Melissa Lake, Becker County, MN
2021 Aquatic Vegetation Management Report

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Project Details

Lake: Melissa (EQuIS# 03-0475-00-202)

Lake Surface Area: 1850 acres **Littoral Area:** 934 acres **County:** Becker

Survey Type: Point-intercept aquatic plant surveys (2021)

Date of Survey (most recent): July 8, 2021 – July 16, 2021 (PRWD)

Surveyor[s]: Meagan Powers and Isaac Cuchna

Report Updated: January 2023

Author[s]:

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Report Details

G. L. Kemper. 2022. Melissa Lake, Becker County: 2021 Aquatic Vegetation Management Report. Water Resource Coordinator Pelican River Watershed District, 211 Holmes Street W., Detroit Lakes, MN 56501. 21 pp.

Summary

The purpose of this report is to provide an overview of aquatic plant distribution and the management of invasive aquatic plants in Melissa Lake, Becker County in 2021. Historical data on water quality, invasive aquatic plant management permits and point-intercept surveys are all summarized in this report. This summary will guide future invasive aquatic plant control projects and can evaluate changes in native plant communities.

Lake Description

Melissa is a small lake with 64 of 69 acres classified as littoral (<15 feet deep). Lake Melissa is a polymictic lake, with 45% of its surface area considered littoral. Lake Melissa is the second largest lake within the Pelican River Watershed District. Lake Melissa is classified as a mesotrophic lake with good water quality. The Pelican River passes through the lake, entering on the north end from Lake Sallie, with an outlet on the south end flowing to Mill Pond. Late summer algal blooms have been observed, typically caused by nutrient movement from the borderline eutrophic Lake Sallie through the Pelican River.

The invasive Zebra Mussel was first observed in Lake Melissa in 2014. Since then, there has been a significant increase in water clarity. Prior to the infestation, mean summer clarity ranged from 8 to 12 feet (9.5 feet average). Subsequent years after the infestation, clarity increased to 12.5 (2015), 14.5 (2016), and 16.5 (2017). There has also been a significant reduction in chlorophyll level, indicating a shift from free floating to benthic (bottom dwelling) algae, which is common with infested lakes.

Lake Melissa is also known to be infested with the invasive aquatic plant Flowering Rush and Curly-leaf Pondweed. The District actively surveys and chemically treats nuisance populations annually to manage the plant density and minimize recreational and environmental impacts.

The shoreline on Lake Melissa has been experiencing intense development in recent years to what was already a highly developed lake shore. There has also been a conversion from small, seasonal cottages, to larger, year-round homes. Residential lots are relatively small, which also contributes to the dense development and shoreline modifications.

Shoreline survey results comparing waterfront equipment between 2008 and 2017 showed a drastic increase in quantity of waterfront equipment present, which is consistent with the increased development. The amount of motorized watercraft present more than doubled from 225 (2008) to 433 (2017), which, with 399 parcels on the lake, accounts for more than one watercraft per parcel. Personal watercraft (PWC, jetskis) were classified separately for the study, where 172 were observed in 2017, a 300% increase from 2008. As to be expected with an increase on watercraft, there was also a significant increase in boat lifts, both covered and uncovered. Interestingly, the largest increase observed was with the non-motorized watercraft (including stand-up paddleboards, kayaks, paddle boats, etc.) which increased by 360% to a total of 276.

There are several water control structures in the Lake Melissa vicinity. The remnant of a lock and dam system is located approximately 100 feet upstream of Lake Melissa. This lock is no longer active and there are no water level manipulation abilities with the remnant structure, which does not inhibit fish passage. There is a bridge located at the outlet of lake Melissa that forms a slight hydraulic constriction. There are no other dam components, such as piers, stops, or concrete crest present. Approximately 300 feet downstream of the outlet is a large culvert below South Melissa Drive. There is a noticeable difference between the headwater and tailwater elevations at the culvert. Also, the velocity of flow in the channel from the lake to the culvert suggests that the headwater elevation at the culvert is slightly lower that the actual elevation of Lake Melissa.

Management History

The lake has two invasive plant species: Curly-leaf Pondweed (*Potamogeton crispus*) (CLP) and Flowering Rush *(Butomus umbellatus) (FR)*. Curly-leaf Pondweed and Flowering Rush have both been present since the 1970s. Mechanical harvesting was the primary method used to control CLP and FR, however in the mid-2000s it became clear that harvesting was not an affective control method. After conducting several years of research, the District used herbicides as its primary control method for CLP and FR.

While Curly-leaf Pondweed and Flowering Rush can be delineated in large areas, MN DNR only allows up to 15% of the Littoral area to be treated with herbicide without a variance. In 2021 treatments for Curly- leaf Pondweed was 0 acres and Flowering Rush was for 48 acres. Management of invasive aquatic plants is summarized in Tables 1 and 2. Over time, the invasive aquatic plant community has fluctuated based in annual field delineations.

Table 1 - Curly-leaf Pondweed Management Summary. Characteristics and history of partial lake invasive plant treatments for Melissa, Becker County (EQuIS# 03-0475-00-202), total acres: 1850, Littoral acres: 934, (15% of Littoral acres: 140). CLP is an abbreviation for curly-leaf pondweed. Total acres permitted does not reflect areas actually treated or delineated. The total acres were rounded to the nearest whole number.

Date (year)	Target Species	Total Acres Permitted	Herbicide	Licensed Commercial Applicator
2021	CLP	0		

Table 2 – Flowering Rush Management Summary. Characteristics and history of partial lake invasive plant treatments for Melissa, Becker County (EQuIS# 03-0475-00-202). FR is an abbreviation for Flowering Rush. Total acres permitted does not reflect areas actually treated or delineated. The total acres are rounded to the nearest whole number.

Date	Target Species	Total Acres Permitted	Herbicide	Licensed Commercial Applicator
6/28/2021	FR	24	Diquat	PLM & Land Management Corp.
8/9/2021	FR	24	Diquat	PLM & Land Management Corp.

Survey Objectives

In 2021, a Point-intercept Survey assessed the distribution of aquatic plants in Melissa 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 PRWD 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

PRWD surveyors used a point-intercept survey method developed by John Madsen in "Aquatic Plant Control Technical Note MI-02, 1999" during the 2021 Survey. Points were placed 72 meters apart using a Geographic Information System (GIS), comprising of 233 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. All plant taxa (submerged, floating-leaf, emergent and free floating) were recorded to species or genera during the survey following Skawinski (2018). 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.

Table 3. Quantitative rake abundance ranking (0-3) used to estimate plant abundance for each species based on rake coverage and/or visual observation (PRWD). 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

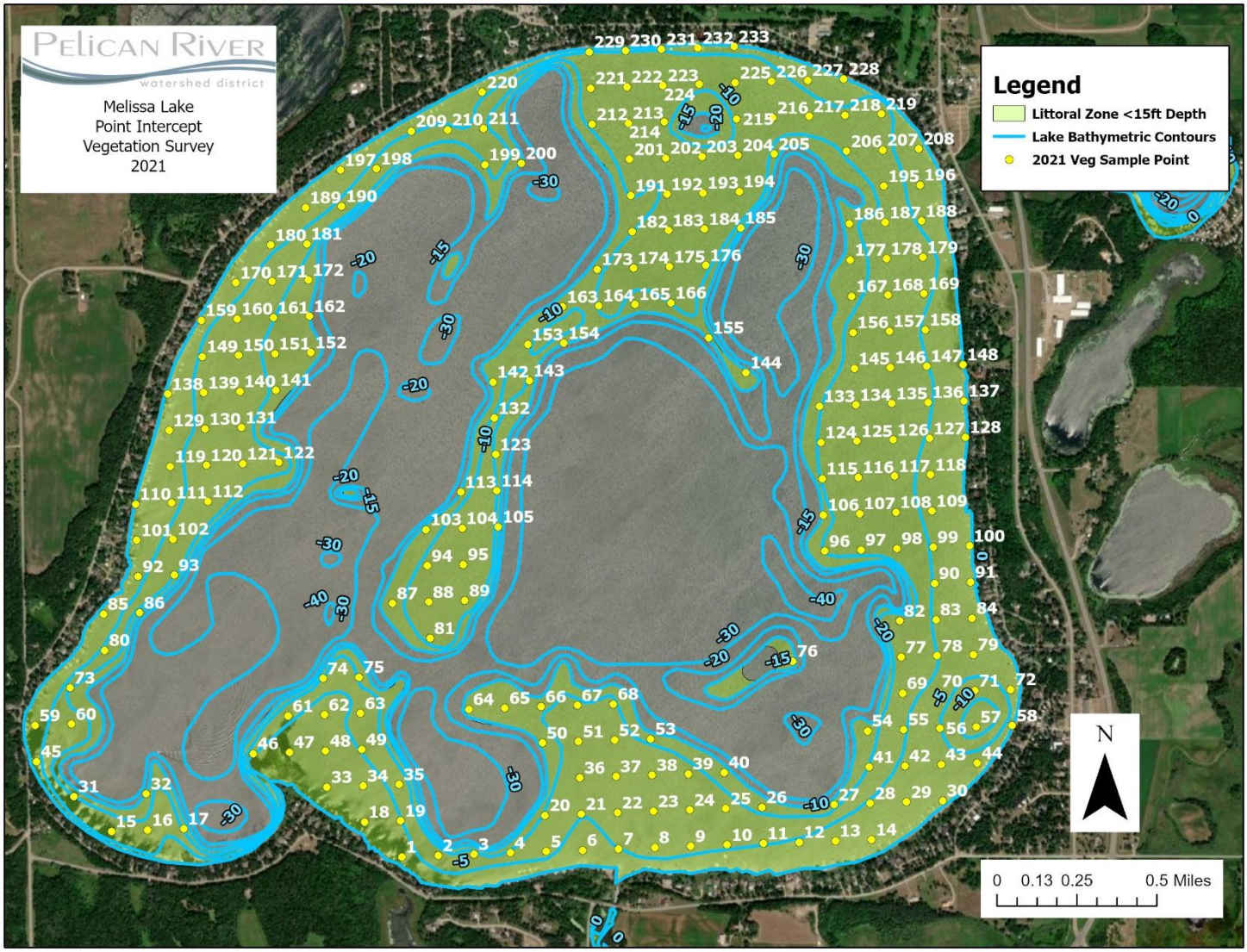

Figure 1 – Point-intercept Survey Grid. Point-intercept survey grid for Melissa Lake, Becker County (EQuIS# 03-0475-00-202). A total of 233 points were surveyed in 2021 at 72 meters apart.

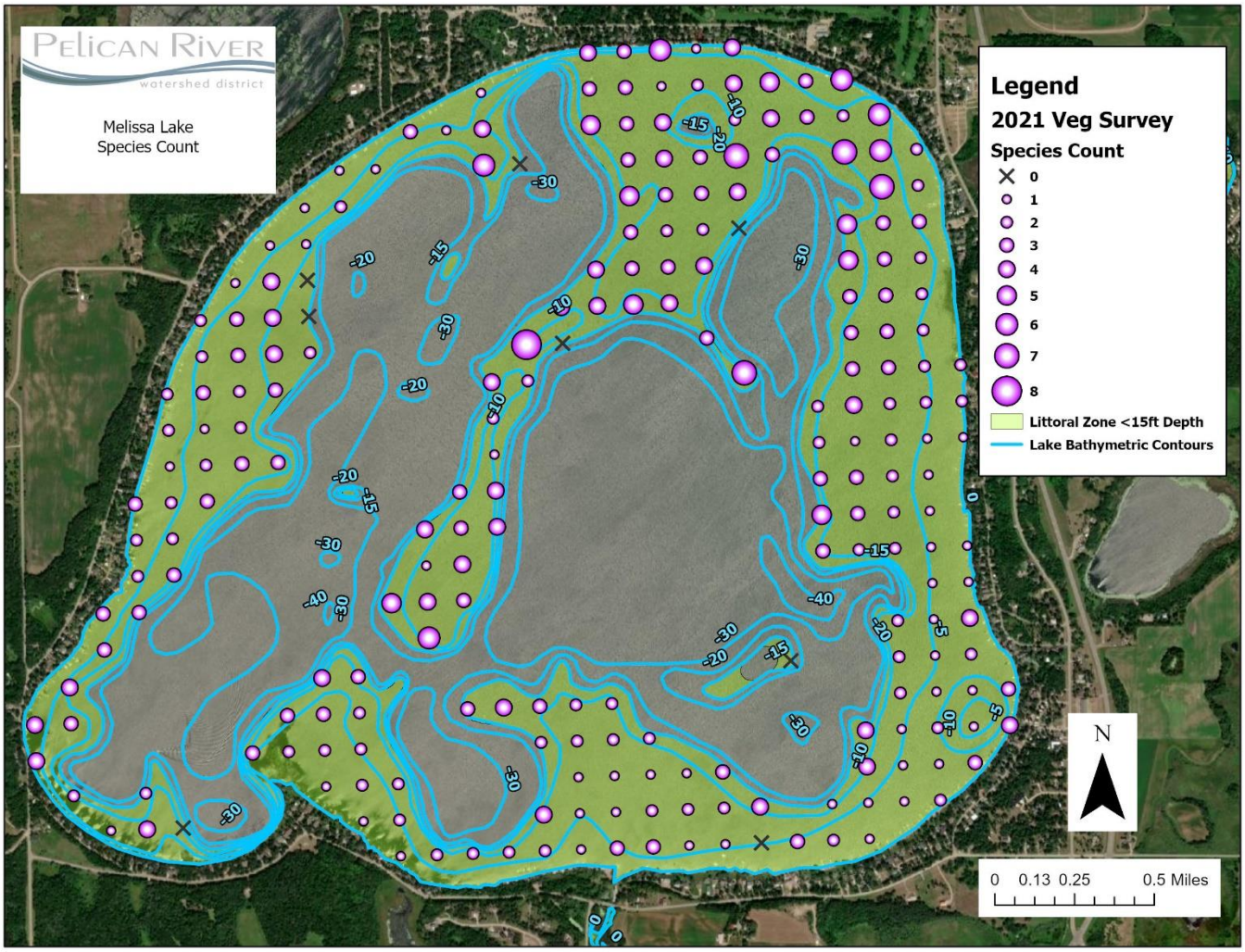

Figure 2 – Species Richness Distribution. Number of species at each site from the 2021 point-intercept survey in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 8 at each point, with a 8 indicating the richness in species presence and 0 indicating no species.

Survey Observations

The vegetation point-intercept survey of Melissa Lake (EQuIS# 03-0475-00-202) conducted by the PRWD occurred between July 22nd and August 8th, 2021. Plants were rooted to a maximum depth (95%) of 15.1 feet, with depths ranging from 0 – 15 feet. However, since 934 acres is considered the littoral zone (< 15 feet deep and where aquatic plants are likely to be found) it was very rare to find any rooted plants deeper than 15 feet. 96% of the points had submersed native vegetation (Table 4) with a mean submersed native taxa per point of 3.8. Melissa Lake has up to 19 submersed native taxa (Table 5) and one non-native submerged taxa (Curly-leaf Pondweed) and one non-native emergent taxa (Flowering Rush).

Table 4 - Point-intercept Metrics. Summary of PRWD point-intercepts metrics Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Shaded values were calculated from littoral depth range (0-15 feet).

Metric	JULY – AUGUST 2021
Surveyor	PRWD
Total # Points Sampled	233
Max depth of growth	15
Depth Range of Rooted Veg (ft.)	0.0 – 15.0
Max Depth of Growth (95%) (ft.)	15
# Of Vegetated Points in Max Depth Range	225
# Points in Littoral (0-15 feet)	233
% Points w/ Submersed Native Taxa	96
Mean Submersed Native Taxa/ Point	3.8
# Submersed Native Taxa	19
# Submersed Non-Native Taxa	1
% Points w/ Submersed Non- native Taxa	0

Based on the 2021 point-intercept survey, the submersed native plant community within the littoral area in Melissa Lake was primarily dominated by Macroalgae (Chara spp./ Nitella spp.) 69%, Illinois Pondweed (*Potamogeton illinoensis)* 43%, Coontail (Ceratophyllum demersum) 19%, Northern Watermilfoil (*Myriophyllum sibiricum)* 15%, Southern Naiad (Najas guadalupensis) 9%, and Common Water Moss (Fontinalis spp.) 7% (3, 4, 5, 6, 7, & 8). These aquatic plants are central to a healthy fish population, offering shelter and providing food and habitat to wildlife. Melissa Lake also has the following floating leaf and emergents: Bladderwort (*Utricularia spp.*) 47%, Bulrush (*Schoenoplectus* sp.) 1%, Star Duckweed (Lemna trisulca) 8%, (Figures 9, 10 and 11) 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.

Melissa Lake has an average of two species per sampling site. Figure 2 displays the spatial distribution and species richness (# of species per sample point) of all native submersed species from the 2021 point-intercept survey.

Table 5 - Plant Frequency Occurrence. Percent frequency of occurrence for observed plant species within the littoral zone (0-15 feet) in Melissa Lake, Becker County (EQuIS# 03-0475-00-202).

July 8, 2021 - July 16, 2021 *b*

Taxonomic Name	Common Name	Frequency (%)
SUBMERSED NON-NATIVE *These plants spread or have been introduced beyond its native range and are either causing harm or have the potential to cause harm.*		
Potamogeton crispus	Curly-leaf Pondweed	3%
SUBMERSED NATIVE *These plants are rooted plants with flaccid or limp stems and most of their vegetative mass is below the water surface, although small portions may stick above the water.*		
Ceratophyllum demersum	Coontail	19%
Chara spp./Nitella spp.	Macroalgae	69%
Heteranthera dubia	Water Stargrass	2%
Fontinalis spp.	Common Water Moss	7%
Myriophyllum sibiricum	Northern Watermilfoil	15%
Myriophyllum heterophyllum	Variable-leaf watermilfoil	1%
Myriophyllum verticillatum	Whorled watermilfoil	2%
Potamogeton nodosus	Long-Leaf Pondweed	3%
Potamogeton richardsonii	Richardson's Pondweed	6%
Potamogeton zosteriformis	Flat-stem Pondweed	6%
Potamogeton praelongus	White-stem Pondweed	2%
Potamogeton pusillus	Small or Slender Pondweed	5%
Vallisneria americana	Water Celery	2%
Stuckenia pectinate	Sago Pondweed	3%
Najas guadalupensis	Southern Naiad	9%
Potamogeton foliosus	Leafy Pondweed	3%
Potomageton Illinoensis	Illinois Pondweed	43%
Potamogeton friesii	Fries' Pondweed	6%
FLOATING LEAF *These plants are rooted in the lake bottom and have leaves that float on the water surface. Many have colorful flowers that extend above the water.*		
Uticularia spp.	Bladderwort	47%
EMERGENT *These plants extend well above the water surface and are usually found in shallow water, near shore.*		
Scirpoides Holoschoenus	Bulrush	1%
EMERGENT NON-NATIVE *These plants spread or have been introduced beyond its native range and are either causing harm or have the potential to cause harm.*		
	Flowering Rush **	

Table 5 Continued - Plant Frequency Occurrence. Percent frequency of occurrence for observed plant species within the littoral zone (0-15 feet) in Melissa Lake, Becker County (EQuIS# 03-0475-00-202).

FREE FLOATING *These plants float freely on the water surface. The entire plant is suspended on the water, allowing the plant to be moved around the pond by wind and water currents.*		
Lemna trisulca	Star Duckweed	8%

b *Percent frequency for 2021 (PI Survey Method) calculated for 0-15 feet zone.*

**** *This species is present on the lake but detected through the lake delineation process and is not recorded in the Point intercept process data.*

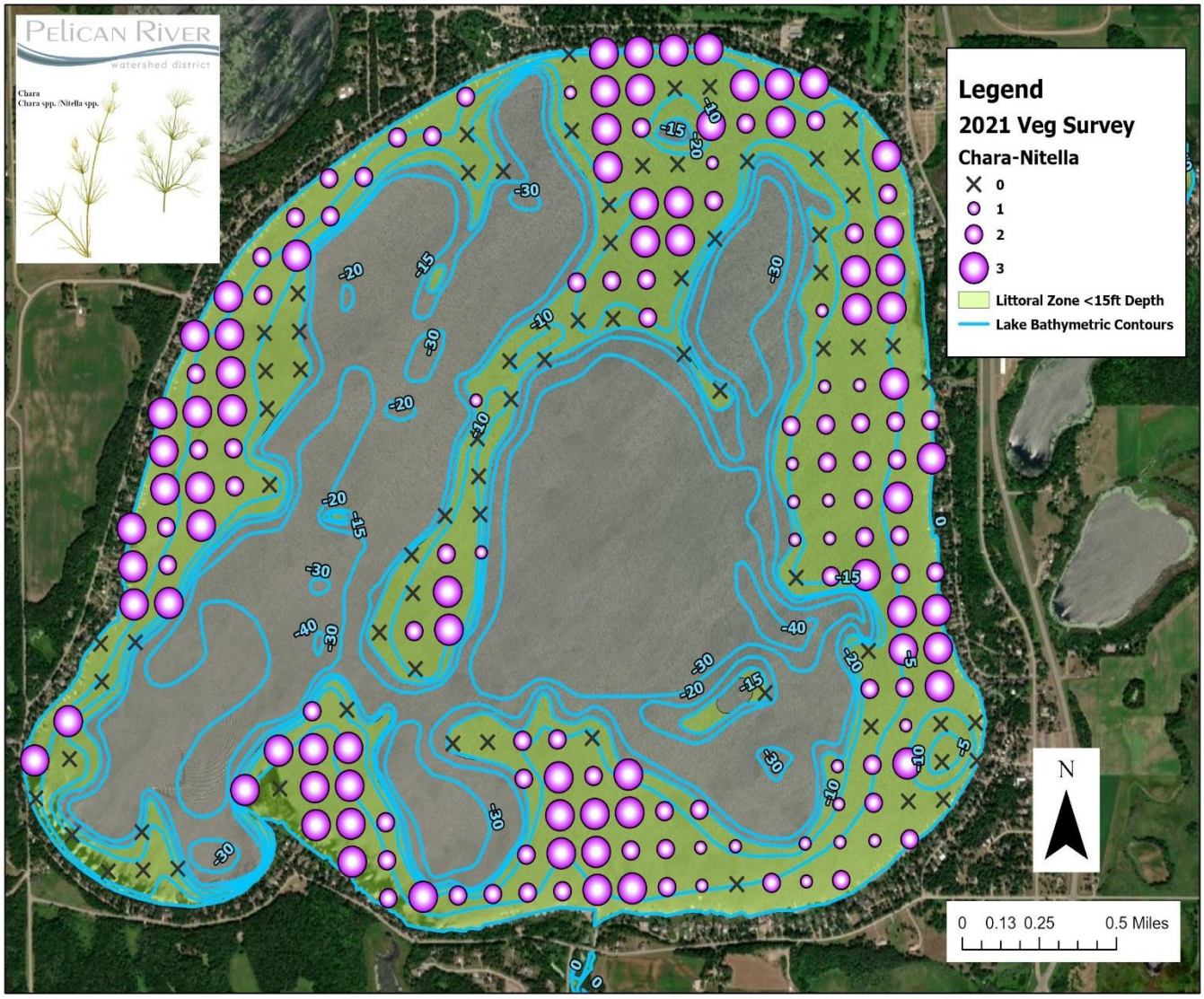

Figure 3 – Chara Distribution. Plant distribution from the 2021 point-intercept survey for Chara in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

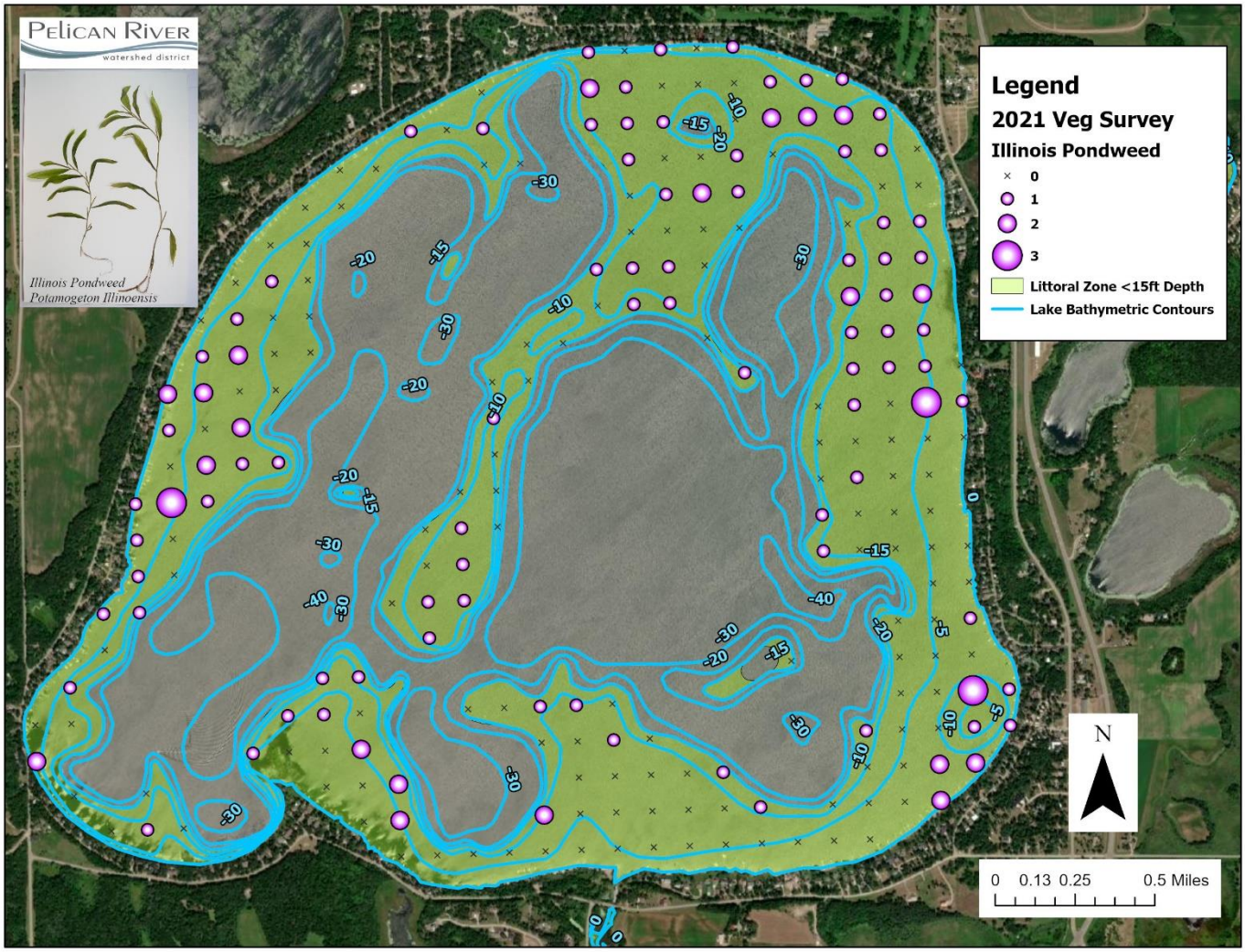

Figure 4 – Illinois Pondweed Distribution. Plant distribution from the 2021 point-intercept survey for Illinois Pondweed in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

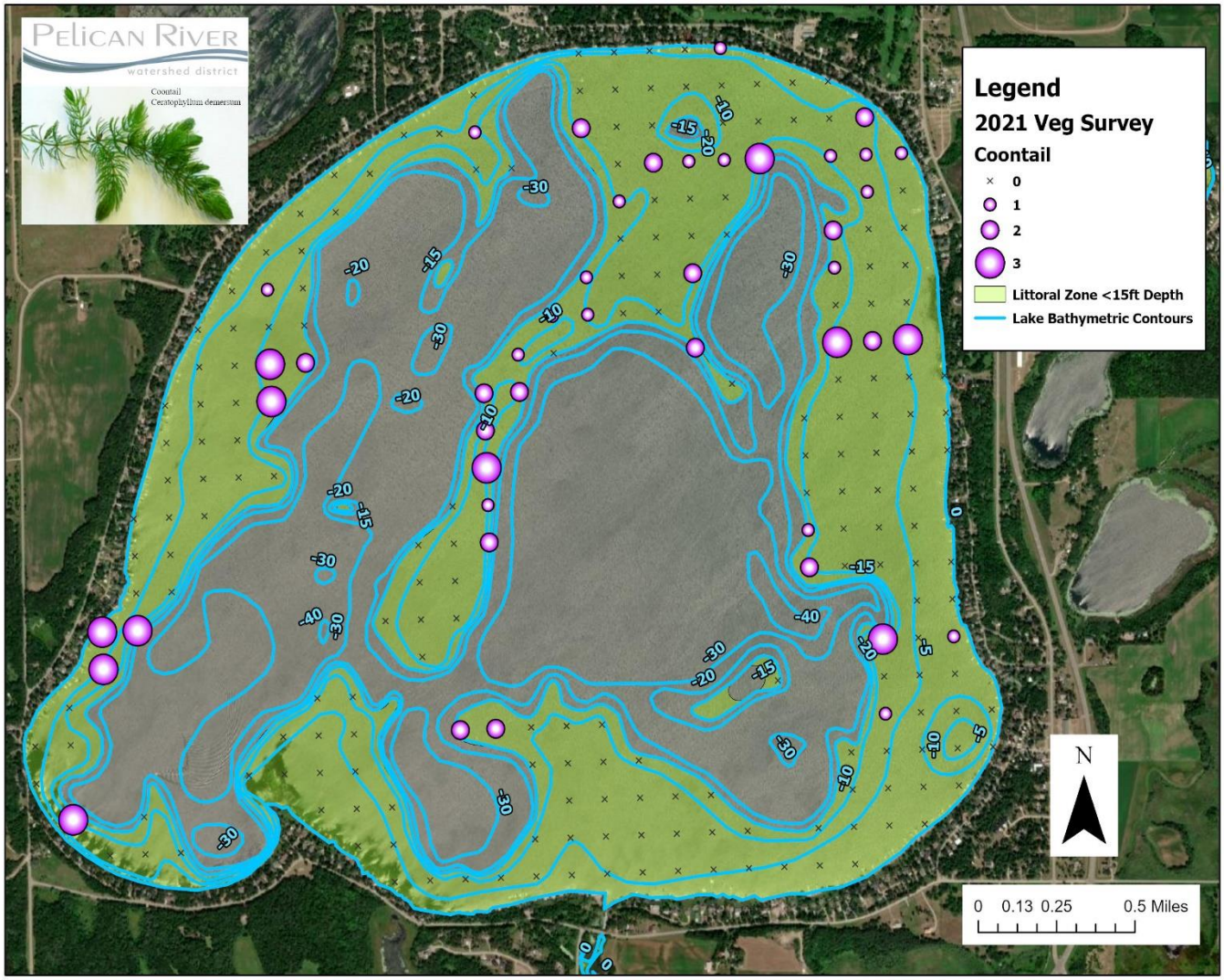

Figure 5 – Coontail Distribution. Plant distribution from the 2021 point-intercept survey for Coontail in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

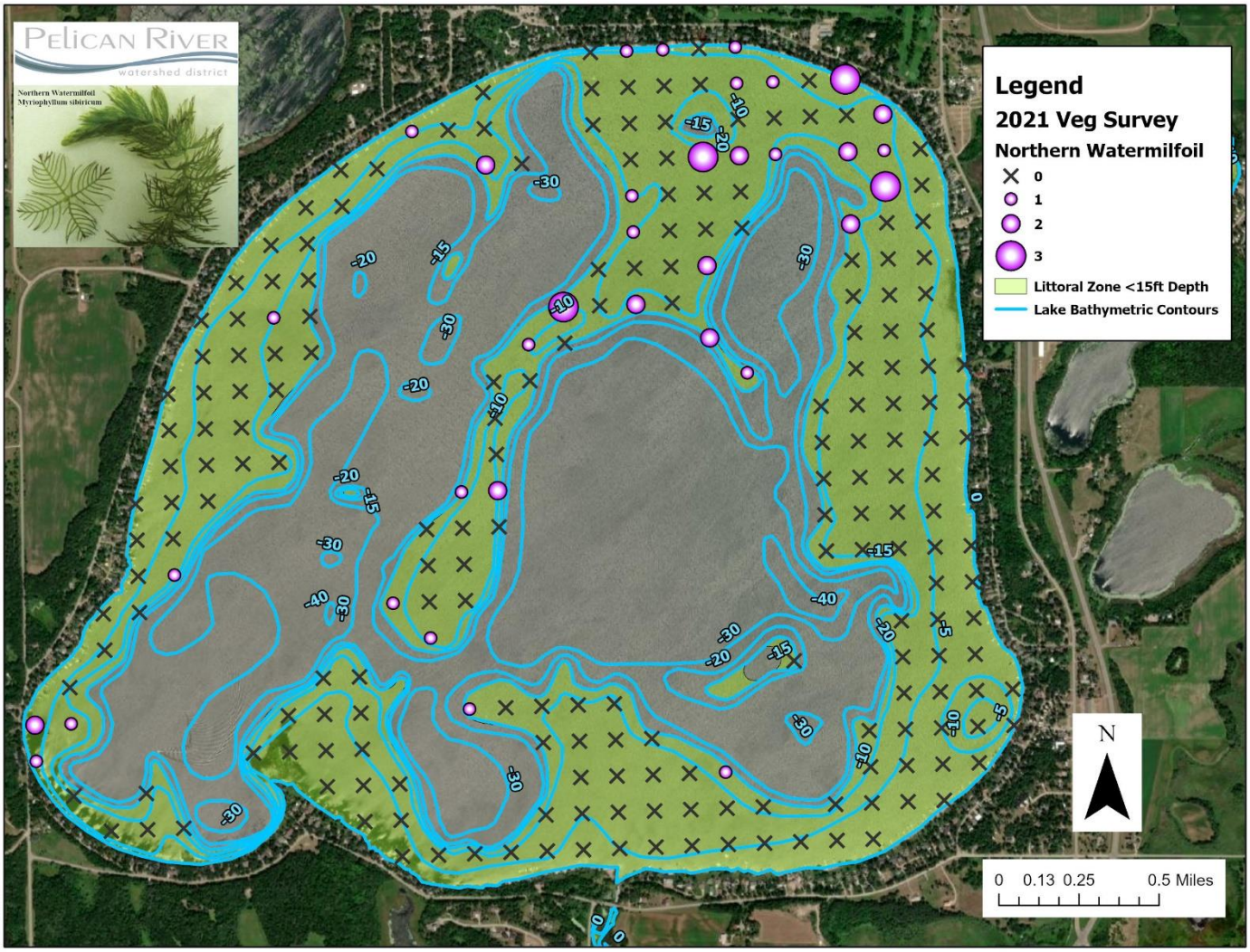

Figure 6 – Northern Watermilfoil Distribution. Plant distribution from the 2021 point-intercept survey for Northern Watermilfoil in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

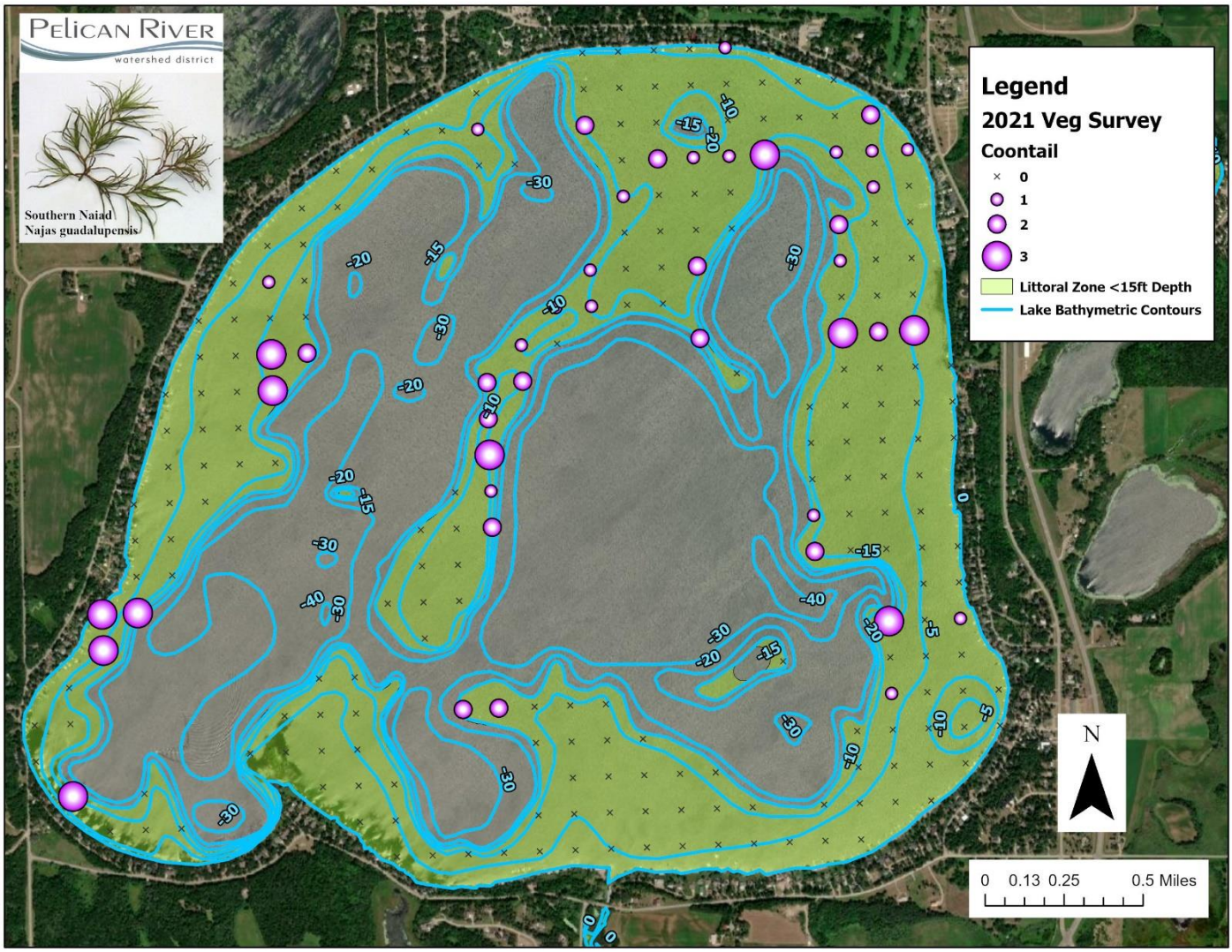

Figure 7 –Southern Naiad Distribution. Plant distribution from the 2021 point-intercept survey for Southern Naiad in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

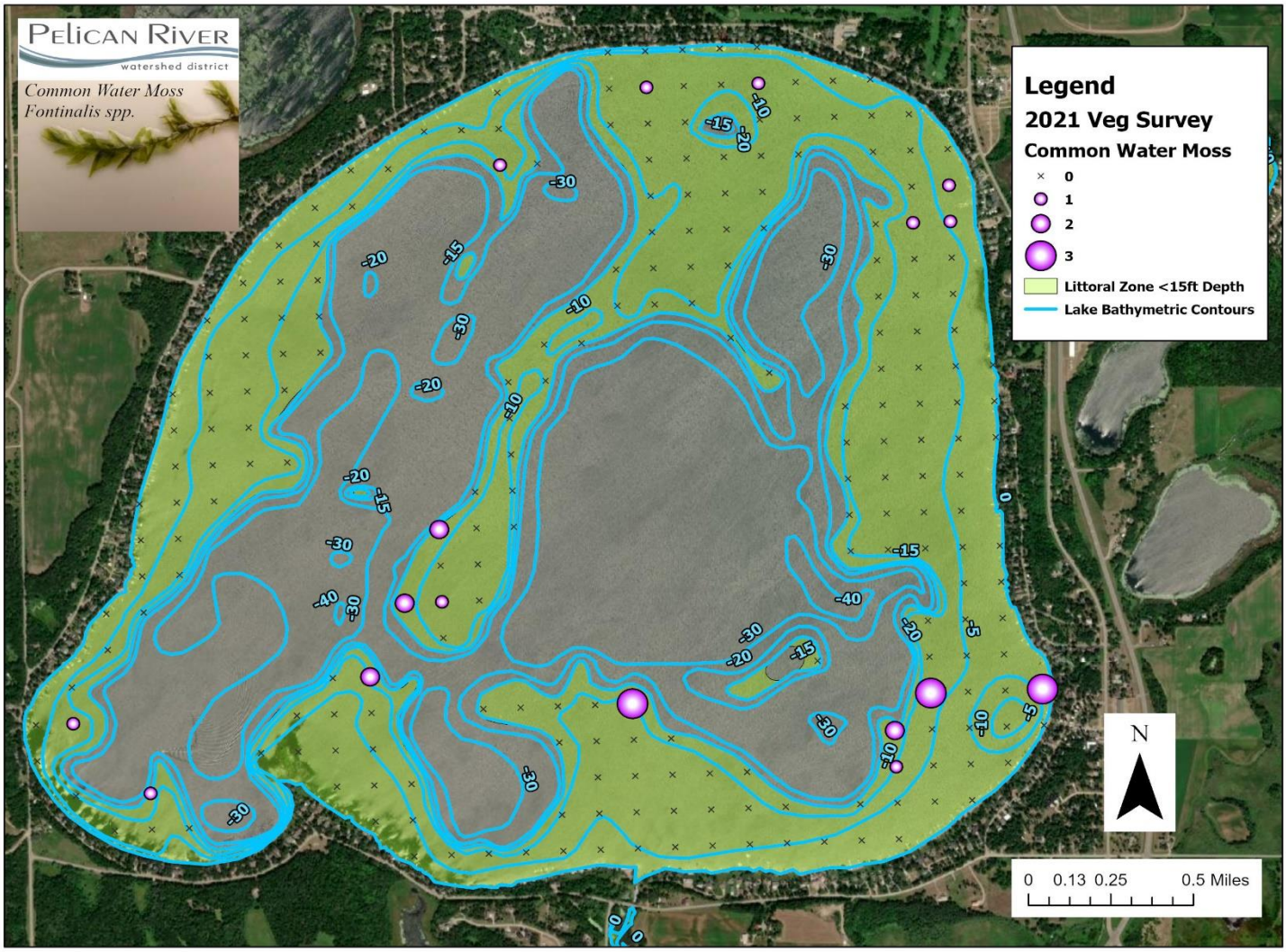

Figure 8 – Common Water Moss Distribution. Plant distribution from the 2021 point-intercept survey for Common Water Moss in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

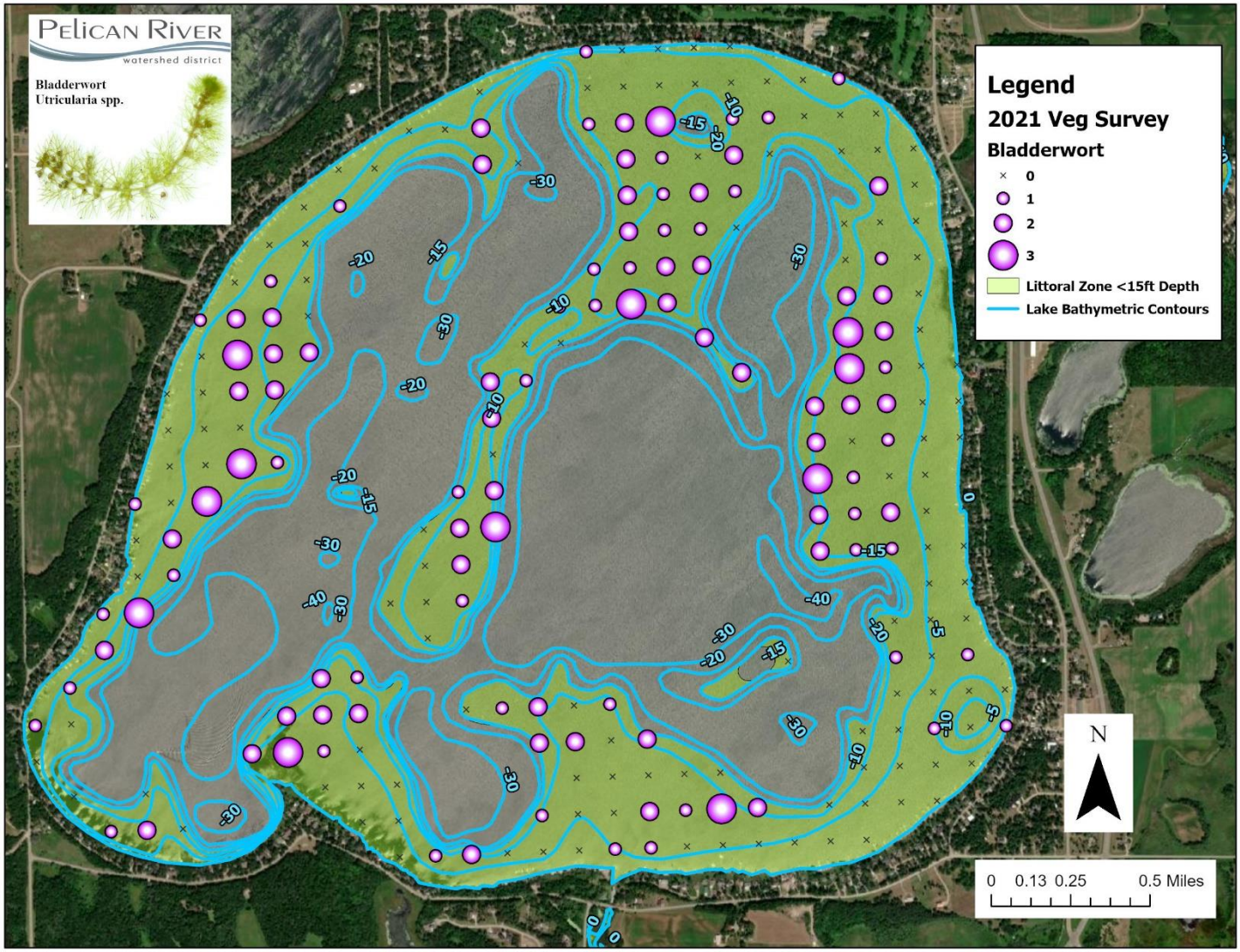

Figure 9 – Bladderwort Distribution. Plant distribution from the 2021 point-intercept survey for Bladderwort in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

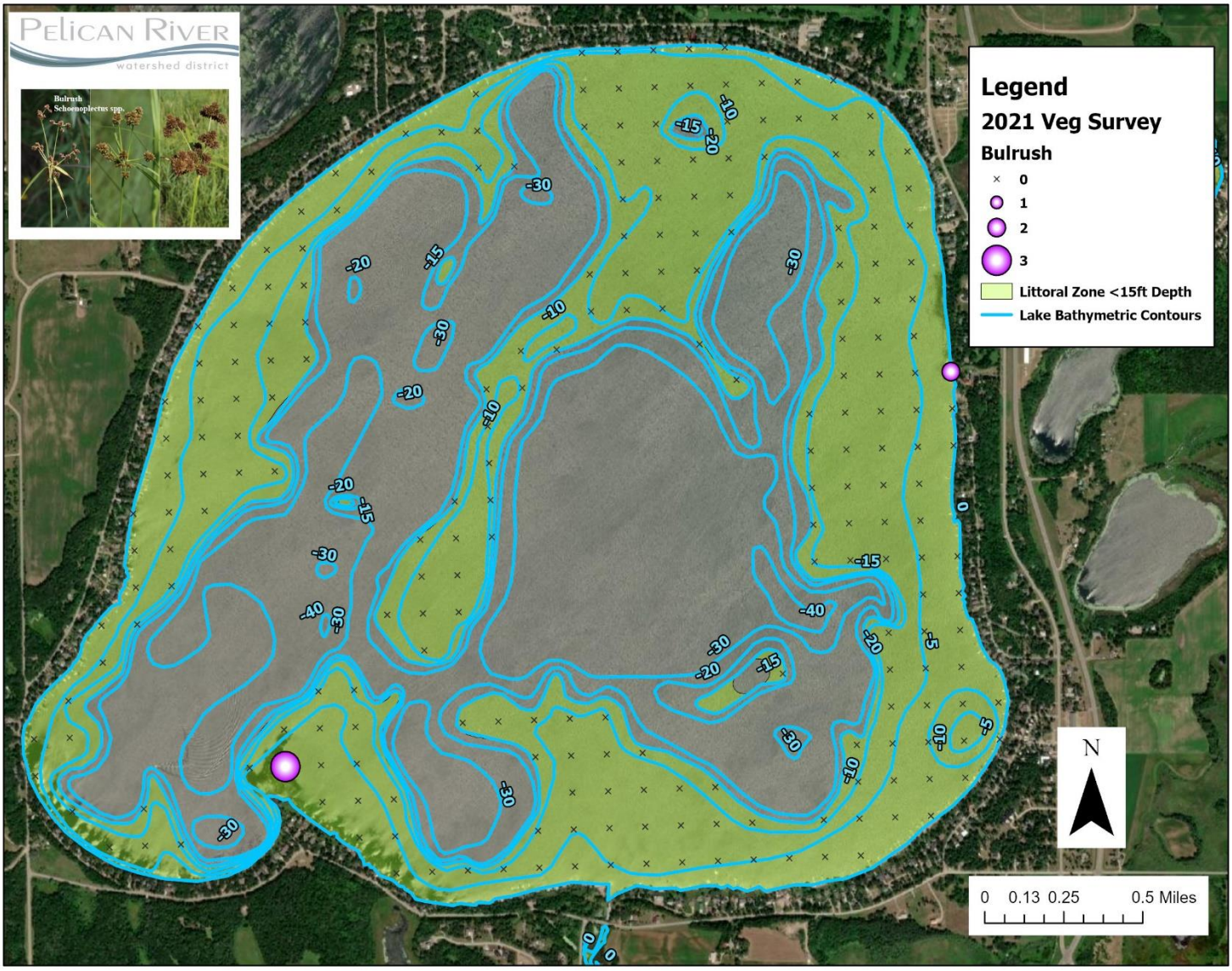

Figure 10 – Bulrush Distribution. Plant distribution from the 2021 point-intercept survey for Bulrush in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

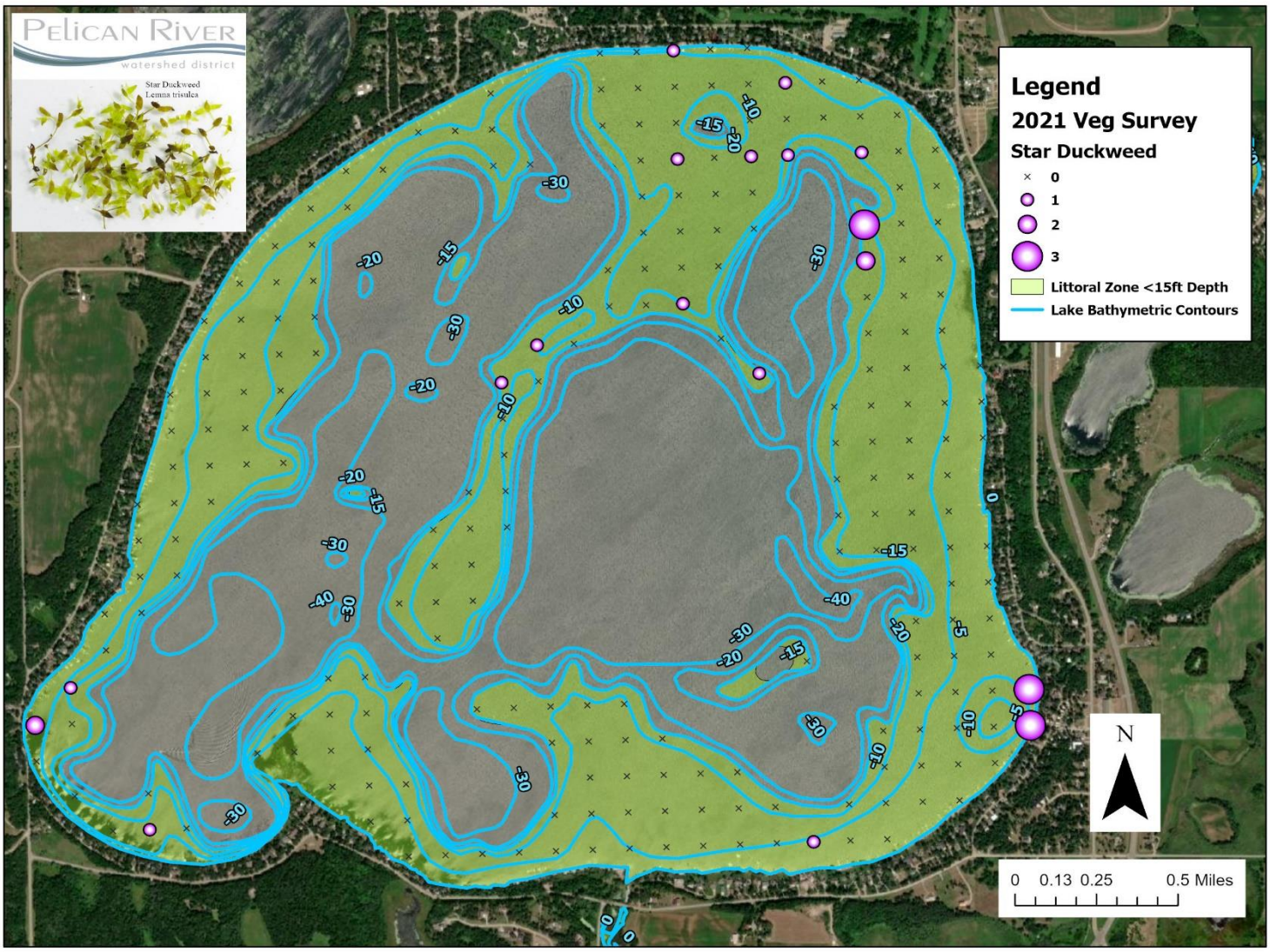

Figure 11 – Star Duckweed Distribution. Plant distribution from the 2021 point-intercept survey for Star Duckweed in Melissa Lake, Becker County (EQuIS# 03-0475-00-202). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

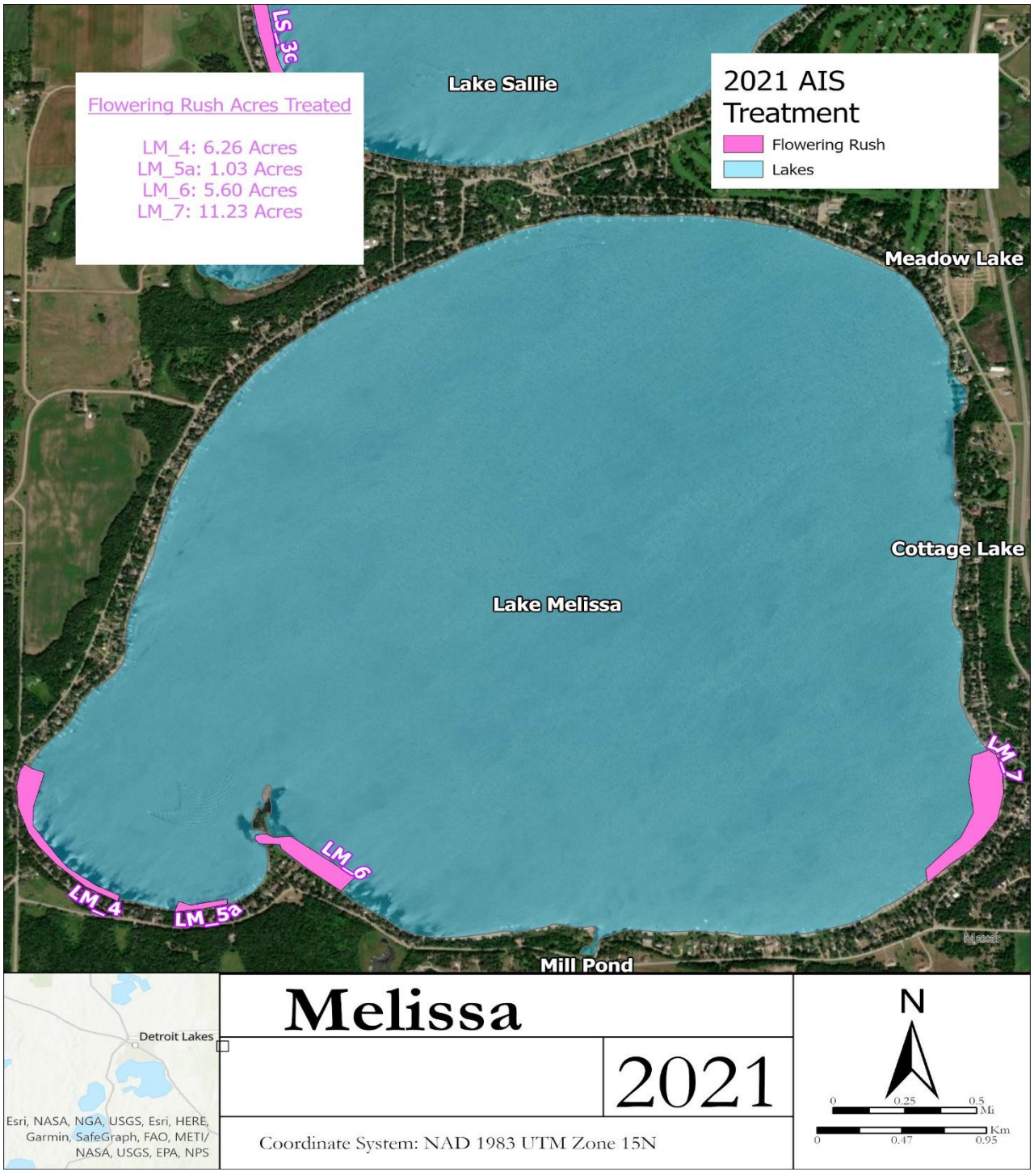

Figure 8 - Flowering Rush Distribution. *Pink polygon* indicates the presence of Flowering Rush in Melissa Lake, Becker County (EQuIS# 03-0475-00-202) based on the delineation survey in 2021.

Literature Cited

Skawinski, Paul M. (2018). *Aquatic Plants of the Upper Midwest*. (Third Edition). Wisconsin: Paul M. Skawinski.

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.