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## LAKE JOSEPHINE, RAMSEY COUNTY: 2023 AQUATIC VEGETATION REPORT

Report by the Invasive Species Program – Division of Ecological and Water Resources  
Minnesota Department of Natural Resources

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**Lake:** Josephine (DOW# 62005700)

**Lake Surface Area:** 117 acres

**Littoral Area:** 79 acres

**County:** Ramsey

**Survey Type:** Point-intercept

**Date of Survey (most recent):** September 12, 2023

**Observer[s]:** Matt Kocian (RCWD)

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**Report updated:** December 21, 2023

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### 2023 Summary:

The most recent submersed aquatic vegetation point-intercept survey of Lake Josephine (DOW# 62005700) was completed on September 12, 2023. Submersed aquatic plants were present throughout the lake to a maximum depth of 2.74 meters (9 feet). Within the littoral zone (area in the lake from the 0 – 15-foot depth range [0 – 4.5 meters]), 73% of the sampled points contained native submersed taxa. The average number of native submersed taxa per sample point was 1.35, and a total of eight submersed plant species were documented during the survey. Two invasive aquatic plants have been observed in Lake Josephine: hybrid watermilfoil (Eurasian watermilfoil x northern watermilfoil) and curly-leaf pondweed. Management of both species has been facilitated by the Lake Josephine Improvement Association.

**Summary Table.** Summary of aquatic submersed plants in Lake Josephine, Ramsey County, Minnesota (DOW# 62005700) as indicated by the results of point-intercept surveys. Values were calculated from the littoral depth range (0 – 15 feet).

YEAR	Treatment Date	Target Species	Acres Treated	PI Survey Date	Max Depth of Growth in feet [95%] <sup>†</sup>	% Points w/ Native Submersed Taxa	Mean Native Submersed Taxa/ Point	# Submersed Taxa	AVG Secchi Depth [m]
2009	-	-	-	JUL 15	11	81	1.3	7	2.6
2013	JUL 1	EWM	7.9	SEPT 10	9	81	1.9	11	2.6
2014	JUN 24	EWM	20.4	JUL 29	13	93	2.3	13	2.4
2015	JUN 23	EWM	19.2	AUG 28	10	81	2	14	2.3
2016	JUN 7	EWM	4.77	AUG 15	10	83	2.1	13	2.9
2017	MAY 24	CLP EWM	28	AUG 7	7	63	1.3	11	2.2
2018	-	-	-	AUG 21	7	59	0.9	12	2.1
2019	MAY 23	CLP	11.1	SEPT 13	7	53	0.9	12	2.6
2020	APR 30	CLP EWM	117	SEPT 16	8	47	0.6	7	2.4
2021	JUN 8	CLP	3.89	AUG 11	12	76	1.1	10	2.3
2022	MAY 25	CLP	10	AUG 31	6	36	0.7	11	2
2023	MAY 26	CLP	14.38	SEPT 12	9	73	1.4	8	3

\* HWM is short for hybrid watermilfoil

† 95th percentile calculated based on all vegetated sampling points

Taxa refers to groups of submersed aquatic plant species or genera

AVG – average Secchi depth (water clarity measurement) from May – September

## Lake Description:

Lake Josephine is a 117-acre lake located near Roseville, Minnesota. Two invasive aquatic plant species are present in the lake: Hybrid watermilfoil (*Myriophyllum spicatum* x *Myriophyllum sibiricum* – abbreviated as HWM) and curly-leaf pondweed (*Potamogeton crispus* – abbreviated as CLP). The maximum depth of water is 13.1 meters (43.1 feet). Approximately 67% of the lake is littoral (water depth zone from 0 – 15 feet where aquatic plants are likely to be found). Lake Josephine is nutrient-rich and water clarity appears to fluctuate annually between 1.8 – 2.9 meters (see **Table 1 – Secchi Averages**). For additional water quality information: <https://webapp.pca.state.mn.us/surface-water/impairment/62-0057-00> and <https://arcgis.dnr.state.mn.us/ewr/whaflakes/>

**Table 1 – Secchi Averages.** Average Secchi disk observations in meters for Lake Josephine, Ramsey County, Minnesota (DOW #62005700). Data collected by the Rice Creek Watershed District unless otherwise noted.

YEAR	MAY	JUNE	JULY	AUG	SEPT	Secchi Depth Average [May – Sept]
2009	2.7	3.4	3.1	1.8	1.3	2.6
2010	4.0	4.2	2.2	1.5	2.0	2.9
2011	2.5	3.2	2.8	1.0	1.5	2.2
2012	3.3	3.1	2.2	1.1	1.1	2.3
2013	3.1	3.9	3.2	1.8	1.3	2.6
2014	2.4	3.8	2.7	1.6	1.5	2.4
2015	3.9	2.5	2.4	1.1	1.0	2.3
2016	4.2	3.2	3.5	1.6	1.4	2.9
2017	3.4	3.2	1.9	1.0	0.9	2.2
2018	2.9	3.4	1.5	0.9	0.7	2.1
2019	3.9	3.1	2.9	1.6	1.1	2.6
2020	3.5	3.6	2.5	1.3	2.4	2.4
2021*	3.5	3.5	1.9	1.6	0.8	2.3
2022*	2.3	2.9	3.0	1.2	0.8	2.0
2023**	4.0	3.6	2.5	2.3	2.5	3.0

\*Data taken from Minnesota Pollution Control Agency station 62-0057-00-401

\*\*Data collected by Ramsey County

## Management History:

Historically, hybrid watermilfoil was treated with 2,4-D formulated herbicides in Lake Josephine on an annual basis since nuisance conditions developed starting in 2013. Variances were also granted to allow treatment in more than 15% of the littoral area of the lake from 2014 – 2017 (see **Table 2 Invasive Plant Management**). In 2017, a 28-acre area was treated mid-season with diquat, targeting both curly leaf pondweed and hybrid watermilfoil. Although the treatment controlled both invasive plants, the treated area was too large and timed too late, henceforth unforeseen damage to the native plant community resulted. To allow native plants to recover, no herbicide treatments for hybrid watermilfoil were permitted in 2018 and 2019. To reduce hybrid watermilfoil at a lake wide occurrence, the lake association was permitted to complete a whole lake fluridone treatment in 2020. Penoxsulam (Galleon), a systemic herbicide, was applied to 10 acres of curly leaf pondweed in 2022 with an additional 4.38 acres treated in 2023 for a total of 14.38 acres. Additional data has been collected by the Minnesota Department of Natural Resources (MNDNR) to evaluate multiple years of targeted CLP management using Galleon and is available upon request. Considering this herbicide has not been widely used in Minnesota, additional monitoring will continue to be conducted.

On October 8, 2020, MNDNR staff re-introduced submerged aquatic vegetation to Lake Josephine, for the purpose of increasing the overall plant species richness and occurrence in the lake after multiple years of invasive aquatic plant management. Native plant propagules were collected from Big Carnelian Lake in Washington County, and staff selected 5 – 6 locations within Lake Josephine along undeveloped shoreline for dispersal. This action was repeated in the summer of 2021. Multiple transplant events may be necessary over several years to establish new plants before they are detected in whole-lake plant surveys, which can help determine if propagation efforts are successful. Follow-up monitoring will continue into the coming years to determine any year-over-year success. Below is a list of plants species collected and introduced.

- *Ceratophyllum demersum*
- *Chara spp.*
- *Elodea canadensis*
- *Heteranthera dubia*
- *Megalodonta beckii*
- *Naiad flexilis*
- *Potamogeton gramineus*
- *Potamogeton illinoensis*
- *Potamogeton praelongus*
- *Potamogeton richardsonii*
- *Potamogeton zosteriformis*
- *Ranunculus aquatilis*

**Table 2 – Invasive Plant Management Summary.** Characteristics and history of herbicide treatments for Lake Josephine, Ramsey County, Minnesota (DOW# 62005700, total acres: 118, littoral acres: 79, 15% littoral acres: 11.8).

Date	Treatment [W, P, N]	Target Species	Total Acres Treated	Herbicide	Licensed Commercial Applicator
<b>JUL 1 2013</b>	P	HWM	7.9	DMA-4	Lake Management Inc.
<b>JUN 24 2014*</b>	W	HWM	20.4	DMA-4	Lake Management Inc.
<b>JUN 23 2015*</b>	W	HWM	19.2	DMA-4	Lake Management Inc.
<b>JUN 7 2016</b>	P	HWM	4.77	DMA-4	Lake Management Inc.
<b>MAY 24 2017*</b>	P	HWM & CLP	28	Diquat	Lake Management Inc.
<b>2018</b>	N				
<b>MAY 23 2019</b>	P	CLP	11.1	Diquat	Lake Management Inc.
<b>APR 30 2020</b>	W	HWM	117	Fluridone	Lake Management Inc.
<b>JUN 8 2021</b>	P	CLP	3.89	Diquat	Lake Management Inc.
<b>2022</b>	P	CLP	10	Galleon	Lake Management Inc.
<b>2023</b>	P	CLP	14.38	Galleon	Lake Management Inc.

Treatment: W (whole lake), P (partial lake), N (no treatment)

CLP is an abbreviation for curly-leaf pondweed

HWM is an abbreviation for hybrid watermilfoil

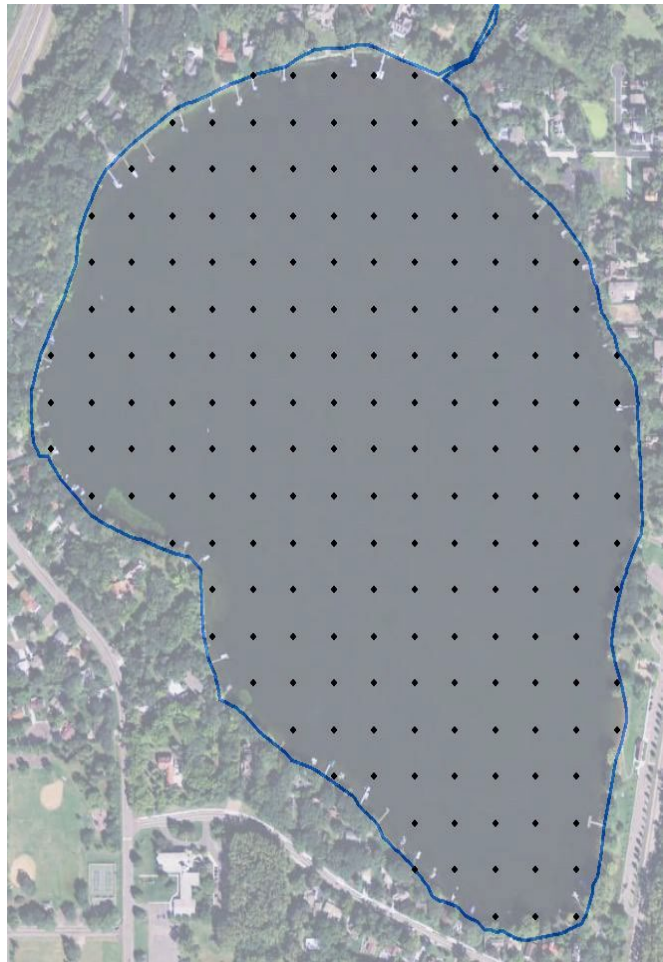
\*Indicates variance year

## Survey Objectives:

Point-intercept surveys were used to assess the distribution of aquatic plants in Lake Josephine. The primary purpose for this type of survey is to 1) develop baseline knowledge of the current plant community in a lake, and over time, 2) compare year-to-year plant variation (in plant presence and spatial location). Moreover, this survey will help the Minnesota Department of Natural Resources and our partners monitor native plant communities and evaluate possible responses to invasive aquatic plant management efforts. It is important to note that distributions of aquatic plants may vary from year to year due to effects such as differences in weather, as well as the effects from plant and water quality management.

## Survey Methods:

We used a point intercept survey method developed by John Madsen in [“Aquatic Plant Control Technical Note MI-02, 1999”](#). Survey points were placed 50 meters apart using a Geographic Information System (GIS), allowing for the placement of 192 points. Plant samples were collected by throwing and dragging a double-sided rake along the lake bottom at each point for approximately three meters. Plant samples were assessed on the boat to determine plant species, and rake fullness was used as a surrogate for density (scale of zero [no plants] to 4 [dense plants, matted on the surface] was used in 2012 – 2017, and a zero to 3 scale in 2018 and all years thereafter). Frequency of occurrence percentages (i.e., how often a plant species was found in the lake) were calculated based on the littoral zone (the portion of the lake that is less than 15 feet in depth).



## Survey Observations:

The most recent survey was conducted on September 12, 2023, by the Rice Creek Watershed District (RCWD). Native submersed plant frequency has historically been high (81 - 93%) but declined after the diquat treatment in 2017 (63%). In more recent years, plant frequency has ranged between 59 – 36% (2018 – 2022), with a resurgence in the most recent 2023 survey (see **Summary Table**). Water clarity had seen a trending decline since 2009, (see **Table 1 – Secchi Averages**), but increased to an average of 3.0 meters in 2023. The mean submersed native taxa per point was lowest in 2020 (0.6), the highest in 2014 (2.3) and was observed at 1.4 in 2023 (see **Summary Table**). Native species richness has remained consistent throughout the years of point intercept surveys with 6 to 12 native plants being observed (**Table 3 – Point Intercept Metrics**).

Although coontail and macroalgae have varied in frequency in the past, large-leaf pondweed presence has remained consistent (see **Table 4 – Plant Frequency of Occurrence**). Water stargrass frequency increased in the 2023 survey, while flat-stem pondweed density has remained steady after being absent in 2019 (see **Table 4 – Plant Frequency of Occurrence**).

Hybrid watermilfoil was confirmed in Lake Josephine in 2016 via genetic testing, and all samples collected were hybrid. Hybrid watermilfoil was observed at its highest frequency in 2013 (34%) and has not been observed since 2019 (**Table 4 – Plant Frequency of Occurrence**). Curly leaf pondweed presence has stayed below 5% frequency since 2019, although additional spring surveys would more appropriately determine temporal CLP frequencies.

**Table 3 – Point Intercept Metrics.** Summary of point intercepts metrics for Lake Josephine, Ramsey County, Minnesota (DOW# 62005700). Shaded values were calculated from the littoral depth range (0 – 15ft). Surveys conducted by either the Rice Creek Watershed District (RCWD) or Minnesota Department of Natural Resources (MNDNR).

Survey Metrics	JUL 15 2009	SEPT 10 2013	JUL 29 2014	AUG 28 2015	AUG 15 2016	AUG 7 2017	AUG 21 2018	SEPT 13 2019	SEPT 16 2020	AUG 11 2021	AUG 31 2022	SEPT 12 2023
Treated (Y/N)	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
Surveyor	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	MN DNR	RCWD
Total # Points Sampled	72	190	190	190	190	188	189	190	185	177	152	153
Max Depth of Growth (95%)	11	9	13	10	10	7	7	7	8	12	6	9
# Point in Max Depth Range	62	127	133	119	118	105	99	93	104	103	71	131
# Points in Littoral (0-15 feet)	68	149	142	144	143	144	151	148	142	107	132	153
% Points w/ Submersed Native Taxa	81	81	93	81	83	63	59	53	47	77	36	73
Mean Submersed Native Taxa/ Point	1.3	1.9	2.3	2.0	2.1	1.3	0.9	0.9	0.6	1.1	0.7	1.4
# Submersed Native Taxa	6	9	11	12	11	9	10	10	7	9	10	7
# Submersed Non-Native Taxa	1	2	2	2	2	2	2	2	0	1	1	1



**Table 4 – Plant Frequency of Occurrence.** Historic percent frequency of occurrence (FOO) for submersed aquatic vegetation within the littoral zone (0 – 15 feet) in Lake Josephine, Ramsey County, Minnesota (DOW# 62005700).

Taxonomic Name SUBMERSED PLANTS	Common Name	JUL 15 2009	SEPT 10 2013	JUL 29 2014	AUG 28 2015	AUG 15 2016	AUG 7 2017	AUG 21 2018	SEPT 13 2019	SEPT 16 2020	AUG 11 2021	AUG 31 2022	SEPT 12 2023
<i>Myriophyllum spicatum x sibiricum</i> *	Hybrid watermilfoil*	-	36	16	5	17	15	22	10	-	-	-	-
<i>Potamogeton crispus</i> *	Curly-leaf pondweed*	79	6	2	1	20	6	13	1	-	4	2	1
<i>Ceratophyllum demersum</i>	Coontail	58	43	45	78	62	43	34	24	3	1	10	48
<i>Macroalgae</i> **	Muskgrass & Nitella	37	4	10	23	27	38	24	32	44	70	22	46
<i>Elodea canadensis</i>	Canadian waterweed	7	1	-	1	-	-	-	-	-	-	-	-
<i>Heteranthera dubia</i>	Water stargrass	-	1	-	3	6	-	1	3	-	1	8	16
<i>Myriophyllum sibiricum</i>	Northern watermilfoil	10	-	2	-	1	-	-	1	-	-	-	-
<i>Najas spp.</i>	Naiad	-	32	27	27	33	11	25	17	-	7	5	-
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	-	6	5	8	5	5	5	9	1	4	8	6
<i>Potamogeton praelongus</i>	White-stem pondweed	-	1	2	6	9	2	1	1	-	-	-	-
<i>Potamogeton pusillus</i>	Small pondweed	-	-	5	-	-	-	-	-	-	8	-	-
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	31	24	30	47	58	22	2	-	8	15	17	16

\*Denotes invasive aquatic plant

\*\*Muskgrass and Nitella combined starting in 2015

**Floating, free-floating & emergent plants observed:** *Lemna trisulca* (forked duckweed), *Nuphar advena* (yellow pond lily), *Nuphar variegata* (bullhead pondlily), *Lythrum salicaria* (purple-loosestrife)

**Less common (< 5% frequency) submersed vegetation observed:** *Potamogeton gramineus* (variable-leaf pondweed) in 2009, *Potamogeton foliosus* (leafy pondweed) in 2013, 2015-2016, and 2018-2022, *Stuckenia pectinata* (sago pondweed) in 2014 and 2022, *Eleocharis acicularis* (needle spikerush) in 2015, and 2017-2020, *Potamogeton illinoensis* (Illinois pondweed) in 2015-2018 and 2020, *Vallisneria americana* (water celery) in 2015-2018, and 2021-2023, *Non-sphagnum moss* (watermoss) in 2019 and 2023, and *Potamogeton pusillus* (very small pondweed) in 2022.



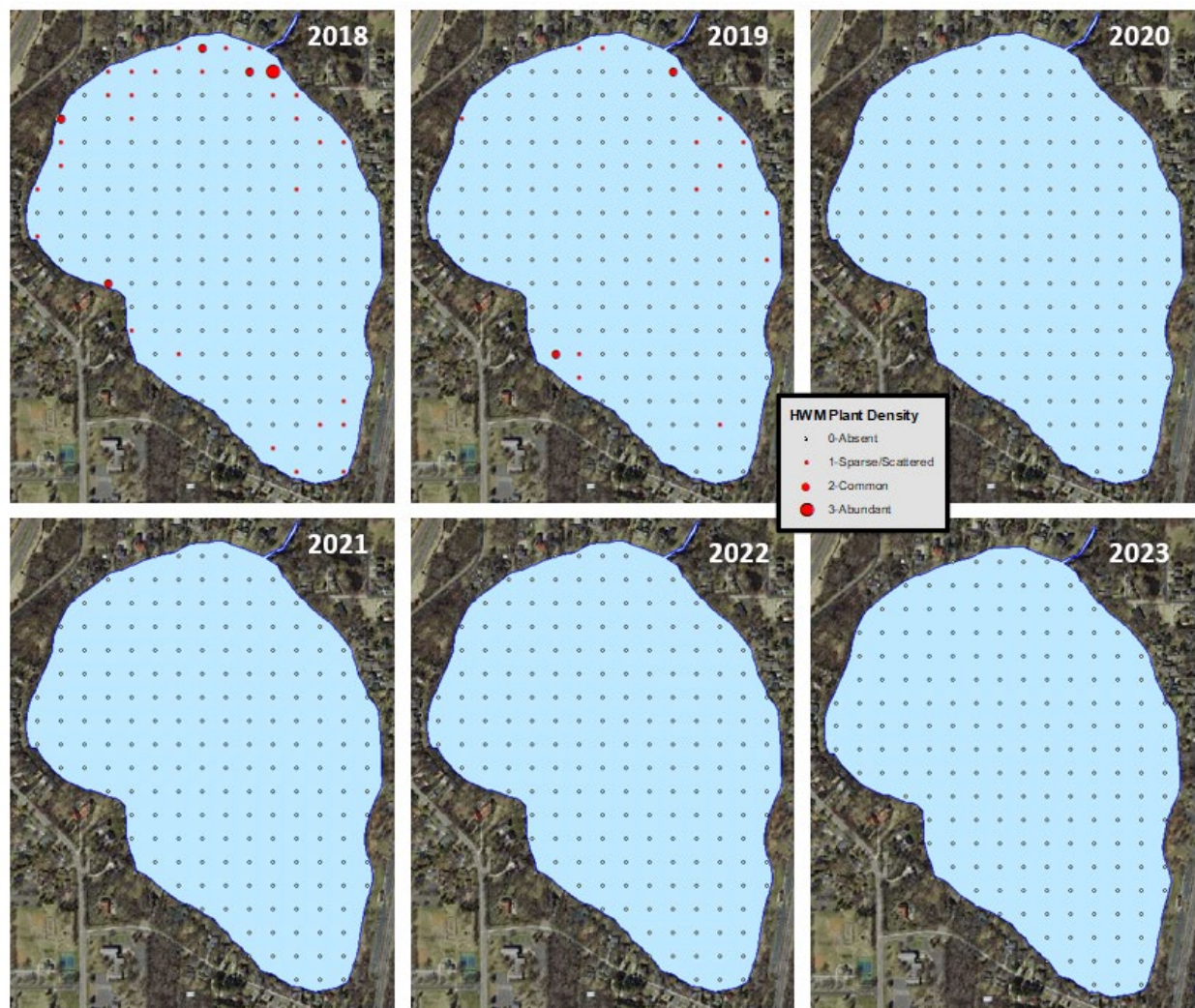
**Photos 1 – 3.** Abundant native submersed plants observed in 2015, 2020 and 2021 surveys respectively (left to right) included coontail (not-pictured), large-leaf pondweed (left; 1), flat-stem pondweed (middle; 2) and *Chara spp.* (right; 3).



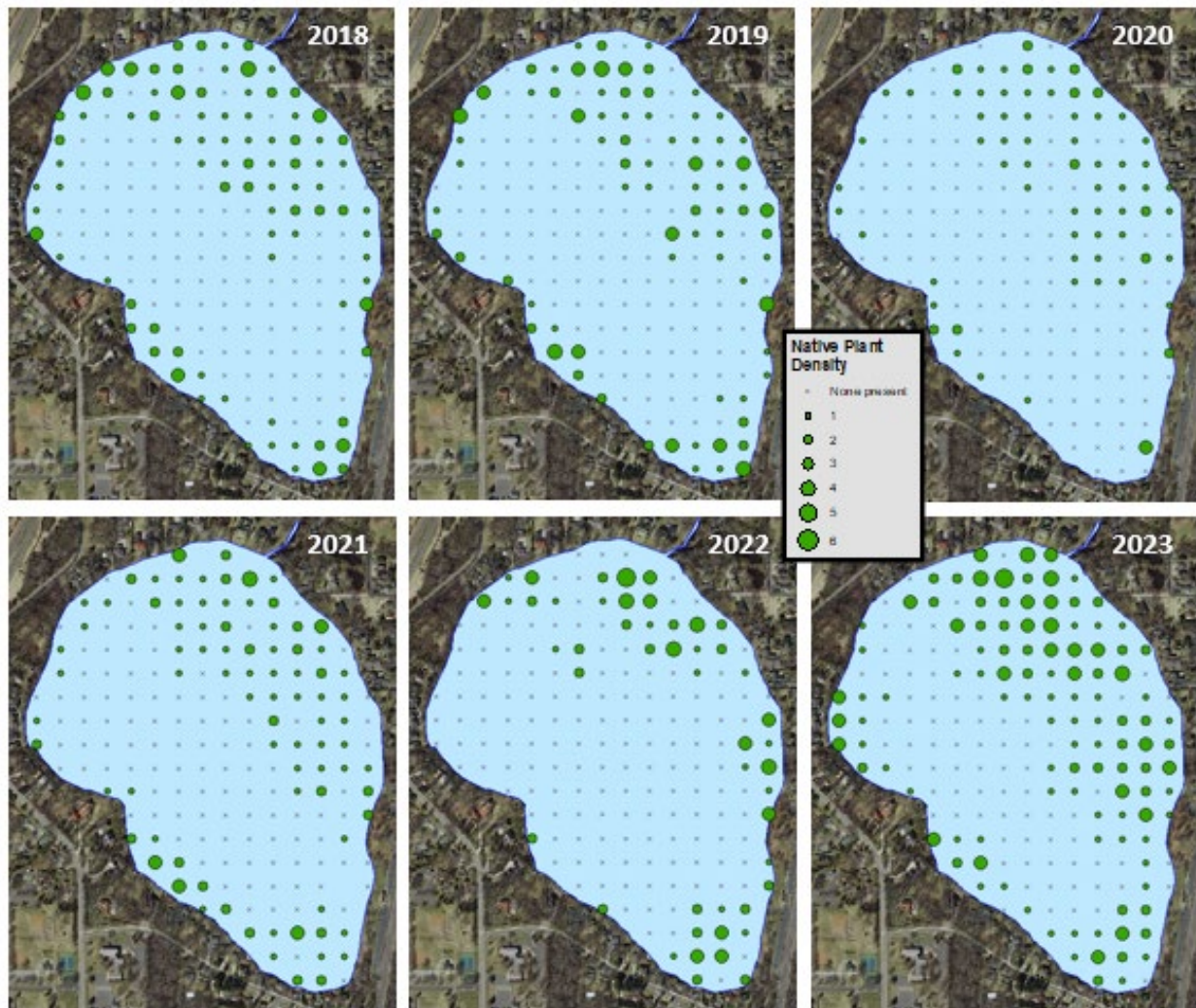


**Photos 4 – 5.** Left (4): Bare stems of hybrid watermilfoil (HWM) were observed in August of 2017 post diquat treatment. Right (5): New curly-leaf pondweed growth during the 2021 summer point intercept survey.





**Figure 1 – Hybrid Watermilfoil Density.** Spatial distribution and rake density per sample point of hybrid watermilfoil (HWM; 2018 - 2023). Surveys were conducted by either the Rice Creek Watershed District (2023) or by the Minnesota Department of Natural Resources (all other years). No HWM was found in 2020, 2021, 2022, or 2023. Data for all survey years provided upon request. Lake Josephine, Ramsey County, Minnesota (DOW# 62005700).



**Figure 2 – Native Species Taxa Density.** Spatial distribution and species richness (# of native aquatic taxa per sample point) of all submersed plant species (2018 - 2023). Surveys were conducted by either the Rice Creek Watershed District (2023) or by the Minnesota Department of Natural Resources (all other years). Data for all survey years provided upon request. Lake Josephine, Ramsey County, Minnesota (DOW# 62005700).

This information can be made available in alternative formats such as large print, braille or audiotape by emailing [info.dnr@state.mn.us](mailto:info.dnr@state.mn.us) or by calling 651-259-5016.