

Analysis of Management

Targeting *Myriophyllum spicatum*  
(Eurasian watermilfoil)

Cedar Lake

St. Croix County, Wisconsin

*August, 2021*

Analysis conducted by Ecological Integrity Service  
Amery, Wisconsin

## Analysis Summary

On June 8, 2021 the herbicide ProcellaCOR (Florpyrauxifen-benzyl ) was utilized to reduce *Myriophyllum spicatum* (EWM) in one bed totaling 18 acres with a mean depth of 4.4 feet. 14.8% of the treatment bed contained a small bed treated with the same herbicide in 2019. The frequency of occurrence (FOO) had a significant reduction ( $p < 0.0001$  from chi square analysis) with an FOO of 83.3% within the treatment bed before treatment to 2.4% (one EWM plant sampled) after treatment. The mean density decreased from 1.4 to 0.02 (scale of 0-3). There was one significant reduction in a native species (*Myriophyllum sibiricum*) comparing frequency in August 2020 to frequency in August 2021. It was sampled five times in the year prior (2020) to treatment within the bed and sampled zero times in the post treatment survey in August 2021.

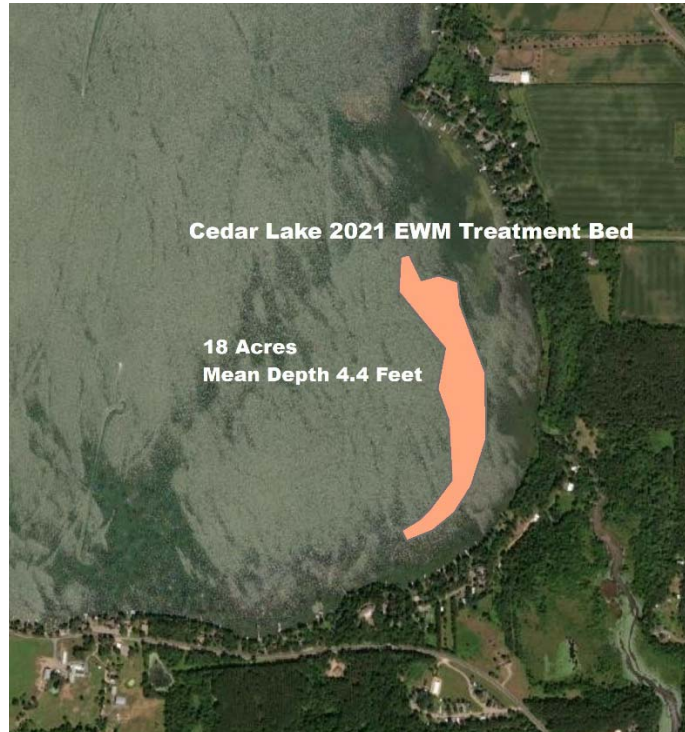
A dive team was also contracted to hand remove EWM from a new area of growth. The mass and/or volume amounts removed were not measured. A qualitative assessment was planned but lack of water clarity made an adequate assessment impossible.

An EWM bed mapping survey indicated a small amount of spreading of EWM to two new areas and the return of EWM to a treatment bed from 2019. Three beds of EWM were delineated totaling 4.22 acres.

A survey utilizing a long-term sampling grid was conducted. The survey data showed a decrease in EWM frequency within the sample grid and a decrease in mean density. Sample points were added for future long-term analysis since EWM has spread some near historical EWM areas.

## Introduction

Cedar Lake, Polk and St. Croix County has had Eurasian watermilfoil (*Myriophyllum spicatum*) since 2015 (year of discovery). On June 8, 2021 an 18-acre bed of EWM was treated with ProcellaCOR (Florpyrauxifen-benzyl). This is the second treatment with ProcellaCOR in Cedar Lake, with two beds treated in 2019 (one of which is contained within the 2021 bed). The bed was delineated in August 19, 2020 and was checked on June 3, 2021 to evaluate EWM was active and to verify boundaries of the bed, which were adjusted mainly for depth. Figure 1 shows the map of the treatment and table 1 summarizes the bed parameters and conditions during treatment.



**Figure 1: Map showing the EWM treatment bed delineated in August 2020 and adjusted May 2021 after bed evaluation.**

Bed Area	Mean Depth	Acre feet	Wind speed/direction	Water temp.	Herbicide application
18 acres	4.4 ft	79.2	0-2 mph/variable (W&SE)	75°F (23.9°C)	3 pdu/acre-ft (total of 238 pdu applied)

**Table 1: Treatment bed statistics and treatment conditions.**

The 2021 treatment bed contains all of one of the two beds treated with ProcellaCOR in 2019. This small bed had a less effective result than the larger bed treated in 2019. The EWM had spread from the 2019 treatment area that led to the delineation of the 2021 treatment bed. The 2019 bed is 14.8% of the 2021 bed. Figure 2 is a map showing the 2019 bed contained within the 2021 bed (yellow outline).



**Figure 2: Map showing one of two 2019 treatment beds overlaying the 2021 treatment bed.**

The effectiveness of the herbicide application was evaluated using the Wisconsin DNR protocol for pretreatment and post treatment surveys of AIS management. The pretreatment survey was data collected in the EWM bed on August 19, 2020. The post treatment survey data was collected on August 18, 2021. The frequency of occurrence (FOO) of EWM as well as the mean bed density was determined in both surveys for comparison. In addition, the native plant species were recorded at each sample point during the pretreatment and post treatment surveys to evaluate any detrimental effect on the native species from the herbicide treatment. A chi-square analysis was run to determine if the reduction of EWM and any reduction in native species were statistically significant ( $p < 0.05$ ).

## Results

### Herbicide Treatment

The results of the pre and post treatment surveys are shown in table 2. The frequency of occurrence and the mean density decreased significantly after treatment. The chi-square analysis indicates a very significant reduction in EWM, which is likely due to the herbicide application. The post treatment survey was conducted approximately 2.5 months after the herbicide was applied, so the effectiveness is based on short-term data. Monitoring in 2022 and beyond will reflect the long-term effectiveness of the application.

Pre-treat FOO (8/19/20)	Post-treat FOO (8/18/21)	Pre-treat mean density	Post-treat mean density	Chi-square P value	Significant reduction?
83.3%	2.4%	1.4	0.02	$6.6 \times 10^{-14}$	YES

Table 2: Summary of frequency and density of pre and post treatment surveys.

Figure 3 are maps showing the distribution and density of EWM within the treatment bed before and after herbicide application. Note that only one EWM plant was sampled or observed in the bed after treatment.

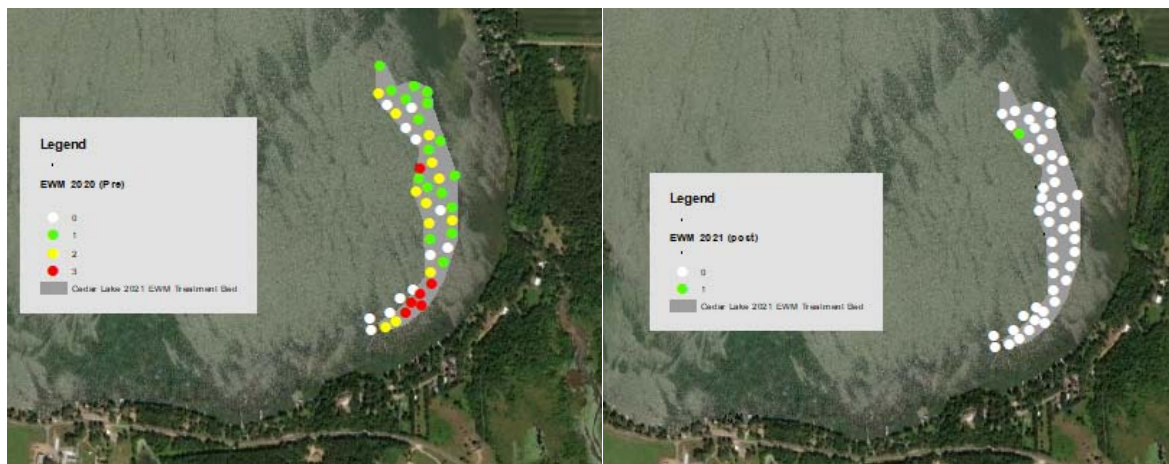


Figure 3: Maps showing density of EWM before (left) and after (right) herbicide treatment.

### Native plant species evaluation

An effective herbicide application to manage an invasive plant species not only reduces the target AIS, but also has little to no effect on the native species in and around the treatment area. A full lake survey conducted about every five years can be used to evaluate any large-scale native plant reductions. The effect on native species within the bed can be evaluated by analyzing the frequency of native species within the bed before and after herbicide application. A chi-square analysis is conducted to evaluate if any reduction is statistically significant.

The native species chi-square indicates that there was one native species that had a statistically significant reduction in frequency ( $p < 0.05$ ). That species was northern watermilfoil (*Myriophyllum sibiricum*), which is in the same genus as the target EWM. Northern watermilfoil may be susceptible to ProcellaCOR and was actively growing at the time of herbicide application. It may be the decrease in the northern watermilfoil was due to the herbicide. Northern watermilfoil was sampled five times in the

2020 survey and zero times in 2021. The water clarity during the post treatment survey in 2021 was poor so observing any northern watermilfoil near the sampling point was not possible. Table 3 summarizes the native species statistics.

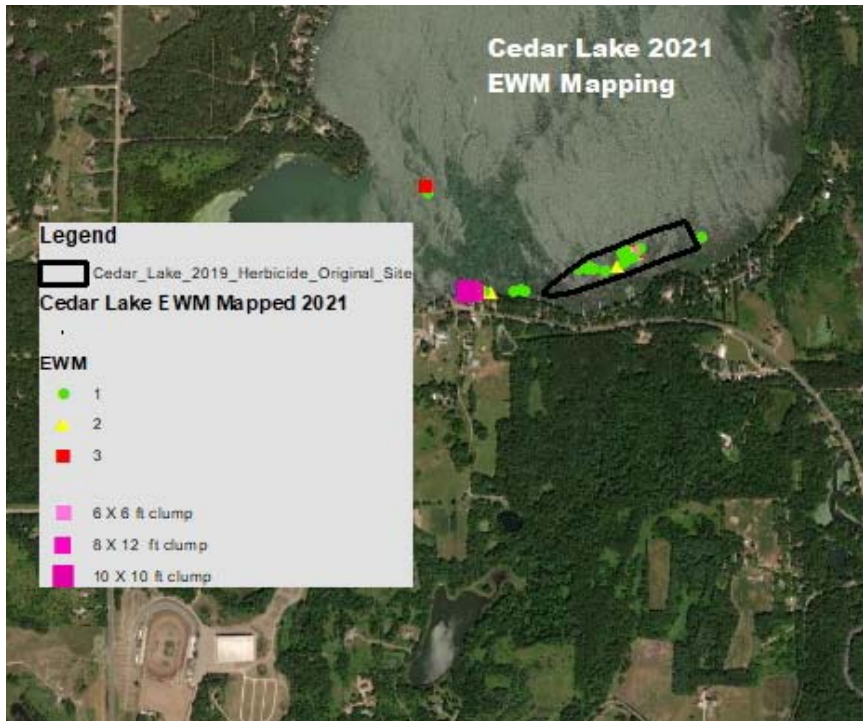
Species	Pre-FOO (8/19/20)	Post FOO (8/18/21)	Chi-square P value
<i>Chara sp.</i>	35.7%	50.0%	0.19
Coontail- <i>Ceratophyllum demersum</i>	54.8%	50.0%	0.13
Wild celery- <i>Vallisneria americana</i>	30.9%	38.1%	0.49
Clasping pondweed <i>Potamogeton richardsonii</i>	38.1%	35.7%	0.82
Slender naiad- <i>Najas flexilis</i>	16.7%	21.4%	0.58
Common waterweed- <i>Elodea canadensis</i>	9.5%	9.5%	1.0
Sago pondweed <i>Stuckenia pectinata</i>	14.3%	9.5%	0.50
Northern watermilfoil- <i>Myriophyllum sibiricum</i>	11.9%	0.0%	0.02
Variable pondweed- <i>Potamogeton gramineus</i>	2.4%	2.4%	1.0
Stiff water crowfoot- <i>Ranunculus aquatilis</i>	0.0%	2.4%	0.31
Small pondweed- <i>Potamogeton pusillus</i>	4.8%	0.0%	0.15

**Table 3: Summary of frequency and chi-square analysis p value for native species evaluation within the treatment bed.**

### **Bed Mapping**

In order to monitor the spread of EWM, the entire littoral zone of Cedar Lake is surveyed annually. In addition, a volunteer also monitors the lake for EWM. On June 3 and updated on July 12, 2021, the EWM was surveyed with the locations and density of EWM was recorded. These data were used to map location of beds that may warrant management. A follow up was conducted on August 18, when the post treatment survey was conducted but the water clarity was too poor to evaluate the EWM.

Figure 4 shows the location of EWM recorded. There were three key areas of EWM. One of them is the treatment bed from 2019. The EWM is starting to return slowly in this bed, with a small area with fairly dense EWM growth and less dense growth scattered in other areas of this bed. The other two areas of EWM are new. One is in front of a restaurant that may have high boat traffic. The other is in a shallow area quite far from any shoreline area.



**Figure 4: Map of EWM locations and density in June and July, 2021. Water clarity was too poor to evaluate in August.**

For purposes of management planning, the areas with fairly dense EWM coverage were delineated into beds to consider for herbicide application. There were three beds delineated totaling 7.5 acres which are shown in Figure 5 with the area of each bed. Bed B did have some hand pulling occur in July 2021 but remained quite dense when observed in August 2021 after hand pulling occurred (see hand pulling section in this later in this analysis). An August update was not possible due to low water clarity, so there may have been more EWM than was last recorded in July.



**Figure 5: Map of delineated EWM beds that may be considered for herbicide application in 2022.**

## Hand Pulling Summary

On July 22, 2021 a dive team was contracted to address EWM mapped in June and July in areas of concern. The hand pulling occurred in a dense (small) bed in front of a set of piers in front of a restaurant (see white circled area on the map: figure 6) and then moved to the east to remove more scattered clumps. The APM lead for Cedar Lake observed that the team had better success in scattered areas than in the dense areas. This was likely due to needing to spend more time in one area, resulting in more cloudy water from disturbing the bottom substrate, reducing the ability to discern EWM. The amount of EWM by weight and/or volume was not recorded. The EWM was loaded onto a pontoon boat and offloaded to a trailer and composted at a designated site.



**Figure 6: Map showing hand pulling location**

Since the EWM areas that were planned for hand pulling were small and scattered and native plants were also pulled, a quantitative evaluation was not likely to be valid. A qualitative evaluation of the hand pulled areas was planned, but the poor water clarity made that impossible. It was observed that a fair amount of EWM still remained in front of the restaurant, but could not determine the status of the scattered clumps.

## Long-term evaluation

To help evaluate the overall increase or reduction of EWM within the area EWM has been present, a large sample grid was established a few years ago. The frequency of EWM and mean density of EWM within this grid is determined annually in August. As more EWM grows outside of the grid, more sample points are added, which was needed in 2021 (the long-term evaluation was not started until 2017). Table 4 summarizes the frequency of EWM within the grid from 2020, to compare 2020 to 2021. The frequency of EWM and mean density of EWM was also determined in 2021 using the added sample points. Comparison is not possible as these added sample points were not evaluated in 2020.

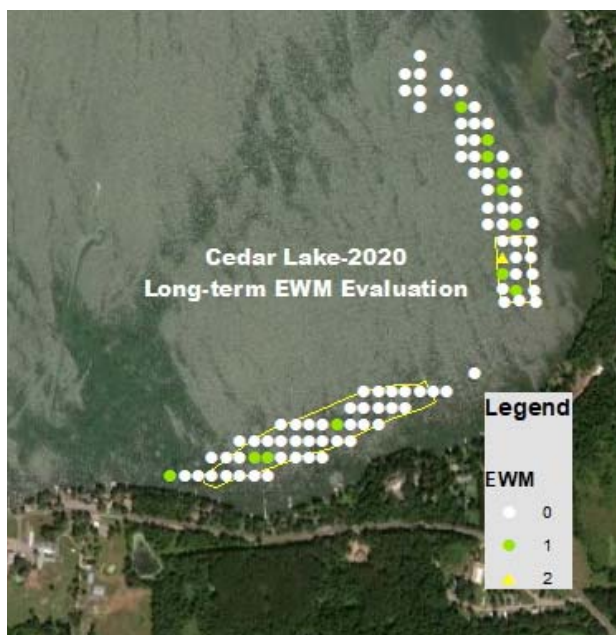


Year	FOO (within sample grid) (est. 2017)	Mean density
2017 (diquat and endothall treatment)	7.03%	0.09
2018 (DASH in treatment 2017 bed)	11.7%	0.16
2019 (ProcellaCOR treatment) (same bed as in 2017 + one new small bed)	0.0%	0.00
2020 (no management)	13.4%	0.14
2021 (ProcellaCOR treatment) (different bed than in 2019)	6.25%	0.11

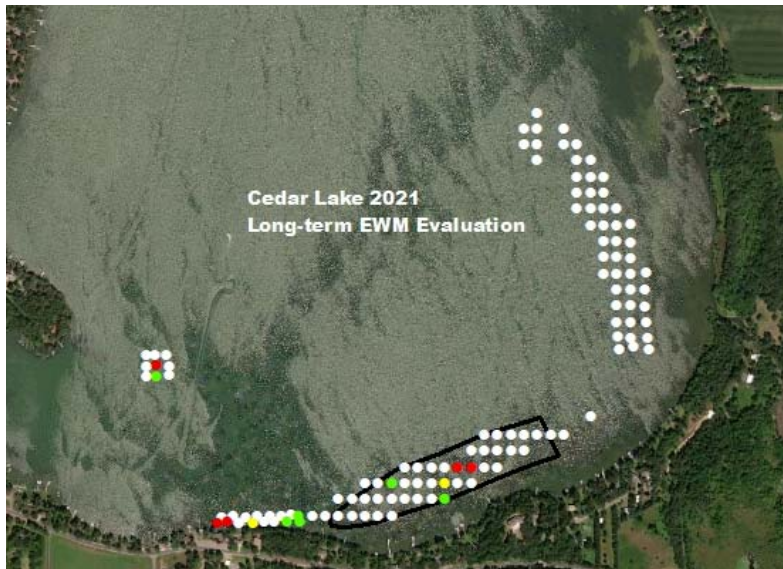
	2021 FOO	2021 mean density
Long term sample grid with added 2021 points	11.6%	0.21

**Table 4: This shows a summary of the data collected in the long-term survey, 2021 and compares to previous years. The bottom portion shows the 2021 frequency and mean density using the 2021 sample point grid. This grid will continue to be used in the future evaluations.**

This survey shows a decrease in the frequency of EWM within the grid. This reflects the reduction in EWM from the herbicide treatment in 2021 (13.4% to 6.25%), which is where most of the 2020 frequency occurred. The original treatment bed (2017) is in the grid as well and since EWM is returning to that older bed, the frequency was higher than zero. The frequency in 2021 is higher (11.6% vs 6.25%) with the added sample points because they were added to areas with EWM growth. This indicates that the EWM is spreading slowly in Cedar Lake, although it is still confined to the south end of the lake. Figures 7 and 8 map the results of the long-term surveys from 2020 and 2021 respectively.



**Figure 7: Map showing the results of the 2020 long-term survey.**



**Figure 8: Map showing the results of the 2021 long-term survey, including the added 2021 sample points.**

## Discussion

The results of the pre and post treatment surveys indicate the short-term results of the herbicide treatment are excellent. Only one EWM plant was sampled or observed within the treatment bed in the post treatment survey. However, the 2021 EWM bed mapping shows that EWM is spreading somewhat and returning to a previous herbicide treatment bed in which ProcellaCOR was used. This indicates the long-term EWM reduction is somewhat limited.

Three beds of EWM were delineated from the June and July EWM survey. These beds are small, but considering that two are new areas and the third is within a historically treated bed, herbicide use may be warranted. The reduction of EWM using ProcellaCOR has been found to be quite effective in small beds. Treating small beds would be an aggressive management approach, but would help confine EWM to this localized area in Cedar Lake. A more passive approach would be to wait and see how much the EWM continues to grow and spread and simply continue to monitor the EWM.

The aquatic plant management plan for Cedar Lake calls for measurements of EWM following hand removal. If this method is used in the future, an alternative assessment method may need to be developed to account for poor water clarity. The mass and/or volume of EWM removed should be measured and recorded by the divers.

## References

Crow, Garrett E. and C. Barre Hellquist. *Aquatic and Wetland Plants of Northeastern North America*. The University of Wisconsin Press. Madison, Wisconsin. Volumes 1 and 2. 2000. 880p.

Ecological Integrity Service. *Myriophyllum spicatum*-Eurasian watermilfoil Management Analysis (herbicide, DASH, hand pull) Cedar Lake, Polk and St. Croix County Wisconsin. 2017.

Ecological Integrity Service. Herbicide Treatment Analysis: Targeting *Myriophyllum spicatum* (Eurasian watermilfoil) Cedar Lake St. Croix County, Wisconsin. August, 2019

Harmony Environmental. *Cedar Lake Management Plan and Aquatic Plant Management Plan*. 2017.

University of Wisconsin-Extension. *Aquatic Plant Management in Wisconsin*. April 2006 Draft. 46 p.

UW-Extension. Aquatic Plant Management website.  
<http://www4.uwsp.edu/cnr/uwexlakes/ecology/apmguide.asp> appendix d.

Wisconsin Department of Natural Resources. Florpyrauxifen-benzyl Fact Sheet. EGAD #: 3200-2018-83. July 2018.