2025 Aquatic Plant & EWM Survey Report

Lake Redstone, Sauk County, Wisconsin

SubPI Surveys of Cardinal, Martin-Meadowlark, & Swallow Bays August 6th, 2025

EWM Bed Survey September 12th, 2025

Report completed January 2026

Project funded by:
Lake Redstone Protection District

Survey and report completed by: Aquatic Plant & Habitat Services, LLC
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Survey Assistance from AEM Aquatic Consulting

1.0 Summary of Results

1.1 Sub-Point-Intercept Surveys of 3 Bays

- Cardinal, Martin-Meadowlark, and Swallow Bays were surveyed August 6th, 2025 using sub-point-intercept survey methods to gauge occurrence of all aquatic plant species.
- There were 192 total sample points among the 3 bays, 66 of which (34%) had aquatic vegetation present. There were only 6 of those sample points with EWM present.
- The deepest rooting depth among all bays was 5 feet deep, which is consistent with previous surveys.
- There was a total of 8 species detected among all 3 bays, which is very low species richness and consistent with previous surveys.
- There was a declining trend in native and non-native aquatic plant occurrence from 2014 through 2022, an increase in 2023, then a decline again in 2024, and another increase in 2025 (Figure 7). Despite the increase in 2025, aquatic plant occurrence on a lake-wide scale is very low based on a decade of surveys and observation.
- Chi-square tests comparing 2025 native species occurrence with that of most recent previous surveys revealed one statistically significant (SS) increase in native plant species and one SS decrease.
- When comparing 2025 native species occurrence with the first year surveyed for the three bays there were 7 statistically significant (SS) declines in native plant species, 2 SS declines in filamentous algae, 1 increase in native plants, and decrease of EWM in 2 bays.
- Bay-wide surveys of ***all bays*** suggest there is no consistent trend in EWM occurrence between 2014 and 2025. EWM occurrence in subPI surveys of bays is among the lowest since 2014 despite no herbicide treatment since 2018.
- Due to the low occurrence of native plant species in Lake Redstone, protection of aquatic plants is recommended at this time.

1.2 EWM Bed Survey of Littoral Zone

- An EWM bed survey of the entire near-shore area of Lake Redstone was conducted September 12, 2025.
- There were 30 beds of EWM delineated, resulting in 12 acres of EWM lake-wide.
- The EWM delineated is lower than 2024 (18.6 acres), 2023 (21 acres), and 2022 (32 acres).
- Of the EWM acreage, the majority was considered “highly scattered” (2.47 acres) or “scattered” (7.25 acres).
- All EWM was found within 20 feet of the shoreline and 6 feet or shallower.
- Small-scale manual removal of EWM that is causing recreational use impairment is recommended.

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1.0 Introduction

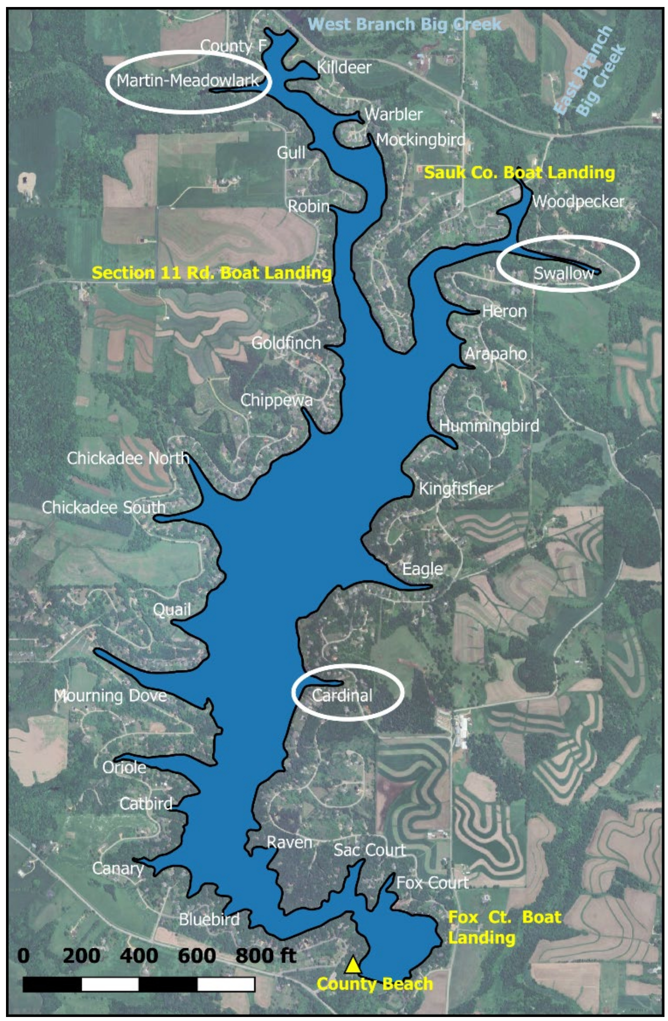
1.1 Recent Management History

The Lake Redstone Protection District (LRPD) partnered with Aquatic Plant and Habitat Services to complete aquatic plant surveys of 3 bays and EWM bed survey in 2025 and continue statistical tracking of EWM occurrence where control activities may be needed. Dredging occurred in Lake Redstone from July through December of 2019 to remove sediment from 27 locations, protect lake property values, maintain and improve the lake, and aim to improve water quality[1]. DASH and manual removal were used on a trial basis in 2021 and 2022 to remove EWM but water clarity was a significant issue for divers, which lead to unsatisfactory results. As a result, LRPD is not pursuing the use of DASH or hired manual removal in the near future. No herbicide treatment occurred in any bays in 2019 through 2025.

1.2 Study Site

Lake Redstone (WBIC 1280400) is located in the Town of La Valle, Sauk Co., Wisconsin. The lake is an impoundment of West and East Branches of Big Creek, although other intermittent streams also flow into the lake. Water flows out of Lake Redstone over a top draw dam at the southern end directly into Big Creek for a short stretch before flowing into the Baraboo River. Lake Redstone was created in the 1960's to create >1500 lots for development. The lake's surface area is 635 acres, maximum depth is 36.5 feet, mean depth is 14 feet, and the shoreline length is 17.5 miles. The lake is an Area of Special Natural Resource Interest due to presence of certain plants or animals or unique ecological communities identified in the WDNR Natural Heritage Inventory. Lake Redstone is classified as a eutrophic system based on data collected since 1979 with low water clarity (Secchi depth of 2-3 feet since 2009). Bays circled in Figure 1 indicate those surveyed with a sub-point-intercept survey in 2025 (Cardinal, Martin-Meadowlark, Swallow). The entire littoral zone (where plants can grow) was also surveyed for Eurasian watermilfoil.

Figure 1 – Lake Redstone Map of Bays



[1] https://www.lakeredstonepd.org/dredging-meeting-minutes. June 2018 Dredging Informational Meeting PowerPoint Presentation.

Table 1 – Summary Statistics of 3 Bays Surveyed in 2025

Bay & Year		1	2	3	4	5	6 Average # of species per site				7 Species Richness		8	
		Total # sites visited	Total # sites w/ vegetation	Max. depth of plants	Total # sites shallower than max. depth of plants	Littoral frequency (%)	a) Shallower than max. depth	b) Vegetated sites only	c) Native shallower than max. depth	d) Native at veg, sites only	a) Total # species on rake at all sites	b) Including visuals	Simpson's Diversity Index	Littoral frequency of EWM (%)
Swallow	2014	70	43	4	64	67.2	1.36	2.02	0.83	1.56	7	7	0.69	52
	2015	71	37	5	71	52.1	0.72	1.38	0.69	1.32	8	10	0.66	1
	2016	72	44	4	65	67.7	1.23	1.82	1.09	1.65	7	7	0.70	9
	2017	72	40	4	66	60.6	1.30	2.15	0.98	1.76	8	8	0.78	29
	2018	72	29	4	58	50.0	0.71	1.41	0.71	1.41	5	7	0.56	0
	2019	71	23	4	62	37.1	0.37	1.00	0.37	1.00	1	3	0	0
	2020	**71**	**14**	**5**	**57**	**24.6**	**0.32**	**1.29**	**0.26**	**1.15**	**5**	**6**	**0.46**	**4**
	2022	69	20	5	52	38.5	0.58	1.50	0.46	1.26	4	5	0.60	12
	2023	69	37	5	61	60.7	1.25	2.05	0.98	1.71	6	7	0.74	26
	2024	71	29	5	60	48.3	0.63	1.31	0.57	1.21	5	7	0.40	5
	2025	70	28	5	63	44.4	0.52	1.18	0.52	1.18	4	5	0.32	0
Cardinal	2015	67	33	7	46	71.7	1.15	1.61	0.85	1.39	7	8	0.74	30
	2016	65	39	6	45	86.7	1.73	2.00	1.42	1.83	9	11	0.83	31
	2017	66	35	7	46	76.1	1.61	2.11	1.11	1.65	8	9	0.76	50
	2018	61	39	11	60	65.0	1.10	1.69	0.90	1.54	10	11	0.75	20
	2019	59	29	9	53	54.72	0.70	1.28	0.55	1.16	5	7	0.71	15
	2020	**62**	**26**	**7**	**45**	**57.8**	**1.09**	**1.88**	**0.78**	**1.52**	**8**	**8**	**0.79**	**31**
	2021	63	18	6*	39	46.2	0.77	1.67	0.46	1.20	6	6	0.76	28
	2022	68	22	5.5	39	56	0.82	1.45	0.46	1.29	8	10	0.78	33
	2023	67	33	11	58	56.9	1.00	1.76	0.50	1.45	7	8	0.69	50
	2024	71	19	5	33	57.6	1.12	1.95	0.94	1.72	8	9	0.80	15
	2025	67	15	3.5	19	79.0	1.37	1.73	1.05	1.67	7	7	0.80	32
Martin-Meadowlark	2014	52	45	4	52	86.5	2.25	2.6	1.81	2.41	7	9	0.8	42
	2015	54	30	3	50	60.0	1.12	1.87	1.12	1.87	7	8	0.75	0
	2016	54	50	4	54	92.6	2.63	2.84	2.41	2.83	8	9	0.83	22
	2017	55	37	3	48	77.1	1.54	2.00	1.31	1.80	6	6	0.79	23
	2018	56	35	3	53	66.0	1.11	1.69	1.04	1.72	7	7	0.72	6
	2019	51	10	3	49	20.4	0.27	1.30	0.22	1.22	3	4	0.62	0
	2020	**54**	**8**	**4**	**33**	**24.2**	**0.33**	**1.38**	**0.33**	**1.38**	**6**	**6**	**0.76**	**0**
	2025	55	23	5	52	44.2	0.62	1.39	0.44	1.05	4	4	0.05	0

Herbicide treatment occurred during the years listed in red text. The results of these herbicide treatment years is considered post-treatment.

Results in BOLD text with blue shading are post-dredging (dredging occurred after the 2019 surveys).

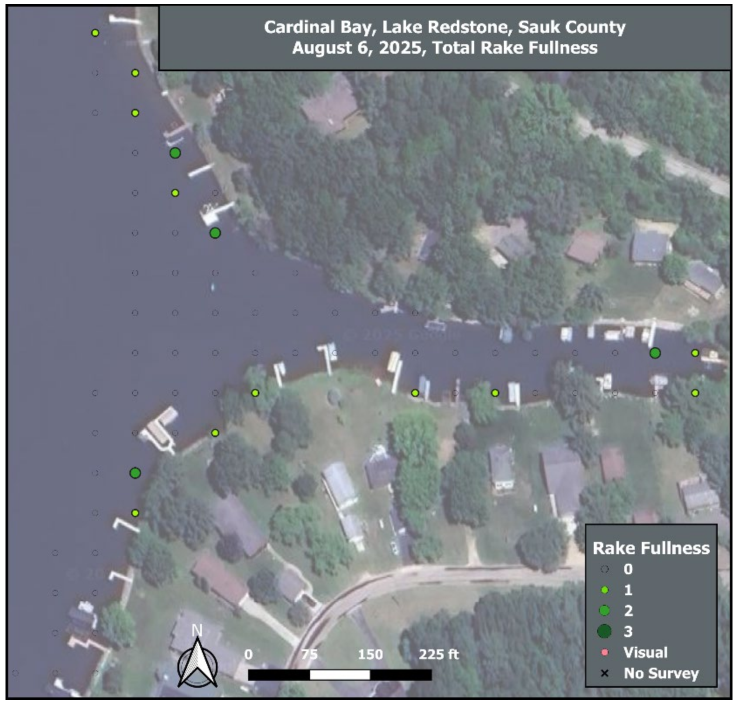
2.0 Methods

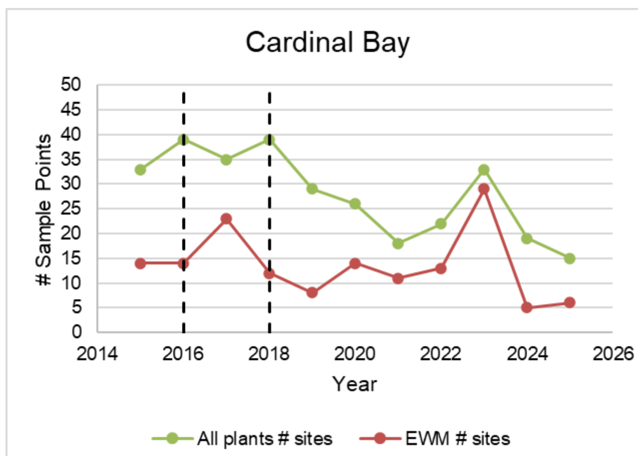
Field survey methods and explanations of surveys statistics such as those in Table 1 are described in Appendix A.

3.0 Results

3.1 Cardinal Bay 2025

- Max rooting depth = 3.5ft (5ft 2024)
- Plants were found at 15 sample points, which is the lowest number of sample points with plants in 11 years of surveying.
- Most common plant was sago pondweed at 8 sites.
- Chi-squared tests revealed a statistically significant decrease in coontail, slender waterweed, and filamentous algae when comparing 2015 data to 2025.
- There was no statistically significant difference among the aquatic plant community in 2025 compared to 2024.
- Cardinal Bay is NOT designated as a critical habitat area





CARDINAL BAY Common Name	CARDINAL BAY Scientific Name	Frequency of Occurrence at Veg. Sites (%)	Littoral Frequency (%)	Relative Frequency (%)	# Sites	Average Rake Fullness	# Visual
Sago pondweed	*Stuckenia pectinata*	53.33	42.11	30.77	8	1.13	0
Eurasian water milfoil	*Myriophyllum spicatum*	40.00	31.58	23.08	6	1.17	1
Small pondweed	*Potamogeton pusillus*	26.67	21.05	15.38	4	1.00	0
Wild celery	*Vallisneria americana*	20.00	15.79	11.54	3	1.00	0
Coontail	*Ceratophyllum demersum*	13.33	10.53	7.69	2	1.00	0
Slender naiad	*Najas flexilis*	13.33	10.53	7.69	2	1.00	0
White water lily	*Nymphaea odorata*	6.67	5.26	3.85	1	1.00	2
Filamentous algae		6.67	5.26		1	2.00	0

3.2 Martin-Meadowlark Bay 2025

- Max rooting depth = 5ft
- 44% Littoral frequency all plants.
- Most common plant was white water lily at 22 sites.
- Chi-squared tests revealed a statistically significant (SS) decrease in EWM, coontail, and duckweed in 2025 compared to 2014. There was a SS increase in white water lily and filamentous algae when comparing 2020 data to 2025.
- Martin-Meadowlark Bay is designated as a critical habitat area.
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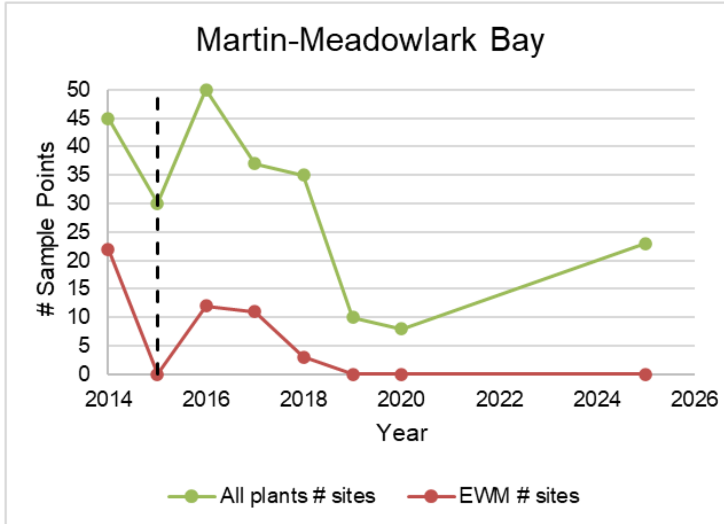
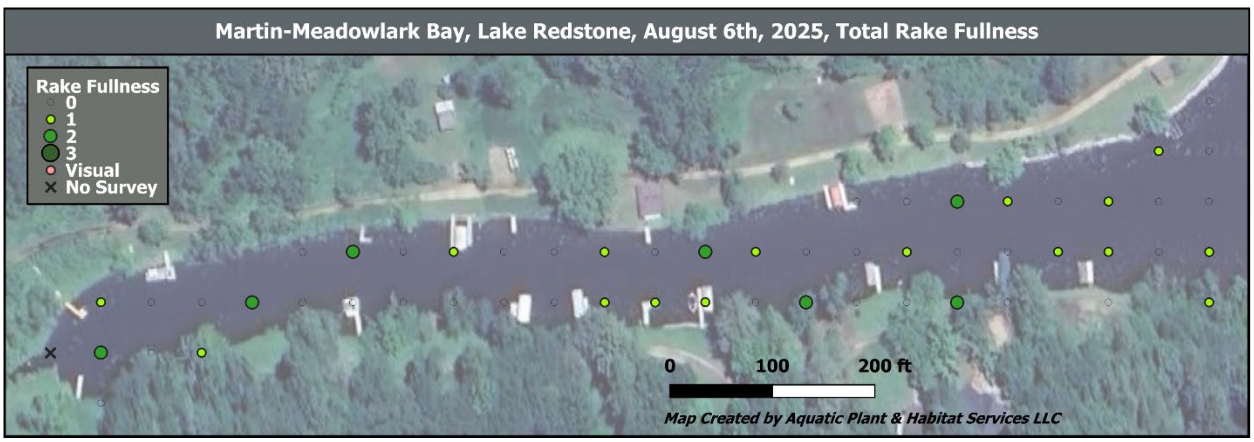
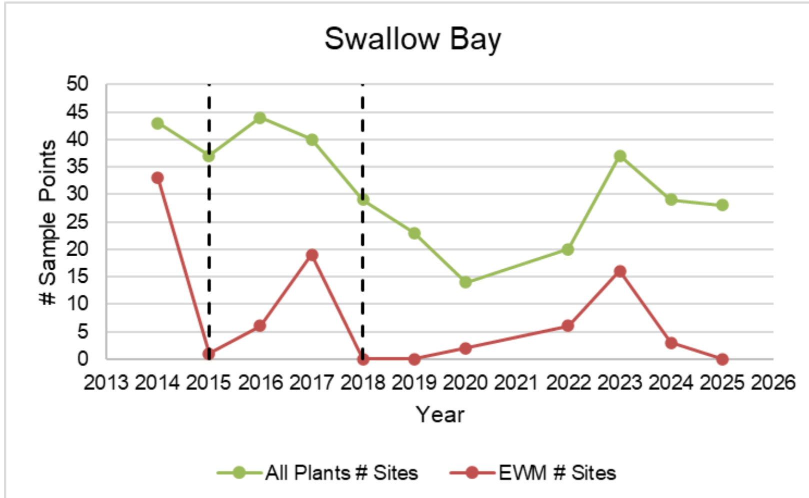


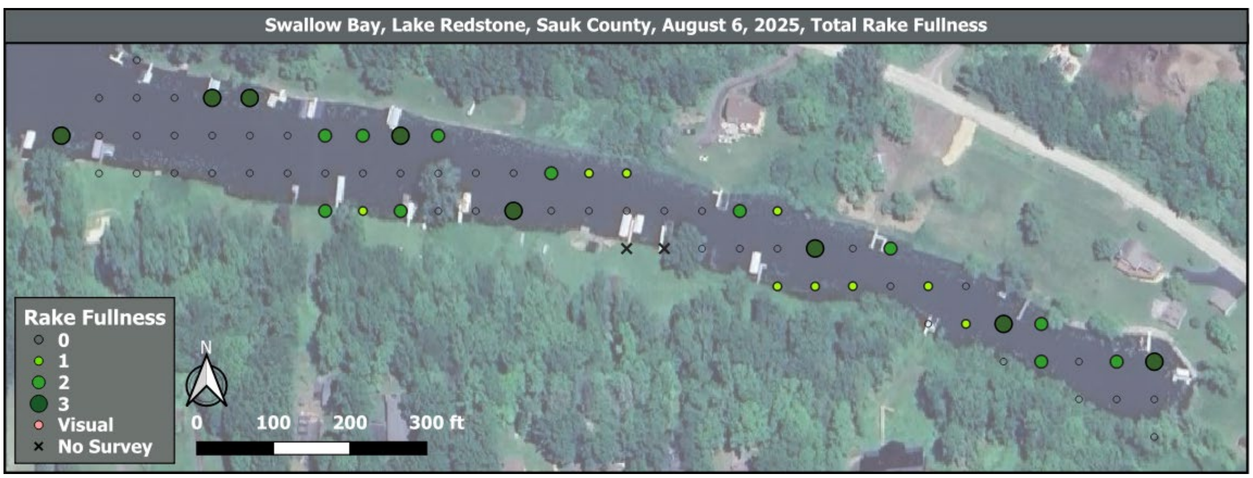


MARTIN-MEADOWLARK BAY Common Name	MARTIN-MEADOWLARK BAY Scientific Name	Frequency of Occurrence at Veg. Sites (%)	Littoral Frequency (%)	Relative Frequency (%)	# Sites	Average Rake Fullness	# Visual
White water lily	*Nymphaea odorata*	95.65	42.31	91.67	22	1.32	20
Filamentous algae	*Myriophyllum spicatum*	78.26	34.62		18	1.00	11
Duckweed	*Lemna sp.*	34.78	15.38	33.33	8	1.00	15
Curly-leaf pondweed	*Potamogeton crispus*	4.35	1.92	4.17	1	1.00	0
Slender waterweed	*Elodea nuttallii*	4.35	1.92	4.17	1	1.00	0

3.3 Swallow Bay 2025

- Max rooting depth = 5ft (same in 2024)
- 44% Littoral frequency all plants (48% in 2024).
- Most common plant was white water lily at 27 sites (2024 was 28 sites).
- Chi-squared tests revealed no statistically significant (SS) changes in 2025 compared to 2024. There was a SS decrease in coontail, EWM, large duckweed, and filamentous algae when comparing 2014 data to 2025. There was a SS increase in white water lily in 2025 compared to 2014. There were no SS differences between the 2024 and 2025 surveys.
- Swallow Bay is designated as a critical habitat area.



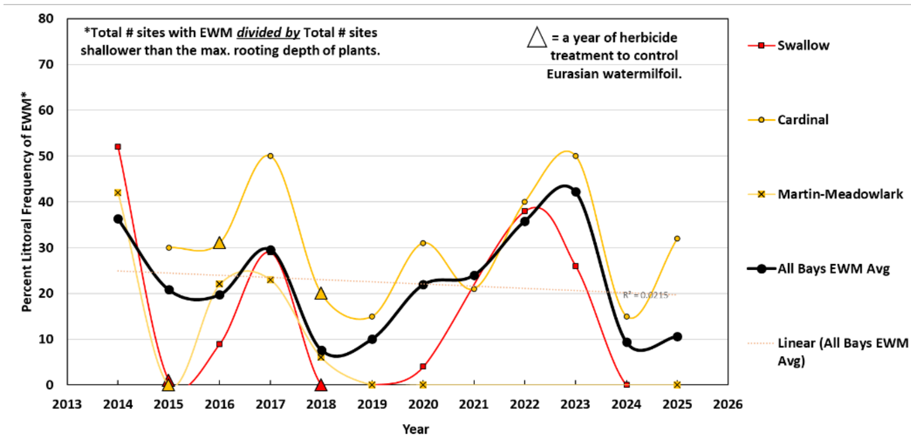


SWALLOW BAY Common Name	SWALLOW BAY Scientific Name	Frequency of Occurrence at Veg. Sites (%)	Littoral Frequency (%)	Relative Frequency (%)	# Sites	Average Rake Fullness	# Visual
White water lily	*Nymphaea odorata*	96.43	42.86	81.82	27	1.96	15
Coontail	*Ceratophyllum demersum*	10.71	4.76	9.09	3	1.00	0
Filamentous algae		10.71	4.76	-	3	1.00	8
Small pondweed	*Potamogeton pusillus*	7.14	3.17	6.06	2	1.50	0
Slender waterweed	*Elodea nuttallii*	3.57	1.59	3.03	1	1.00	0
Eurasian watermilfoil	*Myriophyllum spicatum*	0.00	0.00	0.00	0	0.00	1

3.4 Eurasian Watermilfoil Results & Management History

Eurasian watermilfoil (EWM) was found at sample points in Cardinal Bay where it was the second most common plant species but was not present at sample points (on the rake) in Swallow or Martin-Meadowlark Bays. Figure 2 illustrates EWM littoral frequency in the 3 bays surveyed in 2025. ***In summary, there was a distinct decline in EWM in 2024 (despite no control activities) after 5 years of EWM increase from 2019 through 2023. The slight increase in average EWM for all bays is entirely due to the increase in Cardinal Bay.***

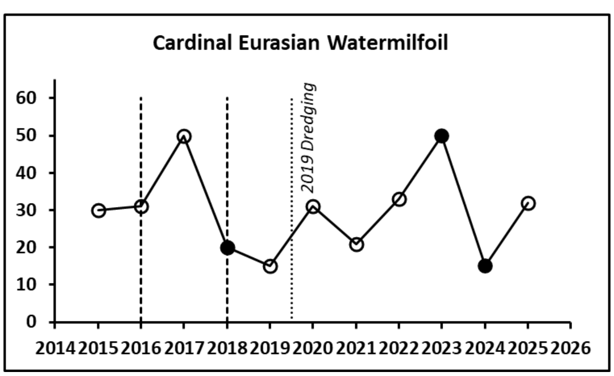
Figure 2 – Eurasian Watermilfoil Littoral Frequency Graph



3.4.1 Cardinal Bay EWM 2025

- EWM was the second most common plant with occurrence at 6 sites (another 1 visual).
- Herbicide was applied in Cardinal Bay in 2016 and 2018.
- Navigation impairment caused by EWM was not observed in 2025. There was a clear channel down the middle of Cardinal Bay allowing for navigation. The near shore areas between docks had greater EWM occurrence and density, likely causing some nuisance for very near-shore areas (between shore and the end of docks).
- A chi-squared test of EWM revealed no statistically significant difference in EWM between 2015 and 2025 and between 2024 and 2025.

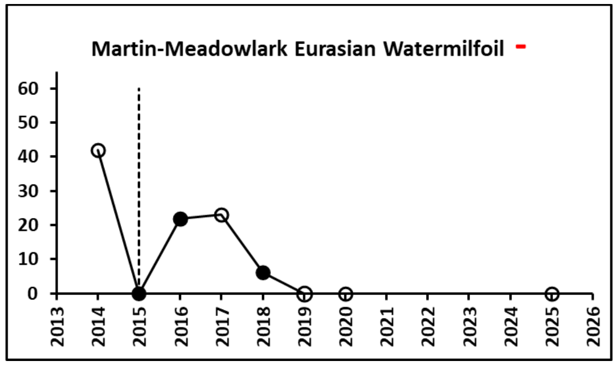
Figure 3 - Cardinal Bay Eurasian Watermilfoil Map & Chi-Square Graph



3.4.2 Martin-Meadowlark Bay EWM 2025

- EWM was not detected in Martin-Meadowlark Bay during either survey in 2025.
- Herbicide treatment was done in 2015 to control EWM.
- Chi-squared tests revealed a statistically significant decrease in EWM in 2025 compared to 2014 and but no difference between 2020 and 2025.

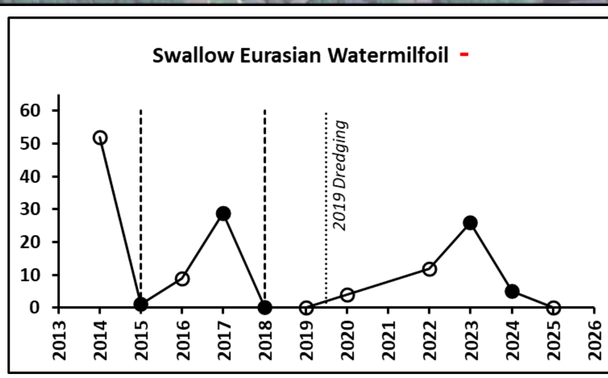
Figure 4 - Martin-Meadowlark Bay Chi-Square Graph



3.4.3 Swallow Bay EWM 2025

- EWM was not on the rake at any sample points but observed visually near one sample point.
- Herbicide treatment was done in 2015 & 2018 to control EWM.
- Chi-squared tests revealed a statistically significant decrease in EWM in 2025 compared to 2014 but no SS difference between 2024 and 2025.
- No EWM was detected in Swallow Bay during the EWM bed mapping survey on Sept. 12.

Figure 5 – Swallow Bay Eurasian Watermilfoil Map 2025 & Chi-square Graph



3.5 Eurasian Watermilfoil Bed Survey Results

EWM beds were surveyed September 12th, 2025. There were 30 beds of EWM (56 in 2024) documented with a total of 12.14 acres (Table 2, Table 3). Figure 6 illustrates EWM beds in Lake Redstone and the locations of 8 higher resolution maps included in this section.

Table 2 – EWM Bed Acreage by Density 2022-2025

Density	2022 Acres	2023 Acres	2024 Acres	2025 Acres
Highly Scattered	8.2	9.58	3.39	2.47
Scattered	4.3	7.56	8.87	7.25
Dominant	6.6	3.44	5.71	2.42
Highly Dominant	12.8	0.56	0.6	0
Total	**31.9**	**21.14**	**18.57**	**12.14**

** 2022-2023 Surveys completed by Cason Lake & Water Management LLC*

Figure 6 – Locator Map for EWM Beds

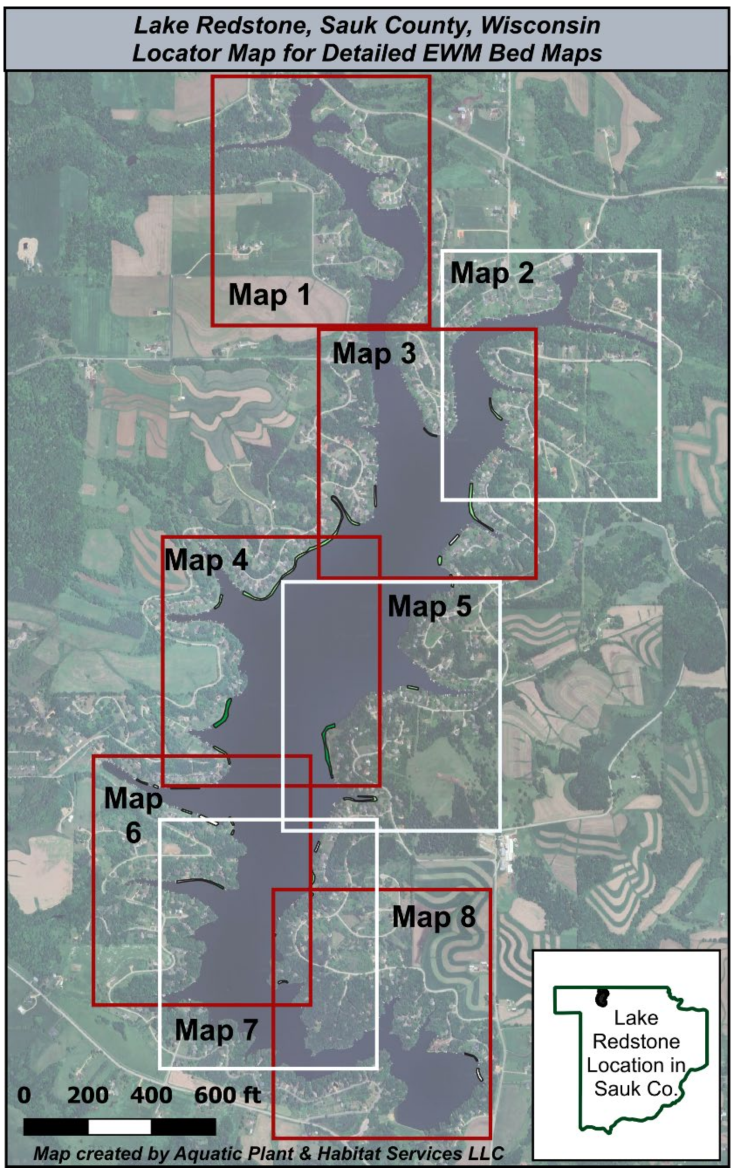
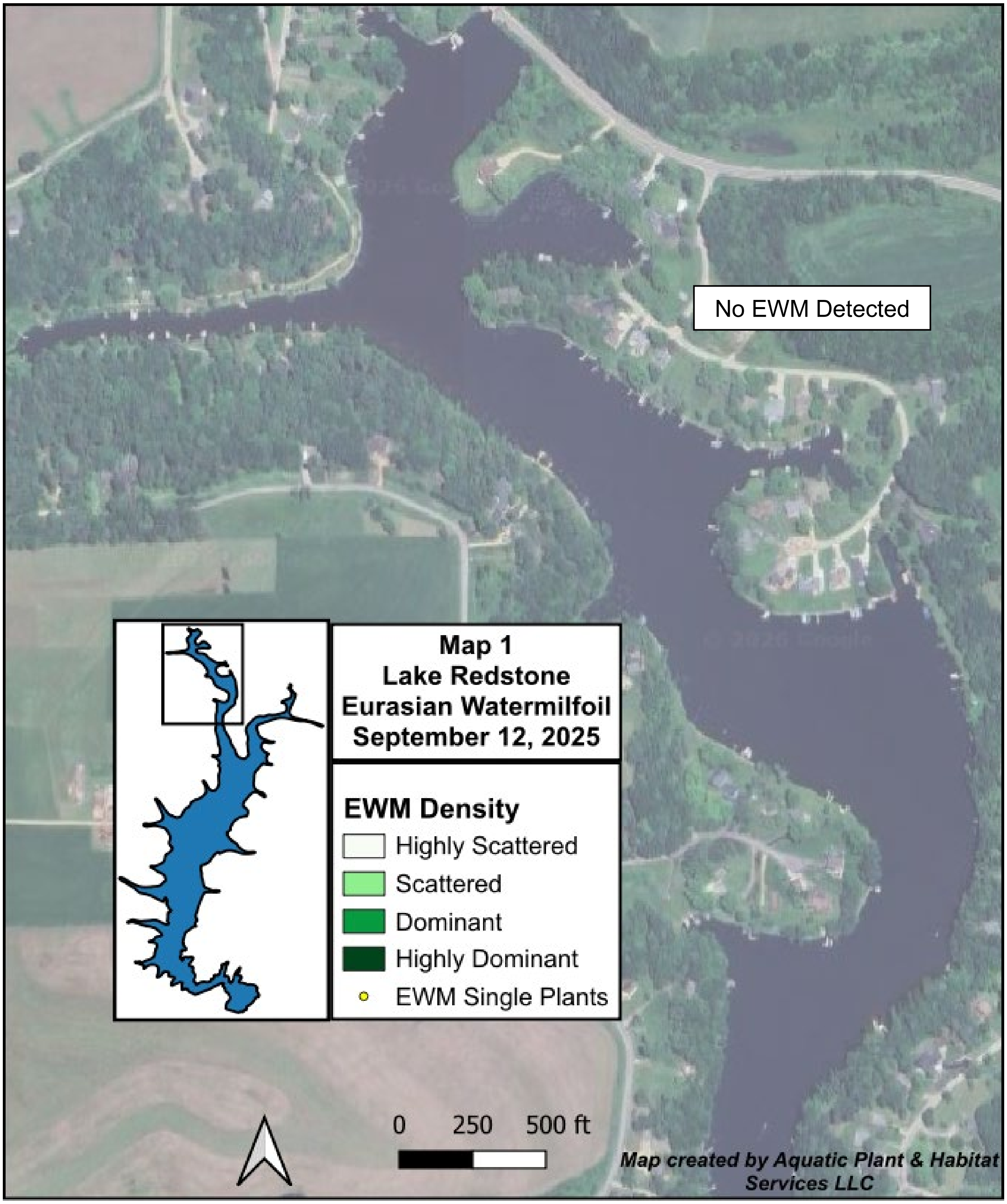
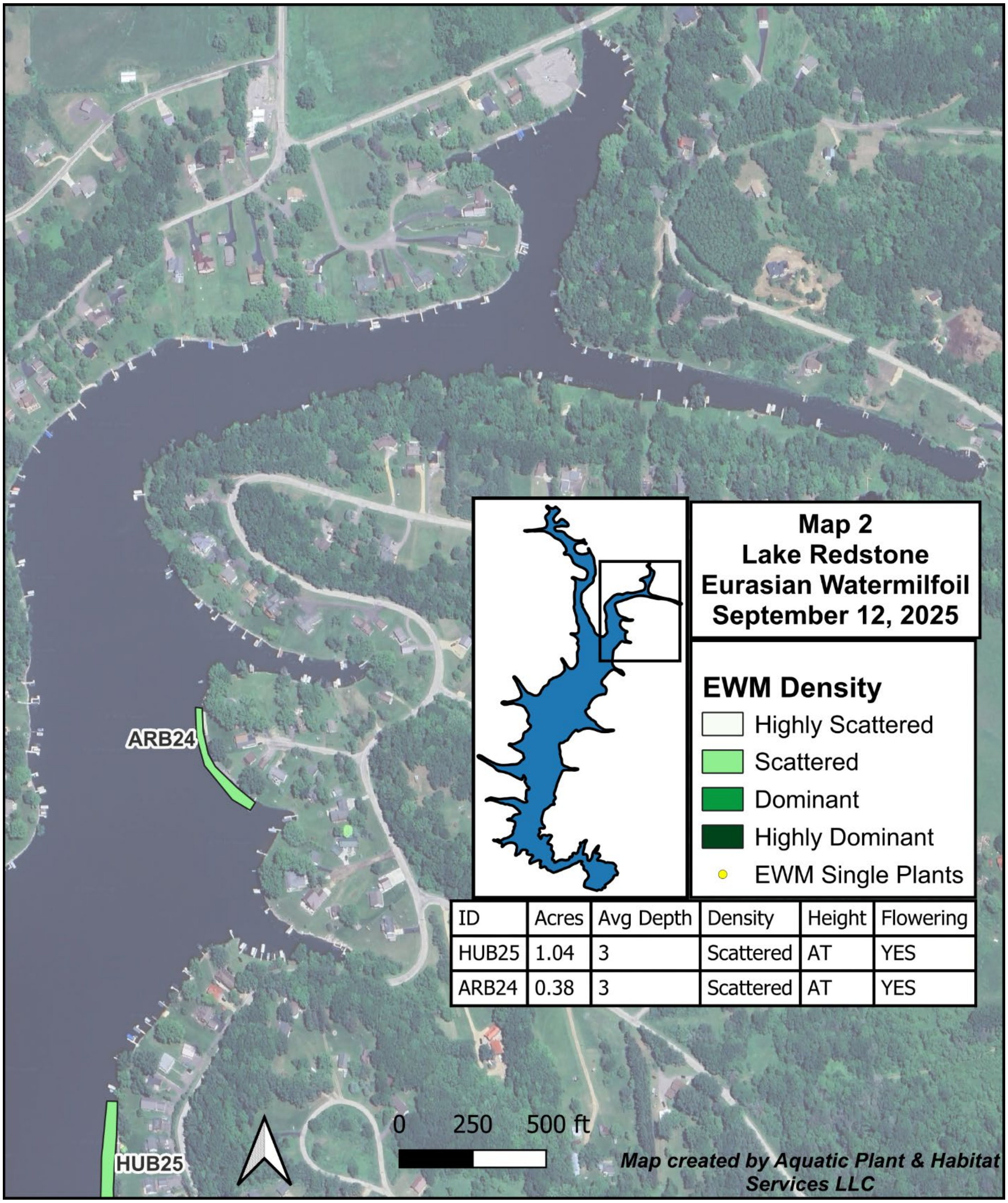


Table 3 – Redstone EWM Beds, 2025

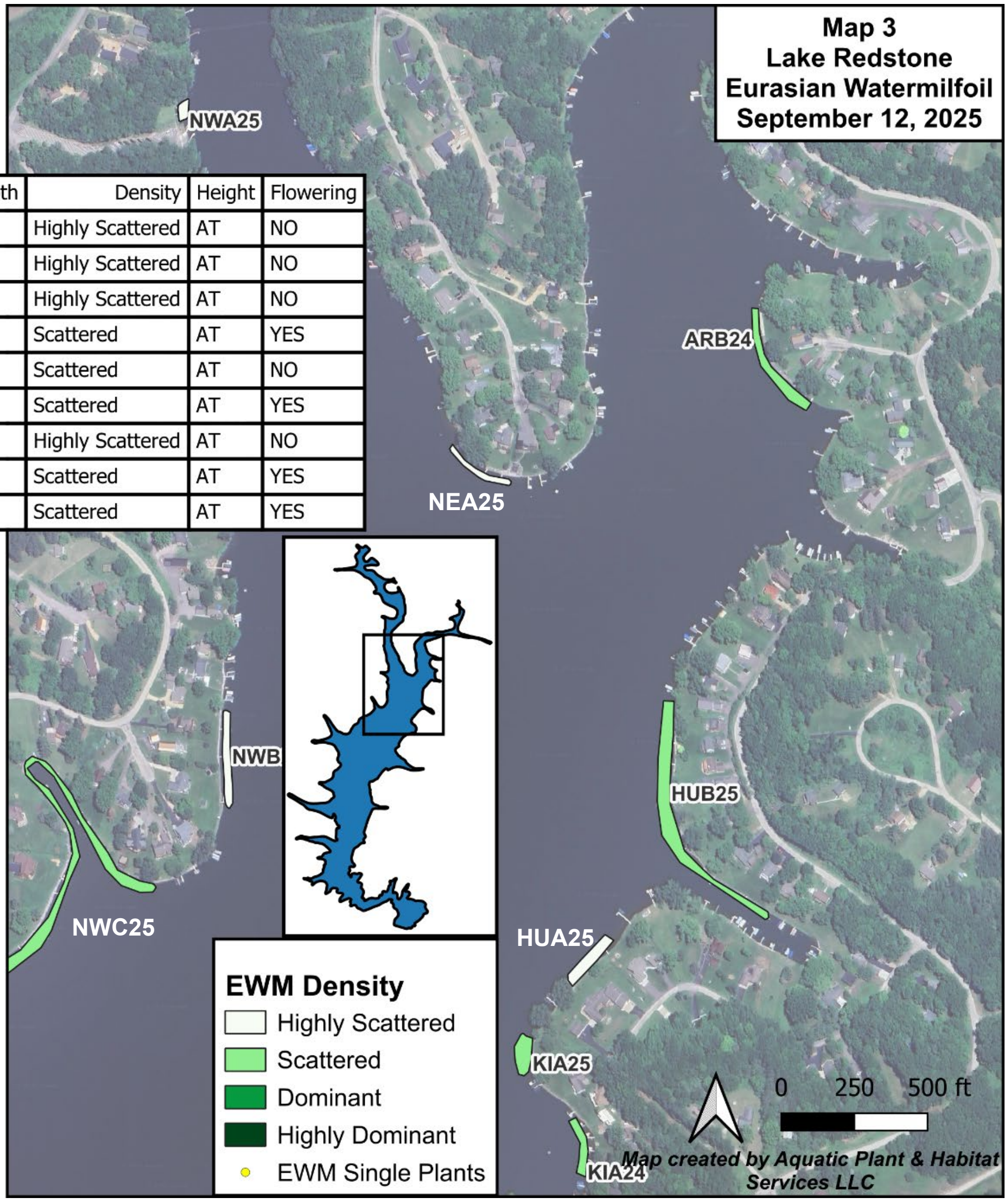
EWMID	Mean Depth (ft)	Density	Height	Flower	Acres
CAB25	3	Dominant	AT	YES	1.14
MDC24	3	Dominant	AT	YES	0.13
ORA25	3	Dominant	AT	YES	0.2
QUA24	3	Dominant	AT	YES	0.92
SEA25	3	Dominant	AT	NO	0.03
CBE24	3	Highly Scattered	AT	NO	0.26
CBF24	2	Highly Scattered	AT	YES	0.15
HUA25	3	Highly Scattered	AT	NO	0.25
MDB24	3	Highly Scattered	AT	NO	0.08
MDF24	3	Highly Scattered	AT	NO	0.55
NEA25	3	Highly Scattered	AT	NO	0.16
NWA25	3	Highly Scattered	AT	NO	0.07
NWB25	3	Highly Scattered	AT	NO	0.28
ORB25	2	Highly Scattered	AT	NO	0.38
RAB24	3	Highly Scattered	AT	NO	0.12
SEC25	3	Highly Scattered	AT	NO	0.17
ARB24	3	Scattered	AT	YES	0.38
CAA25	3	Scattered	AT	YES	0.55
CHA25	2	Scattered	AT	NO	0.24
EAA24	3	Scattered	AT	YES	0.19
HUB25	3	Scattered	AT	YES	1.04
KIA24	3	Scattered	AT	NO	0.18
KIA25	3	Scattered	AT	YES	0.22
MDA24	3	Scattered	AT	YES	0.27
MDA25	3	Scattered	AT	NO	0.12
MDB25	3	Scattered	AT	NO	0.07
MDE24	3	Scattered	AT	NO	0.14
NWC25	3	Scattered	AT	YES	3
QUA25	3	Scattered	AT	NO	0.37
SEB25	3	Scattered	AT	YES	0.48
Total Acres					**12.14**

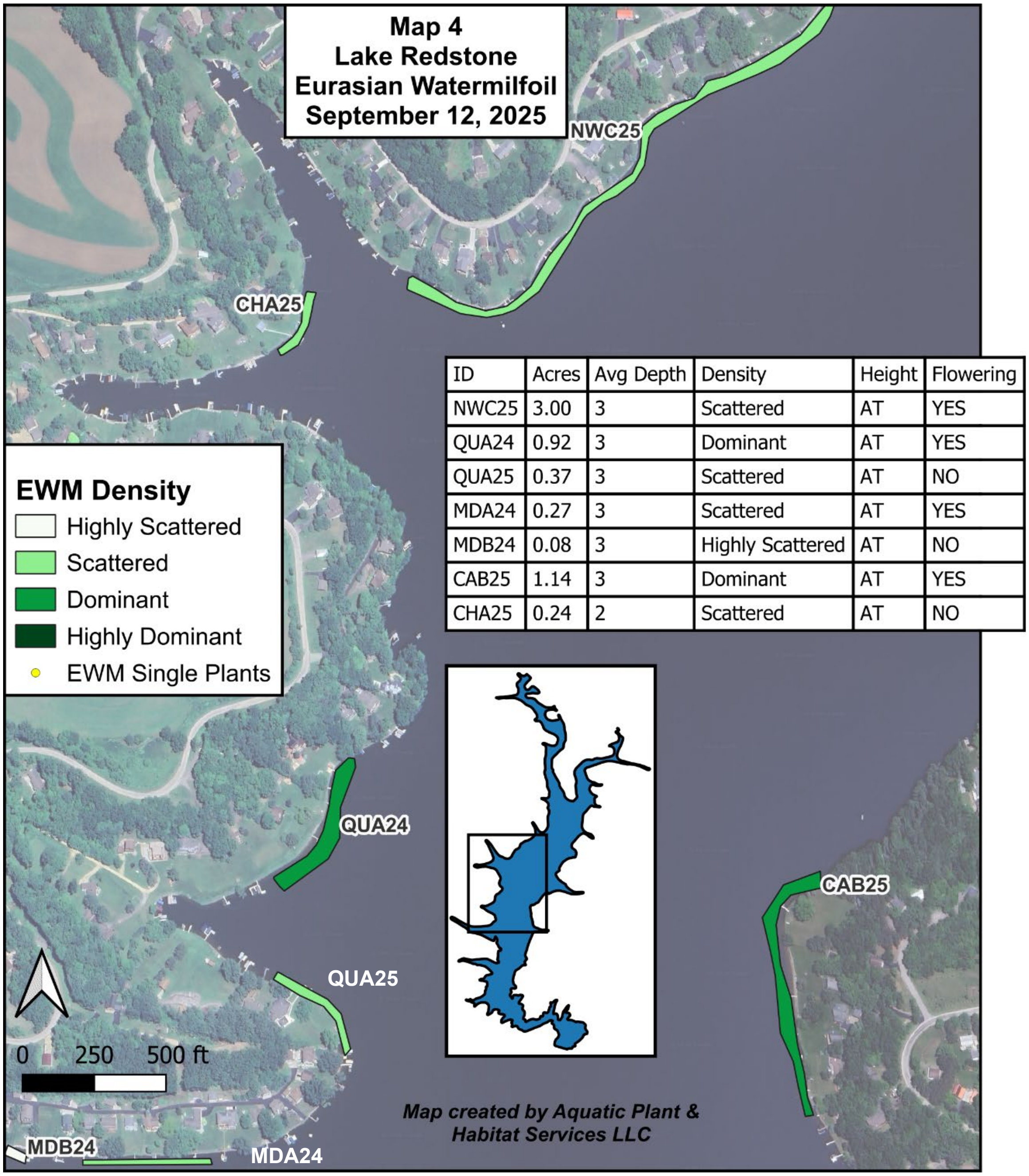

No EWM Detected
Map 1
Lake Redstone
Eurasian Watermilfoil
September 12, 2025
EWM Density
Highly Scattered
Scattered
Dominant
Highly Dominant
EWM Single Plants
0 250 500 ft
Map created by Aquatic Plant & Habitat Services LLC



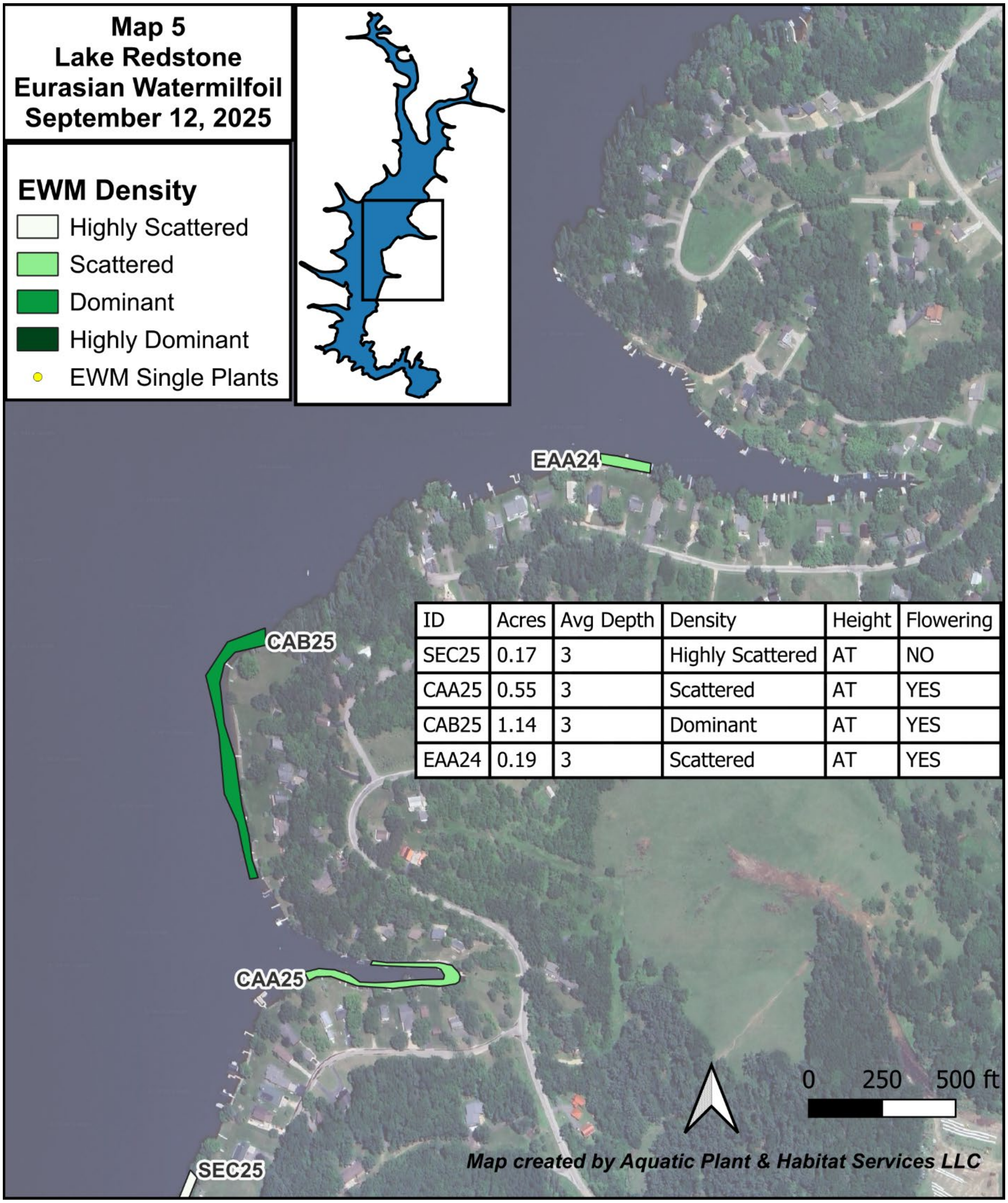
ID	Acres	Avg Depth	Density	Height	Flowering
HUB25	1.04	3	Scattered	AT	YES
ARB24	0.38	3	Scattered	AT	YES

ID	Acres	Avg Depth	Density	Height	Flowering
NEA25	0.16	3	Highly Scattered	AT	NO
NWA25	0.07	3	Highly Scattered	AT	NO
NWB25	0.28	3	Highly Scattered	AT	NO
NWC25	3.00	3	Scattered	AT	YES
KIA24	0.18	3	Scattered	AT	NO
KIA25	0.22	3	Scattered	AT	YES
HUA25	0.25	3	Highly Scattered	AT	NO
HUB25	1.04	3	Scattered	AT	YES
ARB24	0.38	3	Scattered	AT	YES

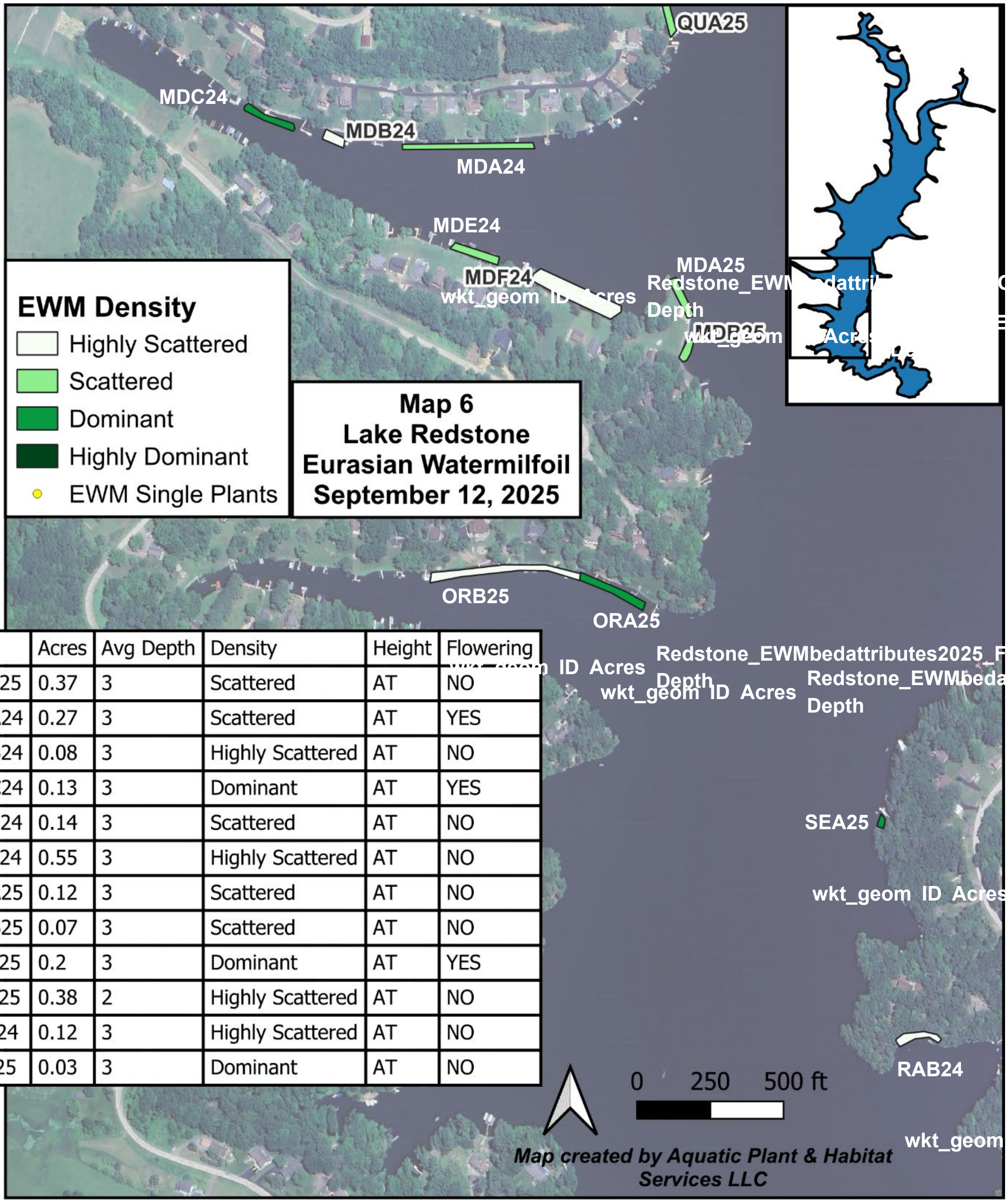




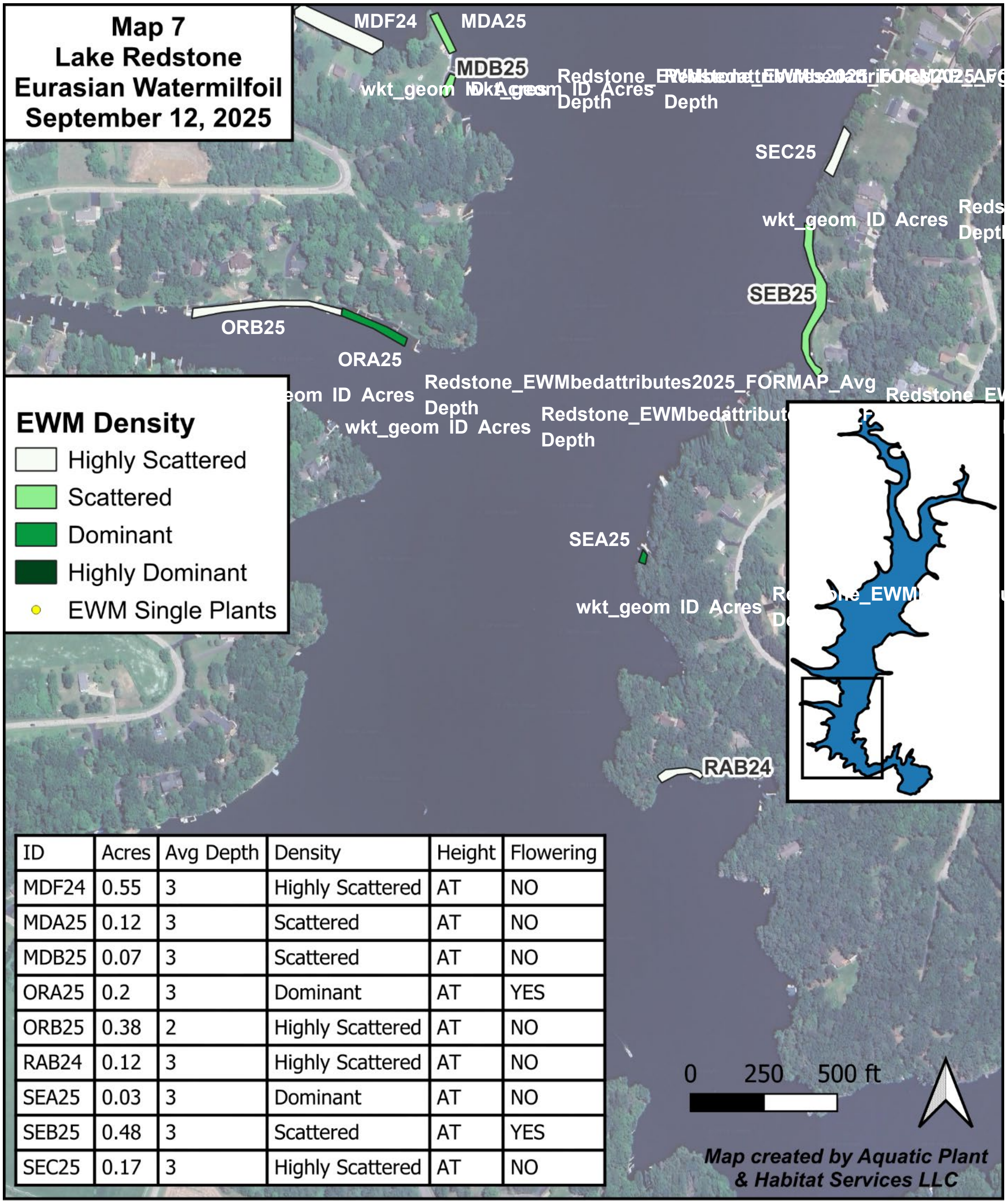
ID	Acres	Avg Depth	Density	Height	Flowering
NWC25	3.00	3	Scattered	AT	YES
QUA24	0.92	3	Dominant	AT	YES
QUA25	0.37	3	Scattered	AT	NO
MDA24	0.27	3	Scattered	AT	YES
MDB24	0.08	3	Highly Scattered	AT	NO
CAB25	1.14	3	Dominant	AT	YES
CHA25	0.24	2	Scattered	AT	NO



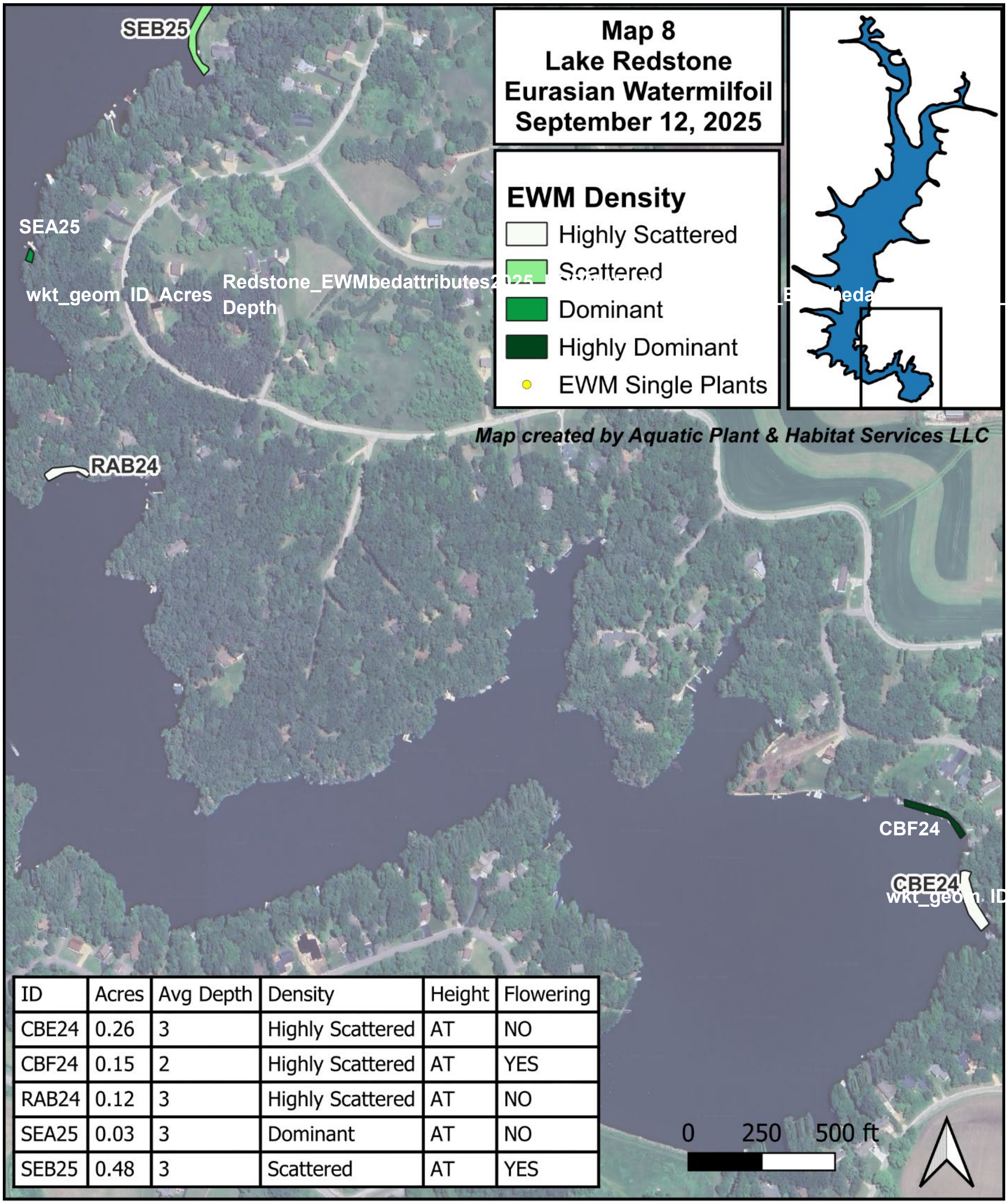
ID	Acres	Avg Depth	Density	Height	Flowering
SEC25	0.17	3	Highly Scattered	AT	NO
CAA25	0.55	3	Scattered	AT	YES
CAB25	1.14	3	Dominant	AT	YES
EAA24	0.19	3	Scattered	AT	YES



ID	Acres	Avg Depth	Density	Height	Flowering
QUA25	0.37	3	Scattered	AT	NO
MDA24	0.27	3	Scattered	AT	YES
MDB24	0.08	3	Highly Scattered	AT	NO
MDC24	0.13	3	Dominant	AT	YES
MDE24	0.14	3	Scattered	AT	NO
MDF24	0.55	3	Highly Scattered	AT	NO
MDA25	0.12	3	Scattered	AT	NO
MDB25	0.07	3	Scattered	AT	NO
ORA25	0.2	3	Dominant	AT	YES
ORB25	0.38	2	Highly Scattered	AT	NO
RAB24	0.12	3	Highly Scattered	AT	NO
SEA25	0.03	3	Dominant	AT	NO



ID	Acres	Avg Depth	Density	Height	Flowering
MDF24	0.55	3	Highly Scattered	AT	NO
MDA25	0.12	3	Scattered	AT	NO
MDB25	0.07	3	Scattered	AT	NO
ORA25	0.2	3	Dominant	AT	YES
ORB25	0.38	2	Highly Scattered	AT	NO
RAB24	0.12	3	Highly Scattered	AT	NO
SEA25	0.03	3	Dominant	AT	NO
SEB25	0.48	3	Scattered	AT	YES
SEC25	0.17	3	Highly Scattered	AT	NO



ID	Acres	Avg Depth	Density	Height	Flowering
CBE24	0.26	3	Highly Scattered	AT	NO
CBF24	0.15	2	Highly Scattered	AT	YES
RAB24	0.12	3	Highly Scattered	AT	NO
SEA25	0.03	3	Dominant	AT	NO
SEB25	0.48	3	Scattered	AT	YES

4.0 Discussion

4.1 Aquatic Plants are Necessary for Healthy Lakes

Aquatic plants serve important functions in lake systems. They provide structural habitat for small invertebrates that are an important food source for juvenile game fish and adult panfish. Plants also provide structural habitat for juvenile and small fish to hide from predators and vice versa as larger predators lurk in wait of forage. Aquatic plants provide foraging and/or hiding structure for reptiles, amphibians, and waterfowl. The shorelines of lakes are buffered from wave action when aquatic plants absorb some of the wave energy. Aquatic plants are important consumers of nutrients that would otherwise be available for nuisance algal growth. Native aquatic plants should be protected in lakes and a healthy aquatic plant community should be promoted.

There are times when native aquatic plants grow to nuisance levels that hinder the aforementioned functions and also negatively impact recreation. An overabundance of vegetation can cause oxygen depletion in the water as plants decompose, thereby reducing the oxygen available to fish and other aquatic organisms. There is no overabundance of vegetation in Lake Redstone. Rather, the aquatic plant community is extremely sparse and all native plant species should be protected.

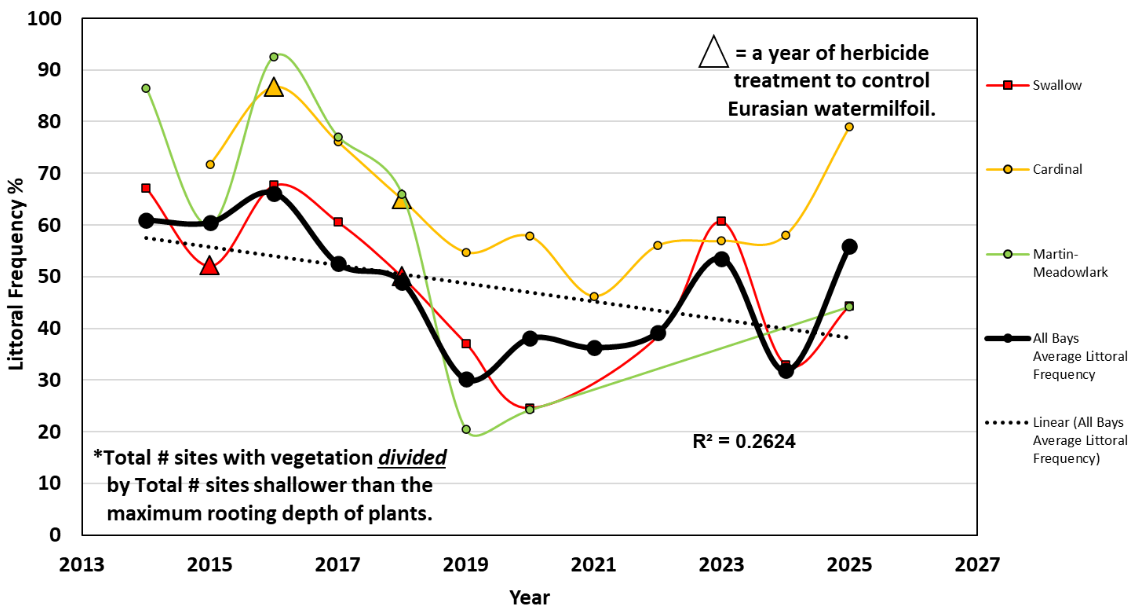
4.2 Changes in Native Plant Occurrence

When comparing 2025 native species occurrence with that of most recent previous surveys, there was one statistically significant (SS) increases in native plant species and no instances of SS decreases. When comparing 2025 native species occurrence with the first year surveyed for each of the bays, there were 7 statistically significant (SS) declines in native plant species, 2 SS declines in filamentous algae, 2 SS declines in EWM, and 1 increase in native plants. As discussed in the updated Aquatic Plant Management Plan in 2023, the continued work by the LRPD to decrease nutrient input (especially phosphorus) and promote shoreland protection to decrease surface water runoff is expected to increase water clarity in the years to come. Increased water clarity is expected to allow more plants to grow and at greater depths with is better for overall lake ecology.

4.3 Reduced Plant Occurrence (Native & Non-native Species)

Figure 7 charts a function of the total number of sites where plants (native & non-native) *do* occur vs. the total number of sites where plants *could* occur (AKA littoral frequency) thereby factoring in water clarity because it only includes points that are equal to or shallower than the maximum depth of aquatic plants. In theory, if water clarity declines so do the number of points shallower than the maximum depth of plants. The bays that were surveyed since 2014 were selected each year based on perceived high aquatic plant abundance, particularly EWM, and therefore the bays are all thought to be representative of bays with overall high plant occurrence in Lake Redstone. Figure 7 illustrates littoral frequency for the bays surveyed in 2025 as well as the average littoral frequency for ***all bays*** surveyed since 2014. A linear trendline[2] of the average littoral frequency among all bays[3] suggests the littoral frequency of aquatic plants (combined native and non-native) was on a downward trend from 2014 through 2022 with an R value of 0.72.[4] Surveys in 2023 weakened the R value down to 0.42, suggesting aquatic plants could be on the rise. The sharp drop in aquatic plant occurrence in 2024 increased the R value to 0.51. The increase in 2025 again weakened the R value down to 0.26. Despite these recent fluctuations in plant occurrence during subPI surveys, observations of aquatic plants on a whole-lake scale continue to indicate aquatic plant occurrence is very low.

Figure 7 – Littoral Plant Frequency Graph



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[2] A **linear trendline** is a best-fit straight line that is used with simple **linear** data sets. Data is **linear** if the pattern in its data points resembles a line. A **linear trendline** usually shows that something is increasing or decreasing at a steady rate.

[3] All bays surveyed includes all those surveyed in a given year except for County F Bay in 2019 & 2020 (see 2020 report for more information).

[4] **R-squared** value measures the **trendline** reliability - the nearer $\mathbf{R}^2$ is to 1, the better the **trendline** fits the data. The $\mathbf{R}^2$ value in 2022 was much stronger at 0.72.

4.4 Using Criteria to Prioritize EWM Control

The Aquatic Plant Management Plan that was finalized in May 2023 included Table 4 to help guide management decisions. Under the “Size & Location” criteria, a trigger frequency of 36% is mentioned and is based on the littoral frequencies of EWM the year before they were treated with herbicide 2014-2018. None of the bays surveyed in 2025 had EWM littoral frequency greater than 36%.

Table 4 – Herbicide Treatment Criteria

Criteria for Prioritizing Eurasian Watermilfoil Control					
SIZE & LOCATION	DENSITY	TRAFFIC	IMPAIRMENT	HABITAT	SURVEY DATA
•Is the area in a sheltered bay or exposed shoreline? •If exposed, is the EWM bed >0.5 ac? •If sheltered, is the EWM frequency at least 36%?	•Is EWM the dominant species? •Is EWM rake fullness >2 on average?	•Is the EWM in an area of high boat traffic? •Is the EWM causing obstruction to navigation for more than a single riparian landowner?	•Is this area causing beneficial use impairment? (aquatic plants prevent activities such as angling, boating, swimming, or other navigation /recreation)	•Is EWM the dominant species to the detriment of native plant species? •Would the proposed treatment have limited impact on native plants?	•Has a pre-treatment survey been completed using standardized methods to document location, size, density, and height?

HOW TO USE THESE CRITERIA – Answer the 6 questions for a particular bed of EWM. If the answer is “yes” for most questions (ideally 4 or more), then that bed of EWM may be considered high priority for control actions. For beds of EWM with fewer “yes” answers, control actions can still be considered but perhaps that area is not the highest priority. This graphic is meant to help the LRPD prioritize if control actions should take place in any given year. Areas that do not receive attention in a given year may be considered higher priority the following year depending on conditions. Any herbicide permit application is subject to conditions in NR107, with particular attention to NR107.05 and NR107.08.

Graphic & criteria developed by Aquatic Plant & Habitat Services LLC

5.0 General Management Recommendations

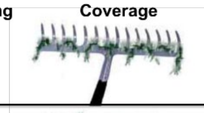
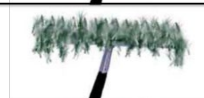
1. **All native aquatic plants should be protected**, especially due to the declining trend in plant occurrence 2014-2022 and again in 2024. Aquatic plant occurrence increased in 2025. Hand removal of nuisance aquatic plants, even native plants, is permitted by Chapter NR 109 but the removal cannot occur in a designated sensitive area without a permit (identified in the updated APMP and includes Martin-Meadowlark and Swallow Bays among other areas), is limited to a single area no more than 30 feet wide measured along shore, and must not harm the overall aquatic plant community.
2. **Volunteer water monitoring and early detection of aquatic invasive species** is an important component of lake management. Continued water monitoring and AIS surveying is recommended.
3. **Conduct aquatic plant surveys** of bays in 2026 as needed. Since EWM and overall plant occurrence was higher in 2025, whether subPI surveys in bays will be needed in 2026 should be determined based on observed plant growth in early summer 2026. If plant occurrence continues to be low, subPI plant surveys could be suspended for a time.
4. **Utilize herbicide treatment criteria in Table 4** to determine whether herbicide treatment should occur. Based on criteria, no herbicide treatment is recommended due to very low native plant and EWM occurrence. Manual removal in shallow areas is currently the best approach for small-scale EWM control on Lake Redstone.
5. **Protect overwintering shoreline habitat for weevils** as an additional tool that is no-cost and lasting for controlling EWM. Weevils will not eliminate all EWM but rather help keep its growth “in check.”

6.0 Appendix A – Methods

6.1 Field Methods

Field methods followed the standardized protocol developed by the Wisconsin Department of Natural Resources (WDNR) in Hauxwell et. al (2010)[5] and WDNR Aquatic Plant Treatment Evaluation Protocol[6]. SubPI Surveys were completed August 6th while the EWM bed survey was completed September 12th, 2025. Point-intercept maps were previously generated for Cardinal (71 pts), Martin-Meadowlark (56 pts), and Swallow (72 pts).

Figure 8 – Rake Fullness Illustration

Rating	Coverage	Description
1		Few plants
2		Plants cover length of the rake but not tines
3		Rake completely covered, tines not visible

For the subPI surveys, the survey coordinates were uploaded to a Garmin device, allowing navigation to each survey point in the bays. Points that were deeper than 12 feet were not surveyed based on previous findings that maximum rooting depth of any bay-wide survey since 2015 was 11 feet. A double-sided rake head on a telescopic pole was used to sample each point for aquatic plants, depth, and dominant sediment type. The rake fullness rating for total coverage of plants on the rake and a separate rake fullness rating for each species present were recorded (Figure 8). Any survey points that were inaccessible were recorded as such and no sample was taken. Aquatic plants found within 6 feet of the sample point but not found on the rake were counted as visual observations.

For the EWM bed survey, boundaries of EWM were visually determined from a boat and mapped while navigating along the bed perimeter. Each EWM bed was assigned a letter identifier followed by the year (e.g., A25). Beds were then classified as highly scattered, scattered, dominant, or highly dominant EWM.

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[5] *Hauxwell, J., S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky and S. Chase. 2010. Recommended baseline monitoring of aquatic plants in Wisconsin: sampling design, field and laboratory procedures, data entry and analysis, and applications. Wisconsin Department of Natural Resources Bureau of Science Services, PUB-SS-1068 2010. Madison, Wisconsin. 46pp.*

[6] *https://apps.dnr.wi.gov/swims/Documents/DownloadDocument?id=158140137*

6.2 Data Analysis Methods

Summary statistics provide a general overview of the plant community in each bay and can be used to make comparisons among the bays and within the same bay over time. However, these statistics should not be used to compare to other lakes where a whole-lake survey has been done. Explanations of summary statistics are in Table 6. ***Individual species statistics*** assess the plant species composition in the 5 bays and allow for comparisons of the plant community within the bays (Table 5). A ***chi-squared test*** of plant occurrence was done for all bays. The statistical test helps determine whether there is a significant difference between two data sets by comparing the number of sites a particular plant species was found in two different years. The alpha, or Type I error rate was set at 0.05, meaning there is a 5% chance of claiming there is a significant change when no real change has occurred. Chi-squared tests compared differences in plant occurrence from the most recent prior survey to 2025. The tests also compared differences from the first year of the bay being surveyed to 2025.

Table 5 – Individual Species Statistics Explanations

Individual Statistic	Explanation
Average Rake Fullness	Mean rake fullness rating ranging from 1 to 3. See Rake Fullness Illustration.
Number of sites where a species was found	The total number of survey points where a particular species was found on the rake.
Number of visual sightings	The total number of times a particular species was visually observed within 6 feet of a sampling point, but not collected on the rake.
Frequency of Occurrence FOO (split into two subcategories)	a) Among vegetated sites only – The number of sites at which a particular species is found on the rake divided by the total number of vegetated sites (Table 2, #2).
	b) Among sites shallower than the maximum depth of plants – The number of sites at which a particular species is found on the rake divided by the total number of sites less than or equal to the maximum depth of plants (Table 2, #4). Also known as **littoral frequency.**
Relative frequency (%)	This value represents the degree to which a particular species contributes to the total of all observations. The sum of all relative frequencies is 100%.

Table 6 – Summary Statistics Explanations

	Statistic	Explanation
1	Total number of sites visited	The total number of sites sampled, which is not necessarily equal to the number of survey points because some sites may not be accessible.
2	Total number of sites with vegetation	Number of sites where at least one plant was found on the rake (does not include moss, sponges, filamentous algae, or liverworts).
3	Maximum depth of plants	Depth of deepest site where at least one plant was found on the rake (does not include moss, sponges, filamentous algae, or liverworts).
4	Total number of sites shallower than maximum depth of plants	Number of sites where depth was less than or equal to the maximum depth where at least one plant was found on the rake.
5	Frequency of occurrence at sites shallower than maximum depth of plants	Total number of sites with vegetation (2) / Total number of sites shallower than maximum depth of plants (4).
6	Average number of species per site (split into four subcategories)	a) Shallower than maximum depth – the average number of species found per site at sites less than or equal to the maximum depth where at least one plant was found on the rake (4).
		b) Vegetated sites only – the average number of species found per site at sites where at least one plant was found on the rake (2).
		c) Native species shallower than maximum depth – Same explanation as 6(a), non-native species excluded from average.
		d) Native species at vegetated sites only – Same explanation as 6(b), non-native species excluded from average.
7	Species Richness (split into two subcategories)	a) Total number of species found on the rake at all sites (does not include moss, sponges, filamentous algae, or liverworts
		b) Including visuals – Same explanation as 7(a) and including visual observations within 6 feet of the sample sight
8	Simpson Diversity Index	Estimates the heterogeneity of a community by calculating the probability that two individuals randomly selected from the data set will be different species. The index ranges from 0-1, and the closer the value is to one, the more diverse the community. Visual observations (within 6 feet of sample point) are not included in calculation of index.
9	Coefficient of Conservatism (C)	This is not a statistical calculation, but rather a value assigned to each plant species based on how sensitive that species is to disturbance. C values range from 1 to 10 with higher values assigned to species that are more sensitive to disturbance (Nichols, 1999).
10	Floristic Quality Index	How similar the aquatic plant community is to one that is undisturbed (Nichols, 1999). This index only factors species raked at survey points and does not include non-native species. The FQI is calculated using coefficient of conservatism values (9).

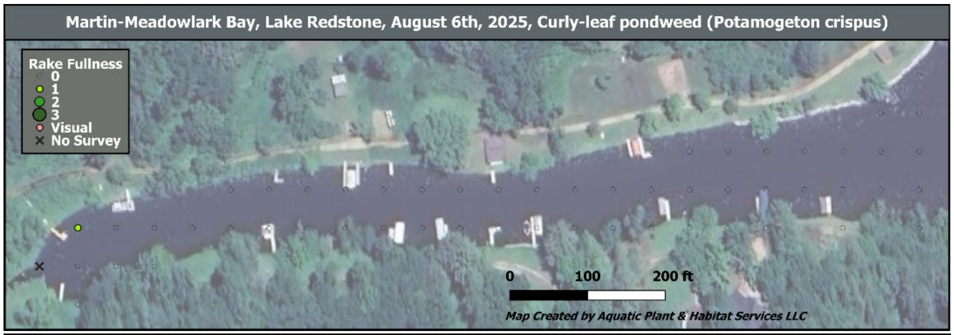
7.0 Cardinal Bay subPI Maps

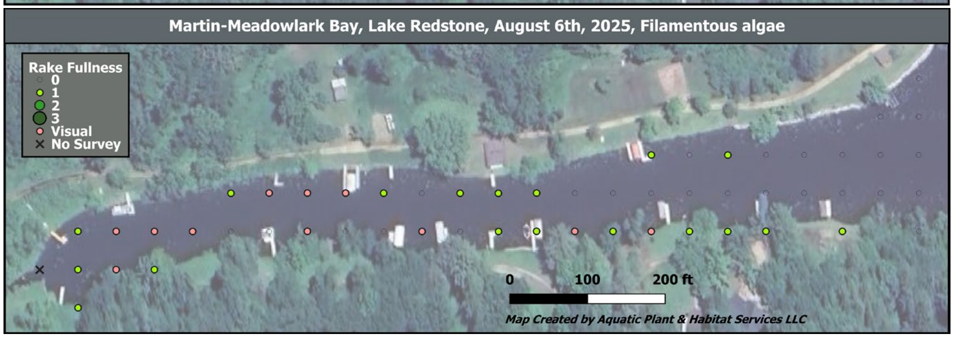

Cardinal Bay, Lake Redstone, Sauk County
August 6, 2025, Small pondweed (Potamogeton pusillus)
Rake Fullness
0
1
2
3
Visual
No Survey
N
0
75
150
225 ft

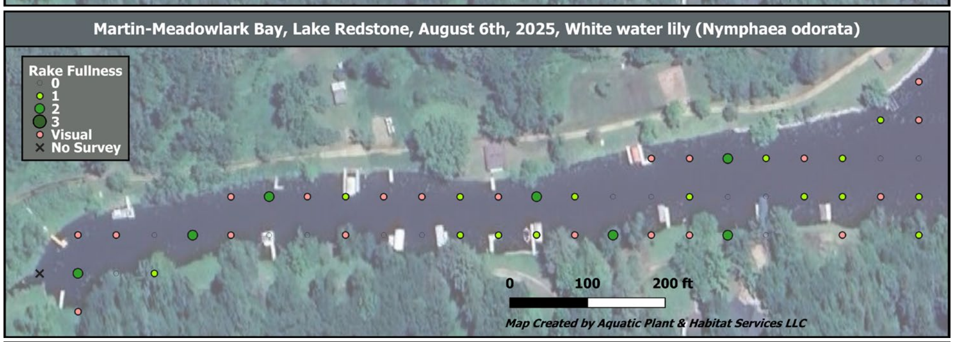

Cardinal Bay, Lake Redstone, Sauk County
August 6, 2025, Filamentous algae
Rake Fullness
0
1
2
3
Visual
No Survey
N
0
75
150
225 ft


Cardinal Bay, Lake Redstone, Sauk County
August 6, 2025, Sago pondweed (Stuckenia pectinata)
Rake Fullness
0
1
2
3
Visual
No Survey
N
0
75
150
225 ft

8.0 Martin-Meadowlark SubPI Maps







9.0 Swallow Bay SubPI Maps