

1.0 INTRODUCTION

Little Star Lake, Town of Plum Lake, Vilas County, is a 95-acre drainage lake with a maximum depth of 9 feet (Figure 1.0-1). Eurasian watermilfoil (*Myriophyllum spicatum*; EWM) was first discovered in Little Star Lake in June 2017 by Onterra during an Early-Season AIS mapping survey. The Town of Plum Lake contracted with Onterra, LLC to conduct future studies aimed at understanding the extent of the EWM population in the lake and form an appropriate course of action



Figure 1.0-1. Little Star Lake - Vilas County, WI.

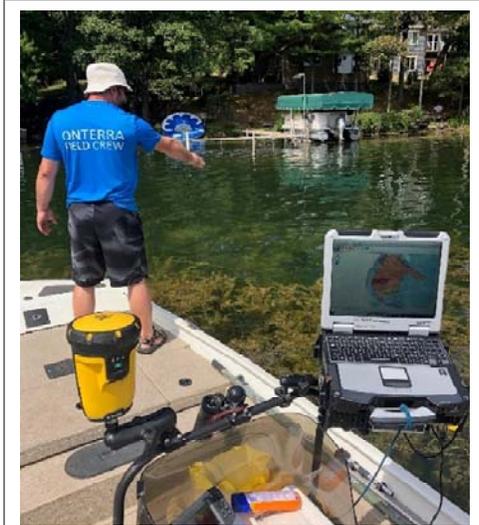
for management going forward. Onterra completed AIS mapping surveys in 2018 and 2019 and continued to document a modest population of EWM within the lake.

In February 2020, the Town of Plum Lake successfully applied for an Aquatic Invasive Species Early Detection Response Grant (AIS-EDR) through the Wisconsin Department of Natural Resources (WDNR). This grant provided funding assistance for EWM monitoring, a point-intercept survey, and hand harvesting activities from 2020 to 2022. Professional monitoring surveys conducted during 2020-2022 showed the EWM population had remained modest and had decreased during 2022 such that very little EWM was found in Little Star Lake. Specific details of the professional EWM mapping surveys and the Town of Plum Lake's EWM monitoring and hand harvesting efforts were included within each year's respective annual email narrative reports.

The grant project was originally scheduled to end in 2022; however, remaining funds allowed for a project time extension. This extension allowed for the remaining funds from the grant to be used during 2023 for continued professional AIS monitoring, reporting, and harvesting that mirrored previous activities that have taken place since the start of the project. The details of the 2023 EWM management and monitoring activities are discussed in this report.

2.0 2023 EWM MANAGEMENT AND MONITORING STRATEGY

A pair of EWM mapping surveys were used to coordinate and monitor the hand-harvesting efforts in Little Star Lake. During the EWM mapping survey, the entire littoral area of the lake is surveyed through visual observations from the boat (Photograph 2.0-1). Field crews supplement the visual survey by deploying a submersible camera along with periodically doing rake tows. The EWM population is mapped using sub-meter GPS technology by using either 1) point-based or 2) area-based methodologies. Large colonies >40 feet in diameter are mapped using polygons (areas) and are qualitatively attributed a density rating based upon a five-tiered scale from *highly scattered* to *surface matting*. Point-based techniques were applied to EWM locations that were considered as *small plant colonies* (<40 feet in diameter), *clumps of plants*, or *single or few plants*.



Photograph 2.0-1. EWM mapping survey on a Wisconsin Lake. Photo credit Onterra.

An Early Season AIS Survey is employed with the purpose of determining an appropriate hand harvesting strategy for the summer and providing the spatial data to guide the harvesting efforts. The Late-Summer EWM Mapping Survey is typically conducted after most or all harvesting efforts have been completed in order to evaluate the hand harvesting control strategy. The late-summer survey also provides an opportunity to follow up with additional hand harvesting efforts following the survey if applicable. Additionally, the late-summer mapping survey is used to determine an initial management strategy for the following year.

3.0 EARLY-SEASON AQUATIC INVASIVE SPECIES SURVEY

Onterra ecologists completed the Early-Season AIS Survey on June 27, 2023. The entire littoral area of the lake was surveyed with extra attention devoted to searching in areas where EWM has been found in previous surveys. The crew noted great survey weather of sunny skies with light wind. However, the crews also noted poor water clarity. While EWM is usually not at its peak growth at this time of year, the water is typically clearer during the early summer allowing for more effective viewing of submersed plants, and EWM is often growing higher in the water column than many of the native aquatic plants at that time of year.

All previously located EWM occurrences were loaded onto the on-board computer allowing the survey crew to search these sites with added focus including rake tows. During the course of the survey, the crews found a few dozen *single or few plants occurrences* of EWM along the northern and northeastern shoreline (Map 1). No large or contiguous colonized areas were identified anywhere in the lake. Following the survey, Onterra provided the spatial data of the survey results to the contracted professional hand harvesting firm to guide the hand harvesting efforts.

4.0 HAND-HARVESTING ACTIVITIES

The Town of Plum Lake has utilized professional divers from Aquatic Plant Management, LLC (APM) to conduct hand-harvesting activities of EWM in Little Star Lake annually since 2017. Divers have harvested a total of 74.95 cubic feet of EWM within Little Star Lake since its discovery. Table 4.0-1 highlights the hand-harvesting activities during this timeframe.

One professional hand harvesting day took place in 2023, occurring on August 7. A total of 4.0 cubic feet of EWM was harvested over the course of 6.5 hours of underwater dive time. Details of the 2023 professional hand harvesting activities are included in the Little Star Lake EWM Removal Report authored by APM, LLC and included with this report as Appendix A.

Year	Hours	EWM Harvested (ft ³)
2017	24	7.65
2018		2.30
2019		12.00
2020	5.5	1.50
2021	12.2	28.50
2022	6.5	19.00
2023	6.5	4.00
Totals	54.7*	74.95

*does not include 2018 and 2019 totals

Table 4.0-1. 2017-2023 hand-harvesting activities in Little Star Lake.

5.0 LATE-SUMMER EWM MAPPING SURVEY RESULTS

The Late-Summer EWM Mapping Survey was conducted on August 9, 2023 to qualitatively assess the hand harvesting efforts as well as to understand the peak growth (peak-biomass) of the EWM population throughout the lake. Again, the crew reported water with low clarity and a brown color. The entire littoral zone of Little Star Lake was meandered and any EWM occurrences were mapped by using the same methodology as the ESAIS survey described above.

The entire littoral area of the lake was searched during the visit with some extra focus given to all areas where EWM has been located previously. The crews located several *single or few plant* occurrences on the northeast and northwest shorelines (Map 2). All of these occurrences were visible from viewing from the bow of the boat. No colonized areas of EWM that required area-based mapping methodologies were located anywhere in the lake during the survey. In comparing the early season to the late season survey, it is clear the hand-harvesting has successfully reduced the EWM in Little Star Lake. In the August 2023 survey there were nine *single or few* plants recorded, compared to over 30 in the June 2023 survey. Overall, the population of EWM in Little Star Lake remains very low.

6.0 CONCLUSIONS AND DISCUSSION

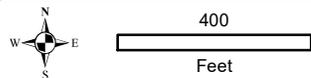
Over the course of this project, semi-annual professional monitoring surveys have guided professional hand harvesting efforts and have been instrumental in maintaining the low EWM population. Detection has been a focus of the Town of Plum Lake’s strategy in managing EWM in the lake, with all recent findings being targeted with removal efforts which inhibits the expansion potential for this species within the lake.

Since its discovery, traditional hand harvesting has been the control strategy utilized on Little Star Lake. In many Wisconsin lakes, this method is able to slow the spread and decrease the population of EWM throughout the lake with some even being able use this control method as a long-term control solution. A continuation of this type of monitoring and management program would seem to be capable of maintaining the EWM population at similarly low levels.

It is difficult to predict what the EWM population would do in Little Star Lake in the absence of management efforts. The fact that relatively low amounts of hand harvesting efforts (1-2 days/year) have kept the population so low, suggests that perhaps EWM will not rapidly increase in population in Little Star Lake and it may have limited growth potential based on water clarity or some other factor. EWM, like native aquatic plants, is influenced greatly by seasonal environmental factors from year to year and may not necessarily increase in population when unmanaged. Eurasian watermilfoil has the potential to create dense stands in lakes; however, in some lakes, EWM appears to integrate itself within the community without becoming a nuisance or having a measurable impact to the ecological function of the lake.

The Town of Plum Lake could consider the option of not conducting management efforts during 2024 in order to understand the natural EWM population dynamics in the lake. If no management efforts take place in 2024, Onterra recommends monitoring the population through the completion of a late-summer EWM mapping survey. The results of that survey will be used to consider whether harvesting in 2025 should be considered.

If the Town prefers to continue an aggressive EWM management strategy, the current known population would likely require around one day of professional hand harvesting efforts which could be guided by the spatial data collected during the 2023 late-summer mapping survey. The Town could continue with a professional firm to conduct these removal efforts, or investigate the potential for any local divers/volunteers that might be able and willing to search for and remove EWM at a reduced cost to the Town.



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Sources:
 Roads and Hydro: WDNR
 Bathymetry: WDNR, digitized by Onterra
 Ortho: NAIP 2022
 Aquatic Plants: Onterra, June 2023
 Map Date: June 30, 2023 TWH



Project Location in Wisconsin

Legend

Eurasian Watermilfoil Survey: June 27, 2023

- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

 Carry-In Access

Map 1
 Little Star Lake
 Vilas County, Wisconsin
**June 2023 EWM
 Survey Results**

A

APPENDIX A

Aquatic Plant Management, LLC EWM Removal Report 2023



Little Star Lake EWM Removal Report 2023

PO Box 1134 Minocqua, WI 54548



Little Star EWM Removal Summary 2023

Dive Background: In August, Aquatic Plant Management LLC (APM) conducted one (1) day of hand harvesting for Eurasian Watermilfoil (EWM) on Little Star Lake in Vilas County, WI. The team focused their efforts at 3 sites as prioritized by the Little Star Lake Association. In total APM was able to remove **4 cubic feet of EWM** from Little Star Lake.

Date	Weather Conditions	Water Temp (F)	Underwater Dive Time (hrs)	AIS Removed (cubic ft)
8/7/2023	Partly Cloudy	70	6.5	3.0
Grand Total			6.5	3.0

Dive Location	Avg. Water Depth	# of Dives	Underwater Dive Time	AIS Removed (cubic feet)
E Boat Landing	4.0	1	1.0	0.5
NE Shoreline	3.5	1	3.0	2.5
W Boat Landing	4.0	1	2.5	1.0
Grand Total	3.8	3	6.5	4.0

Dive Highlights and Recommendations: The dive team spent ~50% of their time at the northeast shoreline where they were chasing highly scattered plants. Overall, Little Star Lake should continue to take an Integrated Pest Management (IPM) approach and evaluate different strategies to manage the EWM population on the lake. Continued monitoring and management efforts are important to prevent the spread of EWM throughout Little Star Lake.

Map of Little Star Lake Dive Sites





Detailed Diving Activities

Date	Dive Location	Latitude	Longitude	Underwater Dive Time (hrs)	AIS Removed (cubic ft)	AIS Density	Avg Water Depth (ft)	Native Species	Native By-Catch	Substrate Type
8/7/2023	E Boat Landing	46.04865	-89.47708	1.00	0.5	Highly Scattered	4.0	Elodea	0.0	Organic/Sand
8/7/2023	W Boat Landing	46.04941	-89.47798	2.50	1.0	Highly Scattered	4.0	Elodea	0.0	Organic/Sand
8/7/2023	NE Shoreline	46.05079	-89.48420	3.00	2.5	Highly Scattered	3.5	Elodea	0.5	Organic/Sand
Total	3			6.50	4.0					