MEMORANDUM REPORT NO. 269

AQUATIC PLANT MANAGEMENT PLAN FOR BIG CEDAR LAKE

WASHINGTON COUNTY, WISCONSIN

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 269

AQUATIC PLANT MANAGEMENT PLAN FOR BIG CEDAR LAKE, WASHINGTON COUNTY, WISCONSIN

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Credit: Commission Staff

INTRODUCTION 1

The Southeastern Wisconsin Planning Commission (Commission) completed this aquatic plant inventory and management study of Big Cedar and Gilbert lakes on behalf of the Big Cedar Lake Protection and Rehabilitation District (District). This memorandum report is the Commission's fourth study focusing on Big Cedar or Gilbert lake.[1] The Wisconsin Department of Natural Resources (WDNR) will use data and conclusions generated as part of the Commission's study to help evaluate the Lake's aquatic plant community and draft an updated Aquatic Plant Control permit.

1.1 PROJECT SETTING, BACKGROUND, SCOPE, AND INTENT

Big Cedar Lake (Lake) is a 937-acre spring lake located within the Towns of West Bend and Polk in Washington County. As a spring-fed lake, groundwater provides most of the water in the Lake although several small unnamed tributaries provide surface-water inflow, including from 44-acre Gilbert Lake to the northwest. The Lake forms the headwaters of Cedar Creek, which is the Lake's outlet. Water leaving Big Cedar flows downstream along Cedar Creek into Little Cedar Lake before flowing into the Milwaukee River near Cedarburg and ultimately discharging into Lake Michigan. The Lake is impounded by a weir along its southeastern shore. Four boat launches provide public access to the Lake: two launches along the western shore on Cedar Park Drive and Gonring Drive and two launches along the eastern shore on Wagner Lane and South Hacker Drive. The WDNR has identified the Lake in their published list of state high-quality waters.[2]

Attaining a maximum depth of 105 feet, the deepest portions of Big Cedar Lake are not capable of supporting an aquatic plant community but shallow nearshore areas do support aquatic plant growth

[1] *The three earlier Commission reports are as follows: SEWRPC Memorandum Report No. 131, Environmental Analysis of the Lands at the Headwaters of Gilbert Lake and Big Cedar Lake, Washington County, Wisconsin, March 1999; SEWRPC Memorandum Report No. 137, A Water Quality Protection and Stormwater Management Plan for Big Cedar Lake, Washington County, Wisconsin, August 2001; and SEWRPC Staff Memorandum, Big Cedar Lake Watershed Land Use and Pollutant Loading Update, June 2020.*

[2] *For more information on the WDNR's Healthy Watersheds, High-Quality Waters initiative, see the following: dnr.wisconsin.gov/topic/SurfaceWater/HQW.html.*

(see Map 1.1).[3] The most recent aquatic plant survey conducted by Marine Biochemists in 2018 observed 26 species, including native species like muskgrass (*Chara* spp.), Sago pondweed (*Stuckenia pectinata*), eelgrass (*Vallisneria americana*), large-leaf pondweed (*Potamogeton amplifolius*), and Illinois pondweed (*Potamogeton illinoensis*). Invasive aquatic plant species, including Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*) were also observed in the Lake during this survey. Several areas of the lake are designated by WDNR as sensitive areas, indicating that these areas support important lake ecological functions and should be protected to the greatest extent feasible (see Map 1.2). Consequently, some aquatic plant management techniques may be prohibited in these areas.

Gilbert Lake is a 44-acre spring lake located in the Town of West Bend in Washington County. The northern half of Gilbert Lake attains a maximum depth of nine feet and consistently has open water while the southern half attains a maximum depth of two feet and is almost entirely covered in dense water lily growth (*Nymphaea odorata* and *Nuphar variegata*). Gilbert Lake drains to the northern end of Big Cedar Lake via a narrow channel that is deep enough to allow boat traffic. Commission staff are not aware of any previous point-intercept aquatic plant surveys of Gilbert Lake, although Commission staff recorded several aquatic native plant species during vegetative surveys in 1968 and 1998, including native pondweeds (*Potamogeton* spp.), muskgrass, bulrushes (*Schoenoplectus* spp.), common bladderwort (*Utricularia vulgaris*), and eelgrass (*Vallisneria americana*) as well as the invasive curly-leaf pondweed.[4] WDNR has designated the entirety of Gilbert Lake as sensitive area (see Map 1.2).

The District manages aquatic plant growth on Big Cedar and Gilbert lakes to enhance navigation and recreational opportunities, primarily through mechanical harvesting although chemical treatments have previously been used for invasive species control. Aquatic plant management is regulated by the WDNR and requires a permit. The District is required to reevaluate the aquatic plant community, update the aquatic plant management plan, and renew the aquatic plant management permit every five years. Aquatic plant inventories and management plans have been completed at the Lake several times in the past to support aquatic plant management permit applications. The last aquatic plant management plan update was completed in 2019 by Marine Biochemists and the District's harvesting permit expires on December 31, 2023.[5,6] To renew their permit, the District must reevaluate the Lake's aquatic plant community and update the aquatic plant management plan. This updated plan needs to consider the present status of the aquatic plant community, must identify plant community changes that may have occurred, must examine the potential success or lack of success of the current aquatic plant management strategies, must consider current trends and issues that pertain to aquatic plant management issues and techniques, and must describe the methods and procedures associated with proposed continuation of aquatic plant management in the Lake.

This updated APM plan summarizes information and recommendations needed to manage nuisance plants (including EWM, curly-leaf pondweed, and starry stonewort). The plan covers four main topics:

- APM Goals and Objectives
- Aquatic Plant Community Changes and Quality
- Aquatic Plant Control Alternatives
- Recommended Aquatic Plant Management Plan

This memorandum focuses upon approaches to monitor and control actively growing nuisance populations of aquatic plants and presents a range of alternatives that could potentially be used to achieve desired APM goals and provides specific recommendations related to each alternative. These data and suggestions can be valuable resources when developing requisite APM permit applications and implementing future aquatic plant management efforts.

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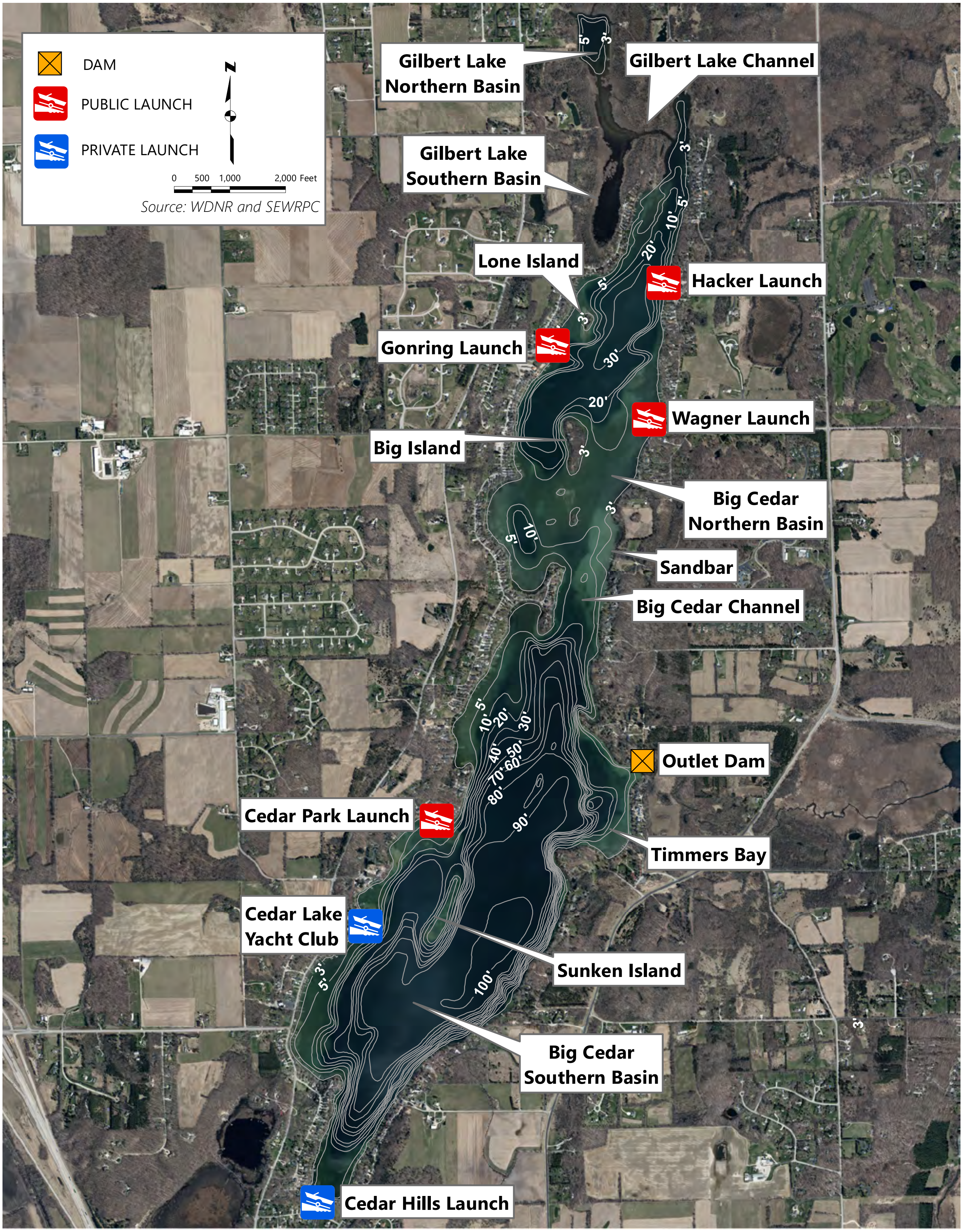
[3] *Marine Biochemists, An Aquatic Plant Survey and Management Plan Update for Big Cedar Lake – Washington County, WI, December 2018.*

[4] *SEWRPC Preliminary Vegetation Survey, Gilbert Lake Deep Marsh, December 2000.*

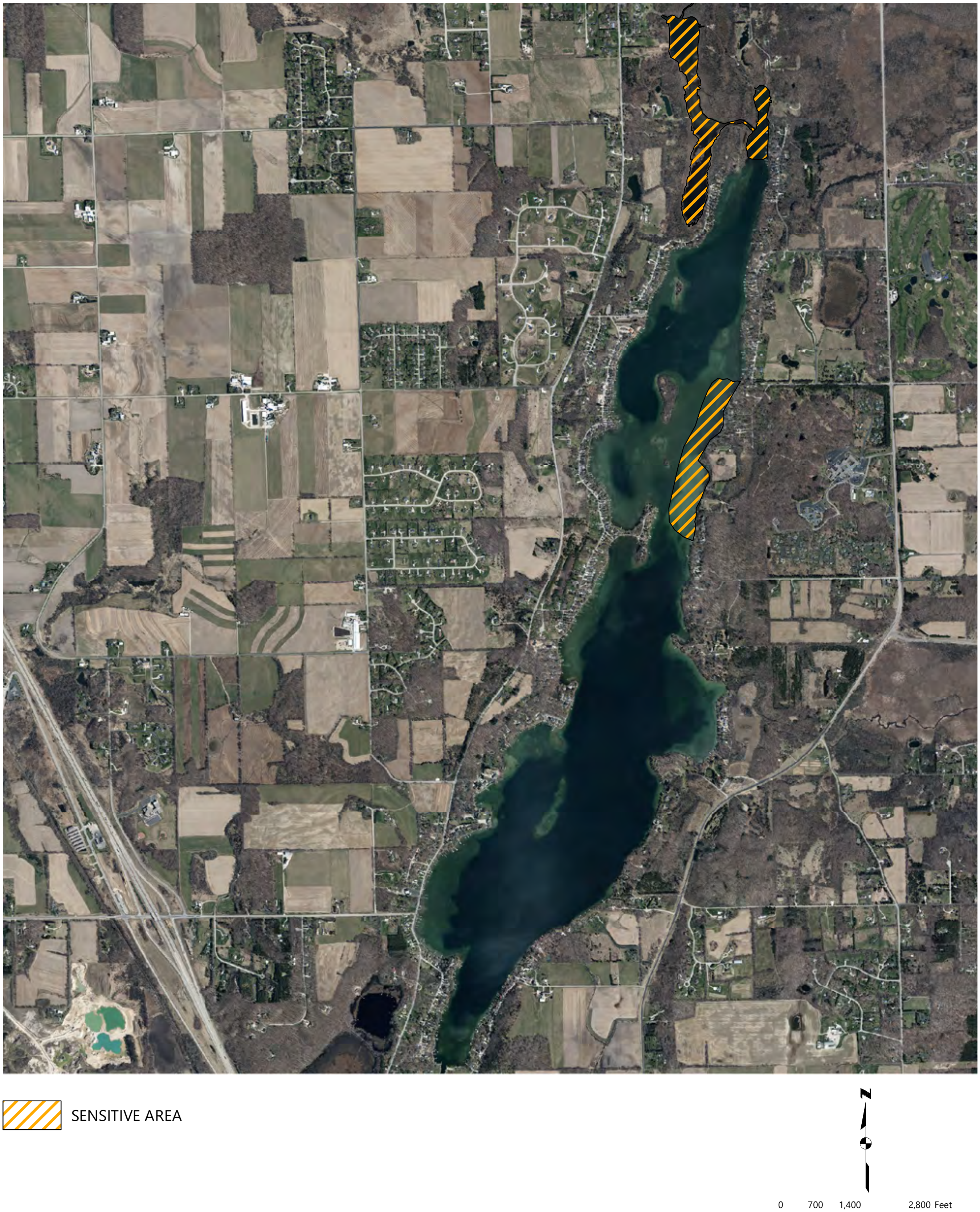
[5] *Marine Biochemists, 2018, op. cit.*

[6] *Wisconsin Department of Natural Resources, 2019-2023 Mechanical Harvesting Permit SE-2019-67-1609M, June 2019.*

Map 1.1
Bathymetry and Local Place Names in Big Cedar and Gilbert Lakes



Map 1.2
WDNR-Designated Sensitive Areas in Big Cedar and Gilbert Lakes



Source: WDNR and SEWRPC

Credit: Commission Staff

INVENTORY FINDINGS AND RELEVANCE TO RESOURCE MANAGEMENT 2

2.1 AQUATIC PLANT MANAGEMENT GOALS AND OBJECTIVES

Aquatic plant management (APM) programs are designed to further a variety of lake user and riparian landowner goals and desires. For example, most APM programs aim to improve lake navigability. However, APM programs must also be sensitive to other lake uses and must maintain or enhance a lake's ecological integrity. Consequently, APM program objectives are commonly developed in close consultation with many interested parties. The Big Cedar Lake APM plan considered input from Big Cedar Lake Protection and Rehabilitation District (District), Wisconsin Department of Natural Resources (WDNR), and the public. Objectives of the Big Cedar APM program include the following.

- Effectively control the quantity and density of nuisance aquatic plant growth in well-targeted portions of Big Cedar and Gilbert lake. This objective helps:
  - Enhance water-based recreational opportunities,
  - Improve community-perceived aesthetic values, and
  - Maintain or enhance the Lake's natural resource value.
- Manage the lakes in an environmentally sensitive manner in conformance with *Wisconsin Administrative Code* standards and requirements under Chapters NR 103 *Water Quality Standards for Wetlands*, NR 107 *Aquatic Plant Management*, and NR 109 *Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations*. Following these rules helps the District preserve and enhance the lakes' water quality, biotic communities, habitat value, and essential structure and relative function in relation to adjacent areas.
- Protect and maintain public health and promote public comfort, convenience, and welfare while safeguarding the lakes' ecological health through environmentally sound management of vegetation, wildlife, fish, and other aquatic/semi-aquatic organisms in and around the lakes.

- Promote a high-quality water-based experience for residents and visitors to the lakes consistent with the policies and practices of the WDNR, as described in the regional water quality management plan, as amended.[7]

To meet these objectives, the District executed an agreement with the Southeastern Wisconsin Regional Planning Commission (Commission) to investigate the characteristics of the lakes and to develop an aquatic plant management update. As part of this planning process, surveys of the aquatic plant community and comparison to results of previous surveys were conducted. This chapter presents the results of each of these inventories.

2.2 AQUATIC PLANT COMMUNITY COMPOSITION, CHANGE, AND QUALITY

All healthy lakes have plants and native aquatic plants form a foundational part of a lake ecosystem. Aquatic plants form an integral part of the aquatic food web, converting sediments and inorganic nutrients present in the water into organic compounds that are directly available as food to other aquatic organisms. Through photosynthesis, plants utilize energy from sunlight and release the oxygen required by many other aquatic life forms into the water. Aquatic plants also serve several other valuable functions in a lake ecosystem, including:

- Improving water quality by filtering excess nutrients from the water
- Providing habitat for invertebrates and fish
- Stabilizing lake bottom substrates
- Supplying food for waterfowl and various lake-dwelling animals

Even though aquatic plants may hinder human use and/or access to a lake, aquatic plants should not necessarily be eliminated or even significantly reduced in abundance because they often support many other beneficial functions. For example, water lilies play a significant role in providing shade, habitat, and food for fish and other important aquatic organisms. They also help prevent damage to the lakeshore by dampening the power of waves that could otherwise erode the shoreline. Additionally, the shade that these plants provide helps reduce the growth of undesirable plants because it limits the amount of sunlight reaching the lake bottom. Given these benefits, large-scale removal of native plants that may be perceived as a nuisance should be avoided when developing plans for aquatic plant management.

Aquatic Plant Surveys

Big Cedar Lake's aquatic plant community has been evaluated at least seven times beginning in 1968 with the most recent survey in 2018 by Marine Biochemists. Species abundance data derived from the 2018 and 2013 surveys for the lake are compared in Table 2.1. The 2018 and 2023 surveys both used the same point-intercept grid and methodology.[8,9,10] In this method, sampling sites are based on predetermined global positioning system (GPS) location points that are arranged in a grid pattern across the entire surface of a lake. The grid pattern for Big Cedar Lake consists of 1,124 sampling points spaced at 58 meters (190.3 feet) apart (see Figure 2.1). At each grid point sampling site, a single rake haul is taken and a qualitative assessment of the

[7] *SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin—2000, Volume One, Inventory Findings, September 1978, Volume Two, Alternative Plans, February 1979, Volume Three, Recommended Plan, June 1979, and SEWRPC Memorandum Report No. 93, A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, March 1995.*

[8] *Sampling methodology changed from transect-based methods in the earlier surveys (1968, 1986, 1989, 1993, 2001, 2008, 2013) to a point-intercept method beginning with the 2018 survey.*

[9] *R. Jesson and R. Lound, Minnesota Department of Conservation Game Investigational Report No. 6, An Evaluation of a Survey Technique for Submerged Aquatic Plants, 1962; as refined in the Memo from S. Nichols to J. Bode, J. Leverence, S. Borman, S. Engel, and D. Helsel, entitled "Analysis of Macrophyte Data for Ambient Lakes-Dutch Hollow and Redstone Lakes Example," Wisconsin Geological and Natural History Survey, University of Wisconsin-Extension, February 4, 1994.*

[10] *J. Hauxwell, S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky, and S. Chase, Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications, Wisconsin Department of Natural Resources, Bureau of Science Services, Publication No. PUB-SS-1068 201, March 2010.*

Table 2.1
Big Cedar Lake Aquatic Plant Survey Summary: August 2018 vs. August 2023

Aquatic Plant Species	Native or Invasive	Number of Sites Found[a] (2018/2023)	Frequency of Occurrence Within Vegetated Areas[b] (2018/2023)	Average Rake Fullness[c] (2018/2023)	Relative Frequency of Occurrence[d] (2018/2023)	Visual Sightings[e] (2018/2023)
Brasenia schreberi (watershield)	Native	0/0	--/--	--/--	--/--	2/0
Ceratophyllum demersum (coontail)	Native	38/29	7.72/5.82	1.89/1.28	3.1/2.2	0/1
Chara spp. (muskgrass)	Native	342/376	69.5/75.5	1.58/1.51	27.5/27.9	0/16
Elodea canadensis (waterweed)	Native	3/9	0.61/1.81	1/1	0.2/0.7	0/0
Heteranthera dubia (water stargrass)	Native	8/10	1.62/2.01	1.75/1	0.6/0.7	1/3
Lemna minor (duckweed)	Native	1/0	0.2/--	1/--	0.1/--	1/0
Myriophyllum sibiricum (northern watermilfoil)	Native	44/11	8.94/2.21	1.27/1	3.5/0.8	0/0
Myriophyllum spicatum (Eurasian watermilfoil)	Invasive	28/27	5.69/5.42	1.29/1.44	2.3/2	1/2
Myriophyllum verticillatum	Native	1/1	0.2/0.20	1/1	0.1/0.17	0/0
Najas flexilis (slender naiad)	Native	226/159	45.9/31.9	1.52/1.12	18.2/11.8	0/1
Najas guadalupensis (southern naiad)	Native	2/26	0.41/5.22	1/1	0.2/1.9	0/0
Najas marina (spiny naiad)[f]	Naturalized	22/6	4.47/1.2	1.23/1	1.8/0.4	0/0
Nitella sp. (stonewort)	Native	26/49	5.28/9.84	1.38/1.41	2.1/3.6	0/0
Nitellopsis obtusa (starry stonewort)	Invasive	0/1	--/0.2	--/1	--/0.1	0/0
Nuphar variegata (spatterdock)[g]	Native	1/0	0.2/--	1/--	0.1/--	3/--
Nymphaea odorata (white water lily)	Native	0/1	--/0.20	--/1	--/0.1	4/6
Persicaria amphibia (water smartweed)	Native	0/0	--/--	--/--	--/--	1/0
Potamogeton amplifolius (large-leaf pondweed)[h]	Native	14/4	2/85/0.8	1.14/1.25	1.1/0.3	5/6
Potamogeton crispus (curly-leaf pondweed)	Invasive	1/7	0.2/1.41	1/1	0.1/0.5	0/0
Potamogeton foliosus (leaf pondweed)	Native	4/0	0.81/--	1/--	0.3/--	0/0
Potamogeton friesii (Fries' pondweed)	Native	0/25	--/5.02	--/1.12	--/1.9	0/0
Potamogeton gramineus (variable pondweed)	Native	26/168	5.28/33.7	1.12/1.10	2.1/12.5	3/25
Potamogeton illinoensis (Illinois pondweed)[h]	Native	122/7	24.8/1.41	1.11/1	9.8/0.5	28/0
Potamogeton natans (floating-leaf pondweed)	Native	0/--	--/--	--/--	--/--	1/0
Potamogeton praelongus (white-stem pondwed)	Native	1/0	0.2/--	1/--	0.1/--	0/0
Potamogeton pusillus (small pondweed)	Native	2/14	0.41/2.81	1/1	0.2/1.0	0/0
Potamogeton richardsonii (clasping-leaf pondweed)[h]	Native	6/10	1.22/2.01	1.17/1.2	0.5/0.7	3/1
Potamogeton strictifolius (stiff pondweed)	Native	0/4	--/0.8	--/1	--/0.3	0/0
Potamogeton zosteriformis (flat-stem pondweed)	Native	42/46	8.54/9.24	1.21/1.37	3.4/3.4	1/3
Ranunculus aquatilis (white water crowfoot)	Native	0/2	--/0.4	--/1	--/0.1	0/0
Spirodela polyrhiza (large duckweed)	Native	0/1	--/0.2	--/1	--/0.1	0/2
Stuckenia pectinata (Sago pondweed)[h]	Native	117/83	23.8/16.7	1.2/1.1	9.4/6.2	3/8
Utricularia vulgaris (bladderwort)	Native	5/30	1.02/6.02	1.2/1.27	0.88/2.2	0/1
Vallisneria americana (eel-grass/wild celery)[h]	Native	159/242	32.3/48.6	1.18/1.11	12.8/18.0	9/8
Wolffia columbiana (common watermeal)	Native	1/0	0.2/--	1/--	0.1/--	0/0

Table continued on next page.

Table 2.1 (Continued)

Note: Sampling occurred at 213 sampling sites on July 10th, 13th, 15th, and 17th, 2023. 498 of the 615 surveyed sites had vegetation. Red text indicates non-native and/or invasive species. See Appendix A for distribution maps and identifying features

[a] *Number of Sites refers to the number of sites at which the species was retrieved and identified on the rake during sampling.*

[b] *Frequency of Occurrence, expressed as a percent, is the percentage of times a particular species occurred when there was aquatic vegetation present at the sampling site.*

[c] *Average rake fullness is the average amount, on a scale of 0 to 3, of a particular species at each site where that species was retrieved by the rake.*

[d] *Relative Frequency of Occurrence, expressed as a percent, is the frequency of that particular species compared to the frequencies of all species present.*

[e] *Visual Sightings is the number of sites where that particular species was visually observed within six feet of the actual rake haul location but was not actually retrieved on the rake and was not, therefore, assigned a rake fullness measurement for that site. At sites where this occurred, the species was simply marked as "present" at that site. Recording the number of visual sightings helps give a better picture of species distribution throughout the lake.*

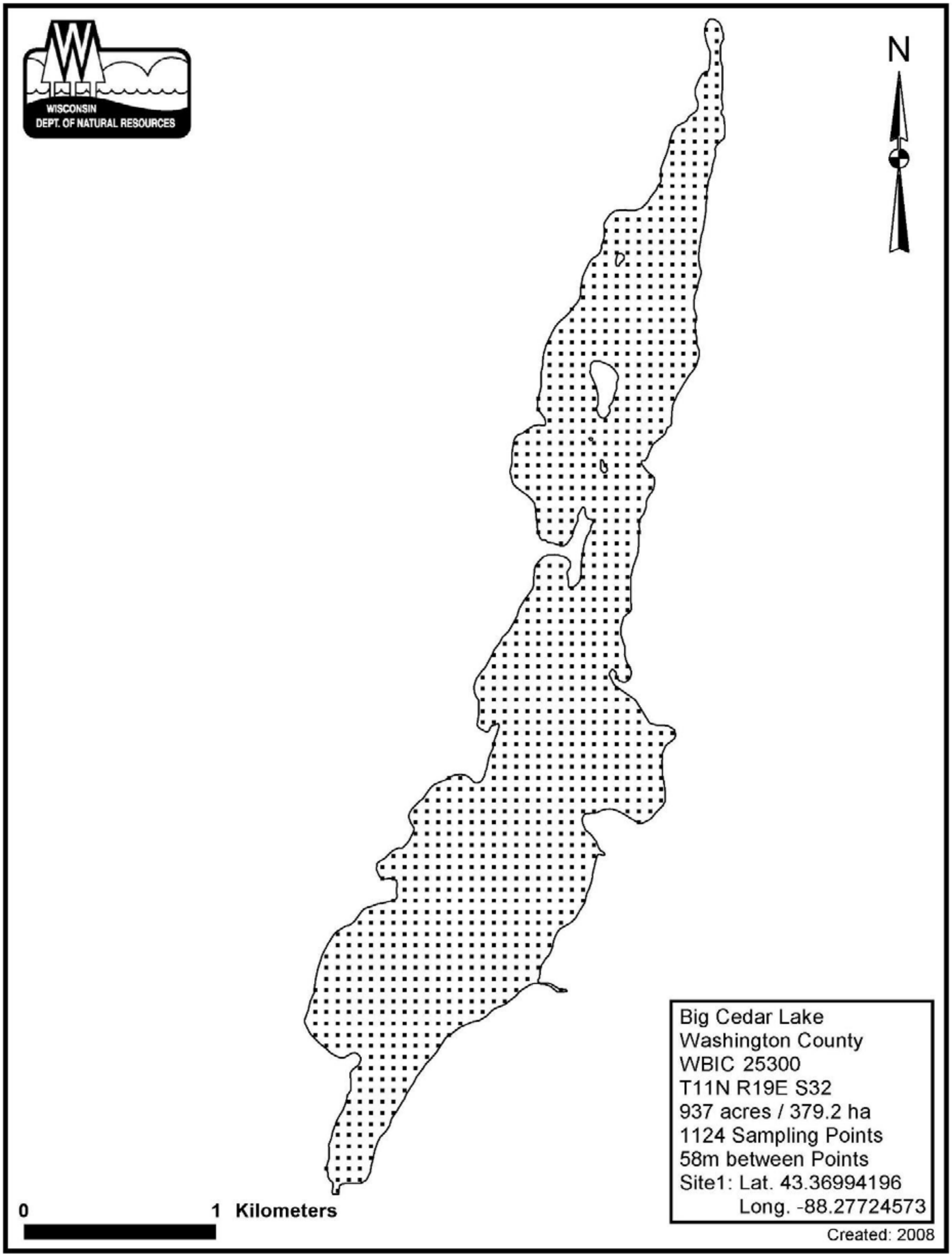
[f] *Spiny naiad was added to the NR 40 list as a restricted species in 2015, meaning it is not allowed to be transported, transferred, or introduced without a permit. Because the species is not native to Wisconsin and can become quite abundant, especially in lakes of poor water quality with hard water, it is currently considered a "naturalized" native species that can provide good habitat and food for fish and macroinvertebrates. Paul M. Skawinski,* Aquatic Plants of the Upper Midwest, 2nd Edition, *2014;* Through the Looking Glass: A Field Guide to Aquatic Plants, 2nd Edition, *2013.*

[g] *Although* Nuphar variegata *was not observed at a survey point in 2023, this species was recorded as a boat survey species near point 1104 and was observed at several other locations around the lake, always in sheltered bays.*

[h] *Considered a high-value aquatic plant species known to offer important values in specific aquatic ecosystems under Section NR 107.08 (4) of the* Wisconsin Administrative Code.

Source: Wisconsin Department of Natural Resources and SEWRPC

Figure 2.1
Aquatic Plant Sampling Map for Big Cedar Lake



Source: SEWRPC

rake fullness, on a scale of zero to three, is made for each species identified. The same points were sampled using the same techniques during the same time of year in 2018 and 2023.

Commission staff conducted the 2023 survey on July 11th and 12th with the assistance of volunteers from the District. Conditions during the survey were good, with largely sunny skies, low wind speeds, and low to moderate boat traffic. Both lakes had superb water clarity, which enhanced visual observations of aquatic plant species within six feet of the sampling location. In general, the aquatic plant specimens were mature, and several species were in flower (e.g., white water lily).

While Commission staff strived to survey as much of both lakes as feasible, certain areas of the lakes were not surveyed in 2023. These areas included the central portion of the southern Big Cedar Lake basin, which was determined to be too deep for vascular aquatic plants to grow, as well as portions of the northern basin, which were also too deep for vascular plants.[11] Other points that were not surveyed were either due to the proximity of a dam, docks, temporary obstacles, and points that were deemed too shallow to survey. In Gilbert Lake, much of the southern basin was shallow and had dense water lily growth that limited Commission staff's ability to survey.

Aquatic Plant Survey Metrics

Each aquatic plant species has preferred habitat conditions in which that species thrives as well as conditions that limit or completely inhibit its growth. For example, water conditions (e.g., depth, clarity, source, alkalinity, and nutrient concentrations), substrate composition, the presence or absence of water movement, and pressure from herbivory and/or competition all can influence the type of aquatic plants found in a water body. All other factors being equal, water bodies with a diverse array of habitat variables are more likely to host a diverse aquatic plant community. Human management can also affect the biological diversity (biodiversity) of waterbodies.

Several metrics are useful to describe aquatic plant community condition and design management strategies. These metrics include total rake fullness, maximum depth of colonization, species richness, biodiversity, evaluation of sensitive species, and relative species abundance. Metrics derived from the 2018 and 2023 point-intercept surveys are described below.

Total Rake Fullness

As described earlier in this section, Commission staff qualitatively rated the plant abundance at each survey point by how much of the sampling rake was covered by all aquatic plant species.[12] This rating, called total rake fullness, can be a useful metric evaluating general abundance of aquatic plants as part of the point-intercept (PI) survey. As shown in Figure 2.2, total rake fullness across all surveyed points in Big Cedar Lake averaged 1.58 in 2023. Total rake fullness was higher in the northern basin of Big Cedar Lake than the southern basin, with the most extensive and abundant aquatic vegetation growth found in the southern half of the northern basin.

Maximum Depth of Colonization

Maximum depth of colonization (MDC) can be a useful indicator of water quality, as turbid and/or eutrophic (nutrient-rich) lakes generally have shallower MDC than lakes with clear water.[13] It is important to note that for surveys using the point-intercept protocol, the protocol allows sampling to be discontinued at depths greater than the maximum depth of colonization for vascular plants. However, aquatic moss and macroalgae, such as muskgrass and nitella (*Nitella* spp.), frequently colonize deeper than vascular plants and thus may be under-sampled in some lakes. For example, *Chara globularis* and *Nitella flexilis* have been found growing as deep as 37 feet and 35 feet, respectively, in Silver Lake, Washington County.

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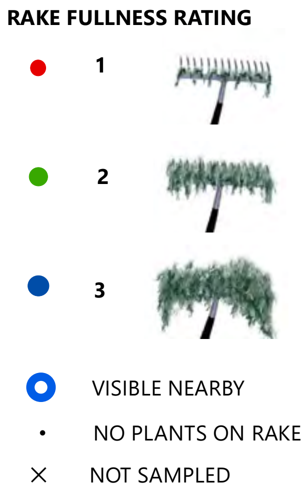
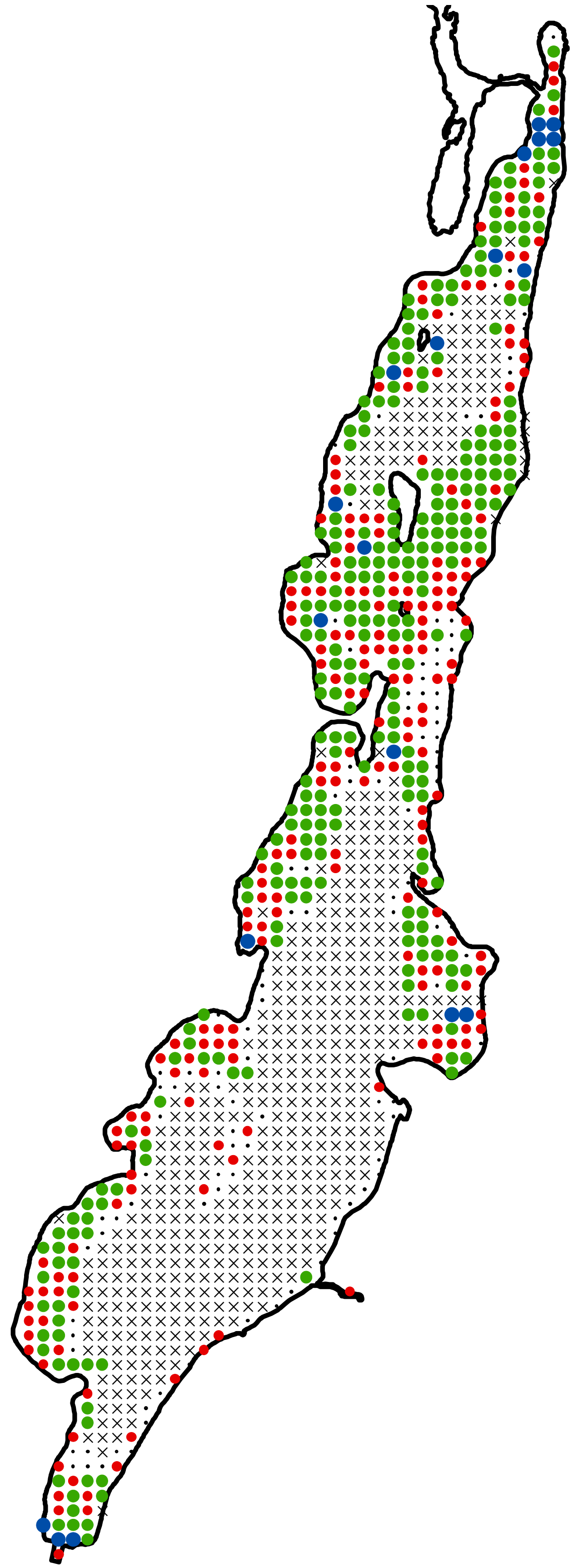
[11] *The southeast portion of the Lake is not an area with active aquatic plant management, as indicated by the 2018 aquatic plant management plan.*

[12] *This method follows the standard WDNR protocol.*

[13] *D.E. Canfield Jr, L. Langeland, and W.T. Haller, "Relations Between Water Transparency and Maximum Depth of Macrophyte Colonization in Lakes," Journal of Aquatic Plant Management 23, 1985.*

Figure 2.2
Total Rake Fullness in Big Cedar Lake: July 2023





Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

In Big Cedar Lake, aquatic plants were observed to a maximum depth of 22 feet in 2018 and to a maximum depth of 27 feet in 2023, although many of the plant observations deeper than 20 feet in both surveys were of *Nitella*. Thus, vascular plants are generally light-limited deeper than 20 feet indicating that water clarity appears to have improved or at least been consistent from 2018 to 2023. While the Commission did not thoroughly survey depths greater than 20 feet, rake tosses greater than 27 feet depth did not return any *Nitella*, suggesting that even this species may be light-limited at and beyond this depth.

Species Richness

The number of distinct types of aquatic plants present in a lake is referred to as the *species richness* of the lake. Larger lakes with diverse lake basin morphology, less human disturbance, and/or healthier, more resilient lake ecosystems have greater species richness. Aquatic plants provide a wide variety of benefits to lakes, examples of which are briefly described in Table 2.2.

The observed species richness of Big Cedar Lake has increased since the initial plant inventory completed in 1968 (see Table 2.3). Some species observed in earlier surveys were not observed during the 2023 survey. It is not uncommon for aquatic plant community diversity to fluctuate in response to a variety of drivers such as weather/climate, predation, and lake-external stimuli such as nutrient supply. This is especially true in the case of a lake's individual pondweed species, which tend to vary in abundance throughout the growing season in response to temperature, insolation, and other ecological factors. The 2023 aquatic plant survey identified 30 species in the Lake, including visual observations and boat survey species. This species richness is higher than average for lakes within Southeastern Wisconsin. The total number of species observed at each sampling point is shown in Figure 2.3.

Biodiversity and Species Distribution

Species richness is often incorrectly used as a synonym for biodiversity. The difference in meaning between these terms is both subtle and significant. Biodiversity is based on the number of species present in a habitat along with the abundance of each species. For the purposes of this study, abundance was determined as the percent of observations of each species compared to the total number of observations made. Aquatic plant biodiversity can be measured with the Simpson Diversity Index (SDI).[14] Using this measure, a community dominated by one or two species would be considered less diverse than one in which several different species have similar abundance. In general, more diverse biological communities are better able to maintain ecological integrity. Promoting biodiversity not only helps sustain an ecosystem but preserves the spectrum of options useful for future management decisions.

The Lake has good biodiversity with an SDI of 0.85 in 2018 and 2023. Between one and eight aquatic plant species were found at any single sampling point throughout the Lake, with generally higher diversity in middle depths (four to thirteen feet) areas than in very shallow or deeper areas (Figure 2.3). Actions that conserve and promote aquatic plant biodiversity are critical to the long term health of the Lake. Such actions not only help sustain and increase the robustness and resilience of the existing ecosystem, but also promote efficient and effective future aquatic plant management.

Sensitive Species

Aquatic plant metrics, such as species richness and the floristic quality index (FQI), can be useful for evaluating lake health. In hard water lakes, such as those common in Southeastern Wisconsin, species richness generally increases with water clarity and decreases with nutrient enrichment.[15] The FQI is an assessment metric used to evaluate how closely a lake's aquatic plant community matches that of undisturbed, pre-settlement conditions.[16] To formulate this metric, Wisconsin aquatic plant species were assigned conservatism (C) values on a scale from zero to ten that reflect the likelihood that each species occurs in undisturbed habitat. These values were assigned based on the species substrate preference, tolerance of water turbidity, water drawdown tolerance, rooting strength, and primary reproductive means. Native "sensitive" species that

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[14] *The SDI expresses values on a zero to one scale where 0 equates to no diversity and 1 equates to infinite diversity.*

[15] *Vestergaard, O. and Sand-Jensen, K. "Alkalinity and Trophic State Regulate Aquatic Plant Distribution in Danish Lakes," Aquatic Botany 67, 2000.*

[16] *S. Nichols, "Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications," Lake and Reservoir Management 15(2), 1999.*

Table 2.2
Ecological Qualities Associated with Aquatic Plant Species in Big Cedar Lake

Aquatic Plant Species Present	Ecological Significance
Ceratophyllum demersum (coontail)	Provides good shelter for young fish; supports insects valuable as food for fish and ducklings; native
Chara spp. (muskgrasses)	A favorite waterfowl food and fish habitat, especially for young fish; native
Elodea canadensis (common waterweed)	Provides shelter and support for insects which are valuable as fish food; native
Heteranthera dubia (water stargrass)	Locally important food source for waterfowl and forage for fish; native
Myriophyllum sibiricum (northern watermilfoil)	Leaves and fruit provide food for waterfowl and shelter and foraging for fish.
Najas flexilis (slender naiad)	Important food source for waterfowl, marsh birds, and muskrats; provides food and shelter for fish; native
Najas guadalupensis (southern naiad)	Important food source for waterfowl, marsh birds, and muskrats; provides food and shelter for fish; native
Nitella spp. (stonewort)	Sometimes grazed by waterfowl; forage for fish; native
Nuphar variegata (spatterdock)	Provides food for waterfowl and mammals; provides habitat for fish and aquatic invertebrates.
Nymphaea odorata (white water lily)	Seeds consumed by waterfowl while rhizoids consumed by mammals.
Potamogeton crispus (curly-leaf pondweed)	Adapted to cold water; mid-summer die-off can impair water quality; invasive nonnative
Potamogeton gramineus (variable pondweed)	The fruit is an important food source for many waterfowl; also provides food for muskrat, deer, and beaver; native
Potamogeton illinoensis (Illinois pondweed)	Provides shade and shelter for fish; harbor for insects; seeds are eaten by waterfowl.
Potamogeton natans (floating-leaf pondweed)	The late-forming fruit provides important food source for ducks; provides good fish habitat due to its shade and foraging opportunities; native
Potamogeton zosteriformis (flat-stem pondweed)	Provides some food for ducks; native
Ranunculus aquatilis (white water crowfoot)	Provides habitat for fish and macroinvertebrates.
Stuckenia pectinata (Sago pondweed)	This plant is the most important pondweed for ducks, in addition to providing food and shelter for young fish; native
Utricularia spp. (bladderworts)	Stems provide food and cover for fish; native
Vallisneria americana (eelgrass/water celery)	Provides good shade and shelter, supports insects, and is valuable fish food; native

Note: Information obtained from A Manual of Aquatic Plants by Norman C. Fassett, University of Wisconsin Press; Guide to Wisconsin Aquatic Plants, Wisconsin Department of Natural Resources; and, Through the Looking Glass: A Field Guide to Aquatic Plants, Wisconsin Lakes Partnership, University of Wisconsin-Extension.

Source: SEWRPC

are intolerant of ecological disturbance receive high C values, while natives that are disturbance tolerant receive low C values. Invasive species are assigned a C value of 0. A lake's FQI is calculated as the average C value of species identified in the lake, divided by the square root of species richness. The Lake's FQI in 2018 was 29.0 while the 2023 FQI was 29.8. Both surveys had higher FQI values than the 20.0 average FQI for the Southeastern Wisconsin Till Plains ecoregion, indicating that the Lake supports species that are more sensitive to ecological disturbance than the average lake in the Region.

Eleven sensitive species, as defined by the Commission as a species with a C value of seven or more, were identified during the 2023 survey: muskgrass, whorled watermilfoil (*Myriophyllum verticillatum*), southern naiad (*Najas guadalupensis*), nitella (*Nitella* spp.), large-leaf pondweed (*Potamogeton amplifolius*), Fries' pondweed (*Potamogeton friesii*), variable-leaved pondweed (*Potamogeton gramineus*), small pondweed (*Potamogeton pusillus*), stiff pondweed (*Potamogeton strictifolius*), white water crowfoot (*Ranunculus aquatilis*), and common bladderwort (*Utricularia vulgaris*). The number of sensitive species identified at each survey points are shown in Figure 2.4.

Table 2.3
Aquatic Plant Species Observed in Big Cedar Lake: 1968-2023

Aquatic Plant Species	Transect Survey						Point-Intercept Survey	
	1968	1986-1989	1993	2001	2008	2013	2018	2023
Ceratophyllum demersum	X	X	X	X	X	X	X	X
Chara spp.	X	X	X	X	X	X	X	X
Elodea canadensis		X	X	X	X	X	X	X
Heteranthera dubia		X		X	X	X	X	X
Lemna minor		X	X	X	X	X	X	X
Lythrum salicaria		X						
Myriophyllum exalbescens	X							
Myriophyllum sibiricum								X
Myriophyllum spicatum		X	X	X	X	X	X	X
Myriophyllum verticillatum								X
Najas flexilis		X	X	X	X	X	X	X
Najas guadalupensis							X	X
Najas marina		X		X	X	X	X	X
Najas minor		X						
Nitella spp.		X		X	X	X	X	X
Nuphar variegata	X	X	X	X	X	X	X	X
Nymphaea odorata	X	X	X	X	X	X	X	X
Polygonum amphibium	X						X	
Potamogeton amplifolius	X	X	X	X	X	X	X	X
Potamogeton crispus	X	X	X	X	X	X	X	X
Potamogeton friesii			X	X	X	X	X	X
Potamogeton gramineus		X	X	X	X	X	X	X
Potamogeton illinoensis		X	X	X	X	X	X	X
Potamogeton natans		X	X	X	X	X	X	X
Potamogeton praelongus					X	X	X	
Potamogeton pusillus		X			X	X	X	X
Potamogeton richardsonii	X	X	X	X	X	X	X	X
Potamogeton zosteriformis		X	X	X	X	X	X	X
Ranunculus aquatilis		X	X	X	X	X	X	
Sagittaria sp.	X	X		X	X	X		
Scirpus sp.	X	X	X	X	X	X		
Schoenoplectus acutus		X	X	X	X	X	X	
Schoenoplectus americanus		X	X	X	X	X	X	
Schoenoplectus tabernaemontanii	X	X	X	X	X	X		
Sparganium eurycarpum	X	X	X	X	X	X		
Stuckenia pectinata	X	X	X	X	X	X	X	X
Utricularia vulgaris		X	X	X	X	X	X	X
Vallisneria americana	X	X	X	X	X	X	X	X
Zannichellia palustris		X		X	X	X		
Species Total	15	32	25	30	32	32	29	26

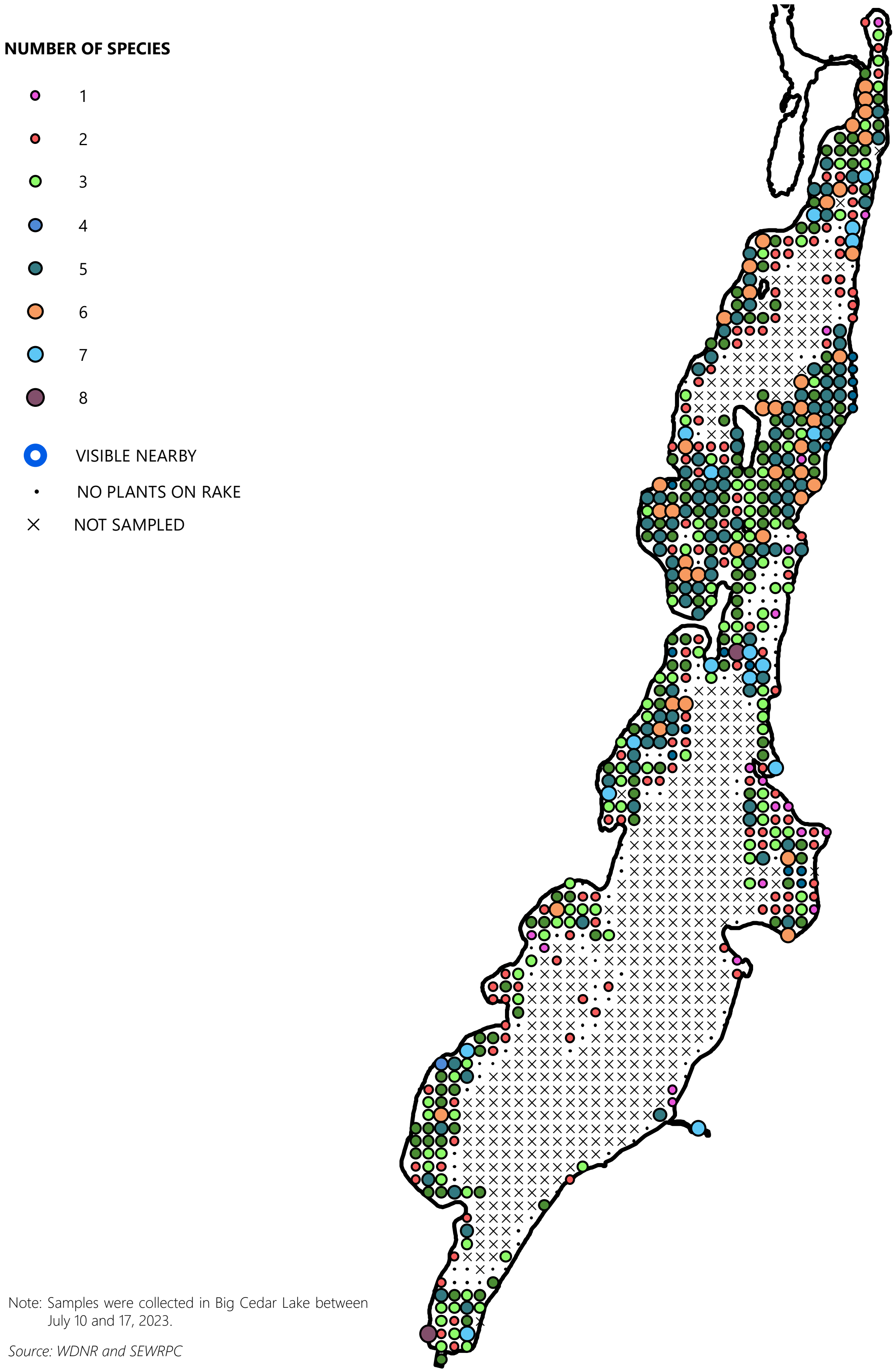
Note: Red text indicates nonnative and/or invasive species.

Source: SEWRPC

Relative Species Abundance

Based on the 2023 point-intercept survey, the five most abundant submerged aquatic plant species in the Lake were, in decreasing order of abundance: 1) muskgrass, 2) eelgrass (*Vallisneria americana*), 3) variable-leaved pondweed, 4) slender naiad (*Najas flexilis*), and 5) sago pondweed (*Stuckenia pectinata*). The aquatic plant community within the lake somewhat stratified with water depth, with slightly different communities in the shallow (three to eight feet), moderate (nine to eighteen feet), and deep (over eighteen feet) zones of the Lake. The shallow zone largely consisted of muskgrass, eelgrass, slender naiad, variable-leaved pondweed, and sago pondweed. The moderate zone had higher diversity, with the aforementioned species but also

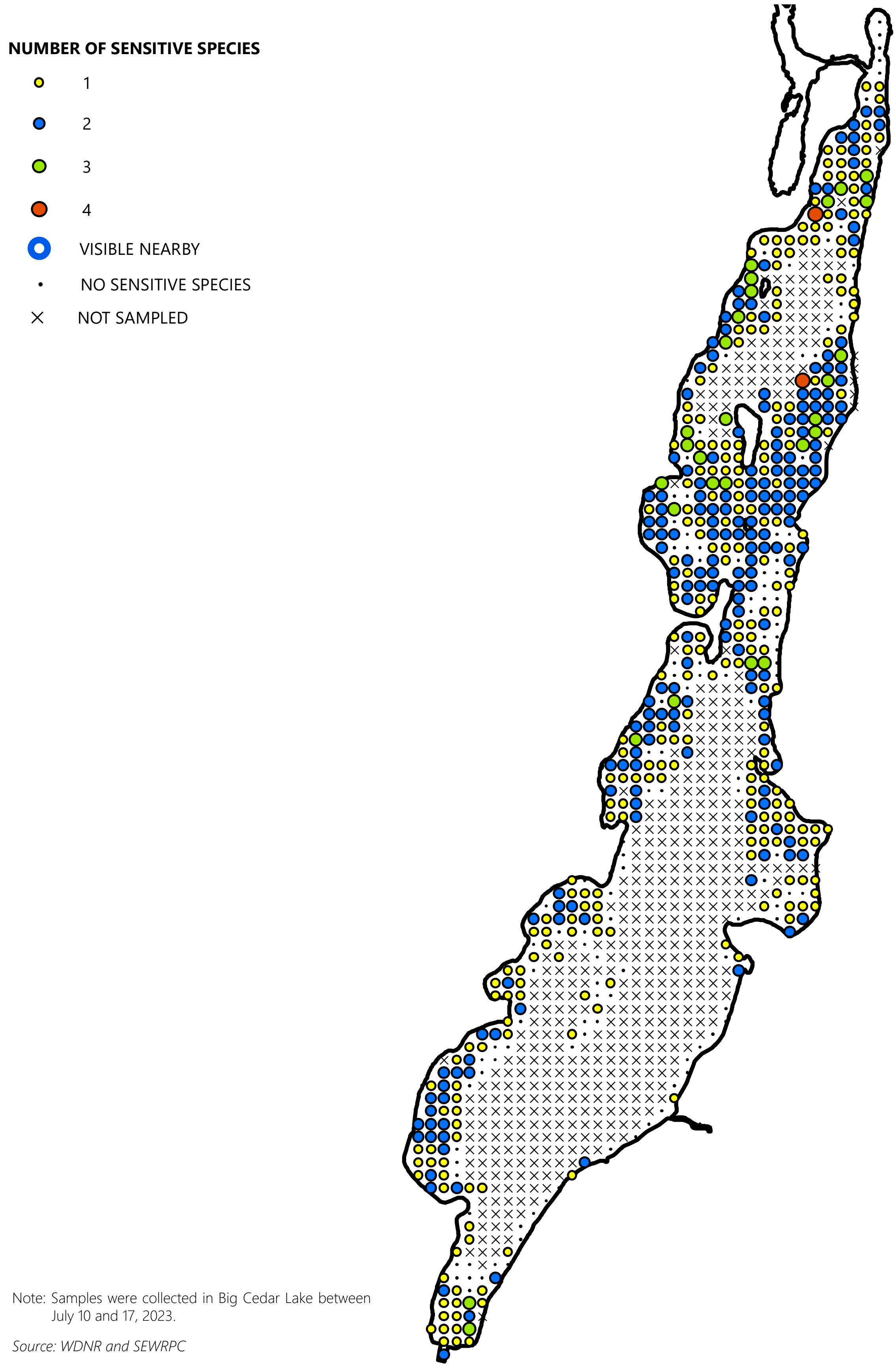
Figure 2.3
Species Richness in Big Cedar Lake: July 2023



Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

Figure 2.4
Sensitive Species Richness in Big Cedar Lake: July 2023



Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

more observations of Illinois pondweed, Fries' pondweed, flatstem pondweed, coontail, southern naiad, and common bladderwort. Few species were observed in the deep zone, which was dominated by nitella but also had observations of muskgrass and coontail. Exotic Eurasian watermilfoil, curly-leaf pondweed, and spiny naiad (*Najas marina*), first observed in a 1986 survey of Big Cedar Lake, were observed relatively infrequently within the lake in the 2023 survey. Photographs of the Lake's aquatic plant community are presented in Figure 2.5.

Since the 1968 survey, muskgrass, a type of macroalgae, has consistently been either the most or one of the most abundant aquatic plants in the Lake. This is a critical group of species to protect, as muskgrass has several unique environmental preferences as well as beneficial functions in lakes. Muskgrass is nearly always associated with hard water lakes, particularly those with significant groundwater seepage and springs. This species has been found to promote marl formation and induce dissolved phosphorus to be precipitated to the lake bottom, reducing phosphorus concentrations in the water column and thus improving water clarity.[17] Additionally, muskgrass is a favorite waterfowl food and helps stabilize lake-bottom sediment, as it has been observed to grow deeper than most vascular plants. Its prevalence in a lake's aquatic plant community may tangibly contribute to lake water quality, promoting the growth of other desirable native plant species.

Changing aquatic plant communities are often the result of change in and around a lake. Causes of change include aquatic plant management practices, land use (which in turn commonly affects nutrient and water supply and availability), lake use, climate, and natural biological processes such as natural population cycles of specific plants. Regarding plant-specific population cycles, it is not uncommon for various pondweed species to succeed each other during the growing season, with some species being more prevalent in cooler water, while others are more prevalent in warmer water. In contrast to such seasonal succession, aquatic plants such as EWM are known to have year-to-year abundance and relative scarcity cycles, possibly due to climatic factors and/or herbivory cycles related to the relative abundance of milfoil weevils (*Eurhychiopsis lecontei*).

Apparent Changes in Observed Aquatic Plant Communities: 2018 Versus 2023

The distribution of the most common aquatic plant species identified as part of the 2023 survey is mapped in Appendix A. The 2023 aquatic plant inventory identified 26 species of aquatic plants (29 including boat survey observations of *Nuphar variegata*, *Decodon verticillatus*, and *Typha* sp.) in the lake while the 2018 survey identified 30 species. Overall, the number of aquatic plant species in the Lake has substantially increased since the 1968 survey (14 species identified), but this may be due in part to the difference in methodology and better aquatic plant identification over the course of these surveys.

In addition to the number of different aquatic plant species detected in the Lake, several other comparisons can be drawn between the 2018 and 2023 aquatic plant survey results, as examined below.

- The total littoral vegetated frequency of occurrence remained high but decreased slightly (86.6 to 82.5 percent) between 2018 and 2023. Most of the lake bottom in the photic zone continues to be covered by aquatic vegetation, with the only large expanses of unvegetated sediment in the very shallow nearshore areas (up to three feet deep). As also noted in the 2019 aquatic plant management plan, these areas are predominantly sand and gravel bottom and may not provide enough nutrients for a more abundant plant community.[18] Physical stress from wave activity may limit plant growth in these areas as well.

- The MDC appears to have remained consistent around 20 feet between 2018 and 2023, indicating that water clarity continues to support aquatic plant growth in nearshore areas of the lake.

- The composition and order of the five most common species shifted between 2018 and 2023. Muskgrass remained the most observed species in 2018 and 2023. Slender naiad, the second-most observed species in 2018, became the third-most observed species in 2023 as eelgrass moved from third into second. Illinois pondweed, the fourth-most observed species in 2018 at 24.8 percent frequency of occurrence was much less abundant in 2023 (1.4 percent) while variable-leaved pondweed was the fourth-most observed in 2023 at 33.7 percent frequency of occurrence. Sago pondweed remained the fifth-most observed species in 2018 and 2023.

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[17] *M. Scheffer and E.H. van Ness, "Shallow Lakes Theory Revisited: Various Alternative Regimes Driven by Climate, Nutrient, Depth, and Lake Size," Hydrobiologia 584, 2007.*

[18] *Marine Biochemists, 2018, op. cit.*

Figure 2.5
Aquatic Plant Community on Big Cedar and Gilbert Lakes

Shoreline of Sensitive Area on Big Cedar

Gilbert Lake Channel

Starry Stonewort on Big Cedar

Aquatic Vegetation in Gilbert Lake

Source: SEWRPC

- Residents and lake users have noted the declining population of "weeds" in Big Cedar Lake and expressed concerns that lack of aquatic vegetation may negatively affect the lake fishery. While the overall vegetative cover did not substantially change between 2018 and 2023, cover by large pondweeds (*Potamogeton amplifolius* and *Potamogeton illinoensis*), which provide excellent gamefish habitat, was significantly lower in 2023 than in 2018. Native eelgrass and variable pondweed, which are smaller in stature and provide different habitat than large pondweeds, were observed much more frequently in 2023 than in 2018 and may have replaced large pondweed stands in some areas.

- EWM occurrence was consistent between 2018 and 2023 while curly-leaf pondweed was found at six more points in 2023 than 2018 and spiny naiad was observed at 16 fewer points in 2023 than in 2018.

- Starry stonewort, an invasive macroalga, was observed for the first time in Big Cedar Lake during the 2023 survey. This species has been previously found in nearby Little Cedar, Lucas, Pike, and Silver lakes in Washington County.

- Several native aquatic plant species have small populations within Big Cedar Lake. White water crowfoot, water stargrass, elodea, white water lily, and several pondweeds (clasping-leaf, Illinois, large-leaf and stiff) were only observed at a few points in the 2023 survey. Spatterdock was not recorded at a PI point but was observed several times throughout the survey and recorded as a boat survey species. Several of these species were only observed in bays or other sheltered areas.

As was described earlier, sensitive aquatic plant species are the most vulnerable to human disturbance. Therefore, changes in sensitive species abundance can indicate the general magnitude of human disturbance derived stress on a waterbody's ecosystem. The number of sensitive species (i.e., species with C value of seven or greater) at each sample point during 2018 and 2023 were contrasted (Figure 2.6). Overall, the sensitive species richness increased between 2018 and 2023, reflecting a stable and healthy plant community. A few significant observations were noted:

- The most common sensitive "species" in the Lake in both the 2018 and 2023 survey was muskgrass.[19] While Commission staff did not identify muskgrass to species at each survey point, specimens of *Chara contraria* and *Chara globularis* were observed during the survey.

- Sensitive species were distributed throughout almost the entire Lake; only 45 of the 615 surveyed points (7.3 percent) did not have a sensitive species present (see Figure 2.4).

- Gains and losses in the number of sensitive species at each survey point were distributed throughout the Lake, with more points gaining sensitive species numbers than losing them (see Figure 2.6).

Gilbert Lake Aquatic Plant Community

Commission staff competed the PI survey of Gilbert Lake on August 4th, 2023. The southern basin of Gilbert Lake is shallow and thickly vegetated with water lilies, so Commission staff focused the survey effort on the deeper northern half of the Gilbert Lake as well as the channel between Gilbert and Big Cedar since as these areas included in the District's harvesting permit. Despite its small size, Gilbert Lake is quite diverse with Commission staff observing 34 species (including visual observations and two boat survey species) (see Table 2.4). The most common species in Gilbert Lake were muskgrass, coontail, sago pondweed, EWM, and common bladderwort. The open-water area in the northern basin sustains a dense muskgrass bed while the nearshore areas grade from submergent vegetation covered with water lilies (*Nymphaea odorata* and *Nuphar variegata*) and arum-leaved arrowhead (*Sagittaria cuneata*) into emergent vegetation (*Decodon verticillatus*, *Schoenoplectus acutus*, *Typha* spp.) near the shore. Despite the relatively isolated nature of the lake, Commission staff did observe invasive EWM, curly-leaf pondweed, and starry stonewort within the lake. Photos of the Gilbert Lake aquatic plant community are presented in Figure 2.5.

Invasive Species

This subsection will discuss invasive species observations in Big Cedar and Gilbert lakes, as these are often the focus of aquatic plant management efforts.

Eurasian Watermilfoil (EWM)

EWM is one of eight milfoil species found in Wisconsin and is the only exotic or nonnative milfoil species. EWM favors mesotrophic to moderately eutrophic waters, fine organic-rich lake-bottom sediment, warmer water with moderate clarity and high alkalinity, and tolerates a wide range of pH and salinity.[20,21] In Southeastern Wisconsin, EWM can grow rapidly and has few natural enemies to inhibit its growth. Furthermore, it can grow explosively following major environmental disruptions, as small fragments of EWM can grow into entirely new plants.[22] For reasons such as these, EWM can grow to dominate an aquatic plant community

[19] *Commission staff did not identify muskgrass to species at each point in the plant survey, so all references to muskgrass are to the genus (Chara spp.). All species of muskgrass are currently identified as sensitive species.*

[20] *U. S. Forest Service, Pacific Islands Ecosystems at Risk (PIER), 2019.: hear.org/pier/species/myriophyllum_spicatum.htm*

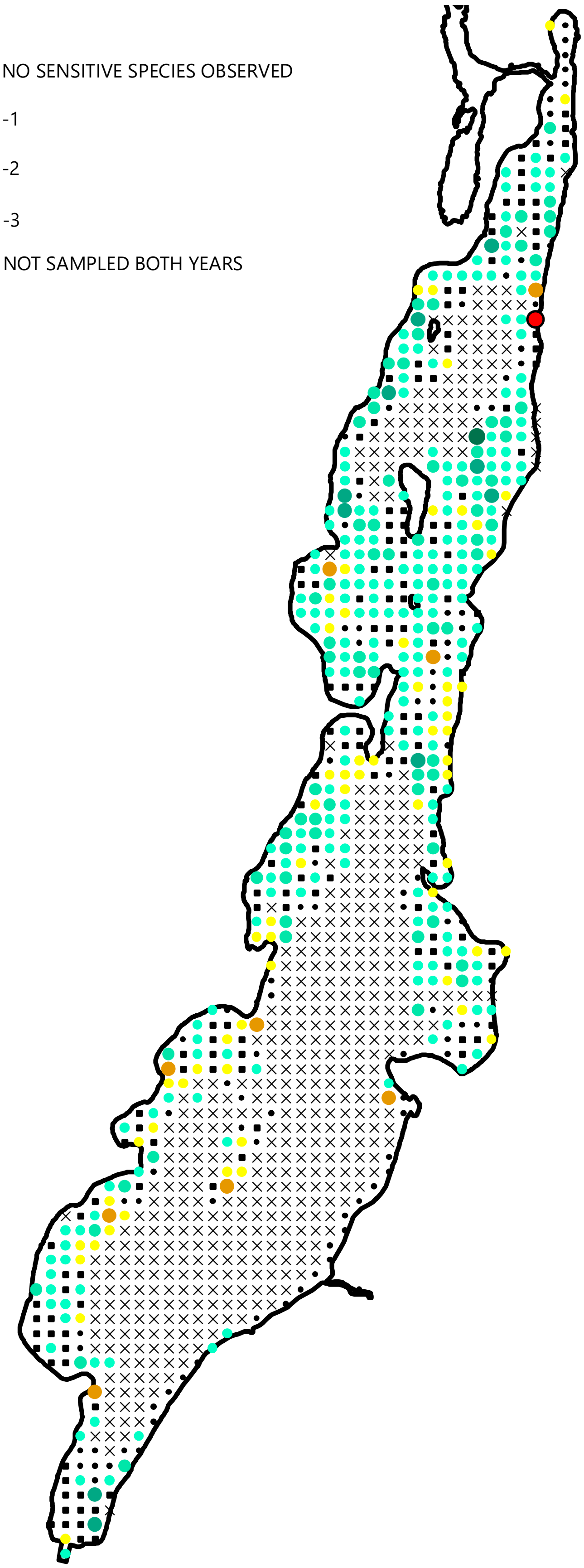
[21] *S.A. Nichols and B. H. Shaw, "Ecological Life Histories of the Three Aquatic Nuisance Plants: Myriophyllum spicatum, Potamogeton crispus, and Elodea canadensis," Hydrobiologia 131(1), 1986.*

[22] Ibid.

Figure 2.6
Change in Sensitive Species Distribution in Big Cedar Lake: 2018 vs. 2023

CHANGE IN SENSITIVE SPECIES RICHNESS

■	SPECIES PRESENT, NO CHANGE	•	NO SENSITIVE SPECIES OBSERVED
●	1	●	-1
●	2	●	-2
●	3	●	-3
●	4	×	NOT SAMPLED BOTH YEARS



Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

Table 2.4
Gilbert Lake Aquatic Plant Survey Summary: August 2023

Aquatic Plant Species	Native or Invasive	Number of Sites Found[a] (2023)	Frequency of Occurrence Within Vegetated Areas[b] (2023)	Average Rake Fullness[c] (2023)	Relative Frequency of Occurrence[d] (2023)	Visual Sightings[e] (2023)
Ceratophyllum demersum (coontail)	Native	27	32.1	1.7	12.6	6
Chara spp. (muskgrass)	Native	53	63.1	2.4	24.8	0
Decodon verticillatus (swamp loosestrife)	Native	0	--	--	--	1
Elodea canadensis (waterweed)	Native	2	2.4	1.0	0.9	0
Heteranthera dubia (water stargrass)	Native	2	2.4	1.0	0.9	0
Lemna sp. (duckweeds)	Native	1	1.2	1.0	0.5	3
Lemna trisulca (forked duckweed)	Native	0	--	--	--	1
Myriophyllum sibiricum (northern watermilfoil)	Native	2	2.4	1.0	0.9	0
Myriophyllum spicatum (Eurasian watermilfoil)	Invasive	19	22.6	1.2	8.9	15
Myriophyllum verticillatum (whorled watermilfoil)	Native	0	--	--	--	1
Najas flexilis (slender naiad)	Native	0	--	--	--	1
Najas marina (spiny naiad)[f]	Naturalized	11	13.1	1.2	5.1	5
Nitellopsis obtusa (starry stonewort)	Invasive	2	2.4	1.5	0.9	0
Nuphar variegata (spatterdock)[g]	Native	2	2.4	2.0	0.9	12
Nymphaea odorata (white water lily)	Native	18	21.4	1.9	8.4	41
Potamogeton amplifolius (large-leaf pondweed)[h]	Native	1	1.2	1.0	0.5	0
Potamogeton crispus (curly-leaf pondweed)	Invasive	0	--	--	--	1
Potamogeton friesii (Fries' pondweed)	Native	4	4.8	1.0	1.9	0
Potamogeton gramineus (variable pondweed)	Native	2	2.4	1.5	0.9	10
Potamogeton illinoensis (Illinois pondweed)[h]	Native	0	--	--	--	2
Potamogeton pusillus (small pondweed)	Native	1	1.2	1.0	0.5	0
Potamogeton richardsonii (clasping-leaf pondweed)[h]	Native	9	10.7	1.4	4.2	6
Potamogeton zosteriformis (flat-stem pondweed)	Native	3	3.6	1.3	1.4	1
Ranunculus aquatilis (white water crowfoot)	Native	6	7.1	1	2.8	1
Sagittaria cuneata (arum-leaved arrowhead)	Native	7	8.3	1.1	3.3	11
Schoenoplectus acutus (hardstem bulrush)	Native	0	--	--	--	2
Spirodela polyrhiza (large duckweed)	Native	0	--	--	--	1
Stuckenia pectinata (Sago pondweed)[h]	Native	21	25.0	1.4	21.0	22
Typha angustifolia (narrow-leaved cattail)	Native	0	--	--	--	2
Utricularia vulgaris (bladderwort)	Native	17	20.2	1.2	7.9	18
Vallisneria americana (eel-grass/wild celery)[h]	Native	3	3.6	1.0	1.4	0
Wolffia sp. (watermeal)	Native	1	1.2	1.0	0.5	0

Table continued on next page.

Table 2.4 (Continued)

Note: Red text indicates non-native and/or invasive species. See Appendix A for distribution maps and identifying features

[a] *Number of Sites refers to the number of sites at which the species was retrieved and identified on the rake during sampling.*

[b] *Frequency of Occurrence, expressed as a percent, is the percentage of times a particular species occurred when there was aquatic vegetation present at the sampling site.*

[c] *Average rake fullness is the average amount, on a scale of 0 to 3, of a particular species at each site where that species was retrieved by the rake.*

[d] *Relative Frequency of Occurrence, expressed as a percent, is the frequency of that particular species compared to the frequencies of all species present.*

[e] *Visual Sightings is the number of sites where that particular species was visually observed within six feet of the actual rake haul location but was not actually retrieved on the rake and was not, therefore, assigned a rake fullness measurement for that site. At sites where this occurred, the species was simply marked as "present" at that site. Recording the number of visual sightings helps give a better picture of species distribution throughout the lake.*

[f] *Spiny naiad was added to the NR 40 list as a restricted species in 2015, meaning it is not allowed to be transported, transferred, or introduced without a permit. Because the species is not native to Wisconsin and can become quite abundant, especially in lakes of poor water quality with hard water, it is currently considered a "naturalized" native species that can provide good habitat and food for fish and macroinvertebrates. Paul M. Skawinski,* Aquatic Plants of the Upper Midwest, 2nd Edition, *2014;* Through the Looking Glass: A Field Guide to Aquatic Plants, 2nd Edition, *2013.*

[g] *Although* Nuphar variegata *was not observed at a survey point in 2022, this species was recorded as a boat survey species near point 58 in the southeastern portion of the Lake.*

[h] *Considered a high-value aquatic plant species known to offer important values in specific aquatic ecosystems under Section NR 107.08 (4) of the Wisconsin Administrative Code.*

Source: Wisconsin Department of Natural Resources and SEWRPC in as little as two years.[23, 24] In such cases, EWM can displace native plant species and interfere with the aesthetic and recreational use of waterbodies. However, established populations may rapidly decline after approximately ten to 15 years.[25]

Human produced EWM fragments (e.g., created by boating through EWM), as well as fragments generated from natural processes (e.g., wind-induced turbulence, animal feeding/disturbance) readily colonize disturbed sites. contributing to EWM spread. EWM fragments can remain buoyant for two to three days in summer and two to six days in fall, with larger fragments remaining buoyant longer than smaller ones.[26] The fragments can also cling to boats, trailers, motors, and/or bait buckets where they can remain alive for weeks contributing to transfer of milfoil to other lakes. For these reasons, it is especially important to remove all vegetation from boats, trailers, and other equipment after removing them from the water and prior to launching in other waterbodies.

EWM was observed at 5.7 percent of vegetated points in Big Cedar Lake during 2018 and 5.4 percent of surveyed points in 2023. The EWM population does not appear to have changed much in the intervening years, with similar average rake fullness (1.3 in 2018 and 1.4 in 2023) and the highest EWM coverage at the northern end of the lake near the channel to Gilbert Lake in both surveys (see Figure 2.7).

Within Gilbert Lake, Commission staff observed EWM at 22.6 percent of vegetated points and growing at depths of 2.5 to 8 feet. These points were almost entirely located within the northern basin as the Commission survey did not extend far into the shallow southern basin.

Starry Stonewort

Starry stonewort is a novel aquatic invasive macroalga species in Wisconsin. As a member of the Characeae, SSW (SSW) is related to native *Chara*, *Lychnothamnus*, *Nitella*, and *Tolypella* species, which have roughly similar characteristics and are found in many hardwater lakes across Wisconsin. Native to Eurasia, the first discovery of SSW in North America was in the St. Lawrence Seaway in 1978; it has since spread to several northeastern and midwestern US states as well as southern Ontario.[27] First observed within Wisconsin in Little Muskego Lake during September 2014, SSW has since been found in 17 lakes in Southeastern Wisconsin.[28] Within Washington County, SSW has been observed in Green, Lucas, Little Cedar, Pike, and Silver lakes.

In its native range, SSW has been shown to provide food and habitat for aquatic organisms as well as enhance lake water quality by reducing sediment suspension and acting as a phosphorus sink.[29] In invaded lakes, SSW can form dense beds, with reported maximum heights of 4 to 7 feet, outcompete both native and other invasive plant species, and cover fish spawning areas.[30,31,32] This species is capable of both sexual and asexual reproduction, which can occur through plant fragments as well as the star-shaped bulbils for

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[23] *S.R. Carpenter, "The Decline of Myriophyllum spicatum in a Eutrophic Wisconsin (USA) Lake," Canadian Journal of Botany 58(5), 1980.*

[24] *Les, D. H., and L. J. Mehrhoff, "Introduction of Nonindigenous Vascular Plants in Southern New England: a Historical Perspective," Biological Invasions 1: 284-300, 1999.*

[25] *S.R. Carpenter, 1980, op. cit.*

[26] *J.D. Wood and M. D. Netherland, "How Long Do Shoot Fragments of Hydrilla (Hydrilla verticillata) and Eurasian Watermilfoil (Myriophyllum spicatum) Remain Buoyant?", Journal of Aquatic Plant Management 55: 76-82, 2017.*

[27] *starrystonewort.org/maps.*

[28] *apps.dnr.wi.gov/lakes/invasives/AISLists.aspx?species=STARRY_STONEW.*

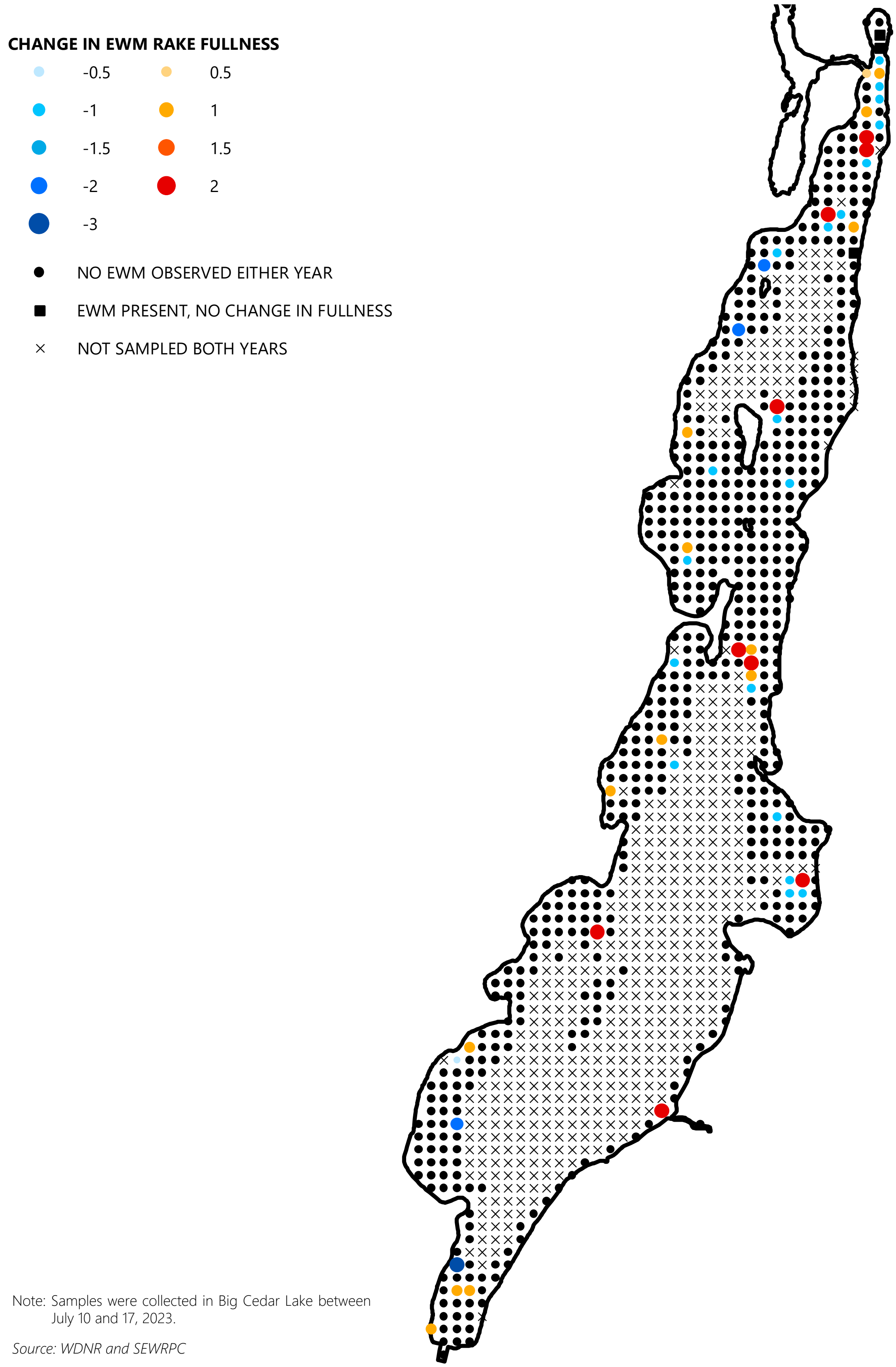
[29] *For a more complete review of SSW ecology in its native and invasive range, see D.J. Larkin, A.K. Monfils, A. Boissezon, R.S. Sleith, P.M. Skawinski, C.H. Welling, B.C. Cahill, and K.G. Karol, "Biology, Ecology, and Management of Starry Stonewort (Nitellopsis obtusa; Characeae): A Red-listed Eurasian Green Alga Invasive in North America," Aquatic Botany 148: 15-24, 2018 as well as State of Michigan, Status and Strategy for Starry Stonewort (Nitellopsis obtusa (Desv. In Loisel.) J. Groves) Management, last updated December 2017 (www.michigan.gov/documents/invasives/egle-ais-nitellopsis-obtusa-strategy_708937_7.pdf).*

[30] Ibid.

[31] *dnr.wisconsin.gov/sites/default/files/topic/Invasives/Nitellopsis%20obtusa.pdf.*

[32] *G.D. Pullman and G. Crawford, "A Decade of Starry Stonewort in Michigan," Lakeline 36-42, 2010.*

Figure 2.7
Change in Eurasian Watermilfoil (*Myriophyllum spicatum*) Distribution in Big Cedar Lake: 2018 vs. 2023



Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

which the species is named.[33] Only male species have been observed in North America thus far, indicating that all spread has been through asexual reproduction. Bulbils may stay viable in lake sediment for several years, making it extremely difficult to eradicate SSW from a waterbody.

Commission staff observed starry stonewort in both Big Cedar and Gilbert lakes during the 2023 survey; this was the first ever SSW observation for either lakes. In Big Cedar Lake, SSW was observed point 1088 of the PI survey, which is located approximately 200 feet from shore north of the Hacker Drive launch (see Appendix A). The SSW was growing at a depth of 16 feet intermixed with native species. After completing the PI survey, Commission staff returned to point 1088 and surveyed the area for several more minutes to confirm the finding. Live specimens and photos of the SSW were collected and presented to Julie Riley, District Office Administrator, upon returning to shore. Photos and pressed specimens were also provided to WDNR staff. In Gilbert Lake, Commission staff observed SSW at point 152 growing in two feet of water intermixed with native species (see Appendix A). Live SSW specimens and photos were collected and provided to WDNR staff.

At the request of the District, Commission staff conducted follow-up sub-PI surveys of SSW on both lakes and prepared an accompanying report describing these observations.[34] In summary, Commission staff found SSW within a one-acre area at between 12 to 17 feet deep in Big Cedar Lake near point 1088 of the PI survey and found SSW within a five-acre area at up to two feet deep in the southern basin of Gilbert Lake. Starry stonewort was mostly intermixed with native species in both lakes, but Gilbert Lake had at least one large, monocultural mat where no native species were present.

Other Exotic Submergent Aquatic Plants

Curly-leaf pondweed was observed at one point in the 2018 Big Cedar Lake survey, at seven points in the 2023 Big Cedar Lake survey, and at one point in the Gilbert Lake survey. This plant, like EWM, is identified in Chapter NR 109 of the *Wisconsin Administrative Code* as a nonnative invasive aquatic plant. Although survey data suggests that it is presently a minor species in terms of dominance, and, as such, is less likely to interfere with recreational boating activities, the plant can grow dense stands that exclude other high value aquatic plants. For this reason, curly-leaf pondweed must continue to be monitored and managed as an invasive member of the aquatic community. As curly-leaf pondweed senesces by midsummer, it may be underrepresented in the inventory data presented in this report.

Spiny naiad is native to North America but was introduced to, and has become naturalized in, Wisconsin. This species is not common within Big Cedar Lake, with observations at 22 points in 2018 and six points in 2023; nor does it grow densely where observed with an average rake fullness of one in 2023. However, spiny naiad is somewhat common with Gilbert Lake where Commission staff observed it at 13 percent of surveyed points. The WDNR has labeled spiny naiad as a restricted species in Wisconsin, identifying it as an established invasive species that has the potential to cause significant environmental or economic harm.[35] However, spiny naiad is reported to be used as a food source for waterfowl, marsh birds, muskrat, and shelter/forage area for fish.

2.3 PAST AND PRESENT AQUATIC PLANT MANAGEMENT PRACTICES

Aquatic plants have been controlled on Big Cedar Lake since at least the 1950s – the earliest date that control program records were kept by State agencies. However, aquatic plant control on the Lake probably predates the 1950s by several decades. This program initially involved the chemical treatment of aquatic plant growths with sodium arsenite. Big Cedar Lake was one of the three most heavily dosed water bodies in Wisconsin, receiving more than 90 tons of sodium arsenite between 1951 and 1963.[36] Applications of sodium arsenite were discontinued in 1969 by the State due to the potential health hazards it posed to aquatic life and human health.[37]

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[33] *dnr.wisconsin.gov/topic/Invasives/fact/StarryStonewort.html.*

[34] *SEWRPC Staff Memorandum, Starry Stonewort Surveys of Big Cedar and Gilbert Lakes, Washington County, Wisconsin, October 2023.*

[35] *Wisconsin Department of Natural Resources, Chapter NR 40, Invasive Species Identification, Classification and Control, April 2017.*

[36] *SEWRPC MR 137, 2001, op. cit.*

[37] Ibid.

The aquatic herbicide 2,4-D was used to control aquatic plant growth on Big Cedar Lake between 1985 and 1987.[38] 2,4-D is a systemic herbicide that is absorbed by the leaves and translocated to other parts of the plant; it is more selective than the other herbicides listed above and is most frequently used to control EWM. However, it can also kill beneficial species, such as water lilies. The District has not applied 2,4-D to the Lake since 1987 and has no plans to utilize 2,4-D or other chemical treatments in the near future.[39]

Since 1987, mechanical aquatic macrophyte harvesting has been the predominant method used to control aquatic plant growth on the Lake with a primary focus on facilitating recreational boating access and to a less extent angling and other forms of recreation. The District is currently permitted to harvest 19.71 acres and the District operates a shore pick-up program.[40,41] Generally, harvesting and shore pick-up operations begin during the second week of June and end by mid-September, although the District staff occasionally continue shore pick-up operations for a few days in late September some years. The District has maintained records of the total volume of harvested plants since 2006 (see Table 2.5). The total volume of aquatic plants harvested each year varies substantially, but harvested volumes are lower than peak volumes between 2009 and 2013. For a lake of its size, the harvest volumes within Big Cedar are remarkably low; this likely reflects the moderate nutrient availability within the lake, the predominance of low stature species (e.g., muskgrass) in its plant community, as well as the large expanses of the lake that are too deep to support aquatic vegetation.

Table 2.5
Aquatic Plants Harvested in Big Cedar and Gilbert Lakes: 2006-2023

Year	Plant Material Removed (cubic yards)
2006	109.8
2007	155.3
2008	168.6
2009	244.1
2010	268.5
2011	257.4
2012	297.3
2013	221.9
2014	104.3
2015	164.2
2016	86.5
2017	108.7
2018	133.1
2019	48.8
2020	78.2
2021	136.5
2022	122.2
2023	96.5
Mean Per Year	155.7

Source: Big Cedar Lake Protection and Rehabilitation District and SEWRPC

A benefit of harvesting versus chemical treatment is that harvesting physically removes plant mass and the nutrients contained therein. The Commission calculated the pounds of total phosphorus removed through harvesting in Big Cedar Lake by multiplying the annual mass of aquatic plants removed by the phosphorus concentration of those aquatic plants, with the following notes and assumptions:

- The density of the wet harvested plants was assumed to be approximately 300 pounds per cubic yard.
- The amount of phosphorus contained by aquatic plants varies by species, lake, and time. The phosphorus content of harvested plants used estimates from the Wisconsin Lutheran College (WLC) on Pewaukee Lake, the U.S. Geological Survey on Whitewater and Rice lakes (Whitewater-Rice), and a study conducted on a eutrophic lake in Minnesota (Minnesota). The WLC study assumed that plant wet weight is 6.7 percent of dry weight and that total phosphorus constitutes 0.2 percent of the total dry weight of the plant. The Whitewater-Rice and Minnesota studies assumed that dry weight is 15 and 7 percent of the wet weight, respectively, and phosphorus constituted 0.31 and 0.30 percent of the dry plant weight, respectively. Assumed values for the percent of dry weight to wet weight and the total phosphorus concentrations are similar to those found other studies.[42,43]

[38] *SEWRPC MR 137, 2001, op. cit.*

[39] *Personal communication between District and Commission staff on October 11, 2023.*

[40] Ibid.

[41] *WDNR Permit SE-2019-67-1609M, 2019, op. cit.*

[42] *K.M. Carvalho and D.F. Martin, "Removal of Aqueous Selenium by Four Aquatic Plants," Journal of Aquatic Plant Management 39: 33-36, 2001.*

[43] *G. Thiébaut "Phosphorus and Aquatic Plants. In: P.J. White and J.P. Hammond (eds) The Ecophysiology of Plant-Phosphorus Interactions," Plant Ecophysiology 7, 2008.*

Using these methods, the Commission estimates that aquatic plant harvesting has removed approximately 680 pounds of phosphorus from the Lake during the six years for which plant harvest records are available (see Figure 2.8). The District's harvesting removes an average of 38 pounds of phosphorus from the Lake each year. A 2001 Commission study estimated that the average total annual phosphorus load to the Lake was 2,340 pounds.[44] Therefore, aquatic plant harvesting may remove up to 1.6 percent of the total phosphorus contributed annually by surface runoff and tributary streams.

2.4 POTENTIAL AQUATIC PLANT CONTROL METHODOLOGIES

Aquatic plant management techniques can be classified into six categories.

- *Physical measures* include lake bottom coverings
- *Biological measures* include the use of organisms such as herbivorous insects
- *Manual measures* involve physically removing plants by hand or using hand-held tools such as rakes
- *Mechanical measures* rely on artificial power sources and remove aquatic plants with a machine known as a harvester or by suction harvesting
- *Chemical measures* use aquatic herbicides to kill nuisance and nonnative plants *in-situ*
- *Water level manipulation measures* utilize fluctuations in water levels to reduce aquatic plant abundance and promote growth of specific native species

All aquatic plant control measures are stringently regulated and most require a State of Wisconsin permit. Chemical controls, for example, require a permit and are regulated under *Wisconsin Administrative Code* Chapter NR 107, "Aquatic Plant Management" while placing bottom covers (a physical measure) requires a WDNR permit under Chapter 30 of the *Wisconsin Statutes*. All other aquatic plant management practices are regulated under *Wisconsin Administrative Code* Chapter NR 109, "Aquatic Plants: Introduction, Manual Removal and Mechanical Control Regulations." Furthermore, the aquatic plant management measures described in this plan are consistent with the requirements of Chapter NR 7, "Recreational Boating Facilities Program," and with the public recreational boating access requirements relating to eligibility under the State cost-share grant programs set forth in *Wisconsin Administrative Code* Chapter NR 1, "Natural Resources Board Policies." Water level manipulations require a permit and are regulated under *Wisconsin Statutes* 30.18 and 31.02.[45,46] More details about aquatic plant management each are discussed in the following sections while recommendations are provided later in this document.

Non-compliance with aquatic plant management permit requirements is an enforceable violation of Wisconsin law and may lead to fines and/or complete permit revocation. The information and recommendations provided in this memorandum help frame permit requirements. Permits can cover up to a five-year period.[47] At the end of that period, the aquatic plant management plan must be updated. The updated plan must consider the results of a new aquatic plant survey and should evaluate the success, failure, and effects of earlier plant management activities that have occurred on the lake.[48] These plans and plan execution are reviewed and overseen by the WDNR regional lakes and aquatic invasive species coordinators.[49]

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[44] *SEWRPC MR 137, 2001, op. cit.*

[45] *docs.legis.wisconsin.gov/statutes/statutes/30/ii/18.*

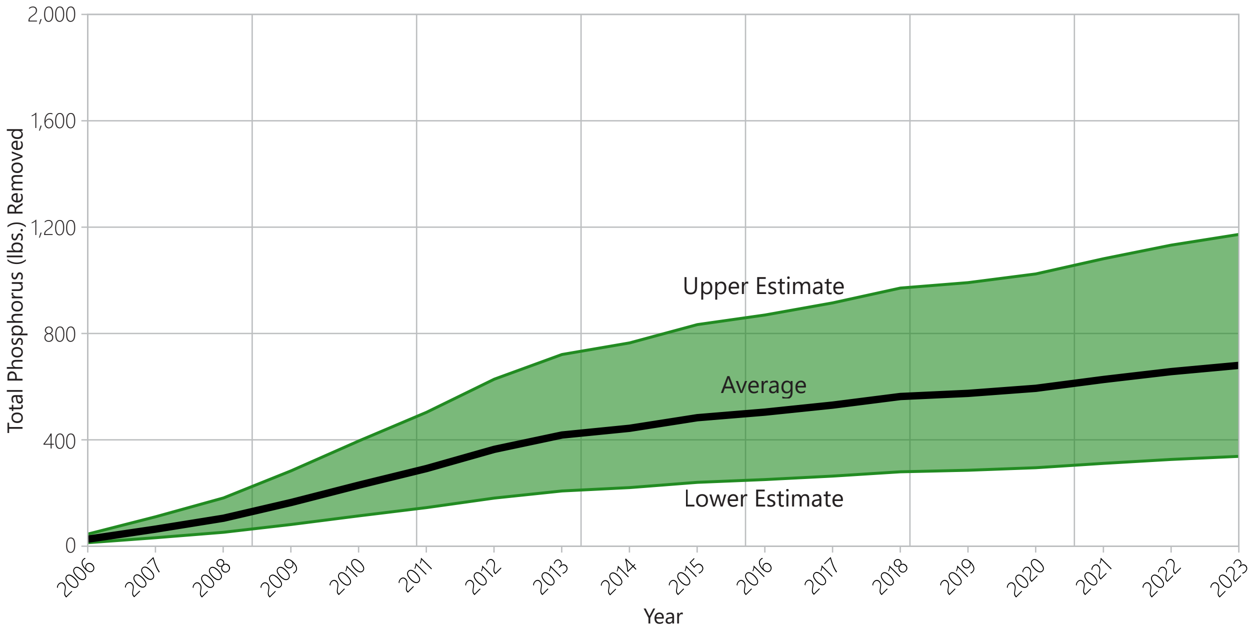
[46] *docs.legis.wisconsin.gov/statutes/statutes/31/02.*

[47] *Five-year permits allow a consistent aquatic plant management plan to be implemented over a significant length of time. This process allows the selected aquatic plant management measures to be evaluated at the end of the permit cycle.*

[48] *Aquatic plant harvesters must report harvesting activities as one of the permit requirements.*

[49] *Information on the current aquatic invasive species coordinator is found on the WDNR website.*

Figure 2.8
Big Cedar Lake Phosphorus Removal by Harvesting: 2006-2023



Source: Big Cedar Lake Protection and Rehabilitation District and SEWRPC

Physical Measures

Lake-bottom covers and light screens provide limited control of rooted plants by creating a physical barrier that reduces or eliminates plant-available sunlight. Various materials such as pea gravel or synthetics like polyethylene, polypropylene, fiberglass, and nylon can be used as covers. The longevity, effectiveness, and overall value of some physical measures is questionable. The WDNR does not permit these kinds of controls. Consequently, lake-bottom covers are not a viable aquatic plant control strategy for the Lake.

Biological Measures

Biological control offers an alternative to direct human intervention to manage nuisance or exotic plants. Biological control techniques traditionally use herbivorous insects that feed upon nuisance plants. This approach has been effective in some southeastern Wisconsin lakes.[50] For example, milfoil weevils (*Eurhychiopsis lecontei)* have been used to control EWM. Milfoil weevils do best in waterbodies with balanced panfish populations,[51] where dense EWM beds reach the surface close to shore, where natural shoreline areas include leaf litter that provides habitat for over-wintering weevils, and where there is comparatively little boat traffic. This technique is not presently commercially available making the use of milfoil weevils non-viable.

Manual Measures

Manually removing specific types of vegetation is a highly selective means of controlling nuisance aquatic plant growth, including invasive species such as EWM. Two commonly employed methods include hand raking and hand pulling. Both physically remove target plants from a lake. Since plant stems, leaves, roots, and seeds are actively removed from the lake, the reproductive potential and nutrients contained by pulled/raked plants material is also removed. These plants, seeds, and nutrients would otherwise re-enter the lake's water column or be deposited on the lake bottom. Hence, this aquatic plant management technique helps

[50] *B. Moorman, "A Battle with Purple Loosestrife: A Beginner's Experience with Biological Control," LakeLine 17(3): 20-21, 34-37, September 1997; see also, C.B. Huffacker, D.L. Dahlsen, D.H. Janzen, and G.G. Kennedy, Insect Influences in the Regulation of Plant Population and Communities, pp. 659-696, 1984; and C.B. Huffacker and R.L. Rabb, editors, Ecological Entomology, John Wiley, New York, New York, USA.*

[51] *Panfish such as bluegill and pumpkinseed are predators of herbivorous insects. High populations of panfish lead to excess predation of milfoil weevils.*

incrementally maintain water depth, improves water quality, and can help decrease the spread of nuisance/ exotic plants. Hand raking and hand pulling are readily allowed by WDNR and are practical methods to control riparian landowner scale problems.

Raking with specially designed hand tools is particularly useful in shallow nearshore areas. This method allows nonnative plants to be removed and provides a safe and convenient aquatic plant control method in deeper nearshore waters around piers and docks. Advantages of this method include:

- Tools are inexpensive ($100 to $150 each)
- The method is easy to learn and use
- It may be employed by riparian landowners without a permit if certain conditions are met
- Results are immediately apparent
- Plant material is immediately removed from a lake (including seeds)

The second manual control method, hand-pulling whole plants (stems, roots, leaves, seeds) where they occur in isolated stands, is a simple means to control nuisance and invasive plants in shallow nearshore areas that may not support large-scale initiatives. This method is particularly helpful when attempting to target nonnative plants (e.g., EWM, curly-leaf pondweed) during the high growth season when native and nonnative species often comingle. Hand pulling is more selective than raking, mechanical removal, and chemical treatments, and, if carefully applied, is less damaging to native plant communities. Recommendations regarding hand-pulling, hand-cutting, and raking are discussed later in this document.

Mechanical Measures

Two methods of mechanical harvesting are currently employed in Wisconsin - mechanical harvesting and suction harvesting. Both are regulated by WDNR and require a permit.[52]

Mechanical Harvesting

Aquatic plants can be mechanically gathered using specialized equipment commonly referred to as harvesters. Harvesters use an adjustable depth cutting apparatus that can cut and remove plants from the water surface to up to about five feet below the water surface. The harvester gathers cut plants with a conveyor, basket, or other device. Mechanical harvesting is often a very practical and efficient means to control nuisance plant growth and is widely employed in Southeastern Wisconsin.

In addition to controlling plant growth, gathering and removing plant material from a lake reduces in-lake nutrient recycling, sedimentation, and targets plant reproductive potential. In other words, harvesting removes plant biomass, which would otherwise decompose and release nutrients, sediment, and seeds or other reproductive structures (e.g., turions, bulbils, plant fragments) into a lake. Mechanical harvesting is particularly effective and popular for large-scale open-water projects. However, small harvesters are also produced that are particularly suited to working around obstacles such as piers and docks in shallow nearshore areas.

An advantage of mechanical harvesting is that the harvester, when properly operated, "mows" aquatic plants and, therefore, typically leaves enough living plant material in place to provide shelter for aquatic wildlife and stabilize lake-bottom sediment. Harvesting, when done properly, does not kill aquatic plants, it simply trims plants back. Aside from residual plant mass remaining because of imperfect treatment strategy execution, none of the other aquatic plant management methods purposely leave living plant material in place after treatment. Aquatic plant harvesting has been shown to allow light to penetrate to the lakebed and stimulate regrowth of suppressed native plants. This is particularly effective when controlling invasive plant species that commonly grow quickly early in the season (e.g., EWM, curly-leaf pondweed) when native plants have not yet emerged or appreciably grown.

[52] *Mechanical control permit conditions depend upon harvesting equipment type and specific equipment specifications.*

A disadvantage of mechanical harvesting is that the harvesting process may fragment plants and thereby unintentionally propagate EWM and curly-leaf pondweed. EWM fragments are particularly successful in establishing themselves in areas where plant roots have been removed. This underscores the need to avoid harvesting or otherwise disrupting native plant roots. Harvesting may also agitate bottom sediments in shallow areas, thereby increasing turbidity and resulting in deleterious effects such as smothering fish breeding habitat and nesting sites. To this end, most WDNR-issued permits do not allow deep-cut harvesting in water less than three feet deep,[53] which limits the utility of this alternative in many littoral and shoal areas. Nevertheless, if employed correctly and carefully under suitable conditions, harvesting can benefit navigation lane maintenance and can reduce regrowth of nuisance plants while maintaining, or even enhancing, native plant communities.

Cut plant fragments commonly escape the harvester's collection system and form mats or accumulate on shorelines. To compensate for this, most harvesting programs include a plant pickup program. Some plant pickup programs use a harvester to gather and collect significant accumulations of floating plant debris as well as sponsor regularly scheduled aquatic plant pick up from lakefront property owner docks. Property owners are encouraged to actively rake plant debris along their shorelines and place these piles on their docks for collection. This kind of program, when applied systematically, can reduce plant propagation from plant fragments and can help alleviate the negative aesthetic consequences of plant debris accumulating on shorelines. Nevertheless, it is important to remember that normal boating activity (particularly during summer weekends) often creates far more plant fragments than generated from mechanical harvesting. Therefore, a plant pickup program is often essential to protect a lake's health and aesthetics, even in areas where harvesting has not recently occurred.

Suction Harvesting and DASH
Another mechanical plant harvesting method uses suction to remove aquatic plants from a lake. Suction harvesting removes sediment, aquatic plants, plant roots, and anything else from the lake bottom and disposes this material outside the lake. Since bottom material is removed from the lake, this technique also requires a dredging permit in addition to the aquatic plant management permit.

First permitted in 2014, DASH is a mechanical process where divers identify and pull select aquatic plants and roots from the lakebed and then insert the entire plant into a suction hose that transports the plant to the surface for collection and disposal. The process is a mechanically assisted method for hand-pulling aquatic plants. Such labor-intensive work by skilled professional divers is, at present, a costly undertaking and long-term monitoring will need to evaluate the efficacy of the technique. Nevertheless, many apparent advantages are associated with this method including: 1) lower potential to release plant fragments when compared to mechanical harvesting, raking, and hand-pulling, thereby reducing spread and growth of invasive plants like EWM; 2) increased selectivity of plant removal when compared to mechanical techniques and hand raking which in turn reduces native plant loss; and 3) lower potential for disturbing fish habitat.

Given how costly DASH can be and how widespread EWM is found in some portions of the Lake, DASH is not considered a viable control option for managing EWM throughout the Lake. Nevertheless, DASH can provide focused relief of nuisance native and non-native plants around piers and other critical areas. If individual property owners chose to employ DASH, a NR 109 permit is required.

Chemical Measures
Aquatic chemical herbicide use is stringently regulated. A WDNR permit and direct WDNR staff oversight is required during application. Chemical herbicide treatment is used for short time periods to temporarily control excessive nuisance aquatic plant growth. Chemicals are applied to growing plants in either liquid or granular form. Advantages of chemical herbicides aquatic plant growth control include low cost as well as the ease, speed, and convenience of application. However, many drawbacks are also associated with chemical herbicide aquatic plant control including the following examples.

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[53] *Deep-cut harvesting is harvesting to within one foot of the lake bottom. This is not allowed in shallow water because it is challenging to ensure that the harvester avoids lake-bottom contact in such areas.*

- **Unknown and/or conflicting evidence about the effects of long-term chemical exposure on fish, fish food sources, and humans.** The U.S. Environmental Protection Agency, the agency responsible for approving aquatic plant treatment chemicals, studies aquatic plant herbicides to evaluate short-term exposure (acute) effects on human and wildlife health. Some studies also examine long-term (chronic) effects of chemical exposure on animals (e.g., the effects of being exposed to these herbicides for many years). However, it is often impossible to conclusively state that no long-term effects exist due to the animal testing protocol, time constraints, and other factors. Furthermore, long-term studies cannot address all potentially affected species.[54] For example, conflicting studies/opinions exist regarding the role of the chemical 2,4-D as a human carcinogen.[55] Some lake property owners judge the risk of using chemicals as being excessive despite legality of use. Consequently, the concerns of lakefront owners should be considered whenever chemical treatments are proposed. Moreover, if chemicals are used, they should be applied as early in the season as practical. This helps assure that the applied chemical decomposes before swimming, water skiing, and other active body-contact lake uses begin.[56] Early season application also is generally the best time to treat EWM and curly-leaf pondweed for a variety of technical reasons explained in more detail as part of the "loss of native aquatic plants and related reduction or loss of desirable aquatic organisms" bullet below.

- **Reduced water clarity and increased risk of algal blooms.** Water-borne nutrients promote growth of both aquatic plants and algae. If rooted aquatic plant populations are depressed, demand for dissolved nutrients will be lessened. In such cases, algae tend to become more abundant, a situation reducing water clarity. For this reason, lake managers must avoid needlessly eradicating native plants and excessive chemical use. Lake managers must strive to maintain balance between rooted aquatic plants and algae - when the population of one declines, the other may increase in abundance to nuisance levels. In addition to upsetting the nutrient balance between rooted aquatic plants and algae, dead chemically treated aquatic plants decompose and contribute nutrients to lake water, a condition that may exacerbate water clarity concerns and algal blooms.

- **Reduced dissolved oxygen/oxygen depletion.** When chemicals are used to control large mats of aquatic plants, the dead plant material settles to the bottom of a lake and decomposes. Plant decomposition uses oxygen dissolved in lake water, the same oxygen that supports fish and many other vital beneficial lake functions. In severe cases, decomposition processes can deplete oxygen concentrations to a point where desirable biological conditions are no longer supported.[57] Ice covered lakes and the deep portions of stratified lakes are particularly vulnerable to oxygen depletion. Excessive oxygen loss can inhibit a lake's ability to support certain fish and can trigger processes that release phosphorus from bottom sediment, further enriching lake nutrient levels. These concerns emphasize the need to limit chemical control and apply chemicals in *early* spring, when EWM and curly-leaf pondweed have not yet formed dense mats.

- **Increased organic sediment deposition.** Dead aquatic plants settle to a lake's bottom, and, because of limited oxygen and/or rapid accumulation, may not fully decompose. Flocculent organic rich sediment often results, reducing water depth. Care should be taken to avoid creating conditions leading to rapid thick accumulations of dead aquatic plants to promote more complete decomposition of dead plant material.

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[54] *U.S. Environmental Protection Agency, EPA-738-F-05-002, 2,4-D RED Facts, June 2005.*

[55] *M.A. Ibrahim et al., "Weight of the Evidence on the Human Carcinogenicity of 2,4-D", Environmental Health Perspectives 96: 213-222, December 1991.*

[56] *Though the manufacturers indicate that swimming in 2,4-D-treated lakes is allowable after 24 hours, it is possible that some swimmers may want more of a wait time to lessen chemical exposure. Consequently, allowing extra wait time is recommended to help lake residents and l users can feel comfortable that they are not being unduly exposed to aquatic plant control chemicals.*

[57] *The WDNR's water quality standard to support healthy fish communities is 5 mg/L for warmwater fish communities and 7 mg/L for coldwater fish communities.*

- **Loss of native aquatic plants and related reduction or loss of desirable aquatic organisms.** EWM and other invasive plants often grow in complexly intermingled beds. Additionally, EWM is physically similar to, and hybridizes with, native milfoil species. Native plants, such as pondweeds, provide food and spawning habitat for fish and other wildlife. A robust and diverse native plant community forms the foundation of a healthy lake and the conditions needed to provide and host desirable gamefish. Fish, and the organisms fish eat, require aquatic plants for food, shelter, and oxygen. If native plants are lost due to insensitive herbicide application, fish and wildlife populations often suffer. For this reason, if chemical herbicides are applied to the Lake, these chemicals must target EWM or curly-leaf pondweed and therefore should be applied in early spring when native plants have not yet emerged. Early spring application has the additional advantage of being more effective due to colder water temperatures, a condition enhancing herbicidal effects and reducing the dosing needed for effective treatment. Early spring treatment also reduces human exposure concerns (e.g., swimming is not particularly popular in early spring).

- **Need for repeated treatments.** Chemical herbicides are not a one-time silver-bullet solution—instead, treatments need to be regularly repeated to maintain effectiveness. Treated plants are not actively removed from the Lake, a situation increasing the potential for viable seeds/ fragments to remain after treatment, allowing target species resurgence in subsequent years. Additionally, leaving large expanses of lakebed devoid of plants (both native and invasive) creates a disturbed area without an established plant community. EWM thrives in disturbed areas. In summary, applying chemical herbicides to large areas can provide opportunities for exotic species reinfestation and new colonization which in turn necessitates repeated and potentially expanded herbicide applications.

- **Hybrid watermilfoil's resistance to chemical treatment**. The presence of hybrid watermilfoil complicates chemical treatment programs. Research suggests that certain hybrid strains may be more tolerant to commonly utilized aquatic herbicides such as 2,4-D and Endothall.[58,59] Consequently, further research regarding hybrid watermilfoil treatment efficacy is required to apply appropriate herbicide doses. This increases the time needed to acquire permits and increases application program costs.

- **Effectiveness of small-scale chemical treatments**. Small-scale EWM treatments using 2,4-D have yielded highly variable results. A study completed in 2015 concluded that less than half of 98 treatment areas were effective or had more than a 50 percent EWM reduction.[60] For a treatment to be effective, a target herbicide concentration must be maintained for a prescribed exposure time. However, wind, wave and other oftentimes difficult to predict mixing actions often dissipate herbicide doses. Therefore, when deciding to implement small-scale chemical treatments, the variability in results and treatment cost of treatment should be examined and contrasted.

Considering the expanse of EWM in the eastern portion of the Lake, a large spot treatment in that basin may be utilized.[61] In addition, small spot treatments enclosed with a barrier (e.g., turbidity barrier) could be a viable alternative for treating shoreline areas and navigation lanes if determined feasible by the District. Whatever the case, monitoring should continue to ensure that EWM does not become more problematic. If further monitoring suggests a dramatic change in these invasive species populations, management recommendations should be reviewed.

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[58] *L.M. Glomski and M.D. Netherland, "Response of Eurasian and Hybrid Watermilfoil to Low Use Rates and Extended Exposures of 2,4-D and Triclpyr," Journal of Aquatic Plant Management 48: 12-14, 2010.*

[59] *E.A. LaRue et al., "Hybrid Watermilfoil Lineages are More Invasive and Less Sensitive to a Commonly Used Herbicide than Their Exotic Parent (Eurasian Watermilfoil)," Evolutionary Applications 6: 462-471, 2013.*

[60] *M. Nault et al., "Control of Invasive Aquatic Plants on a Small Scale," Lakeline 35-39, 2015.*

[61] *WDNR has been studying the efficacy of spot treatments versus whole lake treatments for the control of Eurasian watermilfoil and it has been found that spot treatments are not an effective measure for reducing Eurasian watermilfoil populations, while whole lake treatments have proven effective depending on conditions.*

Water Level Manipulation Measures

Manipulating water levels can also be an effective method for controlling aquatic plant growth and restoring native aquatic plant species, particularly emergent species such as bulrush and wild rice.[62] In Wisconsin, water level manipulation is considered to be most effective by using winter lake drawdowns, which expose lake sediment to freezing temperatures while avoiding conflict with summer recreational uses. One to two months of lake sediment exposure can damage or kill aquatic plant roots, seeds, and turions through freezing and/or desiccation. As large areas of lake sediment need to remain exposed for extended periods, water level manipulation is most cost effective in lakes with operable dam gates that can provide fine levels of control of water elevations within the lake. In lakes without dams, high capacity water pumping can be used to reduce lake levels at much greater cost.

While water level manipulation affects all aquatic plants within the drawdown zone, not all plants are equally susceptible to drawdown effects. Abundance of water lilies and milfoils (*Myriophyllum* spp.) can be greatly reduced by winter drawdowns while other species, such as duckweeds, may increase in abundance.[63] Two studies from Price County, Wisconsin show reduced abundance of invasive EWM and curly-leaf pondweed and increased abundance of native plant species following winter drawdowns.[64,65] Thus, drawdowns can be used to dramatically alter the composition of a lake's aquatic plant community. Many emergent species rely upon the natural fluctuations of water levels within a lake. Conducting summer and early fall drawdowns have effectively been used to stimulate the growth of desired emergent vegetation species, such as bulrush, burreeds, and wild rice, in the exposed lake sediments, which subsequently provide food and habitat for fish and wildlife. However, undesired emergent species, such as invasive cattails and phragmites, can also colonize exposed sediment, so measures should be taken to curtail their growth during a drawdown.[66]

Water level manipulation can also have unintended impacts on water chemistry and lake fauna.[67,68] Decreased water clarity and dissolved oxygen concentrations as well as increased nutrient concentrations and algal abundance have all been reported following lake drawdowns. Rapid drawdowns can leave lake macroinvertebrates and mussels stranded in exposed lake sediment, increasing their mortality, and subsequently reducing prey availability for fish and waterfowl. Similarly, drawdowns can disrupt the habitat and food sources of mammals, birds, and herptiles, particularly when nests are flooded as water levels are raised in the spring. Therefore, thoughtful consideration of drawdown timing, rates, and elevation as well as the life history of aquatic plants and fauna within the lake is highly recommended. Mimicking the natural water level regime of the lake as closely as possible may be the best approach to achieve the desired drawdown effects and minimize unintended and detrimental consequences.

As discussed above, water level manipulation is large-scale, permitted operation that can major effects on lake ecology. Consequently, detailed information on the Lake's hydrology, including groundwater, should be compiled before undertaking such an operation. The WDNR would likely require and consider the following during review of the drawdown permit application:

- Existing lake bottom contours should be reevaluated (see Map 1.1) with any changes mapped to develop updated bathymetric information.
- Lake volume needs to be accurately determined for each foot of depth contour.

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[62] *For detailed literature reviews on water level manipulation as an aquatic plant control measure, see C. Blanke, A. Mikulyuk, M. Nault, et al., Strategic Analysis of Aquatic Plant Management in Wisconsin, Wisconsin Department of Natural Resources, pp. 167-171, 2019 as well as J.R. Carmignani and A.H. Roy, "Ecological Impacts of Winter Water Level Drawdowns on Lake Littoral Zones: A Review," Aquatic Sciences 79: 803-824, 2017.*

[63] *G.D. Cooke, "Lake Level Drawdown as a Macrophyte Control Technique," Water Resources Bulletin 16(2): 317-322, 1980*

[64] *Onterra, LLC, Lac Sault Dore, Price County, Wisconsin: Comprehensive Management Plan, 2013.*

[65] *Onterra, LLC, Musser Lake Drawdown Monitoring Report, Price County, Wisconsin, 2016.*

[66] *Blanke et al., 2019, op. cit.*

[67] Ibid.

[68] *Cooke, op. cit.*

- Lake bottom acreage exposed during various intervals of the drawdown must be determined.

- Knowledge of the drawdown and refill times for the Lake would guide proper timing of drawdown to maximize effectiveness and minimize impacts to Lake users.

- A safe drawdown discharge rate would need to be calculated to prevent downstream flooding and erosion.

- Effects on the lake drawdown to the structural integrity of outlet dams should be examined.

- A WDNR permit and WDNR staff supervision are required to draw down a lake. Additionally, lakeshore property owners need to be informed of the drawdown and permit conditions before the technique is implemented. Targeted invasive species populations should be monitored before and after refill is complete to assess efficacy and guide future management.

Credit: Commission Staff

MANAGEMENT RECOMMENDATIONS AND PLAN IMPLEMENTATION 3

Big Cedar and Gilbert lakes support robust and diverse aquatic plant communities. The Wisconsin Department of Natural Resources (WDNR) has identified Big Cedar Lake in their published list of state high-quality waters.[69] However, the invasives Eurasian watermilfoil (EWM), starry stonewort (SSW), and curly-leaf pondweed are present in both lakes and require careful management. On account of these and other factors, aquatic plant management continues to be an important approach to maintaining the excellent natural resource service the lakes provide. This chapter presents holistic management alternatives and recommended refinements to the existing aquatic plant management plan.

3.1 RECOMMENDED AQUATIC PLANT MANAGEMENT PLAN

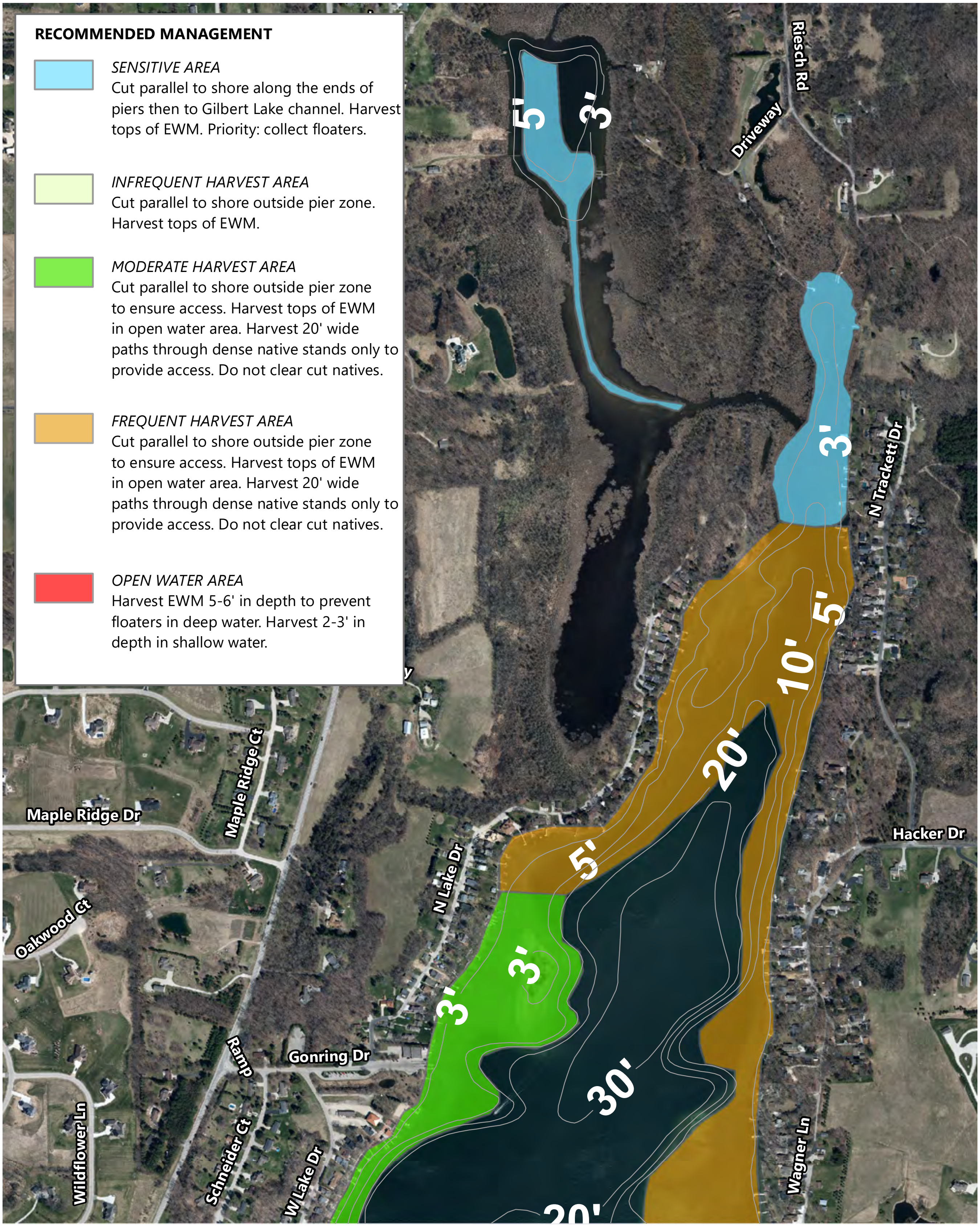
The most effective plans to manage nuisance and invasive aquatic plant growth rely on a combination of methods and techniques as well as consideration of when and where these techniques should be applied. The recommended aquatic plant management plan is presented in Figures 3.1, 3.1a, 3.2, and 3.3 and briefly summarized in the following paragraphs. These management techniques were discussed with both the Big Cedar Lake Protection and Rehabilitation District (District) and the WDNR (see Appendix B).[70] Public comments on the plan were received and incorporated into the plan (see Appendix C).

1. **Mechanically harvest invasive and nuisance aquatic plants.** Mechanical harvesting should remain the primary means to manage invasive and nuisance aquatic plants on Big Cedar Lake. Harvesting must avoid, or must be substantially restricted, in certain areas of the Lake. This includes areas of greater ecological value, areas that provide unique habitat, areas that are difficult to harvest due to lake morphology (e.g., excessively shallow water depth), and where boat access is not desired or necessary (e.g., marshland areas).

[69] *For more information on the WDNR's Healthy Watersheds, High-Quality Waters initiative, see the following: dnr.wisconsin.gov/topic/SurfaceWater/HQW.html.*

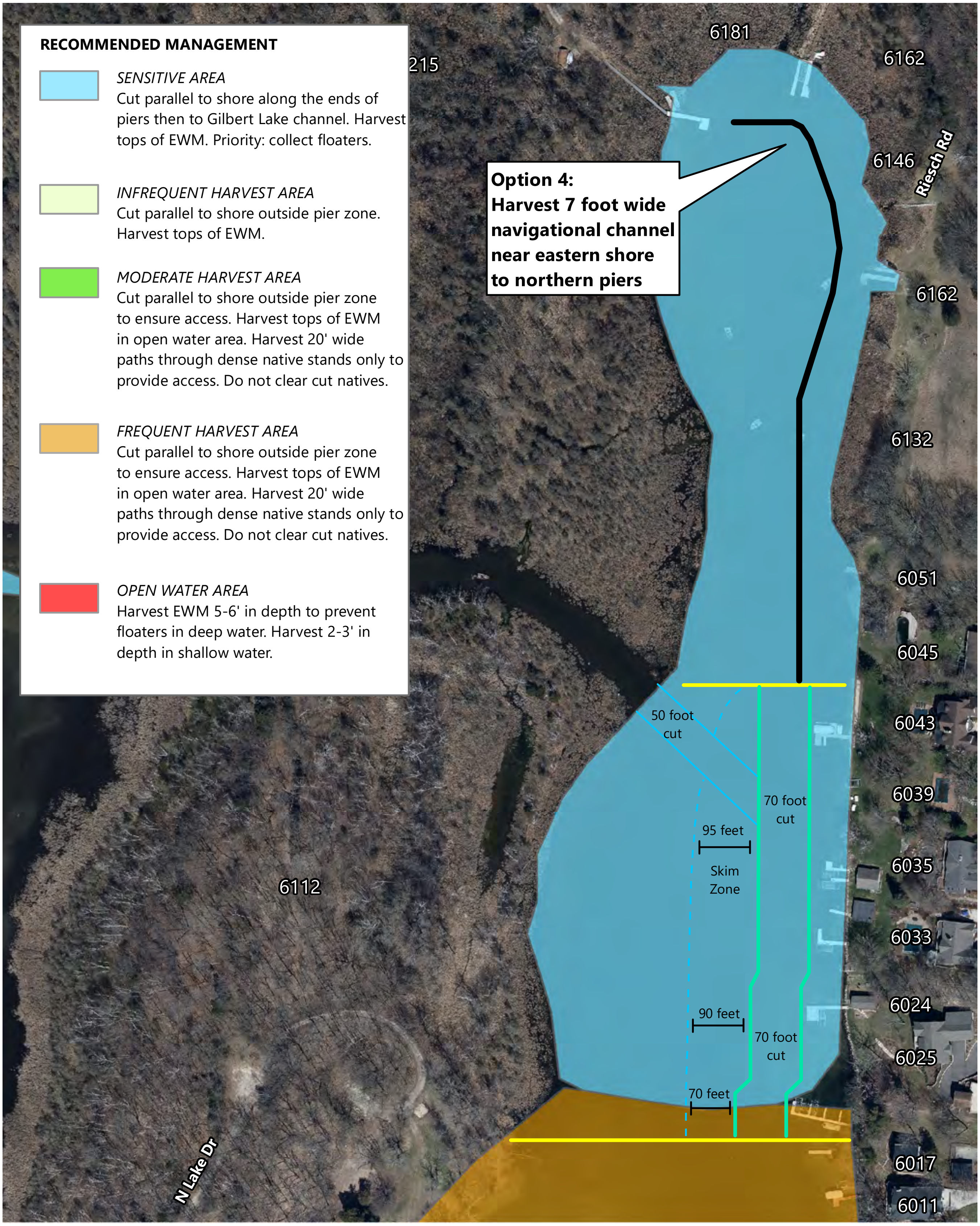
[70] *Big Cedar Harvest Expansion, Buoy Placement, Expansion of Slow No Wake Area, Proposed Edits to Aquatic Plant Management Plan, Big Cedar Lake, Wisconsin Department of Natural Resources, April 9th, 2024.*

Figure 3.1
Big Cedar Lake Aquatic Plant Management Plan: Gilbert Lake and Northern Section



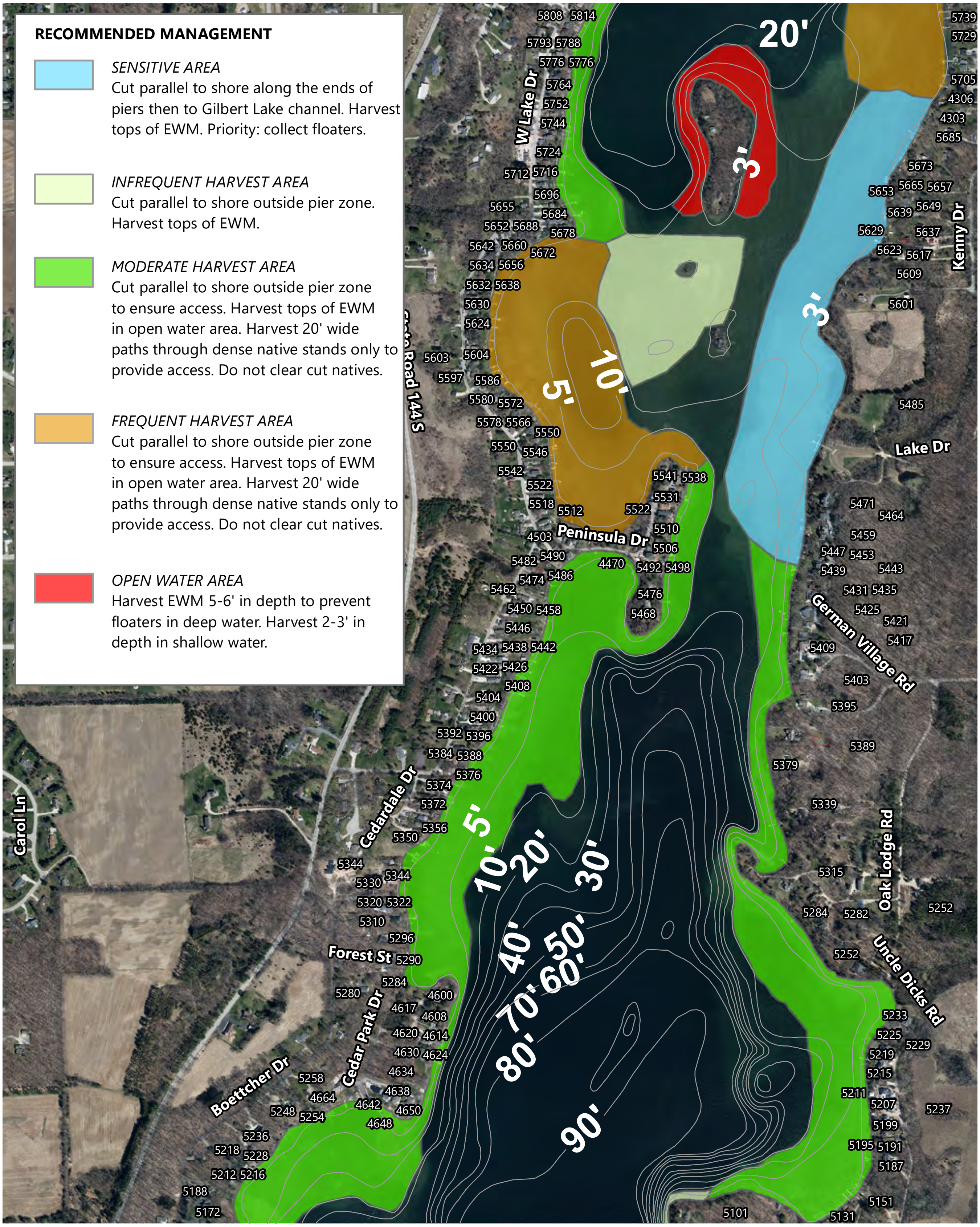
Source: SEWRPC

Figure 3.1a
Harvesting Within Northern Sensitive Area of Big Cedar Lake



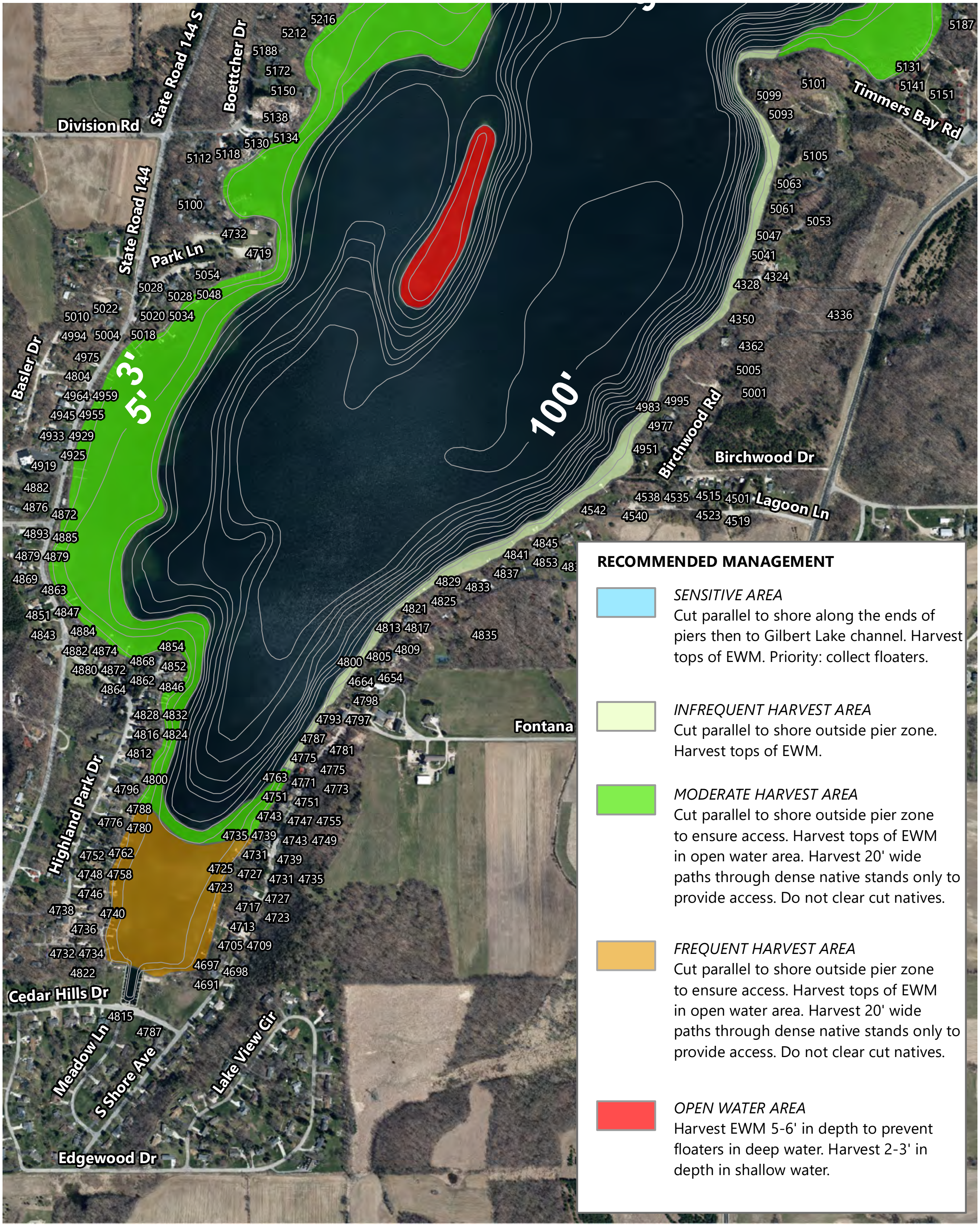
Source: SEWRPC

Figure 3.2
Big Cedar Lake Aquatic Plant Management Plan: Middle Section



Source: SEWRPC

Figure 3.3
Big Cedar Lake Aquatic Plant Management Plan: Southern Section



Source: SEWRPC

2. **Manually remove nearshore invasive and nuisance plant growth.** Manual removal involves controlling aquatic plants by hand or using hand-held non-powered tools. Manual removal does not require a permit if riparian landowners remove only invasive plants without injuring native plants or remove nuisance native aquatic plants along 30 or less feet of shoreline (inclusive of dock, pier, and other lake access areas) and generally not more than 100 feet into the lake.

3. **Limit chemical use. Large-scale chemical treatment is not part of the District's aquatic plant management plan.** Chemical use is not recommended within WDNR-designated "Sensitive Areas." Nevertheless, the District may want to consider a rapid response chemical treatment for Chapter NR 40 prohibited species (e.g., hydrilla, *Hydrilla verticillata*), where appropriate, if such a species were to appear in the Lake in the future. However, this method of aquatic plant control has several drawbacks (e.g., water quality, comparatively nonselective, chemical side effects, and more) and should only be considered under exceptional circumstances.

4. **Continue monitoring for invasive species populations.** The District should conduct frequent monitoring near the boat launches and any other access points. Conducting pre- and post-treatment sub-point-intercept surveys would be ideal for evaluating the effects of any treatment on SSW, EWM, and non-target species. Frequently conducting meander surveys or spot checks near the outlet dam and public and private launches can allow more rapid detection and response before SSW can spread from these locations. The District should share updates on its invasive species population monitoring with the WDNR and the Washington County AIS Coordinator.

5. **Expand participation in the Clean Boats Clean Waters program to at least all public launches.** Participation in this program proactively encourages lake users to clean boats and equipment before launching and using them in Big Cedar and Gilbert lakes.[71] This will help lower the probability of invasive species entering and leaving the lakes. The District already maintains an aquatic invasive species removal sign and a removal station at the Gonring Drive public launch (see Figure 3.4).

6. **Consider limiting boat traffic in parts of WDNR-designated Sensitive Areas and other sensitive parts of the lake.** Sensitive areas are designated by WDNR for their capacity to support the lake's ecological health, such as by supporting beneficial native plant species or providing important fish spawning habitat. The southern extent of the Sensitive Area north of the channel is largely devoid of vegetation, likely in part due to extensive boat traffic and anchoring in this area. While this area is an important area for recreation on the Lake, its capacity to support the lake's ecology should also be recognized and restored to the great extent feasible. The District should consider placing advisory buoys in this area as well as other areas around the lake, such as the "Sunken Island" in the southern basin, to notify boaters of these shallow areas and minimize the disturbance caused by boat traffic (see Figure 3.5 and comments regarding "Option Two" in Appendix B).

   Relatedly, the District should consider extending the slow-no-wake zones in the bays north and south of Peninsula Drive to help protect the large native pondweed species (*Potamogeton amplifolius* and *Potamogeton illinoensis*) found in these areas (see Figure 3.6 and comments regarding "Option One" in Appendix B). These species provide excellent habitat for fish, particularly larger sport fish, but their growth can be hindered by physical stress from boat propellers and downwash. Extending slow-no-wake zones in these bays may reduce this physical stress and help these species recover and expand their populations to other areas of the lake.

7. **Provide signage, education, and outreach regarding starry stonewort.** Consider placing signage and conducting outreach with lake residents and users regarding the presence of starry stonewort in Big Cedar and Gilbert lakes. Signs and/or advisory buoys could be placed near the populations in each lake to warn boats to check their boats, anchors, and/or pets if they recreate in these areas. Additionally, the District could place signs at each entrance to the channel between Gilbert and Big Cedar lake asking boaters to reverse their motors to remove vegetation before the entering the channel, thus minimizing spread of invasive species between the lakes (see Figure 3.7 and comments regarding "Option Three" in Appendix B).

[71] *Further information about Clean Boats Clean Waters can be found on the WDNR website at: dnr.wi.gov/lakes/cbcw.*

Figure 3.4
Aquatic Plant Management Features on Big Cedar Lake

Big Cedar Outlet Dam

Invasive Species Removal Station

Aquatic Plant Harvester

Invasive Species Sign at Gonring Launch

Source: SEWRPC

8. **Stay abreast of best management practices to address invasive species.** The District should regularly communicate with the Washington County AIS Coordinator and WDNR staff about the most effective treatment options for EWM and SSW as novel techniques and/or chemical products that may more effectively target these species become available.

Management Methods

The following subsection provides recommendations on which aquatic plant management methods are currently suitable for Big Cedar and Gilbert lakes.

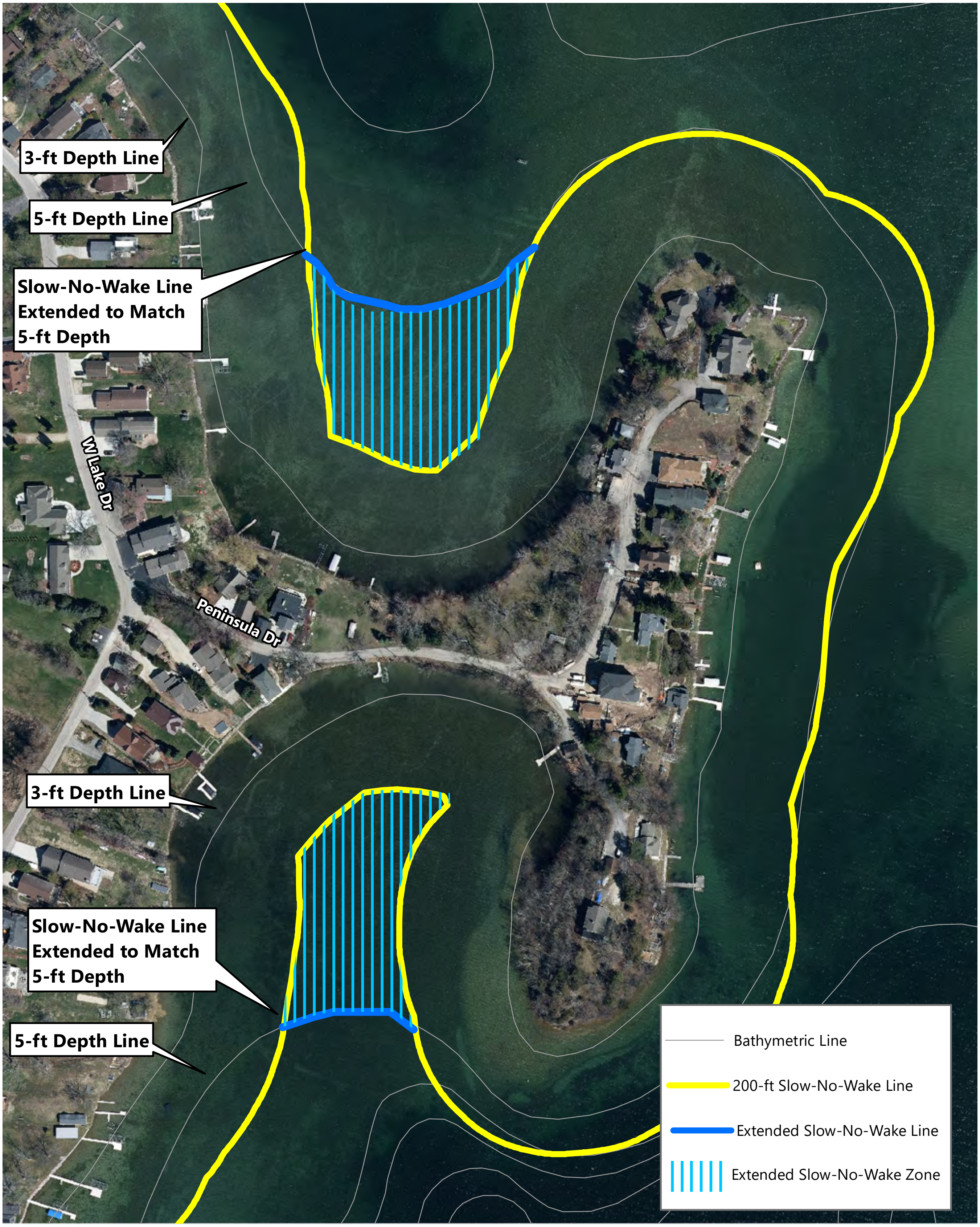
Mechanical Harvesting

The District currently operates two harvesters: an Aquarius Systems HM-620 and an Inland Lake Harvesters, Inc. ILH7-450 (see Figure 3.4). The HM-620 can cut up to 5.2 feet deep using a 9 foot wide cutter bar while ILH7-450 can cut up to 6 feet deep using a 7 foot wide cutter bar. These cutting depths are suitable for harvesting in most of the Lake. In shallow waters, slow speed operation and extreme diligence must be taken to avoid contacting the lake bottom with the cutter head. In all areas, at least one foot of living plant material must remain attached to the lake bottom after cutting. These harvesters are supported by an Inland

Figure 3.5
Advisory "Shallow" Buoys Over "Sunken Island" in Southern Basin of Big Cedar Lake

Source: SEWRPC

Figure 3.6
Extend Slow-No-Wake Zone in Bays North and South of Peninsula Drive on Big Cedar Lake



Source: SEWRPC

Figure 3.7
Signs and Buoy for Starry Stonewort at Gilbert Lake Channel

Source: SEWRPC

Lake Harvesters, LLC transport shuttle barge, two Aquarius Systems transport barges (models T-34 and T-45), and an Inland Lake Harvesters, LLC shore conveyor that are used to transport cut plants to a dump truck on shore for off-site disposal. The harvesters are equipped with global positioning system (GPS) and mapping units.

The approximate orientation and extent of proposed harvesting areas within the Lake were largely maintained as published in the 2018 aquatic plant management plan due to the robust and improving aquatic plant community observed during the 2023 survey.[72] The general locations of harvesting areas are schematically illustrated in Figures 3.1, 3.1a, 3.2, and 3.3. The precise locations of the harvest areas must be chosen carefully and must be maintained in a fixed position throughout the year to avoid unintentional disturbance to adjacent sensitive areas. Harvesting lane position should consider water depth, plant species present, lane use, and boating habits/practices on the Lake. For example, whenever possible, lanes should favor deeper water areas, should support the Lake's recreational uses, and should attempt to focus plant harvest on invasive species. Additional information regarding cutting patterns and depth is provided below.

1. **Except for navigational access lanes, harvesters must not be operated nearshore in water less than 36 inches feet deep.** Mechanical harvesting may be expanded in shallow, obstacle-prone nearshore areas throughout the Lake if a small-scale harvester is available. Even though the District's harvester may be able to navigate in shallow waters when empty, at least 12 inches of plant growth should remain standing after harvesting. Therefore, aside from regulatory restrictions, mechanically harvesting aquatic plants in extremely shallow water (e.g., areas with less than 24 inches of water depth) is not practical.

2. **Maintain at least 12 inches of living plant material after harvesting.** The District's current aquatic plant harvesters can cut aquatic plants up to 72 inches below the water surface. Harvesting equipment operators must not intentionally denude the lakebed. Instead, the goal of harvesting is to maintain and promote healthy native aquatic plant growth. Harvesting invasive aquatic plants can promote native plant regrowth since many invasive aquatic plants grow early in the season depriving later emerging native plants of light and growing room.

3. **Collect and properly dispose harvested plants and collected plant fragments.** Outside of mapped areas, the harvester may surface skim free-floating vegetation that has been previously cut or uprooted, but not collected, to a depth of one foot. Use of the cutter head is not permitted for this action. In addition, plant cuttings and fragments must be immediately collected upon cutting to the extent practicable. Plant fragments accumulating along shorelines should be collected by riparian landowners. Fragments collected by the landowners can be used as garden mulch or compost.

   All harvested and collected plant material is deposited at individual sites within the Township that are not located in a floodplain or wetland. Disposing any aquatic plant material within identified floodplain and wetland areas is prohibited. Plant material will be collected and disposed daily to reduce undesirable odors and pests, to avoid leaching nutrients back into waterbodies, and to minimize visual impairment of lakeshore areas. Operators will stringently police the off-loading to assure efficient, neat operation.

4. **Adapt harvester cutting patterns and depths to support lake use and promote ecological health.** Aquatic plant harvesting techniques should vary in accordance with the type and intensity of human recreational use, lake characteristics, the distribution and composition of aquatic plants, and other biological considerations. The approaches to employ in differing management areas are illustrated in Figures 3.1, 3.1a, 3.2, and 3.3 and described below.

   a. <u>Harvesting is limited in certain areas of the Lake:</u> Harvesting is limited to navigational lanes only in areas denoted as "Sensitive Areas" in Figures 3.1, 3.1a, 3.2, and 3.3. Raking and other manual aquatic plant removal methods should be utilized in these areas to better target invasive species and limit disturbance to native vegetation, fish, and other aquatic life.

[72] *Marine Biochemists, 2018, op. cit.*

Harvesting in Gilbert Lake should only occur at most twice per year between July 15th and the third week of August to protect the sensitive nature of this area and fish spawning within the lake. This harvesting should be limited to areas within the northern basin of Gilbert Lake illustrated on Figure 3.1. No harvesting should occur within the Gilbert Lake channel or the southern basin of Gilbert Lake.

Harvesting within the northernmost Sensitive Area of Big Cedar Lake should be limited to a 7-foot wide channel near the eastern shore towards the northern piers; no harvesting should occur near the western shoreline as this could disrupt or destroy the sensitive flora and fauna along this shoreline and nearshore wetland areas (see Figure 3.1a). This harvesting could occur at most twice per year between July 15th and the third week of August to protect the sensitive nature of this area and its importance for fish spawning (see comments regarding "Option 4" in Appendix B). Due to the shallow water depths within this Sensitive Area, harvesting should only be permitted if the harvester can feasibly cut plant material without disturbing bottom sediments; this operation requires at least three feet of water depth. As with all other areas of the lake, at least 12 inches of plant growth should remain standing after harvesting is completed; the mechanical harvester should not be used to dredge lake bottom sediments. Consequently, it may not be possible to harvest directly to the end of the piers in the northwestern and northeastern corners of the Sensitive Area. If navigational concerns are not addressed through mechanical harvesting, then riparian owners in this area of the lake should consider applying for a permit to dredge a navigational channel to facilitate their access to the rest of the lake. This dredged channel may alleviate the need to mechanically harvest this area and limit impacts to fish and other aquatic life.

b. Recreational boating access lanes are given high priority: Channels providing travel thoroughfares for watercraft, such as the channel between the northern and southern basin, should continue to be prioritized. Additionally, 20' wide paths may be cut through dense native stands in "Moderate Harvest Areas" and "Frequent Harvest Areas" only to provide access to deeper water. Harvesting in these areas should strive to leave at least two-feet of vegetation above the Lake bottom to promote fish habitat.

c. "Infrequent Harvest Area" and "Open Water Area" areas are given low priority: Predominantly EWM should be targeted in these areas with top cuts in the "Infrequent Harvest Area" and cut varying with water depth in the "Open Water Area. Minimizing harvesting in these areas should help promote native species growth, particularly for areas with exposed sediment such as the sandbar in the southern basin. Again, at least one foot of plant material must remain on the Lake bottom to minimize resuspension of lake-bottom sediment and maintain desirable plant communities.

5. Harvesting native pondweeds (*Potamogeton* spp.) and muskgrasses (*Chara* spp.) is prohibited. These plants provide habitat for young fish, reptiles, and insects in the Lake.

6. **Immediately return incidentally captured living animals to the water.** As harvested plants are brought on board the harvester, plant material must be actively examined for live animals. Animals such as turtles, fish, and amphibians commonly become entangled within harvested plants, particularly when cutting large plant mats. A second deckhand equipped with a net should accompany and help the harvester operator rescue animals incidentally collected during aquatic plant harvesting. If a second deckhand is not available, the harvester operator shall halt harvesting and remove animals incidentally collected during plant harvesting. Such stop-and-start work can dramatically decrease harvesting efficiency. Therefore, the WDNR recommends two staff be present on operating harvesters.

7. **Insurance, maintenance, repair, and storage.** Appropriate insurance covering the harvester and ancillary equipment will be incorporated into the District's policy. The District will provide liability insurance for harvester operators and other staff. Insurance certificates will be procured and held by the District. Routine day-to-day equipment maintenance will be performed by the harvester operator or other individuals identified by the District in accordance with the manufacturer's recommendations and suggestions. To this end, harvester operators shall be familiar with equipment manuals and appropriate maintenance/manufacturer contacts. Operators will immediately notify District staff of

any equipment malfunctions, operating characteristics, or sounds suggesting malfunction and/or the need for repair. Equipment repair beyond routine maintenance will be arranged by the District. Maintenance and repair costs will be borne by the District. The District will be responsible for properly transporting and storing harvesting equipment during the off season.

8. **Management, record keeping, monitoring, and evaluation.** District staff manage harvesting operations, and, although they may delegate tasks, are responsible for overall plan execution and logistics. Nevertheless, daily harvesting activities will be documented in writing by the harvester operator in a permanent harvester operations log. Harvesting patterns, harvested plant volumes, weed pickup, plant types, and other information will be recorded. Daily maintenance and service logs recording engine hours, fuel consumed, lubricants added, oil used, and general comments will be recorded. Furthermore, this log should include a section to note equipment performance problems, malfunctions, or anticipated service. Monitoring information will be summarized in an annual summary report prepared by the District, submitted to the WDNR, and available to the public. The report will also present information regarding harvesting operation and maintenance, equipment acquisitions and/or needs, expenditures, and budgets.

9. **Logistics, supervision, and training.** Harvesting equipment is owned and operated by the District. District staff are responsible for overall harvesting program oversight and supervision. Although District staff are responsible for equipment operation, they may delegate tasks to competent individuals when technically and logistically feasible. The District must assure such individuals are appropriately trained to carry out their respective job functions successfully and efficiently. For example, District staff have extensive experience operating and maintaining harvesting equipment and have detailed knowledge of lake morphology, plant growth, and overall lake biology. These individuals should actively share this knowledge through an on-the-job training initiative. The equipment manufacturer may also be able to provide advice, assistance, and insight regarding equipment operation. Boating safety courses are available through many media and are integral to individuals involved with on-the-water work.

   All harvester operators must successfully complete appropriate training, must be thoroughly familiar with equipment function, must be able to rapidly respond to equipment malfunction, must be familiar with the Lake's morphology and biology, and must recognize landmarks to help assure adherence to harvesting permit specifications and limitations. Additionally, harvester operators must be able to recognize the various native and invasive aquatic plants present in the Lake. Such training may be provided through printed and on-line study aids, plant identification keys, and the regional WDNR aquatic species coordinator. At a minimum, training should:

   - Explain "deep-cut" versus "shallow-cut" techniques and when to employ each in accordance with this plan

   - Discuss equipment function, capabilities, limitations, hazards, general maintenance, and the similarities and differences between the various pieces of equipment they may be expected to operate

   - Review the aquatic plant management plan and associated permits with special emphasis focused on the need to restrict cutting in shallow and nearshore areas

   - Assure operators can confidentially identify aquatic plants and understand the positive values such plants provide to the Lake's ecosystem which in turn encourages preservation of native plant communities

   - Reaffirm that all harvester operators are legally obligated to accurately track and record their work to include in permit-requisite annual reports.

   The training program must integrate other general and job-specific items such as boating navigational conventions, safety, courtesy and etiquette, and State and local boating regulations. Other topics that should be covered include first aid training, safety training, and other elements that help promote safe, reliable service.

10. **Dispose of debris and collected plant material from harvesting activities at the designated disposal sites.** The disposal site currently used by the District's harvesting program is illustrated on Map 3.1. Disposing of any aquatic plant material within identified floodplain and wetland areas is prohibited and special care should be taken to ensure that plant debris is not disposed of in such areas.

Nearshore Manual Aquatic Plant Removal

In nearshore areas where other management efforts are not feasible, raking may be a viable and practical method to manage overly abundant and/or undesirable plant growth. Should Lake residents decide to utilize raking to manually remove aquatic plants, the District or other interested party could acquire several specially designed rakes for riparian owners to use on a trial basis and/or rent or loan. If those rakes satisfy users' needs and objectives, additional property owners would be encouraged to purchase their own rakes.

Hand-pulling EWM is considered a viable option in the Lake and should be employed wherever practical. Volunteers or homeowners could employ this method, if they are properly trained to identify EWM, curly-leaf pondweed, or any other invasive plant species of interest. WDNR provides a wealth of guidance materials (including an instructional video describing manual plant removal) to help educate volunteers and homeowners.[73]

Pursuant to Chapter NR 109 *Aquatic Plants: Introduction, Manual Removal and Mechanical Control Regulations* of the *Wisconsin Administrative Code*, riparian landowners may rake or hand pull aquatic plants without a WDNR permit under the following conditions:

- EWM, curly-leaf pondweed, and purple loosestrife may be removed by hand if the native plant community is not harmed in the process

- Raked, hand-cut, and hand-pulled plant material must be removed from the lake

- No more than 30 lineal feet of shoreline may be cleared; however, this total must include shoreline lengths occupied by docks, piers, boatlifts, rafts, and areas undergoing other plant control treatment. In general, regulators allow vegetation to be removed up to 100 feet out from the shoreline

- Plant material that drifts onto the shoreline must be removed

Any other manual removal technique requires a State permit, unless specifically used to control designated nonnative invasive species such as EWM. Mechanical equipment (e.g., dragging equipment such as a rake behind a motorized boat or the use of weed rollers) is not authorized for use in Wisconsin at this time. Nevertheless, riparian landowners may use mechanical devices to cut or mow exposed lakebed. Furthermore, purple loosestrife may also be removed with mechanical devices if native plants are not harmed and if the control process does not encourage spread or regrowth of purple loosestrife or other nonnative vegetation.

Prior to the hand-pulling season, shoreline residents should be reminded of the utility of manual aquatic plant control through an educational campaign. This campaign should also foster shoreline resident awareness of native plant values and benefits, promote understanding of the interrelationship between aquatic plants and algae (i.e., if aquatic plants are removed, more algae may grow), assist landowners identify the types of aquatic plants along their shorelines, and familiarize riparian landowners with the specific tactics they may legally employ to "tidy up" their shorelines.[74]

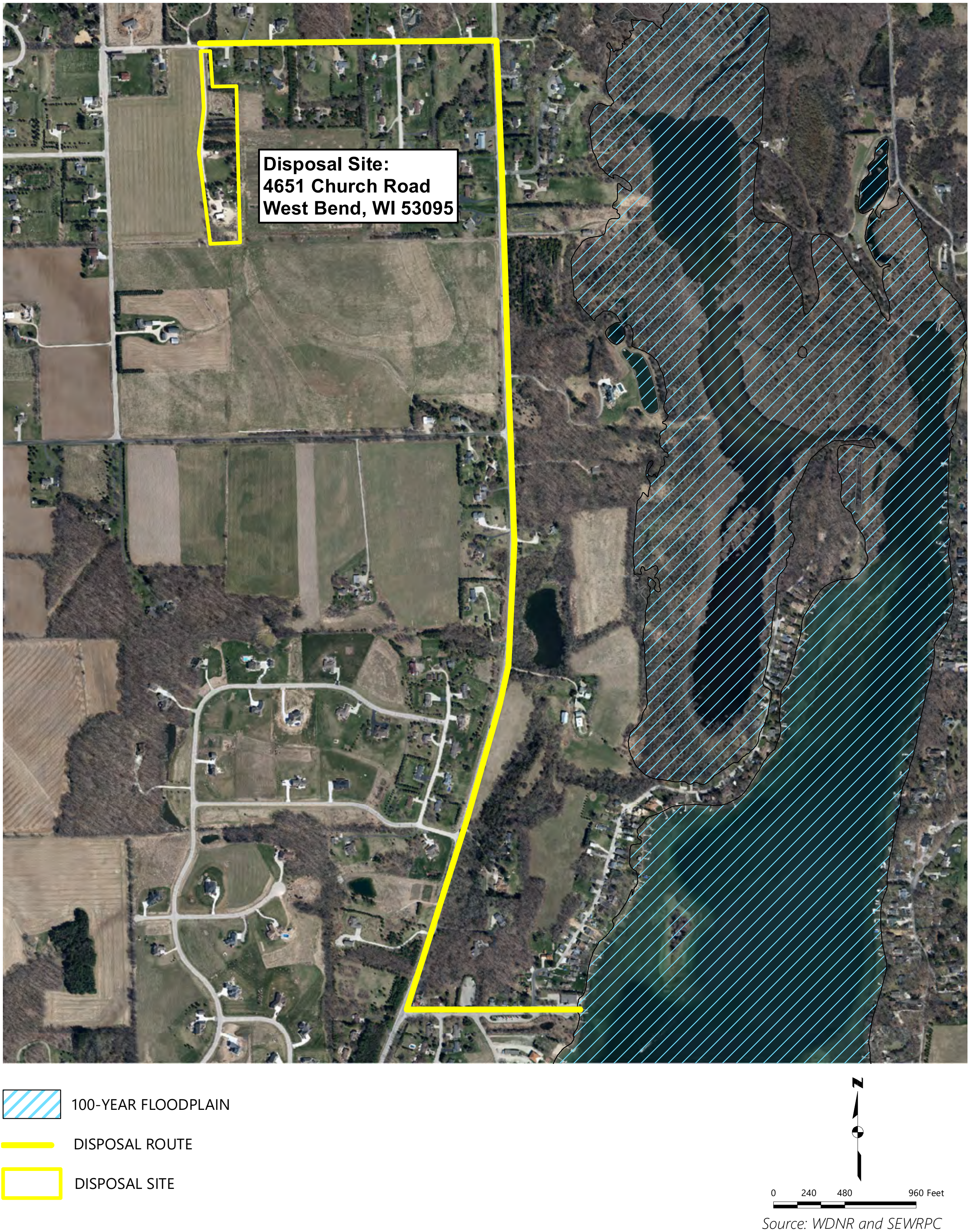
Suction Harvesting and DASH

Suction harvesting may be a practical method to control aquatic plants, but it is not likely to be a cost-effective, environmentally friendly, or practical method to manage aquatic plants alone. For this reason, suction harvesting is not practical for widespread application at the Lake.

[73] *Visit dnr.wi.gov/lakes/plants for more information on identification and control of invasive aquatic plants.*

[74] *Commission and WDNR staff could help review documents developed for this purpose.*

Map 3.1
Harvesting Disposal Site



Source: WDNR and SEWRPC

Given how time consuming and costly DASH can be to employ and given the limited presence of invasive and nuisance plant growth across the Lake, DASH will never likely be a primary component part of the District's general nuisance and invasive plant management strategy. Nevertheless, some lake organizations have employed DASH to aggressively combat small-scale pioneer infestations of invasive species. The District may wish to consider using DASH should such a situation arise in the future.

DASH may be of interest to private parties in specific situations. For example, DASH could be employed by individuals to control nuisance native and nonnative plants around piers and other congested areas. If an individual landowner or groups of landowners choose to utilize DASH, the activity is typically confined to the same area as riparian landowner manual aquatic plant manual control (30 feet of shoreline per property extending no more than 100 feet in areas including piers and other navigation aids). DASH requires a permit under *Wisconsin Administrative Code Chapter NR 109 Aquatic Plants: Introduction, Manual Removal and Mechanical Control Regulations*.

Chemical Treatment

Large-scale chemical treatment is not recommended in Big Cedar or Gilbert lakes due to the low relative abundance of invasive species and the high diversity and abundance of sensitive species distributed throughout much of the Lake; these sensitive species may be negatively affected by such a treatment. Small spot treatments enclosed with a barrier (e.g., turbidity barrier) could be a viable alternative for treating nuisance invasive species populations in navigation lanes and shoreline areas, provided that these areas are not within WDNR-designated "Sensitive Areas." If monitoring suggests a dramatic change in invasive species populations, recommendations regarding large-scale chemical treatments should be reviewed.

Water Level Manipulation

The Big Cedar Lake dam controls water levels in the lakes (see Figure 3.4). A lake-wide drawdown would not effectively target the invasive species populations in the lake and would expose many sensitive species to desiccation. Consequently, a drawdown is not recommended at this time, but the option should be considered if an invasive species population becomes much more widespread. If the District wishes to utilize drawdowns as a lake management tool, a hydrologic study of the lakes should first be conducted to better inform how the lakes would respond to drawdown scenarios.

Future Funding

Current efforts pursued by the District have been exhibiting effectiveness at maintaining a healthy and diverse aquatic plant community while suppressing aquatic invasive species communities. The District should continue to utilize WDNR Surface Water Grants to further their efforts with monitoring in the Lake, watercraft inspection efforts at the boat launch, and targeted management within Big Cedar and Gilbert lakes. Key grant programs to fund these efforts are as follows:

- **Clean Boats, Clean Waters** – this grant program covers up to 75 percent of up to $24,000 to conduct watercraft inspections, collect data, educate boaters about invasive species, and reporting invasive species to the WDNR.

- **Aquatic Invasive Species Supplemental Prevention** – this grant program provides supplemental funding for waterbodies that are high priorities for AIS spread statewide, due to large amounts of boat traffic and/or the presence of particular invasive species. Big Cedar is an eligible waterbody for this program, which covers up to 75 percent of up to $4,000 that can fund the acquisition of decontamination equipment at public boat launches as well as targeted management at the boat launch or other access points. The District must continue to participate in the Clean Boats, Clean Waters program to maintain eligibility for this grant program.

- **Aquatic Invasive Species Control** – this grant program covers up to 75 percent of up to $50,000 for small-scale projects and $150,000 for large-scale projects that suppress or reduce an AIS population within a lake. Given the current limited spread of EWM and SSW within the lakes, the small-scale project is more appropriate at this time. Aquatic Invasive Species Control grants fund projects that utilize integrated pest management and are designed to cause multi-season suppression of the target species. An approved aquatic plant management plan is a requirement to participate in this program and only approved recommendations from the plan are eligible projects for funding through this program.

The District should consider applying for these grant programs whenever possible to support the monitoring, communication, watercraft inspection, and targeted management recommended in this aquatic plant management plan.

Public Comments

The draft aquatic plant management plan was posted on the Commission's website with a comment box to receive public comments on the plan between May 1st, 2024 and May 23rd, 2024. The District posted a notification on their website with a link to the Commission's website encouraging the public to leave comments on the plan. Commission staff notified WDNR staff of the opening and closing of the public comment period. Five comments were received during the public comment period (see Appendix C). One public comment was received after the comment period closed, but prior to the publication of this plan.

All six public comments addressed aquatic plant management in the northern Sensitive Area of Big Cedar Lake as part of their comments. Three of the comments expressed an interest in expanding either harvesting and/or skimming in the northern Sensitive Area to enhance navigation and riparian access while three comments stressed that management should be limited or prohibited in this area due to its ecologically sensitive nature. One of these commenters expressed a concern the District has conducted harvesting beyond what was allowed in the previous WDNR Mechanical Control permit. Another commenter seemed to be under the impression that a 70-foot skim area would be implemented north of the Gilbert Lake channel as part of this plan; however, as illustrated on Figure 3.1a, only a 7-foot wide harvesting lane along the eastern shore was included in the plan.

Following discussions with the District, WDNR, and the public at District meetings, a 7-foot wide harvesting lane selected for the plan to balance the needs of riparian users on the northern end to access the main body of the Lake while also protecting sensitive ecological resources in the Sensitive Area by sizing of the harvesting lane to the width of the harvester cutting bar, placing the location of the lane along the developed eastern shore, timing the harvesting to occur after fish spawning, and limiting the number of trips to match what was permitted for Gilbert Lake (the entirety of which is WDNR-designated Sensitive Area). WDNR biologists determined that this option could be approved in a Mechanical Control permit application if requested (see Appendix B). Harvesting was permitted near the eastern shore because the aquatic plant survey identified that EWM was the predominant species in this part of the Sensitive Area while the western section is inhabited by several native plant species, has been identified as important fish spawning area, and is important habitat for waterfowl, reptiles, and amphibians through its connection to the Gilbert Lake Wetlands and Uplands, a SEWRPC-designated Natural Area of Countywide or Regional significance. A few commenters requested that a larger skim zone be utilized instead of a harvesting lane. However, WDNR biologists shared concerns that a larger skim zone to address floaters would remove more vegetation that provides forage for waterfowl and could increase use of and disturbance to the area by boaters. Consequently, the WDNR could not approve a permit that included a larger skim zone within the Sensitive Area (see Appendix B).

Two public comments also addressed SSW management in Big Cedar Lake. Both comments requested that boaters entering and leaving the Lake via the Gonring boat launch be required to use the District's CD3 (Clean, Drain, Dry, Dispose) equipment as both commenters noted that many boats do not use this equipment. The District has posted aquatic invasive species signage at the launch notifying boaters of their requirements (as described in Chapter NR 40 of *Wisconsin State Statutes*) to inspect their watercraft, remove all plants and animals, drain all water, and never move plants and animals to and from the Lake (see Figure 3.4). Additionally, the District has put signage on the CD3 equipment encouraging boaters to use it and notifying them that it's free for public use (see Figure 3.4). None of the other public launches on the lake had decontamination equipment available at the time of the aquatic plant survey, so acquiring and providing this equipment at these launches should be a top priority. Neither Washington County nor any of its municipalities have passed a law requiring boaters use decontamination equipment at launches when it's available; however, Burnett County passed such a law in 2018.[75] Discussion about developing a

[75] Burnett County, Wisconsin Municipal Code Chapter 18, Article V, Sec. 18-233(b) *states "If a decontamination station is available for use at a public or private access, the boater shall decontaminate per posted directions using the decontamination station provided."*

similar ordinance could be included as part of the forthcoming Aquatic Invasive Species Strategic Plan for Washington County or could be addressed at the municipality level with the Towns of Polk and West Bend.[76]

One public comment addressed enforcing and monitoring of the aquatic plant management plan. The aquatic plant management plan does not provide the authority for large-scale aquatic plant management on the Lake; this authority is provided through WDNR via a Mechanical Control or Chemical Control permit. Consequently, the WDNR is responsible for enforcing and monitoring the permit it provides to conduct large-scale aquatic plant management activities on Big Cedar and Gilbert Lakes.[77] Complaints regarding aquatic plant management on the Lakes can be addressed to the District or the WDNR via the Wetland and Waterway Complaint Submittal System.[78]

3.2 SUMMARY AND CONCLUSIONS

As requested by the District, the Commission worked with the District to develop a scope of work and secure funding to provide information useful to short- and long-term lake management. The primary motivation for this effort was to gather information needed to renew the District's aquatic plant management permit. This report, which documents the findings and recommendations of the study, examines existing and anticipated conditions, potential aquatic plant management problems, and lake-use. Conformant with the study's intent, the plan includes recommended actions and management measures. Figures 3.1 through 3.7 summarize and locate where aquatic plant management recommendations should be implemented.

Successfully implementing this plan will require vigilance, cooperation, and enthusiasm, not only from local management groups, but also from State and regional agencies, Washington County, municipalities, and residents/users of the Lake. The recommended measures help foster conditions sustaining and enhancing the natural beauty and ambience of Big Cedar and Gilbert ecosystems while promoting a wide array of water-based recreational activities suitable for the Lake's intrinsic characteristics.

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[76] *For more information on the Washington County Aquatic Invasive Species Strategic Plan, see www.washcowisco.gov/departments/community_development/long-range___strategic_plans/aquatic_invasive_species_strategic_plan.*

[77] *See NR 107 and NR 109 of* Wisconsin State Statute *regulation of chemical and mechanical control, respectively, on Wisconsin waterways.*

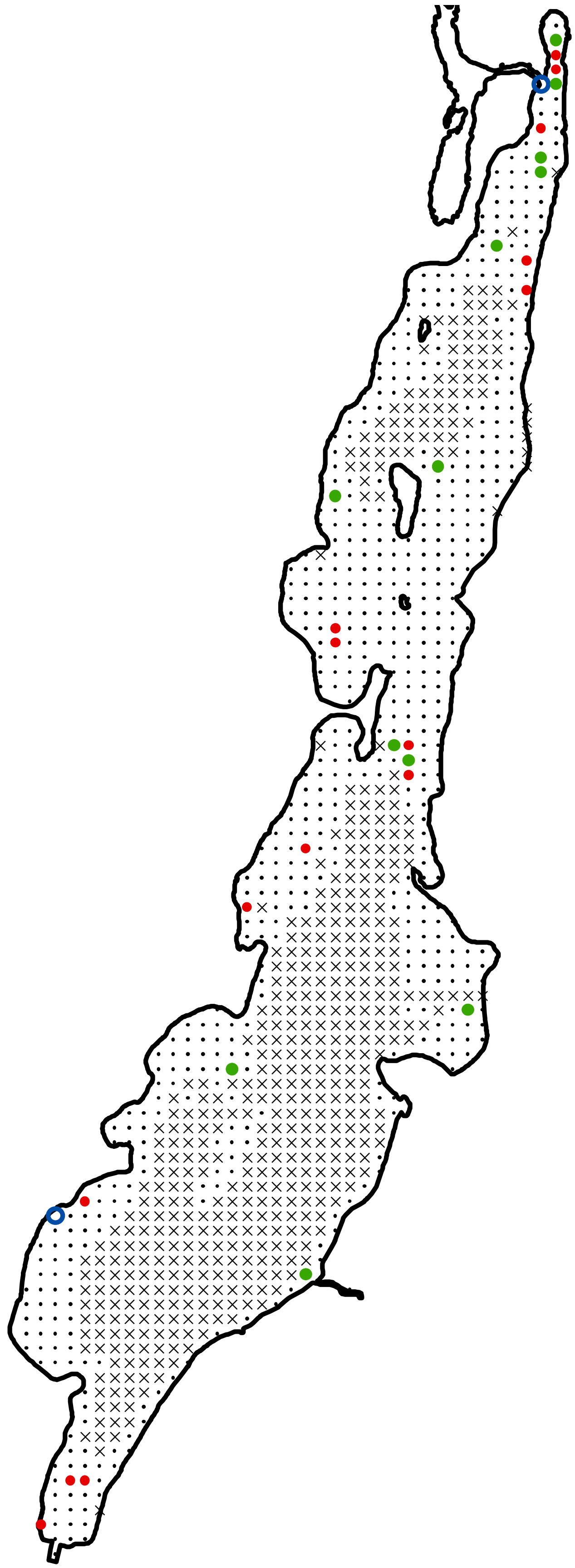
[78] *For more information see, www.surveymonkey.com/r/WWcomplaint.*

APPENDICES

BIG CEDAR LAKE AQUATIC PLANT SPECIES DETAILS

APPENDIX A

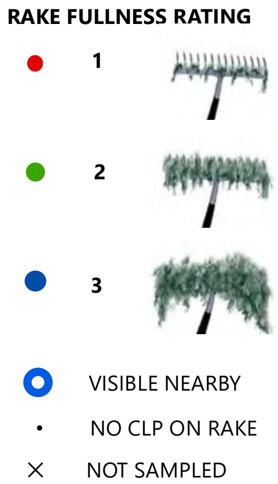
Figure A.1
Eurasian Watermilfoil (*Myriophyllum spicatum*) Distribution in Big Cedar Lake: July 2023

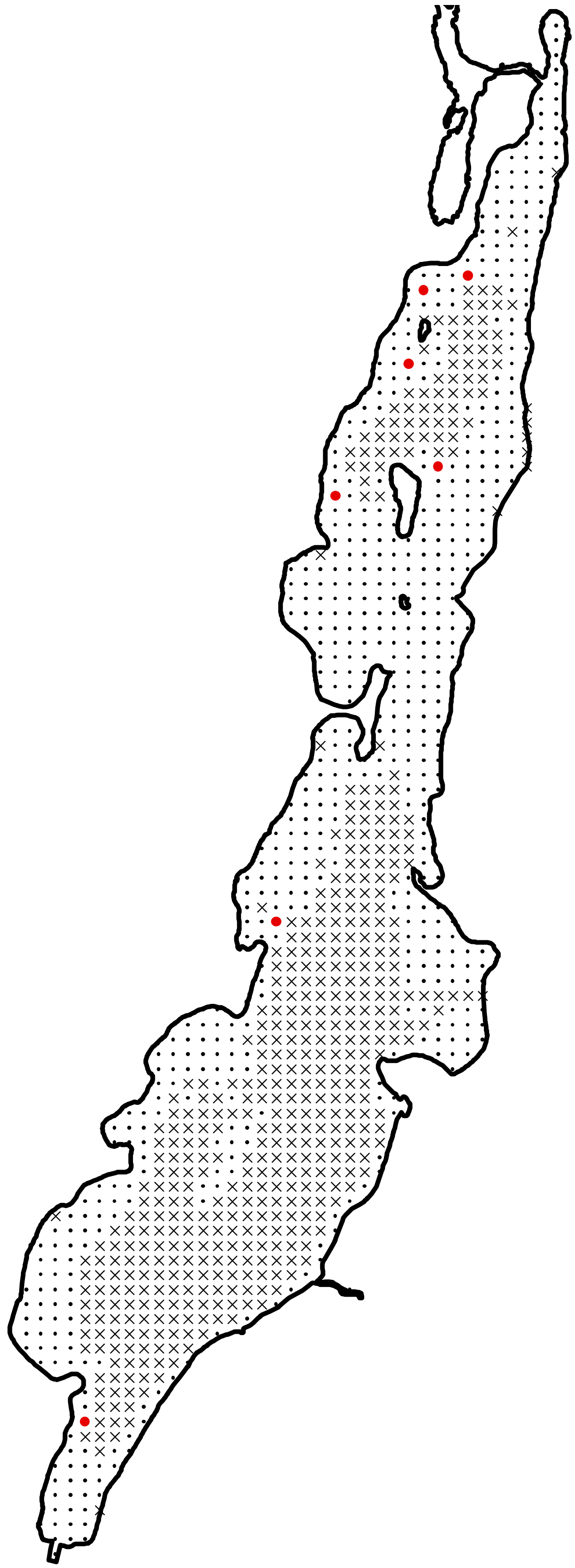


Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

Figure A.2
Curly-leaf Pondweed (*Potamogeton crispus*) Distribution in Big Cedar Lake: July 2023

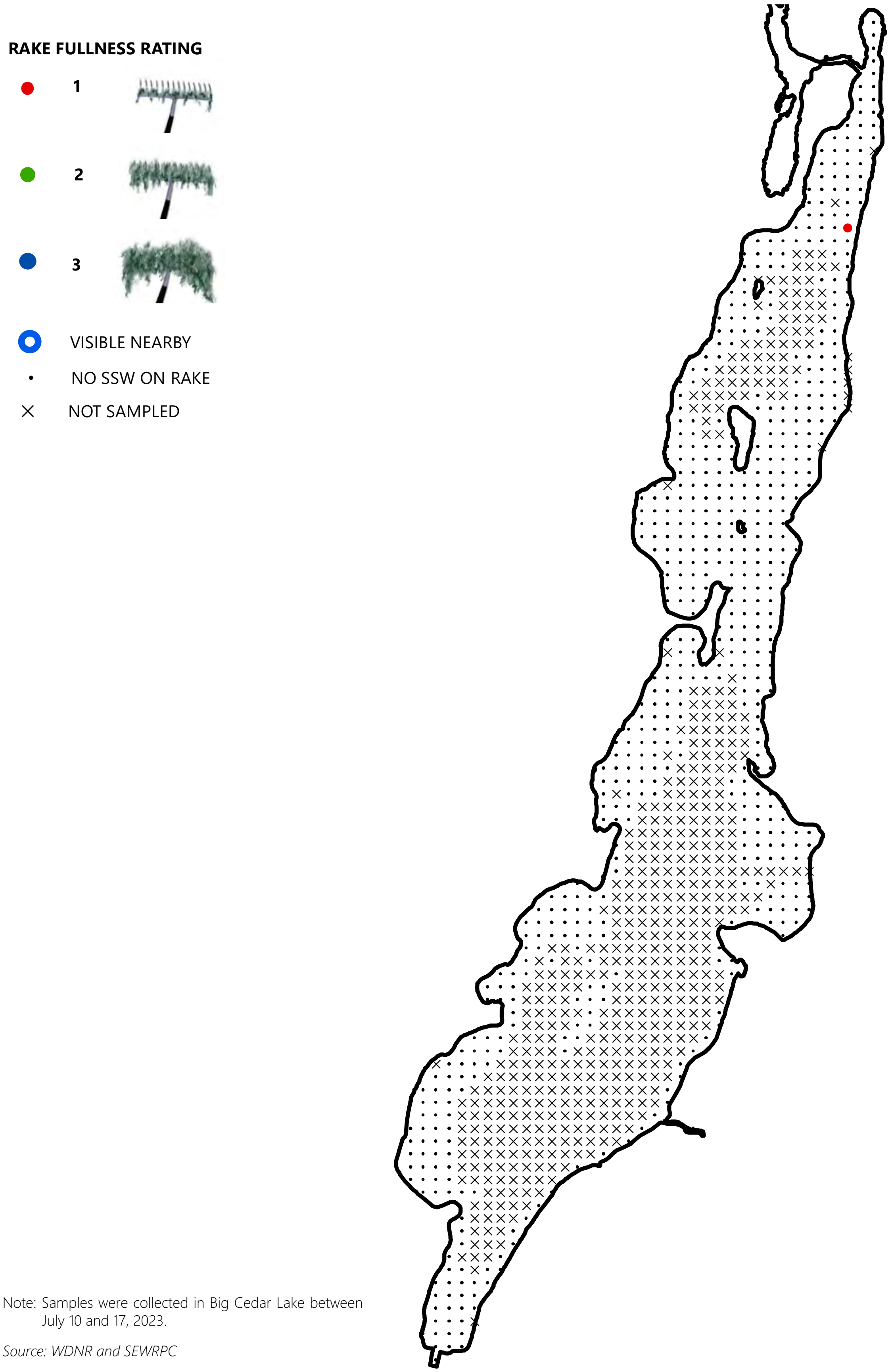




Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

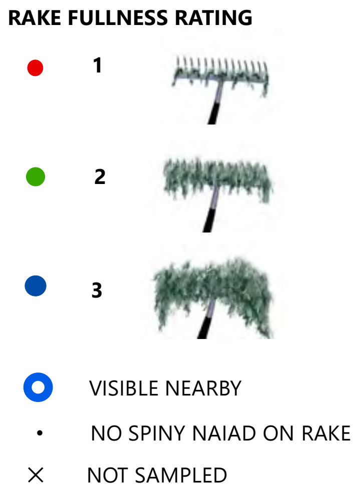
Figure A.3
Starry Stonewort (*Nitellopsis obtusa*) Distribution in Big Cedar Lake: July 2023

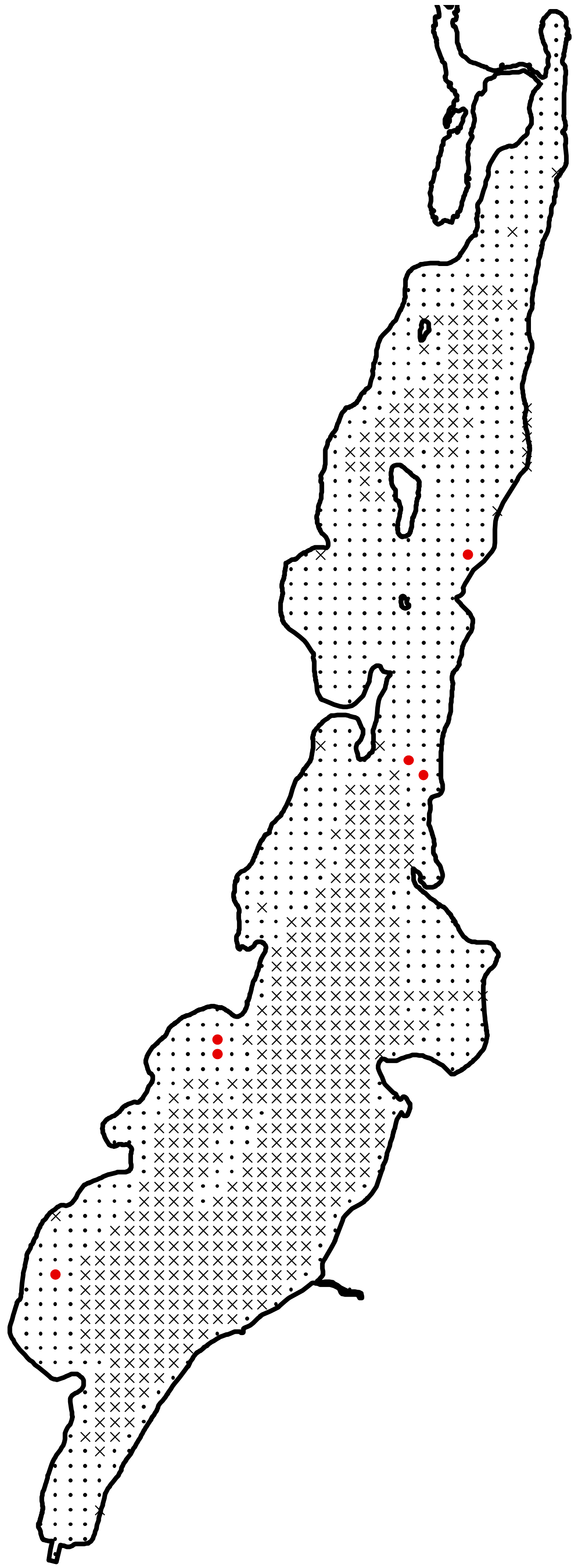


Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

Figure A.4
Spiny Naiad (*Najas marina*) Distribution in Big Cedar Lake: July 2023

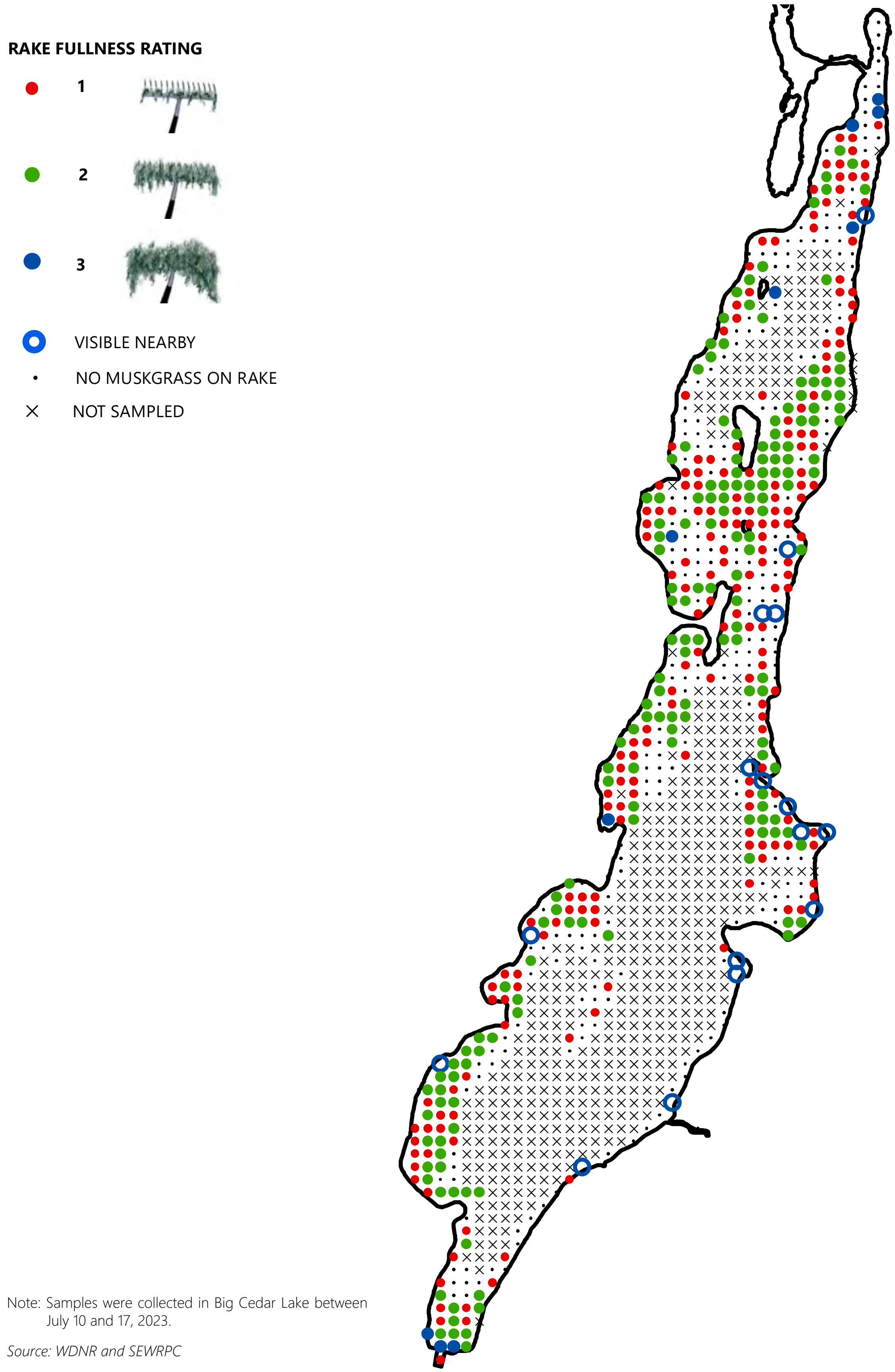




Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

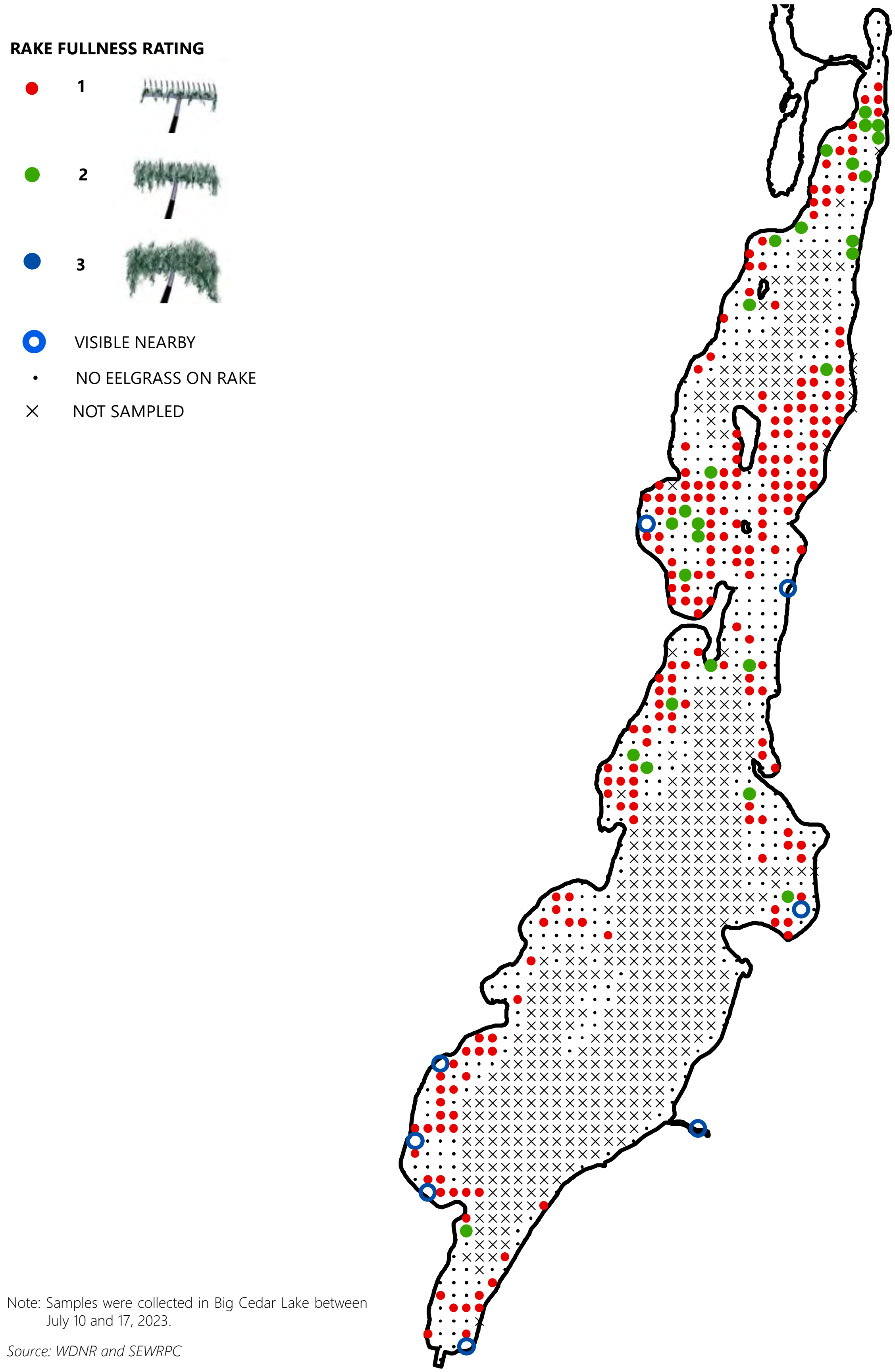
Figure A.5
Muskgrass (*Chara* spp.) Distribution in Big Cedar Lake: July 2023



Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

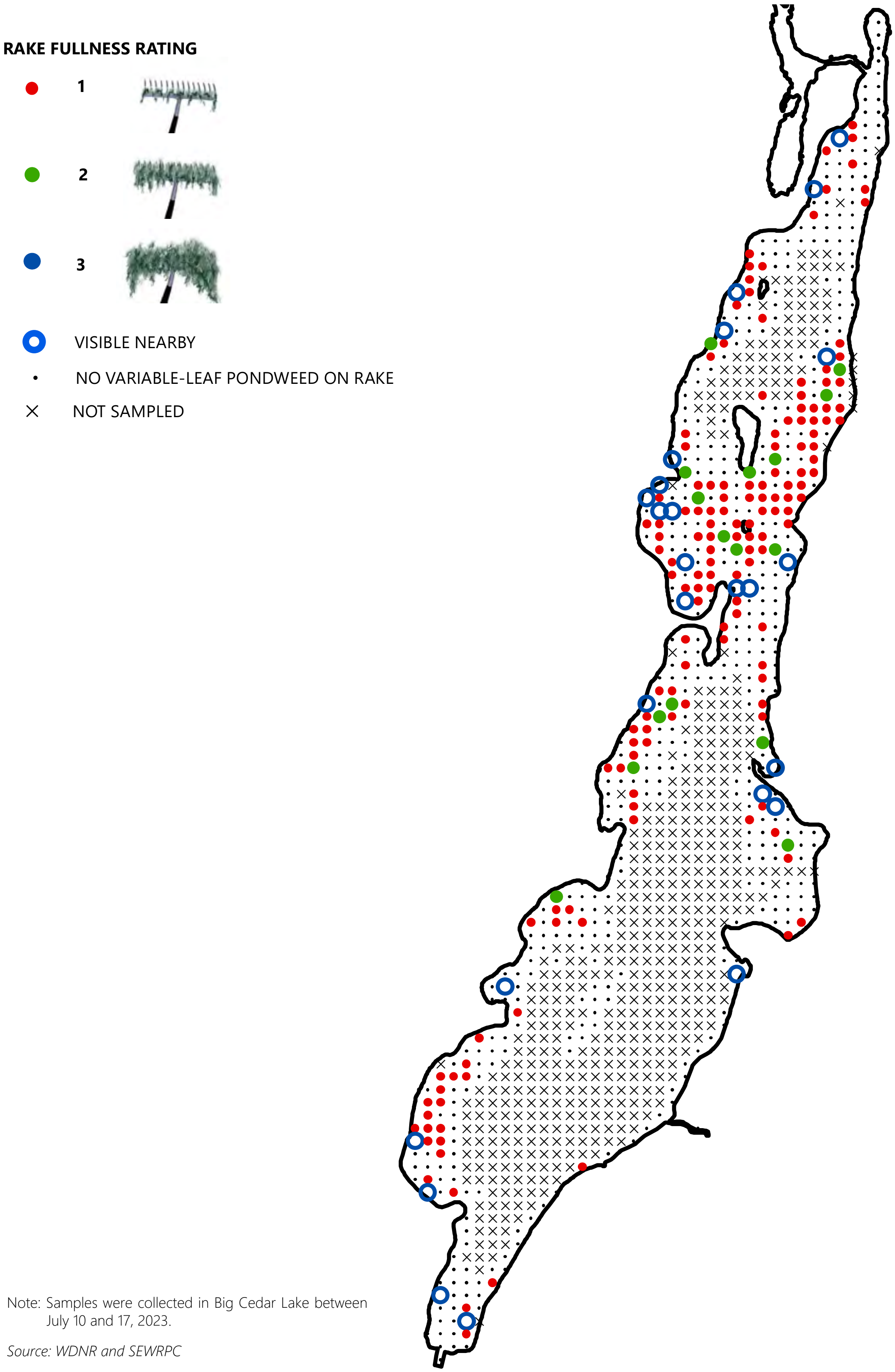
Figure A.6
Eelgrass (*Vallisneria americana*) Distribution in Big Cedar Lake: July 2023



Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

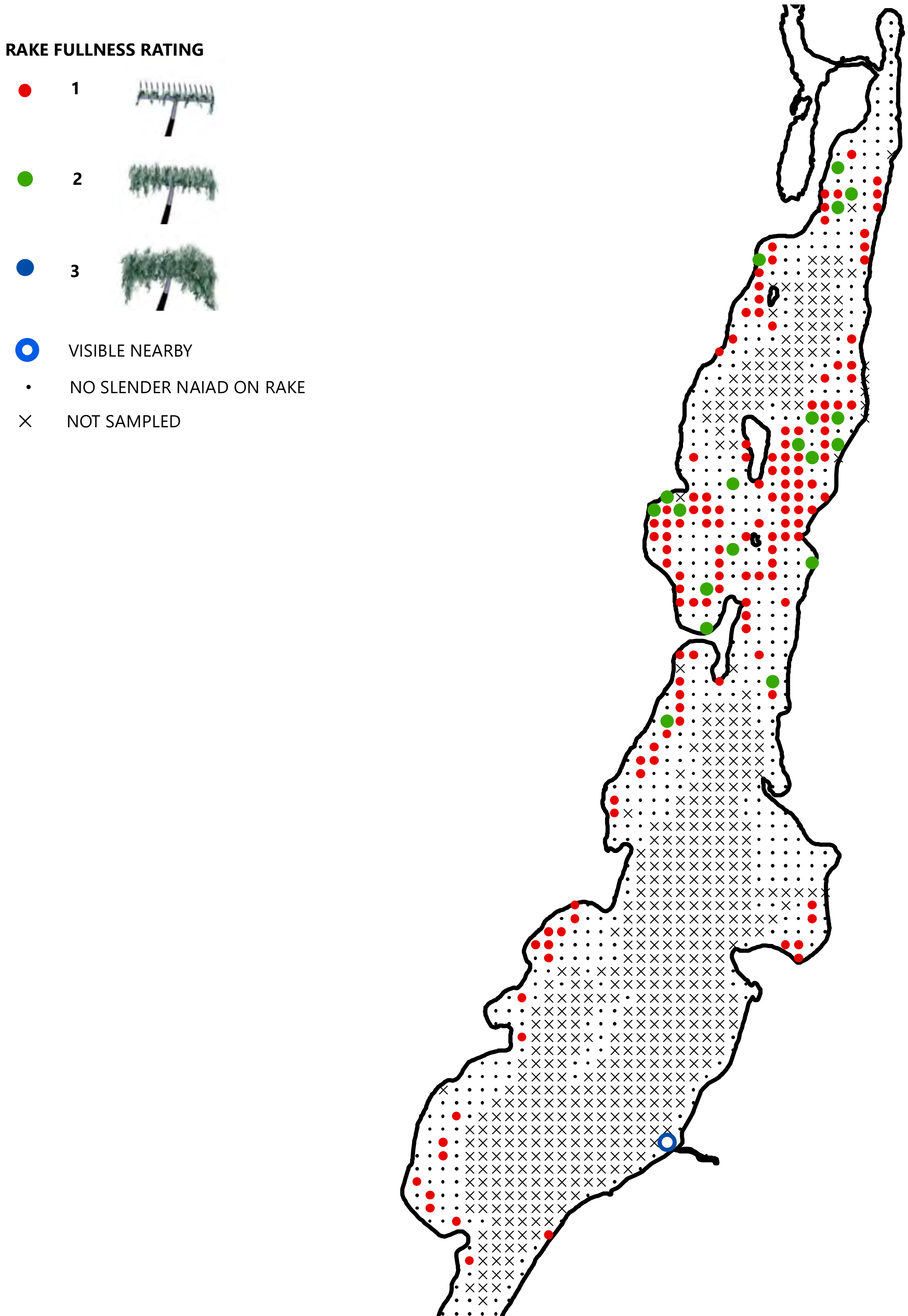
Figure A.7
Variable-leaf Pondweed (*Potamogeton gramineus*) Distribution in Big Cedar Lake: July 2023



Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

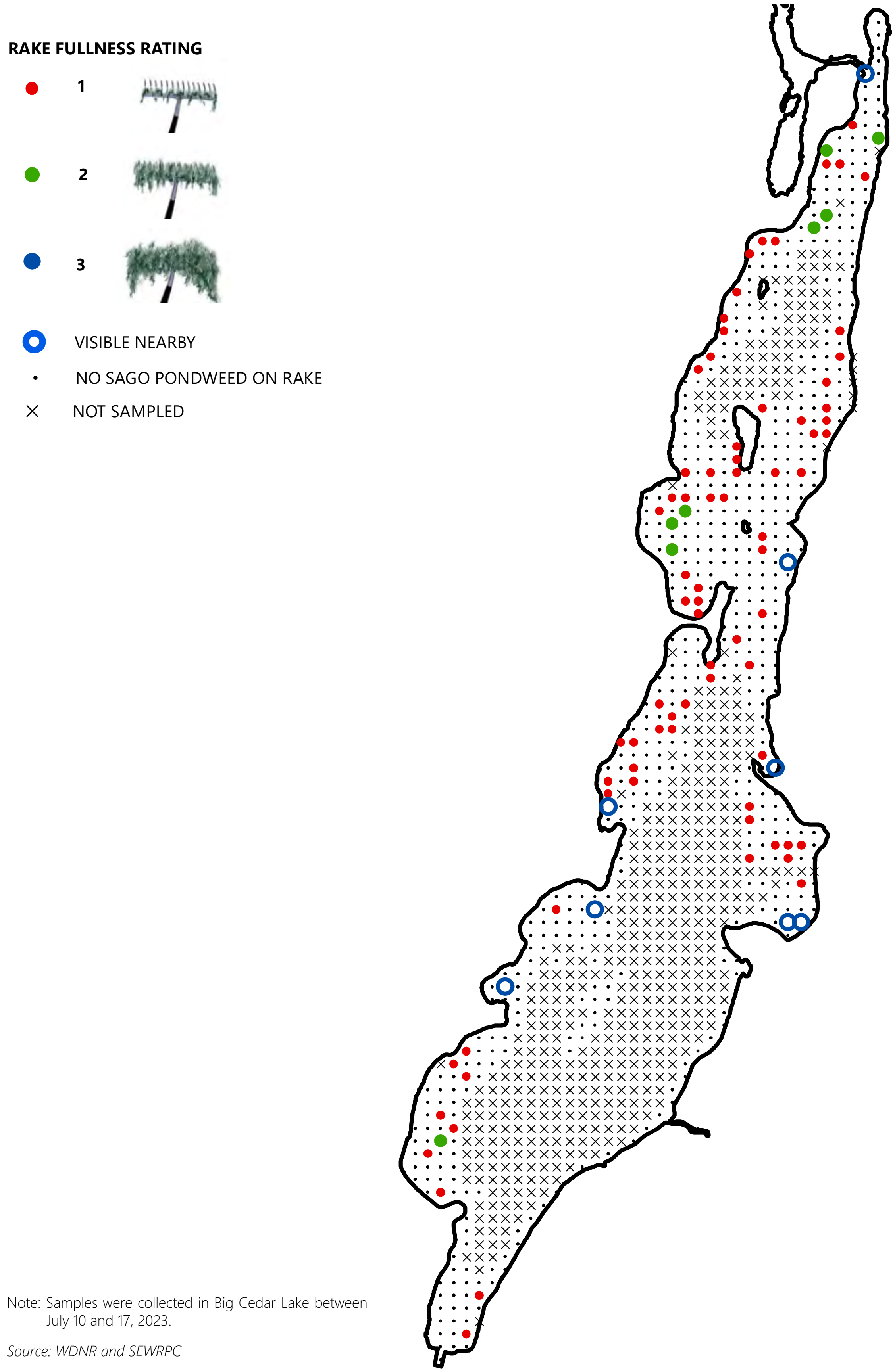
Figure A.8
Slender Naiad (*Najas flexilis*) Distribution in Big Cedar Lake: July 2023



Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

Figure A.9
Sago Pondweed (*Stuckenia pectinata*) Distribution in Big Cedar Lake: July 2023



Note: Samples were collected in Big Cedar Lake between July 10 and 17, 2023.

Source: WDNR and SEWRPC

MATERIALS RECEIVED FROM WISCONSIN DEPARTMENT OF NATURAL RESOURCES

APPENDIX B

Big Cedar Harvest Expansion, Buoy Placement, Expansion of Slow no Wake Area
Proposed Edits to Aquatic Plant Management Plan, Big Cedar Lake

APM Update written by Justin Poinsatte, SEWRPC
Department Comments provided 4/09/2024

Option One comments:

- Fisheries and Wildlife biologists have no concern about this proposal.
- Water Resources biologist is in favor of this proposal to protect rooted aquatic plants.
- Conservation warden: Boaters tend to not go into the two bays. Any high speed boating typically originates from the piers out to the main lake. The southern bay is more rocky and the northern bay has more soft sediment. The southern bay provides good fishing habitat.

Option Two comments:

- This is not an issue for Fisheries, Wildlife or Water Resources Biologists.
- Conservation warden has no objections to this proposal.

Option Three comments:

- Water resource, wildlife and fisheries biologists all are in favor of the reverse motor request signs placed at each end of the channel connecting Big Cedar Lake and Gilbert Lake

Options Four and Five comments:

Fisheries comments:

- FYKE net data collected in the spring of 2023. Data is still being entered. Fisheries reported that the net was not overly productive. Net was placed where the channel is leaving Big Cedar Lake to travel to Gilbert Lake.
- If aquatic plants are sparse and loose sediment is abundant, fish habitat is less than optimal.
- Harvesting in the center of the northern tip will not cause population level impacts to fish species.
- Crappie spawning typically done by middle of May.

Water Resources comments:

- Data from P/I indicates the following vegetation: EWM, Coontail, Elodea, Water star grass, White water lily, large leaf pondweed, Illinois pondweed, Flat stem (2) pondweed, sago pondweed, filamentous algae. All rated 0, 1 or V over 7 P/I points with the exception of flat stem pondweed at a 2 in one location.
- Vegetation documented in the middle of the tip is sparse.
- Pier in NW corner is located in a very shallow area. Harvesting equipment is required to operate in 3 feet of water minimum. The harvesting equipment will not be able to harvest directly to the end of the pier in the NW corner or the end of the pier in the NE corner.
- Western shore of the northern tip has diverse vegetation and much of the shoreline on the western shore has dense vegetation both in the water and in the wetland. Personal observations of Blandings Turtles utilizing the western shore, as well as painted turtles, frogs, multiple bird species and fish.

Wildlife comments:

- Waterfowl will use the plants documented, but the low density indicates that this area of Big Cedar Lake is not a key feeding area. Ideal forage area is on the west shore outside of the expanded harvest area, both north and south of the Gilbert Lake entrance channel.
- Harvesting in the center of the northern tip will not significantly impact forage availability for waterfowl.
- Western shore provides good forage habitat for waterfowl, limiting harvesting activities to the more eastern side of the tip will decrease disturbance of waterfowl.
- 7 foot cut preferred to 50 foot wide skim zone. 50 foot wide skim zone will remove more vegetation for waterfowl forage. 50 foot wide skim zone will increase area of use/disturbance by boaters, which impact waterfowl forage opportunities.

Conservation Warden Comments:

- Northern tip: Prime crappie spawning habitat – early April start if weather is warmer
- Patrol observations: Pike, LM bass also use the area, occasional bluegill, walleye feed at night

Water Resource Biologist NR 109 permit decision, Options 4 and 5:

- The Department will not be able to approve an NR 109 permit application that includes Option 5.
- The Department will, *if requested in the NR 109 permit application*, approve an NR 109 permit that includes Option 4. This cut would be allowed 2 times a year after July 15th of any year.

Biologist Review Staff:

Fisheries: Travis Motl
Wildlife: Steffen Peterson
Water Resources: Heidi Bunk

Conservation Warden: Steve Swiertz

APPENDIX C

PUBLIC COMMENTS RECEIVED

FirstName1: Denise

LastName1: Goergen

Email: XXXXXXXXXX

City1: West bend

State1: WI

comments: I respectfully submit three comments: (1) The public should be provided with the basis for selecting approximately half of the north end as a no skim area. Why half?Has that been studied to be a safe delineation of sensitive habitat to recreational use? As a resident of that area, I have witnessed close encounters of motorized boats competing with kayaks, canoes, and paddle boards. I respectfully request that area be smaller particularly given the plan's approach to the area north of the Gilbert's Channel. 2) The unskimmed area becomes choked with floaters that blow north with the south winds, becoming smelly and buggy. The thickness of the floaters appears to kill off the lily pads by mid-summer. I suggest allowing a one or two time skim to remove the floater blanket and providing recommendations to the district on enhancing retrieval of cut weeds. 3) what is the vision for the north end as invasives continue to proliferate? Residents have a right to the enjoyment of their riparian rights and are concerned about the let it all grow approach of the plan.

FirstName1: Glenn

LastName1: Goergen

Email: XXXXXXXXXX

City1: West Bend

State1: WI

comments: If your new plan is to jeopardize the safety of boaters, kayakers, paddle boarders and the people who live on Artist Bay, then your plan is perfect. If you want to continue to have a smelling mass of weeds and floaters on the West side of Artist Bay, please continue to ignore the requirement in the Plan to pick up floaters in that area. I am always impressed by the DNR's complete inability to find a middle ground for the people it supposedly serves.

FirstName1: Meg

LastName1: Jansky

Email: XXXXXXXXXX

City1: West Bend

State1: WI

comments: There are three areas of the plan that are of great concern to me. First, is the weed harvesting on the north end of the lake. This is a highly ecological sensitive area and is the only area in the lake that is actively protected. It is unclear to me how the weed harvesting plan can ignore the sensitive area and change so drastically from the previous plan. Here is the contrast. The previous weed harvesting map in FREQUENT harvesting areas was only 20 feet wide. The newly proposed plan for the SENSITIVE area is recommending a 70 feet cut with an additional 90 feet for skim cutting. I'm highly concerned that the only remaining sensitive area on the lake will become barren like the sandbar, which in years prior had been covered in native plants. It's ruined. My second area of concern is with respect to the prevention of starry stonewort. This plan does not go far enough to prevent the continued proliferation of this destructive invasive. We should have mandatory cleaning of boats rather than suggested. It doesn't make sense to have this great piece of machinery sitting idle and optional. It should be required to be used at the main Gonring launch where the majority of boats are launched. My third area of concern is with enforcing and monitoring of the plan. Who will ultimately be responsible for the enforcement of the plan? For example, the previous weed harvesting plan was not enforced as there has been considerable cutting over the entire north end of the lake for the last 3 years. The weed cutter has been cutting beyond the buoys all the way to the end of the lake. Please take into consideration my concerns. I thank you for the opportunity to comment.

FirstName1: Christina

LastName1: Fiasca

Email: XXXXXXXXXX

City1: West Bend

State1: Wisconsin

comments: My concern is the north end. Option 4 does not take care of the piers on the north end. A 7 ft swath cut 2 times after July 15th does not give the homeowners the lake access they need In addition, with the prevailing southwestern winds during June, July and August the weeds pile up on the north end and choking out our lily pads and making the shoreline a smelly mess. Cutting a 50 ft swath to the piers with the ability to pick up all floaters in the north end should be the minimum service the piers should get.

FirstName1: Joe

LastName1: Jansky

Email: XXXXXXXXXX

City1: West Bend

State1: Wisconsin

comments: It is very disappointing that the DNR is expanding the weed harvesting activities on Big Cedar Lake on the north end, which is and always has been designated a highly sensitive area. For the last several years, the Big Cedar Lake PRD has done weed harvesting beyond what was allowed in the weed harvesting permit. We have ariel pictures from last year, under the old, restricted permit and you can clearly see the amount of weed harvesting that went all the way to the north end of the lake. There are no controls in place to insure adherence to the permit restrictions. With the expanded access, that area will be over harvested and threaten the sensitive area. The north end residents have complained about floaters, but expanded harvesting in that sensitive area will not fix the problem with floaters. Many weed floaters are being ripped from the lake from growing boating activities and those weeds naturally float to the north end with summer winds. The PRD has already taken steps to address the weed issue with weekly barge trips with PRD members that get into the water and manually rake the weeds from shore. There is no need to expand the weed harvesting. Please remove the expanded weed harvesting activities in the north end of the lake. Instead, please take more aggressive steps to address the starry stone wart invasive species that have already been found in big cedar lake and gilbert lake. The PRD has cleaning equipment on the Gonring launch. The majority of off lake access uses that launch but do not use the cleaning equipment. It's time that the DNR mandate cleaning, otherwise Big Cedar will have an invasive overload like Silver Lake. Is the DNR going to fund the future remediation costs? If not, then it's time to do something now before it's a major problem or start collecting fees from the public for a future sinking fund. It's cost hundreds of thousands to try and address the problem in Silver Lake. I am sending the arial pictures of the north end weed harvesting to Justin via his email since I cannot attach the photos. I would appreciate a response of some sort, as we have provided input in the past and no one has acknowledged our concerns. Thank you for taking more steps to protect big cedar and gilbert lake for future generations.

FirstName1: Susan

LastName1: Crowley

Email: XXXXXXXXXX

City1: West Bend

State1: WI

comments: Hello, I have been unable to comment for over a month and I'm just now getting to my desk to take care of such things! I hope I'm not too late to comment on aquatic plant management in Big Cedar & Gilbert lakes. One of the treasures of these 2 lakes and their channel connecting them is the native and natural aquatic life! The plants are breeding areas and habitat for, not only fish, but also a variety of insects, reptiles, amphibians. What starts below the surface of the water affects the whole food chain. Therefore, I am very much in favor of continuing to protect the north end of Big Cedar from potential increases in harvesting. That north end of Big Cedar is a sensitive & crucial niche in need of protection because of its aquatic life. There are invasives showing up on the shoreline of Gilbert Lake that need attention because their density is increasing each season. They might be considered "above water level" and therefore not aquatic, per se, but invasives in general are, of course, a big concern. Thank you for the opportunity to weight in. I have an assumption that the caretakers of these lakes are working in the best interest of the LAKES.