KIESER & ASSOCIATES
ENVIRONMENTAL SCIENCE & ENGINEERING

A Summary of Findings from LakeScan™
Guided Surveys and Analysis of:

Cedar Lake North

Iosco County

2022 DATA AND ANALYSIS SUMMARY REPORT WITH MANAGEMENT RECOMMENDATIONS

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LakeScan™

Executive Summary

Kieser & Associates, LLC (K&A) conducted vegetation monitoring on Cedar Lake (Alcona and Iosco Counties, MI) during the summer of 2022 using LakeScan™ assessment methods. The purpose of these efforts was to assess aquatic vegetation during the summer recreational season in the context of nuisance conditions and management needs/outcomes. LakeScan™ methods combine detailed field data collection with mapping capabilities and whole-lake analyses based on established scientific metrics to score various lake conditions. This approach allows lake managers to readily and consistently identify successful lake management activities highlight potential issues requiring intervention, and gather critical planning information necessary for improving the lake's ecological and recreational conditions.

Cedar Lake North averaged scores from early-season and late-season LakeScan™ 2022 surveys are summarized in Table ES - 1.[1] Results show scores met or exceeded management goals for all LakeScan™ Metrics. High scores for the Shannon Biodiversity and Shannon Morphological indices indicate Cedar Lake North has a diverse plant community harboring good habitat for fish and macroinvertebrates. The consistently high Floristic Quality Index results indicate a higher distribution of desirable, native plant species and a lower distribution of undesirable species, such as Eurasian watermilfoil (*Myriophyllum spicatum x sibiricum*; EWM). Recreational Nuisance Presence was below the optimal management goal of <10%, which is an improvement from previous years. Eurasian watermilfoil presented some nuisance conditions, but most were caused by native species such as variable-leaf watermilfoil (*Myriophyllum heterophyllum*), variable pondweed (*Potamogeton gramineus*), Richardson's pondweed (*Potamogeton richarsonii*), and wild celery (*Vallisneria americana*). These species exhibited growth that could impede boating activities due to the location and height in the water column. The Algal Bloom Risk rating for Cedar Lake North is "low" reflecting the low proportion of agricultural and urban land use draining to the lake.

Table ES-1 – Summary of lake analysis metrics.

LakeScan™ Metrics	2022 Average	Management Goal
Species Richness	23	n/a
Shannon Biodiversity Index	11.0	> 8.4
Shannon Morphology Index	8.2	> 6.0
Floristic Quality Index	28.1	> 20
Recreational Nuisance Presence	5%	< 10%
Algal Bloom Risk	Low	Low

[1] See LakeScan™ Metrics section for a more detailed explanation of these management indices.

The Cedar Lake North early-season Lakescan™ vegetation survey was conducted on Wednesday, July 13, 2022. Variable-leaf watermilfoil, variable pondweed, Illinois pondweed (*Potamogeton Illinoensis)*, *Chara* (*Chara sp.*), naiad (*Najas sp.*), and elodea (*Elodea canadensis*) were among the most common native species observed during the early-season survey. Emergent plants observed included white water-lily (*Nymphaea odorata*), spadderdock (*Nuphar advena*), and bullrush (*Scirpoides holoschoenus*). The only aquatic invasive species observed was Eurasian watermilfoil. Nuisance conditions were primarily found within the trenches and offshore (Tier 4 AROS) along the western shoreline.

The late-season LakeScan™ survey on North Cedar took place on Tuesday, September 20, 2022. The most common native species observed during the vegetation survey include variable-leaf watermilfoil, variable pondweed, Illinois pondweed, Richardson's pondweed, wild celery, naiad, and *Chara*. Eurasian watermilfoil was again the only aquatic invasive species observed. Abundances of EWM were much lower compared to the early-season survey, suggesting that the late-season treatments successfully controlled the population.

For this report, K&A also analyzed the past five years of LakeScan™ data for invasive species coverage (Figure ES -1). Cedar Lake North's Eurasian watermilfoil coverage maintains a minimal presence and has begun to exhibit a slight downward trend over the past five years. It is likely management activities are successfully controlling the Eurasian watermilfoil population and suppressing any additional population growth. While variable-leaf watermilfoil is not considered an invasive species, it does contribute to nuisance conditions on Cedar Lake. Over the last five years, variable-leaf watermilfoil has exhibited a slight decrease in coverage, after two relatively high coverage years in 2019 and 2020. This suggests that recent management activities have been an effective means to suppress the growth of this species. During both 2021 and 2022, variable-leaf watermilfoil coverage decreased from previous highs to 3.8% and 3.7%, respectively.

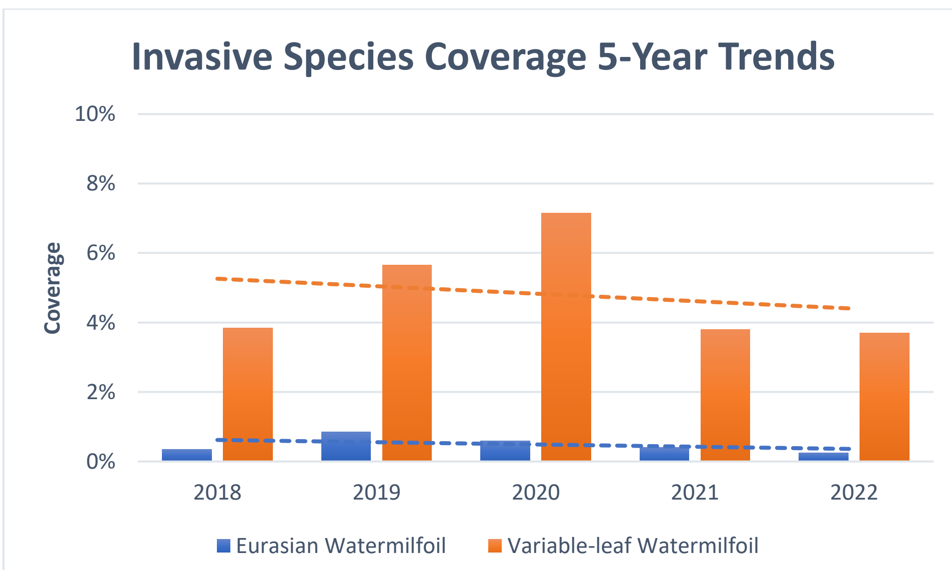

Figure ES-1 – Invasive and Nuisance Species Coverage 5-year Trends.

Based on 2022 findings, K&A recommends the following management considerations for 2023:

- **Continued management intervention is recommended for Eurasian watermilfoil.** Eurasian watermilfoil coverages have trended downward over the last five years and coverage in 2022 was the lowest observed since 2018. Thus, current managmenet interventions appear to be effective at suppressing growth and reducing the cumulative coverage of EWM. Cedar Lake Improvement Board should explore the use of new chemical technologies as they become available to treat Eurasian watermilfoil residing in the northern trenches.
- **Continued ProcelleCOR applications to treat Eurasian watermilfoil in the northern trenches** of Cedar Lake North is recommended. Recent ProcelleCOR applications in Cedar Lake appear to have been an effective strategy for treating Eurasian watermilfoil in 2021 and 2022. Applications and testing should continue through 2023 to determine if ProcelleCOR continues to be an effective means to control Eurasian watermilfoil.
- **Consider a combination of management strategies to control EWM**, such as diver assisted suction harvesting (DASH), with targeted herbicide applications to reach even lower populations of target species. K&A recommends a desktop feasibility assessment for 2023 that will look at potential costs and effectiveness of DASH being used in other Michigan and Midwest settings.
- **Continue to monitor coverage and nuisance conditions of Variable-leaf watermilfoil**. Treatments in 2020 targeting variable-leaf watermilfoil causing recreational nuisance conditions should have lasting effects for up to three years. Based on 2021 and 2022 LakeScan™ surveys, the 2020 treatments appear to have suppressed nuisance conditions. It will be important to closely monitor these areas to see if treatment results persist into 2023.
- **K&A recommends exploring alternative management strategies to control native aquatic plant** nuisance conditions. Because EGLE restricts chemical treatments for native aquatic plant nuisance conditions, it may be feasible to explore other options, such as harvesting, to alleviate nuisance variable-leaf watermilfoil conditions in the future.
- **Continued LakeScan™ vegetation monitoring twice a year** (once during the late-spring or early-summer and another during the late-summer) is recommended to assess aquatic vegetation during the growing season. Information collected during these surveys allows lake managers to readily and consistently identify successful lake management activities, highlight potential issues requiring intervention, and gather critical information necessary to improve the lake's ecological and recreational conditions.

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1.0. Introduction

Inland lakes are complex systems, and managing them for both ecological health and recreational enjoyment involves balancing goals that are sometimes at odds with one another. Successful lake management requires a solid understanding of a lake's current ecological and recreational conditions, as well as how those conditions are changing over time. The LakeScan™ program combines a detailed data collection methodology with mapping capabilities and whole-lake analysis metrics backed by scientific literature. This analysis allows lake managers to identify successful lake management activities, as well as highlight potential issues requiring intervention. Appropriately targeted aquatic plant suppression can minimize weedy and nuisance species while allowing beneficial species to flourish at ecologically balanced levels supporting healthy lake conditions. This kind of adaptive management system provides a scientifically sound and consistent methodology to better manage a lake's ecological and recreational conditions.

The LakeScan™ analysis involves collecting data over two vegetation surveys during the critical summer recreational season. These surveys are based on a system where the lake is first divided into biological tiers (see Table 1) and then further subdivided into Aquatic Resource Observation Sites (AROS; see Figure 1). For each survey, field personnel record the density, distribution, and position in the water column of each aquatic plant species in each AROS, as well as noting any nuisance conditions. Dissolved oxygen profiles and temperature profiles as well as Secchi depth are additionally recorded. Other water quality sampling can be included with surveys when requested.

Aquatic plant communities change over the course of a year, so the surveys are split into early and late season observations. Early season surveys are scheduled with the goal of taking place within 10 days of early summer treatments to best observe treatment-targeted and non-targeted vegetation. However, this scheduling is subject to weather and times of increased boat activity.

Table 1 – Biological Tier Descriptions.

Tier*	Description
2	Emergent Wetland
3	Near Shore
4	Off Shore
5	Off Shore, Drop-Off
6	Canals
7	Around Islands and Sandbars
9	Off Shore Island Drop-Off

*Tiers 1 and 8 are reserved for future use.

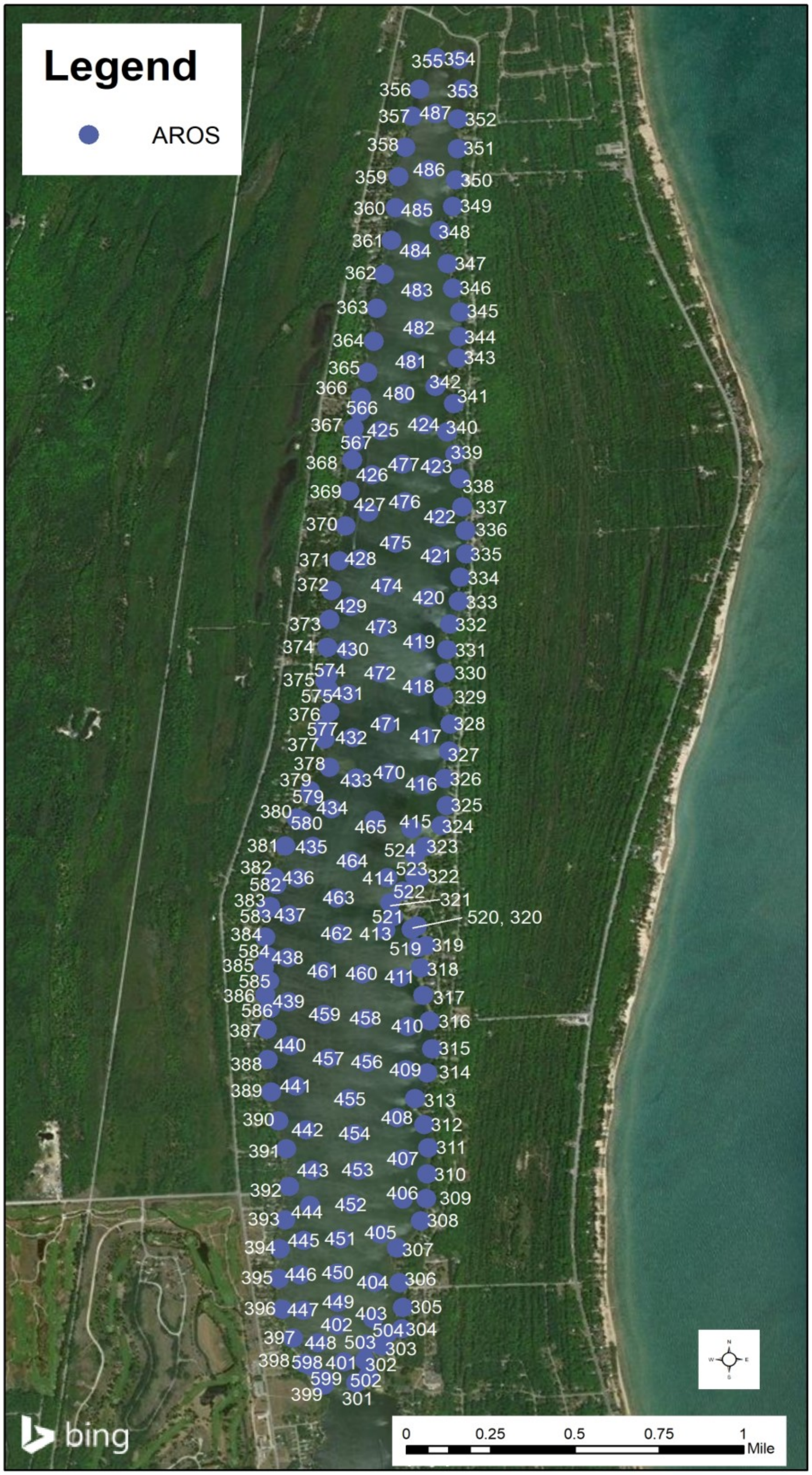

Figure 1 - Map of Aquatic Resource Observation Sites (AROS).

The following sections describe the lake and watershed characteristics, field water quality measurements, results of the aquatic vegetation surveys, and aquatic vegetation management activities and recommendations for Cedar Lake North using LakeScan™ methods.

2.0. Lake and Watershed Characteristics

This section provides a brief overview of physical and geopolitical characteristics of the lake and its watershed.

Location

County: Alcona and Iosco

Township: Greenbush and Oscoda (respectively)

Township/Range/Section(s): T25N, R9E Section: 25, 35, 36 and T25N, R9E Section: 3 & 10 (respectively)

GPS Coordinates: 44.528853, -83.331903

Morphometry

Total Area: 830 acres

Shoreline Length: 47,339 feet

Maximum Depth: 10 feet

Watershed Factors

Tributaries: Sherman Creek, Jones Creek

Outlet type: Fixed weir at northern end of lake

Other Features: Two wetland shoreline complexes

Administrative Management

Management Authority: Cedar Lake Improvement Board

Years in LakeScan™ Program: 2003 to present

2.1. Algal Bloom Risk Level

K&A calculates an algal bloom risk level for each LakeScan™ lake based on the characteristics of its watershed. Agricultural and urban land uses contribute more phosphorus to receiving waters than grasslands or forested land uses; phosphorus being the limiting nutrient that drives algal blooms. Lakes with watersheds that have high proportions of land in agricultural and urban land uses are more likely to be at risk of algal blooms. Not all algal blooms contain cyanobacteria and their associated toxins (Harmful Algal Blooms or HABs). It is important to note that the risk factor reported here is based on a limited watershed analysis. Lakes at high risk of algal blooms should consider more in-depth studies that can identify possible watershed or in-lake improvements to mitigate the risk of HABs.

The algal bloom risk for Cedar Lake North is: **Low**

3.0. Water Quality

Secchi depth, dissolved oxygen and temperature data were collected during each vegetation survey. Data are shown in Figures 2 and 3 for early and late season surveys, respectively. Secchi disk transparency is the depth at which a Secchi disk (a flat white or black and white platter, approximately 20 centimeters in diameter) suspended into a lake disappears from the investigator's sight. In general, the greater depth at which the Secchi disk can be viewed, the lower the productivity of the water body. Secchi depth readings of greater than 15 feet can be indicative of low productivity or oligotrophic conditions.[2]

A sufficient supply of dissolved oxygen (DO) in lake water is necessary for most forms of desirable aquatic life. Colder waters contain more dissolved oxygen than warmer waters. Oxygen depletion can occur in deeper, unmixed bottom waters during warmer summer months in highly productive lakes. Increased algal growth associated with additional nutrients in the lake can lead to severe decreases in DO in lake bottom waters. This decrease in oxygen is due in part to dead algae and other organic matter, such as leaves, grass and other plant debris washed in from shoreline lawns and storm drains settling to the bottom of the lake. This organic matter is then consumed along with oxygen by organisms in the sediment. DO depletion is most often observed in lake bottom waters during periods of temperature stratification in warmer summer months and, to a lesser degree, under winter ice cover conditions.

Dissolved oxygen levels and temperature were measured by K&A using a YSI ProODO dissolved oxygen meter, calibrated prior to use. Michigan water quality standards for surface waters designated for warm water fish and aquatic life call for a DO of at least 5 mg/L.[3] Temperature and DO concentrations during both the early and late-season surveys were relatively uniform from the surface to the lake bottom. Both parameters fell within the range of desirable conditions for fish and aquatic life.

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[2] US Geological Survey. 2012. "Water Quality Characteristics of Michigan's Inland Lakes, 2001-10." Scientific Investigations Report 2011–5233. Available online at: https://pubs.usgs.gov/sir/2011/5233/.

[3] Michigan Department of Environmental Quality. 2006. "Part 4-Water Quality Standards." Water Bureau, Water Resources Protection. Available online at: https://www.michigan.gov/documents/deq/wrd-rules-part4_521508_7.pdf.

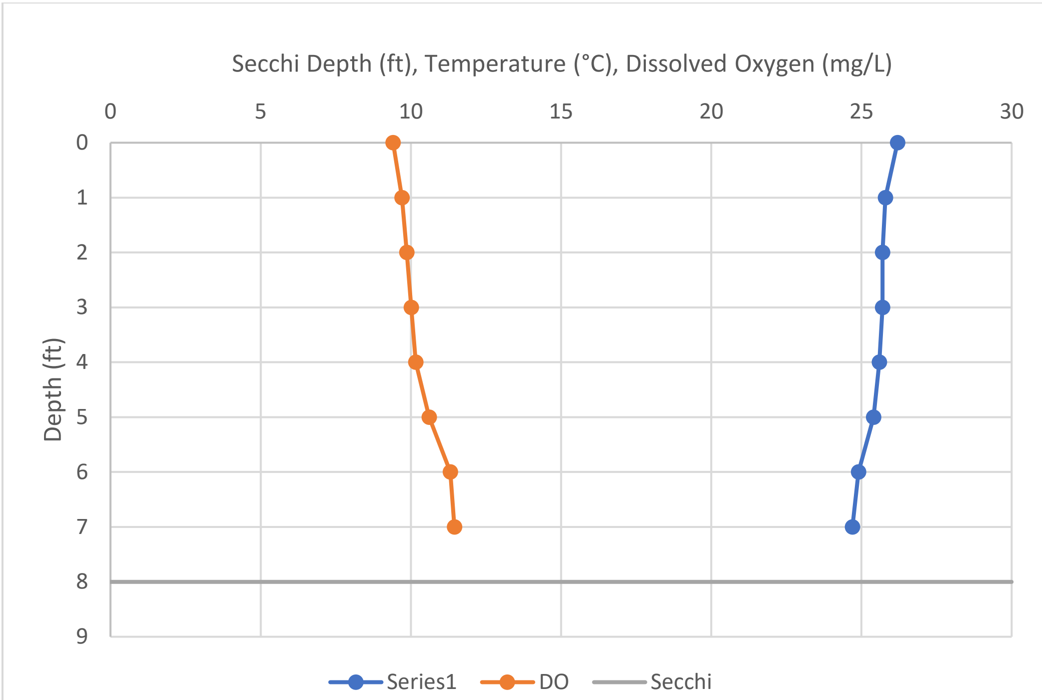

Figure 2 - Early season survey (July 13, 2022) dissolved oxygen and temperature profiles with Secchi depth, taken at the deepest point in the lake.

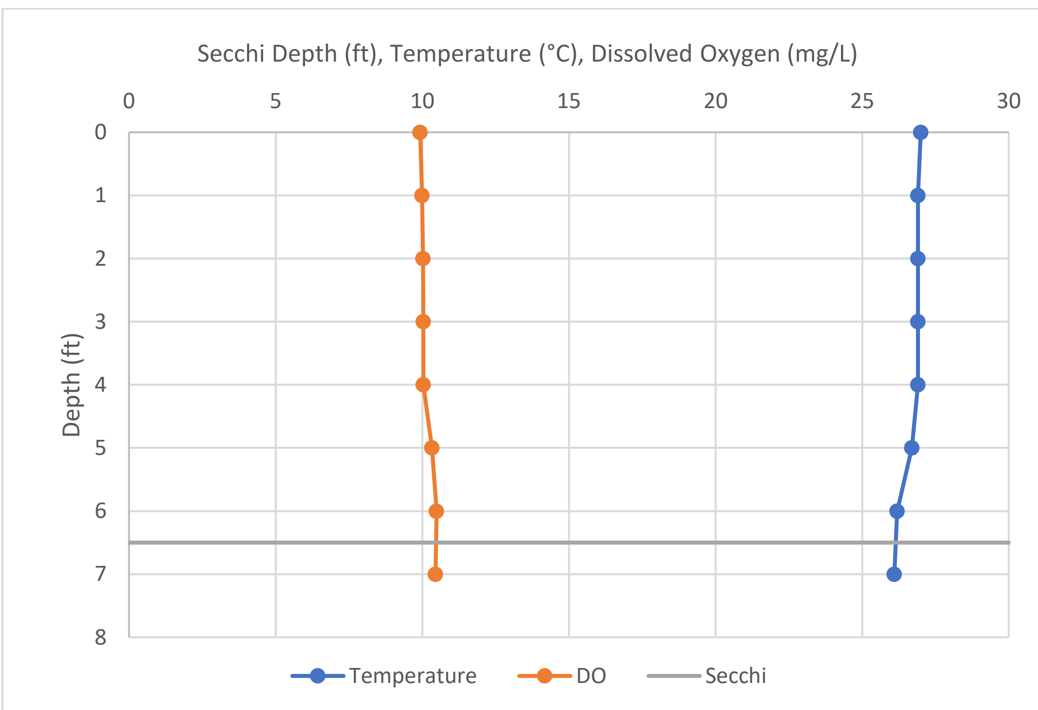

Figure 3 - Late season survey (September 20, 2022) dissolved oxygen and temperature profiles with Secchi depth, taken at the deepest point in the lake.

4.0. Aquatic Vegetation

This section details findings from the two vegetation surveys that were conducted on the lake in 2022. This includes observations, aquatic vegetation mapping, and LakeScan™ analysis metrics.

4.1. Early-Season Survey

The Cedar Lake North early-season LakeScan™ vegetation survey was conducted on Wednesday, July 13, 2022. The morning of the survey began with overcast skies, temperatures of 60°F, and 5 mph west winds. Weather in the afternoon shifted to sunny and partly cloudy skies with temperatures reaching up to 75°F and northeast winds of 5-10mph. Visibility through the water column was good with a Secchi disk depth reading of 7.2ft. However, the overcast skies and high winds made visibility challenging at times throughout the day. Figure 4 depicts data on all combined species using three-dimensional density, which reflects a combination of vegetation density, distribution and height observations of all species observed on Cedar Lake North during the early-season survey. Color-coding is provided for each AROS that helps to spatially depict observed vegetation data. The colors range from dark blue which depicts no vegetation observed, to yellow depicting medium density and distribution of plant species, to red which depicts high density and distribution of vegetation within the AROS.

Variable-leaf watermilfoil (*Myiophyllum heterophyllum)*, variable pondweed (*Potamogeton gramineus)*, Illinois pondweed (*Potamogeton Illinoiensis*), American pondweed (*Potamogeton nodosus*), Richardson's pondweed (*Potamogeton richardsonii*), *Chara* (*Chara sp.*), naiad (*Najas sp.*), and elodea (*Elodea canadensis*) were a few of the most common native species observed during the early-season survey. In addition, emergent plant species, such as white water-lily (*Nymphaea odorata*), spadderdock (*Nuphar advena*) and bullrush (*Scirpoides holoschoenus*), were regularly observed nearshore. *Chara* was the most widely distributed species, being found in almost every AROS. This species was commonly found with pondweed species or naiad.

Variable-leaf watermilfoil has historically created recreational nuisance conditions within Cedar Lake. While this species does still exhibit some nuisance conditions, its density coverage has decreased since it was targeted for management in 2020. Figure 5 shows variable-leaf watermilfoil coverage during the early-season survey. Other native species causing nuisance conditions during the early-season survey include variable pondweed, American pondweed, and Richardson's pondweed. Variable-leaf watermilfoil and Richardson's pondweed were typically found intermixed and offshore in the Tier 4 AROS. Generally, these species exhibited recreational nuisance conditions along the western shoreline and in the northern portion of the lake (AROS 413, 420, 432, 435-444, 473, & 476). High densities of native species were also commonly observed causing nuisance conditions within the trenches (Tier 5 AROS).

Eurasian watermilfoil (*Myriophyllum spicatum x sibiricum*; EWM) was the only aquatic invasive species observed at the time of the survey. EWM was observed at a total of only 9 locations (Figure 6). Primarily, EWM was observed within or around the trenches along the eastern shoreline (AROS 358, 359, 377, 435, 436, 439, 577, 579, 580). Early-season herbicide treatments to treat EWM took place on Wednesday, June 22, 2022. This was 21 days prior to the early-season vegetation survey. Generally, chemical treatments take about 10 days before full effects are observed, therefore, full treatment efficacy would have been observed during the early-season vegetation survey. Observations made during the survey deemed that the herbicide treatments appeared to be only moderately effective at controlling Eurasian watermilfoil. Each location identified as an EWM treatment area still had EWM present following the herbicide applications. Lower densities of Eurasian watermilfoil were observed at each of the treatment locations compared to the pre-season survey. (Treatment maps are provided in Appendix C).

Figure 4 - Early season survey (July 13, 2022) vegetation 3D Density (a function of observed vegetation coverage, and height of all vegetation species).

Figure 5 - Early season (July 13, 2022) Variable-leaf Watermilfoil coverage.

Figure 6 - Early season (July 13, 2022) Eurasian Watermilfoil and Hybrids coverage.

4.2. Late-Season Survey

The late-season LakeScan™ vegetation survey for North Cedar Lake took place on Tuesday, September 20, 2022. Weather was sunny and partly cloudy with temperatures reaching 80°F and southwest winds of 5-10 mph. Visibility through the water column was good with a Secchi disk depth reading of 8.2 feet. Figure 7 depicts data on all combined species using three-dimensional density, which reflects a combination of vegetation density, distribution and height observations of all species observed on Cedar Lake North during the late-season survey.

Variable-leaf watermilfoil, variable pondweed, Illinois pondweed, Richardson's pondweed, wild celery, naiad, and *Chara* were the most abundant native species observed during the survey. Native emergent species commonly observed nearshore include white water-lily, spadderdock and bullrush. *Chara sp.* and naiad were the most widely distributed species within Cedar Lake. Both of these species were found intermixed within nearly every AROS at low densities. Wild celery, variable-leaf watermilfoil and the various pondweed species were most often observed exhibiting greater densities in nearshore areas (AROS Tier 3) and in the trenches (AROS Tier 5). Low to moderate densities were observed scattered throughout the center of the lake as well (AROS Tier 4). The native pondweed species and wild celery reached the surface of the water in some areas causing some minor recreational or navigational nuisance conditions. Specifically, potential nuisance conditions were most often observed within the trenches (AROS Tier 5) and nearshore at AROS 301, 312, 320-322, and 341-348. Variable-leaf watermilfoil only exhibited potential nuisance conditions within AROS 458-461. Variable-leaf watermilfoil was widely distributed but often observed at low densities (Figure 8). This suggests that the 2020 variable-leaf watermilfoil treatments have successfully controlled growth over multiple years.

The late-season herbicide treatment took place 14 days prior to the late-season survey on September 6, 2022, allowing for enough time to observe the effectiveness of the herbicide applications (Appendix C). Eurasian watermilfoil was targeted for treatment, the only aquatic invasive species observed in Cedar Lake during the late-season survey. Eurasian watermilfoil was observed during the late-season survey in a single location, AROS 598, and at very low densities (Figure 9). The density and distribution of Eurasian watermilfoil observed during the late-season survey was much lower compared to observations made during the early-season survey. This would suggest that the herbicide applications on September 6th did effectively control the Eurasian watermilfoil population and treatments were much more successful compared to the June herbicide applications.

Figure 7 - Late season survey (September 20, 2022) vegetation 3D Density (a function of observed vegetation coverage, and height of all vegetation species).

Figure 8 - Late season (September 20, 2022) Variable-leaf Watermilfoil coverage.

Figure 9 -Late season (September 20, 2022) Eurasian Watermilfoil and hybrids coverage.

4.3. Summary Observations for Early & Late Surveys

Aquatic plant species observed during the 2022 vegetation surveys are identified in Table 2. The 'T Value' in this table is a qualitative value ranging from 1 to 4 that is assigned to each species, where 1 represents an undesirable species highly likely to require treatment and 4 represents a desirable species highly unlikely to require treatment (thus, 1 is 'bad'; 4 is 'good'). 'Frequency' represents the percentage of survey sites (AROS) where a given species was found. 'Coverage' represents the lake bottom spatial cover observed for each species, represented as a percentage of available area. 'Dominance' represents the degree to which a species is more numerous than its competitors. Figure 10 illustrates dominance by T Value categories for early and late season surveys over the last few years.

Table 2- Aquatic Plant Species Observed in 2022.

Common Name	T Value	Frequency		Coverage		Dominance	
		Early '22	Late '22	Early '22	Late '22	Early '22	Late '22
American Pondweed	3	25.7%	0.0%	2.8%	0.0%	5.1%	0.0%
Arrow head	4	0.0%	0.5%	0.0%	0.1%	0.0%	0.1%
Cattail	3	7.4%	7.9%	0.6%	0.7%	1.1%	1.2%
Chara	4	90.6%	86.6%	10.5%	11.5%	19.2%	21.0%
Clasping-leaf Pondweed	3	4.0%	0.0%	0.4%	0.0%	0.7%	0.0%
Common Bladderwort	3	8.9%	16.3%	0.6%	1.1%	1.1%	2.0%
Elodea	3	6.4%	2.5%	0.6%	0.2%	1.1%	0.5%
Eurasian Watermilfoil Hybrid	1	4.5%	0.5%	0.5%	0.0%	0.9%	0.1%
Green/Variable-leaf Watermilfoil	2	36.1%	28.2%	4.2%	3.2%	7.6%	5.9%
Illinois Pondweed	3	55.0%	23.3%	7.5%	2.4%	13.6%	4.5%
Naiad	2	37.6%	62.9%	3.2%	6.7%	5.9%	12.3%
Phragmites	1	0.5%	0.5%	0.0%	0.0%	0.1%	0.1%
Pickerelweed	3	3.0%	2.0%	0.2%	0.2%	0.5%	0.3%
Purple Loosestrife	1	1.5%	0.0%	0.1%	0.0%	0.2%	0.0%
Richardson's Pondweed	2	45.0%	50.5%	5.9%	9.6%	10.7%	17.4%
Robbin's Pondweed	3	0.0%	1.5%	0.0%	0.1%	0.0%	0.2%
Rush	4	25.7%	20.8%	2.2%	2.3%	4.0%	4.2%
Sago Pondweed	2	4.5%	2.0%	1.1%	0.4%	1.9%	0.7%
Spadderdock	2	11.9%	1.0%	1.5%	0.1%	2.7%	0.1%
Swamp Loosestrife	4	0.5%	4.5%	0.0%	0.6%	0.1%	1.1%
Thin Leaf Pondweed	4	2.0%	1.0%	0.2%	0.1%	0.4%	0.2%
Variable-leaf Pondweed	2	77.2%	71.3%	8.1%	7.6%	14.8%	13.8%
Water Stargrass	2	0.0%	1.0%	0.0%	0.2%	0.0%	0.3%
White Water-lily	2	13.4%	11.4%	3.8%	1.4%	6.9%	2.5%
Hybrid Water-lily	2	0.0%	1.0%	0.0%	0.1%	0.0%	0.1%
White-stem Pondweed	3	0.0%	9.9%	0.0%	1.0%	0.0%	1.8%
Wild Celery	2	12.9%	38.1%	0.9%	5.4%	1.6%	9.9%

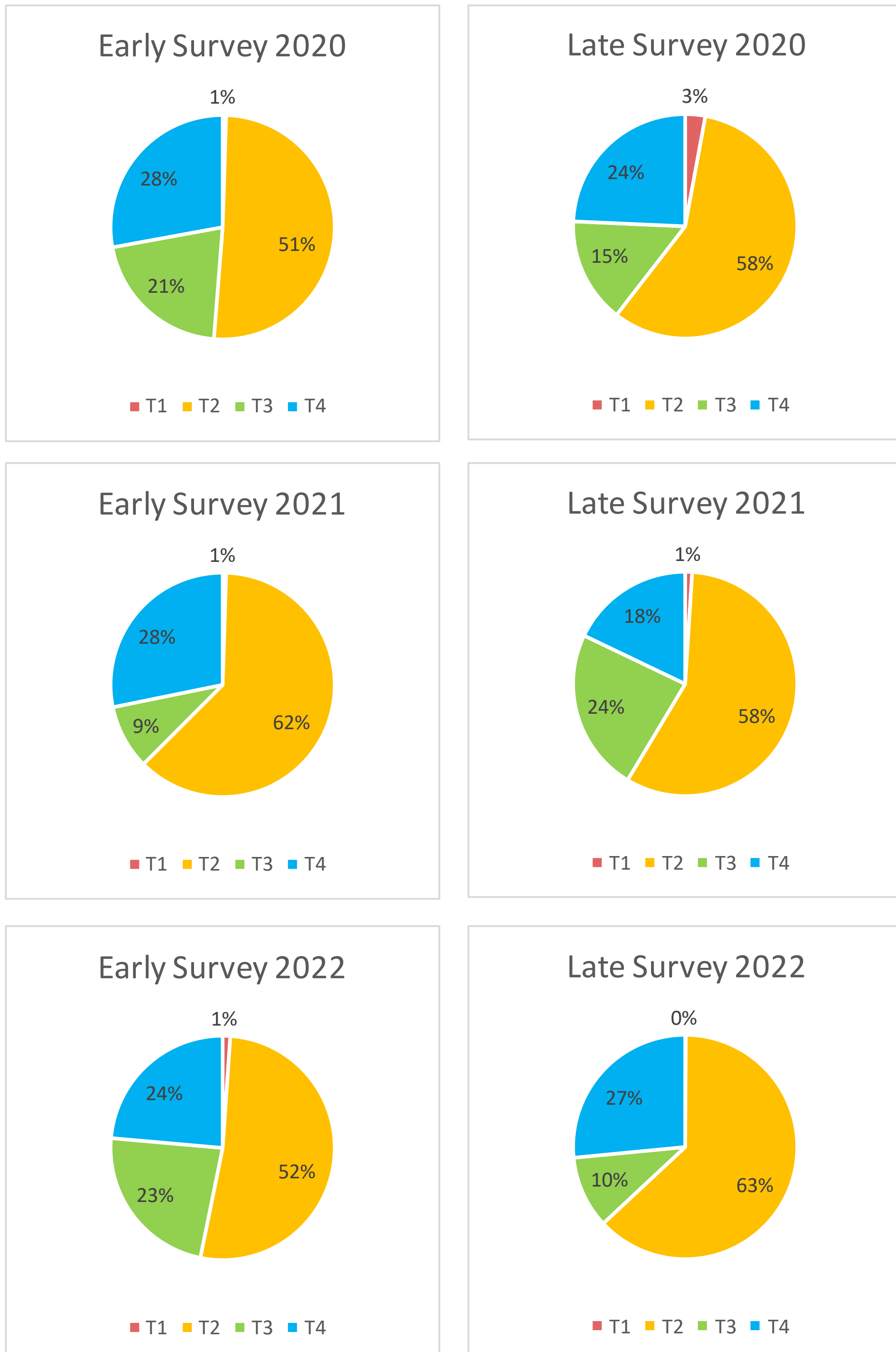

Figure 10 - Distribution of aquatic plant coverage by T Value comparing early-season and late-season surveys from 2020 – 2022.

4.4. LakeScan™ Metrics

Six important metrics for defining lake conditions are presented here for the 2022 vegetation surveys (Table 3). Early and late season scores are averaged for a yearly score and compared against a management goal for each metric. Management goals are based on median Michigan lake values (Shannon Biodiversity Index and Shannon Morphology Index), scientific literature (Floristic Quality Index), and professional judgement (Recreational Nuisance Presence and Algal Bloom Risk). Green shading in Table 3 highlights scores meeting management goals, while yellow and red highlights represent scores needing improvement. A total lake score[4] is presented with 1 being poor and 10 being excellent. Descriptions of each metric are as follows:

- **Species Richness** – the number of aquatic plant species present in the lake. (More species are generally indicative of a healthier ecosystem, but not all species are desirable.)
- **Shannon Biodiversity Index** – a measure of aquatic plant species diversity and distribution evenness, indicative of the plant community's stability and diversity. (Also known as the Shannon Expected Number of Species[5].)
- **Shannon Morphology Index** – a measure of aquatic plant morphology type diversity and distribution evenness, indicative of fish and macroinvertebrate habitat quality. (This is calculated using morphology types instead of species.)
- **Floristic Quality Index[6]** – a measure of the distribution of desirable aquatic plants. (This index is used by Midwestern states for aquatic habitats, with higher scores indicative of increased biodiversity and a positive ratio of desirable versus undesirable aquatic plant species.)
- **Recreational Nuisance Presence** – the percentage of survey sites that identified aquatic plants inhibiting recreational activities. (Areas where any vegetation is growing densely enough to inhibit boating and/or swimming.)
- **Algal Bloom Risk** – a calculated algal bloom risk level based on the characteristics of the lake's watershed. (Lakes with watersheds that have high proportions of land in agricultural and urban land uses are more likely to be at risk of algal blooms because these land uses contribute more phosphorus to receiving waters than grasslands or forests.)

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[4] A total lake score is a summary of the category scores where: "red" scores receive 0 points, "yellow" scores receive 1 point, and "green" scores receive 2 points. The Floristic Quality Index is double-weighted, and the total is then refit to a 1 to 10 scale for more simplified scaling and interpretation of the overall lake condition.

[5] Hill, M. O. (1973). Diversity and evenness: a unifying notation and its consequences. *Ecology*, 54(2), 427-432.

[6] Nichols, S. A. (1999). Floristic quality assessment of Wisconsin lake plant communities with example applications. *Lake and Reservoir Management*, 15(2), 133-141.

Table 3 – 2022 LakeScan™ Metric Results.

LakeScan™ Metrics	Score Range	2022 Early Season	2022 Late Season	2022 Average	Management Goal
Species Richness	5 - 30	22	24	23	n/a
Shannon Biodiversity Index	1 -15	11.8	10.2	11.0	> 8.4
Shannon Morphology Index	1 - 10	8.3	8.1	8.2	> 6.0
Floristic Quality Index	1 - 40	26.8	29.3	28.1	> 20
Recreational Nuisance Presence	0 - 100%	10%	1%	5%	< 10%
Algal Bloom Risk	Low - High	n/a	n/a	Low	Low
Total Lake Score	1 - 10	n/a	n/a	10.0	n/a

*n/a = not applicable

Cedar Lake North's yearly average scores met optimal management goals set forth in the Shannon Biodiversity Index, Shannon Morphological Index, Floristic Quality Index and Recreational Nuisance Presence. High Shannon Biodiversity Index and Shannon Morphological Index scores indicate a diverse plant community providing good habitat for fish and macroinvertebrates. High Floristic Quality Index scores indicate a high ratio of desirable, native aquatic plant species to undesirable, invasive aquatic plant species. Recreational Nuisance Presence scoring did not meet the management goal of less than 10% in the early-season survey (10%), but nuisance conditions substantially decreased by the late-season survey. The invasive, Eurasian watermilfoil, and native species such as variable-leaf watermilfoil, variable pondweed, and Richardson's pondweed caused many of the nuisance conditions observed during the early-season. Late-season herbicide applications for EWM likely resulted in reduced nuisance conditions during the late-season survey. The Algal Bloom Risk rating for Cedar Lake North is "low" reflecting the high proportion of wetland and forest land use and low proportion of urban and agricultural land use draining to the lake. The overall total lake score for Cedar Lake North is 10 out of 10.

The 5-year historical trends for Floristic Quality Index (FQI) scores and invasive species coverage values are presented in Figures 11 and 12, respectively. Trendlines shown are calculated using Microsoft Excel's linear trendline function. Positive trends for the FQI scores indicate increases in desirable plant species and/or decreases in undesirable plant species. Negative trends for the invasive species coverage values indicate that herbicide treatment and other lake management activities are showing success.

Over the last five years, the FQI score for Cedar Lake North has exhibited a positive trend, which indicates an increase in desirable, native plant species and a decrease in undesirable, non-native plant species (Figure 11). For the last five years, Cedar Lake North's FQI score has exceeded the management goal of 20. Furthermore, Cedar Lake North's Eurasian watermilfoil coverage has exhibited a slight declining trend over the last five years (Figure 12), suggesting that management activities appear to be controlling the invasive and suppressing any additional Eurasian watermilfoil population expansion. Variable-leaf watermilfoil, has also experienced a decreasing trend over the last five years (Figure 12). During the past two seasons, this species has exhibited lower average coverage compared to what was observed in the three years prior. This suggests that the management actions which had targeted variable-leaf watermilfoil in 2020 have successfully acted as a multi-year control for this species.

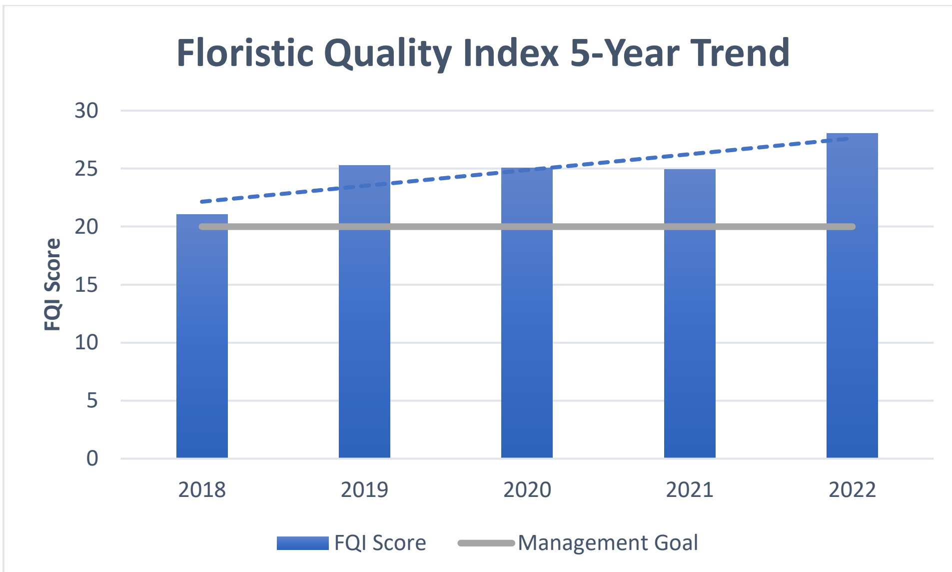

Figure 11 – Floristic Quality Index 5-Year Trend.

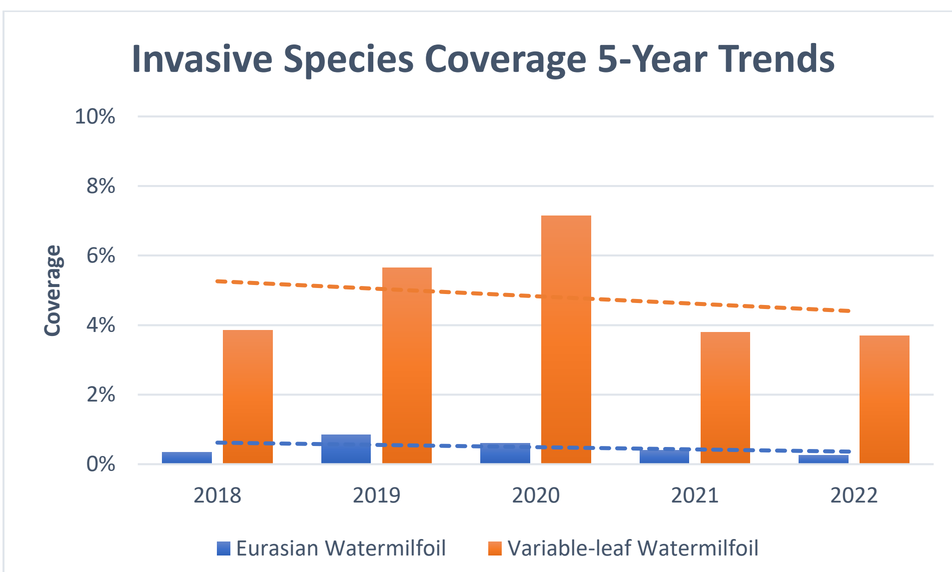

Figure 12 – Invasive and Nuisance Native Species Coverage 5-Year Trends.

5.0. Lake Management

There are several species that typically become a nuisance in Michigan's inland lakes (see Appendix B). These species are usually targeted for very selective control to prevent them from becoming an aesthetic or recreational nuisance and to protect desirable plants that are part of healthy lake ecosystems. This section includes an analysis on nuisance conditions in the lake, as well as a description of any management actions that were taken in 2022. Figure 13 shows the coverage changes of targeted species over both surveys. (Copies of the herbicide applicator treatment maps are included in Appendix C.)

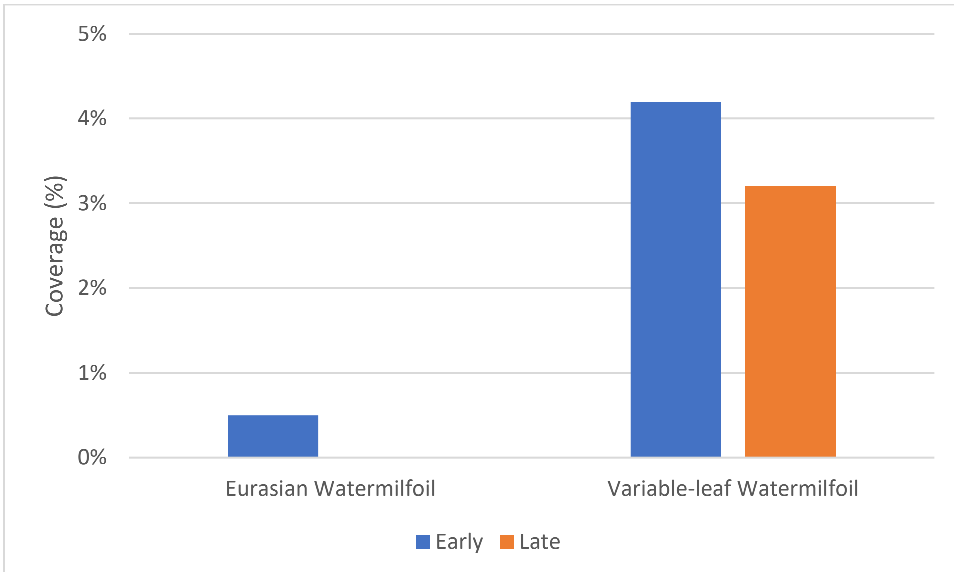

Figure 13 – Changes in coverage across both surveys for targeted species.

Variable-leaf watermilfoil and native pondweeds have been some of the most dominant species observed on Cedar Lake. Historically, variable-leaf watermilfoil has frequently grown in dense patches throughout the main body of the lake and created recreational nuisance conditions in many of these areas. Within the deeper "trenches" of Cedar Lake, aquatic plant growth is typically very dense. Eurasian watermilfoil, variable-leaf watermilfoil, elodea, wild celery, Richardson's pondweed and other native pondweeds grow to nuisance levels in these trenches forming dense bands of vegetation that can cause navigational hazards.

During the 2020 late-season survey, variable-leaf watermilfoil was observed creating recreational nuisance conditions throughout the center of the lake. The year-over-year increases and excessive nuisance conditions exhibited by variable-leaf watermilfoil prompted a treatment in September of 2020 to target select areas. According to survey results, locations that received the September 2020 treatment did appear to see suppressed variable-leaf watermilfoil growth during both 2021 and 2022. These observations suggest that the treatment of variable-leaf watermilfoil was successful at limiting growth and suppressing the recreational nuisance conditions caused by this species.

It is important to monitor the growth of variable-leaf watermilfoil since this species has been known to cause nuisance conditions on Cedar Lake North. In the future, it might be necessary to submit permit amendments to allow for selective treatment of variable-leaf watermilfoil (considered a native species in Michigan); however, there is no assurance that these efforts will be successful as treatment restrictions tighten. Because of the treatment restrictions on variable-leaf watermilfoil and the considerable nuisance conditions this species poses for Cedar Lake North, it may be feasible to explore harvesting options to allow for boat passage in critical areas of the lake. However, harvesting can be expensive and may not provide long-term control due to issues such as plant fragmentation.

Eurasian watermilfoil coverage in 2022 was the lowest observed in Cedar Lake since 2018. Low coverage in 2022 and a slight decrease in coverage trend over the last five years suggest that lake management activities have successfully been suppressing Eurasian watermilfoil growth and expansion. It is also possible that conditions are not conducive for substantial Eurasian watermilfoil growth outside of the deep trenches on Cedar Lake North.

ProcellaCOR was applied to the northern trenches as a pilot test to treat the persistent Eurasian watermilfoil population on June 16, 2021. This pilot test was done to test how effective PrecellaCOR is for treating Eurasian watermilfoil and hybrids on Cedar Lake. Initial results in 2021 suggested that treatment of EWM with this herbicide have been successful, with the exception of the northern-most portion of Trench 1 which still exhibited a significant amount of EWM following treatment. To remedy this, a late-season treatment was applied in 2021 to ensure this area received treatment. EWM was absent from Trench 1 during the 2022 vegetation surveys and native plants were the only observations made, with *Chara* being the most dominant species. These results indicate that successful long-term control of EWM using ProcelleCOR is promising.

Of relevant consideration going forward, are EGLE restrictions with timing of herbicide applications for copper products on Cedar Lake, limiting applications to after June 10^{th} in order to limit any negative impacts to fish spawning. Also, herbicide treatments cannot be conducted on Cedar Lake when water temperatures exceed 75°F; unless dissolved oxygen concentrations exceed 5 mg/L. Early-season survey data of DO and temperature monitoring remain important for discerning such potential restrictions.

Additionally, a historic mussel survey conducted in 1953, indicated the presence of an endangered mussel, the Eastern pondmussel (originally referred to as, *Ligumia nasuta* but now as, *Sagittunio nasutus*), in the southern portion of Cedar Lake. Though more recent surveys conducted between 1998 and 2015 did not observe this species presence,[7] a Central Michigan University (CMU) mussel assessment in 2022 confirmed its presence in Cedar Lake.[8] Of the six CMU sampling locations examined on Cedar Lake, it was found at three of these in Cedar Lake North. As such, EGLE will likely include expanded exclusion zones as a permit restriction for Cedar Lake North and South in 2023.

EGLE restrictions will also limit native emergent and floating leaf aquatic plant control to a 40-foot x 40-foot area for swimming and boat launching, and a 20-foot-wide boat lane to reach open water per residentially developed parcel. EGLE restricts treatment of native algae and submersed aquatic plants to

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[7] Badra, P. J. (2017). Status Assessment of Unionid Mussel Species in the Huron-Manistee National Forest. *Michigan Natural Features Inventory.*

[8] Vlasak, A. L, Barczewski, A. J., Laszlo, A. M., Vellequette, N. M., and D. A. Woolnough. 2022. "Unionids of Cedar Lake, Michigan, USA: Community, Abundances, and Invasive Mollusk Risks." Department of Biology and Institute for Great Lakes Research, Central Michigan University, Mt. Pleasant, MI – Poster Presentation for CMU Biology Undergraduate Research Symposium; provided by R. Vaughn, CLIB to K&A on February 20, 2023.

100 feet of frontage per residential property. Herbicides may be applied to native vegetation up to 100 feet from shore or to the 5-foot depth contour (whichever is closer to shore). Thus, a resurgence of variable-leaf watermilfoil may portend alternative treatments in Cedar Lake South if in areas covered by such EGLE restrictions.

5.1. Future Management Recommendations

Continued LakeScan™ vegetation monitoring twice a year (once during the spring-early summer and another during the late summer) is recommended to assess aquatic vegetation during the growing season. Information collected during these surveys allows lake managers to readily and consistently identify successful lake management activities, highlight potential issues requiring intervention, and gather critical information necessary to improve the lake's ecological and recreational conditions.

Continued management intervention is recommended for Eurasian watermilfoil. Although Eurasian watermilfoil early-season treatments were not very effective, EWM coverage substantially decreased between the early and late-season surveys (the latter conducted after a second EWM treatment). Furthermore, Eurasian watermilfoil coverages have trended downward over the last five years and coverage in 2022 was the lowest observed since 2018. Thus, current managmenet interventions appear to be effective at suppressing the possible spread and reducing the cumulative coverage of Eurasian watermilfoil. Cedar Lake Improvement Board should explore the use of new chemical technologies as they become available to treat Eurasian watermilfoil residing in the northern trenches.

Until it no longer appears effective, continued ProcelleCOR applications to treat Eurasian watermilfoil in the northern trenches of Cedar Lake North is recommended. Recent ProcelleCOR applications in Cedar Lake appear to have been an effective strategy for controlling the Eurasian watermilfoil population. Applications and testing should continue through 2023 to determine if ProcelleCOR continues to be an effective means to treat Eurasian watermilfoil.

The CLIB might consider a combination of management strategies to control EWM, such as diver assisted suction harvesting (DASH), with targeted herbicide applications to reach even lower populations of target species. K&A recommends a desktop feasibility assessment for 2023 that will look at potential costs and effectiveness of DASH being used in other Michigan and Midwest settings.

Close monitoring of coverage and nuisance conditions of Variable-leaf watermilfoil should continue. Variable-leaf watermilfoil tends to create recreational nuisances on Cedar Lake North. These were specifically targeted for treatment in September 2020, which was forecast to have lasting effects for up to three years. Based on 2021 and 2022 LakeScan™ surveys, the 2020 treatments appear to have suppressed nuisance conditions; 2023 will be three years post-treatment.

K&A recommends exploring alternative management strategies to potentially control native aquatic plant nuisance conditions. Because EGLE restricts chemical treatments for native aquatic plant nuisance conditions, it may be feasible to explore other options, such as harvesting, to alleviate nuisance variable-leaf watermilfoil conditions in the future, which would not require additional EGLE permitting.

6.0. Appendices

Appendix A: Blue-green Algae

Blue-green algal blooms are becoming increasingly common in Michigan. Blooms can appear as though green latex paint has been spilled on the water, or resemble an oil slick in enclosed bays or along leeward shores. Blue-green algal blooms are usually temporal events and may disappear as rapidly as they appear. Such blooms have become more common for a variety of potential reasons; however, the spread and impact of zebra mussels has been closely associated with blooms of blue-green algae.

Figure A1: Example blue-green algae images from the 2019 LakeScan^{TM} field crew.

Blue-green algae are really a form of bacteria known as cyanobacteria. They are becoming an important issue for lake managers, riparian property owners and lake users because studies have revealed that substances made and released into the water by some of these nuisance algae can be toxic. They are known to have negative impacts on aquatic ecosystems and can potentially poison and sicken pets, livestock, and wildlife. Blue-green algae can have both direct and indirect negative impacts on fisheries. Persons can be exposed to the phytotoxins by ingestion or dermal absorption (through the skin). They can also be exposed to toxins by inhalation of aerosols created by overhead irrigation, strong winds, and boating activity.

Approximately one-half of blue-green algae blooms contain phytotoxins, and this is determined through lab testing. It is recommended that persons not swim in waters where blue-green algal blooms are conspicuously present. Specifically, persons should avoid contact with water where blooms appear as though green latex paint has been spilled on the water, or where the water in enclosed bays appears to be covered by an “oil slick”. Pets should be prevented from drinking from tainted water. Since blue-green algal toxins can enter the human body through the lungs as aerosols, it is suggested that water containing obvious blue-green algae blooms not be used for irrigation in areas where persons may be exposed to it.

Blue-green algae typically bloom and become a nuisance when resources are limiting to other plant and algae or when biotic conditions reach certain extremes, particularly warm water conditions. Some of the reasons that blue-green algae can bloom and become noxious are listed below:

TP and TN: The total phosphorus (TP) concentration in a water resource is usually positively correlated with the production of suspended algae (but not rooted plants). Very small amounts of phosphorus may result in large algal blooms. If the ratio of total nitrogen (TN) to total phosphorus is low (<20), suspended algae production may become nitrogen limited and noxious blue-green algae may dominate a system because they are able to “fix” their own nitrogen from atmospheric sources. Other common and desirable algae are not able to do this.

Biotic Factors: Zebra mussels and zooplankton (microscopic, free-floating animals) are filter feeding organisms that strain algae and other substances out of the lake water for food. Studies have shown that filter-feeding organisms often reject cyanobacteria and feed selectively on other more desirable algae. Over time, and given enough filter feeding organisms, a lake will experience a net loss in “good” algae and a gain in “bad” blue-green algae as the “good” algae are consumed and the “bad” algae are rejected back into the water column. This is one of the most disturbing factors associated with the invasion and proliferation of zebra mussel.

Management: Treatment methods for blue-green algae are generally preventative rather than reactionary. One of the most common forms of algae treatment is limiting nutrients, namely phosphorus, from entering the lake ecosystem through several sources. Phosphorus mainly enters lake systems through surface water inputs such as rivers, creeks, or overland runoff. In some inland lakes that experience late-summer stratification, sediment-bound phosphorus at the lake bottom becomes mobilized due to low-oxygen conditions which, under high sustained wind conditions, can mix surface and bottom waters. This is particularly problematic in the late summer. Phosphorus-reducing practices include: implementing Best Management Practices (BMPs) in upstream agricultural and urban areas, limiting nutrient (fertilizer) applications on lawns, planting vegetative buffer strips between nutrient-producing areas and surface water, reducing septic system leaching (if riparian homes are not sewered), binding lake-bottom phosphorus using alum or other adsorbent materials (e.g., Phoslock®), and treating/infiltrating stormwater prior discharge into upstream surface waters of the lake.

Research has shown that water circulation devices such as bubblers or aeration systems may limit the viability of blue-green algae over native algae species.[9] Blue-green algae are more buoyant than native algae species and often float to the water’s surface during quiescent conditions to increase the amount of sunlight needed for photosynthesis. Circulation systems disturb the water column and eliminate this evolutionary advantage portrayed by blue-green algae. The intended result is a shift from a blue-green algae dominated community to a mix of green algae species. When nuisance conditions occur, contact algaecides or hydrogen peroxide may be used as a reactionary treatment to destroy algae cells present in the water column. However, chemicals should be applied with caution due to concerns of bioaccumulation and toxicity to other forms of aquatic life. Moreover, chemical applications will often need to ‘chase’ blooms that can be pushed to different areas of the lake with prevailing winds.

[9] Pastorok, R., T. Ginn, AND M. Lorenzen. Evaluation of Aeration/Circulation as a Lake Restoration Technique. U.S. Environmental Protection Agency, Washington, D.C., EPA/600/3-81/014 (NTIS PB81191884), 1981.

Appendix B: Common Aquatic Invasive Species

Eurasian Watermilfoil and Hybrids:

Background: Anecdotal evidence suggests that hybrid watermilfoil has been found in Michigan inland lakes for a long time (since the late 1980's). University of Connecticut professor Dr. Don Les was the first to determine that there were indeed, Eurasian watermilfoil and northern watermilfoil hybrids in Michigan based on samples sent to his Connecticut lab by Dr. Douglas Pullman, Aquest Corp. in 2003. Experience has proven that it is usually not possible to determine whether the watermilfoil observed is either Eurasian or hybrid genotype. However, because they play such similar roles in lake ecology, they are simply "lumped together" and referred to collectively as Eurasian watermilfoil hybrids. Eurasian watermilfoil hybrids are a very common nuisance in many Michigan inland lakes.

Management: Lake disturbance, such as weed control, unusual weather, and heavy lake use can destabilize the lake ecosystem and encourage the sudden nuisance bloom of weeds, like Eurasian watermilfoil. Eurasian watermilfoil is an ever-present threat to the stable biological diversity of the lake ecosystem. Species selective, systemic herbicide combinations have been used to suppress the nuisance production of Eurasian watermilfoil and support the production of a more desirable flora. However, it is becoming much more resistant to herbicidal treatments. Herbicide resistant Eurasian watermilfoil and hybrid watermilfoil have been observed in many lakes throughout the Midwest.[10,11] Continued chemical applications can select for herbicide resistant plants, resulting in hybrid watermilfoil.[12] Some research suggests this resistance can be defeated with the use of microbiological system treatments. Eurasian watermilfoil community genetics are dynamic and careful monitoring is needed to adapt to the expected changes in the dominance of distinct Eurasian watermilfoil genotypes. Some of these genotypes may be more herbicide resistant than others and treatment strategies must be adjusted to remain effective in different parts of the lake.

Figure B1: Example Eurasian Watermilfoil and Hybrids images from the 2019 LakeScan™ field crew.

[10] Berger, S. T., Netherland, M. D., & MacDonald, G. E. (2015). Laboratory documentation of multiple-herbicide tolerance to fluridone, norflurazon, and topramazone in a hybrid watermilfoil (*Myriophyllum spicatum× M. sibiricum)* population. Weed Science, 63(1), 235-241.
[11] Netherland, M. D., & Willey, L. (2017). Mesocosm evaluation of three herbicides on Eurasian watermilfoil (*Myriophyllum spicatum*) and hybrid watermilfoil (*Myriophyllum spicatum x Myriophyllum sibiricum*): Developing a predictive assay. J. Aquat. Plant Manage, 55, 39-41.
[12] Netherland and Wiley, 2017.

Starry Stonewort:

Background: Starry stonewort, a macroalgae native to northern Eurasia, invaded North American inland lakes after becoming established in the St. Lawrence Seaway/Great Lakes system. Though not positively identified in a Michigan inland lake until 2006, by Aquest Corporation in Lobdell Lake, Genesee County, starry stonewort has likely been present in Michigan's inland lakes since the late 1990's. Since then, this invasive species has spread throughout Michigan. Able to spread by both fragmentation and asexual reproduction, starry stonewort has thrived in Michigan's high-quality oligotrophic and mesotrophic lakes, particularly those with marl sediments. Once established, this opportunistic species will bloom and crash and impose a very significant and deleterious impact on many ecosystem functions. Bloom and crash events are unpredictable and can happen at any time of the year. In some years starry stonewort can become a horrendous nuisance while it can be inconspicuous in others. It can comingle with other similar species and be very difficult to find when it is not blooming.

Management: Starry stonewort is capable of growing to extreme nuisance levels and can significantly impact important ecosystem functions. This species is difficult to control due to its asexual reproductive structures (bulbils) which embed in lake sediments.[13] While many strategies have been employed to manage starry stonewort, no single strategy has emerged as a panacea for controlling infestations.

Diver-assisted suction harvesting (DASH) or diver-assisted hand-pulling of small starry stonewort infestations could reduce populations over time.[14] While these methods can be effective and have high specificity, they are expensive, labor-intensive strategies that require long-term commitment.[15] These strategies may not be viable for large-scale infestations, however, due to their labor-intensive nature and their potential for increasing distribution of the target plant species through fragmentation during removal.

Starry stonewort chemical treatments using copper-, diquat- and endothall-based algaecides have produced mixed results and long-term management has yet to be achieved using chemical biocides alone.[16] While starry stonewort is susceptible to most selective algaecides, the dense mats of vegetation are very difficult to penetrate and provide reasonable biocide exposure. Consequently, multiple algaecide applications may be required to "whittle down" dense starry stonewort growth if the mats reach sufficient height.

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[13] Glisson, W. J., Wagner, C. K., McComas, S. R., Farnum, K., Verhoeven, M. R., Muthukrishnan, R., & Larkin, D. J. (2018). Response of the invasive alga starry stonewort (*Nitellopsis obtusa*) to control efforts in a Minnesota lake. Lake and Reservoir Management, 34(3), 283-295.

[14] Glisson et al., 2018.

[15] Larkin, D.J., Monfils, A.K., Boissezon, A., Sleithd, R.S., Skawinski, P.M., Welling, C.H., Cahill, B.C., and Karold, K.G. 2018. Biology, ecology, and management of starry stonewort (*Nitellopsis obtusa*; Characeae): A Red-listed Eurasian green alga invasive in North America. https://doi.org/10.1016/j.aquabot.2018.04.003

[16] Pokrzywinski, K. L., Getsinger, K. D., Steckart, B., & Midwood, J. D. (2020). Aligning research and management priorities for *Nitellopsis obtusa* (starry stonewort).


Figure B2: Example starry stonewort images from the 2019 LakeScanTM field crew.

Curly-leaf Pondweed:

Background: Curly-leaf pondweed (CLP) is one of the world's most widespread aquatic plant species. Although it is found worldwide, CLP is native to only Eurasia. The earliest verifiable records of the plant are from Pennsylvania in the 1840s, and has been found in Michigan since 1910. Curly-leaf pondweed is currently found in inland lakes of 34 counties in Michigan, distributed both in the upper and lower peninsulas.[17] Scientific literature suggests that curly-leaf pondweed is an aggressively growing species that often expands to nuisance levels when native plants are damaged.

Curly-leaf pondweed can create problems such as recreational nuisances, ecological nuisances (by outcompeting native species and reducing light availability to other plants), and degraded fish spawning habitat. Curly-leaf pondweed is easily detectable in early spring as it will be one of the few plants readily growing and the first submersed plant to reach the surface. This gives it a competitive advantage and can grow 4 to 5 feet tall before other plants begin germinating from the bottom sediments. As water temperatures rise in late June and early July, curly-leaf pondweed stems begin to die, break down, and can be completely gone by mid-July.[18]

Management: Like other invasive species, CLP is difficult to control once established and is considered widespread in Michigan. Therefore, prevention of new populations in uninfected waters is the most economical management approach. Several herbicides have been shown to be effective at long-term control of CLP, but eradication is difficult after establishment. Bottom barriers have shown effectiveness at combating CLP in small areas, and mechanical harvesting of CLP can be effective if timed and managed correctly.[19]

The most viable ways to control CLP is through chemical and physical means after developing an integrated pest management plan. Early infestations may best be controlled by manual removal, diver-

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[17] MDEQ. (2018). "State of Michigan's Status and Strategy for Curly-leafed Pondweed (*Potamogeton crispus L.*)." Accessed online: <https://www.michigan.gov/documents/invasives/egle-ais-potamogeton-crispus_708948_7.pdf>.

[18] Hart, Steven, M. Klepinger, H. Wandell, D. Garling, L. Wolfson. (2000). "Integrated Pest Management for Nuisance Exotics in Michigan Inland Lakes." Accessed online: <https://www.michigan.gov/documents/invasives/egle-great-lakes-aquatics-IPM-manual_708904_7.pdf>.

[19] MDEQ, 2018

assisted suction harvesting (DASH), or benthic barrier use during spring before turions are produced. Aquatic herbicides including endothall, diquat, and imazamox are the most effective for general applications. Aquatic herbicides including flumioxazin and imazamox are effective for specific types of application and in specific environments. Chemical treatments are a part of a long-term integrated management plan as the turions are viable for at least 5 years and only diquat, fluridone, and some hormone treatments have shown a reduction of turion development in the laboratory.[20]

Figure B3: Example curly-leaf pondweed image from the 2021 LakeScan™ field crew.

[20] MDEQ, 2018.

Appendix C: Herbicide Applicator Maps

Copies of the herbicide treatment maps obtained by the herbicide applicators are included below.

Figure C1 – Herbicide applicator treatment maps from June 22, 2022 chemical treatments targeting Eurasian watermilfoil

Figure C2 – Herbicide applicator treatment maps from September 6, 2022 chemical treatments to target Eurasian watermilfoil and native pondweeds.