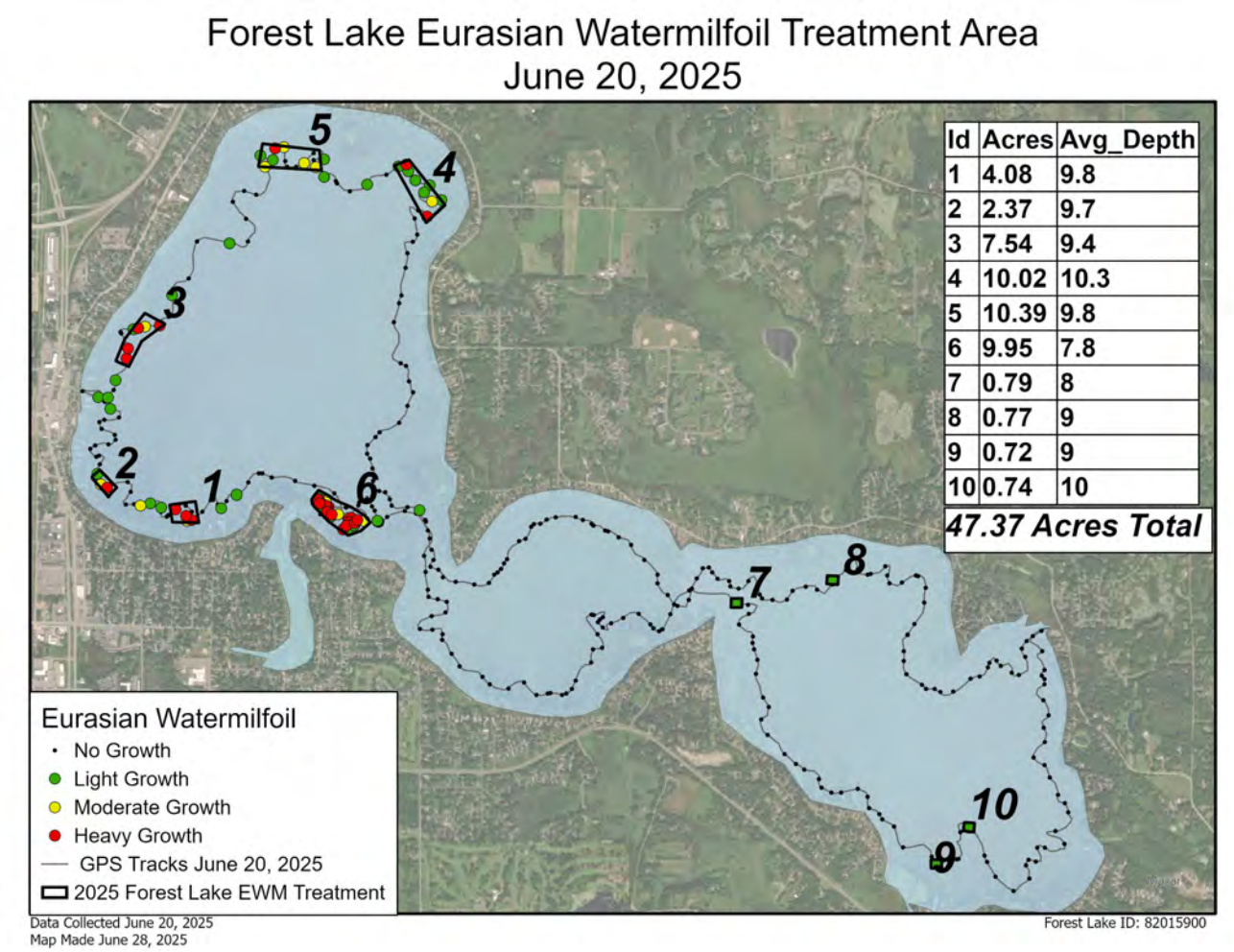

Figure 10. EWM treatment areas in 2025.

Eurasian Watermilfoil Assessment on September 15 and October 24, 2025

After the EWM treatment in July 2025, an EWM assessment on September 15 and October 24, 2025 was conducted using a combination of visual inspections and rake sampling. Only light EWM growth was observed in the treated areas in Forest Lake (Table 4 and Figure 11). The 2,4-D herbicide had good control as did the diquat plus ProcellaCOR herbicide combination.

Table 4. Treatment on July 2, 2024.

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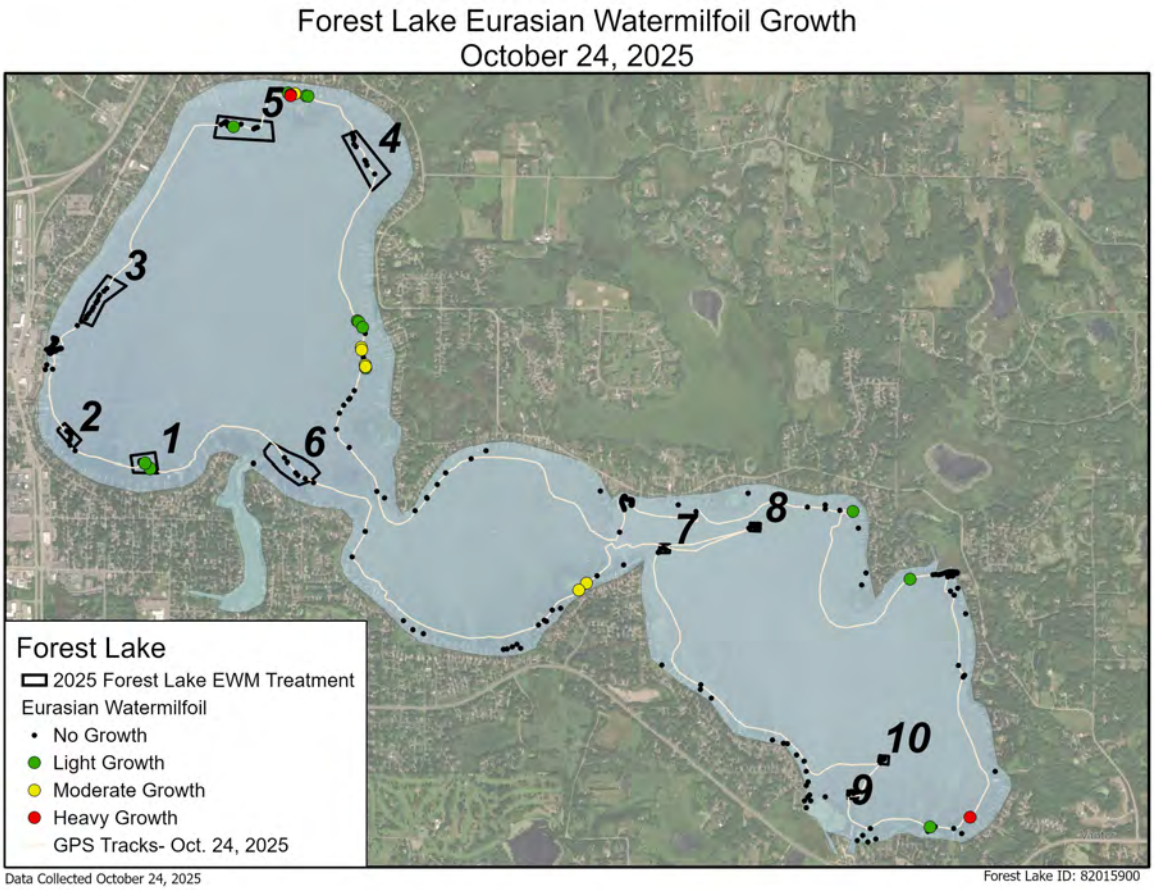
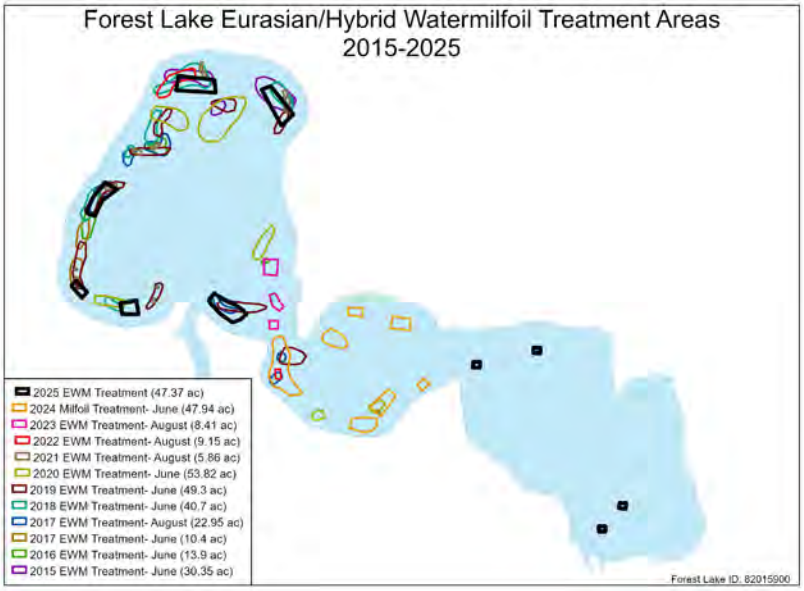


Figure 11. ASSESSMENT: Map of EWM distribution in Forest Lake and the treatment areas on October 24, 2025.

Eurasian Watermilfoil Treatments from 2015-2025

Eurasian watermilfoil was first observed in Forest Lake in 2015. EWM treatments have occurred in 2015 through 2025. All areas from 2015-2025 that have been treated are shown in Figure 12. EWM growth is primarily in the first and second lakes at this time.

Based on lake sediment characteristics, it is predicted that EWM growth should be mostly light to moderate in much of Forest Lake with some variability from year to year (Figure 12).



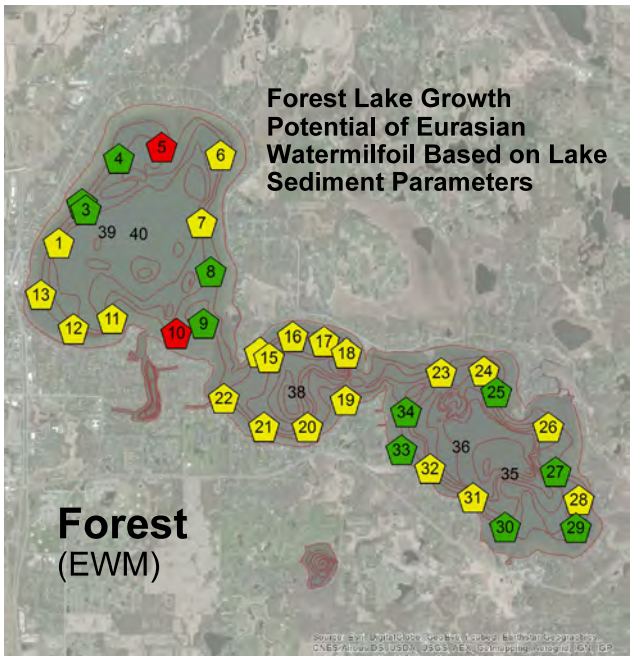


Figure 12.[left] Map of historical treatment of Eurasian watermilfoil in Forest Lake, 2015-2025.
[right] Eurasian watermilfoil potential growth based on lake sediment analyses for Forest Lake.
Key: green = light growth, yellow = moderate growth, and red = heavy growth.

What's Next for 2026?

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.

For CLP, there may be a growth pattern in Forest Lake. Since 2012, over 100 acres of curlyleaf has been treated annually for 1 or 2 years, followed by treatments of less than 100 acres for 1 or 2 years.

In the long history of CLP management, mechanical harvesting was conducted before large-scale herbicide treatments took over and CLP has frequently sustained heavy growth over the years. Despite annual control efforts, CLP has not shown a declining growth trend. It is likely that unless lake sediment chemistry conditions change, CLP will continue to produce heavy growth in most years.

Using existing delineation methods, most of the projected heavy growth of curlyleaf pondweed was controlled in 2025 although the early warm weather forced an early delineation and some CLP sprouted after the April 23, 2025 delineation.

Since 167 CLP acres were treated in 2025, it is predicted a lower acreage will be considered for treatment in 2026. For 2026, it is proposed to delineate CLP later in April or early May to capture late sprouting CLP.

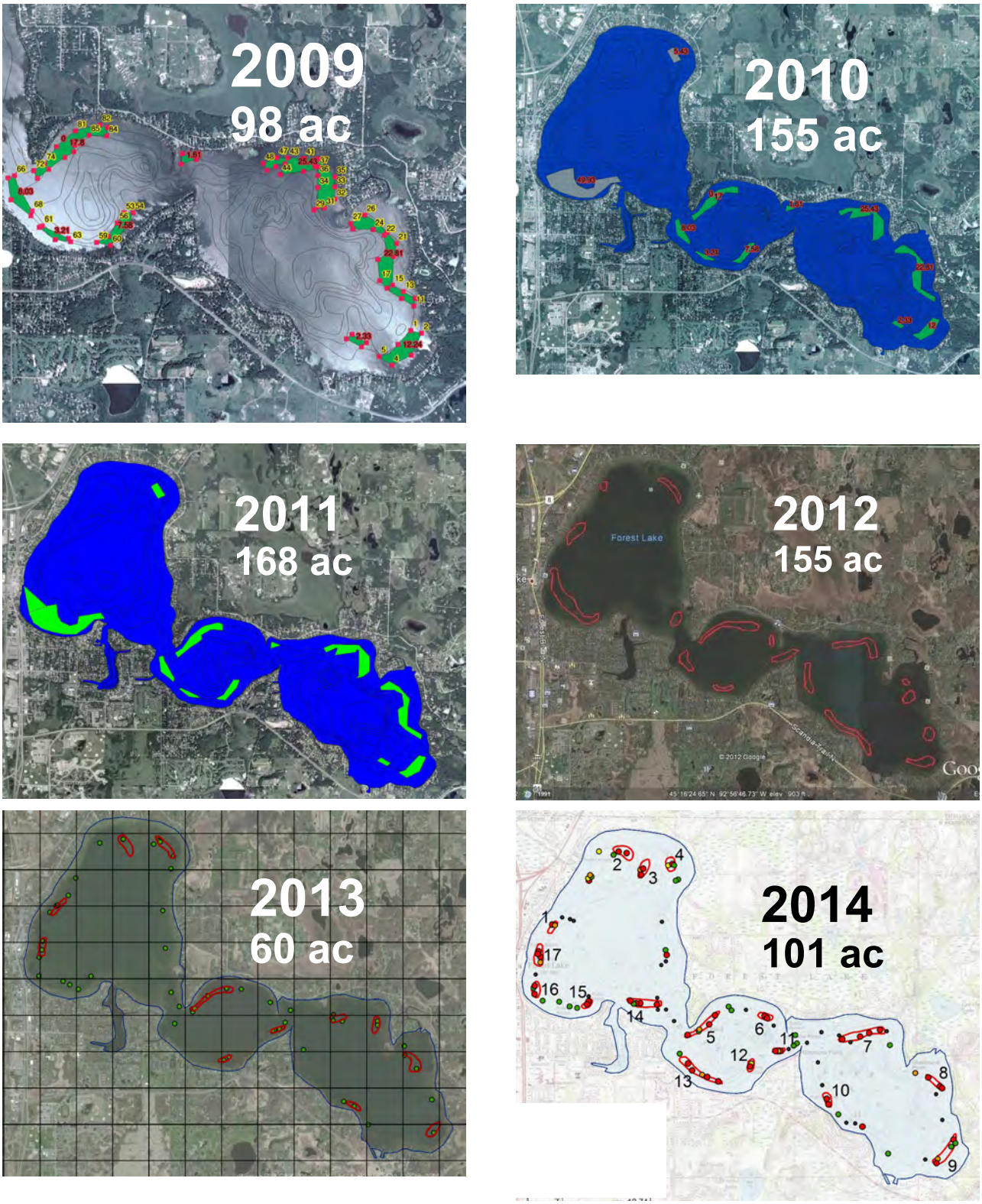
Eurasian Watermilfoil: In 2025, the application of 2,4-D herbicide for EWM controlled the heavy EWM growth. The same basic approach for EWM control was used in 2017 through 2019. In 2020 through 2024, the herbicides diquat and ProcellaCOR were applied together and control was very good. In 2025, diquat and ProcellaCOR were applied in 6 treatment areas and 2,4-D Amine was applied in 4 areas. Excellent control was found in all treated areas. Often ProcellaCOR can produce EWM control for more than 1 growing season, whereas 2,4-D is good for 1 growing season and sometimes additional years.

In 2024, a new milfoil outbreak was found in the middle basin. Genotype sampling found most of the milfoil to be hybrid milfoil with 6 out of 8 treatment areas dominated by the hybrid. All areas were treated with ProcellaCOR in 2024. No milfoil was observed in the middle basin in 2025.

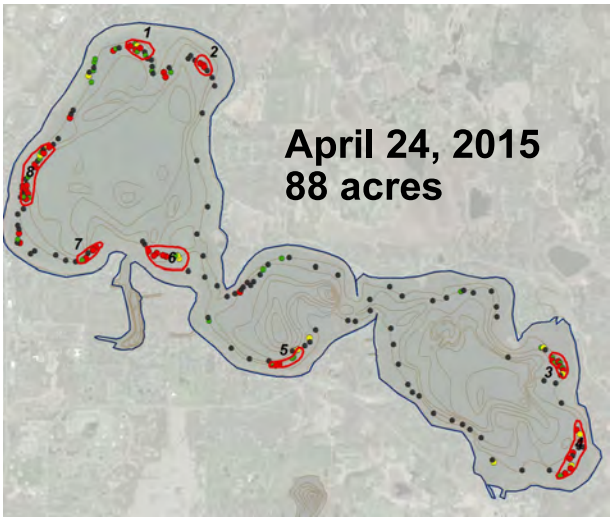
For 2026, the 2025 treatment areas should be checked and 2,4-D may be a good option for treatments in 2026 along with some diquat/ProcellaCOR treatments as well.

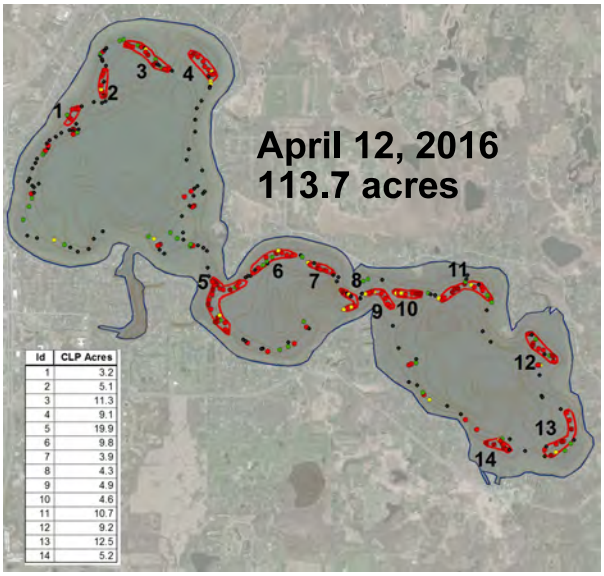
APPENDIX

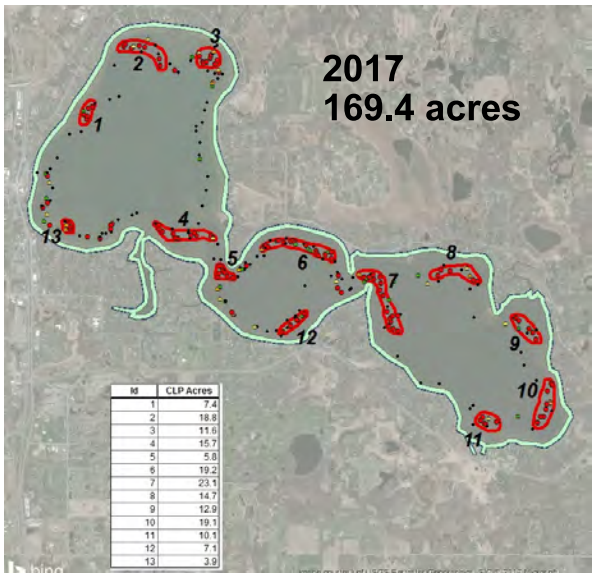
Forest Lake Curlyleaf Treatment Areas for 2009-2024

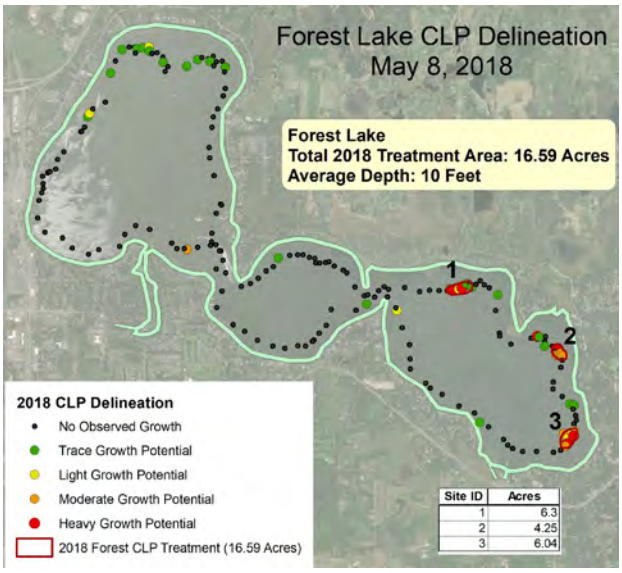


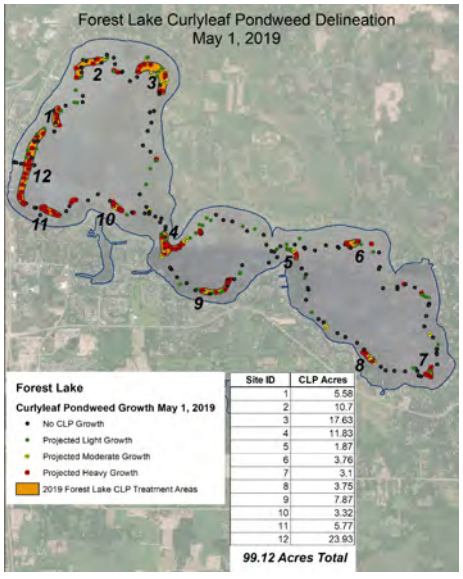
Curlyleaf treatment areas in 2009 through 2014.

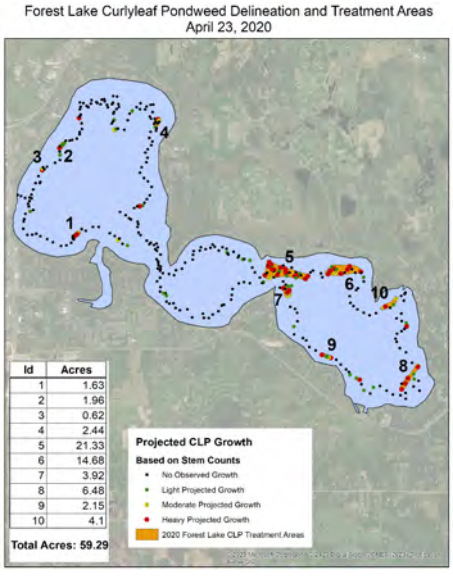




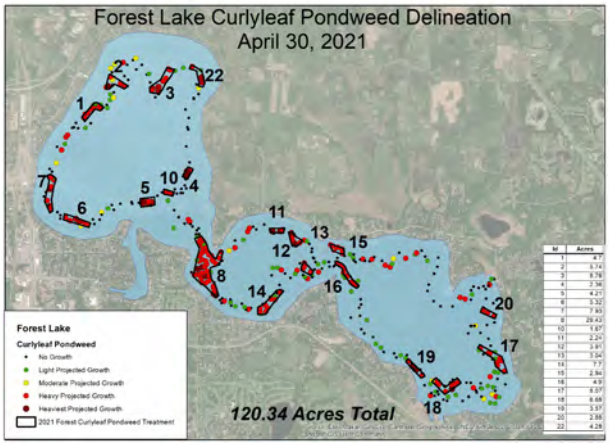


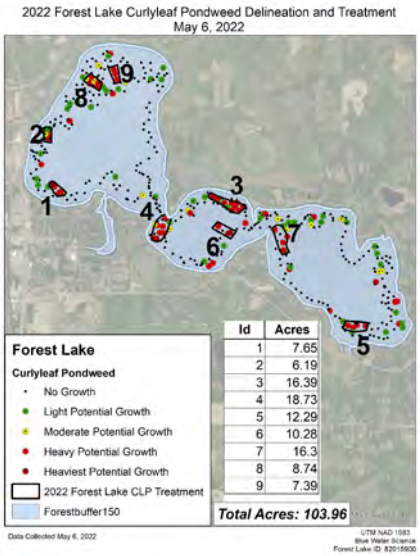


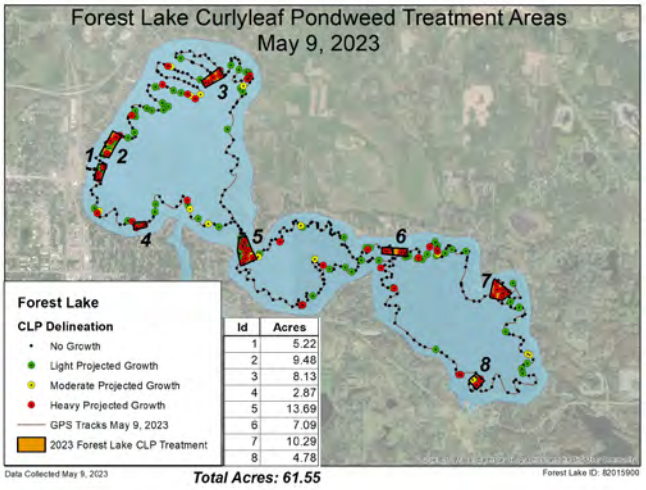


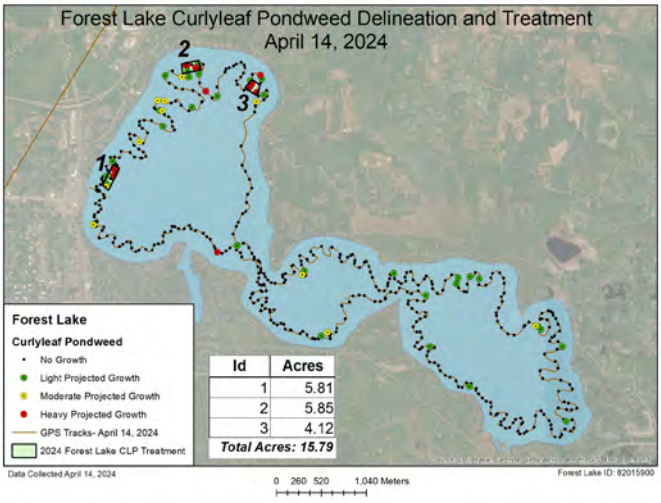


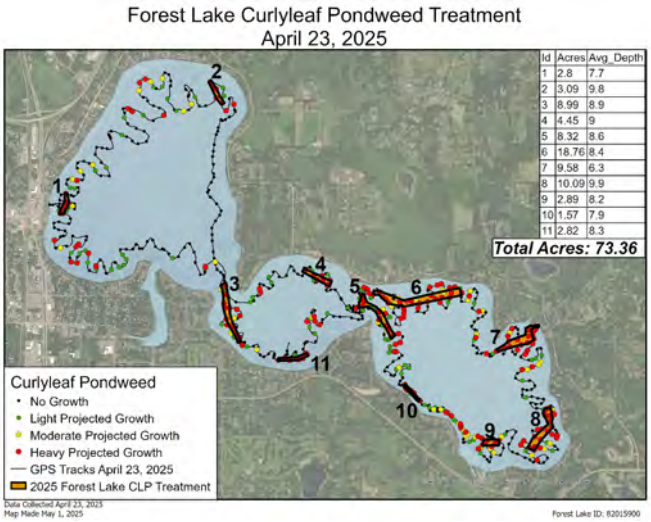
Curlyleaf treatment areas in 2015 through 2020.





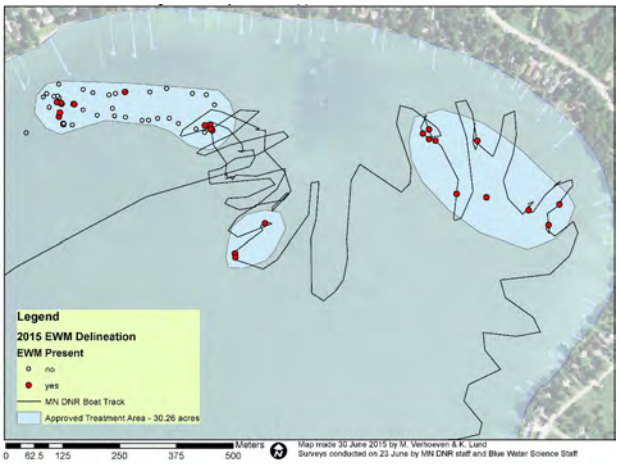


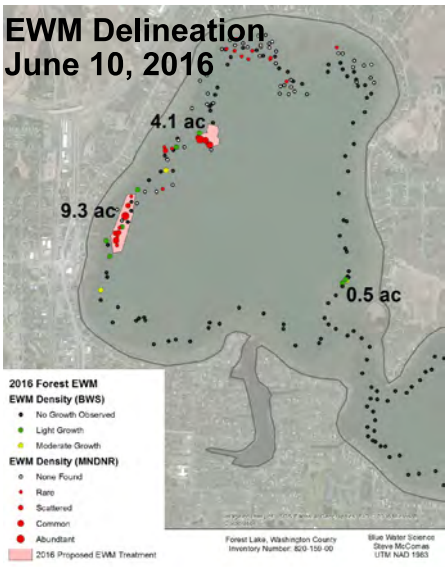


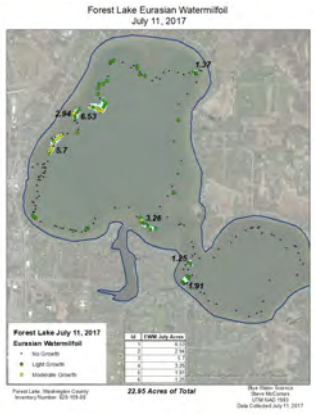


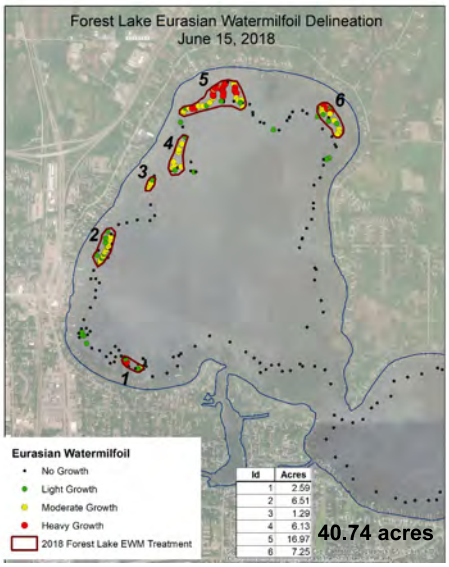
Curlyleaf treatment areas in 2021 through 2025.

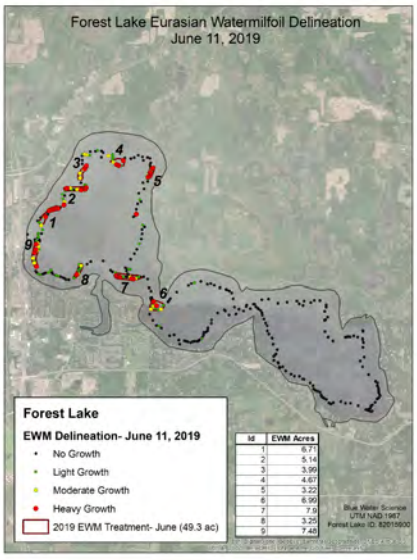
Forest Lake EWM Treatment Areas for 2015-2025

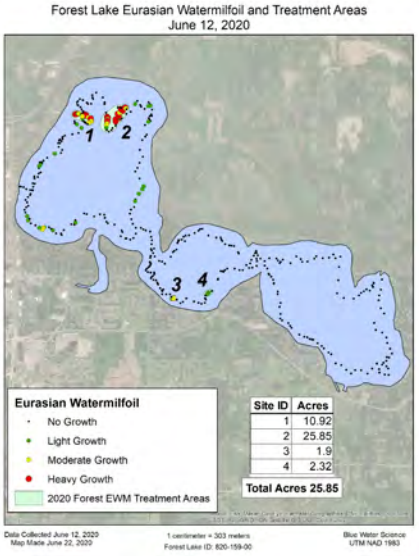






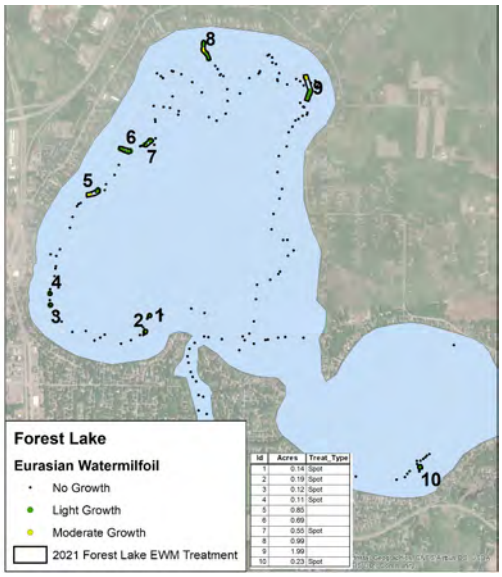






Eurasian watermilfoil treatment areas in 2015 through 2020.

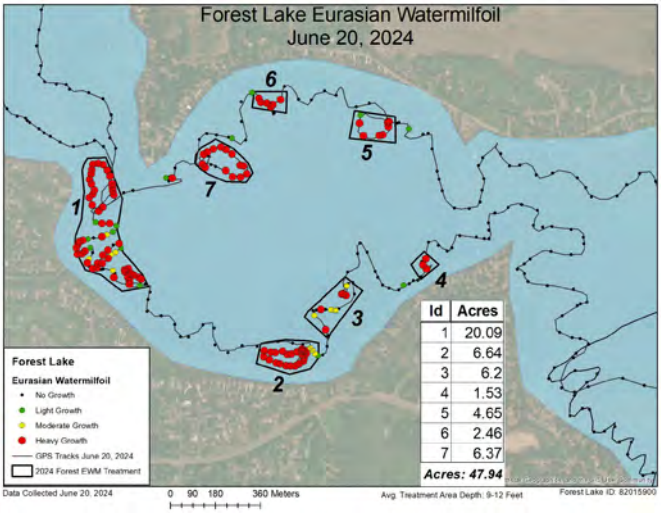
2021



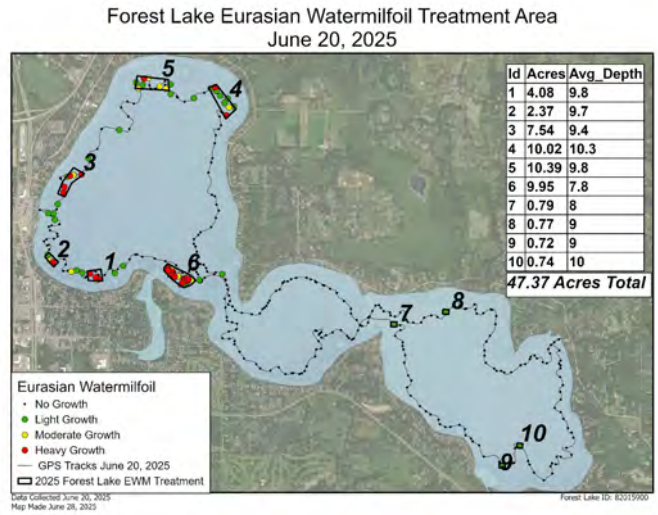
2022

2023

2024



2025



Eurasian watermilfoil treatment areas in 2021 through 2025.