

---

# Muskrat Lake, Becker County

## 2022 Aquatic Vegetation Management Report

Report by the Invasive Species Program - Pelican River Watershed District

---



**Prepared by:**

Gina Kemper

Water Resource Coordinator

Pelican River Watershed District

### Project Details

**Lake:** Muskrat (EQUIS# 03-0360-00-201)

**Lake Surface Area:** 69 acres

**Littoral Area:** 64 acres

**County:** Becker

**Survey Type:** Point-intercept aquatic plant surveys (2022)

**Date of Survey (most recent):** July 18, 2018 (PRWD)

**Surveyor[s]:** Beatrice Jaszczak & Blaine Henderson

**Report Updated:** December 2022

**Author[s]:**

Gina Kemper (PRWD), prwdmonitor@arvig.net, 218-846-0436

### Report Details

G. Kemper. 2022. Muskrat Lake, Becker County: 2022 Aquatic Vegetation Management Report. Water Resource Coordinator Pelican River Watershed District, 211 Holmes Street W., Detroit Lakes, MN 56501. 19 pp.

## Summary

The purpose of this report is to provide an overview of aquatic plant distribution and the management of invasive aquatic plants in Muskrat Lake, Becker County between 2018 and 2022. Historical data on water quality, invasive aquatic plant management permits and point-intercept surveys are all summarized in this report. These summaries will guide future invasive aquatic plant control projects and can evaluate changes in native plant communities.

## Lake Description

Muskrat Lake is a 69 acre lake located 8.6 miles south of the town of Detroit Lakes, in Becker County, MN. The maximum depth of water in Muskrat Lake is 18 feet, and 93% of the lake is classified as littoral (the area of the lake where aquatic plants are most likely to grow). Water clarity during the summer has generally averaged between 6 - 11.4 feet. According to surveys from the Minnesota Pollution Control Agency (MPCA), Sugar Lake is classified as a mesotrophic lake based on its Trophic State Index (TSI) of 46. Mesotrophic lakes are lakes with an intermediate level of productivity and are typically clear water lakes with some summer algal blooms. The three parameters that are factored into the trophic state index are total phosphorus (nutrients in the water), chlorophyll-a (measure of the amount of algae growing in the water) and Secchi depths (water transparency). For more information on water quality, go to [Sugar Lake's water quality data](#) on the MPCA website:

(<https://cf.pca.state.mn.us/water/watershedweb/wdip/details.cfm?wid=86-0233-00>).

## Management History

The lake has two invasive plant species: Curly-leaf Pondweed (*Potamogeton crispus*) and Flowering Rush (*Butomus umbellatus*). Curly-leaf Pondweed and Flowering Rush have both been present at least since 2018. Invasive aquatic plant management in Muskrat Lake has focused on Curly-leaf Pondweed and Flowering Rush since 2018, using Endothall and Diquat herbicides. Lake-wide curly-leaf treatments had occurred between 2018- 2022, although only partial-lake treatments of both invasive aquatic plants have taken place in recent years. The most recent treatment was for Curly-leaf Pondweed in 2021 for 8.9 acres and the last treatment for Flowering Rush was in

2018 for 0.4 acres, both organized by the Sugar Lake Association. Management of invasive aquatic plants is summarized in Tables 1 and 2. Over time, the invasive aquatic plant community has fluctuated based on permitted treatment areas. Pre-treatment survey data (i.e. point-intercept surveys or lake-wide delineations that can be repeatable), collected over time, would be a recommended course of action for analyzing plant abundance and distribution trends into the future.

**Table 1 - Curly-leaf Pondweed Management Summary.** Characteristics and history of partial lake invasive plant treatments for Muskrat, Becker County (EQuIS# 03-0360-00-201), total acres: 69, Littoral acres: 64, (15% of Littoral acres: 9.6). CLP is an abbreviation for curly-leaf pondweed. Total acres permitted does not reflect areas actually treated or delineated. The total acres was rounded to the nearest whole number.

Date (year)	Target Species	Total Acres Permitted	Herbicide	Licensed Commercial Applicator
2018	CLP	4.6	Endothall	PLM & Land Management Corp.
2020	CLP	2.4	Endothall	PLM & Land Management Corp.
2021	CLP	8.9	Endothall	PLM & Land Management Corp.

**Table 2 - Eurasian Watermilfoil Management Summary.** Characteristics and history of partial lake invasive plant treatments for Sugar Lake, Wright County (DOW#86023300). EWM is an abbreviation for Eurasian watermilfoil. Total acres permitted does not reflect areas actually treated or delineated. The total acres is rounded to the nearest whole number.

Date (year)	Target Species	Total Acres Permitted	Herbicide	Licensed Commercial Applicator
2002	EWM	12	Auxin-mimic	Lake Restoration
2003	EWM	7	Auxin-mimic	Lake Restoration
2004	EWM	7	Auxin-mimic	Lake Restoration
2005	EWM	27	Auxin-mimic	Lake Restoration
2006	EWM	0	Auxin-mimic	Lake Restoration
2007	EWM	2	Auxin-mimic	Lake Restoration
2008	EWM	29	Auxin-mimic	Lake Restoration
2009	EWM	8	Auxin-mimic	Lake Restoration
2010	EWM	4	Auxin-mimic	Lake Restoration
2011	EWM	4	Auxin-mimic	Lake Restoration
2012	EWM	20	Auxin-mimic	Lake Restoration
2013	EWM	12	Auxin-mimic	Lake Restoration
2014	EWM	50	Auxin-mimic	Lake Restoration
2015	EWM	16	Auxin-mimic	Lake Restoration
2016	EWM	0	Auxin-mimic	Lake Restoration
2017	EWM	31	Auxin-mimic	Lake Restoration
2018	EWM	0	Auxin-mimic	Lake Restoration

### Survey Objectives




Point-intercept surveys were used to assess the distribution of aquatic plants in Sugar Lake. 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) and 3) track invasive aquatic plants. Moreover, this survey will help the DNR and our partners to monitor native plant communities and evaluate possible responses to invasive aquatic plant management via herbicide control. It is important to note that distributions and occurrences of aquatic plants may vary from year to year due to natural variations (water clarity,

snow cover, water temperatures, and natural fluctuation in plant species) or human induced alterations, such as, herbicide and shoreline management activities.

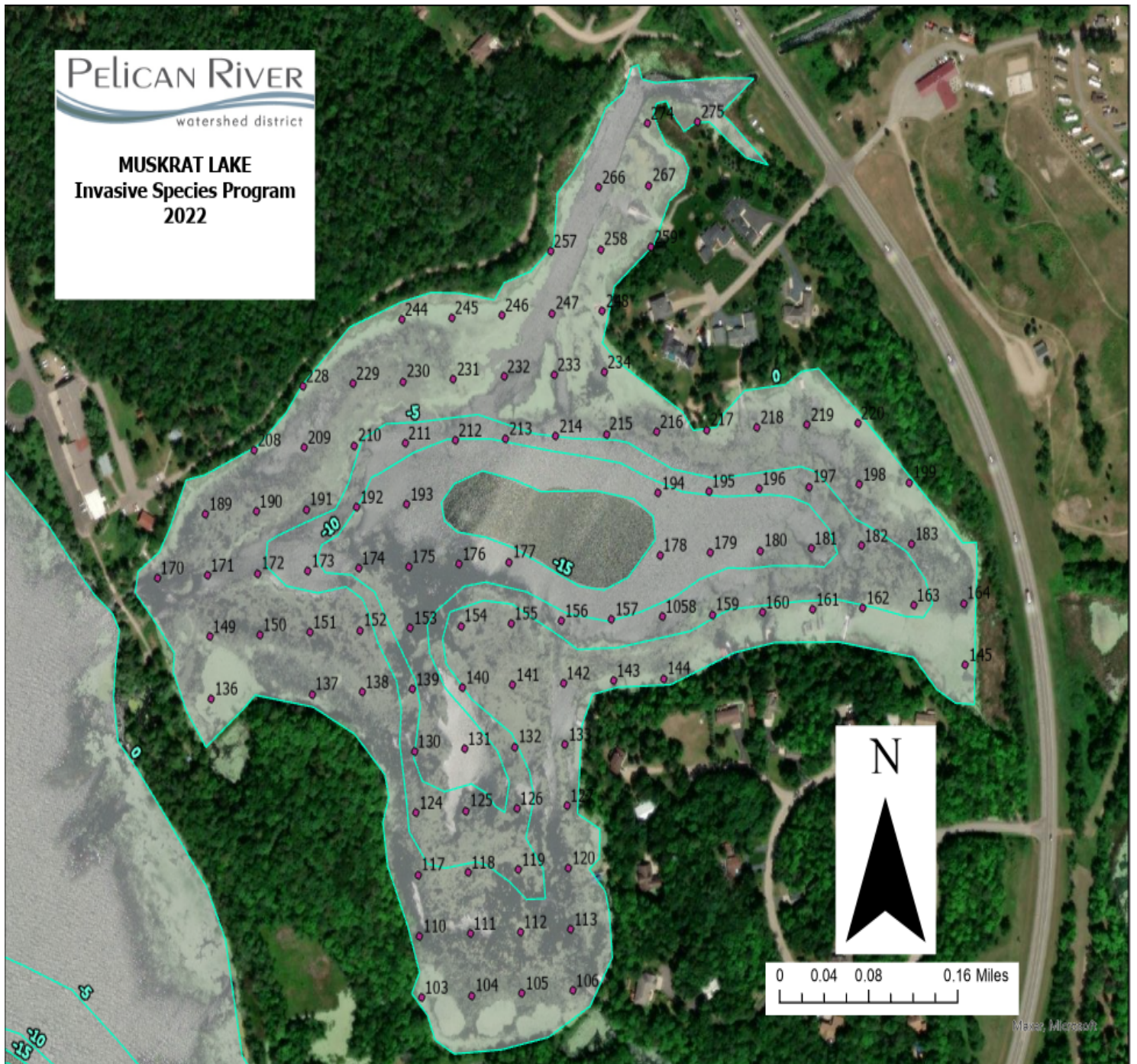
### Survey Methods

The MN DNR surveyors used a point-intercept survey method developed by John Madsen in “Aquatic Plant Control Technical Note MI-02, 1999” for surveys during the years of 2009, 2010, 2011 and 2018. For the most recent survey, points were placed 125 meters apart using a Geographic Information System (GIS), comprising of 115 points on a grid (Figure 1). Plant samples were collected by throwing and dragging a double-sided rake along the lake bottom at each point. Plant samples were collected by throwing and dragging a double-sided rake along the lake bottom at each point. All plant taxa (submerged, floating-leaf, emergent and free floating) were recorded to species or genera during the survey following Crow and Hellquist (2000). Plant samples were assessed on the boat to determine species presence-absence and abundance. The abundance rake rating are as follows: 1: sparse, 2: common/ frequent/ occasional, and 3: abundant/matted (Table 3). Frequencies of occurrence percentages (i.e., how often a plant species was sampled in the lake) were calculated based on the littoral zone. Maximum depths were calculated at the 95<sup>th</sup> percentile for all vegetated sampling points.

**Table 3. Quantitative rake abundance ranking** (0-3) used to estimate plant abundance for each species based on rake coverage and/or visual observation (MN DNR). A zero (0) ranking indicates no target plants were retrieved or observed in a sample.

Abundance Ranking	Rake Coverage	Description
1		Sparse; plants covering <25% of the rake head
2		Common; plants covering 25%-75% of the rake head
3		Abundant; plants covering >75% of the rake head





**Figure 1 – Point-intercept Survey Grid.** Point-intercept survey grid for Sugar Lake, Wright County (DOW#86023300). A total of 115 points were surveyed in 2018 at 125 meters apart.

## Survey Observations

The most recent aquatic vegetation point-intercept survey of Sugar Lake (DOW #86023300) occurred on July 18, 2018. Plants were rooted to a maximum depth (95%) of 15.1 feet, with depths ranging from 1.5- 19.0 feet. However, it was very rare to find any rooted plants deeper than 15 feet. In the littoral zone (water depth from 0 to 15 feet, where aquatic plants are likely to be found), 97% of the points had submersed native vegetation (Table 4) with a mean submersed native taxa per point of 3.0. Lake has up to 17 submersed native taxa (Table 5) and two non-native submerged taxa (curly- leaf pondweed and Eurasian watermilfoil), comprising of 4% of the littoral area.

**Table 4 - Point-intercept Metrics.** Summary of MN DNR point-intercepts metrics for Sugar Lake, Wright County (DOW#86023300). Shaded values were calculated from littoral depth range (0-15 feet).

Metric	JULY 2009	AUG 2010	AUG 2011	JULY 2018
Surveyor	MN DNR	MN DNR	MN DNR	MN DNR
Total # Points Sampled	60	56	116	115
Max depth of growth	13	19.3	29	19
Depth Range of Rooted Veg (ft.)	2.1- 13	4.1- 19.3	5.2- 29	1.5- 19.0
Max Depth of Growth (95%) (ft.)	11.0	12.6	19.2	15.1
# of Vegetated Points in Max Depth Range	57	49	91	115
# Points in Littoral (0-15 feet)	60	55	89	94
% Points w/ Submersed Native Taxa	98	91	99	97
Mean Submersed Native Taxa/ Point	2.5	2.3	2.9	3.0
# Submersed Native Taxa	15	17	15	16
# Submersed Non-Native Taxa	2	1	1	1
% Points w/ Submersed Non- native Taxa	15	13	3	4

Based on the 2018 point-intercept survey, the native plant community within the littoral area in Sugar Lake was primarily dominated by muskgrass (*Chara* sp.) 62%, coontail (*Ceratophyllum demersum*) 51%, bladderwort (*Utricularia vulgaris*) 21% and water celery (*Vallisneria americana*) 21% (Figures 2, 3, 4, and 5). These aquatic plants are central to a healthy fish population, offering shelter and providing food and habitat to wildlife. Sugar Lake also has the following emergent: sedges (*Cyperaceae* sp.), bulrushes (*Schoenoplectus* sp.), cattails (*Typha* sp.) and wild rice (*Zizania palustris*). These emergent plants are especially good at preventing shoreline erosion, habitat and providing food sources for waterfowl. Plants also absorb nutrients and reduce algae, thereby



improving water quality. The invasive aquatic plant surveyed in the lake was curly-leaf pondweed (4%; Table 5). Eurasian watermilfoil is present in the lake, although not recorded during the 2018 survey. Moreover, this taxa has decreased over time (Figure 7). Sugar Lake has a diverse aquatic plant community with an average of three species per a sampling site. Figure 8 displays the spatial distribution and species richness (# of species per sample point) of all native submersed species from the most recent point-intercept survey.

**Table 5 - Plant Frequency Occurrence.** Percent frequency of occurrence for observed plant species within the littoral zone (0-15 feet) in Sugar Lake, Wright County (DOW#86023300).

Taxonomic Name	Common Name	JUNE 2008 <sup>a</sup>	AUG 2008 <sup>a</sup>	JULY 2009 <sup>b</sup>	AUG 2010 <sup>b</sup>	AUG 2011 <sup>b</sup>	SEPT 2012 <sup>c</sup>	JULY 2018 <sup>b</sup>
<b>SUBMERSED NON-NATIVE</b>								
<i>Potamogeton crispus</i>	curly-leaf pondweed	31	14	2	0	0	1	4
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	3	8	15	13	3	6	0
<b>SUBMERSED NATIVE</b>								
<i>Bidens beckii</i>	water marigold	4	4	10	4	7	8	4
<i>Ceratophyllum demersum</i>	coontail	43	50	52	36	65	46	51
<i>Chara</i> sp.	muskgrass	56	47	67	75	61	52	62
<i>Elodea canadensis</i>	Canadian waterweed	6	5	3	2	6	4	19
<i>Heteranthera dubia</i>	water star-grass	0	0	0	5	3	7	0
<i>Myriophyllum sibiricum</i>	northern watermilfoil	42	43	18	11	25	18	13
<i>Najas</i> sp.	naiad species	7	16	18	25	36	21	20
<i>Nitella</i> sp.	nitella species	1	0	0	0	0	0	0
<i>Potamogeton amplifolius</i>	large-leaved pondweed	1	5	0	0	0	1	0
<i>Potamogeton illinoensis</i>	Illinois pondweed	19	22	17	5	16	1	11
<i>Potamogeton freisii</i>	Fries' pondweed	0	0	0	0	0	0	18
<i>Potamogeton praelongus</i>	whitestem pondweed	4	3	10	2	2	17	2
<i>Potamogeton gramineus</i>	variable pondweed	0	0	0	4	0	0	0
<i>Potamogeton pusillus</i>	slender pondweed	0	0	0	2	2	0	0
<i>Potamogeton richardsonii</i>	clasping-leaved pondweed	3	1	5	7	9	9	20
<i>Potamogeton</i> spp.	narrow-leaf pondweed	6	0	0	0	0	5	15
<i>Potamogeton zosteriformis</i>	flat-stemmed pondweed	24	18	3	2	1	1	1
<i>Ranunculus</i> sp.	water crowfoot	4	2	2	0	0	1	0

Taxonomic Name	Common Name	JUNE 2008 <sup>a</sup>	AUG 2008 <sup>a</sup>	JULY 2009 <sup>b</sup>	AUG 2010 <sup>b</sup>	AUG 2011 <sup>b</sup>	SEPT 2012 <sup>c</sup>	JULY 2018 <sup>b</sup>
<i>Stuckenia pectinata</i>	sago pondweed	0	7	13	7	11	9	15
<i>Utricularia vulgaris</i>	common bladderwort	20	15	7	16	24	5	21
<i>Vallisneria americana</i>	water celery	9	24	20	27	28	24	21
<i>Zanichellia palustris</i>	horned pondweed	0	0	5	0	0	0	0
<b>FLOATING LEAF</b>								
<i>Nymphaea odorata</i>	white waterlily	3	4	3	0	3	6	4
<i>Nuphar variegata</i>	yellow waterlily	2	1	2	5	7	5	6
<i>Potamogeton natans</i>	floating-leaved pondweed	0	0	0	2	0	0	0
<b>EMERGENT</b>								
<i>Cyperaceae</i> sp.	sedge species	1	0	0	0	0	0	0
<i>Schoenoplectus</i> sp.	bulrush species	1	1	10	13	6	5	5
<i>Typha</i> sp.	Cattail species	7	9	P	4	0	6	1
<i>Zizania palustris</i>	wild rice	4	0	5	0	0	0	4
<b>FREE FLOATING</b>								
<i>Brasenia schreberi</i>	watershield	2	0	3	0	3	1	0
<i>Lemna trisulca</i>	star duckweed	12	8	2	5	7	0	2
<i>Lemna</i> sp.	duckweed species	2	2	0	0	0	0	0
<i>Wolffia</i> sp.	watermeal	0	0	P	0	0	0	0
<i>Spirogyra</i> sp.	filamentous algae	0	0	32	9	7	0	10

p Indicates taxon was present in the lake but not observed in any sample sites.

<sup>a</sup> The depth zone used to calculate percent frequency values for both 2008 surveys (PI survey method) was not specified (Dindorf 2008).

<sup>b</sup> Percent frequency for 2009, 2010, 2011 and 2018 (PI survey method) calculated for the 0-15 feet zone.

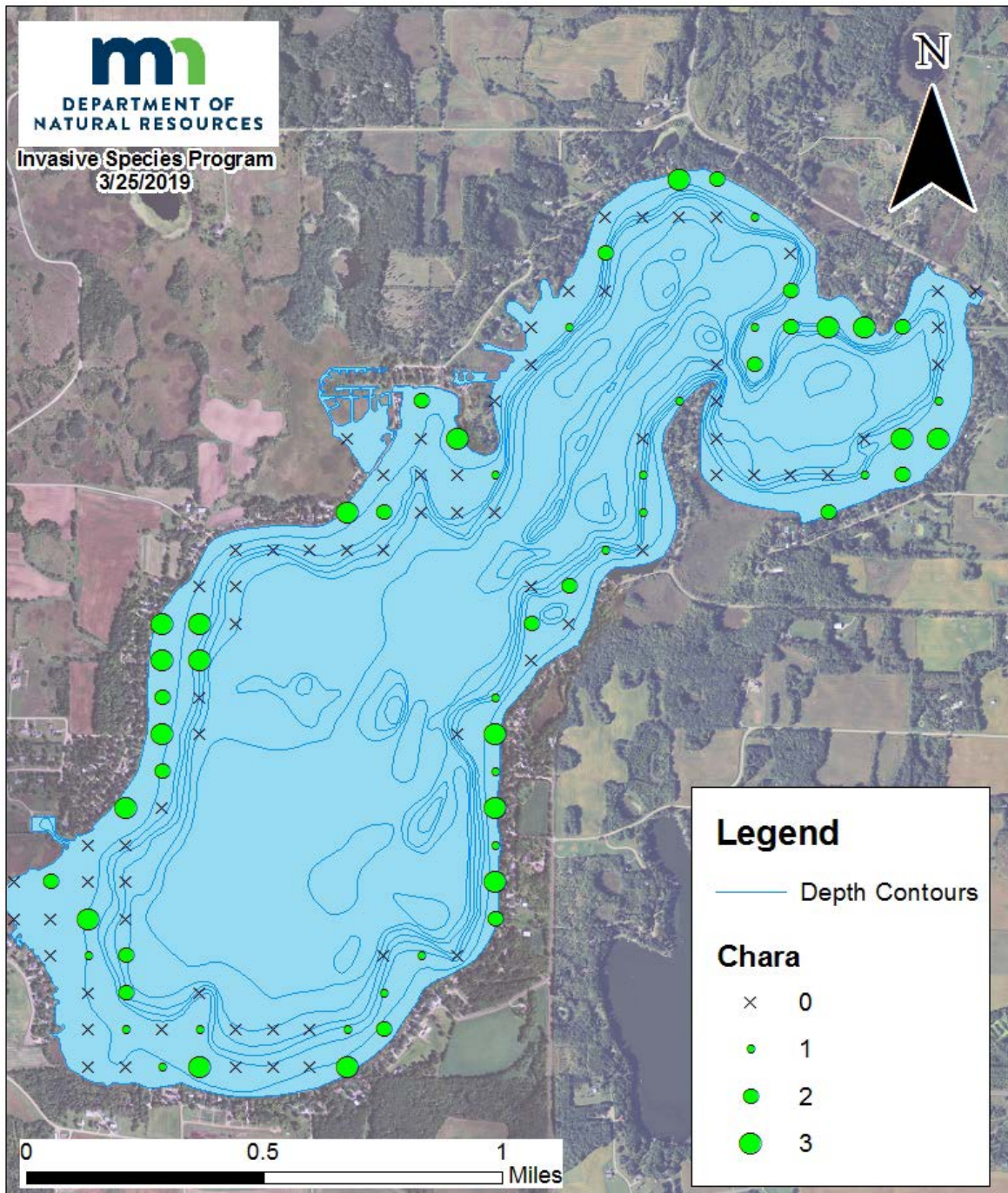
<sup>c</sup> Percent frequency values for 2012 (PI survey method) are calculated for the 0-20 feet zone (McComas 2012).

### Comparison to previous years

Numerous aquatic plant survey have taken place on Sugar Lake, although not all surveys are included in this report since the survey methods are not comparable to the point-intercept method. When comparing survey years, it is important to note when the survey was conducted and survey method. For example, curly- leaf pondweed peak abundance is June, although for most native aquatic plants, mid to late summer is the best time to evaluate native aquatic plant communities. Based on the MN DNR surveys from 2009 to 2018, the percent of points with submersed native taxa

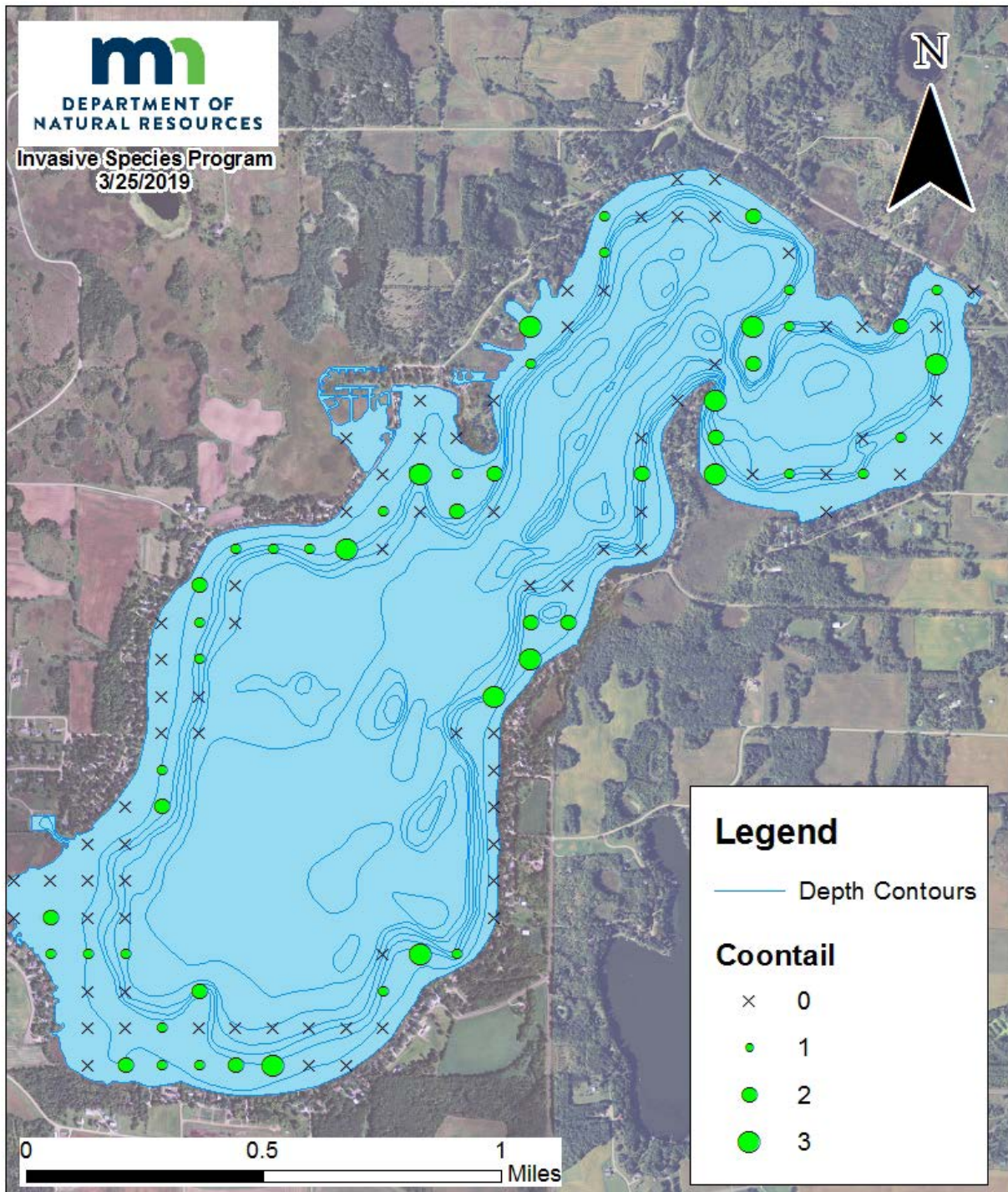
Sugar Lake, Wright County: 2018 Aquatic Vegetation Management Report

had remained above 90%, with some decline in the percent of non-native aquatic taxa. As of 2018, the frequency of occurrence of invasive aquatic plants was less than 5%. Overall, Sugar Lake has a very diverse aquatic plant community.



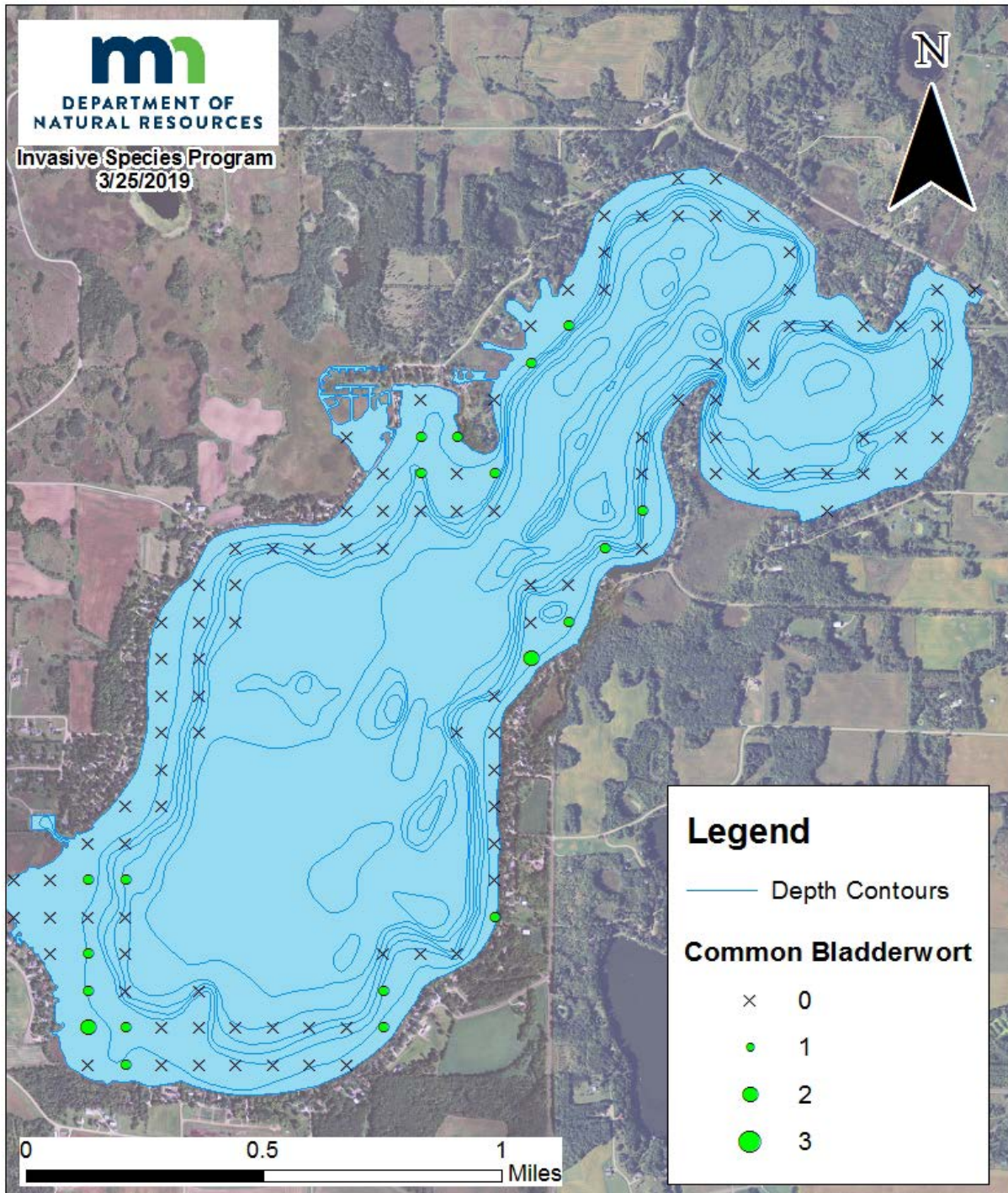
**Figure 2 –Muskgrass Distribution.** Plant distribution from the 2018 point-intercept survey for muskgrass in Sugar Lake, Wright County (DOW#86023300). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.





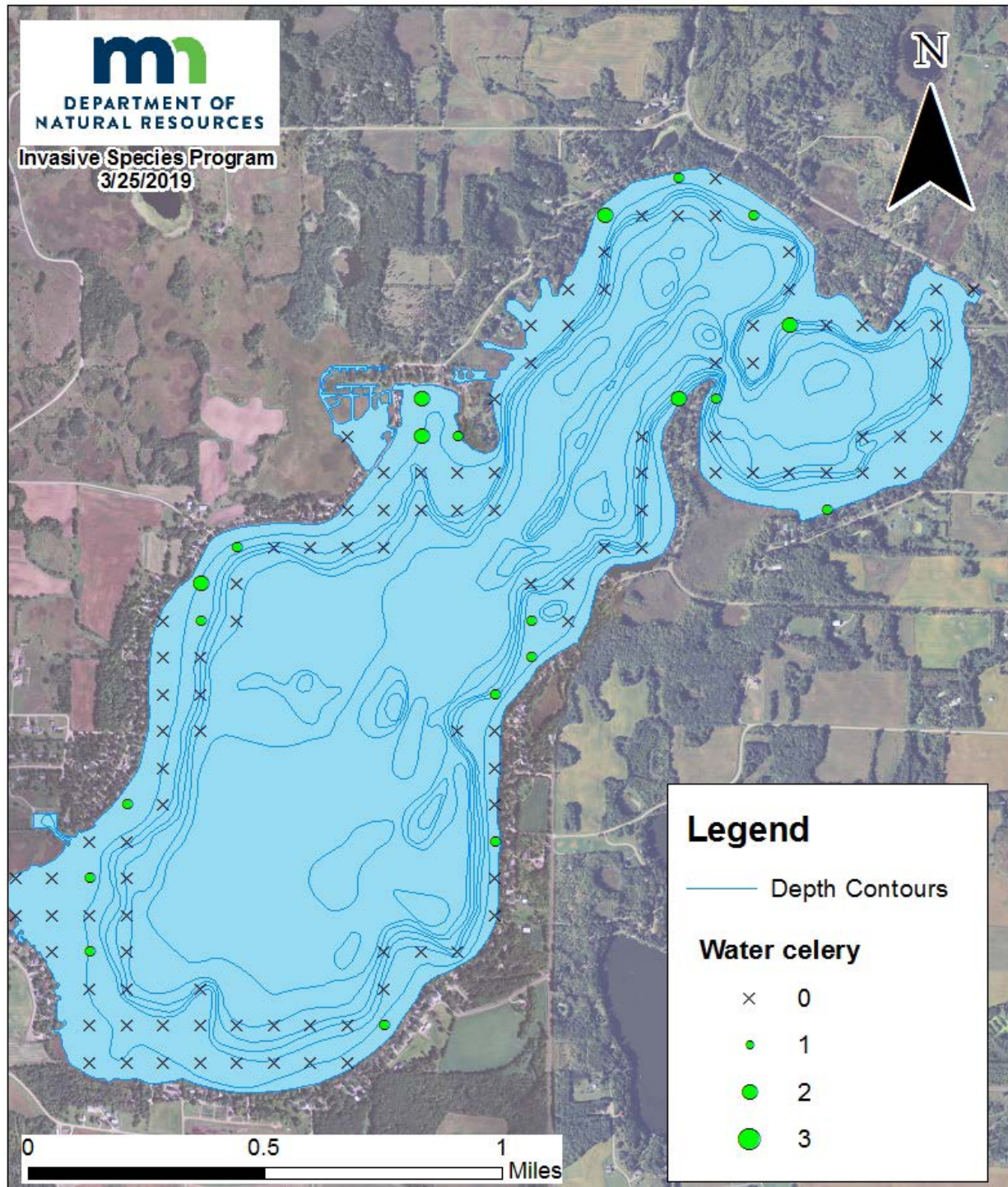
**Figure 3 –Coontail Distribution.** Plant distribution from the 2018 point-intercept survey for coontail in Sugar Lake, Wright County (DOW#86023300). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.





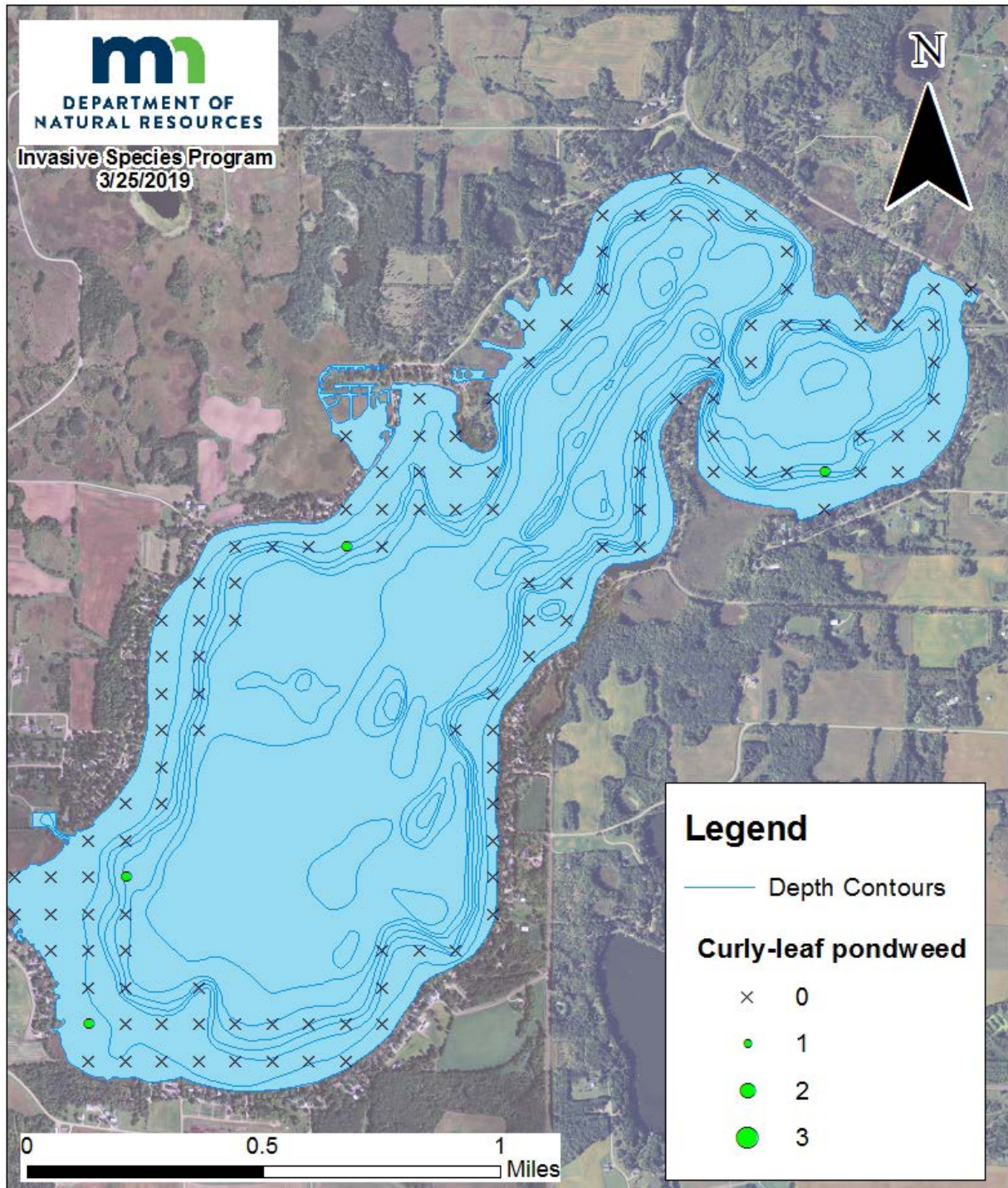
**Figure 4 –Common bladderwort Distribution.** Plant distribution from the 2018 point-intercept survey for common bladderwort in Sugar Lake, Wright County (DOW#86023300). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.





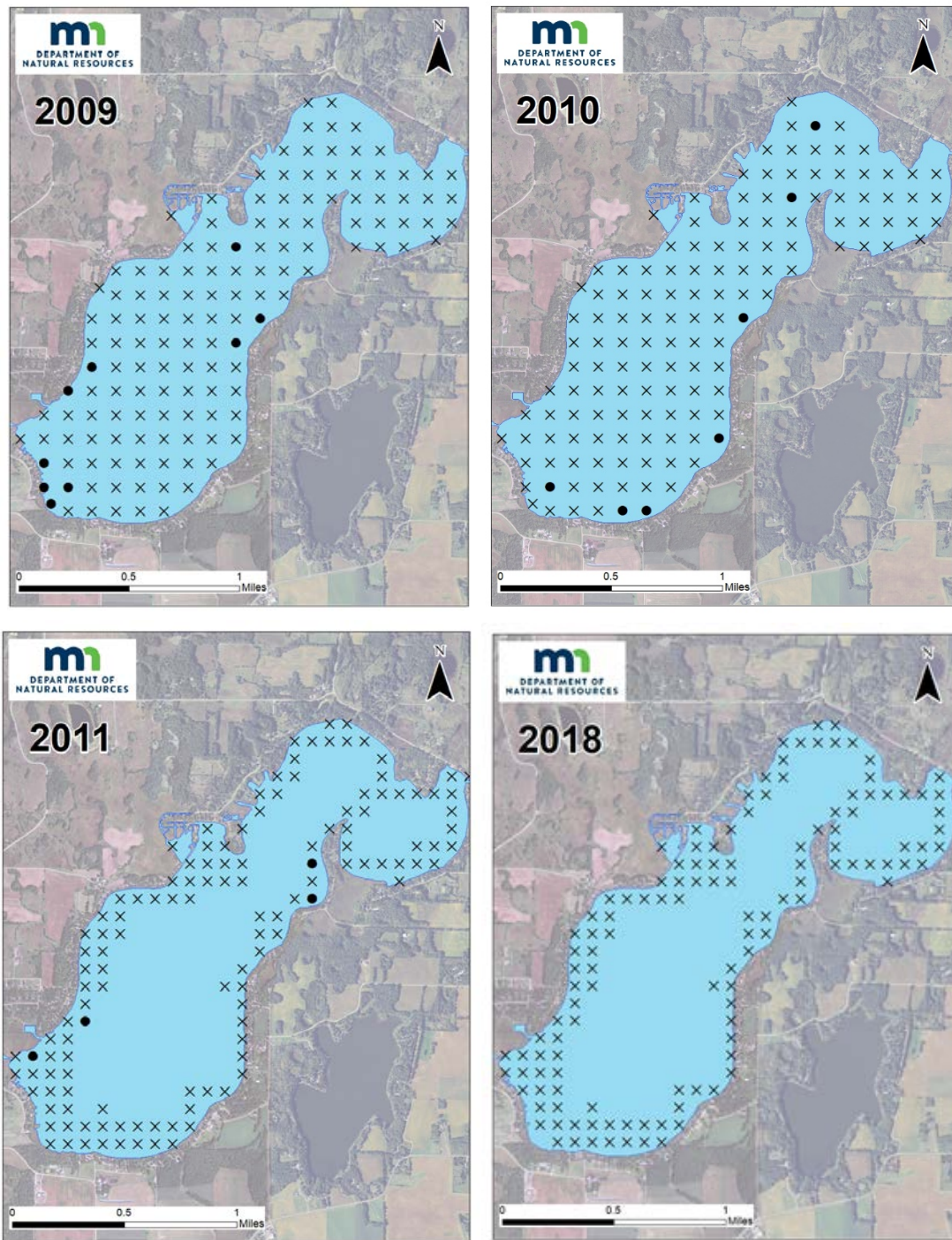
**Figure 5 –Water celery Distribution.** Plant distribution from the 2018 point-intercept survey for water celery in Sugar Lake, Wright County (DOW#86023300). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.





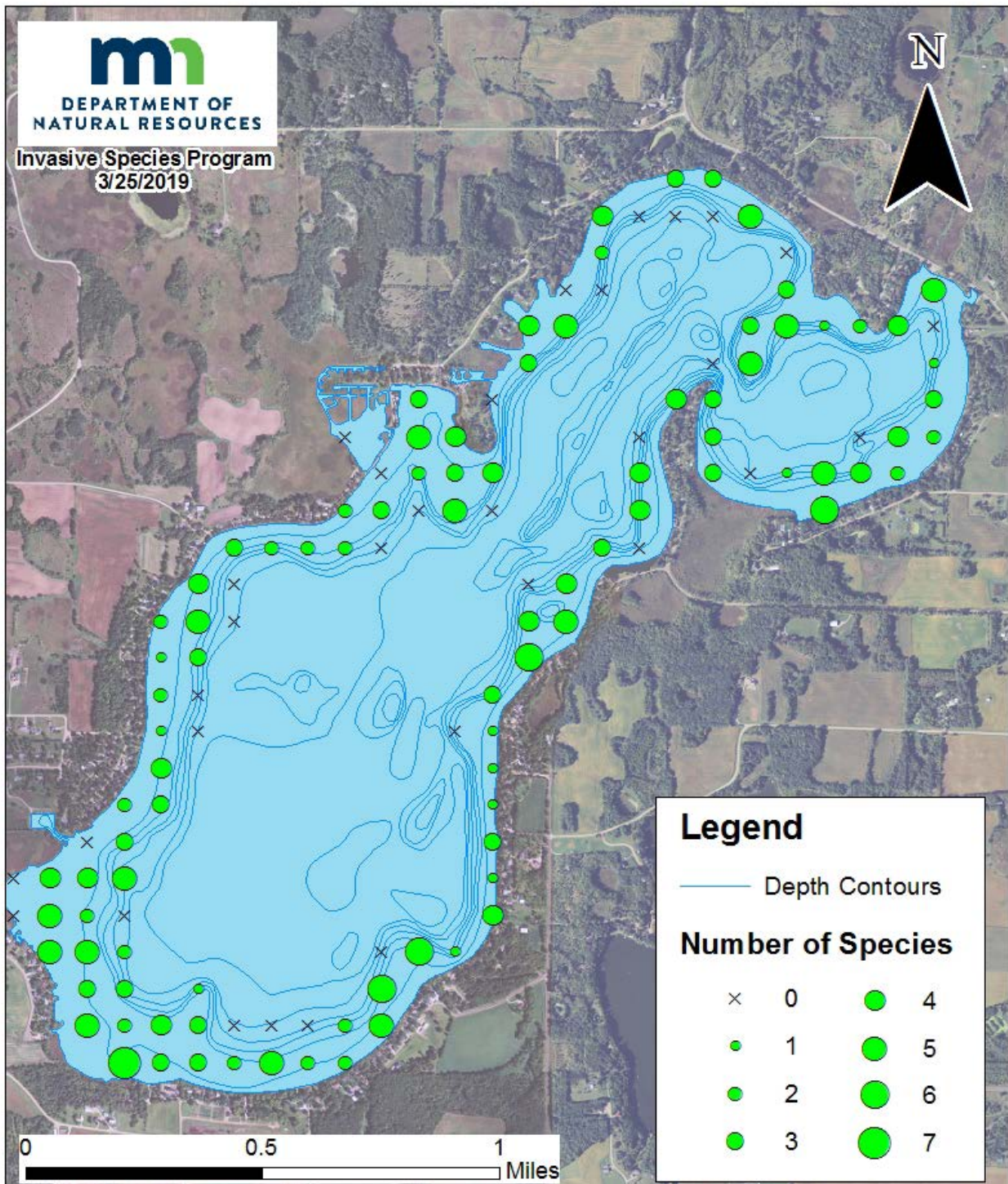
**Figure 6 – Curly-leaf pondweed Distribution.** Curly-leaf pondweed distribution map from the 2018 point-intercept survey in Sugar Lake, Wright County (DOW#86023300). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.





**Figure 7- Eurasian watermilfoil Distribution among Years.** Black circles indicate the present of Eurasian watermilfoil and X's indicate not present in Sugar Lake, Wright County (DOW#86023300) based on point-intercept surveys between 2009 and 2018.





**Figure 8- Species Richness Distribution.** Number of species at each site from the 2018 point-intercept survey in Sugar Lake, Wright County (DOW#86023300).

## Literature Cited

Crow, G. and C. Hellquist. (2000). *Aquatic and wetland plants of Northeastern North America*. (Vols. 1 & 2). Madison, WI: The University of Wisconsin Press.

Dindorf, C. and K. Schonhorst. 2008. Sugar Lake Aquatic Plant Survey. Prepared for the Sugar Lake Association. 18 pp.

Madsen, J. (1999). *Point-intercept and line intercept methods for aquatic macrophytes management*. APCRP Technical Notes Collection (TN APCRP-M1-02). Vicksburg, MS: U.S. Army Engineer Research and Development Center.

McComas S. and J. Stuckert. 2006. Lake Vegetation Management Plan for Sugar Lake, Wright County, Minnesota 2006. Prepared for the Sugar Lake Association and the MN DNR, St. Paul. 40 pp.

McComas S. and J. Stuckert. 2012. Aquatic Plant Point-intercept Survey for Sugar Lake, Wright County, Minnesota 2012. Prepared for Sugar Lake Association. 26 pp.