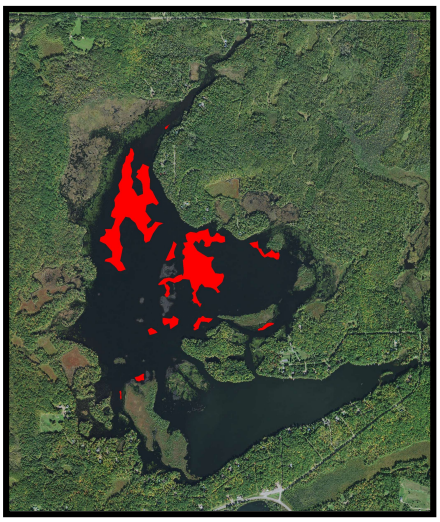
Eurasian water-milfoil (*Myriophyllum spicatum*)
Late-summer Bed Mapping Survey
Mud Lake (WBIC: 2434800)
Sawyer County, Wisconsin

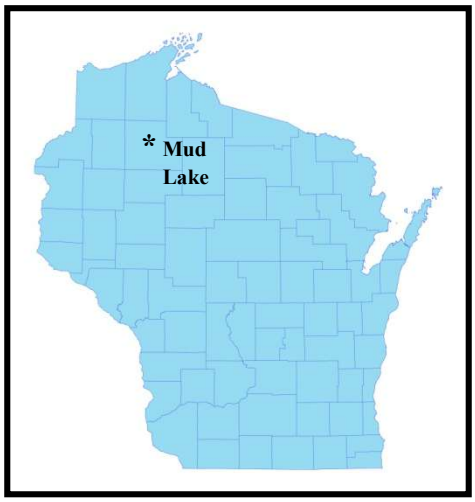


Eurasian Water-milfoil beds on Mud Lake – 8/30/25

Canopied mat of Eurasian water-milfoil visible in calm conditions - 8/30/25

Project Initiated by:

The Callahan and Mud Lakes Protective Association,
Lake Education and Planning Services, LLC, and the
Wisconsin Department of Natural Resources (Grant ACEI35725)



Close-up view of canopied Eurasian water-milfoil on the lake's north side – 8/30/25

Survey Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
Saint Croix Falls, Wisconsin
August 30, 2025

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

INTRODUCTION:

Mud Lake (WBIC 2434800) is a 464-acre drainage lake created by an 8ft dam on the north fork of the Chief River in north-central Sawyer County, Wisconsin in the Town of Round Lake (T41N R7W S27/28 and 33/34). It has a maximum depth of 15ft and an average depth of 6ft. The lake is mesotrophic in nature, and water clarity is good with summer Secchi readings averaging 9.1ft in 2021 – the last year data was available (WDNR 2025). The lake's bottom substrate is primarily sand along the shoreline before transitioning to a sandy muck at most depths over 7ft (Bush et al. 1968) (Figure 1).

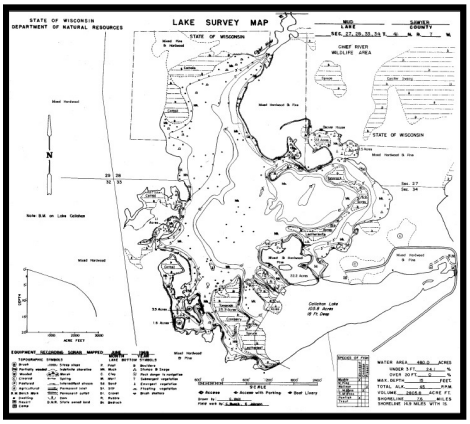


Figure 1: Mud Lake Bathymetric Map

BACKGROUND AND STUDY RATIONALE:

Eurasian water-milfoil (*Myriophyllum spicatum*) (EWM) is an exotic invasive plant species that was first identified in Mud Lake in the fall of 2005. Following an initial whole lake point-intercept survey in 2008 (J. Williamson), the Callahan and Mud Lakes Protective Association (CMLPA) and the Sawyer County Land and Water Conservation Department (SCLWC - K. Maki) used a 2009 Wisconsin Department of Natural Resources (WDNR) rapid response grant to hire Ayres Associates to write the lakes' original Aquatic Plant Management Plan (APMP) that called for herbicide applications to control the infestation (Kleczewski 2009). Using data gathered from our 2020 and 2021 late-summer EWM bed mapping surveys and our 2021 whole lake point-intercept surveys, Dave Blumer (Lake Education and Planning Services, LLC - LEAPS) updated this plan in 2022. In addition to continued small-scale herbicide treatments, the new APMP outlined manual removal efforts that included diver assisted suction harvesting (DASH).

Per WDNR expectations (Pamela Toshner/Alex Smith, WDNR – pers. comm.), whole-lake plant surveys on actively managed lakes are normally repeated every five to seven years to remain current. In anticipation of updating their plan in 2026, the CMLPA – again under the direction of LEAPS – applied for and received a WDNR grant (ACEI35725) to help cover the cost of surveys and the APMP review. In order to determine the current levels of EWM, in addition to the point-intercept surveys, the CMLPA, LEAPS, and the WDNR requested we complete follow-up late-summer EWM bed mapping survey of the lakes in 2025. Data from the surveys will provide current acreage and density of EWM that will help guide any future management. This report is the summary analysis of our August 30, 2025 field survey.

METHODS:

Late-summer Eurasian Water-milfoil Bed Mapping Survey:

During the survey, we searched the visible littoral zone of the lake. By definition, a "bed" was determined to be any area where we visually estimated that Eurasian water-milfoil made up >50% of the area's plants, was generally continuous with clearly defined borders, and was canopied or close enough to being canopied that it would likely interfere with boat traffic. After we located a bed, we motored around the perimeter taking GPS coordinates at regular intervals. We also estimated the rake density range and mean rake fullness of the bed (Figure 2), the range and mean depth of the bed, whether it was canopied, and the impact it was likely to have on navigation (**none** – easily avoidable with a natural channel around or narrow enough to motor through/**minor** – one prop clear to get through or access open water/**moderate** – several prop clears needed to navigate through/**severe** – multiple prop clears and difficult to impossible to row through). These data were then mapped using ArcMap 9.3.1, and we used the WDNR's Forestry Tools Extension to determine the acreage of each bed to the nearest hundredth of an acre.

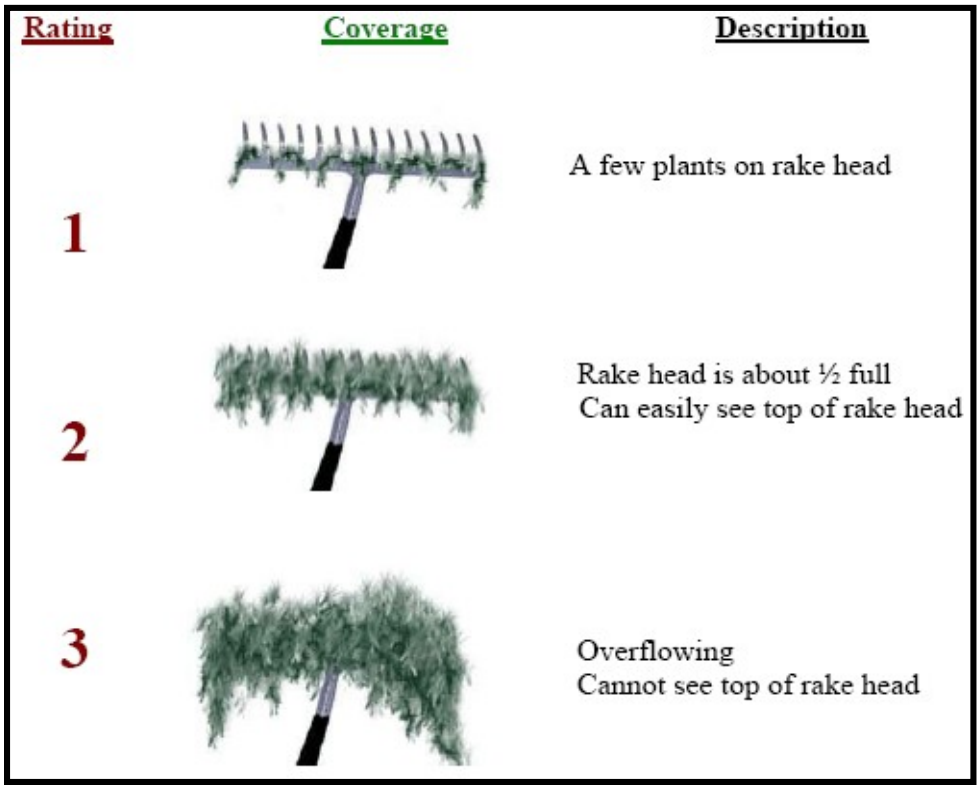


Figure 2: Rake Fullness Ratings (UWEX 2010)

RESULTS:

Late-summer Eurasian Water-milfoil Bed Mapping Survey:

During the August 6-7, 2025 point-intercept survey and the follow-up August 30, 2025 Eurasian water-milfoil bed mapping survey, we searched a combined total of 72.1km (44.8 miles) of transects throughout the lake's visible littoral zone (Figure 3). Collectively, we mapped 11 beds that covered 52.78 acres (11.37% of the lake's surface area) (Figure 4) (Appendix I). This was a 39.77-acre increase **(+305.69%)** compared to 2021 when we delineated 29 beds that totaled 13.01 acres (2.80% of the lake's surface area). It was also 41.72 acres more **(+377.69%)** than the 2020 survey when we documented 28 beds on 11.06 acres (2.38% coverage) (Table 1).

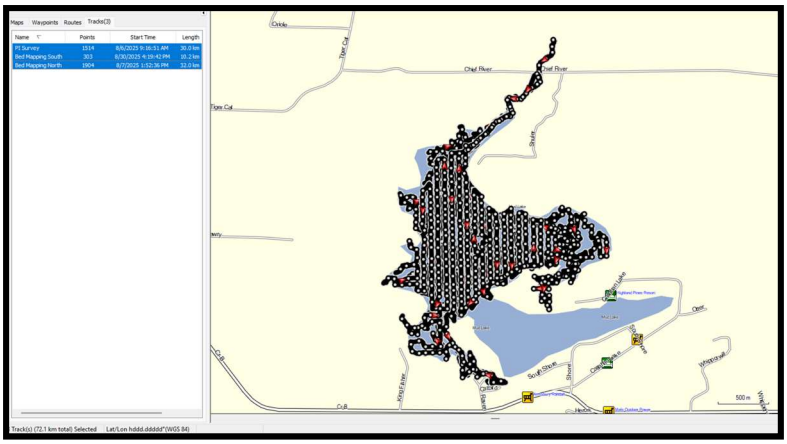


Figure 3: 2025 EWM Littoral Zone Survey – GPS Tracks

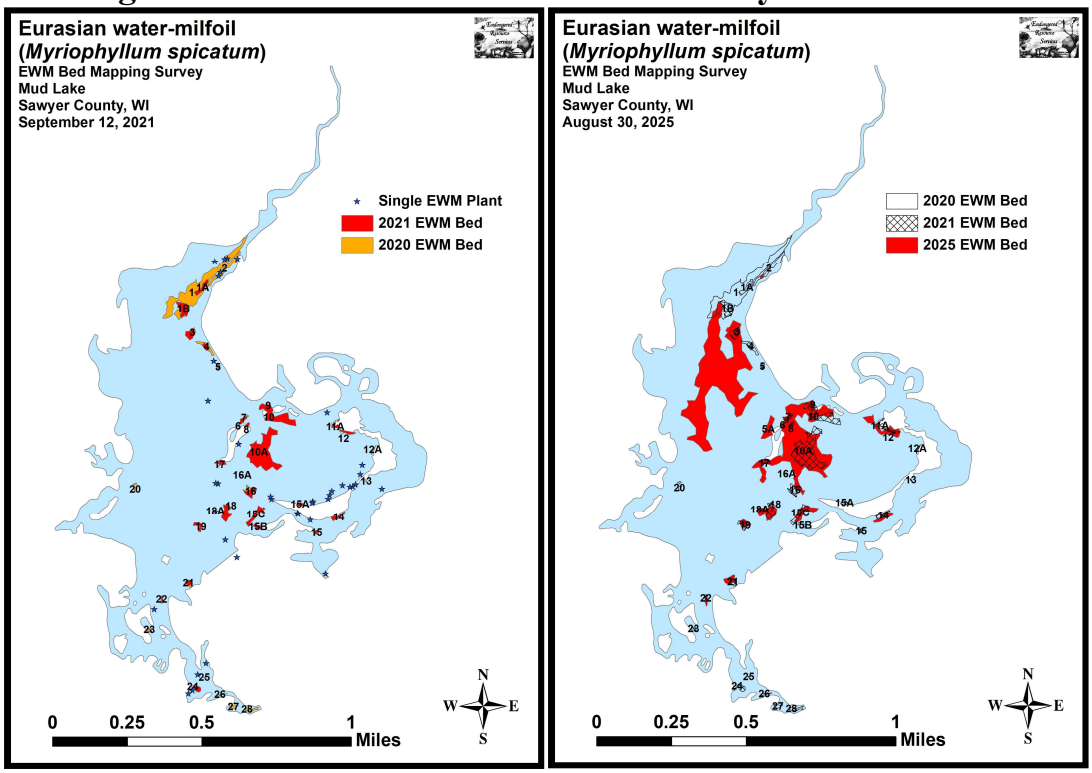


Figure 4: 2021 and 2025 Eurasian Water-milfoil Bed Maps

Table 1: Late-summer Eurasian Water-milfoil Bed Mapping Summary
Mud Lake - Sawyer County, WI
August 30, 2025

Bed Number	2025 Acreage	2021 Acreage	2020 Acreage	2021-2025 Change in Acreage	Rake Range and Mean Rake Fullness	Depth Range and Mean Depth	Canopied	Navigation Impairment	2025 Field Notes
1 (A + B)	27.40	1.19	7.18	25.75	<<<1-3; 2	3-7; 6	Yes	Moderate	Prop-clipped plants throughout – canopied mat at core.
2	0.08	0	0.92	0.08	<<<1-3; 2	3-5; 4	Yes	Minor	Too narrow to be a moderate impairment.
3	Merged	0.46	0.23	-	<<<1-3; 2	4-6; 5	Yes	Moderate	Merged with Bed 1.
4	0	0.20	0.48	-0.20	<<<1-1; <1	3-5; 4	Yes	None	Scattered individuals.
5	0	0.02	0.07	-0.02	<<<1-1; <1	3-5; 4	Yes	None	Scattered individuals.
5A	0.96	0	0	0.96	<<<1-3; 1	4-6; 5	Yes	Minor	Open fragmented patch of super clusters.
6 and 7	Merged	0.19	0.18	-	<<1-3; 3	4-8; 6	Yes	Moderate	Merged with Bed 10A.
8	Merged	0.08	0.07	-	<<1-3; 3	4-8; 6	Yes	Moderate	Merged with Bed 10A.
9 and 10	Merged	2.08	0.15	-	<<<1-3; 3	4-9; 7	Yes	Minor	Merged with Bed 10A.
10A	18.92	4.88	0	11.01	<<<1-3; 2	2-11; 7	Yes	Minor	Much of bed is subcanopy or it would be mod. impair.
11	Merged	0.02	<0.01	-	1-3; 2	4-7; 6	Yes	Minor	Merged with Bed 12.
11A	Merged	0.15	0	-	<1-3; 2	4-7; 6	Yes	Minor	Merged with Bed 12.
12	1.56	0.21	0.09	1.18	<<<1-3; 2	4-9; 6	Yes	Minor	Too narrow to be a moderate impairment.
12A	0	0.04	0	-0.04	<<<1	4-8; 6	Yes	None	Scattered individuals.
13	0	<0.01	0.01	-<0.01	<<1-2; 1	2-5; 4	Yes	None	Scattered individuals.
14	0.49	0.26	0.05	0.23	<<<1-3; 1	3-6; 5	Yes	Minor	Small open bed with ribbon of microclusters.
15	0	0.07	0.06	-0.07	-	-	-	-	No EWM seen – residual control from Callahan?
15A	0	0.11	0	-0.11	<<1	4-6; 5	Yes	None	Handful of scattered plants.
15B/C	1.05	0.83	0	0.22	<<<1-3; 2	4-7; 6	Yes	Minor	Too narrow to be a moderate impairment.
16	Merged	0.47	0.45	-	<<<1-2; 1	2-6; 4	Yes	Minor	Merged with Bed 10A.
16A	0	0.02	0	-0.02	<<<1	5-7; 6	Yes	None	Handful of scattered plants.
17	Merged	0.21	0.03	-	<<1-2; 1	2-5; 3	Yes	Minor	Merged with Bed 10A.
18 and 18A	1.29	0.79	0.02	0.50	<<<1-3; 1	4-8; 6	Yes	Minor	Open bed.
19	0.43	0.24	0.09	0.19	<<<1-3; 2	3-7; 5	Yes	Minor	Too narrow to be a moderate impairment.

Table 1 (continued): Late-summer Eurasian Water-milfoil Bed Mapping Summary
Mud Lake - Sawyer County, WI
August 30, 2025

Bed Number	2025 Acreage	2021 Acreage	2020 Acreage	2021-2025 Change in Acreage	Rake Range and Mean Rake Fullness	Depth Range and Mean Depth	Canopied	Navigation Impairment	2025 Field Notes
20	0	0	0.12	0	<<<1	1-4; 3	Yes	None	Handful of scattered plants.
21	0.48	0.16	0.21	0.32	<<<1-3; 2	2-6; 4	Yes	Minor	Too narrow to be a moderate impairment.
22	0.12	0.06	0.10	0.06	<<<1-3; 2	2-6; 4	Yes	Minor	Too narrow to be a moderate impairment.
23	0	0.04	0.08	-0.04	<<<1	4-5; 5	Yes	None	Handful of scattered plants.
24	0	0.23	0.04	-0.23	<<<1	4-5; 5	Yes	None	Handful of scattered plants.
25	0	0	0.01	0	<<<1	4-5; 5	Yes	None	Handful of scattered plants.
26	0	0	0.06	0	<<<1	4-5; 5	Yes	None	Handful of scattered plants.
27	0	0	0.15	0	<<<1	4-5; 5	Yes	None	Handful of scattered plants.
28	0	0	0.20	0	<<<1	4-5; 5	Yes	None	Handful of scattered plants.
Total Acres	**52.78**	**13.01**	**11.06**	**+39.77**					

Descriptions of Past and Present Eurasian Water-milfoil Beds:

Beds 1-3 – Past treatments in the lake inlet have resulted in a significant decline in the Eurasian water-milfoil population in these upstream areas, and we noted Bed 2 was little more than a narrow sliver along the channel. However, Bed 1 has merged with Bed 3 and showed dramatic expansion to the south. Outside of the main navigation channel where regular boat traffic was keeping a lane open down the middle of the bed, the majority of the area's core was a dense canopied mat that represents the worst area on the lake (see report cover). Here, we noted floating fragments and prop trails were common throughout.

Beds 4-5 – EWM plants were only widely-scattered in these former shoreline beds.

Bed 5A – This bed was located west of a muck bog island. Although still fragmented, super clusters were beginning to merge, and it was likely at least a minor impairment.

Beds 6-10A, 16/16A, and 17 – In 2020, we found that the stained water in the system seemed to largely restrict EWM from growing in areas deeper than 7ft. During the 2021 and 2025 growing seasons, low water levels and improved clarity appear to have allowed EWM to expand into deeper areas, and this giant bed had nearly continuous low-density plants on the periphery that were approaching canopy in up to 11ft. In shallower areas, EWM often formed dense canopied mats; especially in areas that were covered by smaller beds in 2021. The majority of Bed 10 would have been a moderate impairment if the EWM was canopied throughout instead of just in patches.

Beds 11/11A and 12 – These beds had merged into a nearly continuous canopied mat, and they would likely have caused moderate impairment if people motored right through them. However, because they were all narrow and occurred along isolated bog islands, they are not likely to be high management priorities.

Beds 12A, 13, and 15A – Low density EWM was scattered along these former microbeds and high-density areas.

Bed 14 – This open bed was a ribbon of plants and microclusters immediately along a bog island. Because of its low density, nearness to shore, and low potential for impairment, it is likely a low management priority.

Bed 15 – Located just north of Callahan Lake, we saw no evidence in EWM in this former bed. This may mean the area received residual control from the 2025 herbicide treatment.

Beds 15B and 15C – These two areas had merged into a more or less continuous bed. Many plants were prop-clipped and several dense microbeds were imbedded in the overall area. Although not likely more than a minor navigation impairment, regular boat traffic through the area makes it worth considering for future management.

Beds 18/18A, and 19 – These beds were scattered along the edges of floating mud bogs. Each was larger than they had been in 2020 and 2021, and we found they were expanding away from the bogs into deeper water; especially Bed 18 which now likely posed a minor to moderate navigation impairment if boats motored right through it. Based on this, it's likely an area to consider for active management in the future.

Beds 21-22 – These two small, moderate-density beds occurred east of the main navigation channel in the southwest bay. Neither was wide enough to likely be more than a minor impairment to navigation.

Beds 20 and 23-28 – We saw no evidence of EWM beds in these parts of the southwest bays and channels. The only EWM present occurred as a few widely-scattered individuals – usually along the margins of the main navigation channel.

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

Eurasian water-milfoil is widespread in the Mud/Callahan system making eradication an unrealistic expectation. Although EWM is still found throughout Mud Lake, past active management has dramatically reduced it from an estimated 109 acres covering 23.49% of the lake's surface area in 2008 (Kleczewski 2009). However, without recent management, levels of EWM are again climbing.

Past management of Eurasian water-milfoil in Mud Lake has come at a high economic cost, and, as herbicides are non-selective, has also likely had significant impacts on the aquatic plant community. With this in mind, working to control its spread in the most cost-effective manner possible, while simultaneously minimizing its impact on the lake's aquatic ecosystem, will likely continue to be important goals for the CMLPA as they update their management plan. Ultimately, the amount of EWM growth the CMLPA and WDNR are comfortable with will determine how much, if any, active management occurs in Mud Lake in 2026. Likewise, what if any future monitoring will occur on the lake is a conversation that needs to occur.

LITERATURE CITED

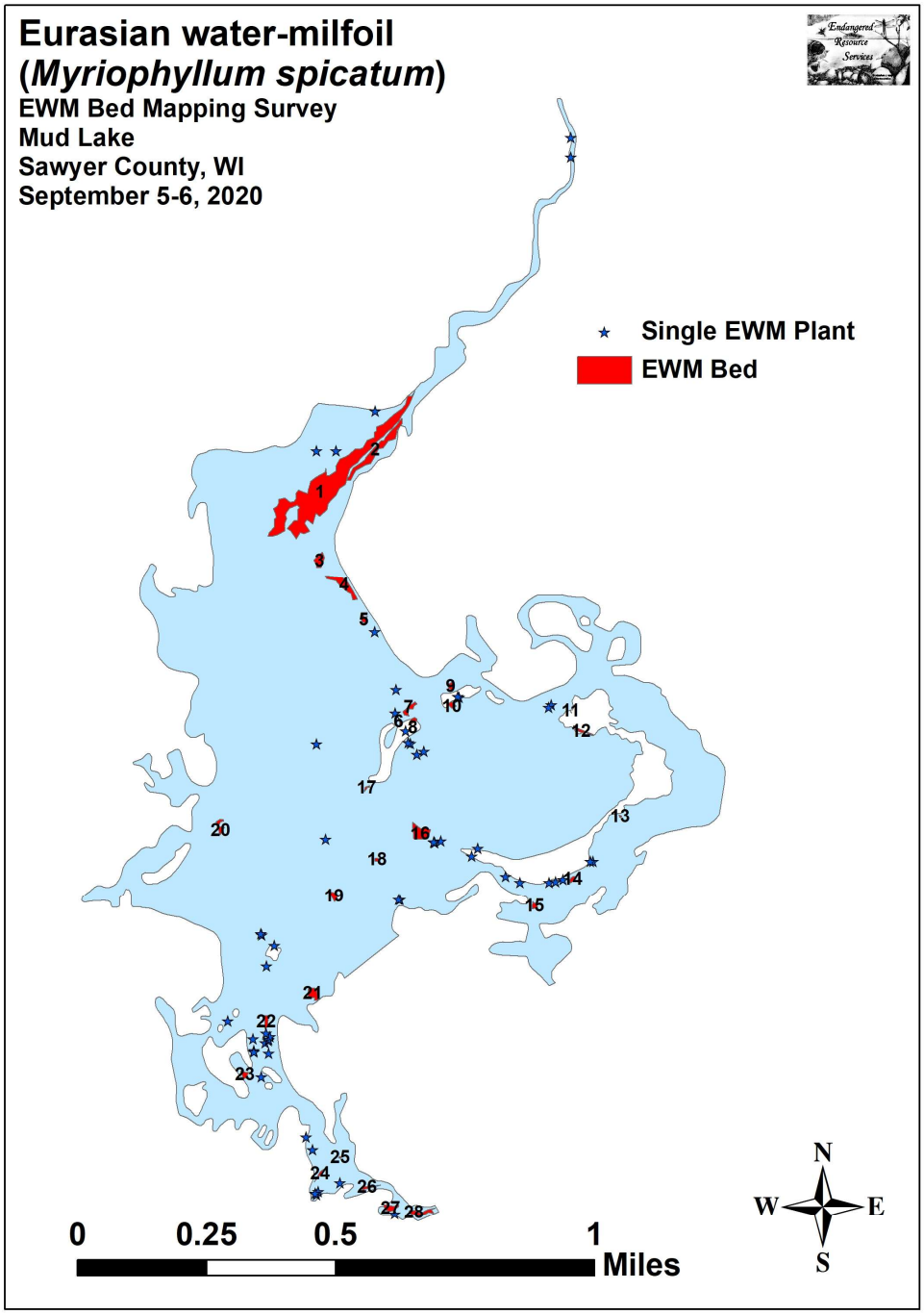
Busch, C., E. Johnson, and C. Holt. [online]. 1968. Mud Lake Map. Available from https://apps.dnr.wi.gov/doclink/lakes_maps/2434800a.pdf (2025 December).

Kleczewski, T. 2009. Callahan and Mud Lakes Aquatic Plant Management Plan. Ayres Associates. Eau Claire, WI

WDNR. [online]. 2025. Mud Lake - Citizen Lake Water Quality Monitoring Database. Available from https://apps.dnr.wi.gov/lakes/waterquality/Station.aspx?id=583216 (2025 December).

WDNR. [online]. 2025. Mud Lake - Wisconsin Lakes Information. Available from Wisconsin Lakes (2025 December).

Appendix I: 2020, 2021, and 2025 Eurasian Water-milfoil Bed Maps


Eurasian water-milfoil
(Myriophyllum spicatum)
EWM Bed Mapping Survey
Mud Lake
Sawyer County, WI
September 5-6, 2020
Endangered Resource Services
Single EWM Plant
EWM Bed
1
2
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4
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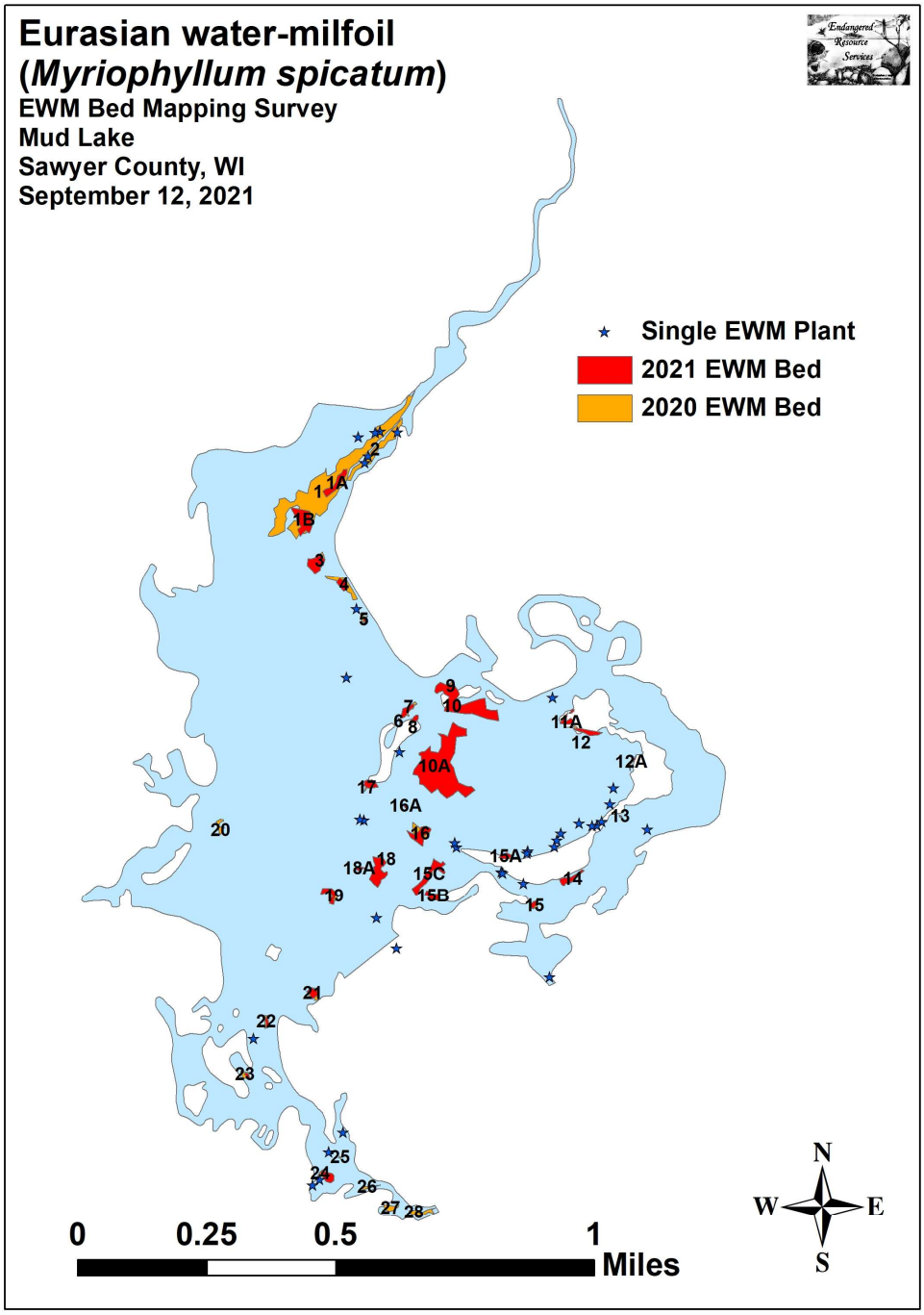
Eurasian water-milfoil
(Myriophyllum spicatum)
EWM Bed Mapping Survey
Mud Lake
Sawyer County, WI
September 12, 2021
Endangered Resource Services
Single EWM Plant
2021 EWM Bed
2020 EWM Bed
1
1A
1B
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6
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8
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10A
11A
12
12A
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15C
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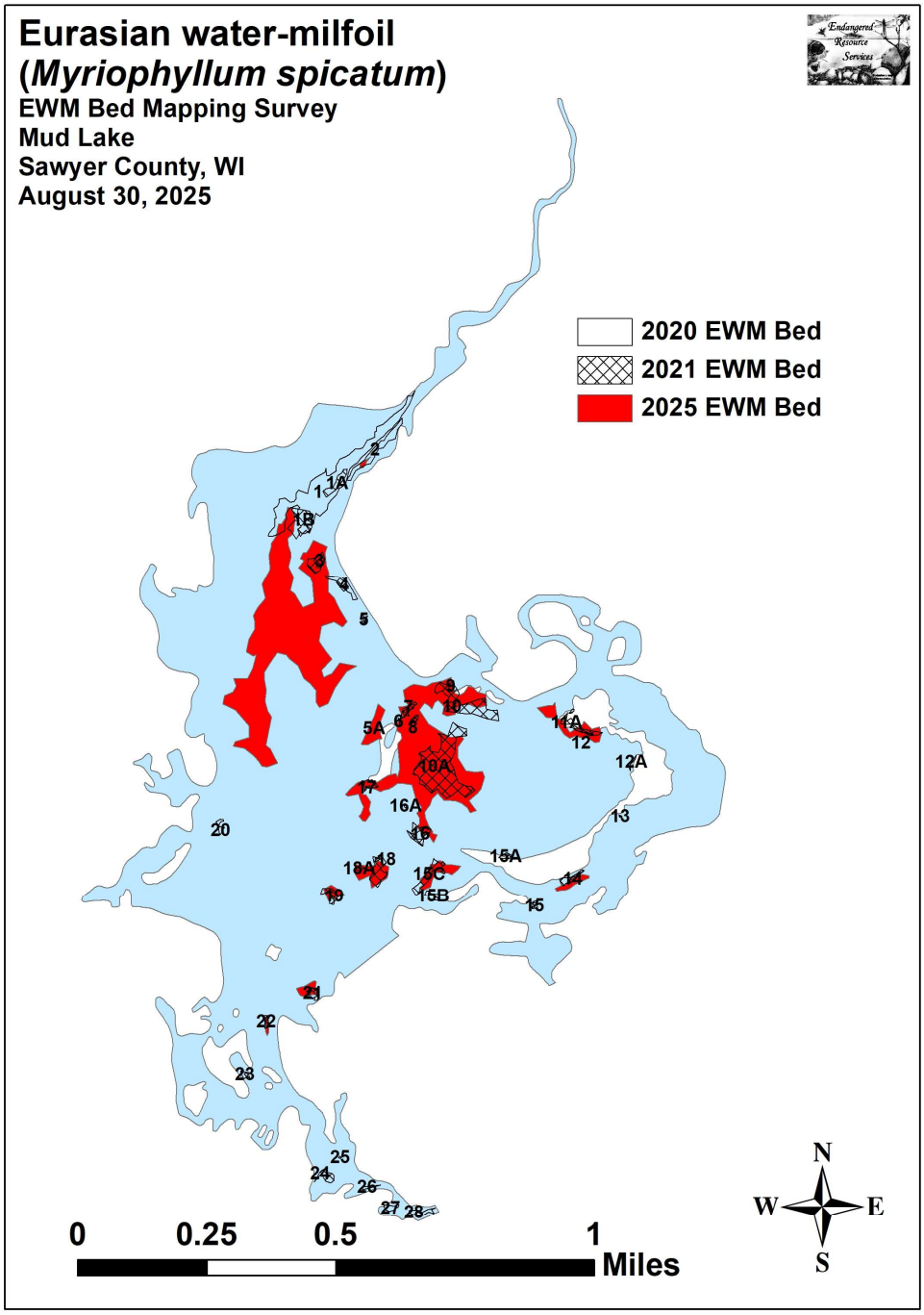
Eurasian water-milfoil
(Myriophyllum spicatum)
EWM Bed Mapping Survey
Mud Lake
Sawyer County, WI
August 30, 2025
Endangered Resource Services
2020 EWM Bed
2021 EWM Bed
2025 EWM Bed
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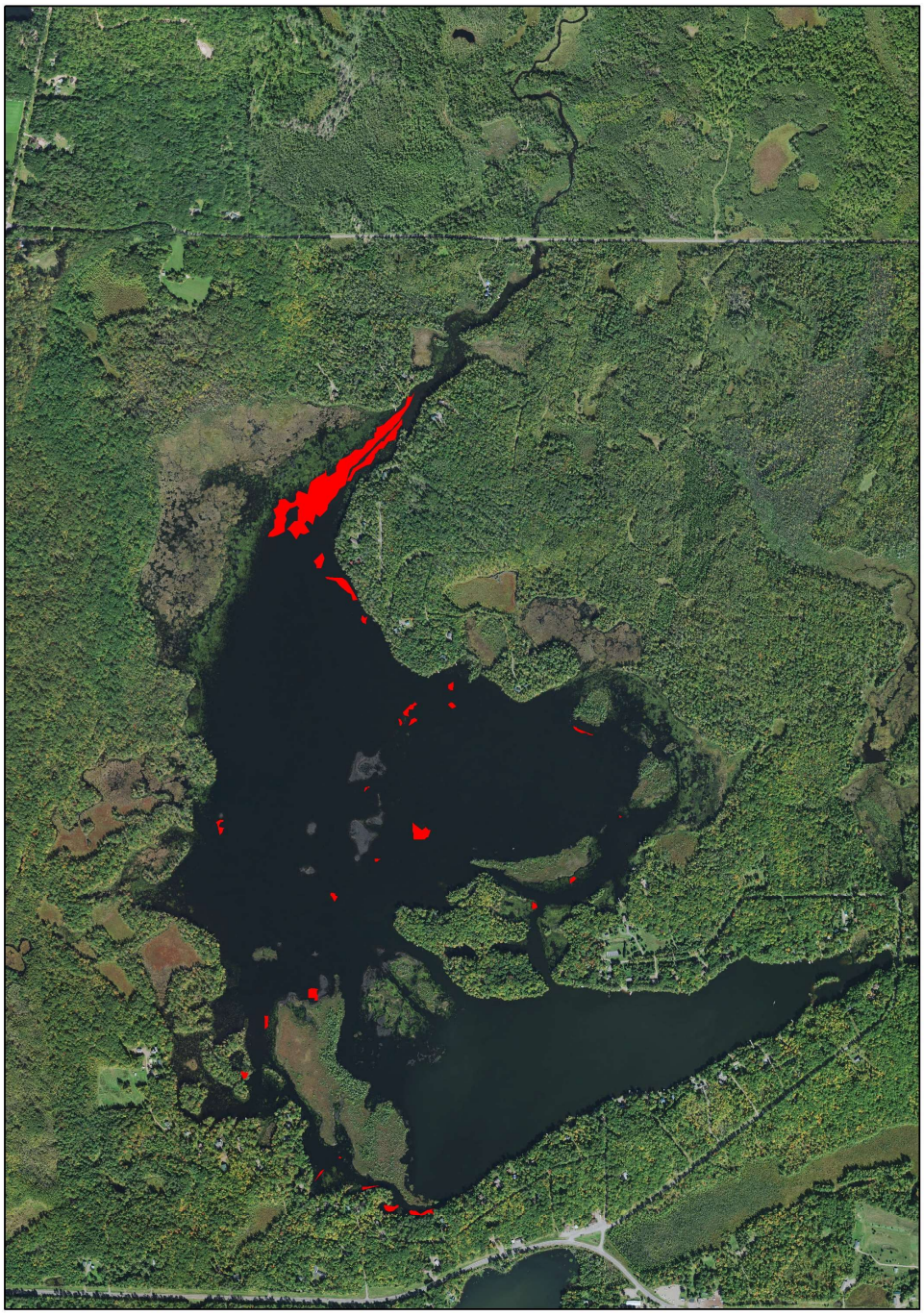
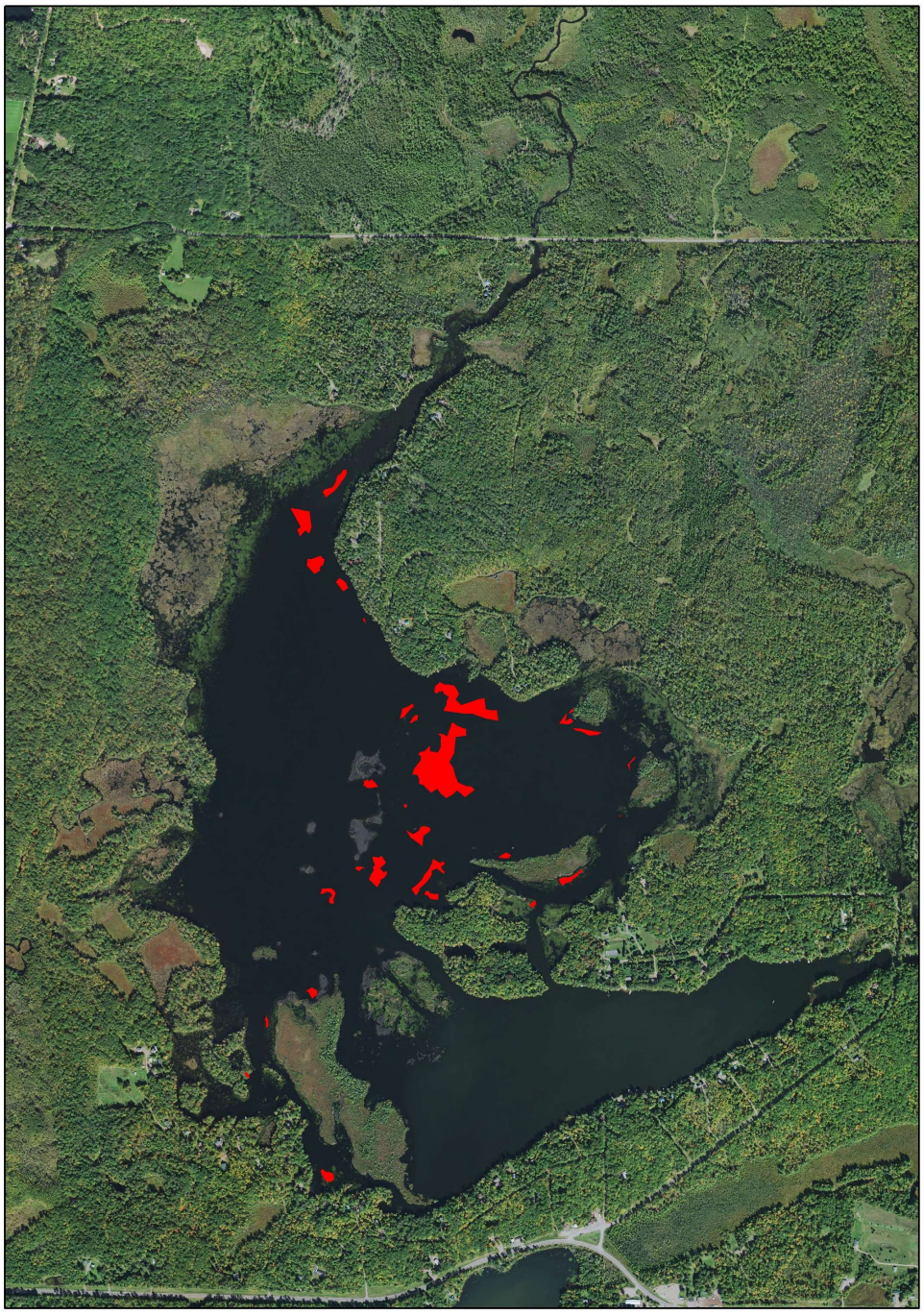
2020 Aerial View



2021 Aerial View



2025 Aerial View