MEMORANDUM REPORT NO. 143
(3RD EDITION)

AQUATIC PLANT MANAGEMENT PLAN UPDATE FOR THE LAUDERDALE LAKES, WALWORTH COUNTY, WISCONSIN: 2020

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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INTRODUCTION 1

Credit: SEWRPC Staff

The Southeastern Wisconsin Planning Commission (Commission) completed this aquatic plant inventory and management study on behalf of the Lauderdale Lakes Lake Management District (the District). The Wisconsin Department of Natural Resources (WDNR) financed much of the project cost through a *Wisconsin Administrative Code* NR 190 *Lake Management Planning Grants* award (project ID LPL169419). This memorandum is the Commission's third study focusing on Walworth County's Lauderdale Lakes.[1]

1.1 PROJECT SETTING, BACKGROUND, SCOPE, AND INTENT

The Lauderdale Lakes are located in the Towns of LaGrange and Sugar Creek, both in Walworth County, Wisconsin. The Lakes are comprised of three natural basins linked as a result of the impoundment of the outlet to Mill Lake, which forms the headwaters of Honey Creek, a tributary stream to the Fox River. The Lakes have a combined surface area of 841 acres and include the 311-acre spring-fed Green Lake, the 259-acre flow-through Middle Lake, and the 271-acre drained Mill Lake.

The Lakes are intensively used for a diverse array of water-based recreation. Although large areas of the Lakes are too deep to support growth of rooted aquatic plants, nearshore areas, bays, and shallow areas support aquatic vegetation. Shallow water areas are most prevalent in Middle and Mill Lake. Much of the western portion of Middle Lake is designated by the Wisconsin Department of Natural Resources (WDNR) as sensitive area, a situation limiting aquatic plant management activity in this area. To help support a wide variety of recreational uses, the District manages aquatic plant populations under a permit issued by the WDNR. The ongoing management program relies primarily upon mechanical aquatic plant harvesting. According to available data, the aquatic plant community is responding well to current management practices, and lake recreational use has not been unduly restricted in most areas.

The District's aquatic plant management (APM) permit was granted for a five-year period beginning in 2015.[2] A new permit is needed, which requires a comprehensive on-the-water aquatic plant inventory. To support

[1] *The two earlier Commission reports include: SEWRPC Memorandum Report No. 143,* An Aquatic Plant Management Plan for the Lauderdale Lakes, Walworth County, Wisconsin*, August 2001; and SEWRPC Memorandum Report No. 143,* An Aquatic Plant Management Plan for the Lauderdale Lakes, Walworth County, Wisconsin, 2nd Edition*, July 2010.*

[2] *Stantec Project: 193703101,* Lauderdale Lakes Aquatic Plant Management Update*, December 11, 2015.*

this endeavor, the Commission completed an aquatic plant inventory during 2019. The resultant data were used to evaluate the Lakes' plant community conditions and apparent reaction to recent management practices. This information was then used to update the 2015 APM plan. The draft plan update was reviewed in 2020 by the District and regulators.

This updated APM plan summarizes information and recommendations needed to manage nuisance plants (including Eurasian watermilfoil and curly-leaf pondweed). 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 on 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. It also provides specific recommendations related to each alternative. These measures focus on those that the District can implement and collaborate with Lake residents/users and the WDNR.

The current study is not intended to be a comprehensive evaluation of the myriad factors influencing the Lakes' overall health and recreational use potential and therefore does not address watershed issues, land use, in-depth water quality or quantity interpretations, history, recreational use, fish and wildlife, and other such topics typical of comprehensive lake plans.

In summary, this document helps interested parties understand the particular plant management measures to be used in and around the Lakes. These data and suggestions can be valuable resources when developing requisite APM permit applications and implementing future aquatic plant management efforts.

Credit: SEWRPC Staff

INVENTORY FINDINGS AND RELEVANCE TO RESOURCE MANAGEMENT 2

Natural resource planning relies upon data to quantify conditions, identify management challenges and limitations, and predict the influence of potential courses of action. These factors are collectively considered to evaluate and recommend practices that promote sustainable use, help safeguard human and environmental health, balance diverse lake user interests, address sometimes disparate lake user desires, and comply with regulatory objectives and requirements. The following sections briefly describe data collection efforts, summarize and highlight resultant data, interpret data trends and relationships, and make conclusions useful to guide resource planning.

2.1 AQUATIC PLANT MANAGEMENT GOALS AND OBJECTIVES

Aquatic plant management (APM) programs are designed to further a variety of lake user and riparian land owner 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 Lauderdale Lakes APM plan considered input from many entities including the Lauderdale Lakes Lake Management District (the District) and the WDNR. Objectives of the Lauderdale Lakes APM program include the following:

- Effectively control the quantity and density of nuisance aquatic plant growth in well-targeted portions of the Lauderdale Lakes. This objective helps:
  - Enhance water-based recreational opportunities
  - Improve community-perceived aesthetic values
  - Maintain or enhance the Lakes' 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, their biotic communities, their habitat value, and their 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 Lauderdale Lakes.

- Promote a high-quality water-based experience for residents and visitors to the Lauderdale Lakes consistent with the policies and practices of the WDNR, as described in the regional water quality management plan, as amended.[3]

To meet these objectives, the District executed an agreement with the Southeastern Wisconsin Regional Planning Commission (Commission) to investigate the characteristics of the Lauderdale 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

The Lakes' aquatic plant communities were evaluated several times since the 1960s. WDNR staff surveyed the aquatic plant community during 1967 and 2014.[4,5,6] Stantec surveyed Green and Mill Lakes in 2014.[7] Commission staff surveyed the Lakes' aquatic plants in 1999,[8] 2008,[9] and 2019. Species lists and abundance data derived from the 2014 and 2019 surveys for each lake are compared in Tables 2.1, 2.2, and 2.3. The 2014 and 2019 surveys both used the same point-intercept grid and methodology.[10,11,12] Therefore, the same points were sampled using the same techniques on roughly the same date approximately five years apart. Such consistency enables more detailed evaluation of aquatic plant abundance and distribution change than has been possible in the past. The raw data generated during the 2019 aquatic plant survey is included in Appendix A.

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[3] *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.*

[4] *B.J. Belonger,* Aquatic Plant Survey of Major Lakes in the Fox River (Illinois) Watershed*, WDNR Research Report Number 39, 1969.*

[5] *SEWRPC and Wisconsin Department of Natural Resources Lake Use Report Nos. FX-17, 18, and 20,* The Lauderdale Lakes, Walworth County, Wisconsin*, 1969.*

[6] *Stantec Project: 193703101, op. cit.*

[7] *Ibid.*

[8] *SEWRPC Memorandum Report No. 143, op. cit.*

[9] *SEWRPC Memorandum Report No. 143, 2nd Edition, op. cit.*

[10] *It is noteworthy that sampling methodology changed from transect-based methods in the earlier surveys (1967 through 2008) to a point-intercept method beginning in 2014.*

[11] *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 Stan 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," University of Wisconsin-Extension, February 4, 1994.*

[12] *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
Aquatic Plant Abundance, Green Lake: July 2014 Versus August 2019

Aquatic Plant Species	Native or Invasive	Number of Points Found[a] (2014/2019)	Frequency of Occurrence Within Vegetated Areas[b] (2014/2019)	Average Rake Fullness[c] (2014/2019)	Relative Frequency of Occurrence[d] (2014/2019)	Visual Sightings[e] (2014/2019)
Myriophyllum spicatum (Eurasian watermilfoil)	Invasive	28/24	14.1/14.3	1.0/1.1	8.5/6.9	0/2
Ceratophyllum demersum (Coontail)	Native	0/1	0/0.6	0/1.0	0/0.3	0/0
Chara sp. (Muskgrasses)*	Native	82/102	41.4/60.7	1.2/1.4	24.9/29.5	0/11
Elodea canadensis (Common waterweed)	Native	2/3	1.0/1.8	1.0/1.0	0.6/0.9	0/0
Heteranthera dubia (Water stargrass)	Native	4/1	2.0/0.6	1.3/1.0	1.2/0.3	0/0
Najas flexilis (Slender naiad)	Native	16/15	8.1/8.9	1.2/1.1	4.9/4.3	0/0
Najas marina (Spiny naiad)[f]	Naturalized	42/30	21.2/17.9	1.0/1.0	12.8/8.7	0/0
Nuphar variegata (Spatterdock)	Native	1/0	0.5/0.0	1.0/0	0.3/0	0/3
Nymphaea odorata (White water lily)	Native	0/0	0/0	0/0	0/0	0/5
Potamogeton alpinus (Alpine pondweed)*	Native	2/0	1.0/0	1.0/0	0.6/0	0/0
Potamogeton friesii (Fries' pondweed)*	Native	0/1	0/0.6	0/1.0	0/0.3	0/0
Potamogeton gramineus (Variable pondweed)*	Native	1/7	0.5/4.2	1.0/1.1	0.3/2.0	0/5
Potamogeton natans (floating-leaf pondweed)	Native	0/0	0/0	0/0	0/0	0/1
Potamogeton praelongus (White-stem pondweed)*[g]	Native	0/5	0/3.0	0/1.0	0/1.4	0/1
Potamogeton zosteriformis (Flat-stem pondweed)	Native	0/2	0/1.2	0/1.0	0/0.6	0/0
Sagittaria cuneata (Arum-leaved arrowhead)*	Native	2/30	1.0/17.9	1.0/1.2	0.6/8.7	1/4
Stuckenia pectinata (Sago pondweed)[g]	Native	66/53	33.3/31.6	1.0/1.1	20.1/15.3	0/2
Utricularia minor (Small bladderwort)*	Native	0/1	0/0.6	0/1.0	0/0.3	0/0
Utricularia vulgaris (Common bladderwort)*	Native	7/8	3.5/4.8	1.0/1.0	2.1/2.3	0/0
Vallisneria americana (Wild celery)[g]	Native	76/63	38.4/37.5	1.0/1.0	23.1/18.2	0/2

Notes:

- During the 2014 survey, sampling occurred at 695 sampling points on July 23, 2019. Of the sampling points visited, 198 were vegetated. During the 2019 survey, sampling occurred at 273 sampling points on August 15 and 16, 2019. Of the sampling points visited, 168 had vegetation.
- Red text indicates non-native and/or invasive species.
- An asterisk (*) next to a species name indicates that the species is considered "sensitive," with a coefficient of conservatism C value of seven or greater.
- See Appendix B for distribution maps and identifying features.

Table continued on next page.

Table 2.1 (Continued)

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

[b] Frequency of Occurrence Within Vegetated Areas, *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 points 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 points 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. (It is likely that visual sightings were not taken in 2011*).

[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] *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

Table 2.2
Aquatic Plant Abundance, Middle Lake: August 2014 Versus August 2019

Aquatic Plant Species	Native or Invasive	Number of Points Found[a] (2014/2019)	Frequency of Occurrence Within Vegetated Areas[b] (2014/2019)	Average Rake Fullness[c] (2014/2019)	Relative Frequency of Occurrence[d] (2014/2019)	Visual Sightings[e] (2014/2019)
Myriophyllum spicatum (Eurasian watermilfoil)	Invasive	34/20	8.5/9.2	1.0/1.1	4.3/4.7	10/13
Potamogeton crispus (Curly-leaf pondweed)	Invasive	1/2	0.2/0.9	1.0/1.5	0.1/0.5	5/0
Ceratophyllum demersum (Coontail)	Native	3/3	0.7/1.4	1.0/1.0	0.4/0.7	0/0
Chara sp. (Muskgrasses)*	Native	319/157	79.6/72.0	1.2/1.7	40.0/36.9	4/10
Elodea canadensis (Common waterweed)	Native	4/2	1.0/0.9	1.0/1.5	0.5/0.5	1/2
Heteranthera dubia (Water stargrass)	Native	1/0	0.2/0	1.0/0	0.1/0	0/0
Myriophyllum verticillatum (Whorled water milfoil)	Native	22/11	5.5/5.0	1.0/1.5	2.8/2.6	14/21
Najas flexilis (Slender naiad)	Native	31/22	7.7/10.1	1.0/1.1	3.9/5.2	3/2
Najas guadalupensis (Southern naiad)	Native	0/0	0/0	0/0	0/0	0/1
Najas marina (Spiny naiad)[f]	Naturalized	121/56	30.2/25.7	1.0/1.3	15.2/13.1	17/5
Nitella tenuissima (small nitella)	Native	0/1	0/0.5	0/1.0	0/0.2	0/0
Nuphar variegata (Spatterdock)	Native	13/6	3.2/2.8	1.0/1.2	1.6/1.4	95/22
Nymphaea odorata (White water lily)	Native	23/2	5.7/0.9	1.0/1.5	2.9/0.5	86/16
Potamogeton foliosus (Leafy pondweed)	Native	0/0	0/0	0/0	0/0	1/0
Potamogeton friesii (Fries' pondweed)*	Native	0/1	0/0.5	0/1.0	0/0.2	0/0
Potamogeton gramineus (Variable pondweed)*	Native	7/9	1.7/4.1	1.0/1.0	0.9/2.1	6/9
Potamogeton illinoensis (Illinois pondweed)	Native	1/0	0.2/0	1.0/0	0.1/0	0/0
Potamogeton natans (Floating-leaf pondweed)	Native	3/2	0.7/0.9	1.0/1.0	0.4/0.5	6/4
Potamogeton richardsonii (Clasping-leaf pondweed)[g]	Native	0/0	0/0	0/0	0/0	1/0
Potamogeton zosteriformis (Flat-stem pondweed)	Native	4/0	1.0/0	1.0/0	0.5/0	0/3
Ranunculus aquatilis (White water crowfoot)*	Native	0/0	0/0	0/0	0/0	0/1
Sagittaria cuneata (Arum-leaved arrowhead)*	Native	0/35	0/16.1	0/1.2	0/8.2	0/19
Sagittaria latifolia (Common arrowhead)	Native	0/0	0/0	0/0	0/0	1/0
Sagittaria sp. (Arrowhead)	Native	50/0	12.5/0	1.0/0	6.3/0	13/0
Schoenoplectus acutus (Hardstem bulrush)	Native	8/0	2.0/0	1.1/0	1.0/0	64/14
Sparganium emersum (Short-stemmed bur-reed)*	Native	0/0	0/0	0/0	0/0	0/1
Sparganium natans (Small bur-reed)*	Native	0/6	0/2.8	0/1.2	0/1.4	0/3
Sparganium sp. (Bur-reed)	Native	8/0	2.0/0	1.0/0	1.0/0	6/0
Stuckenia pectinata (Sago pondweed)[g]	Native	70/33	17.5/15.1	1.0/1.0	8.8/7.7	20/8
Typha sp. (Cattail)	Native	0/0	0/0	0/0	0/0	2/0
Utricularia geminiscapa (Twin-stemmed bladderwort)*	Native	4/0	1.0/0	1.0/0	0.5/0	3/0

Table continued on next page.

Table 2.2 (Continued)

Aquatic Plant Species	Native or Invasive	Number of Points Found[a] (2014/2019)	Frequency of Occurrence Within Vegetated Areas[b] (2014/2019)	Average Rake Fullness[c] (2014/2019)	Relative Frequency of Occurrence[d] (2014/2019)	Visual Sightings[e] (2014/2019)
Utricularia gibba (Creeping bladderwort)*	Native	12/0	3.0/0	1.0/0	1.5/0	1/0
Utricularia vulgaris (Common bladderwort)*	Native	27/15	6.7/6.9	1.0/1.0	3.4/3.5	15/3
Vallisneria americana (Wild celery)[g]	Native	31/43	7.7/19.7	1.0/1.1	3.9/10.1	2/5
Zizania aquatica (Southern wild rice)* [g]	Native	1/0	0.2/0	1.0/0	0.1/0	9/5

Notes:

- During the 2014 survey, sampling occurred at 588 sampling points on August 11, 12, and 13, 2014. Of the sampling points visited, 401 were vegetated. During the 2019 survey, sampling occurred at 286 sampling points on August 19, 20, and 21, 2019. Of the sampling points visited, 218 had vegetation.
- Red text indicates non-native and/or invasive species.
- An asterisk (*) next to a species name indicates that the species is considered "sensitive," with a coefficient of conservatism C value of seven or greater.
- See Appendix B for distribution maps and identifying features.

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

[b] Frequency of Occurrence Within Vegetated Areas, *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 points 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 points 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. (It is likely that visual sightings were not taken in 2011).*

[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] *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

Table 2.3
Aquatic Plant Abundance, Mill Lake: July 2014 Versus August 2019

Aquatic Plant Species	Native or Invasive	Number of Points Found[a] (2014/2019)	Frequency of Occurrence Within Vegetated Areas[b] (2014/2019)	Average Rake Fullness[c] (2014/2019)	Relative Frequency of Occurrence[d] (2014/2019)	Visual Sightings[e] (2014/2019)
Myriophyllum spicatum (Eurasian watermilfoil)	Invasive	109/137	36.8/47.4	1.0/1.2	18.4/18.8	0/4
Potamogeton crispus (Curly-leaf pondweed)	Invasive	2/0	0.7/0	1.0/0	0.3/0	0/3
Ceratophyllum demersum (Coontail)	Native	15/8	5.1/2.8	1.1/1.8	2.5/1.1	0/1
Chara sp. (Muskgrasses)*	Native	141/196	47.6/67.8	1.1/1.7	23.7/27.0	0/0
Elodea canadensis (Common waterweed)	Native	13/8	4.4/2.8	1.0/1.0	2.2/1.1	0/0
Heteranthera dubia (Water stargrass)	Native	3/8	1.0/2.8	1.0/1.3	0.5/1.1	0/0
Myriophyllum verticillatum (Whorled water milfoil)	Native	0/15	0/5.2	0/1.4	0/2.1	0/1
Najas flexilis (Slender naiad)	Native	20/20	6.8/6.9	1.0/1.1	3.4/2.8	0/1
Najas guadalupensis (Southern naiad)	Native	0/19	0/6.6	0/1.1	0/2.6	0/0
Najas marina (Spiny naiad)[f]	Naturalized	60/54	20.3/18.7	1.0/1.2	10.17.4	0/1
Nitella flexilis (Slender nitella)	Native	0/4	0/1.4	0/1.3	0/0.6	0/0
Nuphar variegata (Spatterdock)	Native	2/1	0.7/0.3	1.0/1.0	0.3/0.1	0/3
Nymphaea odorata (White water lily)	Native	3/2	1.0/0.7	1.0/2.0	0.5/0.3	0/8
Potamogeton alpinus (Alpine pondweed)*	Native	18/0	6.1/0	1.0/0	3.0/0	0/0
Potamogeton amplifolius (Large-leaf pondweed)*[g]	Native	0/0	0/0	0/0	0/0	0/1
Potamogeton gramineus (Variable pondweed)*	Native	0/12	0/4.2	0/1.0	0/1.7	0/2
Potamogeton natans (Floating-leaf pondweed)	Native	3/0	1.0/0	1.0/0	0.5/0	0/6
Potamogeton zosteriformis (Flat-stem pondweed)	Native	1/5	0.3/1.7	1.0/1.0	0.2/0.7	0/1
Sagittaria cuneata (Arum-leaved arrowhead)*	Native	4/4	1.4/1.4	1.0/1.3	0.7/0.6	0/3
Stuckenia pectinata (Sago pondweed)[g]	Native	31/47	10.5/16.3	1.0/1.1	5.2/6.5	0/2
Utricularia vulgaris (Common bladderwort)*	Native	31/35	10.5/12.1	1.0/1.1	5.2/4.8	0/1
Vallisneria americana (Wild celery)[g]	Native	138/151	46.6/52.2	1.0/1.2	23.2/20.8	0/5

Notes:

- During the 2014 survey, sampling occurred at 457 sampling points on July 30, 2014. Of the sampling points visited, 296 were vegetated. During the 2019 survey, sampling occurred at 365 sampling points on August 13, 14, and 16, 2019. Of the sampling points visited, 289 had vegetation.
- Red text indicates non-native and/or invasive species.
- An asterisk (*) next to a species name indicates that the species is considered "sensitive," with a coefficient of conservatism C value of seven or greater.
- See Appendix B for distribution maps and identifying features.

Table continued on next page.

Table 2.3 (Continued)

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

[b] Frequency of Occurrence Within Vegetated Areas, *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 points 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 points 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. (It is likely that visual sightings were not taken in 2011).*

[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] *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

Each aquatic plant species has preferred habitat conditions in which that species generally 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. For similar reasons, some areas of a particular lake may contain plant communities with very little diversity, while other areas of the same lake may exhibit good diversity. Historically, human manipulation has often favored certain plants and reduced biological diversity (biodiversity). Thoughtful aquatic plant management can help maintain or even enhance aquatic plant biodiversity.

Several metrics are useful to describe aquatic plant community condition and design management strategies. These metrics include maximum depth of colonization, species richness, biodiversity, evaluation of sensitive species, and relative species abundance. Metrics derived from the 2014 and 2019 point-intercept surveys are described below.

Maximum Depth of Colonization

The maximum depth to which aquatic plants grow in a lake, known as the maximum depth of colonization (MDC), is a useful indicator of water quality, as turbid and/or eutrophic (nutrient-rich) lakes generally have shallower MDC than lakes with clear water.[13] The MDC of the Lauderdale Lakes system was generally 12-13 feet below the water surface during 2014 and 2019, indicating generally high water clarity. In all of the Lakes, steep lake contours contribute to a reduced area that is shallow enough for plants to colonize, limiting aquatic plant abundance within the Lakes. 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 *Chara* spp. and *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.

Species Richness

The number of different 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 generally have greater species richness. Aquatic plants provide a wide variety of benefits to lakes, examples of which are briefly described in Table 2.4. Middle Lake typically hosts more aquatic plant species when compared to Green and Mill Lakes; however, all three Lakes exhibit high species richness.

The Lauderdale Lakes exhibited high species richness overall during the initial plant inventory completed in 1967 (see Tables 2.5, 2.6, and 2.7). At that time species location was not differentiated by specific basins (i.e., Green, Middle, or Mill Lake). All three Lakes have maintained high species richness throughout the surveys that followed with only slight increases or decreases from year to year. 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 (amount of solar radiation reaching a given area), and other ecological factors. The 2019 aquatic plant survey identified 15 native submerged species in Green Lake, 18 species in Middle Lake, and 16 species in Mill Lake.

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), a metric that ranges from 0 (no diversity) to 1 (infinite diversity). Using this measure, a community dominated by

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

Table 2.4
Examples of Positive Ecological Qualities Associated with Aquatic Plant Species Present in the Lauderdale Lakes

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. (muskgrass)	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 spicatum (Eurasian watermilfoil)	None known. Invasive nonnative. Hinders navigation, outcompetes desirable aquatic plants, reduces water circulation, depresses oxygen levels, and reduces fish/invertebrate populations
Myriophyllum verticillatum (whorled watermilfoil)	Waterfowl utilize fruit and foliage as food source; foliage provides invertebrate habitat, as well as shade, shelter, and foraging for fish; native
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
Najas marina (spiny 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
Potamogeton amplifolius (large-leaf pondweed)	Also known as bass-weed or musky-weed, this plant is highly prized by fishermen as prime fish habitat; provides excellent shelter for small fish and foraging opportunities for predator fish; valuable waterfowl food; native
Potamogeton crispus (curly-leaf pondweed)	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 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 praelongus (white-stem pondweed)	Provides shade and shelter for fish; harbor for insects; seeds are eaten by wildfowl; the presence of white-stem pondweed in a lake is usually an indicator of good water quality due to this plant's intolerance of polluted conditions; native
Potamogeton zosteriformis (flat-stem pondweed)	Provides some food for ducks; native
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 vulgaris (common bladderwort)	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

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.

Data collected during 2019 reveal that Green Lake's SDI was 0.83, a very slight increase from 0.82 measured during 2014. Although the number of native species found in Green Lake increased from 10 to 15, the additional species were found in few locations and in low abundance and thus did not greatly increase the SDI. Similarly, Middle Lake's SDI slightly increased from 0.80 in 2014 to 0.82 in 2019 for the same reasons. Mill Lake's SDI slightly decreased from 0.84 in 2014 to 0.83 in 2019, likely due to increasing dominance by Eurasian watermilfoil (EWM) (*Myriophyllum spicatum*) and muskgrass (*Chara* spp.). All SDI values reveal considerable biodiversity in the Lakes. As mentioned above, the 2019 aquatic plant survey of Lauderdale Lakes identified 15 native submerged aquatic plant species in Green Lake, 18 species in Middle Lake, and 16 species in Mill Lake. Actions that conserve and promote aquatic plant biodiversity are critical to the long

Table 2.5
Submerged Aquatic Plant Species Observed in Green Lake: 1967-2019

Submerged Aquatic Plant Species	1967	1999	2008	2014	2019
Invasive Aquatic Plants					
Myriophyllum spicatum (Eurasian watermilfoil)	--	X	X	X	X
Najas marina (spiny naiad)	X	X	X	X	X
Potamogeton crispus (curly-leaf pondweed)	X	X	X	--	--
Total Invasive Species Observed	2	3	3	2	2
Native Aquatic Plants					
Ceratophyllum demersum (coontail)	X	X	X	--	X
Chara spp. (muskgrasses)	X	X	X	X	X
Elodea canadensis (common waterweed)	X	X	X	X	X
Heteranthera dubia (water stargrass)	--	X	X	X	X
Myriophyllum sibiricum (northern watermilfoil)	X	X	X	--	--
Najas flexilis (slender naiad)	X	X	X	X	X
Nitella spp. (stonewort)	X	--	--	--	--
Potamogeton alpinus (alpine pondweed)	--	X	--	X	--
Potamogeton foliosus (leafy pondweed)	--	X	X	--	--
Potamogeton friesii (Fries' pondweed)	--	--	--	--	X
Potamogeton gramineus (variable pondweed)	X	--	X	X	X
Potamogeton illinoensis (Illinois pondweed)	--	X	X	--	--
Potamogeton natans (floating-leaf pondweed)	X	--	X	--	X
Potamogeton nodosus (long-leaf pondweed)	X	--	--	--	--
Potamogeton praelongus (white-stem pondweed)	X	--	--	--	X
Potamogeton pusillus (small pondweed)	--	--	X	--	--
Potamogeton richardsonii (clasping-leaf pondweed)	--	--	X	--	--
Potamogeton spp. (pondweed)	X	X	--	--	--
Potamogeton zosteriformis (flat-stem pondweed)	X	X	X	--	X
Ranunculus aquatilus (white water crowfoot)	X	--	--	--	--
Sagittaria cuneata (arum-leaved arrowhead)	--	--	--	X	X
Stuckenia pectinata (Sago pondweed)	X	X	X	X	X
Utricularia minor (small bladderwort)	--	--	--	--	X
Utricularia spp. (bladderwort)	X	--	X	--	--
Utricularia vulgaris (common bladderwort)	--	--	--	X	X
Vallisneria americana (eelgrass/water celery)	X	X	X	X	X
Total Native Species Observed	16	13	16	10	15
Total Species Richness	18	16	19	12	17

Note: Species presence was reported collectively for the Lauderdale Chain of Lakes in the 1967 survey. Observations did not specify Green, Middle, or Mill Lake.

Source: Wisconsin Department of Natural Resources, Stantec, and SEWRPC

term health of the Lakes. 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.

Even though all three Lakes exhibit good species richness and biodiversity, no one location in the Lauderdale Lakes contained all identified aquatic plant species. During 2019, between one and six aquatic plant species (includes native and invasive plants) were found at any one sampling point throughout the Lakes (Figure 2.1). Green and Middle Lakes' greatest species richness occurred in the southwestern and eastern bays. Mill Lake's greatest species richness was found in its northern half as well as in the small eastern bay.

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.[14] The FQI is an assessment metric used

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

Table 2.6
Submerged Aquatic Plant Species Observed in Middle Lake: 1967-2019

Submerged Aquatic Plant Species	1967	1999	2008	2014	2019
Invasive Aquatic Plants					
Myriophyllum spicatum (Eurasian watermilfoil)	--	X	X	X	X
Najas marina (spiny naiad)	X	X	X	X	X
Potamogeton crispus (curly-leaf pondweed)	X	X	X	X	X
Total Invasive Species Observed	2	3	3	3	3
Native Aquatic Plants					
Ceratophyllum demersum (coontail)	X	X	X	X	X
Chara spp. (muskgrasses)	X	X	X	X	X
Elodea canadensis (common waterweed)	X	X	X	X	X
Heteranthera dubia (water stargrass)	--	X	--	X	--
Myriophyllum sibiricum (northern watermilfoil)	X	X	X	--	--
Myriophyllum verticillatum (whorled watermilfoil)	--	--	--	X	X
Najas flexilis (slender naiad)	X	X	X	X	X
Najas guadalupensis (southern naiad)	--	--	--	--	X
Nitella spp. (stoneworts)	X	--	--	--	--
Nitella tenuissima (small nitella)	--	--	--	--	X
Potamogeton foliosus (leafy pondweed)	--	--	X	--	X
Potamogeton friesii (Fries' pondweed)	--	--	--	--	X
Potamogeton gramineus (variable pondweed)	X	--	X	X	X
Potamogeton illinoensis (Illinois pondweed)	--	X	X	X	--
Potamogeton natans (floating-leaf pondweed)	X	X	--	X	X
Potamogeton nodosus (long-leaf pondweed)	X	--	X	--	--
Potamogeton praelongus (white-stem pondweed)	X	--	--	--	--
Potamogeton richardsonii (clasping-leaf pondweed)	--	--	--	--	X
Potamogeton spp. (pondweeds)	X	--	X	--	--
Potamogeton zosteriformis (flat-stem pondweed)	X	X	X	X	X
Ranunculus aquatilis (white water crowfoot)	X	--	--	--	X
Sagittaria cuneata (arum-leaved arrowhead)	--	--	--	--	X
Stuckenia pectinata (Sago pondweed)	X	X	X	X	X
Utricularia geminiscapa (twin-stemmed bladderwort)	--	--	--	X	--
Utricularia gibba (creeping bladderwort)	--	--	--	X	--
Utricularia spp. (bladderworts)	X	X	X	--	--
Utricularia vulgaris (common bladderwort)	--	--	--	X	X
Vallisneria americana (eelgrass/water celery)	X	X	X	X	X
Total Native Species Observed	16	12	14	15	18
Total Species Richness	18	15	17	18	21

Note: Species presence was reported collectively for the Lauderdale Chain of Lakes in the 1967 survey. Observations did not specify Green, Middle, or Mill Lake.

Source: Wisconsin Department of Natural Resources, Stantec, and SEWRPC

to evaluate how closely a lake's aquatic plant community matches that of undisturbed, pre-settlement conditions.[15] 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 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 the lake's species richness. The FQI increased in both Green and Mill Lakes from 2014 to 2019, while Middle Lake exhibited a slight decrease from 26.8 to 23.5. As mentioned previously, plant communities naturally fluctuate based on many different factors and slight changes in FQI may be reflective of these fluctuations rather than a persistent trend in the aquatic

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

Table 2.7
Submerged Aquatic Plant Species Observed in Mill Lake: 1967-2019

Submerged Aquatic Plant Species	1967	1999	2008	2014	2019
Invasive Aquatic Plants					
Myriophyllum spicatum (Eurasian watermilfoil)	--	X	X	X	X
Najas marina (spiny naiad)	X	X	X	X	X
Potamogeton crispus (curly-leaf pondweed)	X	X	X	X	X
Total Invasive Species Observed	2	3	3	3	3
Native Aquatic Plants					
Ceratophyllum demersum (coontail)	X	X	X	X	X
Chara spp. (muskgrasses)	X	X	X	X	X
Elodea canadensis (common waterweed)	X	X	X	X	X
Heteranthera dubia (water stargrass)	--	X	X	X	X
Myriophyllum sibiricum (northern watermilfoil)	X	X	X	--	--
Myriophyllum verticillatum (whorled watermilfoil)	--	--	--	--	X
Najas flexilis (slender naiad)	X	X	X	X	X
Najas guadalupensis (southern naiad)	--	--	--	--	X
Nitella flexilis (slender nitella)	--	--	--	--	X
Nitella spp. (stoneworts)	X	--	X	--	--
Potamogeton alpinus (Alpine pondweed)	--	--	--	X	--
Potamogeton amplifolius (large-leaf pondweed)	--	X	X	--	X
Potamogeton foliosus (leafy pondweed)	--	X	X	--	--
Potamogeton gramineus (variable pondweed)	X	--	X	--	X
Potamogeton illinoensis (Illinois pondweed)	--	X	--	--	--
Potamogeton natans (floating-leaf pondweed)	X	X	--	X	X
Potamogeton nodosus (long-leaf pondweed)	X	--	X	--	--
Potamogeton praelongus (white-stem pondweed)	X	--	--	--	--
Potamogeton pusillus (small pondweed)	--	--	X	--	--
Potamogeton spp. (pondweed)	X	X	--	--	--
Potamogeton zosteriformis (flat-stem pondweed)	X	X	X	X	X
Ranunculus aquatilus (white water crowfoot)	X	--	--	--	--
Sagittaria cuneata (arum-leaved arrowhead)	--	--	--	X	X
Stuckenia pectinata (Sago pondweed)	X	X	X	X	X
Utricularia spp. (bladderworts)	X	X	X	--	--
Utricularia vulgaris (common bladderwort)	--	--	--	X	X
Vallisneria americana (eelgrass/water celery)	X	X	X	X	X
Total Native Species Observed	16	15	16	12	16
Total Species Richness	18	18	19	15	19

Note: Species presence was reported collectively for the Lauderdale Chain of Lakes in the 1967 survey. Observations did not specify Green, Middle, or Mill Lake.

Source: Wisconsin Department of Natural Resources, Stantec, and SEWRPC

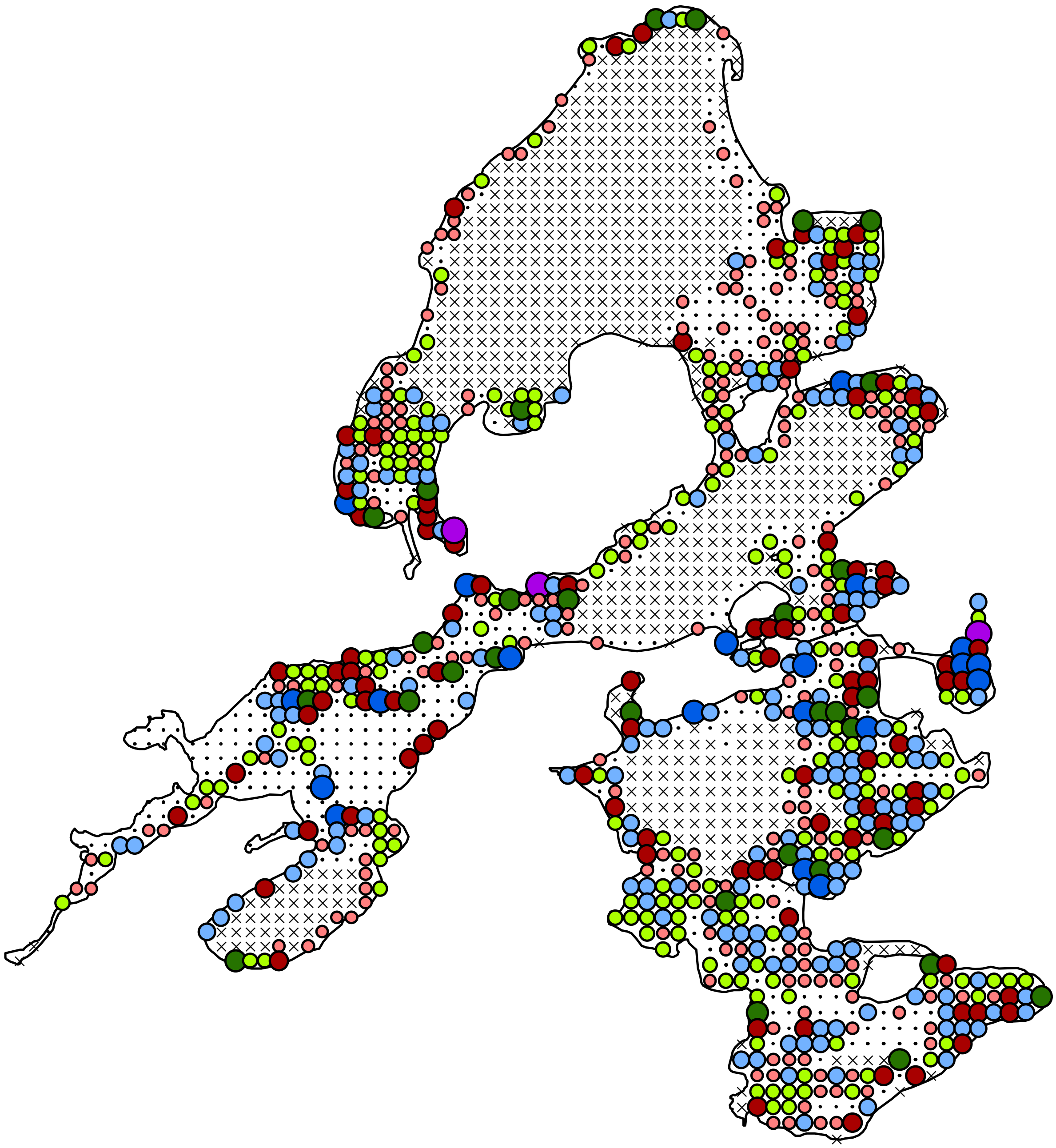
plant community. All six surveys had FQI values that are higher than average for the Southeastern Wisconsin Till Plains ecoregion of 20.0, indicating that these lakes have stable and healthy aquatic plant communities.

Relative Species Abundance

Over the past 50 years, muskgrass, a type of macroalgae, has consistently been either the most or one of the most abundant aquatic plants in all three Lakes. This is a critical 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.[16] 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

[16] *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.*

Figure 2.1
Aquatic Plant Species Richness, Lauderdale Lakes: August 2019



NUMBER OF SPECIES OBSERVED

·	NO PLANTS FOUND	●	5
●	1	●	6
●	2	●	7
●	3	×	NOT SAMPLED
●	4		

Note: Samples were collected in Lauderdale Lakes between August 13, and August 21, 2019.
Source: Wisconsin Department of Natural Resources and SEWRPC

community may tangibly contribute to lake water quality, promoting the growth of other desirable native plant species.

A wide variety of high value and oftentimes sensitive pondweed species (*Potamogeton*, spp.) are also found in the Lakes. Other native aquatic plants that have been found over the years in varying abundance include eelgrass or water celery (*Vallisneria americana*), slender naiad (*Najas flexilis*), and Sago pondweed (*Stuckenia pectinata*). EWM has been found throughout the Lakes since the 1990s and often exhibits the highest abundance in Mill Lake. However, overall EWM abundance has decreased.

Changing aquatic plant communities, such as those described in the preceding paragraphs, are often the result of change in and around the 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. In regard to 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 as a consequence of climatic factors and/or predation cycles related to the relative abundance of milfoil weevils (*Eurhychiopsis lecontei*).

Based on the 2019 point-intercept survey, the four most abundant submerged aquatic plant species in Green Lake were, in decreasing order of abundance: 1) muskgrass, 2) water celery, 3) sago pondweed, and 4) spiny naiad (*Najas marina*). The four most abundant submerged aquatic plant species in Middle Lake were, in decreasing order of abundance: 1) muskgrass, 2) spiny naiad, 3) water celery, and 4) arum-leaved arrowhead (*Sagittaria cuneata*). Finally, the four most abundant submerged aquatic plant species in Mill Lake were, in decreasing order of abundance: 1) muskgrass, 2) water celery, 3) EWM, and 4) spiny naiad.

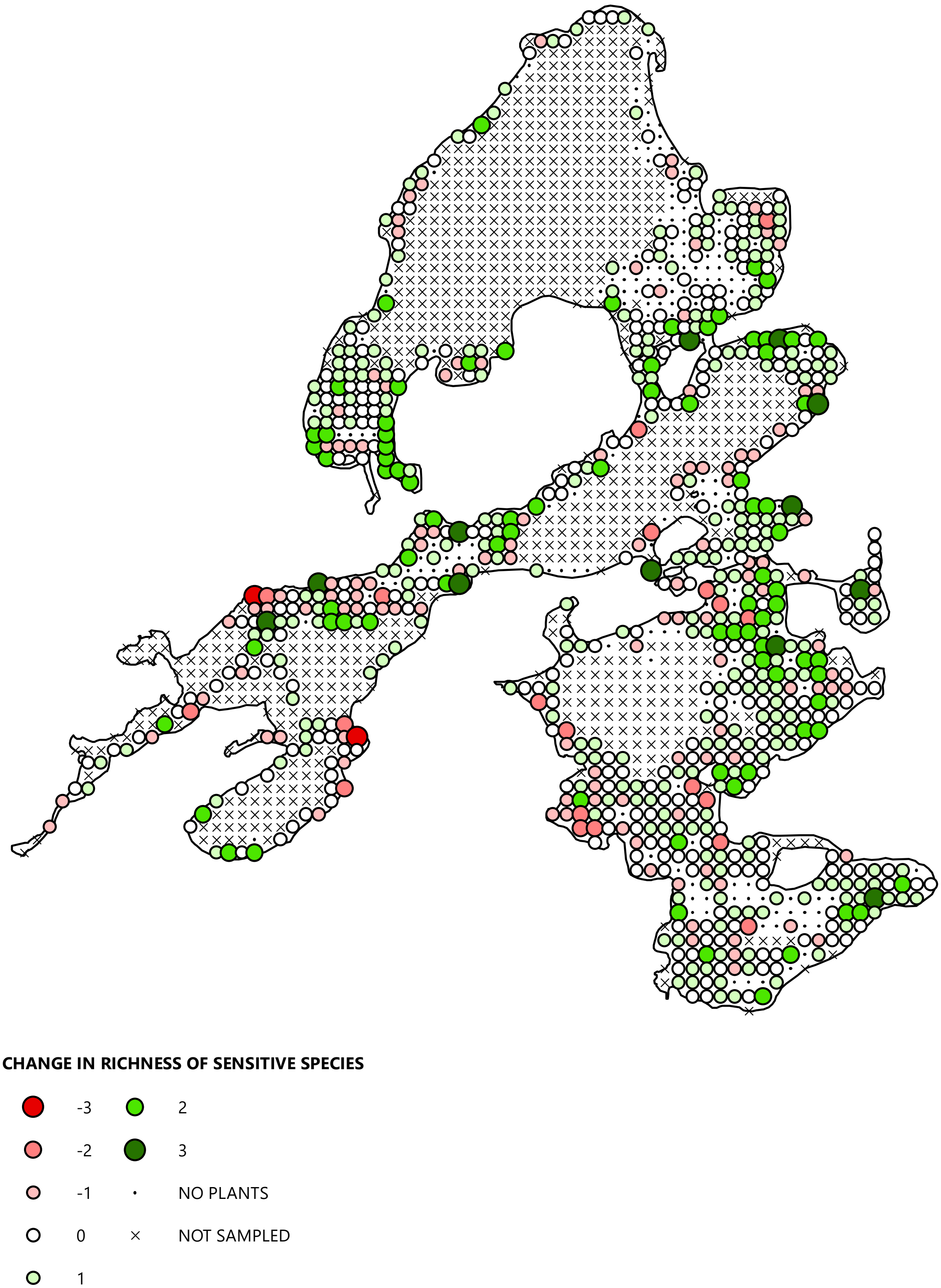
Apparent Changes in Observed Aquatic Plant Communities: 2014 Versus 2019

The distribution of each aquatic plant species identified as part of the 2019 survey is mapped in Appendix B. The 2019 aquatic plant inventory identified 15 species of submerged aquatic plants (17 counting floating and emergent plants) in Green Lake, 18 species (21 counting floating and emergent plant species) in Middle Lake, and 16 species (19 counting floating and emergent plant species) in Mill Lake. In contrast, the 2014 aquatic plant inventory identified 10 submerged aquatic plant species (12 total) in Green Lake, 15 submerged aquatic plant species (18 total) in Middle Lake, and 12 submerged species (15 total) in Mill Lake. The unusually cold and extended winter from 2013 to 2014 could have contributed to reducing the number of species in the Lakes in 2014. All three Lakes exhibited an increase from 2014 but, overall, the number of submerged plant species in the Lakes has been relatively stable over time (Tables 2.5, 2.6, and 2.7).

As was described earlier, sensitive aquatic plant species are likely 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 2014 and 2019 were contrasted (Figure 2.2). Overall, sensitive species richness only slightly increased or decreased reflecting a stable and healthy plant community and the natural periodicity of plant communities. A few significant changes were noted. One sensitive species, muskgrass (*Chara* spp., C value of 7), was identified at approximately 50 percent fewer points in Middle Lake in 2019 than in 2014, but was identified at almost 40 percent more points in Mill Lake in 2019. Bladderwort (*Utricularia* spp.) presence decreased in Middle Lake as well. However, two of the species identified in the 2014 survey (*Utricularia geminiscapa* and *Utricularia gibba*) were located in an area Commission staff were unable to access in 2019. Arum-leaved arrowhead (C value of 7) presence in Green Lake greatly increased between 2014 and 2019. Additionally, native whorled watermilfoil (*Myriophyllum verticillatum*, C value of 8) was identified in Mill Lake in 2019 for the first time since aquatic plant surveys had been conducted on Lauderdale Lakes.

In addition to the number of different aquatic plant species detected in each Lake, several other comparisons can be drawn between the 2014 and 2019 aquatic plant survey results, as examined in the following text.

Figure 2.2
Change in Sensitive Species Richness, Lauderdale Lakes: 2014 Versus 2019



Note: Samples were collected in Lauderdale Lakes between August 13, and August 21, 2019.

Source: Wisconsin Department of Natural Resources and SEWRPC

General Trends – Green Lake

- Of the nine native species of submerged aquatic plants sampled in both 2014 and 2019, five were found to be growing at more points, while four were found at fewer points during 2019. Furthermore, six native species of submerged species were found in 2019 but not in 2014. Overall, these data suggest the natural variations in plant communities and reflect yearly changes in weather conditions.

- Based on average rake fullness, plant density slightly increased from 2014 to 2019. Most of the species exhibited only slightly higher rake fullness averages, four species exhibited no change in rake fullness, and only two species exhibited slightly lower average rake fullness averages.

- Two species, muskgrasses and arum-leaved arrowhead, exhibited the greatest increase in abundance, from being identified at 26 percent of littoral points in 2014 to 38 percent of littoral points in 2019, and from 0.6 percent in 2014 to 11 percent in 2019, respectively.

- The two exotic species (EWM and spiny naiad) were found at fewer points in 2019 than 2014.

- Spiny naiad was more widespread than EWM.

- Muskgrass remains the most widespread plant in the Lake and its frequency of occurrence relative to all other species in the Lake was similar in both surveys.

- In general terms, the overall composition of the aquatic plant community seems to have been relatively stable over the last 50 years, with the decrease in species present in 2014 being most likely attributable to an extremely cold winter and longer and cooler than usual spring.

- Invasive EWM was present but not particularly abundant in either 2014 or 2019. EWM was the fifth most widespread plant in 2014 and sixth most widespread plant in 2019. Nevertheless, the lake use, habitat value threats, and attendant management challenges posed by EWM are serious. EWM must continue to be monitored and managed vigilantly and aggressively.

- Several submerged aquatic plant species have been found at only a few sampling points. Coontail (*Ceratophylum demersum*), Fries' pondweed (*Potamogeton friesii*), floating-leaf pondweed (*Potamogeton natans*), white-stem pondweed (*Potamogeton praelongus*), flat-stem pondweed (*Potamogeton zosteriformis*), and small bladderwort (*Utricularia minor*) were not noted in the 2014 survey but were collected as part of the 2019 sampling event, while alpine pondweed (*Potamogeton alpinus*) was collected as part of the 2011 sampling event but was not noted during 2019. The presence of these species, particularly the high C value species like several of the pondweeds, can substantially impact the Lake's FQI.

General Trends – Middle Lake

- The overall composition and frequency of desirable native plants decreased between 2014 and 2019.

- Based on average rake fullness, aquatic plant growth density increased slightly between 2014 and 2019.

- Of the 11 native submerged aquatic plant species identified in both 2014 and 2019, eight were found to be growing at fewer points, two were found at more points, and one was found at the same number of points.

- Six submerged species observed in 2014 (water stargrass (*Heteranthera dubia*), leafy pondweed (*Potamogeton foliosus*), Illinois pondweed (*Potamogeton illinoensis*), clasping-leaf pondweed (*Potamogeton richardsonii*), twin-stemmed bladderwort (*Utricularia geminiscapa*), and creeping bladderwort (*Utricularia gibba*)) were not observed in 2019. Four submerged native plant species observed in 2019 (southern naiad (*Najas guadalupensis*), small nitella (*Nitella tenuissima*), Fries' pondweed (*Potamogeton friessi*), and white water crowfoot (*Ranunculus aquatilis*)) were not observed in 2014. It is unclear whether these species have recently established in Middle Lake or were simply not observed in the 2014 survey due to their relative scarcity in this Lake.

- Several plants were found at half or fewer points in 2019 as compared to 2014 (i.e., muskgrass, common waterweed (*Elodea canadensis*), whorled watermilfoil, sago pondweed).

- Two of the three exotic species (EWM and spiny naiad) were found at substantially fewer points in 2019 as compared to 2014.

- Spiny naiad abundance decreased by half from 2014 to 2019, but remained the second most widespread species in 2019.

- The shallow southwestern bay of Middle Lake, also known as the “springs” area, had the greatest abundance of bulrush, burreeds, and wild rice within the Lauderdale Lakes. Additionally, this area supported the most dense muskgrass growth, as determined by rake fullness, within the Lauderdale Lakes.

General Trends – Mill Lake

- In general terms, the overall composition and frequency hierarchy of the aquatic plant community shifted towards more desirable native plants between 2014 and 2019.

- Based on average rake fullness, aquatic plant growth density increased slightly between 2014 and 2019.

- Of the 11 aquatic plant species of identified in both 2014 and 2019, two were found to be growing at fewer points, seven were found at more points, and two were found at the same number of points.

- One submerged species observed in 2014 (alpine pondweed (*Potamogeton alpinus*)) was not observed in 2019. Five submerged native plant species observed in 2019 (whorled watermilfoil, southern naiad, slender naiad, large-leaf pondweed (*Potamogeton amplifolius*), and variable pondweed (*Potamogeton gramineus*)) were not observed in 2014. It is unclear whether these species have recently established in Mill Lake or were simply not observed in the 2014 survey due to their relative scarcity in this lake. Again, the 2013/2014 winter may have influenced species presence and absence in 2014 as well.

- Only coontail (*Ceratophyllum demersum*) was found at half or fewer points in 2019 as compared to 2014.

- Presence of spiny naiad decreased in 2019 as compared to 2014.

- Curly-leaf pondweed (CLP) (*Potamogeton crispus*) remained sparse between 2014 and 2019. Since CLP senesces early in the season, the mid- to late-summer sampling timeframe may not accurately represent this plant’s true abundance in the Lake.

- EWM remained the third most dominant aquatic plant and the most widespread submerged exotic plant in the Lake in 2019. Don Jean Bay on the southern half of the Lake has the most abundant EWM within the Lauderdale Lakes

- Muskgrass abundance increased between 2014 and 2019 and it remained the most widespread species in the Lake. The spread of muskgrass is desirable from lake water quality and habitat value perspectives.

Relative Abundance of Milfoil Species

Three milfoil species have been reported in the Lauderdale Lakes during the past 50 years. These include native or northern watermilfoil (*Myriophyllum sibiricum*, formerly known as *Myriophyllum exalbescens*), native whorled watermilfoil, and exotic EWM (*Myriophyllum spicatum*). The native milfoil species can appear similar to EWM and can hybridize with EWM, conditions confounding identification.

The relative abundance of each milfoil species has fluctuated considerably over the years. For example, northern watermilfoil resided in all three Lakes between 1967 and 2008 but was absent from the Lauderdale Lakes the remaining years. Similarly, whorled watermilfoil was absent until 2008 but present all remaining years. This dichotomy suggests the variation in native *Myriophyllum* species abundance may be related to identification procedures rather than actual fluctuation in native milfoil species abundance. Given the ability of EWM to hybridize with at least northern milfoil, it is also possible that the relative abundance of EWM and native watermilfoil may be somewhat blurred, especially in the historical surveys. Therefore, dramatic year-to-year variation in *Myriophyllum* species abundance should be viewed with some skepticism.

Eurasian Watermilfoil

EWM is an ongoing and serious concern in many Wisconsin lakes, especially nutrient-rich lakes such as those common in Southeastern Wisconsin. EWM has been one of the District's primary targets for control through its ongoing aquatic plant management program. Additionally, riparian landowners also direct substantial effort to EWM control.

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.[17,18] 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.[19] For reasons such as these, EWM can grow to dominate an aquatic plant community in as little as two years.[20, 21] 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 10 to 15 years.[22]

EWM is a significant recreational use problem in Southeastern Wisconsin lakes. For example, boating through dense EWM beds can be difficult and unpleasant. Because EWM can reproduce from stem fragments, recreational use conflicts can help spread EWM. Human produced EWM fragments (e.g., fragments created by power boating through EWM), as well as fragments generated from natural processes (e.g., wind-induced turbulence, animal feeding/disturbance) readily colonize new sites, especially 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.[23] 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 very 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 is not particularly widespread in Green Lake, occurring chiefly in nearshore and other shallow areas where water is less than 10 feet deep. EWM was observed at 28 points of 317 points shallower than the MDC (i.e., about 8.8 percent of visited points), in Green Lake during 2014 and 24 points of the 273 points visited (i.e., again about 8.8 percent of points shallower than the MDC) during 2019 (see Tables 2.1, 2.2 and 2.3). Therefore, the area occupied by EWM relative to other plants remained the same between 2014 and 2019. In addition, EWM average rake fullness remained low between 2014 and 2019 (Figure 2.3)

Similarly, EWM is sparse around Middle Lake, growing predominantly in nearshore areas. EWM was observed at 34 points of 467 points shallower than the MDC (i.e., about 7.3 percent of visited points), in Middle Lake

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[17] *U. S. Forest Service, Pacific Islands Ecosystems at Risk (PIER), 2019. May be downloaded at the following website: hear.org/pier/species/myriophyllum_spicatum.htm*

[18] *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.*

[19] *Ibid.*

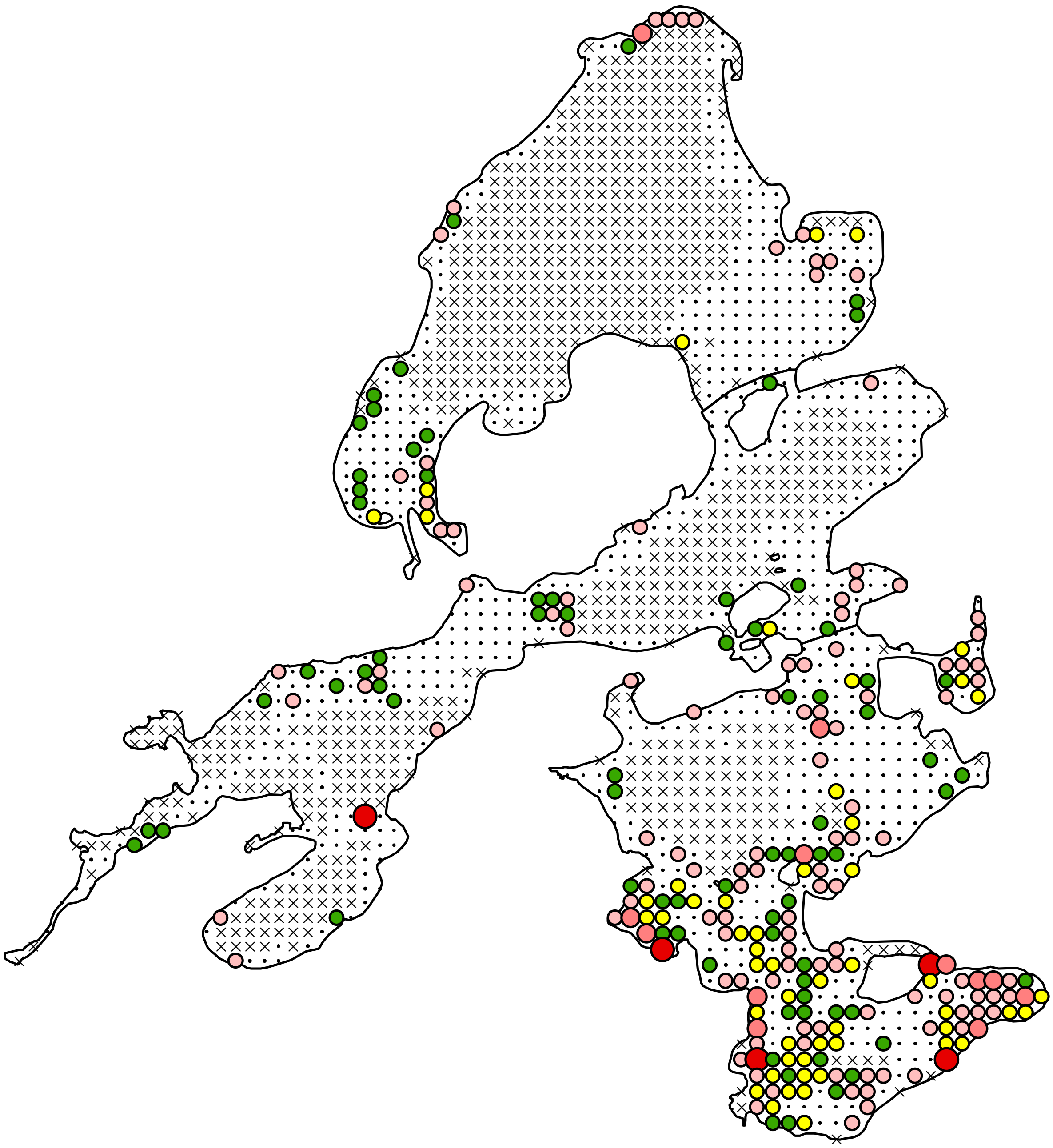
[20] *S.R. Carpenter, "The Decline of Myriophyllum spicatum in a Eutrophic Wisconsin (USA) Lake,"* Canadian Journal of Botany, *58(5), 1980.*

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

[22] *S.R. Carpenter, op. cit.*

[23] *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.*

Figure 2.3
Change in Eurasian Watermilfoil Rake Fullness, Lauderdale Lakes: 2014 Versus 2019



CHANGE IN RAKE FULLNESS RATING OF EURASIAN WATERILFOIL

- INCREASE OF 3
- INCREASE OF 2
- INCREASE OF 1
- NO CHANGE, RAKE FULLNESS OF 1
- DECREASE OF 1
- NO EURASIAN WATERMILFOIL
- NOT SAMPLED

Note: Samples were collected in Lauderdale Lakes between August 13, and August 21, 2019.

Source: Wisconsin Department of Natural Resources and SEWRPC

during 2014 and 20 points of the 286 points visited (i.e., about 7.0 percent of points shallower than the MDC) during 2019 (see Tables 2.1, 2.2 and 2.3). Therefore, as in Green Lake, the area occupied by EWM relative to other plants remained the same between 2014 and 2019 and average rake fullness remained low and unchanged (Figure 2.3).

EWM is more widespread in Mill Lake than in Green or Middle Lakes. EWM growth is most dense in the southern third of Mill Lake. EWM is present throughout the Lake and the number of sampling points where EWM was found increased from 36.8 percent in 2014 to 47.4 percent in 2019 (Tables 2.1, 2.2 and 2.3). Average rake fullness also increased slightly from 1.0 in 2014 to 1.2 in 2019. As can be seen in Figure 2.3, EWM rake fullness remained the same in many locations throughout the lake and also increased particularly in the western and eastern bays of the Lake.

Other Exotic Submergent Aquatic Plants

CLP continues to be present in the Lauderdale Lakes. 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 relatively 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, CLP must continue to be monitored and managed as an invasive member of the aquatic community. Lastly, it must be remembered that CLP senesces by midsummer, and therefore 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. Spiny naiad is abundant in all three Lakes, however, it was found at fewer points in each Lake during 2019 as compared to 2014. Spiny naiad is a restricted species in Wisconsin, and is therefore identified as an established invasive species that has the potential to cause significant environmental or economic harm.[24] 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 the Lauderdale Lakes since at least the 1950s – the earliest date that control program records were kept by State agencies. However, aquatic plant control on the Lakes probably predates the 1950s by several decades. Early aquatic plant control relied on chemical treatment with sodium arsenite. Sodium arsenite applications were discontinued in 1969 and were supplanted by organic-based herbicides. To control floating algae, copper sulfate and Cutrine-Plus were applied to the Lakes. Aquatic herbicide use is minimal on the Lauderdale Lakes (Table 2.8).

Since 1992, mechanical aquatic macrophyte harvesting has been the primary aquatic plant control method used on the Lakes and chemical treatments have been limited to private property applications. The volume of aquatic plants harvested each year varies substantially (Table 2.9). 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 the Lakes by multiplying the annual mass of aquatic plants removed by the phosphorus concentration of those aquatic plants, with the following notes and assumptions:

- Although plants were harvested from 1992 through 2001 and during 2011, the volume of plant material removed was not available at the time of printing. The average annual phosphorus removal rate from 2002 to 2019 (546 pounds) was substituted into 2011 for our estimates.

- The density of the wet harvested plants was assumed to be approximately 900 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-

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

Table 2.8
Lauderdale Lakes Aquatic Plant Chemical Control History

Year	Total Acres Treated	Algae Control			Macrophyte Control					
		Copper Sulfate (pounds)	Blue Vitriol (pounds)	Cutrine or Cutrine Plus (gallons)	Sodium Arsenite (pounds)	2,4-D (gallons)	2,4,5-TP (gallons)	2,4,5-T (gallons)	Diquat (gallons)	Endothall/ Aquathol (gallons)
1950-1969	--	15,181.0	--	--	20,566	80.0	92.6	52.0	78.0	9.0 + 48.4 lbs.
1970	9.0	--	--	--	--	--	--	--	15.0	10.0 + 300.0 lbs.
1971	3.4	--	--	--	--	--	--	--	--	67.0
1972	--	--	--	--	--	--	--	--	6.0	41.0
1973	--	--	--	--	--	--	--	--	18.0	8.0
1974	--	--	--	--	--	--	--	--	--	--
1975	--	--	--	--	--	4.0	--	--	--	8.0
1976	N/A	--	--	--	--	--	--	--	--	--
1977	--	--	--	--	--	--	--	--	--	22.0
1978	N/A	--	--	5.0	--	--	--	--	--	--
1979	--	--	--	5.0	--	--	--	--	2.0	10.0 + 100.0 lbs.
1980	--	100.0	--	--	--	48.0	--	--	4.0	9.0 + 50.0 lbs.
1981	--	8.0	--	--	--	--	--	--	5.5	12.0 + 160.0 lbs.
1982	--	30.0	--	--	--	--	--	--	4.0	28.0
1983	N/A	--	--	--	--	--	--	--	--	--
1984	3.8	36.0	--	--	--	13.5	--	--	1.0	10.0
1985	--	--	--	--	--	13.0	--	--	1.0	14.0
1986	8.2	3.0	--	--	--	41.0	--	--	1.5	61.7 lbs.
1987	14.4	0.5	--	--	--	21.0	--	--	0.5	3.5
1988	12.3	--	--	--	--	22.0	--	--	--	1.5
1989	N/A	--	--	--	--	--	--	--	--	--
1990	6.0	--	--	--	--	14.0	--	--	--	--
1991	N/A	--	--	--	--	6.0	--	--	--	--
1992	0.9	--	--	--	--	2.5	--	--	--	--
1993-2001	N/A	--	--	--	--	--	--	--	--	--
2002[a]	1.3	2.7 gal.	--	--	--	--	--	--	2.7	2.7 + 10.0 lbs.
2003	1.0	1.3 gal.	--	--	--	--	--	--	1.3	1.0
2004	3.4	--	--	--	--	2.5 + 138 lbs.	--	--	--	--

Table continued on next page.

Table 2.8 (Continued)

Year	Total Acres Treated	Algae Control			Macrophyte Control					
		Copper Sulfate (pounds)	Blue Vitriol (pounds)	Cutrine or Cutrine Plus (gallons)	Sodium Arsenite (pounds)	2,4-D (gallons)	2,4,5-TP (gallons)	2,4,5-T (gallons)	Diquat (gallons)	Endothall/ Aquathol (gallons)
2005	0.4	--	--	--	--	--	--	--	0.8	1.0
2006	0.3	1.0 gal.	--	--	--	--	--	--	0.5	1.7
2007	0.9	2.0 gal.	--	--	--	--	--	--	1.5	2.5
2008	0.3	2.0 gal.	--	--	--	--	--	--	0.6	2.5
2009-Present[b]	--	--	--	--	--	--	--	--	--	--
Total	--	15,358.5 + 9.0 gal.	--	10.0	20,566	267.5 + 138 lbs.	92.6	52.0	143.9	264.4 + 730.1 lbs.

Note: N/A indicates records are not available or no chemical applications were reported as made during this year.

[a] *In 2002, 0.7 gallon of Aquashade was applied*

[b] *Chemical treatments have been limited to private property applications since the inception of the harvesting program on Lauderdale Lakes.*

Source: Wisconsin Department of Natural Resources and SEWRPC

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.[25, 26]

Using these methods, the Commission estimates that aquatic plant harvesting has removed approximately 10,000 pounds of phosphorus from the Lakes during the 17 years for which plant harvest records are available (see Figure 2.4). During the past three years, about 500 pounds of phosphorus were removed from the Lakes each year. The WDNR's Presto-Lite tool estimates that the average total annual phosphorus load to the Lakes is 260 pounds. Therefore, aquatic plant harvesting may remove more phosphorus from the Lakes than is contributed annually by runoff and tributary streams.

Table 2.9
Volume of Aquatic Plants Harvested from the Lauderdale Lakes: 2002-2019

Year	Plant Material Removed (cubic yards)
2002	3,720
2003	2,322
2004	2,406
2005	2,082
2006	2,436
2007	2,172
2008	2,112
2009	2,454
2010	1,674
2011	N/A
2012	2,061
2013	2,313
2014	1,899
2015	2,094
2016	2,079
2017	2,187
2018	2,178
2019	2,052

Note: Information for 2011 was not available.

Source: Lauderdale Lakes Lake Management District

2.4 IDENTIFIED SENSITIVE AREAS

The WDNR has identified seven sensitive areas in the Lauderdale Lakes (Map 2.1).[27] Sensitive Areas 1, 2, 5, 6, and 7 occupy relatively small areas scattered throughout the Lakes. In contrast, essentially the entire western portion of Middle Lake is identified as Sensitive Area 3. In addition, Sensitive Area 4 occupies the southwestern bay of Mill Lake.

WDNR sensitive area reports include management recommendations and other information that both benefit and constrain aquatic plant management and riparian land owners. A copy of the sensitive area report for the Lauderdale Lakes is included in Appendix C. In general, the WDNR's management recommendations are designed to help maintain the valuable functions sensitive areas provide lakes. All sensitive areas trap sediment and nutrients and thereby help protect the Lauderdale Lakes' water quality. They also provide spawning, nursery, and foraging opportunities to native fish and are excellent habitat for waterfowl, furbearers, and herptiles. However, protecting these areas requires limitations and restrictions be placed upon aquatic plant management. A few examples of these limitations and restrictions include the following:

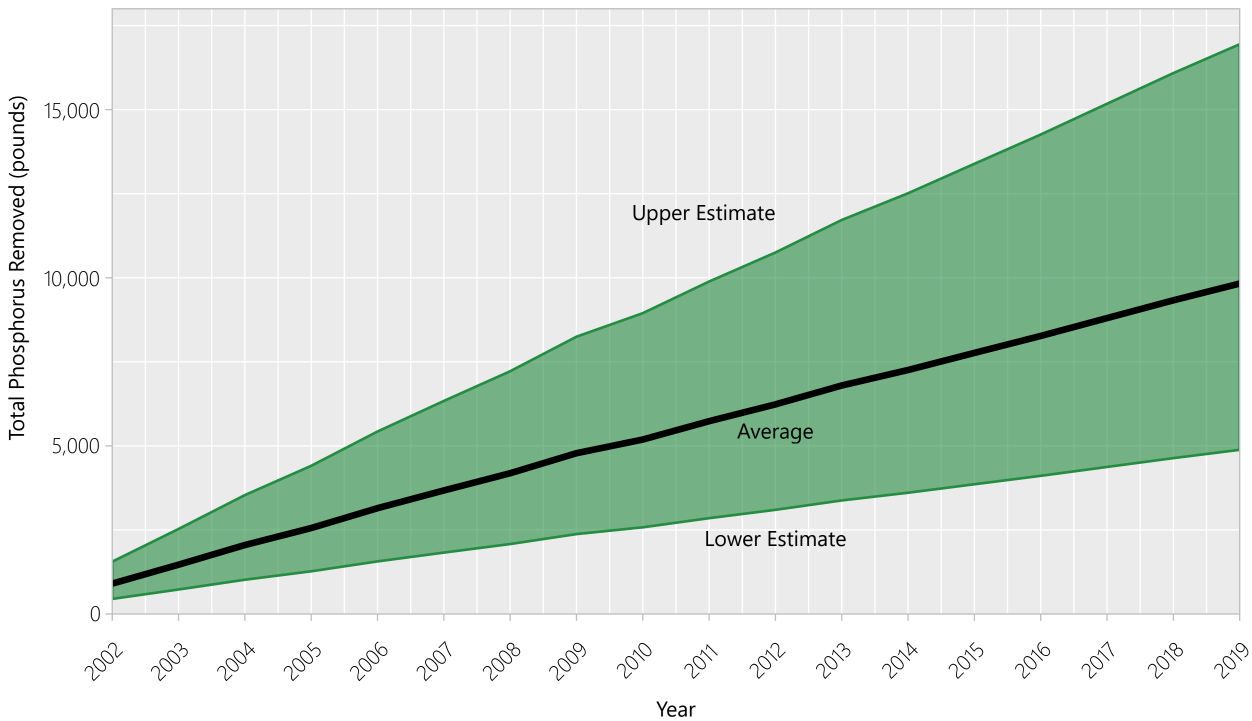
- Mechanical harvesting in Sensitive Area 1 is limited to a 25-foot wide navigational channel from the boat launch to open water.
- Chemical treatment is only permitted in Sensitive Areas 3, 6, and 7 to target infestations of exotic species such as purple loosestrife, EWM, or CLP.
- In Sensitive Area 3, mechanical harvesting of a navigational channel along the shoreline is restricted until after fish spawning activities have finished.

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

[26] *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.*

[27] *The WDNR is granted authority to define sensitive areas under Section NR 107.05(3)(i) of the* Wisconsin Administrative Code*.*

Figure 2.4
Approximate Cumulative Mass of Phosphorus Removed from the Lauderdale Lakes by Aquatic Plant Harvesting: 2002-2019



Note: Average annual phosphorus removal (546 lbs/year) used for missing data in 2011.

Source: Lauderdale Lakes Lake Management District and SEWRPC

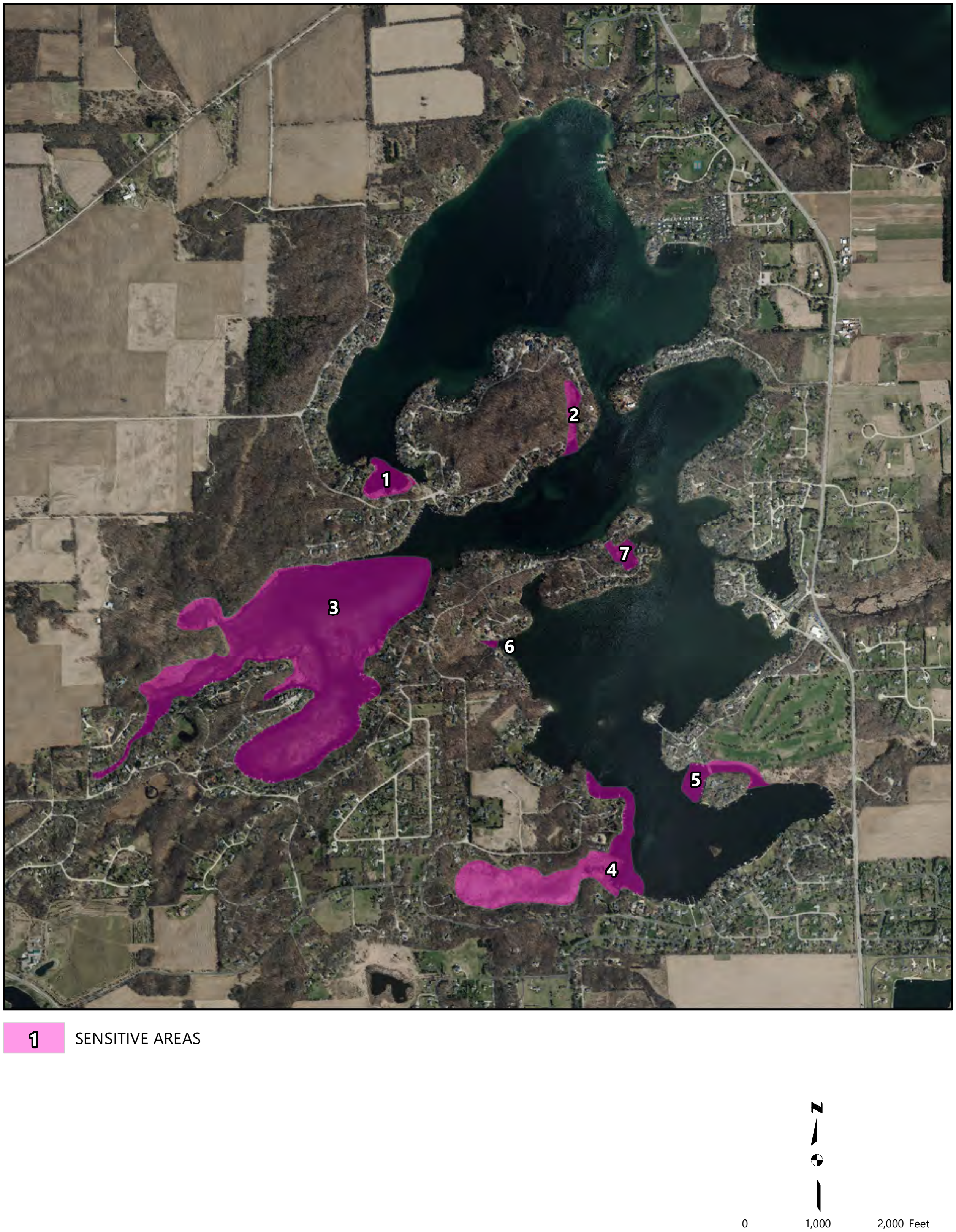
2.5 POTENTIAL AQUATIC PLANT CONTROL METHODOLOGIES

Aquatic plant management techniques can be classified into six categories.

1. *Physical measures* include lake bottom coverings
2. *Biological measures* include the use of organisms such as herbivorous insects
3. *Manual measures* involve physically removing plants by hand or using hand-held tools such as rakes
4. *Mechanical measures* rely on artificial power sources and remove aquatic plants with a machine known as a harvester or by suction harvesting
5. *Chemical measures* use aquatic herbicides to kill nuisance and nonnative plants in-situ
6. *Water level manipulation measures* use lake drawdowns to kill aquatic plants through freezing and desiccation.

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

Map 2.1
WDNR-Designated Lauderdale Lakes Sensitive Areas: 2020



Source: Wisconsin Department of Natural Resources and SEWRPC
Date of Photography: April 2015

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." More details about aquatic plant management 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.[28] 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.[29] These plans and plan execution are reviewed and overseen by the WDNR regional lakes and aquatic invasive species coordinators.[30]

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 Lakes.

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.[31] For example, milfoil weevils have been used to control EWM. Milfoil weevils do best in waterbodies with balanced panfish populations,[32] 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 incrementally maintain water depth, improves water quality, and can help decrease the spread of nuisance/exotic plants. Since hand raking and hand pulling are readily allowed by WDNR, and since both are practical methods to control riparian landowner scale problems, these methods are described in more detail in the following paragraphs.

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

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[28] *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.*

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

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

[31] *B. Moorman, "A Battle with Purple Loosestrife: A Beginner's Experience with Biological Control,"* LakeLine*, 17(3), 20-21, 34-37, 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, (eds),* Ecological Entomology*, John Wiley, New York, New York, USA.*

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

- Tools are relatively 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, CLP) 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.[33]

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 very early in the season (e.g., EWM, CLP) when native plants have not yet emerged or appreciably grown.

A disadvantage of mechanical harvesting is that the harvesting process may fragment plants and thereby unintentionally propagate EWM and CLP. 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

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

three feet deep,[34] 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 ultimately reduce regrowth of nuisance plants while maintaining, or even enhancing, native plant communities.

Cut plant fragments can escape the harvester's collection system and form mats or accumulate on shorelines. This negative side effect is fairly common. 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.

An alternative aquatic plant suction harvesting method has emerged called Diver Assisted Suction Harvesting (DASH). 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 essentially 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 Lakes, DASH is not considered a viable control option for managing EWM throughout the Lakes. 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 to contol aquatic plant growth include relatively 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.

- **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

[34] *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.*

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.[35] For example, conflicting studies/opinions exist regarding the role of the chemical 2,4-D as a human carcinogen.[36] 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.[37] Early season application also is generally the best time to treat EWM and CLP 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 tends 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 generally 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.[38] 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 CLP 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 so as to promote more complete decomposition of dead plant material.

- **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

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

[36] *M.A. Ibrahim, G.G. Bond, T.A. Burke, et al., "Weight of the Evidence on the Human Carcinogenicity of 2,4-D,"* Environmental Health Perspectives*, 96, 213-222, 1991.*

[37] *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.*

[38] *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.*

populations often suffer. For this reason, if chemical herbicides are applied to the Lakes, these chemicals must target EWM or CLP 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 very early spring).

- **Need for repeated treatments.** Chemical herbicides are not a one-time silver-bullet solution—instead, treatments generally 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 lake bed 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 that 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.[39,40] 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. Hybrid watermilfoil has not been verified to exist in the Lauderdale Lakes, but is likely present.

- **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.[41] 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 Mill Lake, a whole-lake treatment, or large spot treatment in that basin, may be utilized.[42] 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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[39] *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.*

[40] *E.A. LaRue, M/P/ Zuellig, M.D. Netherland, 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.*

[41] *M. Nault, S. Knight, S. Van Egeren, et al., "Control of Invasive Aquatic Plants on a Small Scale,"* LakeLine*, 35: 35-39, 2015.*

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

Water Level Manipulation

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.[43] In Wisconsin, water level manipulation is generally 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 long 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 generally 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 (*Nymphaea* spp. and *Nuphar* spp.) and milfoils (*Myriophyllum* spp.) can be greatly reduced by winter drawdowns while other species, such as duckweeds (*Lemna* spp.), may increase in abundance.[44] Two studies from Price County, Wisconsin show reduced abundance of invasive EWM and CLP and increased abundance of native plant species following winter drawdowns.[45,46] 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.[47]

Water level manipulation can also have unintended impacts on water chemistry and lake fauna.[48,49] 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.

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[43] *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.*

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

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

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

[47] *Blanke et al., op. cit.*

[48] *Ibid.*

[49] *Cooke, op. cit.*

3 MANAGEMENT RECOMMENDATIONS AND PLAN IMPLEMENTATION

Credit: SEWRPC Staff

The Lauderdale Lakes generally contain a robust and fairly diverse aquatic plant community. Although EWM is present throughout the Lakes and particularly abundant in Mill Lake, its density remains low. Furthermore, the Lakes contain several WDNR-designated Sensitive Areas with a particularly rich array of sensitive and rare native aquatic plant species. On account of this and other factors, aquatic plant management continues to be an important approach to maintaining the excellent natural resource service the Lakes provide.

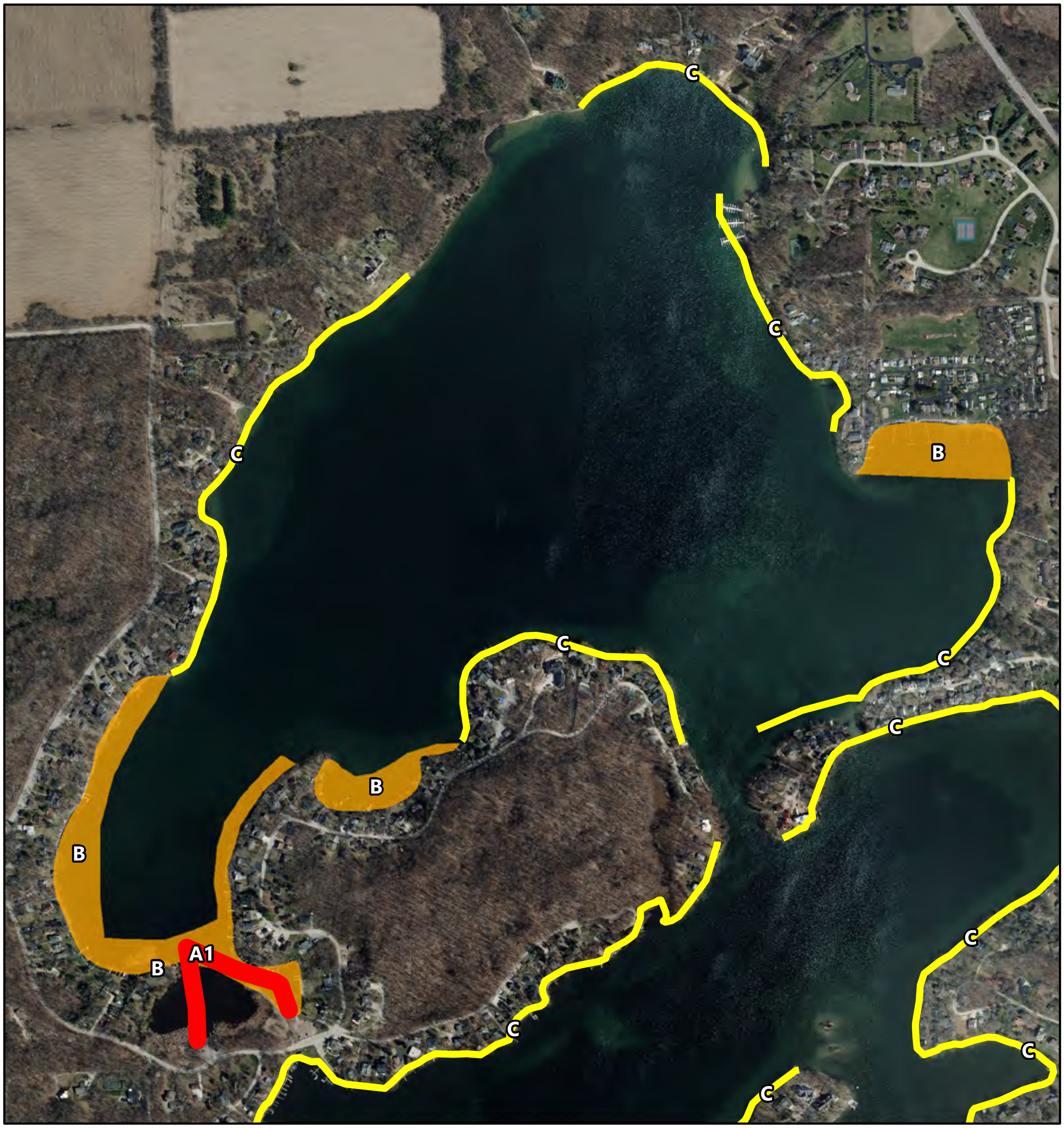
Holistic management alternatives and recommended refinements to the existing aquatic plant management plan are presented in this chapter. Given the scope of this study, little emphasis is given to measures whose scope and location are more suitably taken up by other governmental agencies. For example, agencies with jurisdiction over areas tributary to the Lakes (e.g., Town or County government) may be better suited to address measures to reduce nutrient inputs to the Lakes. Reduced nutrient input can passively reduce aquatic plant abundance and thereby tangibly influence aquatic plant management. Nevertheless, to most effectively manage aquatic plants, the District should actively seek out and collaborate with such agencies.

3.1 RECOMMENDED AQUATIC PLANT MANAGEMENT PLAN

The most effective plans to manage nuisance and invasive aquatic plant growth generally rely on a *combination* of methods and techniques. A single-minded “silver bullet” strategy rarely produces the most efficient, most reliable, or best overall result. Therefore, to enhance lake access, recreational use, and lake health, this plan recommends a combination of several aquatic plant management techniques. For the reader’s convenience, the various elements of the recommended aquatic plant management plan are schematically presented (Figures 3.1, 3.2, and 3.3) and are briefly summarized in the following paragraphs. The WDNR used data and conclusions generated as part of the Commission’s study to help evaluate the Lakes’ aquatic plant community and draft the 2020 – 2024 Aquatic Plant Control permit (see Appendix D) which outlines WDNR-approved aquatic plant control practices. Additional details useful to implement the plant management plan follow this summary.

1. **Mechanically harvest invasive and nuisance aquatic plants.** Mechanical harvesting should remain the primary means to manage invasive and nuisance aquatic plants on the Lauderdale Lakes. Harvesting must avoid, or must be substantially restricted, in certain areas of the Lakes. This includes

Figure 3.1
Recommended Harvesting Plan for Green Lake: 2020

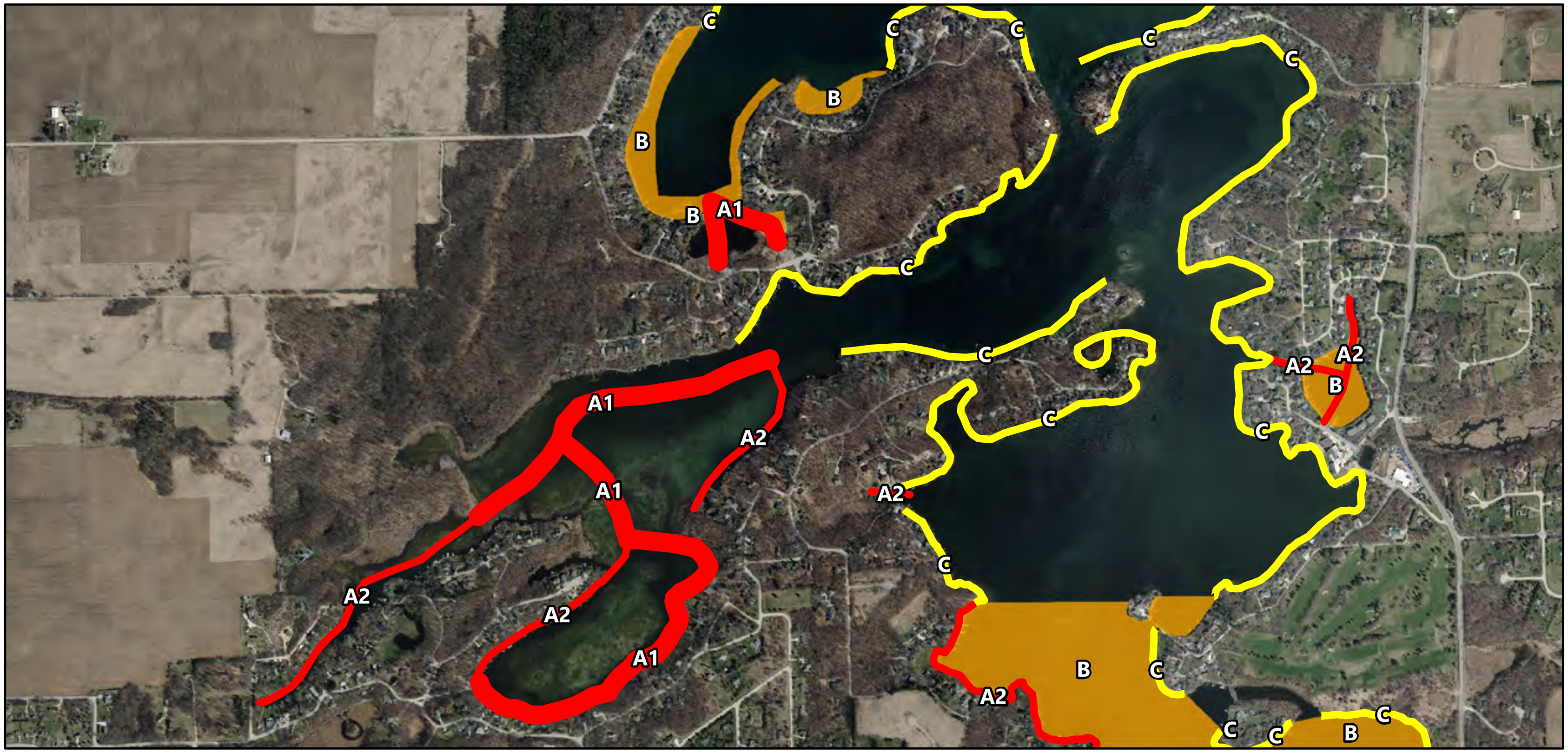


Area	Instructions
HIGH PRIORITY AREAS	
A1	Cut a lane 50′ wide to the 5′ contour – Must leave 12″ of plant growth on the bottom
A2	Cut a lane 15′ wide to the 5′ contour – Must leave 12″ of plant growth on the bottom
MODERATE PRIORITY AREAS	
B	EWM Management Areas: Top cut to a depth of 4′ to control surface matting of EWM growth and promote native species growth – Must leave 12″ of plant growth on the bottom
LOW PRIORITY AREAS	
C	Surface cut only from pier heads to open water (variable widths) – Manual harvest ONLY from shore to pier heads

Note: See Appendix D for WDNR-approved mechanical and manual aquatic plant control in Lauderdale Lakes from 2020-2024.

Source: Stantec, Wisconsin Department of Natural Resources and SEWRPC
Date of Photography: April 2015

Figure 3.2
Recommended Harvesting Plan for Middle Lake: 2020

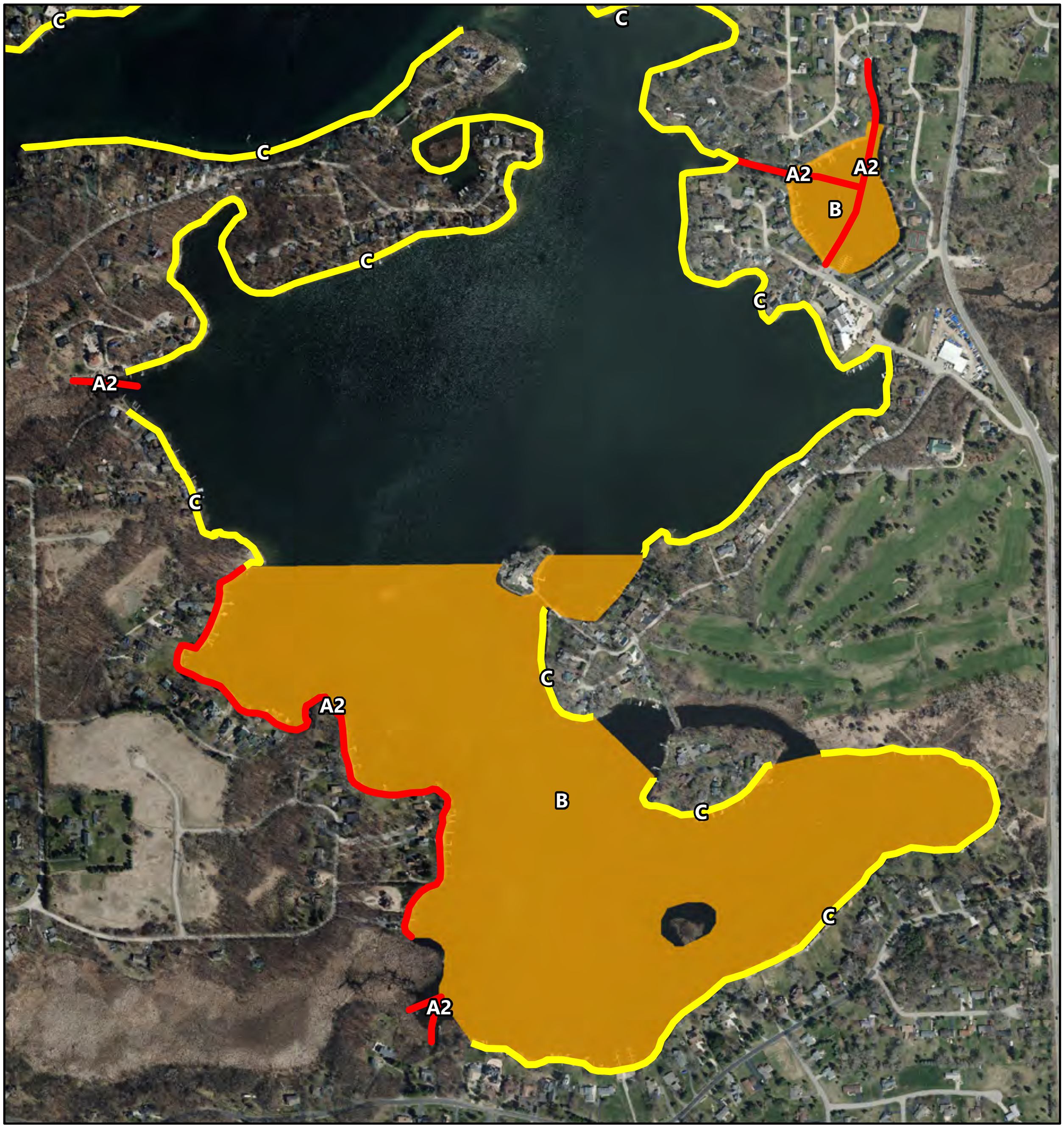


Area	Instructions
HIGH PRIORITY AREAS	
A1	Cut a lane 50' wide to the 5' contour – Must leave 12" of plant growth on the bottom
A2	Cut a lane 15' wide to the 5' contour – Must leave 12" of plant growth on the bottom
MODERATE PRIORITY AREAS	
B	EWM Management Areas: Top cut to a depth of 4' to control surface matting of EWM growth and promote native species growth – Must leave 12" of plant growth on the bottom
LOW PRIORITY AREAS	
C	Surface cut only from pier heads to open water (variable widths) – Manual harvest ONLY from shore to pier heads

Note: See Appendix D for WDNR-approved mechanical and manual aquatic plant control in Lauderdale Lakes from 2020-2024.

Source: Stantec, Wisconsin Department of Natural Resources and SEWRPC
Date of Photography: April 2015

Figure 3.3
Recommended Harvesting Plan for Mill Lake: 2020



Area	Instructions
HIGH PRIORITY AREAS	
A1	Cut a lane 50′ wide to the 5′ contour – Must leave 12″ of plant growth on the bottom
A2	Cut a lane 15′ wide to the 5′ contour – Must leave 12″ of plant growth on the bottom
MODERATE PRIORITY AREAS	
B	EWM Management Areas: Top cut to a depth of 4′ to control surface matting of EWM growth and promote native species growth – Must leave 12″ of plant growth on the bottom
LOW PRIORITY AREAS	
C	Surface cut only from pier heads to open water (variable widths) – Manual harvest ONLY from shore to pier heads

Note: See Appendix D for WDNR-approved mechanical and manual aquatic plant control in Lauderdale Lakes from 2020-2024.

Source: Stantec, Wisconsin Department of Natural Resources and SEWRPC
Date of Photography: April 2015

areas of particular 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). Almost half of Middle Lake is sensitive area, a situation restricting mechanical harvesting to lanes that protect sensitive areas yet allows riparian residents and boat launch users to access and navigate the Lakes, engage in a variety of water-related recreational pursuits, and access open water areas. In all cases on all three Lakes, care should be taken to avoid harvesting native aquatic plants – harvesting should focus on areas of profuse invasive plant growth.

2. **Manually remove nearshore invasive and nuisance plant growth.** Manual removal involves controlling aquatic plants by hand or using hand-held non-powered tools. Riparian landowners should consider manual removal of undesirable plants an integral and vital part of the Lakes' overall plant management plan. Manual removal is often the plan element that yields the transitional interface between landowner uses, desires, and concerns, and public management of the overall waterbody. 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. **Chemically treat nonnative plants around private piers.** Large-scale chemical treatment is not part of the District's aquatic plant management plan for a variety of reasons, and is unlikely to be incorporated into District's general aquatic plant management anytime soon. 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 Lakes in the future. In addition, because EWM frequency in the littoral zone of Mill Lake was greater than 30 percent in 2019 (Table 2.3) the District may choose to pursue a whole-lake chemical treatment in Mill Lake to reduce the population. Individual property owners with frontage not abutting designated sensitive areas may pursue a Chapter NR 107 permit to treat their shorelines. This method of aquatic plant control has a number of drawbacks (e.g., water quality, comparatively nonselective, chemical side effects, and more) and should only be considered under special circumstances. When employed, a physical barrier (e.g., turbidity barrier) should be used to reduce chemical dispersal.

4. **Use DASH in high-use, congested, nearshore areas.** Riparian landowners could supplement or supplant manual harvesting by using DASH. If an individual landowner chooses to implement DASH, the activity is typically confined to the same area undergoing manual aquatic plant control—it is not a method to increase the amount of lakefront undergoing active management. DASH requires a Chapter NR 109 permit.

5. **Continue participation in the Clean Boats Clean Waters program** (a State program targeting invasive species prevention) to proactively encourage Lake users to clean boats and equipment before launching and using them in the Lauderdale Lakes.[50] This will help lower the probability of invasive species entering the Lakes.

Mechanical Harvesting

The District operates one Aquarius Systems brand harvester on the Lakes: Model HM-420. This full-size harvester is well suited to open water areas where water is generally greater than 36-inches deep. 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.

The approximate orientation and extent of proposed harvesting lanes within the Lauderdale Lakes are similar to those published in the 2015 aquatic plant management plan. The general locations of harvesting lanes are schematically illustrated in Figures 3.1, 3.2, and 3.3. The precise locations of the harvest lanes must be chosen carefully and must be maintained in a fixed position throughout the year to avoid unintentional disturbance to adjacent sensitive areas. Lane position should consider water depth, plant species present, lane use, and boating habits/practices on the Lakes. For example, whenever possible, lanes should favor

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

deeper water areas, should support the Lakes' 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 possibly be expanded in shallow, obstacle-prone nearshore areas throughout the Lakes if a small-scale harvester is available. Even though the District's harvester may be able to navigate in waters in as shallow as 12 inches 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 18 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 harvester can cut aquatic plants up to 66 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 very 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.** To this end, surface skimming is allowed in all locations except for WDNR Sensitive Areas. 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 will be deposited at the approved primary disposal site—Don West Farm at N5865 Territorial Road. A secondary back-up site is Frank Taylor Farm at N8676 Tamarack Road (Map 3.1). 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. For example, in sensitive areas, relatively wide transit lanes connect boat launches, highly populated shorelines, and open-water areas. Narrower access lanes connect less trafficked areas and sparsely populated shorelines to open-water areas and transit lanes. The approaches to employ in differing management areas are summarized in Table 3.1 and described below.

   a. <u>Navigation Lanes are given high priority</u>: Channels about 15 to 50-feet wide should be prioritized to maintain navigation access lanes to and from boat landings and common navigation lanes to provide travel thoroughfares for recreational watercraft. These channels generally parallel the shoreline or cross a lake. Plant cutting depths vary from 18 to 66 inches, as water depth allows. At least one foot of plant material must remain on the Lake bottoms to minimize resuspension of lake-bottom sediment and maintain desirable plant communities.

   b. <u>EWM Management Areas are given medium priority</u>: EWM Management Areas should be top cut to a maximum depth of four feet to control surface matting of EWM growth and promote native species growth. Again, at least one foot of plant material must remain on the Lake bottoms to minimize resuspension of lake-bottom sediment and maintain desirable plant communities.

Map 3.1
Lauderdale Lakes Harvesting Disposal Site

DISPOSAL LOCATION

IDENTIFIED WETLANDS

100-YEAR FLOODPLAIN

N

0 1,000 2,000 Feet

Source: Wisconsin Department of Natural Resources and SEWRPC
Date of Photography: April 2015

Table 3.1
General Guidance for Harvester Operation

Area	Description	Instructions
		High Priority Areas
A1	Common access navigation lanes	Cut a lane 50' wide to the 5' contour – must leave 12" of plant growth on lake bottom
A2	Boating access lanes	Cut a lane 15' wide to the 5' contour – must leave 12"
		Moderate Priority Areas
B	EWM management areas	Top cut to a depth of 4' to control surface matting of EWM growth and promote native species growth – must leave 12" of plant growth on lake bottom
		Low Priority Areas
C	Recreational areas	Surface cut only from pier heads to open water. Manual harvest ONLY from shore to pier heads.

Note: In Middle Lake, cutting depth is limited to 2 feet beginning after June 30th ONLY.

Source: Stantec, Wisconsin Department of Natural Resources, and SEWRPC

c. Recreation areas are given low priority: These areas are for alleviating nuisance, surface-matting growth for riparian owners. Surface cutting should be employed and restricted from pier heads to open water for riparian access. Harvesting from pier heads to shore will not be mechanically harvested; only manual methods will be used. Avoid harvesting wild celery except in areas that reach "nuisance" conditions – when water celery is closer than two feet from the water's surface. To reduce the risk for water quality degradation, special effort should be taken to avoid cutting wild celery wherever and whenever possible. Conversely, harvesting intensity should be increased during times of the year (i.e., spring and early summer) when invasive aquatic plant growth predominates and within areas where invasive species are most abundant. For example, CLP may be particularly abundant early in the cutting season but is largely absent by midsummer, a growth cycle that may require changes to harvesting routes and schedules over the season.

5. **Harvesting native pondweeds and muskgrasses is prohibited.** These plants provide habitat for young fish, reptiles, and insects in the Lakes.

6. **Limit aquatic plant management and human disturbance in designated sensitive areas.** Restrict harvesting to navigation channels only within these areas up to a depth of two feet, leaving 12 inches of plant growth on the lake bottom. Harvesting in these areas cannot begin until after June 30th. Delineation/management reports for these environmentally sensitive areas are included in Appendix C. Management approaches within these areas are summarized below.

7. **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.

8. **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.

9. **Management, record keeping, monitoring, and evaluation.** District staff manage harvesting operations, and, although they may delegate tasks, are ultimately 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 general public. The report will also present information regarding harvesting operation and maintenance, equipment acquisitions and/or needs, expenditures, and budgets.

10. **Logistics, supervision, and training.** Harvesting equipment is owned and operated by the District. District staff or delegated board members are responsible for overall harvesting program oversight and supervision. Although District staff are ultimately 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 successfully and efficiently carry out their respective job functions. For example, District members/staff likely 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 and maintenance. 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 Lakes' 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 Lakes. 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
    - Help operators identify WDNR-designated Sensitive Areas and be well versed regarding the aquatic plant management restrictions therein
    - Assure operators can confidentially identify aquatic plants and understand the positive values such plants provide to the Lakes' 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.

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 Lauderdale Lakes residents decide to utilize raking to manually remove aquatic plants, the District or other interested party could acquire a number of 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 and CLP is considered a viable option in the Lauderdale Lakes and should be employed wherever practical. Volunteers or homeowners could employ this method, as long as they are properly trained to identify EWM, CLP, 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.[51]

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, CLP, 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
- The subject shoreline cannot be a designated sensitive area

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.

Permits are also required if riparian property owners abut a sensitive area or if another group actively engages in such work.[52] Several areas within the Lauderdale Lakes are designated sensitive areas, and a permit is therefore required to manually remove aquatic plants in many shoreline areas around the Lakes.

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.[53]

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

[52] *If a lake district or other group wants to remove invasive species along the shoreline, a permit is necessary under Chapter NR 109, "Aquatic Plants: Introduction, Manual Removal and Mechanical Control Regulations," of the* Wisconsin Administrative Code*, as the removal of aquatic plants is not being completed by an individual property owner along his or her property.*

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

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 Lakes. However, it may provide a practical alternative in excessively shallow nearshore areas where increased water depth could meaningfully improve navigability.

Given how time consuming and costly DASH can be to employ, and given the limited presence of invasive and nuisance plant growth across the Lakes, DASH will never likely be a primary component part of the District's general nuisance and invasive plant management strategy. Nevertheless, some lake districts 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 generally 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

Considering the large expanse of EWM in Mill Lake, a whole-lake treatment may be beneficial.[54] 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.

Water Level Manipulation

The Lauderdale Lakes Dam is a fixed crest structure and thus does not have the capacity to precisely control water level fluctuations or draw water down below the crest elevation without costly high capacity pumping. As such, use of winter drawdowns to control invasive species is not recommended in the Lauderdale Lakes at this time. However, if the District were to consider modifying the dam in the future, retrofitting the dam with a gate would enable water level manipulation as an option for aquatic plant management. In addition to enabling winter drawdowns to reduce EWM abundance, the District could also allow the Lakes to more naturally fluctuate their water levels. Mimicking natural fluctuations to the greatest extent practicable could potentially be used to promote the growth of emergent vegetation, such as bulrush and wild rice within the southwestern bay of Middle Lake.

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, 3.2, and 3.3 summarize and generally 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, Walworth County, municipalities, and residents/users of the Lakes. The recommended measures help foster conditions sustaining and enhancing the natural beauty and ambience of the Lauderdale Lakes ecosystems while promoting a wide array of water-based recreational activities suitable for the Lakes' intrinsic characteristics.

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[54] *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.*

APPENDICES

LAUDERDALE LAKES 2019 POINT-INTERCEPT SURVEY DATA

APPENDIX A

Table A.1

Green Lake Point-Intercept Aquatic Plant Survey Data: August 15 – 16, 2019

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum* , Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus* , Curly-leaf pondweed	*Ceratophyllum demersum* , Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis* , Common waterweed	*Heteranthera dubia* , Water star-grass	*Lemna minor* , Small duckweed	*Najas flexilis* , Slender naiad	*Najas marina* , Spiny naiad	*Nuphar variegata* , Spatterdock	*Nymphaea odorata* , White water lily	*Potamogeton friesii* , Fries' pondweed	*Potamogeton gramineus* , Variable pondweed	*Potamogeton natans* , Floating-leaf pondweed	*Potamogeton praelongus* , White-stem pondweed	*Potamogeton zosteriformis* , Flat-stem pondweed	*Sagittaria cuneata* , Arum-leaved arrowhead	*Stuckenia pectinata* , Sago pondweed	*Utricularia minor* , Small bladderwort	*Utricularia vulgaris* , Common bladderwort	*Vallisneria americana* , Wild celery	Filamentous algae						
2	Name	Green	1	42.771053	-88.577548				NOT SAMPLED																													
3	County	Walworth	2	42.771395	-88.576073	4	S			1				1							V						1				1							
4	WBIC	755800	3	42.771767	-88.577042	4	S			2				1							V						2				1							
5	Date	8/15, 8/16/2019	4	42.771761	-88.576554	5	S			2	1			2													1											
6	Field Crew	Zofia Noe	5	42.771755	-88.576065	4	S			2	1			1	1				1	V					1				1									
7		Justin Poinsatte	6	42.772158	-88.579478	3	S			1								1							1		1				1							
8			7	42.772152	-88.578989	4	M			2	1			1				1									1	1										
9			8	42.77214	-88.578012	4	M			2				2																								
10			9	42.772127	-88.577034	3.5	S			2	1			1	1												1											
11			10	42.772524	-88.579959	4	S			2				1				1		V					1		V				2							
12			11	42.772518	-88.57947	5	S			1								1										1										
13			12	42.772512	-88.578981	6	S		NO PLANTS																						V							
14			13	42.772506	-88.578492	6	S		NO PLANTS																													
15			14	42.7725	-88.578003	6	S		NO PLANTS																													
16			15	42.772494	-88.577515	6	S			1								1													1							
17			16	42.772488	-88.577026	4	S			2	1			V								1					2											
18			17	42.772884	-88.57995	4	S			2				1				2							V		1											
19			18	42.772878	-88.579462	5.5	S			1				1											1						1							
20			19	42.772872	-88.578973	6	S		NO PLANTS																													
21			20	42.772866	-88.578484	6	S		NO PLANTS																													
22			21	42.77286	-88.577995	6.5	S		NO PLANTS																													
23			22	42.772854	-88.577506	6	S		NO PLANTS																													
24			23	42.772848	-88.577018	4.5	S			2	1			1	1												2				1							
25			24	42.773244	-88.579942	4	S			3				3									1		1													
26			25	42.773238	-88.579453	7	S			1				1														1										
27			26	42.773232	-88.578965	7	S			3				3																								
28			27	42.773226	-88.578476	7.5	S			1				1					1											1								
29			28	42.77322	-88.577987	7	S			1	1			1																								
30			29	42.773214	-88.577498	6.5	S			2				2				1													1							
31			30	42.773208	-88.577009	4	S			2				2				1									2											
32			31	42.773604	-88.579934	7	S		NO PLANTS					V																								
33			32	42.773598	-88.579445	6	S			2								2					1								1							
34			33	42.773592	-88.578956	7.5	S		NO PLANTS																													
35			34	42.773586	-88.578468	8	S			1				1					1																			
36			35	42.77358	-88.577979	7	S			2				2			V																					
37			36	42.773574	-88.57749	7	S			2				2																								
38			37	42.773568	-88.577001	5	S			3	2			3																								
39			38	42.773964	-88.579926	5	S			2				1													2				1							
40			39	42.773958	-88.579437	7	S			1																				1								
41			40	42.773952	-88.578948	8	S			1																		1										
42			41	42.773946	-88.578459	8	S			2				2					1																			
43			42	42.77394	-88.57797	8	S			1				1														1										
44			43	42.773934	-88.577482	8	S			3				3																								
45			44	42.773928	-88.576993	6	S			3				3																1								
46			45	42.774324	-88.579917	6	S			1				1				1									1	1										
47			46	42.774318	-88.579429	6.5	S			3				3																	1							
48			47	42.774312	-88.57894	8	S			1				1														1		1	1							
49			48	42.774306	-88.578451	9	S			1				1																								
50			49	42.7743	-88.577962	9.5	S			1				1					1																			
51			50	42.774294	-88.577473	10	S			2				2																	1							
52			51	42.774288	-88.576985	10	S			1									1									1										
53			52	42.774282	-88.576496	6	M			3				3																1								
54			53	42.774679	-88.57942	6	M			1																	1				1							
55			54	42.774672	-88.578932	8.5	S			1																	1											

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	Myriophyllum spicatum, Eurasian water-milfoil or Hybrid water-milfoil	Potamogeton crispus, Curly-leaf pondweed	Ceratophyllum demersum, Coontail	Chara sp., Muskgrasses	Elodea canadensis, Common waterweed	Heteranthera dubia, Water star-grass	Lemna minor, Small duckweed	Najas flexilis, Slender naiad	Najas marina, Spiny naiad	Nuphar variegata, Spatterdock	Nymphaea odorata, White water lily	Potamogeton friesii, Fries' pondweed	Potamogeton gramineus, Variable pondweed	Potamogeton natans, Floating-leaf pondweed	Potamogeton praelongus, White-stem pondweed	Potamogeton zosteriformis, Flat-stem pondweed	Sagittaria cuneata, Arum-leaved arrowhead	Stuckenia pectinata, Sago pondweed	Utricularia minor, Small bladderwort	Utricularia vulgaris, Common bladderwort	Vallisneria americana, Wild celery	Filamentous algae						
56			55	42.774666	-88.578443	10	S			1				1																								
57			56	42.77466	-88.577954	10.5	S			1				1																								
58			57	42.774654	-88.577465	10	S			2				2					1																			
59			58	42.774648	-88.576976	9	S			1				1					1									1										
60			59	42.774642	-88.576488	8	S			1				1														1			1							
61			60	42.774618	-88.574532	7.5	S		NO PLANTS																													
62			61	42.774612	-88.574044				NOT SAMPLED																													
63			62	42.774606	-88.573555	8.5	S			1				1														1			1							
64			63	42.774599	-88.573066	4	S		NO PLANTS					V														V										
65			64	42.775039	-88.579412				NOT SAMPLED																													
66			65	42.775033	-88.578923	8	S			1				1					1												1							
67			66	42.775026	-88.578435	10	S			1																		1										
68			67	42.77502	-88.577946	11	S			1				1																								
69			68	42.775014	-88.577457				NOT SAMPLED																													
70			69	42.775008	-88.576968	11	S			1				1				1																				
71			70	42.775002	-88.576479				DEEP																													
72			71	42.774996	-88.57599				DEEP																													
73			72	42.77499	-88.575502	4.5	S			1								1																				
74			73	42.774978	-88.574524				NONNAVIGABLE																													
75			74	42.774972	-88.574035	7	S			1									1									1										
76			75	42.774966	-88.573546	8	S			1				1					1									1		1	1							
77			76	42.77496	-88.573058	8	M			1									1												1							
78			77	42.775399	-88.579404				ON LAND																													
79			78	42.775393	-88.578915	6.5	M			1				1				1													1							
80			79	42.775387	-88.578426	10	M			1				1																								
81			80	42.775381	-88.577938	11	M			1																		1			1							
82			81	42.775374	-88.577449	12	S			1				1					1												1							
83			82	42.775368	-88.57696				DEEP																													
84			83	42.775362	-88.576471				DEEP																													
85			84	42.775356	-88.575982				DEEP																													
86			85	42.77535	-88.575493	6.5	M			1				1																								
87			86	42.775344	-88.575005	8	S		NO PLANTS																													
88			87	42.775338	-88.574516	9	S			1				1					1																			
89			88	42.775332	-88.574027				DEEP																													
90			89	42.775326	-88.573538	9	S			1				1																	1							
91			90	42.77532	-88.573049	9	S			1				1					1																			
92			91	42.775314	-88.572561				DEEP																													
93			92	42.775307	-88.572072	6	S		NO PLANTS					V													V	V										
94			93	42.775246	-88.567184				ON LAND																													
95			94	42.77524	-88.566695	6.5	S			1				1																	1							
96			95	42.775234	-88.566206	9	S			1				1																								
97			96	42.775753	-88.578907				ON LAND																													
98			97	42.775747	-88.578418	9	S			1																					1							
99			98	42.775741	-88.577929	12	M		NO PLANTS																													
100			99	42.775735	-88.57744				DEEP																													
101			100	42.775728	-88.576952				DEEP																													
102			101	42.775722	-88.576463				DEEP																													
103			102	42.775716	-88.575974				DEEP																													
104			103	42.77571	-88.575485				DEEP																													
105			104	42.775704	-88.574996				DEEP																													
106			105	42.775698	-88.574508				DEEP																													
107			106	42.775692	-88.574019				DEEP																													
108			107	42.775686	-88.57353				DEEP																													
109			108	42.77568	-88.573041				DEEP																													

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Najas flexilis*, Slender naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton praelongus*, White-stem pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia minor*, Small bladderwort	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae						
110			109	42.775674	-88.572552				DEEP																													
111			110	42.775668	-88.572063				DEEP																													
112			111	42.775607	-88.567175				DEEP																													
113			112	42.7756	-88.566686	8	S			1				1																								
114			113	42.775594	-88.566198	8	S			2				2																								
115			114	42.775588	-88.565709				PIER																													
116			115	42.776107	-88.57841	5.5	S			1																	1											
117			116	42.776101	-88.577921	7.5	S																								1							
118			117	42.776095	-88.577432				DEEP																													
119			118	42.776089	-88.576943				DEEP																													
120			119	42.776083	-88.576455				DEEP																													
121			120	42.776076	-88.575966				DEEP																													
122			121	42.77607	-88.575477				DEEP																													
123			122	42.776064	-88.574988				DEEP																													
124			123	42.776058	-88.574499				DEEP																													
125			124	42.776052	-88.57401				DEEP																													
126			125	42.776046	-88.573522				DEEP																													
127			126	42.77604	-88.573033				DEEP																													
128			127	42.776034	-88.572544				DEEP																													
129			128	42.776028	-88.572055				DEEP																													
130			129	42.775967	-88.567167				NOT SAMPLED																													
131			130	42.775961	-88.566678	8.5	S			3				3														1										
132			131	42.775954	-88.566189	9	S			1				1					1																			
133			132	42.775948	-88.5657	9	S			1																		1										
134			133	42.775942	-88.565212	7	S			1				1				1									1											
135			134	42.775936	-88.564723	8	S			1									1									1										
136			135	42.77593	-88.564234	8	S			2				2														1			1							
137			136	42.775924	-88.563745	7	S			1				1													1	1			1							
138			137	42.776461	-88.577913				ON LAND																													
139			138	42.776455	-88.577424	9	S			1			1	1																								
140			139	42.776449	-88.576935				DEEP																													
141			140	42.776443	-88.576446				DEEP																													
142			141	42.776437	-88.575957				DEEP																													
143			142	42.77643	-88.575469				DEEP																													
144			143	42.776424	-88.57498				DEEP																													
145			144	42.776418	-88.574491				DEEP																													
146			145	42.776412	-88.574002				DEEP																													
147			146	42.776406	-88.573513				DEEP																													
148			147	42.7764	-88.573025				DEEP																													
149			148	42.776394	-88.572536				DEEP																													
150			149	42.776388	-88.572047				DEEP																													
151			150	42.776333	-88.567647				ON LAND																													
152			151	42.776327	-88.567159	8	S			2				2														1										
153			152	42.776321	-88.56667	9	S			1																		1										
154			153	42.776315	-88.566181	9.5	S		NO PLANTS																													
155			154	42.776308	-88.565692	9	S			1									1																			
156			155	42.776302	-88.565203	9	S		NO PLANTS																													
157			156	42.776296	-88.564715	9	S		NO PLANTS																													
158			157	42.77629	-88.564226	9	S			1				1																								
159			158	42.776284	-88.563737	9	M			1				1																								
160			159	42.776278	-88.563248	8	M			2				1													2											
161			160	42.776272	-88.562759				PIER																													
162			161	42.776809	-88.576927	10	S			1				1									1															
163			162	42.776803	-88.576438				DEEP																													

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum* , Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus* ,Curly-leaf pondweed	*Ceratophyllum demersum* , Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis* , Common waterweed	*Heteranthera dubia* , Water star-grass	*Lemna minor* , Small duckweed	*Najas flexilis* , Slender naiad	*Najas marina* , Spiny naiad	*Nuphar variegata* , Spatterdock	*Nymphaea odorata* , White water lily	*Potamogeton friesii* , Fries' pondweed	*Potamogeton gramineus* , Variable pondweed	*Potamogeton natans* , Floating-leaf pondweed	*Potamogeton praelongus* , White-stem pondweed	*Potamogeton zosteriformis* , Flat-stem pondweed	*Sagittaria cuneata* , Arum-leaved arrowhead	*Stuckenia pectinata* , Sago pondweed	*Utricularia minor* , Small bladderwort	*Utricularia vulgaris* , Common bladderwort	*Vallisneria americana* , Wild celery	Filamentous algae						
164			163	42.776797	-88.575949				DEEP																													
165			164	42.776791	-88.57546				DEEP																													
166			165	42.776784	-88.574972				DEEP																													
167			166	42.776778	-88.574483				DEEP																													
168			167	42.776772	-88.573994				DEEP																													
169			168	42.776766	-88.573505				DEEP																													
170			169	42.77676	-88.573016				DEEP																													
171			170	42.776754	-88.572527				DEEP																													
172			171	42.776748	-88.572039				DEEP																													
173			172	42.776742	-88.57155				DEEP																													
174			173	42.776711	-88.569106				DEEP																													
175			174	42.776705	-88.568617				DEEP																													
176			175	42.776699	-88.568128				DEEP																													
177			176	42.776693	-88.567639	8	S			1	1			1													1				1							
178			177	42.776687	-88.56715	9.5	S		NO PLANTS																													
179			178	42.776681	-88.566661				DEEP																													
180			179	42.776675	-88.566173	10	S		NO PLANTS																													
181			180	42.776669	-88.565684	10	S		NO PLANTS																													
182			181	42.776662	-88.565195	10	S		NO PLANTS																													
183			182	42.776656	-88.564706	`10	S			1									1																			
184			183	42.77665	-88.564217	10	S		NO PLANTS																													
185			184	42.776644	-88.563729	9	S			1									1									1										
186			185	42.776638	-88.56324	9.5	S			1																		1										
187			186	42.776632	-88.562751	8.5	S		NO PLANTS																													
188			187	42.776626	-88.562262	8	M			1																		1										
189			188	42.776619	-88.561773	7	M			1				1													1				1							
190			189	42.777169	-88.576919	11	S		NO PLANTS																													
191			190	42.777163	-88.57643				DEEP																													
192			191	42.777157	-88.575941				DEEP																													
193			192	42.777151	-88.575452				DEEP																													
194			193	42.777145	-88.574963				DEEP																													
195			194	42.777138	-88.574474				DEEP																													
196			195	42.777132	-88.573986				DEEP																													
197			196	42.777126	-88.573497				DEEP																													
198			197	42.77712	-88.573008				DEEP																													
199			198	42.777114	-88.572519				DEEP																													
200			199	42.777108	-88.57203				DEEP																													
201			200	42.777102	-88.571541				DEEP																													
202			201	42.777096	-88.571053				DEEP																													
203			202	42.77709	-88.570564				DEEP																													
204			203	42.777084	-88.570075				DEEP																													
205			204	42.777078	-88.569586				DEEP																													
206			205	42.777071	-88.569097				DEEP																													
207			206	42.777065	-88.568609				DEEP																													
208			207	42.777059	-88.56812	12	S		NO PLANTS																													
209			208	42.777053	-88.567631	10	S			1				1																								
210			209	42.777047	-88.567142	10	S		NO PLANTS																													
211			210	42.777041	-88.566653	9.5	S		NO PLANTS																													
212			211	42.777035	-88.566164	10.5	S			1																					1							
213			212	42.777029	-88.565676	10	S		NO PLANTS																													
214			213	42.777022	-88.565187	10.5	S		NO PLANTS																													
215			214	42.777016	-88.564698	10	S		NO PLANTS																													
216			215	42.77701	-88.564209	10	S			1									1																			
217			216	42.777004	-88.56372	10	S			1																		1										

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	Myriophyllum spicatum , Eurasian water-milfoil or Hybrid water-milfoil	Potamogeton crispus ,Curly-leaf pondweed	Ceratophyllum demersum , Coontail	Chara sp., Muskgrasses	Elodea canadensis , Common waterweed	Heteranthera dubia , Water star-grass	Lemna minor , Small duckweed	Najas flexilis , Slender naiad	Najas marina , Spiny naiad	Nuphar variegata , Spatterdock	Nymphaea odorata , White water lily	Potamogeton friesii , Fries' pondweed	Potamogeton gramineus , Variable pondweed	Potamogeton natans , Floating-leaf pondweed	Potamogeton praelongus , White-stem pondweed	Potamogeton zosteriformis , Flat-stem pondweed	Sagittaria cuneata , Arum-leaved arrowhead	Stuckenia pectinata , Sago pondweed	Utricularia minor , Small bladderwort	Utricularia vulgaris , Common bladderwort	Vallisneria americana , Wild celery	Filamentous algae						
218			217	42.776998	-88.563231	10	S			1																		1										
219			218	42.776992	-88.562743	9.5	S		NO PLANTS																													
220			219	42.776986	-88.562254	8.5	S		NO PLANTS																													
221			220	42.77698	-88.561765	8	S			2				2														1										
222			221	42.776973	-88.561276	6.5	S			1																1	1				1							
223			222	42.777529	-88.57691	8	S			1				1																								
224			223	42.777523	-88.576422				DEEP																													
225			224	42.777517	-88.575933				DEEP																													
226			225	42.777511	-88.575444				DEEP																													
227			226	42.777505	-88.574955				DEEP																													
228			227	42.777499	-88.574466				DEEP																													
229			228	42.777493	-88.573977				DEEP																													
230			229	42.777486	-88.573489				DEEP																													
231			230	42.77748	-88.573				DEEP																													
232			231	42.777474	-88.572511				DEEP																													
233			232	42.777468	-88.572022				DEEP																													
234			233	42.777462	-88.571533				DEEP																													
235			234	42.777456	-88.571044				DEEP																													
236			235	42.77745	-88.570556				DEEP																													
237			236	42.777444	-88.570067				DEEP																													
238			237	42.777438	-88.569578				DEEP																													
239			238	42.777432	-88.569089				DEEP																													
240			239	42.777425	-88.5686				DEEP																													
241			240	42.777419	-88.568111				DEEP																													
242			241	42.777413	-88.567623	10	S		NO PLANTS																													
243			242	42.777407	-88.567134	10	S		NO PLANTS																													
244			243	42.777401	-88.566645	9.5	S		NO PLANTS																													
245			244	42.777395	-88.566156	10	S		NO PLANTS																													
246			245	42.777389	-88.565667	10	S		NO PLANTS																													
247			246	42.777383	-88.565178	10.5	S		NO PLANTS																													
248			247	42.777376	-88.56469	10.5	S			1																		1										
249			248	42.77737	-88.564201	11	S		NO PLANTS																													
250			249	42.777364	-88.563712	10.5	S		NO PLANTS																													
251			250	42.777358	-88.563223	10	S		NO PLANTS																													
252			251	42.777352	-88.562734	10	S		NO PLANTS																													
253			252	42.777346	-88.562245	9	S		NO PLANTS																													
254			253	42.77734	-88.561757	8.5	S		NO PLANTS																													
255			254	42.777334	-88.561268	6.5	S			2				2													2	1			1							
256			255	42.777883	-88.576413				DEEP																													
257			256	42.777877	-88.575924				DEEP																													
258			257	42.777871	-88.575436				DEEP																													
259			258	42.777865	-88.574947				DEEP																													
260			259	42.777859	-88.574458				DEEP																													
261			260	42.777853	-88.573969				DEEP																													
262			261	42.777847	-88.57348				DEEP																													
263			262	42.77784	-88.572991				DEEP																													
264			263	42.777834	-88.572503				DEEP																													
265			264	42.777828	-88.572014				DEEP																													
266			265	42.777822	-88.571525				DEEP																													
267			266	42.777816	-88.571036				DEEP																													
268			267	42.77781	-88.570547				DEEP																													
269			268	42.777804	-88.570058				DEEP																													
270			269	42.777798	-88.56957				DEEP																													
271			270	42.777792	-88.569081				DEEP																													

Table A.1 (Continued)

1	Entry																																					
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
			sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum* , Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus* ,Curly-leaf pondweed	*Ceratophyllum demersum* , Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis* , Common waterweed	*Heteranthera dubia* , Water star-grass	*Lemna minor* , Small duckweed	*Najas flexilis* , Slender naiad	*Najas marina* , Spiny naiad	*Nuphar variegata* , Spatterdock	*Nymphaea odorata* , White water lily	*Potamogeton friesii* , Fries' pondweed	*Potamogeton gramineus* , Variable pondweed	*Potamogeton natans* , Floating-leaf pondweed	*Potamogeton praelongus* , White-stem pondweed	*Potamogeton zosteriformis* , Flat-stem pondweed	*Sagittaria cuneata* , Arum-leaved arrowhead	*Stuckenia pectinata* , Sago pondweed	*Utricularia minor* , Small bladderwort	*Utricularia vulgaris* , Common bladderwort	*Vallisneria americana* , Wild celery	Filamentous algae						
272			271	42.777786	-88.568592				DEEP																													
273			272	42.777779	-88.568103				DEEP																													
274			273	42.777773	-88.567614	13	S			1				1																								
275			274	42.777767	-88.567125	11	S		NO PLANTS																													
276			275	42.777761	-88.566637	9.5	S		NO PLANTS																													
277			276	42.777755	-88.566148	9	R		NO PLANTS																													
278			277	42.777749	-88.565659	9	R		NO PLANTS																													
279			278	42.777743	-88.56517	10	S			1				1																								
280			279	42.777737	-88.564681	7.5	S		NO PLANTS																													
281			280	42.77773	-88.564192	11	S		NO PLANTS																													
282			281	42.777724	-88.563704	11	S		NO PLANTS																													
283			282	42.777718	-88.563215	10.5	S		NO PLANTS																													
284			283	42.777712	-88.562726	9.5	S		NO PLANTS																													
285			284	42.777706	-88.562237	9.5	S			1																		1										
286			285	42.7777	-88.561748	8.5	S			1				1																1								
287			286	42.777694	-88.561259	7	S			1																	1											
288			287	42.777687	-88.560771				SWIM AREA																													
289			288	42.778243	-88.576405	11	S			1				1																								
290			289	42.778237	-88.575916				DEEP																													
291			290	42.778231	-88.575427				DEEP																													
292			291	42.778225	-88.574939				DEEP																													
293			292	42.778219	-88.57445				DEEP																													
294			293	42.778213	-88.573961				DEEP																													
295			294	42.778207	-88.573472				DEEP																													
296			295	42.778201	-88.572983				DEEP																													
297			296	42.778194	-88.572494				DEEP																													
298			297	42.778188	-88.572006				DEEP																													
299			298	42.778182	-88.571517				DEEP																													
300			299	42.778176	-88.571028				DEEP																													
301			300	42.77817	-88.570539				DEEP																													
302			301	42.778164	-88.57005				DEEP																													
303			302	42.778158	-88.569561				DEEP																													
304			303	42.778152	-88.569072				DEEP																													
305			304	42.778146	-88.568584				DEEP																													
306			305	42.77814	-88.568095				DEEP																													
307			306	42.778133	-88.567606				DEEP																													
308			307	42.778127	-88.567117				DEEP																													
309			308	42.778121	-88.566628	12.5	R		NO PLANTS																													
310			309	42.778115	-88.566139	11	M			1				1																								
311			310	42.778109	-88.565651	10	M			1				1																								
312			311	42.778103	-88.565162	11	M		NO PLANTS																													
313			312	42.778097	-88.564673	11	S		NO PLANTS																													
314			313	42.778091	-88.564184	11	S			1																		1				1						
315			314	42.778084	-88.563695	11	M		NO PLANTS																													
316			315	42.778078	-88.563206	10	M		NO PLANTS																													
317			316	42.778072	-88.562718	9.5	M			1																	1	1			1							
318			317	42.778066	-88.562229	9	S			1																		1										
319			318	42.77806	-88.56174	8	M			1																	1	1										
320			319	42.778054	-88.561251	8	M			1																	1											
321			320	42.778048	-88.560762	1	R		NO PLANTS																													
322			321	42.778603	-88.576397	9	S			1																		1			1							
323			322	42.778597	-88.575908				DEEP																													
324			323	42.778591	-88.575419				DEEP																													
325			324	42.778585	-88.57493				DEEP																													

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum* , Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus* ,Curly-leaf pondweed	*Ceratophyllum demersum* , Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis* , Common waterweed	*Heteranthera dubia* , Water star-grass	*Lemna minor* , Small duckweed	*Najas flexilis* , Slender naiad	*Najas marina* , Spiny naiad	*Nuphar variegata* , Spatterdock	*Nymphaea odorata* , White water lily	*Potamogeton friesii* , Fries' pondweed	*Potamogeton gramineus* , Variable pondweed	*Potamogeton natans* , Floating-leaf pondweed	*Potamogeton praelongus* , White-stem pondweed	*Potamogeton zosteriformis* , Flat-stem pondweed	*Sagittaria cuneata* , Arum-leaved arrowhead	*Stuckenia pectinata* , Sago pondweed	*Utricularia minor* , Small bladderwort	*Utricularia vulgaris* , Common bladderwort	*Vallisneria americana* , Wild celery	Filamentous algae						
326			325	42.778579	-88.574441				DEEP																													
327			326	42.778573	-88.573953				DEEP																													
328			327	42.778567	-88.573464				DEEP																													
329			328	42.778561	-88.572975				DEEP																													
330			329	42.778555	-88.572486				DEEP																													
331			330	42.778548	-88.571997				DEEP																													
332			331	42.778542	-88.571508				DEEP																													
333			332	42.778536	-88.57102				DEEP																													
334			333	42.77853	-88.570531				DEEP																													
335			334	42.778524	-88.570042				DEEP																													
336			335	42.778518	-88.569553				DEEP																													
337			336	42.778512	-88.569064				DEEP																													
338			337	42.778506	-88.568575				DEEP																													
339			338	42.7785	-88.568086				DEEP																													
340			339	42.778494	-88.567598				DEEP																													
341			340	42.778487	-88.567109				DEEP																													
342			341	42.778481	-88.56662				DEEP																													
343			342	42.778475	-88.566131				DEEP																													
344			343	42.778469	-88.565642	11	S			1									1																			
345			344	42.778463	-88.565153	10.5	S		NO PLANTS																													
346			345	42.778457	-88.564665	10.5	S		NO PLANTS																													
347			346	42.778451	-88.564176	10.5	S		NO PLANTS																													
348			347	42.778445	-88.563687	10.5	S			1				1																								
349			348	42.778438	-88.563198	10	S		NO PLANTS																													
350			349	42.778432	-88.562709	9.5	S			1	1																	1										
351			350	42.778426	-88.56222	9	S			1																	1											
352			351	42.77842	-88.561732	8.5	M		NO PLANTS																													
353			352	42.778414	-88.561243	7	M			1	1			1					1																			
354			353	42.778408	-88.560754	4	R			1						1											1											
355			354	42.778969	-88.576877				PIER																													
356			355	42.778963	-88.576389	9.5	S		NO PLANTS																													
357			356	42.778957	-88.5759				DEEP																													
358			357	42.778951	-88.575411				DEEP																													
359			358	42.778945	-88.574922				DEEP																													
360			359	42.778939	-88.574433				DEEP																													
361			360	42.778933	-88.573944				DEEP																													
362			361	42.778927	-88.573455				DEEP																													
363			362	42.778921	-88.572967				DEEP																													
364			363	42.778915	-88.572478				DEEP																													
365			364	42.778909	-88.571989				DEEP																													
366			365	42.778902	-88.5715				DEEP																													
367			366	42.778896	-88.571011				DEEP																													
368			367	42.77889	-88.570522				DEEP																													
369			368	42.778884	-88.570034				DEEP																													
370			369	42.778878	-88.569545				DEEP																													
371			370	42.778872	-88.569056				DEEP																													
372			371	42.778866	-88.568567				DEEP																													
373			372	42.77886	-88.568078				DEEP																													
374			373	42.778854	-88.567589				DEEP																													
375			374	42.778847	-88.5671				DEEP																													
376			375	42.778841	-88.566612				DEEP																													
377			376	42.778835	-88.566123				DEEP																													
378			377	42.778829	-88.565634	11.5	S			1				1					1									1										
379			378	42.778823	-88.565145	12	S			1																		1										

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Najas flexilis*, Slender naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton praelongus*, White-stem pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia minor*, Small bladderwort	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae						
380			379	42.778817	-88.564656	11	S		NO PLANTS																													
381			380	42.778811	-88.564167	11	S			1				1																	1							
382			381	42.778805	-88.563679	8.5	S			1																					1							
383			382	42.778798	-88.56319	5	R		NO PLANTS																													
384			383	42.778792	-88.562701	8	M			1	1																	1			1							
385			384	42.778786	-88.562212	8	M			2	1			2														1			1							
386			385	42.77878	-88.561723	7	M			1																	1	1										
387			386	42.778774	-88.561234	6.5	M			2				2														1			1							
388			387	42.778768	-88.560746	4	M			2				2									1								1							
389			388	42.77933	-88.576869	7	S		NO PLANTS					V																								
390			389	42.779323	-88.57638	9	M		NO PLANTS																													
391			390	42.779317	-88.575891				DEEP																													
392			391	42.779311	-88.575403				DEEP																													
393			392	42.779305	-88.574914				DEEP																													
394			393	42.779299	-88.574425				DEEP																													
395			394	42.779293	-88.573936				DEEP																													
396			395	42.779287	-88.573447				DEEP																													
397			396	42.779281	-88.572958				DEEP																													
398			397	42.779275	-88.57247				DEEP																													
399			398	42.779269	-88.571981				DEEP																													
400			399	42.779263	-88.571492				DEEP																													
401			400	42.779256	-88.571003				DEEP																													
402			401	42.77925	-88.570514				DEEP																													
403			402	42.779244	-88.570025				DEEP																													
404			403	42.779238	-88.569536				DEEP																													
405			404	42.779232	-88.569048				DEEP																													
406			405	42.779226	-88.568559				DEEP																													
407			406	42.77922	-88.56807				DEEP																													
408			407	42.779214	-88.567581				DEEP																													
409			408	42.779208	-88.567092				DEEP																													
410			409	42.779201	-88.566603				DEEP																													
411			410	42.779195	-88.566114				DEEP																													
412			411	42.779189	-88.565626	12	S		NO PLANTS																													
413			412	42.779183	-88.565137	12	S		NO PLANTS																													
414			413	42.779177	-88.564648	12	S		NO PLANTS																													
415			414	42.779171	-88.564159	10	M			1	1								1									1			1							
416			415	42.779165	-88.56367	4	R		NO PLANTS											V							V											
417			416	42.779159	-88.563181	5.5	S		NO PLANTS																													
418			417	42.779152	-88.562693	6	S		NO PLANTS																													
419			418	42.779146	-88.562204	7	S			1				1																	1							
420			419	42.77914	-88.561715	6.5	M			2				2														1		1	1							
421			420	42.779134	-88.561226	6	M		NO PLANTS																													
422			421	42.779128	-88.560737	5	M			1				V																	1							
423			422	42.779684	-88.576372	8	M			1	1																											
424			423	42.779677	-88.575883	9	M			1																					1							
425			424	42.779671	-88.575394				DEEP																													
426			425	42.779665	-88.574906				DEEP																													
427			426	42.779659	-88.574417				DEEP																													
428			427	42.779653	-88.573928				DEEP																													
429			428	42.779647	-88.573439				DEEP																													
430			429	42.779641	-88.57295				DEEP																													
431			430	42.779635	-88.572461				DEEP																													
432			431	42.779629	-88.571972				DEEP																													
433			432	42.779623	-88.571484				DEEP																													

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum* , Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus* ,Curly-leaf pondweed	*Ceratophyllum demersum* , Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis* , Common waterweed	*Heteranthera dubia* , Water star-grass	*Lemna minor* , Small duckweed	*Najas flexilis* , Slender naiad	*Najas marina* , Spiny naiad	*Nuphar variegata* , Spatterdock	*Nymphaea odorata* , White water lily	*Potamogeton friesii* , Fries' pondweed	*Potamogeton gramineus* , Variable pondweed	*Potamogeton natans* , Floating-leaf pondweed	*Potamogeton praelongus* , White-stem pondweed	*Potamogeton zosteriformis* , Flat-stem pondweed	*Sagittaria cuneata* , Arum-leaved arrowhead	*Stuckenia pectinata* , Sago pondweed	*Utricularia minor* , Small bladderwort	*Utricularia vulgaris* , Common bladderwort	*Vallisneria americana* , Wild celery	Filamentous algae						
434			433	42.779617	-88.570995				DEEP																													
435			434	42.77961	-88.570506				DEEP																													
436			435	42.779604	-88.570017				DEEP																													
437			436	42.779598	-88.569528				DEEP																													
438			437	42.779592	-88.569039				DEEP																													
439			438	42.779586	-88.56855				DEEP																													
440			439	42.77958	-88.568062				DEEP																													
441			440	42.779574	-88.567573				DEEP																													
442			441	42.779568	-88.567084				DEEP																													
443			442	42.779562	-88.566595				DEEP																													
444			443	42.779555	-88.566106				DEEP																													
445			444	42.779549	-88.565617				DEEP																													
446			445	42.779543	-88.565128	11.5	M		NO PLANTS																													
447			446	42.779537	-88.56464	10	S		NO PLANTS																													
448			447	42.779531	-88.564151	7.5	S		NO PLANTS																													
449			448	42.779519	-88.563173	4	M			1	1			1									V								1							
450			449	42.779513	-88.562684	5.5	S			1	1			1									V															
451			450	42.779506	-88.562195	5.5	S			1				1																	1							
452			451	42.7795	-88.561707	5.5	M			1																		1			1							
453			452	42.779494	-88.561218	5	M			2	1			2														1			1							
454			453	42.779488	-88.560729	4	M			3				3																	1							
455			454	42.780038	-88.575875	7.5	M			3																		3										
456			455	42.780032	-88.575386				DEEP																													
457			456	42.780025	-88.574897				DEEP																													
458			457	42.780019	-88.574408				DEEP																													
459			458	42.780013	-88.57392				DEEP																													
460			459	42.780007	-88.573431				DEEP																													
461			460	42.780001	-88.572942				DEEP																													
462			461	42.779995	-88.572453				DEEP																													
463			462	42.779989	-88.571964				DEEP																													
464			463	42.779983	-88.571475				DEEP																													
465			464	42.779977	-88.570986				DEEP																													
466			465	42.779971	-88.570498				DEEP																													
467			466	42.779964	-88.570009				DEEP																													
468			467	42.779958	-88.56952				DEEP																													
469			468	42.779952	-88.569031				DEEP																													
470			469	42.779946	-88.568542				DEEP																													
471			470	42.77994	-88.568053				DEEP																													
472			471	42.779934	-88.567564				DEEP																													
473			472	42.779928	-88.567076				DEEP																													
474			473	42.779922	-88.566587				DEEP																													
475			474	42.779916	-88.566098				DEEP																													
476			475	42.779909	-88.565609				DEEP																													
477			476	42.779903	-88.56512	12	M		NO PLANTS																													
478			477	42.779897	-88.564631	9.5	S			1																					1							
479			478	42.779891	-88.564142	6	S		NO PLANTS																													
480			479	42.779879	-88.563165	3	M			1	V			1							V		V								1							
481			480	42.779873	-88.562676				BOAT																													
482			481	42.779867	-88.562187				BOAT																													
483			482	42.77986	-88.561698				BOAT																													
484			483	42.779854	-88.561209				BOAT																													
485			484	42.779848	-88.560721						V			V							V			V							V							
486			485	42.780398	-88.575867	8	S			1	1			1									1								1							
487			486	42.780392	-88.575378	10	S		NO PLANTS																													

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	**Entry**		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum* , Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus* ,Curly-leaf pondweed	*Ceratophyllum demersum* , Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis* , Common waterweed	*Heteranthera dubia* , Water star-grass	*Lemna minor* , Small duckweed	*Najas flexilis* , Slender naiad	*Najas marina* , Spiny naiad	*Nuphar variegata* , Spatterdock	*Nymphaea odorata* , White water lily	*Potamogeton friesii* , Fries' pondweed	*Potamogeton gramineus* , Variable pondweed	*Potamogeton natans* , Floating-leaf pondweed	*Potamogeton praelongus* , White-stem pondweed	*Potamogeton zosteriformis* , Flat-stem pondweed	*Sagittaria cuneata* , Arum-leaved arrowhead	*Stuckenia pectinata* , Sago pondweed	*Utricularia minor* , Small bladderwort	*Utricularia vulgaris* , Common bladderwort	*Vallisneria americana* , Wild celery	Filamentous algae						
488			487	42.780386	-88.574889				DEEP																													
489			488	42.780379	-88.5744				DEEP																													
490			489	42.780373	-88.573911				DEEP																													
491			490	42.780367	-88.573422				DEEP																													
492			491	42.780361	-88.572934				DEEP																													
493			492	42.780355	-88.572445				DEEP																													
494			493	42.780349	-88.571956				DEEP																													
495			494	42.780343	-88.571467				DEEP																													
496			495	42.780337	-88.570978				DEEP																													
497			496	42.780331	-88.570489				DEEP																													
498			497	42.780325	-88.57				DEEP																													
499			498	42.780318	-88.569512				DEEP																													
500			499	42.780312	-88.569023				DEEP																													
501			500	42.780306	-88.568534				DEEP																													
502			501	42.7803	-88.568045				DEEP																													
503			502	42.780294	-88.567556				DEEP																													
504			503	42.780288	-88.567067				DEEP																													
505			504	42.780282	-88.566578				DEEP																													
506			505	42.780276	-88.56609				DEEP																													
507			506	42.78027	-88.565601				DEEP																													
508			507	42.780263	-88.565112	13	S		NO PLANTS																													
509			508	42.780257	-88.564623	8.5	S			1																					1							
510			509	42.780251	-88.564134	4.5	S			1				1																								
511			510	42.780752	-88.57537	8	S			1				1																								
512			511	42.780746	-88.574881	10.5	S		NO PLANTS																													
513			512	42.78074	-88.574392				DEEP																													
514			513	42.780733	-88.573903				DEEP																													
515			514	42.780727	-88.573414				DEEP																													
516			515	42.780721	-88.572925				DEEP																													
517			516	42.780715	-88.572436				DEEP																													
518			517	42.780709	-88.571948				DEEP																													
519			518	42.780703	-88.571459				DEEP																													
520			519	42.780697	-88.57097				DEEP																													
521			520	42.780691	-88.570481				DEEP																													
522			521	42.780685	-88.569992				DEEP																													
523			522	42.780679	-88.569503				DEEP																													
524			523	42.780672	-88.569014				DEEP																													
525			524	42.780666	-88.568526				DEEP																													
526			525	42.78066	-88.568037				DEEP																													
527			526	42.780654	-88.567548				DEEP																													
528			527	42.780648	-88.567059				DEEP																													
529			528	42.780642	-88.56657				DEEP																													
530			529	42.780636	-88.566081				DEEP																													
531			530	42.78063	-88.565592				DEEP																													
532			531	42.780624	-88.565104	12	M		NO PLANTS																													
533			532	42.780617	-88.564615	9	M		NO PLANTS																													
534			533	42.780611	-88.564126	4	S			1				1												1												
535			534	42.781106	-88.574872	9	S			1									1									1										
536			535	42.7811	-88.574384				DEEP																													
537			536	42.781094	-88.573895				DEEP																													
538			537	42.781087	-88.573406				DEEP																													
539			538	42.781081	-88.572917				DEEP																													
540			539	42.781075	-88.572428				DEEP																													
541			540	42.781069	-88.571939				DEEP																													

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Najas flexilis*, Slender naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton praelongus*, White-stem pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia minor*, Small bladderwort	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae						
542			541	42.781063	-88.57145				DEEP																													
543			542	42.781057	-88.570962				DEEP																													
544			543	42.781051	-88.570473				DEEP																													
545			544	42.781045	-88.569984				DEEP																													
546			545	42.781039	-88.569495				DEEP																													
547			546	42.781033	-88.569006				DEEP																													
548			547	42.781026	-88.568517				DEEP																													
549			548	42.78102	-88.568028				DEEP																													
550			549	42.781014	-88.56754				DEEP																													
551			550	42.781008	-88.567051				DEEP																													
552			551	42.781002	-88.566562				DEEP																													
553			552	42.780996	-88.566073	12	S		NO PLANTS																													
554			553	42.78099	-88.565584	11.5	S			1																		1										
555			554	42.780984	-88.565095	8	S		NO PLANTS																													
556			555	42.780977	-88.564606				DEEP																													
557			556	42.78146	-88.574375				DEEP																													
558			557	42.781454	-88.573886				DEEP																													
559			558	42.781448	-88.573398				DEEP																													
560			559	42.781441	-88.572909				DEEP																													
561			560	42.781435	-88.57242				DEEP																													
562			561	42.781429	-88.571931				DEEP																													
563			562	42.781423	-88.571442				DEEP																													
564			563	42.781417	-88.570953				DEEP																													
565			564	42.781411	-88.570464				DEEP																													
566			565	42.781405	-88.569976				DEEP																													
567			566	42.781399	-88.569487				DEEP																													
568			567	42.781393	-88.568998				DEEP																													
569			568	42.781387	-88.568509				DEEP																													
570			569	42.78138	-88.56802				DEEP																													
571			570	42.781374	-88.567531				DEEP																													
572			571	42.781368	-88.567042				DEEP																													
573			572	42.781362	-88.566553	13	S		NO PLANTS																													
574			573	42.781356	-88.566065	12	S		NO PLANTS																													
575			574	42.78135	-88.565576	10	S		NO PLANTS																													
576			575	42.781344	-88.565087	6.5	R		NO PLANTS																													
577			576	42.781814	-88.573878	8	R			1				1																								
578			577	42.781808	-88.573389	8	R			1				1																								
579			578	42.781802	-88.5729				DEEP																													
580			579	42.781796	-88.572412				DEEP																													
581			580	42.781789	-88.571923				DEEP																													
582			581	42.781783	-88.571434				DEEP																													
583			582	42.781777	-88.570945				DEEP																													
584			583	42.781771	-88.570456				DEEP																													
585			584	42.781765	-88.569967				DEEP																													
586			585	42.781759	-88.569478				DEEP																													
587			586	42.781753	-88.56899				DEEP																													
588			587	42.781747	-88.568501				DEEP																													
589			588	42.781741	-88.568012				DEEP																													
590			589	42.781734	-88.567523				DEEP																													
591			590	42.781728	-88.567034				DEEP																													
592			591	42.781722	-88.566545				DEEP																													
593			592	42.781716	-88.566056	11	S			1																					1							
594			593	42.78171	-88.565567	5	S		NO PLANTS																													
595			594	42.782162	-88.572892	7	S			2				2									V															

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Najas flexilis*, Slender naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton praelongus*, White-stem pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia minor*, Small bladderwort	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae						
596			595	42.782156	-88.572403				DEEP																													
597			596	42.78215	-88.571914				DEEP																													
598			597	42.782143	-88.571426				DEEP																													
599			598	42.782137	-88.570937				DEEP																													
600			599	42.782131	-88.570448				DEEP																													
601			600	42.782125	-88.569959				DEEP																													
602			601	42.782119	-88.56947				DEEP																													
603			602	42.782113	-88.568981				DEEP																													
604			603	42.782107	-88.568492				DEEP																													
605			604	42.782101	-88.568003				DEEP																													
606			605	42.782095	-88.567515				DEEP																													
607			606	42.782088	-88.567026				DEEP																													
608			607	42.782082	-88.566537				DEEP																													
609			608	42.782076	-88.566048	10	R		NO PLANTS																													
610			609	42.78207	-88.565559	3	R		NO PLANTS																													
611			610	42.782516	-88.572395	4	R		NO PLANTS					V																								
612			611	42.78251	-88.571906				DEEP																													
613			612	42.782504	-88.571417				DEEP																													
614			613	42.782497	-88.570928				DEEP																													
615			614	42.782491	-88.57044				DEEP																													
616			615	42.782485	-88.569951				DEEP																													
617			616	42.782479	-88.569462				DEEP																													
618			617	42.782473	-88.568973				DEEP																													
619			618	42.782467	-88.568484				DEEP																													
620			619	42.782461	-88.567995				DEEP																													
621			620	42.782455	-88.567506				DEEP																													
622			621	42.782449	-88.567017				DEEP																													
623			622	42.782442	-88.566529	13.5	S			1				1																								
624			623	42.782436	-88.56604	8	R		NO PLANTS																													
625			624	42.78287	-88.571898				DEEP																													
626			625	42.782864	-88.571409				DEEP																													
627			626	42.782858	-88.57092				DEEP																													
628			627	42.782851	-88.570431				DEEP																													
629			628	42.782845	-88.569942				DEEP																													
630			629	42.782839	-88.569454				DEEP																													
631			630	42.782833	-88.568965				DEEP																													
632			631	42.782827	-88.568476				DEEP																													
633			632	42.782821	-88.567987				DEEP																													
634			633	42.782815	-88.567498				DEEP																													
635			634	42.782809	-88.567009				DEEP																													
636			635	42.782803	-88.56652	10	R		NO PLANTS																													
637			636	42.782796	-88.566031				PIER																													
638			637	42.78323	-88.57189	7	R			1				1																								
639			638	42.783224	-88.571401				DEEP																													
640			639	42.783218	-88.570912				DEEP																													
641			640	42.783212	-88.570423				DEEP																													
642			641	42.783205	-88.569934				DEEP																													
643			642	42.783199	-88.569445				DEEP																													
644			643	42.783193	-88.568956				DEEP																													
645			644	42.783187	-88.568467				DEEP																													
646			645	42.783181	-88.567979				DEEP																													
647			646	42.783175	-88.56749				DEEP																													
648			647	42.783169	-88.567001				DEEP																													
649			648	42.783163	-88.566512	9.5	S		NO PLANTS																													

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	Myriophyllum spicatum , Eurasian water-milfoil or Hybrid water-milfoil	Potamogeton crispus ,Curly-leaf pondweed	Ceratophyllum demersum , Coontail	Chara sp., Muskgrasses	Elodea canadensis , Common waterweed	Heteranthera dubia , Water star-grass	Lemna minor , Small duckweed	Najas flexilis , Slender naiad	Najas marina , Spiny naiad	Nuphar variegata , Spatterdock	Nymphaea odorata , White water lily	Potamogeton friesii , Fries' pondweed	Potamogeton gramineus , Variable pondweed	Potamogeton natans , Floating-leaf pondweed	Potamogeton praelongus , White-stem pondweed	Potamogeton zosteriformis , Flat-stem pondweed	Sagittaria cuneata , Arum-leaved arrowhead	Stuckenia pectinata , Sago pondweed	Utricularia minor , Small bladderwort	Utricularia vulgaris , Common bladderwort	Vallisneria americana , Wild celery	Filamentous algae						
650			649	42.783156	-88.566023				SWIM AREA																													
651			650	42.783584	-88.571392	12	S		NO PLANTS																													
652			651	42.783578	-88.570904				DEEP																													
653			652	42.783572	-88.570415				DEEP																													
654			653	42.783566	-88.569926				DEEP																													
655			654	42.783559	-88.569437				DEEP																													
656			655	42.783553	-88.568948				DEEP																													
657			656	42.783547	-88.568459				DEEP																													
658			657	42.783541	-88.56797				DEEP																													
659			658	42.783535	-88.567481				DEEP																													
660			659	42.783529	-88.566993				DEEP																													
661			660	42.783523	-88.566504				DEEP																													
662			661	42.783517	-88.566015				DEEP																													
663			662	42.783938	-88.570895	9	R		NO PLANTS																													
664			663	42.783932	-88.570406				DEEP																													
665			664	42.783926	-88.569918				DEEP																													
666			665	42.78392	-88.569429				DEEP																													
667			666	42.783913	-88.56894				DEEP																													
668			667	42.783907	-88.568451				DEEP																													
669			668	42.783901	-88.567962				DEEP																													
670			669	42.783895	-88.567473				DEEP																													
671			670	42.783889	-88.566984				DEEP																													
672			671	42.783883	-88.566495				DEEP																													
673			672	42.783871	-88.565518				DEEP																													
674			673	42.784298	-88.570887	7	M			1																	1											
675			674	42.784292	-88.570398				DEEP																													
676			675	42.784286	-88.569909				DEEP																													
677			676	42.78428	-88.56942				DEEP																													
678			677	42.784274	-88.568931				DEEP																													
679			678	42.784267	-88.568443				DEEP																													
680			679	42.784261	-88.567954				DEEP																													
681			680	42.784255	-88.567465				DEEP																													
682			681	42.784249	-88.566976				DEEP																													
683			682	42.784243	-88.566487																																	
684			683	42.784237	-88.565998	12.5	R		NO PLANTS																													
685			684	42.784231	-88.565509				SWIM AREA																													
686			685	42.784658	-88.570879				SHALLOW					V							V																	
687			686	42.784652	-88.57039	6	R		NO PLANTS																													
688			687	42.784646	-88.569901	8	M			1									1				V					1			1							
689			688	42.78464	-88.569412	9	M			2																		2			1							
690			689	42.784634	-88.568923				DEEP																													
691			690	42.784628	-88.568434				DEEP																													
692			691	42.784621	-88.567945				DEEP																													
693			692	42.784615	-88.567456				DEEP																													
694			693	42.784609	-88.566968				DEEP																													
695			694	42.784603	-88.566479				DEEP																													
696			695	42.784597	-88.56599	14.5	S		NO PLANTS																													
697			696	42.784591	-88.565501				SWIM AREA																													
698			697	42.784994	-88.568915	7	M			2	2							1					1								1							
699			698	42.784988	-88.568426				DEEP																													
700			699	42.784982	-88.567937				DEEP																													
701			700	42.784975	-88.567448				DEEP																													
702			701	42.784969	-88.566959				DEEP																													
703			702	42.784963	-88.56647				DEEP																													

Table A.1 (Continued)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
1	**Entry**		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum* , Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus* ,Curly-leaf pondweed	*Ceratophyllum demersum* , Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis* , Common waterweed	*Heteranthera dubia* , Water star-grass	*Lemna minor* , Small duckweed	*Najas flexilis* , Slender naiad	*Najas marina* , Spiny naiad	*Nuphar variegata* , Spatterdock	*Nymphaea odorata* , White water lily	*Potamogeton friesii* , Fries' pondweed	*Potamogeton gramineus* , Variable pondweed	*Potamogeton natans* , Floating-leaf pondweed	*Potamogeton praelongus* , White-stem pondweed	*Potamogeton zosteriformis* , Flat-stem pondweed	*Sagittaria cuneata* , Arum-leaved arrowhead	*Stuckenia pectinata* , Sago pondweed	*Utricularia minor* , Small bladderwort	*Utricularia vulgaris* , Common bladderwort	*Vallisneria americana* , Wild celery	Filamentous algae						
704			703	42.784957	-88.565982	3	S		NO PLANTS					V																								
705			704	42.785348	-88.568418	8.5	M			2	1								1				2					1			1							
706			705	42.785342	-88.567929	10	M			1	1								1												1							
707			706	42.785335	-88.56744	11	M			1	1																				1							
708			707	42.785329	-88.566951	9	M			1	1			V					1								V				1							
709			708	42.785323	-88.566462				PIER																													

Table A.2

Summary Statistics for the Green Lake Point-Intercept Aquatic Plant Survey: August 15 – 16, 2019

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1		**STATS**	Total vegetation	*Myriophyllum spicatum*,Eurasian water milfoil	Ceratophyllum demersum, Coontail	Chara sp., Muskgrasses	Elodea canadensis, Common waterweed	Heteranthera dubia, Water star-grass	Lemna minor, Small duckweed	Najas flexilis, Slender naiad	Najas marina, Spiny naiad	Nuphar variegata, Spatterdock	Nymphaea odorata, White water lily	Potamogeton friesii, Fries' pondweed	Potamogeton gramineus, Variable pondweed	Potamogeton natans, Floating-leaf pondweed	Potamogeton praelongus, White-stem pondweed	Potamogeton zosteriformis, Flat-stem pondweed	Sagittaria cuneata, Arum-leaved arrowhead	Stuckenia pectinata, Sago pondweed	Utricularia minor, Small bladderwort	Utricularia vulgaris, Common bladderwort	Vallisneria americana, Wild celery	Filamentous algae		
2	**Lake**	Green																								
3	**County**	Walworth																								
4	**WBIC**	755800																								
5	**Survey Date**	8/15, 8/16/2019																								
6		**INDIVIDUAL SPECIES STATS:**																								
7		**Frequency of occurrence within vegetated areas (%)**		14.29	0.60	60.71	1.79	0.60		8.93	17.86			0.60	4.17		2.98	1.19	17.86	31.55	0.60	4.76	37.50	0.60		
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		8.82	0.37	37.50	1.10	0.37		5.51	11.03			0.37	2.57		1.84	0.74	11.03	19.49	0.37	2.94	23.16	0.37		
9		**Relative Frequency (%)**		6.9	0.3	29.5	0.9	0.3		4.3	8.7			0.3	2.0		1.4	0.6	8.7	15.3	0.3	2.3	18.2			
10		Relative Frequency (squared)	0.17	0.00	0.00	0.09	0.00	0.00		0.00	0.01			0.00	0.00		0.00	0.00	0.01	0.02	0.00	0.00	0.03			
11		**Number of sites where species found**		24	1	102	3	1		15	30			1	7		5	2	30	53	1	8	63	1		
12		**Average Rake Fullness**	1.32	1.08	1.00	1.37	1.00	1.00		1.13	1.00			1.00	1.14		1.00	1.00	1.23	1.06	1.00	1.00	1.02	1.00		
13		**#visual sightings**		2		11			1			3	5		5	1	1		4	2			2			
14		**present (visual or collected)**		present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present		
15																										
16		**SUMMARY STATS:**																								
17		**Total number of sites visited**	**273**																							
18		**Total number of sites with vegetation**	**168**																							
19		**Total number of sites shallower than maximum depth of plants**	**272**																							
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**61.76**																							
21		**Simpson Diversity Index**	**0.83**																							
22		**Maximum depth of plants (ft)****	**13.50**																							
23		**Number of sites sampled using rake on Rope (R)**	**0**																							
24		**Number of sites sampled using rake on Pole (P)**	**0**																							
25		**Average number of all species per site (shallower than max depth)**	**1.28**																							
26		**Average number of all species per site (veg. sites only)**	**2.07**																							
27		**Average number of native species per site (shallower than max depth)**	**1.09**																							
28		**Average number of native species per site (veg. sites only)**	**1.80**																							
29		**Species Richness**	**16**																							
30		**Species Richness (including visuals)**	**20**																							
31																										
32		****SEE "MAX DEPTH GRAPH" WORKSHEET TO CONFIRM**																								

Table A.3

Middle Lake Point-Intercept Aquatic Plant Survey Data: August 19 – 21, 2019

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	Myriophyllum spicatum, Eurasian water-milfoil or Hybrid water-milfoil	Potamogeton crispus, Curly-leaf pondweed	Ceratophyllum demersum, Coontail	Chara sp., Muskgrasses	Elodea canadensis, Common waterweed	Lemna minor, Small duckweed	Myriophyllum verticillatum, Whorled water-milfoil	Najas flexilis, Slender naiad	Najas guadalupensis, Southern naiad	Najas marina, Spiny naiad	Nuphar variegata, Spatterdock	Nymphaea odorata, White water lily	Potamogeton friesii, Fries' pondweed	Potamogeton gramineus, Variable pondweed	Potamogeton natans, Floating-leaf pondweed	Potamogeton zosteriformis, Flat-stem pondweed	Ranunculus aquatilis, White water crowfoot	Sagittaria cuneata, Arum-leaved arrowhead	Schoenoplectus acutus, Hardstem bulrush	Sparganium emersum, Short-stemmed bur-reed	Sparganium natans, Small bur-reed	Stuckenia pectinata, Sago pondweed	Utricularia vulgaris, Common bladderwort	Vallisneria americana, Wild celery	Zizania aquatica, Southern wild rice	Filamentous algae	Nitella tenuissima, Small nitella			
2	Name	Middle	1	42.775882	-88.55975				ON LAND																															
3	County	Walworth	2	42.775561	-88.565014	8	M			1				1						1														1						
4	WBIC	755700	3	42.775554	-88.564488	7	M			1				1										V				1												
5	Date	8/19-21/2019	4	42.775548	-88.563963	4.5	R		NO PLANTS					V																										
6	Field Crew	Zofia Noe	5	42.775528	-88.562386				ON LAND																															
7		Justin Poinsatte	6	42.775521	-88.561861	4.5	S			2				1				1		2								1				1		1						
8			7	42.775515	-88.561335	5	S			1				1														1				1								
9			8	42.775508	-88.56081	5	S			2	1			1														2				1		1						
10			9	42.775501	-88.560285	5	S			2				1				2										1						1						
11			10	42.775495	-88.559759	4.5	S			1				1																				1						
12			11	42.775488	-88.559234	3	S			1				1							1							1												
13			12	42.775187	-88.566074																																			
14			13	42.77518	-88.565548																																			
15			14	42.775154	-88.563446	3	S			1				1																										
16			15	42.775147	-88.562921	6.5	S			1				1						1													1							
17			16	42.775141	-88.562395	6	M			2				1						2												1								
18			17	42.775134	-88.56187	6	S			1										1												1		1						
19			18	42.775128	-88.561344	7	M			1				1						1								1				1								
20			19	42.775121	-88.560819	7.5	M			1				1																										
21			20	42.775114	-88.560294	7	S			2				2																			1							
22			21	42.775108	-88.559768	6	S		NO PLANTS															V																
23			22	42.775101	-88.559243	4	S			1				1				1							V			V												
24			23	42.775095	-88.558717	4	S			1										1						V		V												
25			24	42.774806	-88.566608	7.5	M			1																						1								
26			25	42.7748	-88.566083	7.5	M			1				1																			1							
27			26	42.774773	-88.563981	5	S			2										2																				
28			27	42.774767	-88.563455	6	S			1				1										V																
29			28	42.77476	-88.56293				DEEP																															
30			29	42.774754	-88.562404				DEEP																															
31			30	42.774747	-88.561879				DEEP																															
32			31	42.77474	-88.561353	10	S			1				1						1																				
33			32	42.774734	-88.560828	7.5	S			1				1																										
34			33	42.774727	-88.560302	7.5	S			2				2																										
35			34	42.774721	-88.559777	6.5	S			1				1																										
36			35	42.774714	-88.559252	5.5	S			1				1														1												
37			36	42.774707	-88.558726	4.5	S			1								1		1								1				1								
38			37	42.774701	-88.558201				ON LAND																															
39			38	42.774419	-88.566617	6	M			1				1														1												
40			39	42.774413	-88.566092	5	R		NO PLANTS																			V												
41			40	42.774386	-88.56399	5	M			2				2																										
42			41	42.77438	-88.563464				DEEP																															
43			42	42.774373	-88.562939				DEEP																															
44			43	42.774367	-88.562413				DEEP																															
45			44	42.77436	-88.561888				DEEP																															
46			45	42.774353	-88.561362				DEEP																															
47			46	42.774347	-88.560837				DEEP																															
48			47	42.77434	-88.560311	8.5	S			1				1																										
49			48	42.774334	-88.559786	7	M			1				1				1															1							
50			49	42.774327	-88.559261	6	M			1																						1								
51			50	42.77432	-88.558735	5	S		NO PLANTS															V																
52			51	42.774026	-88.566101	5	M			3				3														V				V								
53			52	42.774006	-88.564524	3	R		NO PLANTS																															
54			53	42.773999	-88.563999	7.5	M			1				1																										
55			54	42.773993	-88.563473				DEEP																															
56			55	42.773986	-88.562948				DEEP																															
57			56	42.773979	-88.562422				DEEP																															
58			57	42.773973	-88.561897				DEEP																															
59			58	42.773966	-88.561371				DEEP																															
60			59	42.77396	-88.560846				DEEP																															
61			60	42.773953	-88.56032				DEEP																															

Table A.3 (Continued)

1	A: Entry	I	J: sampling point	K: Latitude (need electronic copy of site locations)	L: Longitude (need electronic copy of site locations)	M: Depth (ft)	N: Dominant sediment type (M=muck, S=Sand, R=Rock)	O: Sampled holding rake pole (P) or rake rope (R)?	P: comments	Q: Total Rake Fullness
62			61	42.773946	-88.559795	7	M			1
63			62	42.77394	-88.559269	6	M			1
64			63	42.773638	-88.566109	6.5	M			1
65			64	42.773632	-88.565584	5.5	M			2
66			65	42.773625	-88.565059	6.5	M			1
67			66	42.773619	-88.564533	7	M			1
68			67	42.773612	-88.564008				DEEP	
69			68	42.773606	-88.563482				DEEP	
70			69	42.773599	-88.562957				DEEP	
71			70	42.773592	-88.562431				DEEP	
72			71	42.773586	-88.561906				DEEP	
73			72	42.773579	-88.56138				DEEP	
74			73	42.773573	-88.560855				DEEP	
75			74	42.773566	-88.560329				DEEP	
76			75	42.773559	-88.559804	7.5	M			1
77			76	42.773553	-88.559278	5	S			1
78			77	42.773258	-88.566644	5	S		NO PLANTS	
79			78	42.773251	-88.566118	8.5	M			1
80			79	42.773245	-88.565593				DEEP	
81			80	42.773238	-88.565067				DEEP	
82			81	42.773232	-88.564542				DEEP	
83			82	42.773225	-88.564017				DEEP	
84			83	42.773218	-88.563491				DEEP	
85			84	42.773212	-88.562966				DEEP	
86			85	42.773205	-88.56244				DEEP	
87			86	42.773199	-88.561915				DEEP	
88			87	42.773192	-88.561389				DEEP	
89			88	42.773185	-88.560864				DEEP	
90			89	42.773179	-88.560338				DEEP	
91			90	42.773172	-88.559813	6	S			1
92			91	42.772871	-88.566653	5	M			1
93			92	42.772864	-88.566127				DEEP	
94			93	42.772858	-88.565602				DEEP	
95			94	42.772851	-88.565076				DEEP	
96			95	42.772844	-88.564551				DEEP	
97			96	42.772838	-88.564026				DEEP	
98			97	42.772831	-88.5635				DEEP	
99			98	42.772825	-88.562975				DEEP	
100			99	42.772818	-88.562449				DEEP	
101			100	42.772812	-88.561924				DEEP	
102			101	42.772805	-88.561398				DEEP	
103			102	42.772798	-88.560873	9	S		NO PLANTS	
104			103	42.772792	-88.560347	6	S			1
105			104	42.772497	-88.567713	3	S			1
106			105	42.77249	-88.567187	6.5	M			1
107			106	42.772484	-88.566662				DEEP	
108			107	42.772477	-88.566136				DEEP	
109			108	42.772471	-88.565611				DEEP	
110			109	42.772464	-88.565085				DEEP	
111			110	42.772457	-88.56456				DEEP	
112			111	42.772451	-88.564034				DEEP	
113			112	42.772444	-88.563509				DEEP	
114			113	42.772438	-88.562984				DEEP	
115			114	42.772431	-88.562458				DEEP	
116			115	42.772424	-88.561933				DEEP	
117			116	42.772418	-88.561407	7	S			1
118			117	42.772123	-88.568772				ON LAND	
119			118	42.772116	-88.568247	5.5	S		NO PLANTS	
120			119	42.77211	-88.567722	6	S		NO PLANTS	
121			120	42.772103	-88.567196				DEEP	

1	R: *Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	S: *Potamogeton crispus*, Curly-leaf pondweed	T: *Ceratophyllum demersum*, Coontail	U: *Chara* sp., Muskgrasses	V: *Elodea canadensis*, Common waterweed	W: *Lemna minor*, Small duckweed	X: *Myriophyllum verticillatum*, Whorled water-milfoil	Y: *Najas flexilis*, Slender naiad	Z: *Najas guadalupensis*, Southern naiad	AA: *Najas marina*, Spiny naiad	AB: *Nuphar variegata*, Spatterdock	AC: *Nymphaea odorata*, White water lily	AD: *Potamogeton friesii*, Fries' pondweed	AE: *Potamogeton gramineus*, Variable pondweed	AF: *Potamogeton natans*, Floating-leaf pondweed	AG: *Potamogeton zosteriformis*, Flat-stem pondweed	AH: *Ranunculus aquatilis*, White water crowfoot	AI: *Sagittaria cuneata*, Arum-leaved arrowhead	AJ: *Schoenoplectus acutus*, Hardstem bulrush	AK: *Sparganium emersum*, Short-stemmed bur-reed	AL: *Sparganium natans*, Small bur-reed	AM: *Stuckenia pectinata*, Sago pondweed	AN: *Utricularia vulgaris*, Common bladderwort	AO: *Vallisneria americana*, Wild celery	AP: *Zizania aquatica*, Southern wild rice	AQ: Filamentous algae	AR: *Nitella tenuissima*, Small nitella	AS	AT	AU
62				1																										
63								1																1						
64				1																										
65				2																										
66				1						1														1						
67				1																		1								
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76				1																		1		1						
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103																														
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105	V										1																			
106				1				1		1																				
107																														
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114																														
115																														
116																														
117				1				1																						
118																														
119																														
120																														
121																														

Table A.3 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	**Entry**		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Ranunculus aquatilis*, White water crowfoot	*Sagittaria cuneata*, Arum-leaved arrowhead	*Schoenoplectus acutus*, Hardstem bulrush	*Sparganium emersum*, Short-stemmed bur-reed	*Sparganium natans*, Small bur-reed	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	*Zizania aquatica*, Southern wild rice	Filamentous algae	*Nitella tenuissima*, Small nitella			
122			121	42.772097	-88.566671				DEEP																															
123			122	42.77209	-88.566145				DEEP																															
124			123	42.772083	-88.56562				DEEP																															
125			124	42.772077	-88.565094				DEEP																															
126			125	42.77207	-88.564569				DEEP																															
127			126	42.772064	-88.564043				DEEP																															
128			127	42.772057	-88.563518				DEEP																															
129			128	42.77205	-88.562992				DEEP																															
130			129	42.772044	-88.562467	3	S		NO PLANTS																															
131			130	42.772037	-88.561942	6	R		NO PLANTS																											V				
132			131	42.771749	-88.569832				ON LAND																															
133			132	42.771742	-88.569307	4.5	M			3	1			3																										
134			133	42.771736	-88.568781	5	M			1				1																										
135			134	42.771729	-88.568256	6.5	M		NO PLANTS					V										V																
136			135	42.771723	-88.56773				DEEP																															
137			136	42.771716	-88.567205				DEEP																															
138			137	42.771709	-88.56668				DEEP																															
139			138	42.771703	-88.566154				DEEP																															
140			139	42.771696	-88.565629				DEEP																															
141			140	42.77169	-88.565103				DEEP																															
142			141	42.771683	-88.564578	7	S		NO PLANTS																															
143			142	42.771677	-88.564052	7	S		NO PLANTS																															
144			143	42.77167	-88.563527				BOAT																															
145			144	42.771663	-88.563001	7	S		NO PLANTS																															
146			145	42.771657	-88.562476	6	S			1																						1								
147			146	42.771362	-88.569841	5	M			1				1																										
148			147	42.771355	-88.569316	5	M			2				2																		1								
149			148	42.771349	-88.56879				DEEP																															
150			149	42.771342	-88.568265				DEEP																															
151			150	42.771335	-88.567739				DEEP																															
152			151	42.771329	-88.567214				DEEP																															
153			152	42.771322	-88.566688				DEEP																															
154			153	42.771316	-88.566163				DEEP																															
155			154	42.771309	-88.565638				DEEP																															
156			155	42.771303	-88.565112	8.5	S		NO PLANTS																															
157			156	42.771296	-88.564587	6	S			1																						1		V						
158			157	42.771289	-88.564061	5	R		NO PLANTS																															
159			158	42.771283	-88.563536	7	S		NO PLANTS															1																
160			159	42.771276	-88.56301	7	S		NO PLANTS																															
161			160	42.77127	-88.562485	4	S			3				3			V											V						1						
162			161	42.770981	-88.570376	4.5	M			3							V	3																						
163			162	42.770975	-88.56985	8	M			1																								1						
164			163	42.770968	-88.569325	8	R		NO PLANTS																															
165			164	42.770962	-88.568799				DEEP																															
166			165	42.770955	-88.568274				DEEP																															
167			166	42.770948	-88.567748				DEEP																															
168			167	42.770942	-88.567223				DEEP																															
169			168	42.770935	-88.566697				DEEP																															
170			169	42.770929	-88.566172				DEEP																															
171			170	42.770922	-88.565647				DEEP																															
172			171	42.770915	-88.565121	6	M			1				1						1																				
173			172	42.770909	-88.564596				ON LAND																															
174			173	42.770902	-88.56407	3	S		NO PLANTS												V				V															
175			174	42.770896	-88.563545	5	R		NO PLANTS																															
176			175	42.770889	-88.563019	6	S		NO PLANTS																															
177			176	42.770883	-88.562494	4	S			3				3						V																				
178			177	42.770601	-88.57091	4.5	S		NO PLANTS					V										V																
179			178	42.770594	-88.570384	8	S		NO PLANTS																															
180			179	42.770588	-88.569859				DEEP																															
181			180	42.770581	-88.569334				DEEP																															

Table A.3 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	Myriophyllum spicatum, Eurasian water-milfoil or Hybrid water-milfoil	Potamogeton crispus, Curly-leaf pondweed	Ceratophyllum demersum, Coontail	Chara sp., Muskgrasses	Elodea canadensis, Common waterweed	Lemna minor, Small duckweed	Myriophyllum verticillatum, Whorled water-milfoil	Najas flexilis, Slender naiad	Najas guadalupensis, Southern naiad	Najas marina, Spiny naiad	Nuphar variegata, Spatterdock	Nymphaea odorata, White water lily	Potamogeton friesii, Fries' pondweed	Potamogeton gramineus, Variable pondweed	Potamogeton natans, Floating-leaf pondweed	Potamogeton zosteriformis, Flat-stem pondweed	Ranunculus aquatilis, White water crowfoot	Sagittaria cuneata, Arum-leaved arrowhead	Schoenoplectus acutus, Hardstem bulrush	Sparganium emersum, Short-stemmed bur-reed	Sparganium natans, Small bur-reed	Stuckenia pectinata, Sago pondweed	Utricularia vulgaris, Common bladderwort	Vallisneria americana, Wild celery	Zizania aquatica, Southern wild rice	Filamentous algae	Nitella tenuissima, Small nitella			
182			181	42.770574	-88.568808				DEEP																															
183			182	42.770568	-88.568283				DEEP																															
184			183	42.770561	-88.567757				DEEP																															
185			184	42.770555	-88.567232				DEEP																															
186			185	42.770548	-88.566706				DEEP																															
187			186	42.770542	-88.566181				DEEP																															
188			187	42.770535	-88.565655				DEEP																															
189			188	42.770528	-88.56513				SHALLOW																															
190			189	42.770522	-88.564605				SHALLOW																															
191			190	42.770515	-88.564079	3	S			2										1	2																			
192			191	42.770509	-88.563554	6	S		NO PLANTS																															
193			192	42.770502	-88.563028	7	S		NO PLANTS					V																										
194			193	42.770495	-88.562503	4	s			1				1																										
195			194	42.770489	-88.561977	5	S			2				2						1			1					V						V						
196			195	42.770482	-88.561452	5	S			2	1			1														2						1						
197			196	42.770476	-88.560927	4	S		NO PLANTS																															
198			197	42.770469	-88.560401	2	S		NO PLANTS		V			V														V				V								
199			198	42.770272	-88.575648	3.5	M			2	1				2					1				1		V								1						
200			199	42.770266	-88.575122	2.5	M		NO PLANTS		V			V			V											V												
201			200	42.77024	-88.57302	4	M			3				3			1	1		1						V		2						1						
202			201	42.770233	-88.572495	4	M			1										1				1				1												
203			202	42.770227	-88.57197	7	M			2				1			2		V															1						
204			203	42.77022	-88.571444	11	M			1										1																				
205			204	42.770214	-88.570919				DEEP																															
206			205	42.770207	-88.570393				DEEP																															
207			206	42.7702	-88.569868				DEEP																															
208			207	42.770194	-88.569342				DEEP																															
209			208	42.770187	-88.568817				DEEP																															
210			209	42.770181	-88.568292				DEEP																															
211			210	42.770174	-88.567766				DEEP																															
212			211	42.770168	-88.567241				DEEP																															
213			212	42.770161	-88.566715				DEEP																															
214			213	42.770154	-88.56619				DEEP																															
215			214	42.770148	-88.565664	7	S		NO PLANTS																															
216			215	42.770141	-88.565139				ON LAND																															
217			216	42.770128	-88.564088				SHALLOW																															
218			217	42.770122	-88.563563	6	S			2							2	1										1												
219			218	42.770115	-88.563037	7	S		NO PLANTS																															
220			219	42.770108	-88.562512	6	S			1				1																										
221			220	42.770102	-88.561986	4.5	M			1				1																		1								
222			221	42.770095	-88.561461	5	S			2	1			2			1			1												1		1						
223			222	42.770089	-88.560936	5	S			2				2														V						1						
224			223	42.770082	-88.56041	4	S			2	V																	2				V		1						
225			224	42.770075	-88.559885	3.5	S			2	1	2																						V						
226			225	42.769885	-88.575657	4	M		NO PLANTS																															
227			226	42.769879	-88.575131	5	M			1																								1						
228			227	42.769872	-88.574606	4.5	M			2				2				1																						
229			228	42.769866	-88.57408	5	M			2				1			1	1						1				V												
230			229	42.769859	-88.573555	4	M			1				1																										
231			230	42.769853	-88.573029	7	M			1																								1						
232			231	42.769846	-88.572504	7	M			1																		1												
233			232	42.76984	-88.571979	7	M			2	1							1						1				2				1								
234			233	42.769833	-88.571453				DEEP																															
235			234	42.769826	-88.570928				DEEP																															
236			235	42.76982	-88.570402				DEEP																															
237			236	42.769813	-88.569877				DEEP																															
238			237	42.769807	-88.569351				DEEP																															
239			238	42.7698	-88.568826				DEEP																															
240			239	42.769794	-88.568301				DEEP																															
241			240	42.769787	-88.567775				DEEP																															

Table A.3 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Ranunculus aquatilis*, White water crowfoot	*Sagittaria cuneata*, Arum-leaved arrowhead	*Schoenoplectus acutus*, Hardstem bulrush	*Sparganium emersum*, Short-stemmed bur-reed	*Sparganium natans*, Small bur-reed	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	*Zizania aquatica*, Southern wild rice	Filamentous algae	*Nitella tenuissima*, Small nitella			
242			241	42.76978	-88.56725				DEEP																															
243			242	42.769774	-88.566724				DEEP																															
244			243	42.769767	-88.566199	8	S		NO PLANTS																															
245			244	42.769734	-88.563572				TEMPORARY OBSTACLE																															
246			245	42.769728	-88.563046				TEMPORARY OBSTACLE																															
247			246	42.769721	-88.562521	7	S			1				1																										
248			247	42.769715	-88.561995	5	S			1	1						1																	1						
249			248	42.769708	-88.56147	4	S			2				2			V											V												
250			249	42.769701	-88.560944	4	M			2				1														1						2						
251			250	42.769505	-88.576191	3	M			2				2				1										1						1						
252			251	42.769498	-88.575665	5	M		NO PLANTS																															
253			252	42.769492	-88.57514	6	M		NO PLANTS																															
254			253	42.769485	-88.574615	6	M		NO PLANTS																			V												
255			254	42.769479	-88.574089	6	M		NO PLANTS																															
256			255	42.769472	-88.573564	6	M		NO PLANTS																															
257			256	42.769466	-88.573038	7	M			1										1				1				1												
258			257	42.769459	-88.572513	8	M			2	1			1														2												
259			258	42.769452	-88.571987	10	M			1																								1						
260			259	42.769446	-88.571462				DEEP																															
261			260	42.769439	-88.570937				DEEP																															
262			261	42.769433	-88.570411				DEEP																															
263			262	42.769426	-88.569886				DEEP																															
264			263	42.76942	-88.56936				DEEP																															
265			264	42.769413	-88.568835				DEEP																															
266			265	42.769407	-88.568309				DEEP																															
267			266	42.7694	-88.567784				DEEP																															
268			267	42.769393	-88.567259				DEEP																															
269			268	42.769387	-88.566733	8	S		NO PLANTS																															
270			269	42.76938	-88.566208	3	R		NO PLANTS																															
271			270	42.769354	-88.564106	3.5	S			2	V							V			V											V	V							
272			271	42.769347	-88.563581	5	S			3				3																			1							
273			272	42.769341	-88.563055	7	S			1				1																										
274			273	42.769334	-88.56253	7	S			1				1														1												
275			274	42.769327	-88.562004	6	S			1	1			1						1								V												
276			275	42.769321	-88.561479	4	R			1				1											V			V												
277			276	42.769118	-88.5762	4	M			3				3				1										V												
278			277	42.769111	-88.575674	6	M		NO PLANTS																															
279			278	42.769105	-88.575149	6	M			1				1																							1			
280			279	42.769098	-88.574623	6.5	M		NO PLANTS																															
281			280	42.769092	-88.574098	6	M		NO PLANTS																															
282			281	42.769085	-88.573573	8	M		NO PLANTS																															
283			282	42.769078	-88.573047	7.5	M		NO PLANTS																															
284			283	42.769072	-88.572522	8.5	M			1				1																		1		1						
285			284	42.769065	-88.571996	13	M			1	1																													
286			285	42.769059	-88.571471				DEEP																															
287			286	42.769052	-88.570945				DEEP																															
288			287	42.769046	-88.57042				DEEP																															
289			288	42.769039	-88.569895				DEEP																															
290			289	42.769033	-88.569369				DEEP																															
291			290	42.769026	-88.568844				DEEP																															
292			291	42.769019	-88.568318				DEEP																															
293			292	42.769013	-88.567793				DEEP																															
294			293	42.769006	-88.567267	7.5	S			1																								1		1				
295			294	42.768993	-88.566217				SHALLOW																															
296			295	42.76898	-88.565166	3.5	M			3	V			3								V											V							
297			296	42.768973	-88.56464	3.5	S			1	1						V											1						1						
298			297	42.768967	-88.564115	3	S			1				1						V								1						1						
299			298	42.76896	-88.56359	5	S			3				3																										
300			299	42.768954	-88.563064	7.5	S		NO PLANTS																															
301			300	42.768947	-88.562539	6	S			1																								1						

Table A.3 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Ranunculus aquatilis*, White water crowfoot	*Sagittaria cuneata*, Arum-leaved arrowhead	*Schoenoplectus acutus*, Hardstem bulrush	*Sparganium emersum*, Short-stemmed bur-reed	*Sparganium natans*, Small bur-reed	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	*Zizania aquatica*, Southern wild rice	Filamentous algae	*Nitella tenuissima*, Small nitella			
302			301	42.76894	-88.562013	6	S		NO PLANTS																															
303			302	42.768744	-88.577259	4	M			3				3				V		1	V													V						
304			303	42.768737	-88.576734	4	M			1				1																										
305			304	42.768731	-88.576209	6	M		NO PLANTS																															
306			305	42.768724	-88.575683	6	M		NO PLANTS																															
307			306	42.768717	-88.575158	6	M		NO PLANTS																															
308			307	42.768711	-88.574632	7	M		NO PLANTS																															
309			308	42.768704	-88.574107	5	M			3				3			V																							
310			309	42.768698	-88.573581	3	S		NO PLANTS																										V					
311			310	42.768691	-88.573056				ON LAND																															
312			311	42.768665	-88.570954	8	S			1				1																										
313			312	42.768659	-88.570429	10.5	S		NO PLANTS																															
314			313	42.768652	-88.569904	9.5	S		NO PLANTS																															
315			314	42.768645	-88.569378	9	S		NO PLANTS																															
316			315	42.768639	-88.568853	8.5	S		NO PLANTS																															
317			316	42.768632	-88.568327				TEMPORARY OBSTACLE																															
318			317	42.768606	-88.566226	3	S			2	V			1				1										1					1	2						
319			318	42.768389	-88.579895	3	M			2				2							V									V			1							
320			319	42.768383	-88.57937	3.5	M			1										1		V																		
321			320	42.768376	-88.578845	4	M			2				2				1																						
322			321	42.76837	-88.578319	4	M			2				1				1		2																				
323			322	42.768363	-88.577794	6	M			1										1																				
324			323	42.768357	-88.577268	6	M		NO PLANTS																															
325			324	42.76835	-88.576743	6	M		NO PLANTS																															
326			325	42.768343	-88.576217	7	M			1																		1												
327			326	42.768337	-88.575692	4.5	M			1				1																										
328			327	42.76833	-88.575167	4	M			3				3			V			1																				
329			328	42.768324	-88.574641	3	M			3				3			V			2	V														V					
330			329	42.768317	-88.574116	3.5	M			2				2			V			1		V		1											V					
331			330	42.768212	-88.565709	2	M			1			1			V						V																		
332			331	42.768206	-88.565184	5	M			2			1							1																V				
333			332	42.768199	-88.564658	3	M			2	V		1	2								V																		
334			333	42.768035	-88.582531	3	M			1	1			1						1		1																		
335			334	42.768028	-88.582006	3.5	M			1	V			1																										
336			335	42.768022	-88.581481	4.5	M			3	V									3																				
337			336	42.768015	-88.580955	4.5	M			2				1						2																				
338			337	42.768009	-88.58043	4.5	M			2		1		1						2												1								
339			338	42.768002	-88.579904	5	M			1				1				1						v										1						
340			339	42.767995	-88.579379	5.5	M			1				1																										
341			340	42.767989	-88.578853	5	M			1	1																							1						
342			341	42.767982	-88.578328	7	M		NO PLANTS																															
343			342	42.767976	-88.577803	6	M		NO PLANTS																															
344			343	42.767969	-88.577277	5	M			1										1																				
345			344	42.767963	-88.576752	3.5	M			1				1						V	V								V											
346			345	42.767956	-88.576226	3	M			2				2			V			V	1								V											
347			346	42.76795	-88.575701				BULRUSHES																															
348			347	42.767943	-88.575175				BULRUSHES																															
349			348	42.767654	-88.583066				BULRUSHES																															
350			349	42.767647	-88.58254	4	M			1										1																				
351			350	42.767641	-88.582015	5	M			1										1																				
352			351	42.767634	-88.581489	4	M			3										3													1							
353			352	42.767628	-88.580964	5	M			1																						1		1						
354			353	42.767621	-88.580439	5	M			1																								1						
355			354	42.767615	-88.579913	5	M			1				V						1														V						
356			355	42.767608	-88.579388	5	M			1	1			1														1				1								
357			356	42.767602	-88.578862	6	M		NO PLANTS																															
358			357	42.767595	-88.578337	6	M		NO PLANTS																															
359			358	42.767589	-88.577811	5	M			3				1						3									V											
360			359	42.767582	-88.577286																																			
361			360	42.767576	-88.576761																																			

Table A.3 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Ranunculus aquatilis*, White water crowfoot	*Sagittaria cuneata*, Arum-leaved arrowhead	*Schoenoplectus acutus*, Hardstem bulrush	*Sparganium emersum*, Short-stemmed bur-reed	*Sparganium natans*, Small bur-reed	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	*Zizania aquatica*, Southern wild rice	Filamentous algae	*Nitella tenuissima*, Small nitella			
362			361	42.767569	-88.576235																																			
363			362	42.767563	-88.57571																																			
364			363	42.767273	-88.5836																																			
365			364	42.767267	-88.583074	3	M			1				1						1		V																		
366			365	42.76726	-88.582549	5	M			1				1						1												1								
367			366	42.767254	-88.582024	5	M			2	1			2			1			1				1				1												
368			367	42.767247	-88.581498	4.5	M			2				1			2			2												1		1						
369			368	42.767241	-88.580973	4	M			3							3			1												1		2						
370			369	42.767234	-88.580447	4.5	M		NO PLANTS																															
371			370	42.767228	-88.579922	4	M			2										1								2												
372			371	42.767221	-88.579397	4.5	M			2				1						2									V				1							
373			372	42.767215	-88.578871	4.5	M			1							V			1	1							1	V				1							
374			373	42.767208	-88.578346	4.5	M			1				1			V			1									V											
375			374	42.767202	-88.57782	5	M			2				2			V			1									V				1							
376			375	42.767195	-88.577295				BULRUSHES																															
377			376	42.767189	-88.576769				BULRUSHES																															
378			377	42.767182	-88.576244				BULRUSHES																															
379			378	42.767176	-88.575719	3.5	M			1				1										V									V							
380			379	42.766925	-88.586761				BULRUSHES																															
381			380	42.766919	-88.586236				BULRUSHES																															
382			381	42.766893	-88.584134				BULRUSHES																															
383			382	42.766886	-88.583609				BULRUSHES																															
384			383	42.76688	-88.583083				BULRUSHES																															
385			384	42.766873	-88.582558	6	M			2				1			2											1												
386			385	42.766867	-88.582032	5	M			1				1			1			1																				
387			386	42.76686	-88.581507	4.5	M			3				1						3	V								V											
388			387	42.766854	-88.580982				BULRUSHES																															
389			388	42.766847	-88.580456				BULRUSHES																															
390			389	42.766841	-88.579931				BULRUSHES																															
391			390	42.766834	-88.579405				BULRUSHES																															
392			391	42.766828	-88.57888				BULRUSHES																															
393			392	42.766821	-88.578355				BULRUSHES																															
394			393	42.766815	-88.577829				BULRUSHES																															
395			394	42.766808	-88.577304				BULRUSHES																															
396			395	42.766802	-88.576778				BULRUSHES																															
397			396	42.766795	-88.576253				BULRUSHES																															
398			397	42.766788	-88.575728				BULRUSHES																															
399			398	42.766551	-88.587821				BULRUSHES																															
400			399	42.766545	-88.587295				BULRUSHES																															
401			400	42.766538	-88.58677				BULRUSHES																															
402			401	42.766532	-88.586245				BULRUSHES																															
403			402	42.766512	-88.584668				BULRUSHES																															
404			403	42.766506	-88.584143				BULRUSHES																															
405			404	42.766499	-88.583617				BULRUSHES																															
406			405	42.766493	-88.583092				BULRUSHES																															
407			406	42.766486	-88.582567	5.5	M			3				3														1												
408			407	42.76648	-88.582041				BULRUSHES																															
409			408	42.766473	-88.581516				BULRUSHES																															
410			409	42.766467	-88.58099				BULRUSHES																															
411			410	42.76646	-88.580465				BULRUSHES																															
412			411	42.766454	-88.57994				BULRUSHES																															
413			412	42.766447	-88.579414				BULRUSHES																															
414			413	42.766441	-88.578889				BULRUSHES																															
415			414	42.766434	-88.578363				BULRUSHES																															
416			415	42.766427	-88.577838				BULRUSHES																															
417			416	42.766421	-88.577313				BULRUSHES																															
418			417	42.766414	-88.576787	3.5	M			1	1			1																			1		V					
419			418	42.766164	-88.58783				BULRUSHES																															
420			419	42.766157	-88.587304				BULRUSHES																															
421			420	42.766151	-88.586779				BULRUSHES																															

Table A.3 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Ranunculus aquatilis*, White water crowfoot	*Sagittaria cuneata*, Arum-leaved arrowhead	*Schoenoplectus acutus*, Hardstem bulrush	*Sparganium emersum*, Short-stemmed bur-reed	*Sparganium natans*, Small bur-reed	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	*Zizania aquatica*, Southern wild rice	Filamentous algae	*Nitella tenuissima*, Small nitella			
422			421	42.766138	-88.585728				BULRUSHES																															
423			422	42.766131	-88.585202				BULRUSHES																															
424			423	42.766125	-88.584677				BULRUSHES																															
425			424	42.766118	-88.584152				BULRUSHES																															
426			425	42.766112	-88.583626				BULRUSHES																															
427			426	42.766105	-88.583101	5	M			1				1																		1	1							
428			427	42.766099	-88.582575				BULRUSHES																															
429			428	42.766092	-88.58205	5.5	M			3				3						1																				
430			429	42.766086	-88.581525	4.5	M			3				3																		1								
431			430	42.766079	-88.580999				BULRUSHES																															
432			431	42.766073	-88.580474				BULRUSHES																															
433			432	42.766066	-88.579948				BULRUSHES																															
434			433	42.76606	-88.579423				BULRUSHES																															
435			434	42.766053	-88.578898				BULRUSHES																															
436			435	42.766047	-88.578372				BULRUSHES																															
437			436	42.76604	-88.577847				BULRUSHES																															
438			437	42.766034	-88.577321	5	M			1				1						1													1		V					
439			438	42.765751	-88.585737				BULRUSHES																															
440			439	42.765744	-88.585211				BULRUSHES																															
441			440	42.765738	-88.584686				BULRUSHES																															
442			441	42.765731	-88.584161				BULRUSHES																															
443			442	42.765725	-88.583635	5	M			2				2																				1						
444			443	42.765718	-88.58311	4	M			3				3																										
445			444	42.765712	-88.582584	4	M			3				3								V							V											
446			445	42.765705	-88.582059				BULRUSHES																															
447			446	42.765699	-88.581534	5	M			3				3															V											
448			447	42.765692	-88.581008				BULRUSHES																															
449			448	42.765686	-88.580483				BULRUSHES																															
450			449	42.765679	-88.579957				BULRUSHES																															
451			450	42.765673	-88.579432				BULRUSHES																															
452			451	42.765666	-88.578907				BULRUSHES																															
453			452	42.76566	-88.578381				BULRUSHES																															
454			453	42.765653	-88.577856	4	M			1												V		1							1	1								
455			454	42.765357	-88.58522				BULRUSHES																															
456			455	42.765351	-88.584695				BULRUSHES																															
457			456	42.765344	-88.584169	3	M			3				3						1	V	V																		
458			457	42.765338	-88.583644				BULRUSHES																															
459			458	42.765331	-88.583119				BULRUSHES																															
460			459	42.765325	-88.582593				BULRUSHES																															
461			460	42.765318	-88.582068				BULRUSHES																															
462			461	42.765312	-88.581542				BULRUSHES																															
463			462	42.765305	-88.581017	4.5	M			1				1							V													1						
464			463	42.765299	-88.580492				BULRUSHES																															
465			464	42.765292	-88.579966				BULRUSHES																															
466			465	42.765286	-88.579441				BULRUSHES																															
467			466	42.765279	-88.578915				BULRUSHES																															
468			467	42.765273	-88.57839				BULRUSHES																															
469			468	42.765266	-88.577865				BULRUSHES																															
470			469	42.764983	-88.58628				BULRUSHES																															
471			470	42.76497	-88.585229	4	M			1				1			V																							
472			471	42.764964	-88.584704	2	M			3				3								V																		
473			472	42.764957	-88.584178				BULRUSHES																															
474			473	42.764951	-88.583653				BULRUSHES																															
475			474	42.764944	-88.583127				BULRUSHES																															
476			475	42.764938	-88.582602				BULRUSHES																															
477			476	42.764931	-88.582077				BULRUSHES																															
478			477	42.764925	-88.581551				BULRUSHES																															
479			478	42.764918	-88.581026	4.5	M			2				2						1		V							V		1	V								
480			479	42.764912	-88.5805				BULRUSHES																															
481			480	42.764905	-88.579975				BULRUSHES																															

Table A.3 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Ranunculus aquatilis*, White water crowfoot	*Sagittaria cuneata*, Arum-leaved arrowhead	*Schoenoplectus acutus*, Hardstem bulrush	*Sparganium emersum*, Short-stemmed bur-reed	*Sparganium natans*, Small bur-reed	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	*Zizania aquatica*, Southern wild rice	Filamentous algae	*Nitella tenuissima*, Small nitella			
482			481	42.764899	-88.57945				BULRUSHES																															
483			482	42.764892	-88.578924				BULRUSHES																															
484			483	42.764886	-88.578399				BULRUSHES																															
485			484	42.764609	-88.587339				BULRUSHES																															
486			485	42.764602	-88.586814				BULRUSHES																															
487			486	42.764596	-88.586289				BULRUSHES																															
488			487	42.764589	-88.585763	4	M			3				3							V																			
489			488	42.764583	-88.585238	3.5	M			3				3																										
490			489	42.764544	-88.582085				BULRUSHES																															
491			490	42.764537	-88.58156				BULRUSHES																															
492			491	42.764531	-88.581035				BULRUSHES																															
493			492	42.764524	-88.580509				BULRUSHES																															
494			493	42.764518	-88.579984				BULRUSHES																															
495			494	42.764511	-88.579458				BULRUSHES																															
496			495	42.764505	-88.578933				TYPHA																															
497			496	42.764222	-88.587348				BULRUSHES																															
498			497	42.764215	-88.586823				BULRUSHES																															
499			498	42.764209	-88.586297	4	M			2				2			V				V											V								
500			499	42.764202	-88.585772				BULRUSHES																															
501			500	42.76415	-88.581569				BULRUSHES																															
502			501	42.764144	-88.581043				BULRUSHES																															
503			502	42.764137	-88.580518	4	M			3				3							V								V			V	1	1						
504			503	42.764131	-88.579993	4	M			3				3							V								V			1								
505			504	42.764124	-88.579467	6	M			3	3										1											1								
506			505	42.764118	-88.578942	4.5	M		NO PLANTS												V	V																		
507			506	42.763848	-88.588408				BULRUSHES																															
508			507	42.763841	-88.587882				BULRUSHES																															
509			508	42.763835	-88.587357	4	M			1				1																										
510			509	42.763828	-88.586832	4	M			3				3																										
511			510	42.763776	-88.582628				TYPHA																															
512			511	42.76377	-88.582103	4	M			1	V														V						1									
513			512	42.763763	-88.581578	4	M			2												V			1				V		2									
514			513	42.763757	-88.581052				BULRUSHES																															
515			514	42.76375	-88.580527	4.5	M			2				2			V				V																			
516			515	42.763744	-88.580002	4	M			1				1																										
517			516	42.763737	-88.579476	6	M			3				3																										
518			517	42.763731	-88.578951	5.5	M			3	V			3																										
519			518	42.763724	-88.578425	4	S		NO PLANTS												V																			
520			519	42.76348	-88.589993				TYPHA																															
521			520	42.763474	-88.589467				TYPHA																															
522			521	42.763467	-88.588942				TYPHA																															
523			522	42.763461	-88.588416	4	M			2				2							V							1												
524			523	42.763454	-88.587891	4.5	M			3				3			V											1												
525			524	42.763402	-88.583688				TYPHA																															
526			525	42.76337	-88.581061	4	M			1				1																										
527			526	42.763363	-88.580536	3	M		BOG MATERIAL	2				2			V					2																		
528			527	42.763357	-88.58001				BULRUSHES																															
529			528	42.76335	-88.579485				BULRUSHES																															
530			529	42.763344	-88.57896	5	M			3				3																	V									
531			530	42.763337	-88.578434	5	M			3				3							V																			
532			531	42.763086	-88.589476	6	M			1				1																						1				
533			532	42.76308	-88.588951	5.5	M			3				3																		V				1				
534			533	42.762989	-88.581595	4	M		NO PLANTS								V											V			V									
535			534	42.762983	-88.58107				BULRUSHES																															
536			535	42.762976	-88.580545				BULRUSHES																															
537			536	42.762969	-88.580019				BULRUSHES																															
538			537	42.762963	-88.579494	6	M			3				3																										
539			538	42.762956	-88.578968	3.5	S			1				1								V														1				
540			539	42.762699	-88.589485				BULRUSHES																															
541			540	42.762608	-88.58213	4.5	M			1							V				V										1									

Table A.3 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton friesii*, Fries' pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Ranunculus aquatilis*, White water crowfoot	*Sagittaria cuneata*, Arum-leaved arrowhead	*Schoenoplectus acutus*, Hardstem bulrush	*Sparganium emersum*, Short-stemmed bur-reed	*Sparganium natans*, Small bur-reed	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	*Zizania aquatica*, Southern wild rice	Filamentous algae	*Nitella tenuissima*, Small nitella			
542			541	42.762602	-88.581604				SHALLOW																															
543			542	42.762595	-88.581079				SHALLOW																															
544			543	42.762589	-88.580553				SHALLOW																															
545			544	42.762582	-88.580028				SHALLOW																															
546			545	42.762576	-88.579503	6	M			3				3																										
547			546	42.762319	-88.590019	4	M			1																								1		1				
548			547	42.762312	-88.589494	4	M			1				1																						1				
549			548	42.762234	-88.583189	4	M			1				1							V	V									1									
550			549	42.762228	-88.582664				SHALLOW																															
551			550	42.762221	-88.582138				SHALLOW																															
552			551	42.762215	-88.581613				SHALLOW																															
553			552	42.762208	-88.581088				SHALLOW																															
554			553	42.762202	-88.580562				SHALLOW																															
555			554	42.762195	-88.580037				SHALLOW																															
556			555	42.762189	-88.579512	5.5	M			3				3																										
557			556	42.762182	-88.578986	4	M			1				1														V												
558			557	42.761938	-88.590553	2.5	M		NO PLANTS						V	V																				V				
559			558	42.76186	-88.584249	4	m			1				1							V	V																		
560			559	42.761854	-88.583723				SHALLOW																															
561			560	42.761847	-88.583198				SHALLOW																															
562			561	42.761841	-88.582673				SHALLOW																															
563			562	42.761834	-88.582147				SHALLOW																															
564			563	42.761828	-88.581622				SHALLOW																															
565			564	42.761821	-88.581096				SHALLOW																															
566			565	42.761815	-88.580571				SHALLOW																															
567			566	42.761808	-88.580046				SHALLOW																															
568			567	42.761802	-88.57952	5.5	M			3				3																										
569			568	42.76148	-88.584783	4	M			1	1			V														V												
570			569	42.761473	-88.584257				SHALLOW																															
571			570	42.761467	-88.583732				SHALLOW																															
572			571	42.76146	-88.583207				SHALLOW																															
573			572	42.761454	-88.582681				SHALLOW																															
574			573	42.761447	-88.582156				SHALLOW																															
575			574	42.761441	-88.581631				SHALLOW																															
576			575	42.761434	-88.581105				SHALLOW																															
577			576	42.761428	-88.58058	7	M			3				3																										
578			577	42.761421	-88.580055	7	M			3				3																										
579			578	42.76117	-88.591096																																			
580			579	42.761099	-88.585317	4	M			1	V														1			V												
581			580	42.761092	-88.584792				SHALLOW																															
582			581	42.761086	-88.584266				SHALLOW																															
583			582	42.761079	-88.583741				SHALLOW																															
584			583	42.761073	-88.583216				SHALLOW																															
585			584	42.761066	-88.58269				SHALLOW																															
586			585	42.76106	-88.582165				SHALLOW																															
587			586	42.761053	-88.58164				SHALLOW																															
588			587	42.761047	-88.581114	5.5	M			3				3																										
589			588	42.76079	-88.59163				SHALLOW																															
590			589	42.760705	-88.5848				SHALLOW																															
591			590	42.760699	-88.584275				SHALLOW																															
592			591	42.760692	-88.58375				SHALLOW																															
593			592	42.760686	-88.583224				SHALLOW																															
594			593	42.760679	-88.582699	3	M		MARL NEARBY	3				3																										
595			594	42.760673	-88.582174				SHALLOW																															
596			595	42.760666	-88.581648	6	M			3				3																										
597			596	42.760409	-88.592164				SHALLOW																															
598			597	42.760312	-88.584284	4	M			1	1			1							V										V	1								
599			598	42.760305	-88.583759	4	M			1				1																		1				1				
600			599	42.760299	-88.583233	6	M			2					V																	2				2				
601			600	42.760292	-88.582708	6	M			3				3	1		V										V													

Table A.4
Summary Statistics for the Middle Lake Point-Intercept Aquatic Plant Survey: August 19 – 21, 2019

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1		**STATS**	Total vegetation	*Myriophyllum spicatum* ,Eurasian water milfoil	*Potamogeton crispus* ,Curly-leaf pondweed	Ceratophyllum demersum, Coontail	Chara sp., Muskgrasses	Elodea canadensis, Common waterweed	Lemna minor, Small duckweed	Myriophyllum verticillatum, Whorled water-milfoil	Najas flexilis, Slender naiad	Najas guadalupensis, Southern naiad	Najas marina, Spiny naiad	Nuphar variegata, Spatterdock	Nymphaea odorata, White water lily	Potamogeton friesii, Fries' pondweed	Potamogeton gramineus, Variable pondweed	Potamogeton natans, Floating-leaf pondweed	Potamogeton zosteriformis, Flat-stem pondweed	Ranunculus aquatilis, White water crowfoot	Sagittaria cuneata, Arum-leaved arrowhead	Schoenoplectus acutus, Hardstem bulrush	Sparganium emersum, Short-stemmed bur-reed	Sparganium natans, Small bur-reed	Stuckenia pectinata, Sago pondweed	Utricularia vulgaris, Common bladderwort	Vallisneria americana, Wild celery	Zizania aquatica, Southern wild rice	Filamentous algae	Nitella tenuissima, Small nitella			
2	**Lake**	Middle																															
3	**County**	Walworth																															
4	**WBIC**	755700																															
5	**Survey Date**	8/19-21/2019																															
6		**INDIVIDUAL SPECIES STATS:**																															
7		**Frequency of occurrence within vegetated areas (%)**		9.17	0.92	1.38	72.02	0.92		5.05	10.09		25.69	2.75	0.92	0.46	4.13	0.92			16.06			2.75	15.14	6.88	19.72		3.67	0.46			
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		6.99	0.70	1.05	54.90	0.70		3.85	7.69		19.58	2.10	0.70	0.35	3.15	0.70			12.24			2.10	11.54	5.24	15.03		2.80	0.35			
9		**Relative Frequency (%)**		4.7	0.5	0.7	36.9	0.5		2.6	5.2		13.1	1.4	0.5	0.2	2.1	0.5			8.2			1.4	7.7	3.5	10.1			0.2			
10		Relative Frequency (squared)	0.18	0.00	0.00	0.00	0.14	0.00		0.00	0.00		0.02	0.00	0.00	0.00	0.00	0.00			0.01			0.00	0.01	0.00	0.01			0.00			
11		**Number of sites where species found**		20	2	3	157	2		11	22		56	6	2	1	9	2			35			6	33	15	43		8	1			
12		**Average Rake Fullness**	1.69	1.10	1.50	1.00	1.69	1.50		1.55	1.14		1.30	1.17	1.50	1.00	1.00	1.00			1.20			1.17	1.03	1.00	1.07		1.13	1.00			
13		**#visual sightings**		13			10	2	2	21	2	1	5	22	16		9	4	3	1	19	14	1	3	8	3	5	5	3				
14		**present (visual or collected)**		present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present			
15																																	
16		**SUMMARY STATS:**																															
17		**Total number of sites visited**	**286**																														
18		**Total number of sites with vegetation**	**218**																														
19		**Total number of sites shallower than maximum depth of plants**	**286**																														
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**76.22**																														
21		**Simpson Diversity Index**	**0.82**																														
22		**Maximum depth of plants (ft)****	**13.00**																														
23		**Number of sites sampled using rake on Rope (R)**	**0**																														
24		**Number of sites sampled using rake on Pole (P)**	**0**																														
25		**Average number of all species per site (shallower than max depth)**	**1.49**																														
26		**Average number of all species per site (veg. sites only)**	**1.95**																														
27		**Average number of native species per site (shallower than max depth)**	**1.22**																														
28		**Average number of native species per site (veg. sites only)**	**1.70**																														
29		**Species Richness**	**19**																														
30		**Species Richness (including visuals)**	**26**																														
31																																	
32		****SEE "MAX DEPTH GRAPH" WORKSHEET TO CONFIRM**																															

Table A.5

Mill Lake Point-Intercept Aquatic Plant Survey Data: August 13 – 16, 2019

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nitella* sp., Nitella	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton amplifolius*, Large-leaf pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae			
2	**Name**	Mill	1	42.76959	-88.557044	5	M			2			2											V								1				
3	**County**	Walworth	2	42.769166	-88.557054	5	M			1	1																					V				
4	**WBIC**	755600	3	42.768808	-88.562232	5.5	S		NO PLANTS																											
5	**Date**	8/13, 8/14, 8/16/20	4	42.768801	-88.561658	4.5	S		NO PLANTS																											
6	**Field Crew**	Zofia Noe	5	42.768743	-88.557064	4	M			2	1		1		1	1			1									1				2				
7		Justin Poinsatte	6	42.7684	-88.563391	4	S			1				1										V		1										
8		Kimberly Walsh	7	42.768392	-88.562816	8	M			2				2															1							
9			8	42.768385	-88.562242	7	M			1	1																									
10			9	42.768378	-88.561668	6	M			2								2											2							
11			10	42.768371	-88.561094	5	M			3	V			3															V			2				
12			11	42.768364	-88.560519				DOCK																											
13			12	42.768356	-88.559945	3.5	S		NO PLANTS																							V				
14			13	42.768327	-88.557648	4	M			2	1					1		1	2									1				2	1			
15			14	42.76832	-88.557074	6	M			1	V		1						1													V				
16			15	42.767984	-88.563975	3	M			2	2								1													1				
17			16	42.767976	-88.563401	6	M			2	1			2							1									1	1	1				
18			17	42.767969	-88.562826	8	S		NO PLANTS																											
19			18	42.767962	-88.562252	7	M			3				3																						
20			19	42.767955	-88.561678	7	M		NO PLANTS																											
21			20	42.767948	-88.561103	6	M			3				3							1										1					
22			21	42.767912	-88.558232	5	M			2	1			1		1																2				
23			22	42.767904	-88.557658	5	M			3	1			3		1		1								V						2				
24			23	42.767897	-88.557083	5	M			3	2				1	2			2											1		2				
25			24	42.767632	-88.569727	4	M			2	1		1	1																		2				
26			25	42.767561	-88.563985	2.5	R		NO PLANTS																				V							
27			26	42.767553	-88.56341	8.5	S		NO PLANTS																											
28			27	42.767546	-88.562836	8.5	S		NO PLANTS																											
29			28	42.767539	-88.562262	7.5	M			2				2																	1					
30			29	42.767532	-88.561687	7.5	M			2	1			2												1						1				
31			30	42.767525	-88.561113	7	M			3				3															1		2	1				
32			31	42.767488	-88.558242	4.5	M			2				2					1					V								2				
33			32	42.767481	-88.557667	4.5	M			2	1			1												V						2				
34			33	42.767474	-88.557093	5	M			2	1		1	1					1											1		2	1			
35			34	42.767217	-88.570311				PIER																											
36			35	42.767209	-88.569737				ON LAND																											
37			36	42.767159	-88.565717	8	M			1																						1				
38			37	42.767152	-88.565143	7	M			1																				1		1				
39			38	42.767145	-88.564569	8	S			1	1			1																		1				
40			39	42.767137	-88.563994	9	S		NO PLANTS																											
41			40	42.76713	-88.56342	9	S			1				1																						
42			41	42.767123	-88.562846	9	S			1				1																1	1					
43			42	42.767116	-88.562272	8	S		NO PLANTS																											
44			43	42.767109	-88.561697	8	M			3				3				2												1		1				
45			44	42.767101	-88.561123	7	M			2	1			2																1	1	1				
46			45	42.767065	-88.558252	4	M			2	1																					V				
47			46	42.767058	-88.557677	6	M			2						2								V												
48			47	42.767051	-88.557103	6	M			1	1					1										1										
49			48	42.766793	-88.570321				SHALLOW																											
50			49	42.766786	-88.569747	3	M			2				2							1			2	V		V									
51			50	42.766757	-88.56745	7	M			2	1							1			1						V			1		2				
52			51	42.76675	-88.566876	8	M			1				1							1											1				
53			52	42.766743	-88.566301	10	S		NO PLANTS																											
54			53	42.766736	-88.565727	13	S		NO PLANTS																											
55			54	42.766729	-88.565153	13	S		NO PLANTS																											

Table A.5 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nitella* sp., Nitella	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton amplifolius*, Large-leaf pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae			
56			55	42.766722	-88.564578	9	M			2				2							1											1				
57			56	42.766714	-88.564004	10	S			1				1																						
58			57	42.766707	-88.56343	9.5	M			2	1			1				2			1									2		1				
59			58	42.7667	-88.562856	10	M			3	1			3				1												2		1				
60			59	42.766693	-88.562281	9	M			2				1				2			1									1		1				
61			60	42.766685	-88.561707	9	M			2				2																						
62			61	42.766678	-88.561133	7.5	S		NO PLANTS																											
63			62	42.766657	-88.55941				ON LAND																											
64			63	42.766363	-88.569757	4	M			2				2							2										1	1				
65			64	42.766356	-88.569182	6	M			1				1							1											1	1			
66			65	42.766349	-88.568608	8	M			2				1							1										2					
67			66	42.766342	-88.568034	14	S		NO PLANTS																											
68			67	42.766334	-88.56746				DEEP																											
69			68	42.766327	-88.566885	10	M		NO PLANTS																											
70			69	42.76632	-88.566311				DEEP																											
71			70	42.766313	-88.565737				DEEP																											
72			71	42.766306	-88.565162				DEEP																											
73			72	42.766298	-88.564588				DEEP																											
74			73	42.766291	-88.564014				DEEP																											
75			74	42.766284	-88.56344	10	M			2											1									1		1				
76			75	42.766277	-88.562865	10.5	M			2	2										1									1						
77			76	42.76627	-88.562291	9	S			1	1			1																						
78			77	42.766262	-88.561717	9	M			2				1							1									1	2	1				
79			78	42.766255	-88.561143	9	M			2				1				1			2									2	1	1				
80			79	42.766248	-88.560568	8	M			2				2							1											1				
81			80	42.766241	-88.559994	7	M			2				1							2															
82			81	42.766233	-88.55942	4	M		NO PLANTS																											
83			82	42.76594	-88.569766	6.5	M			1				1							1											1				
84			83	42.765933	-88.569192				DEEP																											
85			84	42.765926	-88.568618				DEEP																											
86			85	42.765918	-88.568044				DEEP																											
87			86	42.765911	-88.567469				DEEP																											
88			87	42.765904	-88.566895				DEEP																											
89			88	42.765897	-88.566321	10	M		NO PLANTS																											
90			89	42.76589	-88.565747				DEEP																											
91			90	42.765882	-88.565172				DEEP																											
92			91	42.765875	-88.564598				DEEP																											
93			92	42.765868	-88.564024				DEEP																											
94			93	42.765861	-88.563449	11.5	M			1											1															
95			94	42.765854	-88.562875	9	M		NO PLANTS																											
96			95	42.765846	-88.562301	8.5	M			3				3							1															
97			96	42.765839	-88.561727	8.5	M			3				3																	1					
98			97	42.765832	-88.561152	9	M			2				2							1									1						
99			98	42.765825	-88.560578	8.5	M		NO PLANTS																											
100			99	42.765818	-88.560004	8	M			1				1				1												1	1					
101			100	42.76581	-88.55943	6	M			2				2							1										1					
102			101	42.765803	-88.558855				SHALLOW																											
103			102	42.765796	-88.558281				SHALLOW																											
104			103	42.765531	-88.570925				NOT SAMPLED																		V									
105			104	42.765524	-88.57035	5.5	S																													
106			105	42.765517	-88.569776				DEEP																											
107			106	42.76551	-88.569202				DEEP																											
108			107	42.765502	-88.568628				DEEP																											
109			108	42.765495	-88.568053				DEEP																											

Table A.5 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
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110			109	42.765488	-88.567479				DEEP																											
111			110	42.765481	-88.566905				DEEP																											
112			111	42.765474	-88.566331				DEEP																											
113			112	42.765467	-88.565756				DEEP																											
114			113	42.765459	-88.565182				DEEP																											
115			114	42.765452	-88.564608				DEEP																											
116			115	42.765445	-88.564033				DEEP																											
117			116	42.765438	-88.563459	9	M		NO PLANTS																											
118			117	42.765431	-88.562885	9	M			1	1			1																						
119			118	42.765423	-88.562311	9	M			1									1		1									1						
120			119	42.765416	-88.561736	9	M			3				3																1		1				
121			120	42.765409	-88.561162	8.5	M			2				1							1									2	1					
122			121	42.765402	-88.560588	8	M			2				2							1															
123			122	42.765394	-88.560014	7.5	M			2				1							2															
124			123	42.765387	-88.559439	6.5	M			1				1							1										1					
125			124	42.76538	-88.558865	6	M			2				1							2											1				
126			125	42.765373	-88.558291	6	M			2				2																		1				
127			126	42.765358	-88.557142				SHALLOW																											
128			127	42.765122	-88.572083	3.5	M		NO PLANTS			V					V	V																		
129			128	42.765115	-88.571509	4	M			1		V		1														1				1				
130			129	42.765108	-88.570934	4.5	S			1				1																		1				
131			130	42.765101	-88.57036	6	M			1				1							1											1				
132			131	42.765094	-88.569786				DEEP																											
133			132	42.765087	-88.569212				DEEP																											
134			133	42.765079	-88.568637				DEEP																											
135			134	42.765072	-88.568063				DEEP																											
136			135	42.765065	-88.567489				DEEP																											
137			136	42.765058	-88.566915				DEEP																											
138			137	42.765051	-88.56634				DEEP																											
139			138	42.765043	-88.565766				DEEP																											
140			139	42.765036	-88.565192				DEEP																											
141			140	42.765029	-88.564618				DEEP																											
142			141	42.765022	-88.564043	9.5	M			1				1																		1				
143			142	42.765015	-88.563469	8.5	M			2				2							1									1		1				
144			143	42.765007	-88.562895	8.5	M			1											1									1		1				
145			144	42.765	-88.56232	9	M			2				2							1											1				
146			145	42.764993	-88.561746	9	M			3											3									2	1					
147			146	42.764986	-88.561172	9	M			1																				1	1					
148			147	42.764979	-88.560598	8.5	M		NO PLANTS																											
149			148	42.764971	-88.560023	8	M		NO PLANTS																											
150			149	42.764964	-88.559449	8	M		NO PLANTS																											
151			150	42.764957	-88.558875	7	M		NO PLANTS																											
152			151	42.76495	-88.558301	6.5	M		NO PLANTS																											
153			152	42.764942	-88.557726	6	M			1																				1		1				
154			153	42.764935	-88.557152	5.5	M			2				2																						
155			154	42.764685	-88.570944	4.5	S		NO PLANTS																											
156			155	42.764678	-88.57037	6	M			2				2																						
157			156	42.764671	-88.569796				DEEP																											
158			157	42.764663	-88.569221				DEEP																											
159			158	42.764656	-88.568647				DEEP																											
160			159	42.764649	-88.568073				DEEP																											
161			160	42.764642	-88.567499				DEEP																											
162			161	42.764635	-88.566924				DEEP																											
163			162	42.764627	-88.56635				DEEP																											

Table A.5 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nitella* sp., Nitella	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton amplifolius*, Large-leaf pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae			
164			163	42.76462	-88.565776				DEEP																											
165			164	42.764613	-88.565202				DEEP																											
166			165	42.764606	-88.564627				DEEP																											
167			166	42.764599	-88.564053	10	M		NO PLANTS																											
168			167	42.764592	-88.563479	9	M			1											1															
169			168	42.764584	-88.562905	9.5	M		NO PLANTS																											
170			169	42.764577	-88.56233	11.5	M			2	1										2															
171			170	42.76457	-88.561756	11	M			1											1									1		1				
172			171	42.764563	-88.561182	9	M			2				2																		1				
173			172	42.764555	-88.560607	8.5	M			1											1															
174			173	42.764548	-88.560033	8	M			3				3																1						
175			174	42.764541	-88.559459	7.5	M			3				2				3			1											1				
176			175	42.764534	-88.558885	7	M			3				3			1													1						
177			176	42.764527	-88.55831	5	R																							V		V				
178			177	42.764255	-88.57038	6	M			2				2	1						1											1				
179			178	42.764247	-88.569805				DEEP																											
180			179	42.76424	-88.569231				DEEP																											
181			180	42.764233	-88.568657				DEEP																											
182			181	42.764226	-88.568083				DEEP																											
183			182	42.764219	-88.567508				DEEP																											
184			183	42.764212	-88.566934				DEEP																											
185			184	42.764204	-88.56636				DEEP																											
186			185	42.764197	-88.565786				DEEP																											
187			186	42.76419	-88.565211				DEEP																											
188			187	42.764183	-88.564637				DEEP																											
189			188	42.764176	-88.564063	11	M			1				1																						
190			189	42.764168	-88.563489	10	M			1											1															
191			190	42.764161	-88.562914				DEEP																											
192			191	42.764154	-88.56234				DEEP																											
193			192	42.764147	-88.561766	12	M			1	1			1																		1				
194			193	42.76414	-88.561192	9	M			3				2							3									1		1				
195			194	42.764132	-88.560617	8.5	M			2				2																	1	1				
196			195	42.764125	-88.560043	7.5	M			3				3																1		1				
197			196	42.764118	-88.559469	7.5	M			3				3							2									1		1				
198			197	42.764111	-88.558894	6	M			1											1										1					
199			198	42.763832	-88.570389	6	M			1																					1	1				
200			199	42.763824	-88.569815	8	M			1				1																1		1				
201			200	42.763817	-88.569241				DEEP																											
202			201	42.76381	-88.568667				DEEP																											
203			202	42.763803	-88.568092				DEEP																											
204			203	42.763796	-88.567518				DEEP																											
205			204	42.763788	-88.566944				DEEP																											
206			205	42.763781	-88.56637				DEEP																											
207			206	42.763774	-88.565795				DEEP																											
208			207	42.763767	-88.565221				DEEP																											
209			208	42.76376	-88.564647				DEEP																											
210			209	42.763752	-88.564073				DEEP																											
211			210	42.763745	-88.563498	9	M			1											1															
212			211	42.763738	-88.562924	9	M			2				2							1									1	1					
213			212	42.763731	-88.56235				DEEP																											
214			213	42.763724	-88.561776	11	M			1	1										1															
215			214	42.763716	-88.561201	9	M			3				3																	1	1				
216			215	42.763709	-88.560627	8	M			2				2																1	1	1				
217			216	42.763702	-88.560053	8	M			2				2				1												1						

Table A.5 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nitella* sp., Nitella	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton amplifolius*, Large-leaf pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae			
218			217	42.763695	-88.559479	7	M			2				1							2										1					
219			218	42.763401	-88.569825	4	M			1								1			V			V												
220			219	42.763394	-88.569251	10	M			3	1			3							1										2					
221			220	42.763387	-88.568676	7.5	M			3				3																	1					
222			221	42.76338	-88.568102				DEEP																											
223			222	42.763373	-88.567528				DEEP																											
224			223	42.763365	-88.566954				DEEP																											
225			224	42.763358	-88.566379				DEEP																											
226			225	42.763351	-88.565805				DEEP																											
227			226	42.763344	-88.565231				DEEP																											
228			227	42.763337	-88.564657	11	S			1																						1				
229			228	42.763329	-88.564082	8.5	M			1				1																1		1				
230			229	42.763322	-88.563508	8.5	M			1				1																		1				
231			230	42.763315	-88.562934	9	M			1				1																						
232			231	42.763308	-88.56236	13.5	M			1	1			1																						
233			232	42.763301	-88.561785	10	M			2	1			2							1										1					
234			233	42.763293	-88.561211	8	M			2				2																						
235			234	42.763286	-88.560637	7	M			2	1			2							1										1	1				
236			235	42.763279	-88.560063	5.5	M			3				3																		1				
237			236	42.762971	-88.56926	4.5	M			1				1													V			1		1				
238			237	42.762964	-88.568686	6.5	S			1				1																						
239			238	42.762957	-88.568112	7	M			2	2			2																						
240			239	42.762949	-88.567538	12	M			1				1																						
241			240	42.762942	-88.566963				DEEP																											
242			241	42.762935	-88.566389				DEEP																											
243			242	42.762928	-88.565815				DEEP																											
244			243	42.762921	-88.565241	8	M			3	1			3							1															
245			244	42.762913	-88.564666	6.5	M			2				2																						
246			245	42.762906	-88.564092	6.5	M			1				1												1		1		1		1				
247			246	42.762899	-88.563518	6	M			3	2			3																1						
248			247	42.762892	-88.562944	6	M			2											2									1						
249			248	42.762885	-88.562369	7	M			2				2																						
250			249	42.762877	-88.561795	7	M			3				3																	1					
251			250	42.762548	-88.56927				ON LAND														V													
252			251	42.762541	-88.568696	5	S		NO PLANTS																											
253			252	42.762533	-88.568122	7	S			1				1																						
254			253	42.762526	-88.567547	8.5	M			3	1			3																						
255			254	42.762519	-88.566973				DEEP																											
256			255	42.762512	-88.566399				DEEP																											
257			256	42.762505	-88.565825	10.5	M			1	1			1					1													1				
258			257	42.762497	-88.56525	7	M			1	1			1																1		1				
259			258	42.76249	-88.564676	6	M			2				2					1												1	1				
260			259	42.762476	-88.563528	3	M			1	1			1										V		1				1		1				
261			260	42.762469	-88.562953	5	M			3	1			2				1												3		2				
262			261	42.762461	-88.562379	6	M			1				1															1			1				
263			262	42.762454	-88.561805	5.5	M			3	1			2																		2				
264			263	42.762132	-88.569854	3	S			1				1					V													1				
265			264	42.762125	-88.56928	5	M			3	1			3																	V					
266			265	42.762117	-88.568706	6	M			1				1																		1				
267			266	42.76211	-88.568131	6.5	M			1	1			1																		1				
268			267	42.762103	-88.567557	6	M			3				3																						
269			268	42.762096	-88.566983	4	M			3				3																	1					
270			269	42.762089	-88.566409	5	S			3				3																						
271			270	42.762082	-88.565834	6	M			1	1			1												1										

Table A.5 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum* , Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus* , Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis* , Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina* , Spiny naiad	*Nitella* sp., Nitella	*Nuphar variegata* , Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton amplifolius*, Large-leaf pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata* , Sago pondweed	*Utricularia vulgaris* , Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae			
272			271	42.762074	-88.56526	6.5	S		NO PLANTS																											
273			272	42.762067	-88.564686	4.5	S		NO PLANTS																											
274			273	42.76206	-88.564112				ON LAND																											
275			274	42.762053	-88.563537	3	M			1				1															V			1				
276			275	42.762046	-88.562963	5	M			2	1			2							1					1					1	2				
277			276	42.762038	-88.562389	5	M			2	1			2																		2				
278			277	42.761709	-88.569864	5.5	M			2	1																					2				
279			278	42.761702	-88.56929	6	M			1	1			1												1										
280			279	42.761694	-88.568715	5.5	M			1				1																		1				
281			280	42.761687	-88.568141	6	M			1				1																		1				
282			281	42.76168	-88.567567	9	M			1	1																					1				
283			282	42.761673	-88.566993	5	M			2				2																						
284			283	42.761666	-88.566418	4	M			2	1			2												1					1	1				
285			284	42.761658	-88.565844	6.5	M			1				1																		1				
286			285	42.761651	-88.56527	6	M			1								1														1				
287			286	42.761644	-88.564696	5.5	S			1				1																						
288			287	42.761637	-88.564121	2	S		NO PLANTS																											
289			288	42.761293	-88.570448	3	M			1	1																					1				
290			289	42.761286	-88.569874	6	M			2	2																					2				
291			290	42.761278	-88.569299	5.5	M			1	1																					1				
292			291	42.761271	-88.568725	5	M			1	1			1																		1				
293			292	42.761264	-88.568151	6	M			2				2																		2				
294			293	42.761257	-88.567577	6	M		NO PLANTS																											
295			294	42.76125	-88.567002	6	M			1	1			1																		1				
296			295	42.761243	-88.566428	5	M			2	2			2																						
297			296	42.761235	-88.565854	5	M			3				3																	1					
298			297	42.761228	-88.56528	5	S		NO PLANTS																								1			
299			298	42.761221	-88.564705	5	M			1																							1			
300			299	42.761214	-88.564131	4	M			3	1			3	1											1										
301			300	42.760855	-88.569309	7	M			3	3																					2				
302			301	42.760848	-88.568735	5	M			1																						1				
303			302	42.760841	-88.568161	5	M			2				2																		2				
304			303	42.760834	-88.567586	6	M		NO PLANTS																											
305			304	42.760827	-88.567012	6	M			1																						1				
306			305	42.760819	-88.566438	6.5	M			2	1			1																		2				
307			306	42.760812	-88.565864	5.5	M			2	1			2																		1				
308			307	42.760805	-88.565289	5.5	M			3	1			3																		1				
309			308	42.760798	-88.564715	5.5	M			1				1																		1				
310			309	42.760791	-88.564141	4.5	M			1	1			1																		1				
311			310	42.760783	-88.563567	2.5	S			1				1																						
312			311	42.760425	-88.568745	5.5	M			3	3																					1				
313			312	42.760403	-88.567022	5	S		NO PLANTS																											
314			313	42.760396	-88.566448	6.5	M			1																						1				
315			314	42.760389	-88.565873	6.5	M			1																						1				
316			315	42.760382	-88.565299	5.5	M			1	1			1												1										
317			316	42.760375	-88.564725	6	M		NO PLANTS																											
318			317	42.760367	-88.564151	5.5	M			1	1																									
319			318	42.76036	-88.563577	4	M			1																						1				
320			319	42.760346	-88.562428	5	M			2	1			2																		2				
321			320	42.760339	-88.561854	5	M			1														V						V		1				
322			321	42.760331	-88.56128				INACCESSABLE																											
323			322	42.760324	-88.560705				INACCESSABLE																											
324			323	42.760317	-88.560131				INACCESSABLE																											
325			324	42.76031	-88.559557				INACCESSABLE																											

Table A.5 (Continued)

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nitella* sp., Nitella	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton amplifolius*, Large-leaf pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae			
326			325	42.75998	-88.567032	4.5	M			3				3																		1				
327			326	42.759973	-88.566457	6	S		NO PLANTS																											
328			327	42.759966	-88.565883	6.5	M			1				1							1											1				
329			328	42.759959	-88.565309	6.5	M			1	1																					1				
330			329	42.759952	-88.564735	6	M			3	1			3																		1				
331			330	42.759944	-88.564161	6	M			3	1			3																		1				
332			331	42.759937	-88.563586	6	M			1				1																						
333			332	42.75993	-88.563012	5	M			1	1			1																		1				
334			333	42.759923	-88.562438	5	M			3	1			3																		2				
335			334	42.759916	-88.561864	5	M			1	1																									
336			335	42.759908	-88.561289				LAND																											
337			336	42.759879	-88.558993	4	M			3	3								1					2						1		1				
338			337	42.759872	-88.558418	1.5	R			2	2								1				V				V									
339			338	42.759557	-88.567041	5	M			1																						1				
340			339	42.75955	-88.566467	5	M			3	1																					3				
341			340	42.759543	-88.565893	5.5	M			2	1																					2				
342			341	42.759536	-88.565319	7.5	M		NO PLANTS																											
343			342	42.759528	-88.564745	6	M			1	1																					1				
344			343	42.759521	-88.56417	6	M			1																						1				
345			344	42.759514	-88.563596	6	M			3				3																						
346			345	42.759507	-88.563022	6	M			1	1																									
347			346	42.7595	-88.562448	5	M			3				3																						
348			347	42.759492	-88.561873	4	M			1				1																		1				
349			348	42.759456	-88.559002	8	M			3	1		3																							
350			349	42.759449	-88.558428	9.5	M			3			3																							
351			350	42.759442	-88.557854	7.5	M			2	2				1																					
352			351	42.759435	-88.55728	7	M			3	3			1																		1				
353			352	42.759427	-88.556706	7.5	M			3	3																					2				
354			353	42.75942	-88.556131	7	M			2	2			1																						
355			354	42.759413	-88.555557	2	R		NO PLANTS		V																V									
356			355	42.759113	-88.565328	6	M			2	2					1																				
357			356	42.759105	-88.564754	7	M		NO PLANTS																											
358			357	42.759098	-88.56418	6	M			2	1			2																						
359			358	42.759091	-88.563606	6	M		NO PLANTS																											
360			359	42.759084	-88.563032	6	M		NO PLANTS																											
361			360	42.759076	-88.562457	6	M		NO PLANTS																											
362			361	42.759069	-88.561883	5	M			1									1																	
363			362	42.75904	-88.559586	5.5	M			1	1															1						1				
364			363	42.759033	-88.559012	6	M			1				1																						
365			364	42.759026	-88.558438	6	M			1	1			1																		1				
366			365	42.759019	-88.557864	6	M			3				3																						
367			366	42.759011	-88.55729	7	M			3	1			3																						
368			367	42.759004	-88.556715	8.5	M			1	1																									
369			368	42.758997	-88.556141	8.5	M			2	2			1								1										1				
370			369	42.75899	-88.555567	8	M			3	3																	1				1				
371			370	42.758983	-88.554993	2	R			1	1	V							1									V				1				
372			371	42.758689	-88.565338	5	M			3	1			3	1				1													2				
373			372	42.758682	-88.564764	7	S		NO PLANTS																											
374			373	42.758675	-88.56419	6.5	S		NO PLANTS																											
375			374	42.758668	-88.563616	6	M			1				1																						
376			375	42.758661	-88.563041	6.5	S		NO PLANTS																											
377			376	42.758653	-88.562467	6	M		NO PLANTS																											
378			377	42.758646	-88.561893	6	S		NO PLANTS																											
379			378	42.758639	-88.561319	5.5	M			2	1			1					1																	

Table A.5 (Continued)

1	A: Entry	I	J: sampling point	K: Latitude (need electronic copy of site locations)	L: Longitude (need electronic copy of site locations)	M: Depth (ft)	N: Dominant sediment type (M=muck, S=Sand, R=Rock)	O: Sampled holding rake pole (P) or rake rope (R)?	P: comments	Q: Total Rake Fullness	R: *Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	S: *Potamogeton crispus*, Curly-leaf pondweed	T: *Ceratophyllum demersum*, Coontail	U: *Chara* sp., Muskgrasses	V: *Elodea canadensis*, Common waterweed	W: *Heteranthera dubia*, Water star-grass	X: *Lemna minor*, Small duckweed	Y: *Myriophyllum verticillatum*, Whorled water-milfoil	Z: *Najas flexilis*, Slender naiad	AA: *Najas guadalupensis*, Southern naiad	AB: *Najas marina*, Spiny naiad	AC: *Nitella* sp., Nitella	AD: *Nuphar variegata*, Spatterdock	AE: *Nymphaea odorata*, White water lily	AF: *Potamogeton amplifolius*, Large-leaf pondweed	AG: *Potamogeton gramineus*, Variable pondweed	AH: *Potamogeton natans*, Floating-leaf pondweed	AI: *Potamogeton zosteriformis*, Flat-stem pondweed	AJ: *Sagittaria cuneata*, Arum-leaved arrowhead	AK: *Stuckenia pectinata*, Sago pondweed	AL: *Utricularia vulgaris*, Common bladderwort	AM: *Vallisneria americana*, Wild celery	AN: Filamentous algae	AO	AP	AQ
380			379	42.758632	-88.560745	5.5	S		NO PLANTS																											
381			380	42.758625	-88.56017	6	S			1				1																						
382			381	42.758617	-88.559596	6.5	S		NO PLANTS																											
383			382	42.75861	-88.559022	6	R		NO PLANTS																											
384			383	42.758603	-88.558448	6	M			1	1			1																		1				
385			384	42.758596	-88.557874	6	M			2	1									1										1		2				
386			385	42.758588	-88.557299	9	M			1	1			1						1		1														
387			386	42.758581	-88.556725	7.5	M			2	1									2												1				
388			387	42.758574	-88.556151	8	M			1	1			1					1													1				
389			388	42.758567	-88.555577	7	M			1	1			1					1																	
390			389	42.758266	-88.565348	5	M			2	2			1																	1	1				
391			390	42.758259	-88.564774	6	S		NO PLANTS		V																									
392			391	42.758252	-88.5642	6.5	S		NO PLANTS																											
393			392	42.758245	-88.563625	6	M			2	2			2					1													1				
394			393	42.758237	-88.563051	6	M			2	2			2																		1				
395			394	42.75823	-88.562477	6	M			1	1			1																		1				
396			395	42.758223	-88.561903	7	M			1				1																						
397			396	42.758216	-88.561329	6.5	S		NO PLANTS																											
398			397	42.758209	-88.560754	6	S		NO PLANTS																											
399			398	42.758201	-88.56018	6	S		NO PLANTS																											
400			399	42.758194	-88.559606	6	S		NO PLANTS																											
401			400	42.758187	-88.559032	6	S			1	1																									
402			401	42.75818	-88.558458	6	M			1	1			1						1																
403			402	42.758172	-88.557883	8	M			3	1			3								2														
404			403	42.758165	-88.557309	8	M			2	2		2							1																
405			404	42.75785	-88.565932				LAND																											
406			405	42.757843	-88.565358	5	M			1	1									1																
407			406	42.757836	-88.564784	6	S		NO PLANTS																											
408			407	42.757829	-88.564209	7	M			2	1			1																		2				
409			408	42.757822	-88.563635	6.5	M			2	2			1																		1				
410			409	42.757814	-88.563061	6	M			2	1			1																		2				
411			410	42.757807	-88.562487	6	M			1	1																					1				
412			411	42.7578	-88.561913	6	S		NO PLANTS																											
413			412	42.757793	-88.561338	5.5	M		NO PLANTS																											
414			413	42.757785	-88.560764	5.5	M		NO PLANTS																											
415			414	42.757778	-88.56019	5.5	M		NO PLANTS																											
416			415	42.757771	-88.559616	6	S		NO PLANTS																											
417			416	42.757764	-88.559042	6	S			1				1																						
418			417	42.757757	-88.558467	7	S			1	1											1														
419			418	42.757749	-88.557893	6.5	M			2	1									2										1		2				
420			419	42.757427	-88.565942	5	M			3	2			3																		1				
421			420	42.75742	-88.565368	4.5	M			3	3									1												2				
422			421	42.757413	-88.564793	6	M			1																						1				
423			422	42.757406	-88.564219	9	M			1	1																									
424			423	42.757398	-88.563645	8	M			1	1																									
425			424	42.757391	-88.563071	7	M		NO PLANTS																											
426			425	42.757384	-88.562497				DEEP																											
427			426	42.757377	-88.561922				DEEP																											
428			427	42.75737	-88.561348				DEEP																											
429			428	42.757362	-88.560774				DEEP																											
430			429	42.757355	-88.5602	4.5	M			3				3	1				1											1		1				
431			430	42.757348	-88.559626	6	M		NO PLANTS																											
432			431	42.757341	-88.559051	5	M			1				1																		1				
433			432	42.757333	-88.558477	5	M			3	3			1																		2				

	A	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
1	Entry		sampling point	Latitude (need electronic copy of site locations)	Longitude (need electronic copy of site locations)	Depth (ft)	Dominant sediment type (M=muck, S=Sand, R=Rock)	Sampled holding rake pole (P) or rake rope (R)?	comments	Total Rake Fullness	*Myriophyllum spicatum*, Eurasian water-milfoil or Hybrid water-milfoil	*Potamogeton crispus*, Curly-leaf pondweed	*Ceratophyllum demersum*, Coontail	*Chara* sp., Muskgrasses	*Elodea canadensis*, Common waterweed	*Heteranthera dubia*, Water star-grass	*Lemna minor*, Small duckweed	*Myriophyllum verticillatum*, Whorled water-milfoil	*Najas flexilis*, Slender naiad	*Najas guadalupensis*, Southern naiad	*Najas marina*, Spiny naiad	*Nitella* sp., Nitella	*Nuphar variegata*, Spatterdock	*Nymphaea odorata*, White water lily	*Potamogeton amplifolius*, Large-leaf pondweed	*Potamogeton gramineus*, Variable pondweed	*Potamogeton natans*, Floating-leaf pondweed	*Potamogeton zosteriformis*, Flat-stem pondweed	*Sagittaria cuneata*, Arum-leaved arrowhead	*Stuckenia pectinata*, Sago pondweed	*Utricularia vulgaris*, Common bladderwort	*Vallisneria americana*, Wild celery	Filamentous algae			
434			433	42.756997	-88.565377	5	M			1	1																									
435			434	42.75699	-88.564803	5.5	M			1	1																									
436			435	42.756982	-88.564229	6.5	M			2				2						1												1				
437			436	42.756975	-88.563655	8	M			1	1			1																						
438			437	42.756968	-88.563081	5.5	M			1	1																									
439			438	42.756961	-88.562506	5	M			2	1			1						1																
440			439	42.756954	-88.561932	4.5	M			1				1																						
441			440	42.756946	-88.561358	5	M			1	1									1																
442			441	42.756939	-88.560784	4.5	M			1	1			3						1												1				
443			442	42.756932	-88.56021	5.5	M		NO PLANTS																											
444			443	42.756925	-88.559635	5	M			2	1			2						1												1				
445			444	42.756918	-88.559061				LAND																											
446			445	42.756581	-88.565961				SHALLOW																											
447			446	42.756574	-88.565387	5.5	M			1	1		V																							
448			447	42.756567	-88.564813	5	M			1	1									1																
449			448	42.756559	-88.564239	6	M			1	1									1																
450			449	42.756552	-88.563665	6	M			1	1			1																						
451			450	42.756545	-88.56309	6	M			1																						1				
452			451	42.756538	-88.562516	6	M			1				1																						
453			452	42.756531	-88.561942	6	M			1	1									1																
454			453	42.756523	-88.561368	6	M			1	1																									
455			454	42.756516	-88.560794	5.5	M		NO PLANTS																											
456			455	42.756509	-88.560219				LAND																											
457			456	42.756158	-88.565971				SHALLOW																											
458			457	42.756151	-88.565397	3.5	M			1	1			1									V	V												
459			458	42.756143	-88.564823	5.5	M			1	1			1																						
460			459	42.756136	-88.564248	6	M			1				1									1													
461			460	42.756129	-88.563674	6.5	M			1										1																
462			461	42.756122	-88.5631	6.5	M		NO PLANTS																											
463			462	42.756115	-88.562526	6.5	M		NO PLANTS																											
464			463	42.756107	-88.561952	6.5	M		NO PLANTS																											
465			464	42.7561	-88.561378	5	M			3	1			3						1																
466			465	42.75572	-88.564832	5	M			1				1																						
467			466	42.755713	-88.564258	5	M			1				1																						
468			467	42.755706	-88.563684	5	M			1	1			1	1																					
469			468	42.755699	-88.56311	4.5	M			2				2																						
470			469	42.755691	-88.562536	5	M			2				2																						
471			470	42.755684	-88.561962	4.5	M			1	1			1						1												1				
472			471	42.755268	-88.562545				ON LAND																											

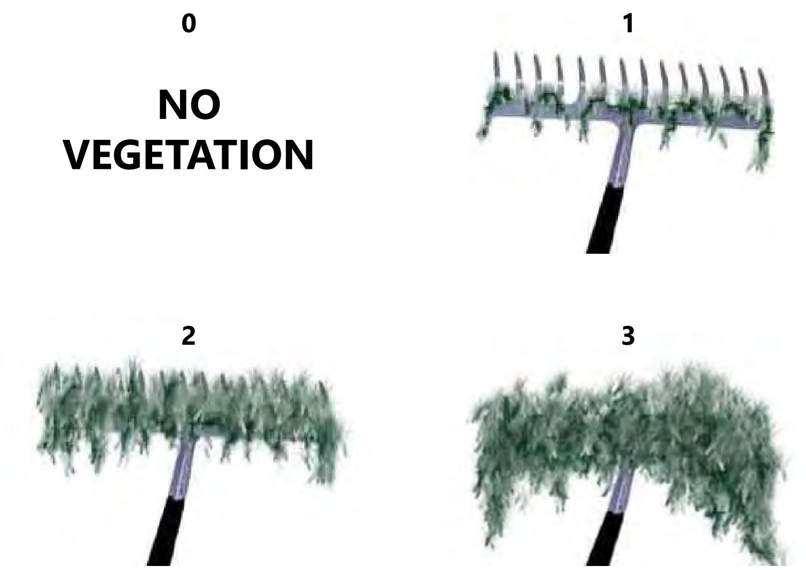
Table A.6

Summary Statistics for the Mill Lake Point-Intercept Aquatic Plant Survey: August 13 – 16, 2019

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
1		**STATS**	Total vegetation	*Myriophyllum spicatum*, Eurasian water milfoil	*Potamogeton crispus*, Curly-leaf pondweed	Ceratophyllum demersum, Coontail	Chara sp., Muskgrasses	Elodea canadensis, Common waterweed	Heteranthera dubia, Water star-grass	Lemna minor, Small duckweed	Myriophyllum verticillatum, Whorled water-milfoil	Najas flexilis, Slender naiad	Najas guadalupensis, Southern naiad	Najas marina, Spiny naiad	Nitella sp., Nitella	Nuphar variegata, Spatterdock	Nymphaea odorata, White water lily	Potamogeton amplifolius, Large-leaf pondweed	Potamogeton gramineus, Variable pondweed	Potamogeton natans, Floating-leaf pondweed	Potamogeton zosteriformis, Flat-stem pondweed	Sagittaria cuneata, Arum-leaved arrowhead	Stuckenia pectinata, Sago pondweed	Utricularia vulgaris, Common bladderwort	Vallisneria americana, Wild celery	Filamentous algae		
2	**Lake**	Mill																										
3	**County**	Walworth																										
4	**WBIC**	755600																										
5	**Survey Date**	8/13, 8/14, 8/16/2019																										
6		**INDIVIDUAL SPECIES STATS:**																										
7		**Frequency of occurrence within vegetated areas (%)**		47.40		2.77	67.82	2.77	2.77	0.35	5.19	6.92	6.57	18.69	1.38	0.35	0.69		4.15		1.73	1.38	16.26	12.11	52.25	1.73		
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		37.64		2.20	53.85	2.20	2.20	0.27	4.12	5.49	5.22	14.84	1.10	0.27	0.55		3.30		1.37	1.10	12.91	9.62	41.48	1.37		
9		**Relative Frequency (%)**		18.8		1.1	27.0	1.1	1.1	0.1	2.1	2.8	2.6	7.4	0.6	0.1	0.3		1.7		0.7	0.6	6.5	4.8	20.8			
10		Relative Frequency (squared)	0.17	0.04		0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00		0.00		0.00	0.00	0.00	0.00	0.04			
11		**Number of sites where species found**		137		8	196	8	8	1	15	20	19	54	4	1	2		12		5	4	47	35	151	5		
12		**Average Rake Fullness**	1.73	1.25		1.75	1.70	1.00	1.25	1.00	1.40	1.10	1.11	1.24	1.25	1.00	2.00		1.00		1.00	1.25	1.15	1.11	1.23	1.00		
13		**#visual sightings**		4	3	1				1	1	1		1		3	8	1	2	6	1	3	2	1	5			
14		**present (visual or collected)**		present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present		
15																												
16		**SUMMARY STATS:**																										
17		**Total number of sites visited**	**365**																									
18		**Total number of sites with vegetation**	**289**																									
19		**Total number of sites shallower than maximum depth of plants**	**364**																									
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**79.40**																									
21		**Simpson Diversity Index**	**0.83**																									
22		**Maximum depth of plants (ft)****	**13.50**																									
23		**Number of sites sampled using rake on Rope (R)**	**0**																									
24		**Number of sites sampled using rake on Pole (P)**	**0**																									
25		**Average number of all species per site (shallower than max depth)**	**2.00**																									
26		**Average number of all species per site (veg. sites only)**	**2.52**																									
27		**Average number of native species per site (shallower than max depth)**	**1.47**																									
28		**Average number of native species per site (veg. sites only)**	**2.01**																									
29		**Species Richness**	**19**																									
30		**Species Richness (including visuals)**	**22**																									
31																												
32		****SEE "MAX DEPTH GRAPH" WORKSHEET TO CONFIRM**																										

LAUDERDALE LAKES
AQUATIC PLANT SPECIES DETAILS
APPENDIX B

Figure B.1
Rake Fullness Ratings



Source: Wisconsin Department of Natural Resources and SEWRPC

SOURCES OF INFORMATION:

Borman, S., Korth, R., & Temte, J. (2014). Through the Looking Glass: A Field Guide to Aquatic Plants, Second Edition. Stevens Point, WI, USA: Wisconsin Lakes Partnership.

Robert W. Freckman Herbarium: wisflora.herbarium.wisc.edu

Skawinski, P. M. (2014). Aquatic Plants of the Upper Midwest: A Photographic Field Guide to Our Underwater Forests, Second Edition. Wausau, Wisconsin, USA: Self-Published.

University of Michigan Herbarium: michiganflora.net/home.aspx

UW-System WisFlora. 2016. wisflora.herbarium.wisc.edu/index.php

Native

COONTAIL
Ceratophyllum demersum

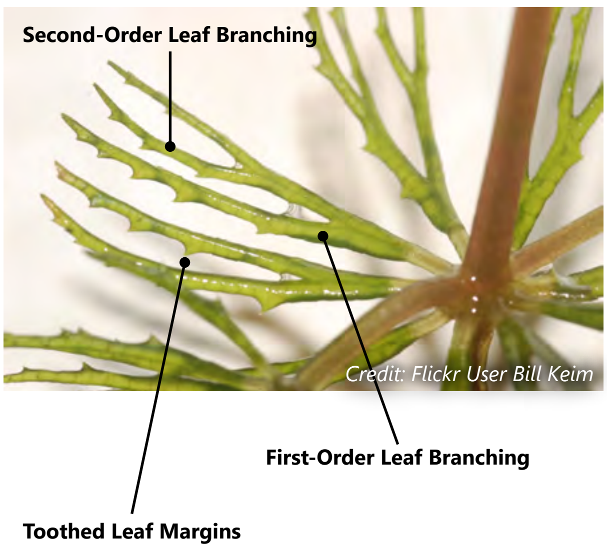
Identifying Features

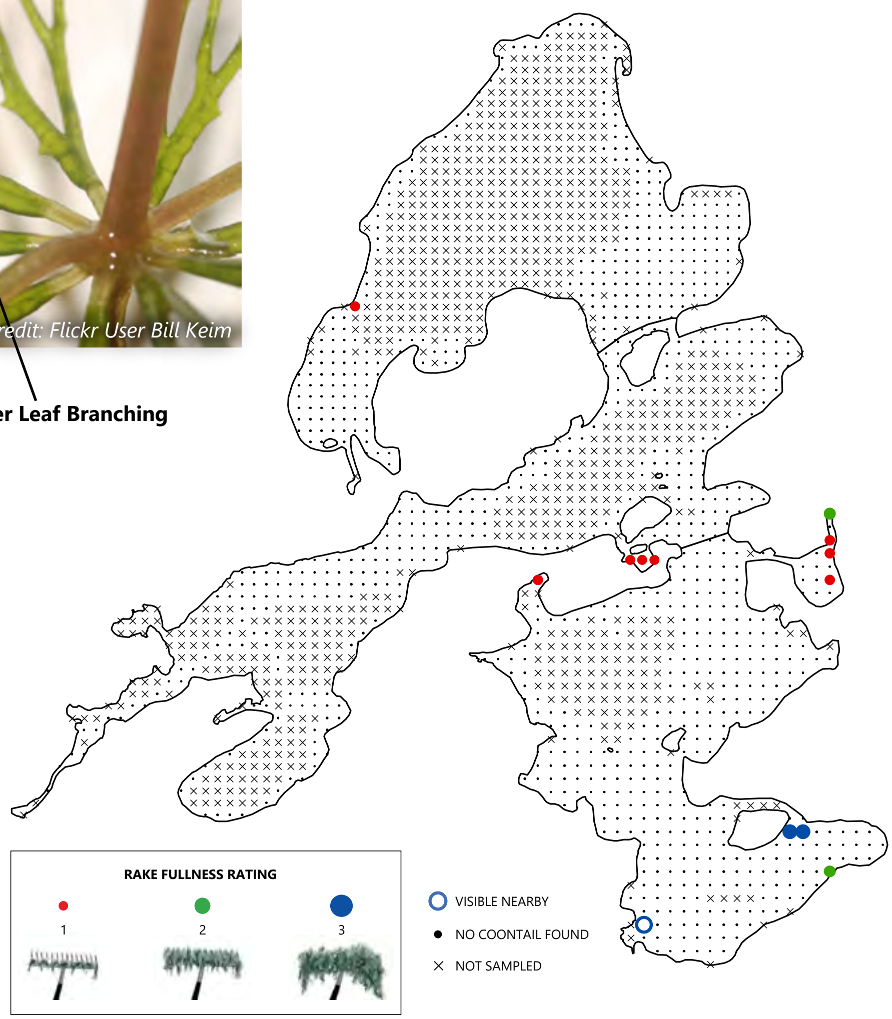
- Often bushy near tips of branches, giving the raccoon tail-like appearance (“coontail”)
- Whorled leaves with one to two orders of
- branching and small teeth on their margins
- Flowers (rare) small and produced in leaf axils

Coontail is similar to spiny hornwort (C. echinatum) and muskgrass (Chara spp.), but spiny hornwort has some leaves with three to four orders of branching, and coontail does not produce the distinct garlic-like odor of muskgrass when crushed

Ecology

- Common in lakes and streams, both shallow and deep
- Tolerates poor water quality (high nutrients, chemical pollutants) and disturbed conditions
- Stores energy as oils, which can produce slicks on the water surface when plants decay
- Anchors to the substrate with pale, modified leaves rather than roots
- Eaten by waterfowl, turtles, carp, and muskrat





Native

MUSKGRASSES
Chara spp.

Credit: Flickr User Jeremy Halls

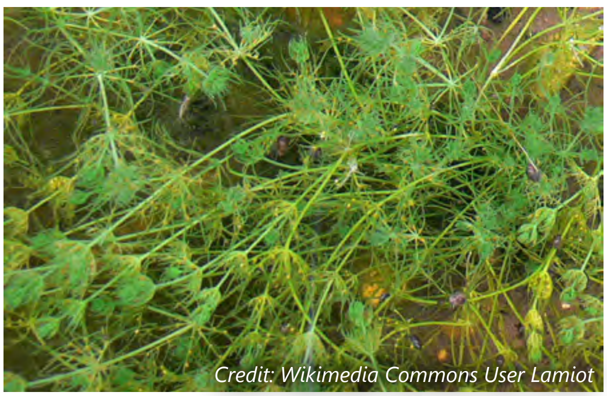
Identifying Features

- Leaf-like, ridged side branches develop in whorls of six or more
- Often encrusted with calcium carbonate, which appears white upon drying (see photo below)
- Yellow reproductive structures develop along the whorled branches in summer
- Emits a garlic-like odor when crushed

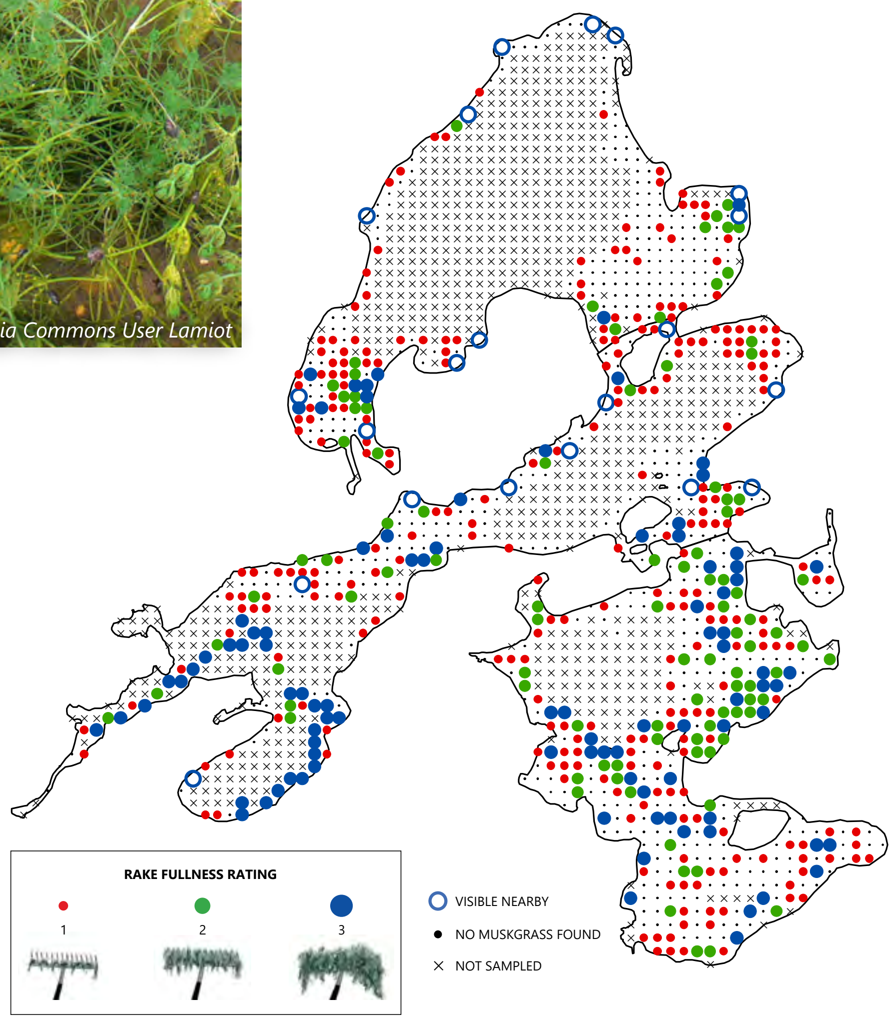
Stoneworts (*Nitella* spp.) are similar large algae, but their branches are smooth rather than ridged and more delicate

Ecology

- Found in shallow or deep water over marl or silt, often growing in large colonies in hard water
- Overwinters as rhizoids (cells modified to act as roots) or fragments
- Stabilizes bottom sediments, often among the first species to colonize open areas
- Food for waterfowl and excellent habitat for small fish



Credit: Wikimedia Commons User Lamiot



Native

COMMON WATERWEED

Elodea canadensis

Credit: Flickr User Corey Raimond

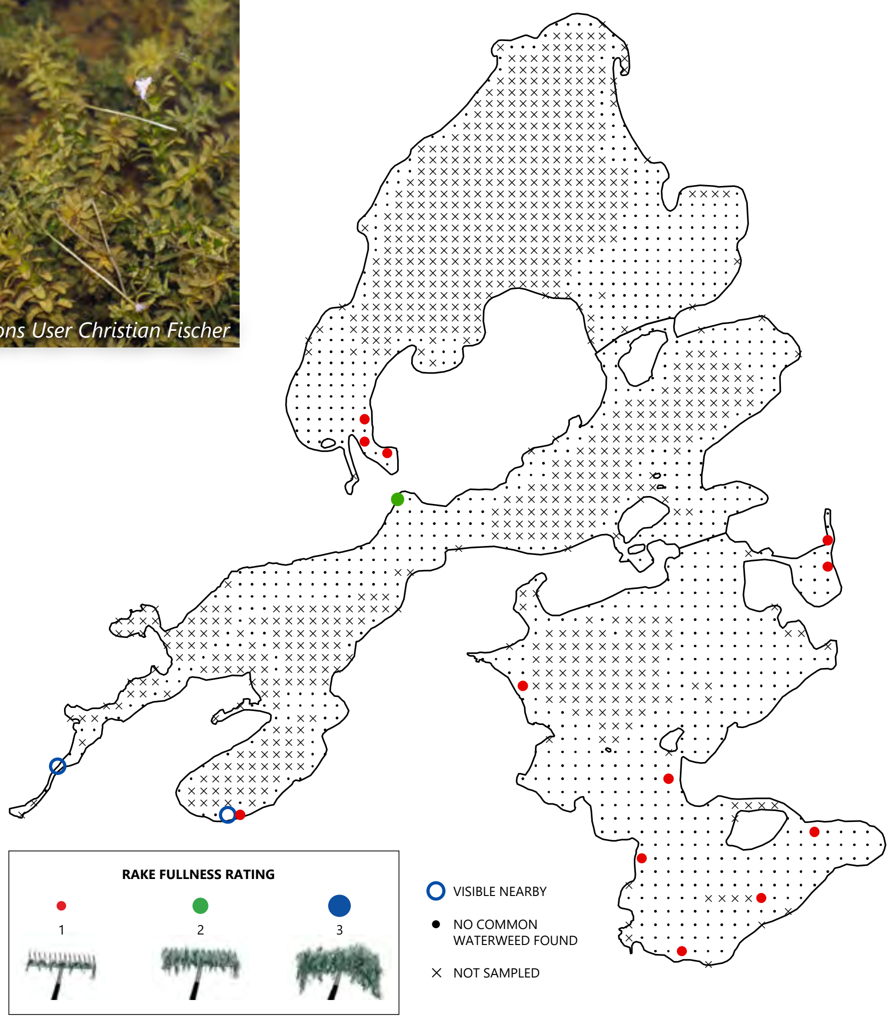
Identifying Features

- Slender stems, occasionally rooting
- Leaves lance-shaped, in whorls of three (rarely two or four), 6.0 to 17 mm long and averaging 2.0 mm wide
- When present, tiny male and female flowers on separate plants (females more common), raised to the surface on thread-like stalks

Ecology

- Found in lakes and streams over soft substrates tolerating pollution, eutrophication and disturbed conditions
- Often overwinters under the ice
- Produces seeds only rarely, spreading primarily via stem fragments
- Provides food for muskrat and waterfowl
- Habitat for fish or invertebrates, although dense stands can obstruct fish movement

Credit: Wikimedia Commons User Christian Fischer



Native

WATER STARGRASS

Heteranthera dubia

Credit: Wikimedia Commons User Fritzflohrreynolds

Identifying Features

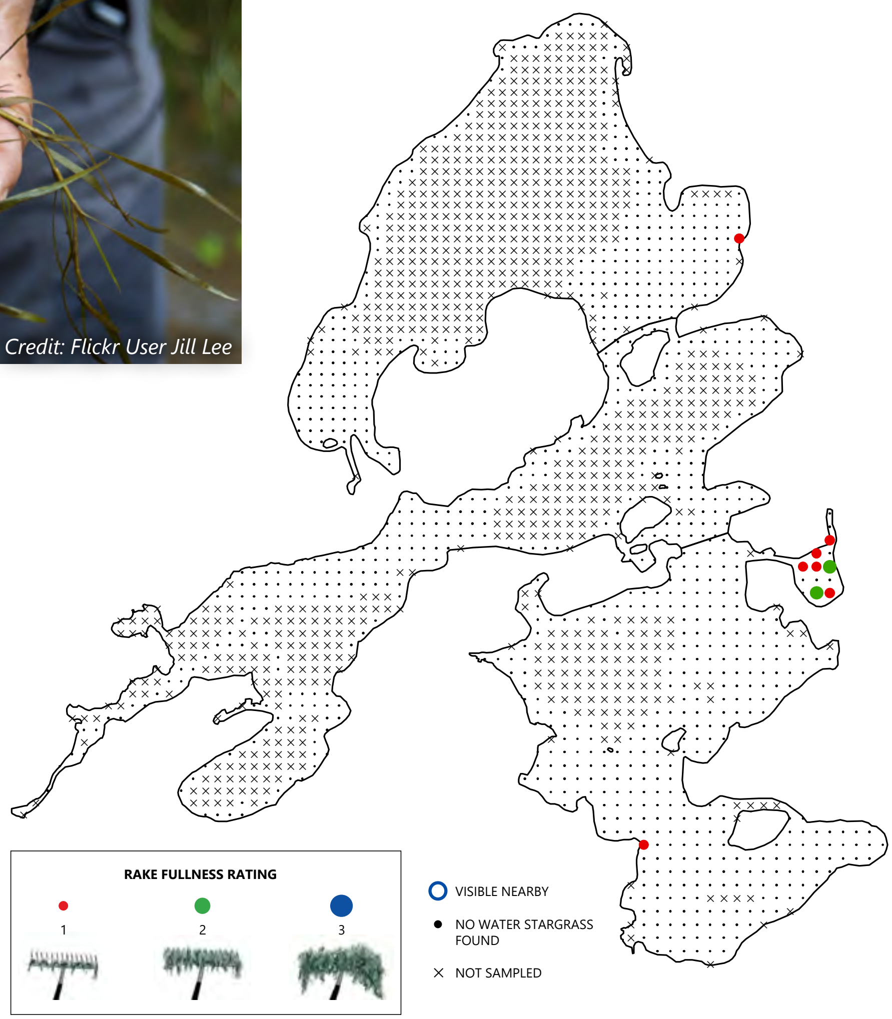
- Stems slender, slightly flattened, and branching
- Leaves narrow, alternate, with no stalk, and lacking a prominent midvein
- When produced, flowers conspicuous, yellow, and star-shaped (usually in shallow water) or inconspicuous and hidden in the bases of submersed leaves (in deeper water)

Yellow stargrass may be confused with pondweeds that have narrow leaves, but it is easily distinguished by its lack of a prominent midvein and, when present, yellow blossoms

Ecology

- Found in lakes and streams, shallow and deep
- Tolerates somewhat turbid waters
- Overwinters as perennial rhizomes
- Limited reproduction by seed
- Provides food for waterfowl and habitat for fish

Credit: Flickr User Jill Lee



Nonnative/ Exotic

EURASIAN WATERMILFOIL

Myriophyllum spicatum

Credit: Paul Skawinski

Identifying Features

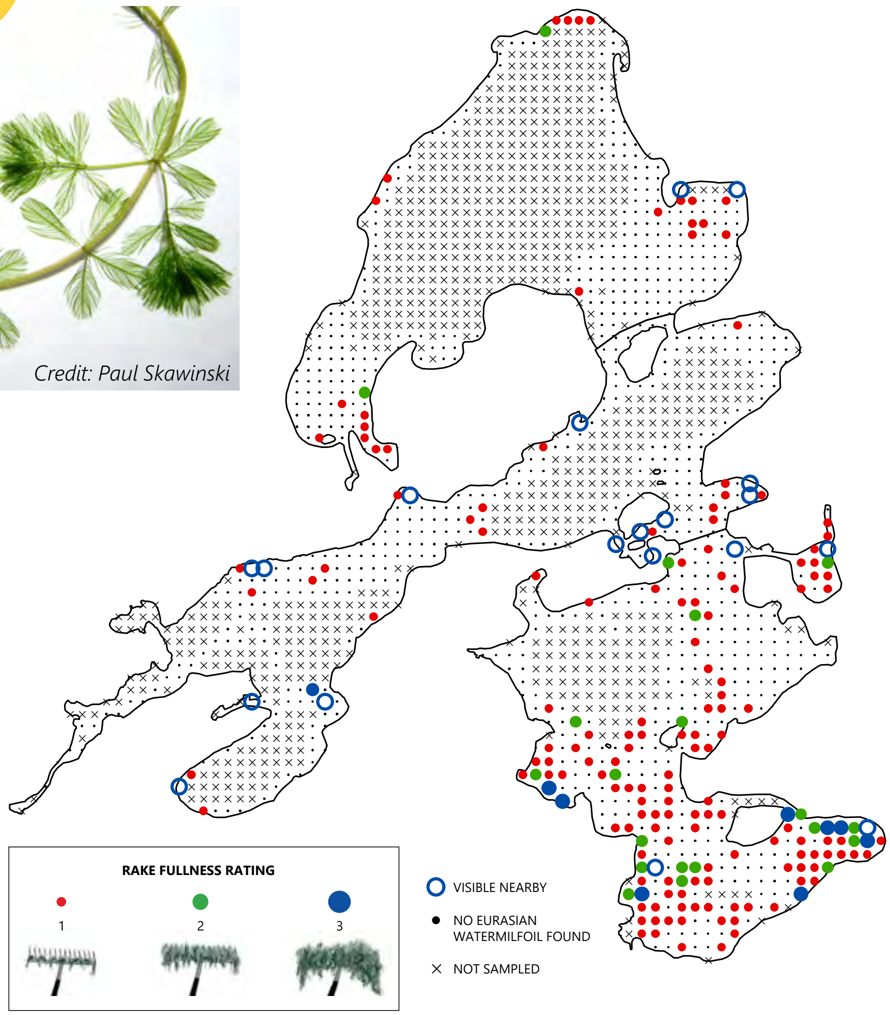
- Stems spaghetti-like, often pinkish, growing long with many branches near the water surface
- Leaves with 12 to 21 pairs of leaflets
- Produces no winter buds (turions)

Eurasian watermilfoil is similar to northern watermilfoil (*M. sibiricum*). However, northern watermilfoil has five to 12 pairs of leaflets per leaf and stouter white or pale brown stems

Ecology

- Hybridizes with northern (native) watermilfoil, resulting in plants with intermediate characteristics
- Invasive, growing quickly, forming canopies, and getting a head-start in spring due to an ability to grow in cool water
- Grows from root stalks and stem fragments in both lakes and streams, shallow and deep; tolerates disturbed conditions
- Provides some forage to waterfowl, but supports fewer aquatic invertebrates than mixed stands of aquatic vegetation

Credit: Paul Skawinski



Native

WHORLED WATERMILFOIL

Myriophyllum vericillatum

Credit: Wikimedia Commons User Panek

Identifying Features

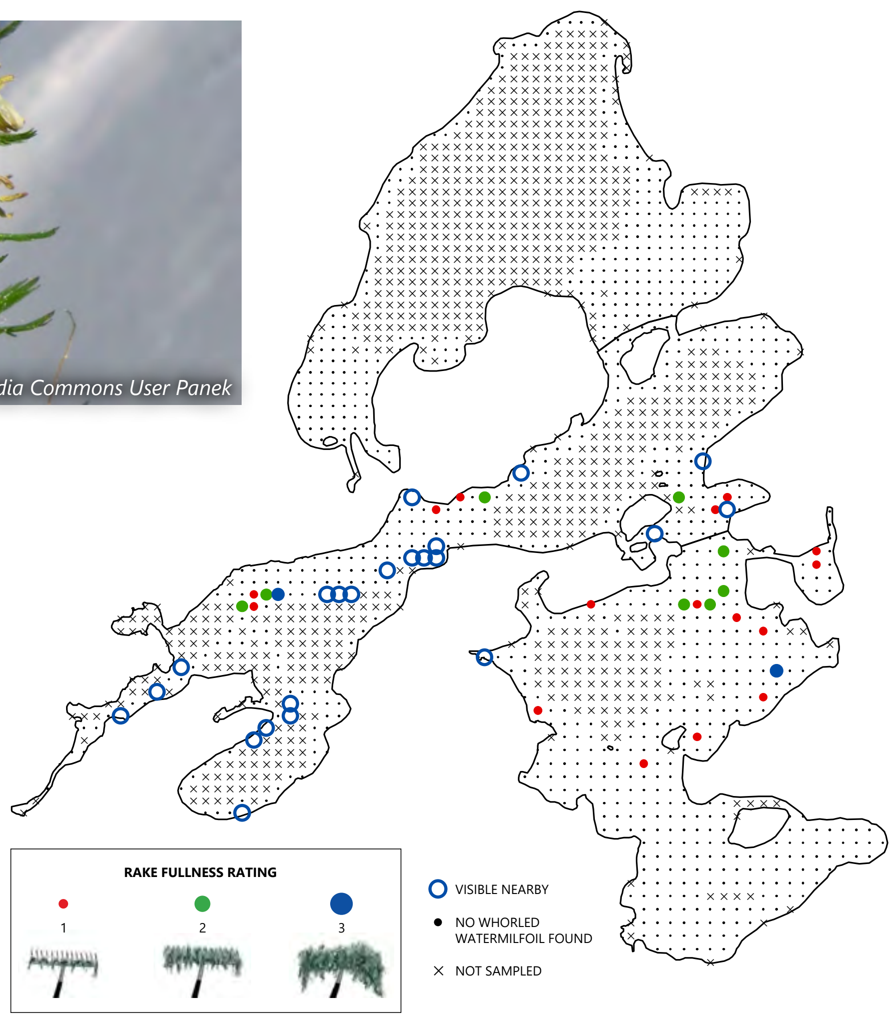
- Very short internodes lead to very bushy appearance
- Leaves in whorls of four to six, most leaves with no leaf stalk, divided into eight to 17 pairs of leaflets
- Small, club-shaped winter buds formed adjacent to stem in autumn
- Flower bracts are deeply lobed

Whorled watermilfoil is similar to other water milfoils. Various-leaved watermilfoil (*M. heterophyllum*) has similarly large leaf bracts that have smooth or slightly serrated edges. Eurasian watermilfoil (*M. spicatum*) tends to be less bushy, limp out of water, and produce more leaflets per leaf.

Ecology

- Found in shallow to deep lakes and streams
- Consumed by waterfowl
- Provides habitat for aquatic invertebrates and shade, shelter, and foraging for fish spawn


Credit: Wikimedia Commons User Panek



Native

BUSHY PONDWEED OR SLENDER NAIAD

Najas flexilis

Credit: Flickr User Tab Tannery

Identifying Features

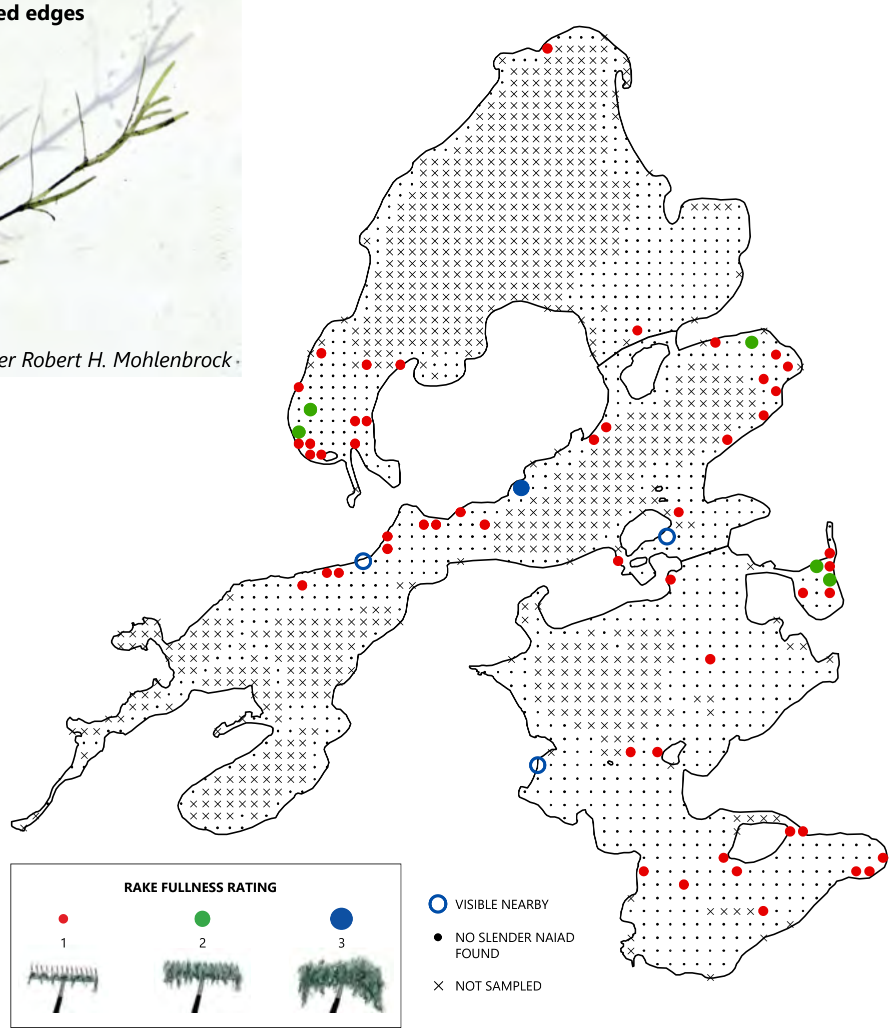
- Leaves narrow (0.4 to 1.0 mm) and pointed with broader bases where they attach to the stem and finely serrated margins
- Flowers, when present, tiny and located in leaf axils
- Variable size and spacing of leaves, as well as compactness of plant, depending on growing conditions

Two other Najas occur in southeastern Wisconsin. Southern naiad (N. guadalupensis) has wider leaves (to 2.0 mm). Spiny naiad (N. marina) has coarsely toothed leaves with spines along the midvein below

Ecology

- In lakes and streams, shallow and deep, often in association with wild celery
- One of the most important forages of waterfowl
- An annual plant that completely dies back in fall and regenerates from seeds each spring; also spreading by stem fragments during the growing season

Credit: Wikimedia Commons User Robert H. Mohlenbrock



Native

SOUTHERN NAIAD

Najas guadalupensis

Credit: Wikimedia Commons User Robert H. Mohlenbrock

Identifying Features

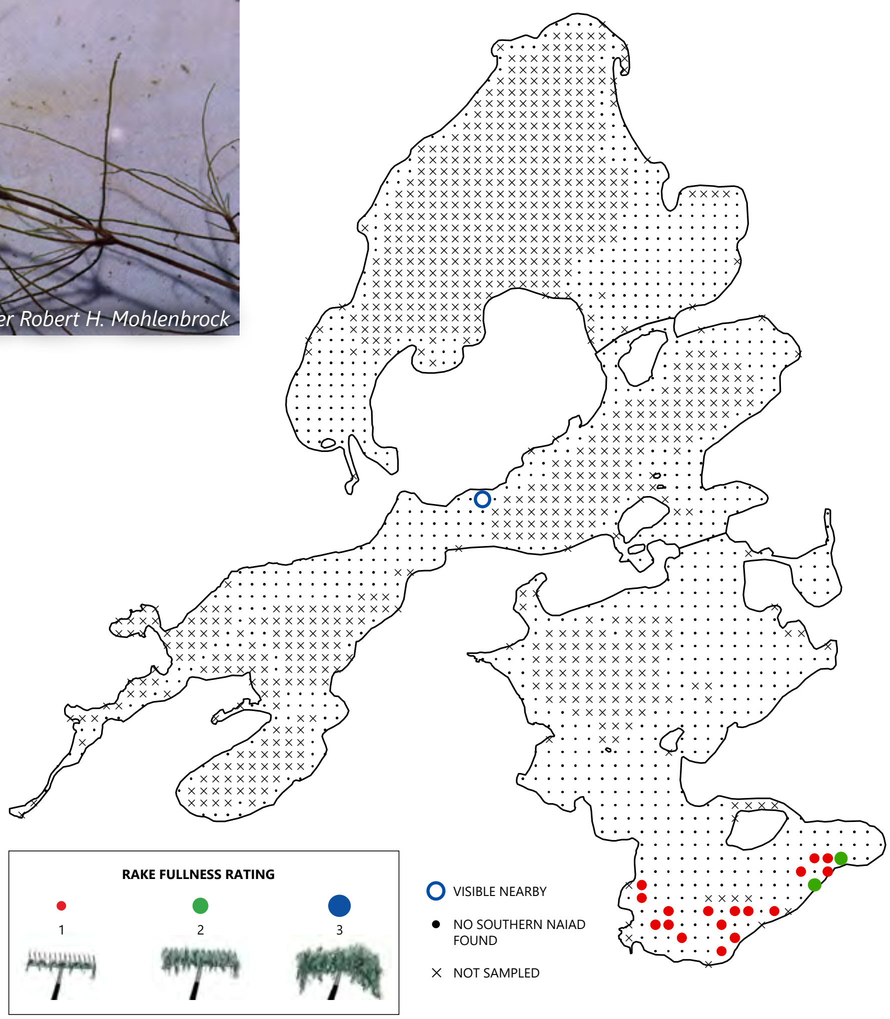
- Leaves 0.2 to 2.0 mm wide and blunt with slight shoulder bases where they attach to the stem and finely serrated margins
- Flowers, when present, tiny and located in leaf axils
- Leaves opposite and may appear loosely whorled

Two other Najas occur in southeastern Wisconsin. Slender naiad (*N. flexilis*) has narrower leaves (to 0.6 mm) with a pointed tip. Spiny naiad (*N. marina*) has coarsely toothed leaves with spines along the midvein below

Ecology

- In shallow to deep lakes and sandy, gravelly soil
- An annual plant that completely dies back in fall and regenerates from seeds each spring; also spreading by stem fragments during the growing season

Credit: Wikimedia Commons User Robert H. Mohlenbrock



Nonnative/ Exotic

SPINY NAIAD

Najas marina

Credit: Wikimedia Commons User Pascale Guinchard

Identifying Features

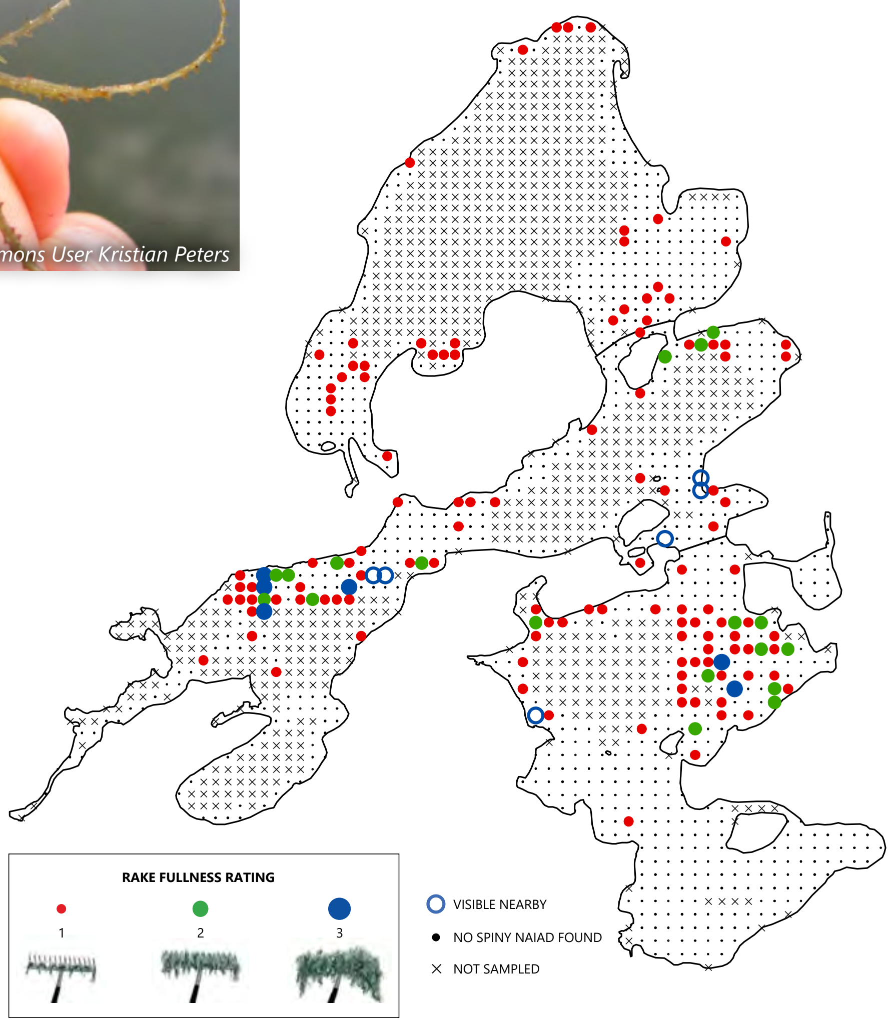
- Stems stiff and spiny, often branching many times
- Leaves stiff, 1.0 to 4.0 mm thick, with coarse teeth along the margins and midvein on the underside

Spiny naiad is quite distinct from other naiads due to its larger, coarsely toothed leaves and the irregularly pitted surface of its fruits. Spiny naiad is presumably introduced in Wisconsin, but it is considered native in other states, including Minnesota

Ecology

- Alkaline lakes, water quality ranging from good to poor
- An annual, regenerating from seed each year
- Occurs as separate male and female plants
- Capable of growing aggressively

Credit: Wikimedia Commons User Kristian Peters



Native

NITELLAS

Nitella spp.


Credit: Wikimedia Commons User Show_ryu

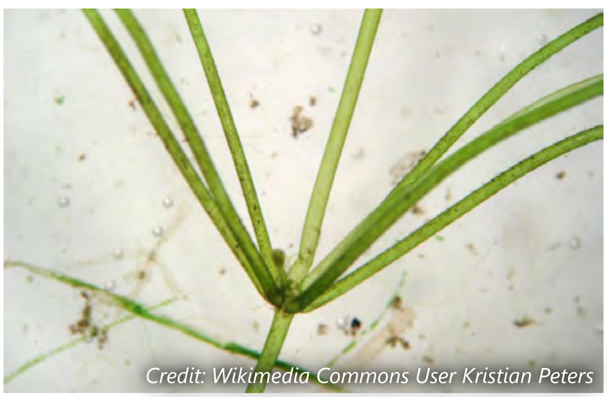
Identifying Features

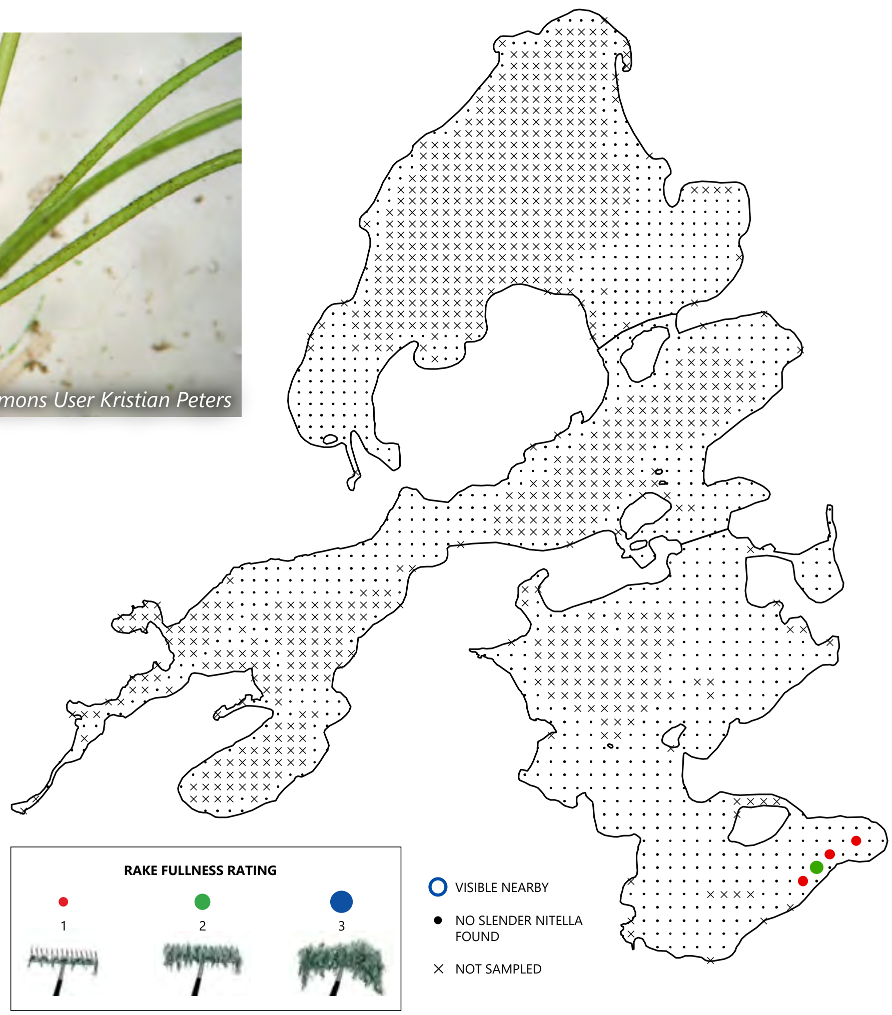
- Stems and leaf-like side branches delicate and smooth, side branches arranged in whorls
- Bright green
- Reproductive structures developing along the whorled branches

Muskgrasses (*Chara* spp.) are large algae similar to stoneworts (*Nitella* spp.), but their branches are ridged and more robust than those of stoneworts. Another similar group of algae, *Nitellopsis* spp., differ from stoneworts by having whorls of side branches that are at more acute angles to the main stem and star-shaped, pale bulbils that, when present, are near where side branches meet the main stem

Ecology

- Often found in deep lake waters over soft sediments
- Overwinters as rhizoids (cells modified to act as roots) or fragments
- Habitat for invertebrates, creating foraging opportunities for fish
- Sometimes browsed upon by waterfowl


Credit: Wikimedia Commons User Kristian Peters



Native

SMALL NITELLA

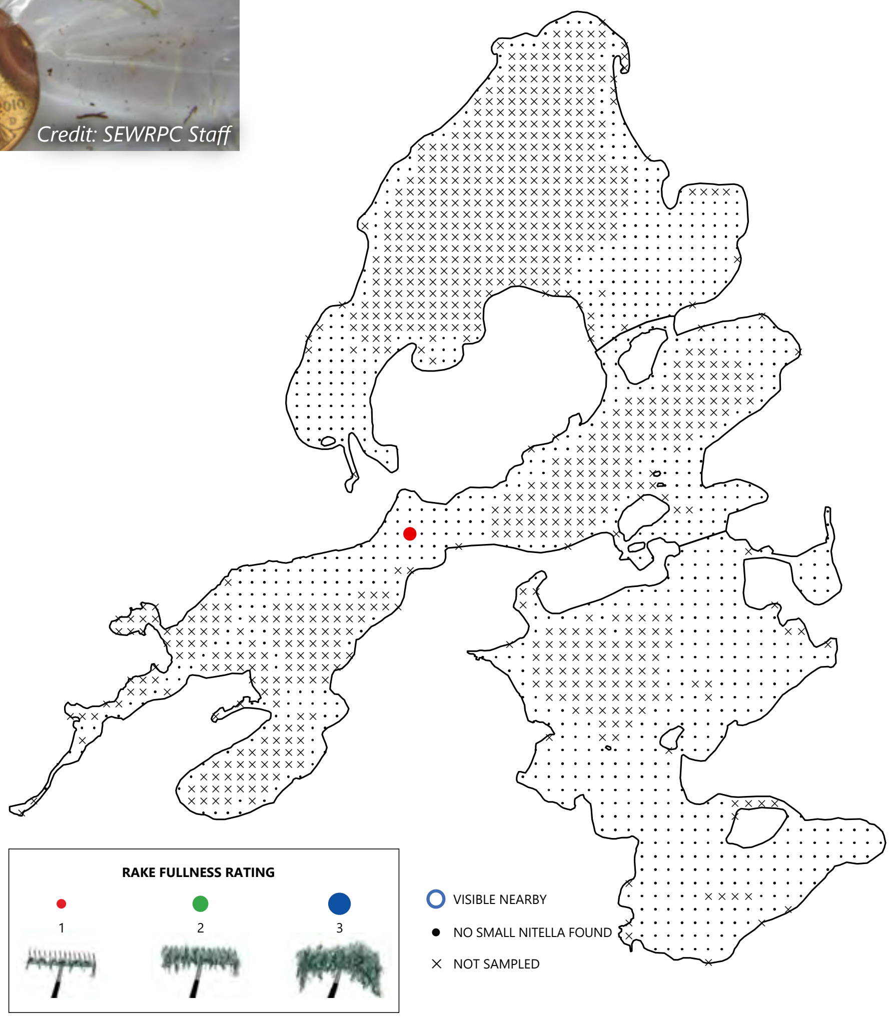
Nitella tenuissima

Identifying Features

- 1-4 inches tall
- Consists of main stem and many tufts or balls of "leaves"
- May be green or encrusted with gray minerals

Ecology

- Occurs in quiet, shallow waters
- Usually not seen until late summer-fall



Native

SPATTERDOCK

Nuphar variegata

Credit: Wikimedia Commons User Cephas

Identifying Features

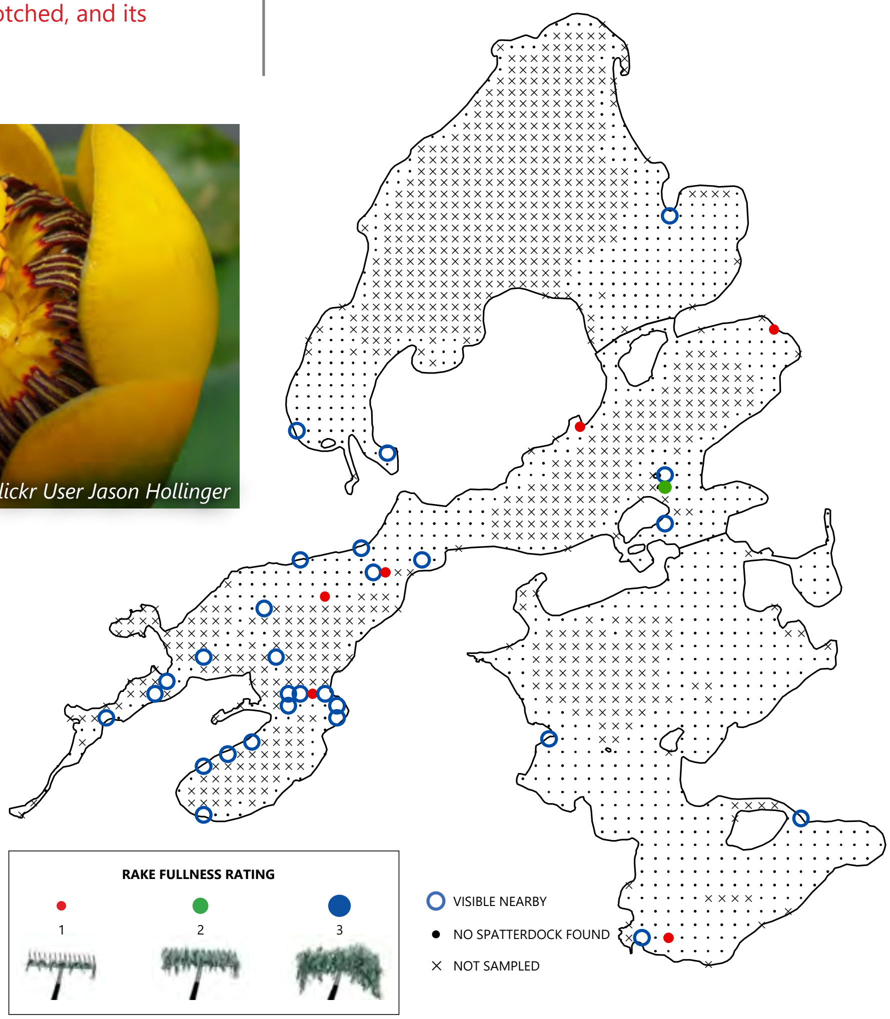
- Leaf stalks winged in cross-section
- Most leaves floating on the water surface, heart-shaped, and notched, with rounded lobes at the base
- Yellow flowers, 2.5 to 5.0 cm wide, often with maroon patches at the bases of the sepals (petal-like structures) when viewed from above

Unlike spatterdock, the similar yellow pond lily (Nuphar advena) has leaf stalks that are not winged in cross-section, leaves that more often emerge above the water surface, and leaf lobes that are more pointed. Spatterdock is superficially similar to water lilies (Nymphea spp.), but it has yellow versus white flowers and leaves somewhat heart-shaped versus round. American lotus (Nelumbo lutea) is also similar, but its leaves are round and un-notched, and its flowers are much larger

Ecology

- In sun or shade and mucky sediments in shallows and along the margins of ponds, lakes, and slow-moving streams
- Overwinters as a perennial rhizome
- Flowers opening during the day, closing at night, and with the odor of fermented fruit
- Buffers shorelines
- Provides food for waterfowl (seeds), deer (leaves and flowers), and muskrat, beaver, and porcupine (rhizomes)
- Habitat for fish and aquatic invertebrates

Credit: Flickr User Jason Hollinger



Native

WHITE WATER LILY

Nymphaea odorata

Credit: Flickr User Ryan Hodnett

Identifying Features

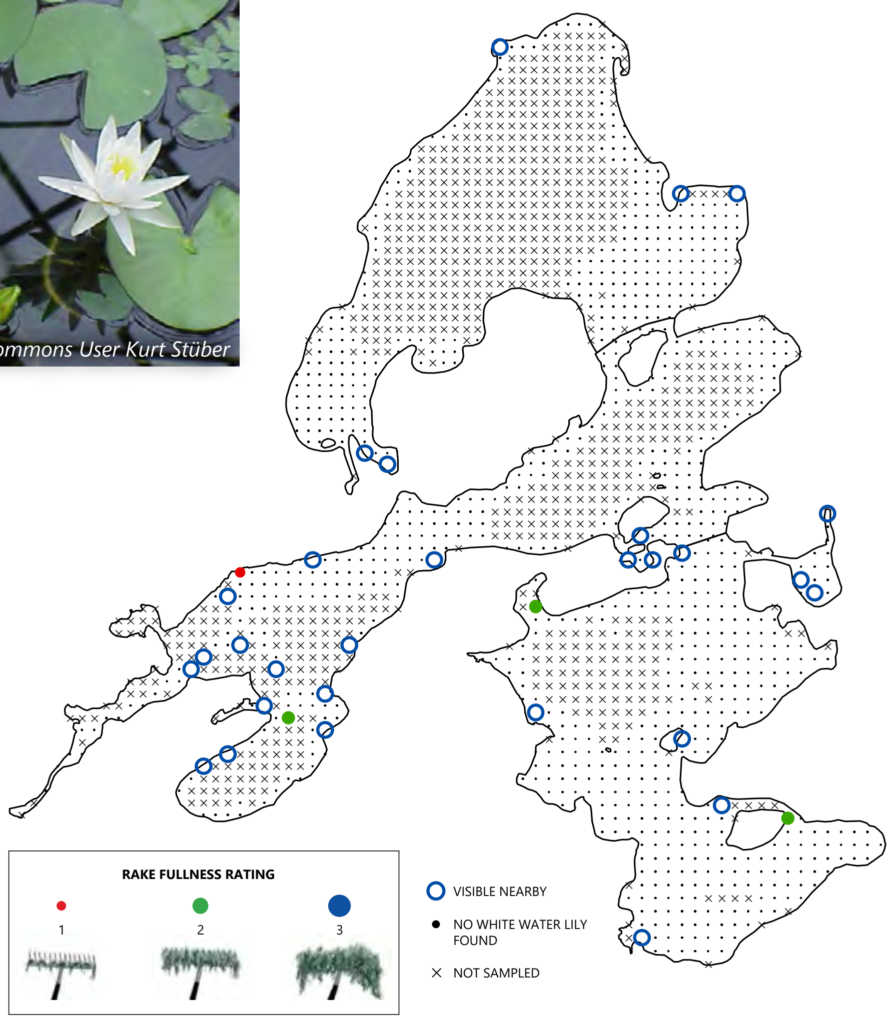
- Leaf stalks round in cross-section with four large air passages
- Floating leaves round (four to 12 inches wide under favorable conditions), *with a notch* from the outside to the center, and reddish-purple underneath
- Flowers white with a yellow center, three to nine inches wide

Pond lilies (*Nuphar* spp.) are superficially similar, but have yellow flowers and leaves somewhat heart-shaped. American lotus (*Nelumbo lutea*) is also similar, but its leaves are unnotched

Ecology

- Found in shallow waters over soft sediments
- Leaves and flowers emerge from rhizomes
- Flowers opening during the day, closing at night
- Seeds consumed by waterfowl, rhizomes consumed by mammals

Credit: Wikimedia Commons User Kurt Stüber



Native

LARGE-LEAF PONDWEED

Potamogeton amplifolious

Credit: Wikimedia Commons User Edward G. Voss

Identifying Features

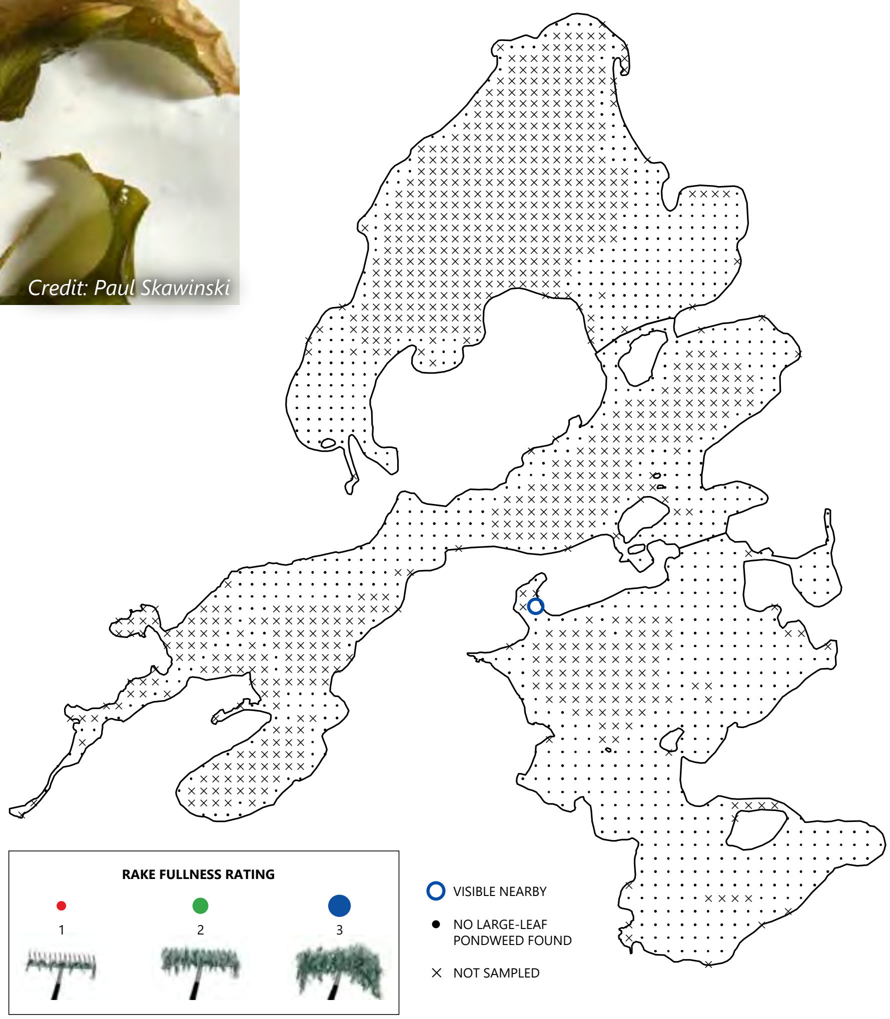
- When produced, floating leaves 2-23 cm long *with 27-49 veins* and petiole longer than leaf blade
- Submersed leaves large and sickle-shaped, 4-7 cm wide, 8-20 cm long, *with more than 19 veins*, and folded upwards along the sides
- White stipules up to 12 cm long

Large-leaf pondweed may be distinguished from Illinois pondweed (*P. illinoensis*) by the greater number of veins on submersed and floating leaves.

Ecology

- Soft substrate, shallow and deep lakes
- Emerges in spring from buds formed along rhizomes
- Provides food for waterfowl, muskrat, beaver, and deer
- Provides habitat and/or food for fish, muskrat, waterfowl, and insects

Credit: Paul Skawinski



Native/ Exotic

CURLY-LEAF PONDWEED

Potamogeton crispus

Credit: Paul Skawinski

Identifying Features

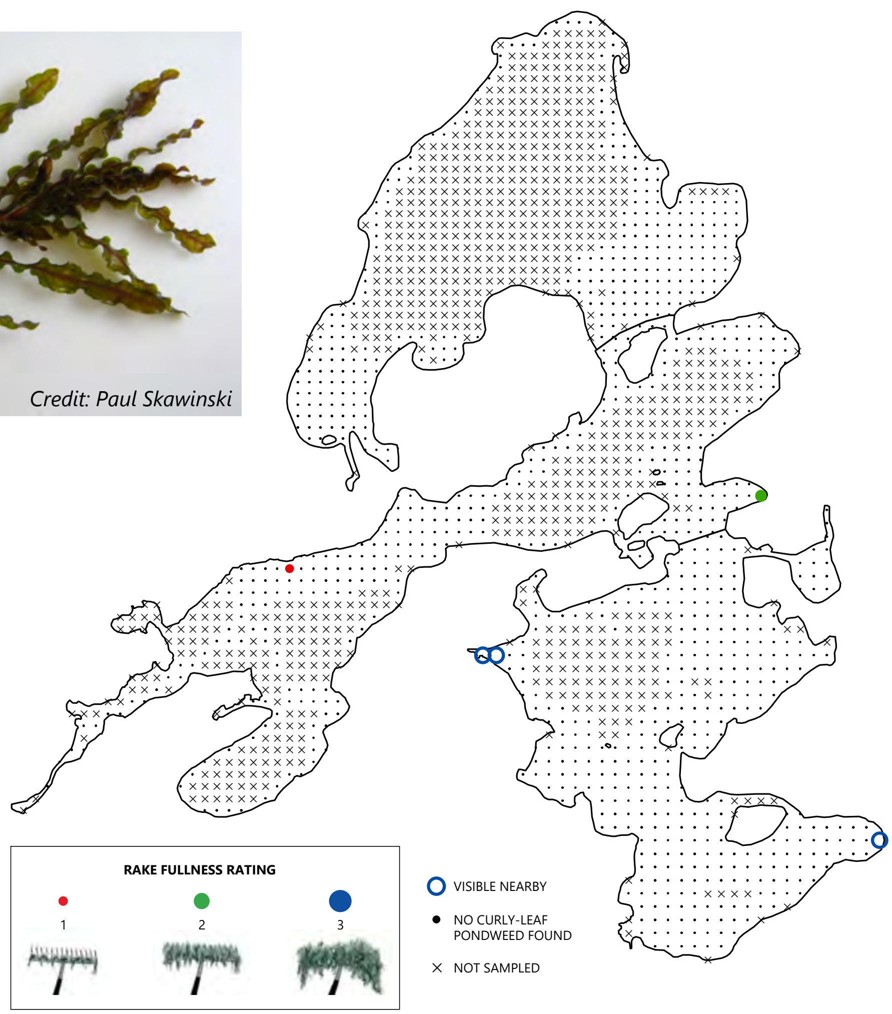
- Stems slightly flattened and both stem and leaf veins often somewhat pink
- Leaf margins very wavy and finely serrated
- Stipules (3.0 to 8.0 mm long) partially attached to leaf bases, disintegrating early in the season
- Produces pine cone-like overwintering buds (turions)

Curly-leaf pondweed may resemble clasping-leaf pondweed (*P. richardsonii*), but the leaf margins of the latter are not serrated

Ecology

- Found in lakes and streams, both shallow and deep
- Tolerant of low light and turbidity
- Disperses mainly by turions
- Adapted to cold water, growing under the ice while other plants are dormant, but dying back during mid-summer in warm waters
- Produces winter habitat, but mid-summer die-offs can degrade water quality and cause algal blooms
- Maintaining or improving water quality can help control this species, because it has a competitive advantage over native species when water clarity is poor

Credit: Paul Skawinski



Native

FRIES' PONDWEED

Potamogeton friesii

Credit: Flickr User Lliam Rooney

Identifying Features

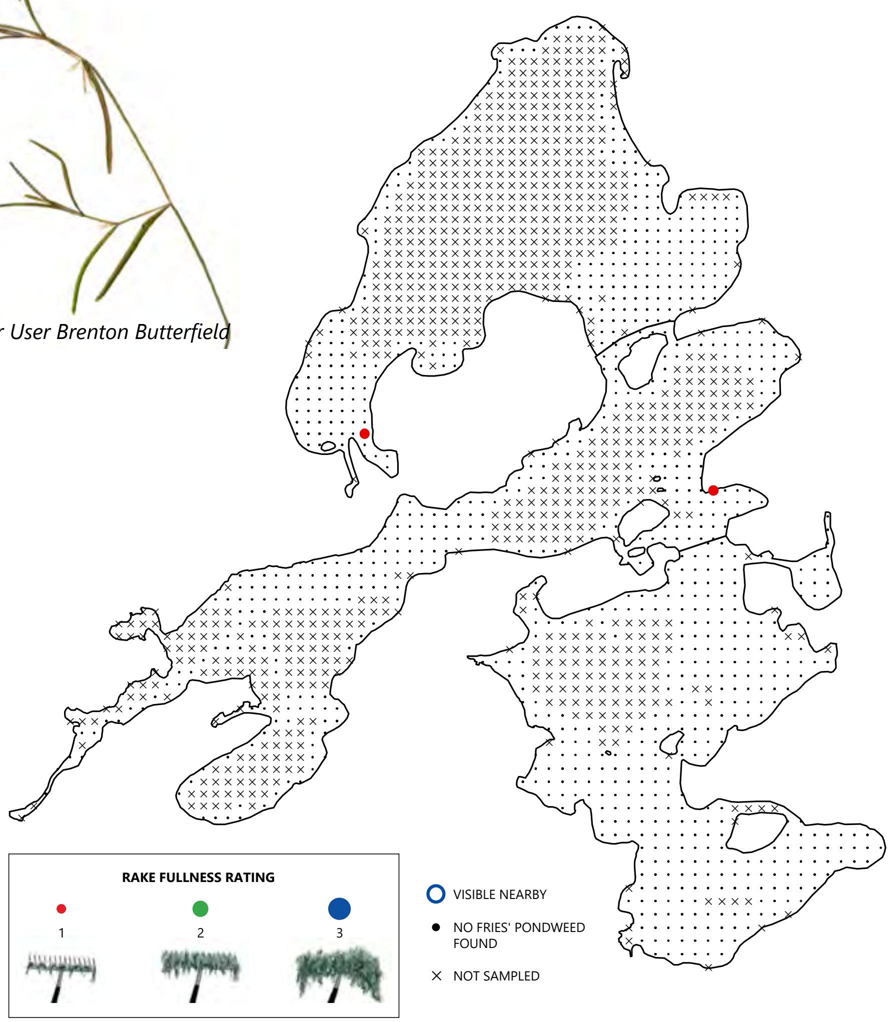
- Slender stems slightly compressed
- Submerged leaves linear with no petiole, one row of lacunar cells on each side of midvein, and 5-7 veins
- Tip of leaf rounded with short bristle
- Winter bud fan shaped and in two planes, with inner leaves at 90 degrees from outer leaves

Fries' pondweed is similar to other narrow-leaved pondweeds such as small pondweed (*P. pusillis*) and stiff pondweed (*P. strictifolius*) but other narrow pondweeds do not create a fan shaped winter bud

Ecology

- Common in calcareous lakes and slow-moving streams
- Overwinters largely as winter buds (turions)
- Provides food for waterfowl,
- Provides habitat for fish and aquatic invertebrates

Credit: Flickr User Brenton Butterfield



Native

VARIABLE PONDWEED

Potamogeton gramineus

Credit: Wikimedia Commons User Tristan He

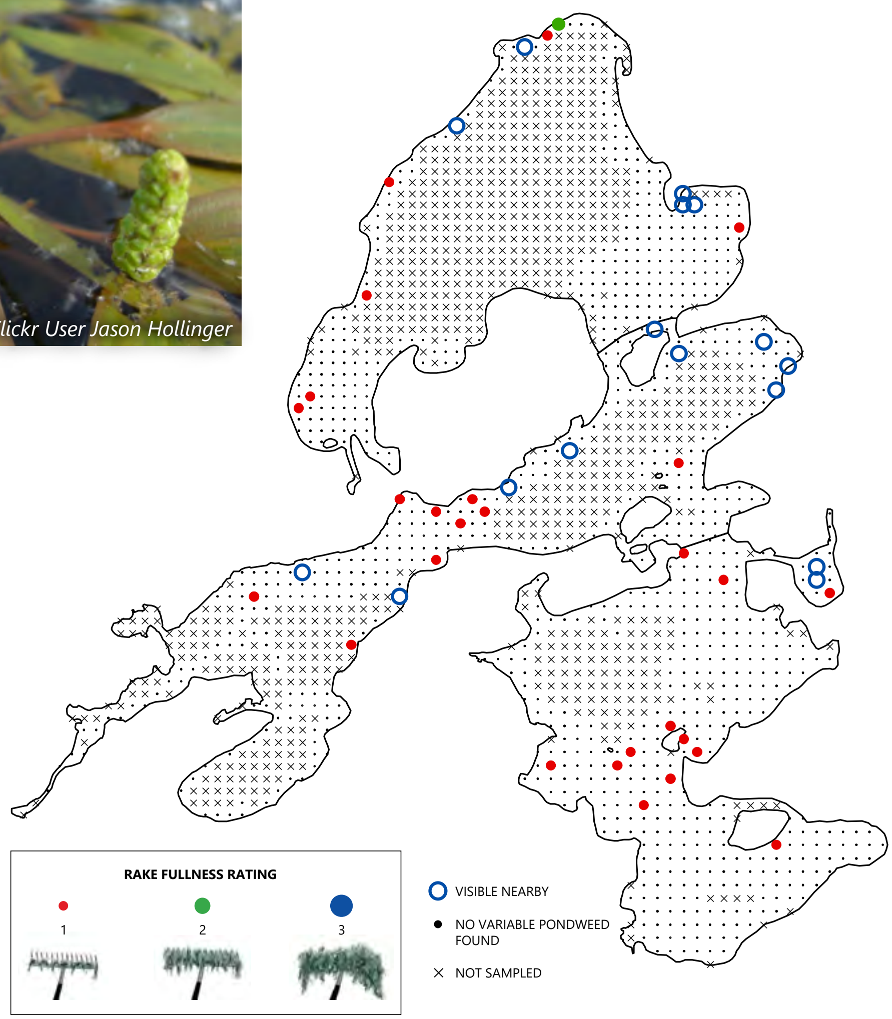
Identifying Features

- Often heavily branched
- Submerged leaves narrow to lance-shaped, with three to seven veins, smooth margins, without stalks, but the blade tapering to the stem
- Floating leaves with 11 to 19 veins and a slender stalk that is usually longer than the blade
- Often covered with calcium carbonate in hard water

Variable pondweed is similar to Illinois pondweed (*P. illinoensis*), but Illinois pondweed has submerged leaves with nine to 19 veins

Ecology

- Shallow to deep water, often with muskgrass, wild celery, and/or slender naiad; requires more natural areas that receive little disturbance
- Overwinters as rhizomes or winter buds (turions)
- Provides food for waterfowl, muskrat, deer, and beaver
- Provides habitat for fish and aquatic invertebrates



Native

FLOATING-LEAF PONDWEED

Potamogeton natans


Credit: Wikimedia Commons User Stefan.lefnaer

Identifying Features

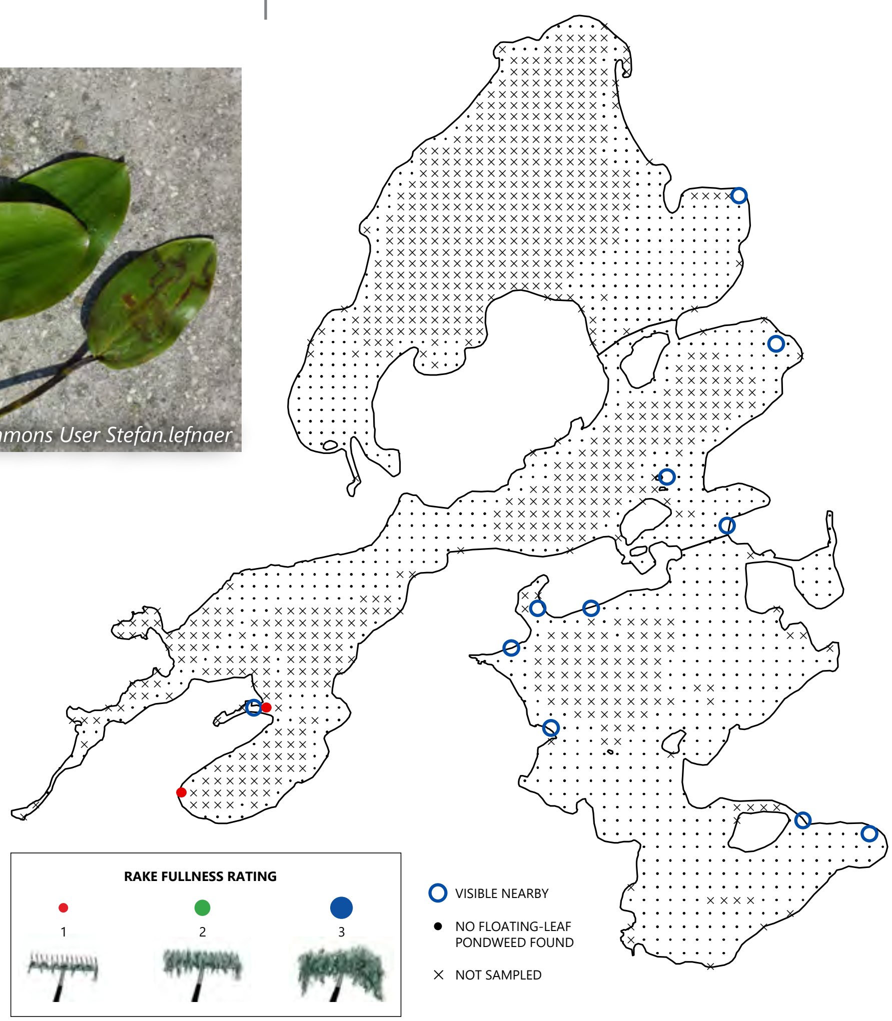
- Floating leaves (5.0 to 10 cm long) with heart-shaped bases and 17 to 37 veins
- Floating leaf stalks bent where they meet the leaf, causing the leaf to be held at roughly a 90-degree angle to the stalk
- Submersed leaves (1.0 to 2.0 mm wide) linear and stalk-like, with three to five veins

Floating-leaf pondweed is similar to Oakes' pondweed (*P. oakesianus*) and spotted pondweed (*P. pulcher*). Oake's pondweed is smaller, with floating leaves 2.5 to 6.0 cm long and submersed leaves 0.25 to 1.0 mm wide. Spotted pondweed differs in having small black spots on its stems and leaf stalks and lance-shaped submersed leaves with wavy margins

Ecology

- Usually in shallow waters (<2.5 m) over soft sediment
- Emerges in spring from buds formed along rhizomes
- Provides food for waterfowl, muskrat, beaver, and deer
- Holds fruit on stalks until late in the growing season, which provides valuable feeding opportunities for waterfowl
- Provides good fish habitat


Credit: Wikimedia Commons User Stefan.lefnaer



Native

WHITE-STEM PONDWEED

Potamogeton praelongus

Credit: Flickr User Bas Kers

Identifying Features

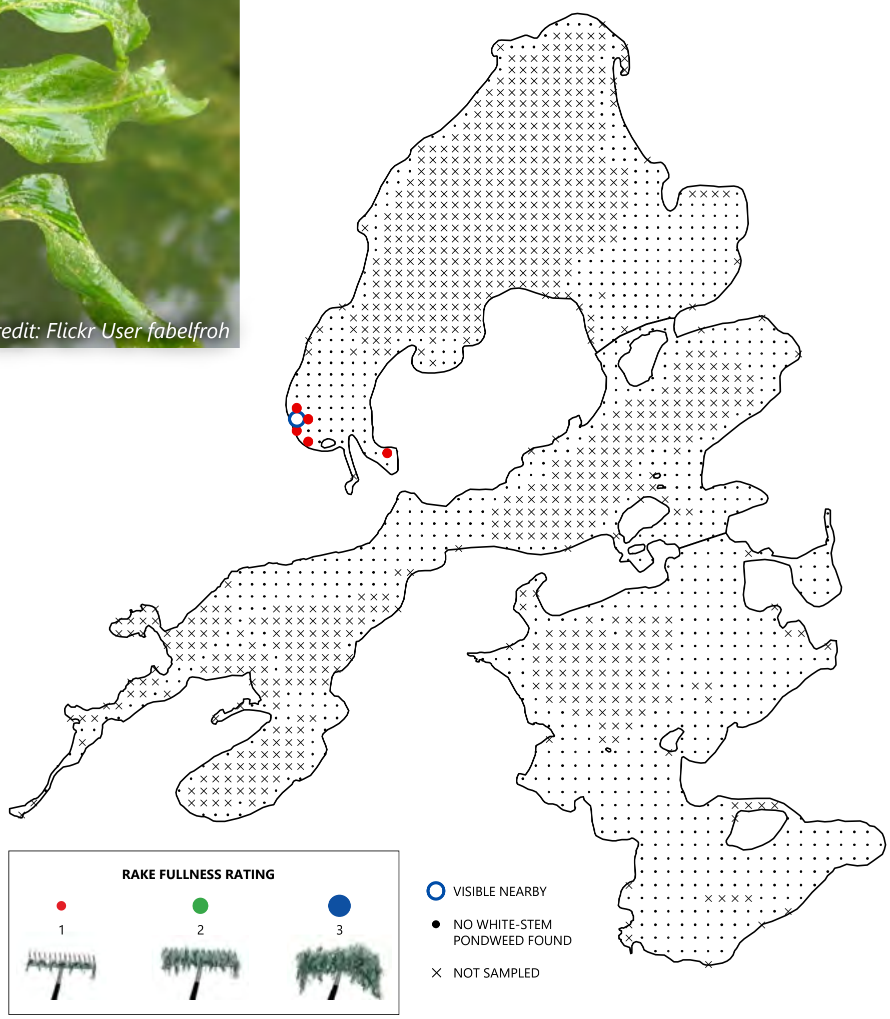
- Stems usually pale and zig-zagging
- Leaves clasping, alternate, with three to five prominent veins and 11 to 35 smaller ones, with boat-shaped tips that often split when pressed between fingers

White-stem pondweed is similar to clasping pondweed (*P. richardsonii*), but the leaves of clasping pondweed do not have boat-shaped tips that split when pressed

Ecology

- Found in clear lakes in water three to 12 feet deep over soft sediments
- "Indicator species" due to its sensitivity to water quality changes; its disappearance indicating degradation; requires more natural areas that receive little disturbance
- Sometimes remains evergreen beneath the ice
- Provides food for waterfowl, muskrat, beaver, and deer
- Provides habitat for trout and muskellunge

Credit: Flickr User fabelfroh



Native

FLAT-STEM PONDWEED

Potamogeton zosteriformis

Credit: Donald Cameron

Identifying Features

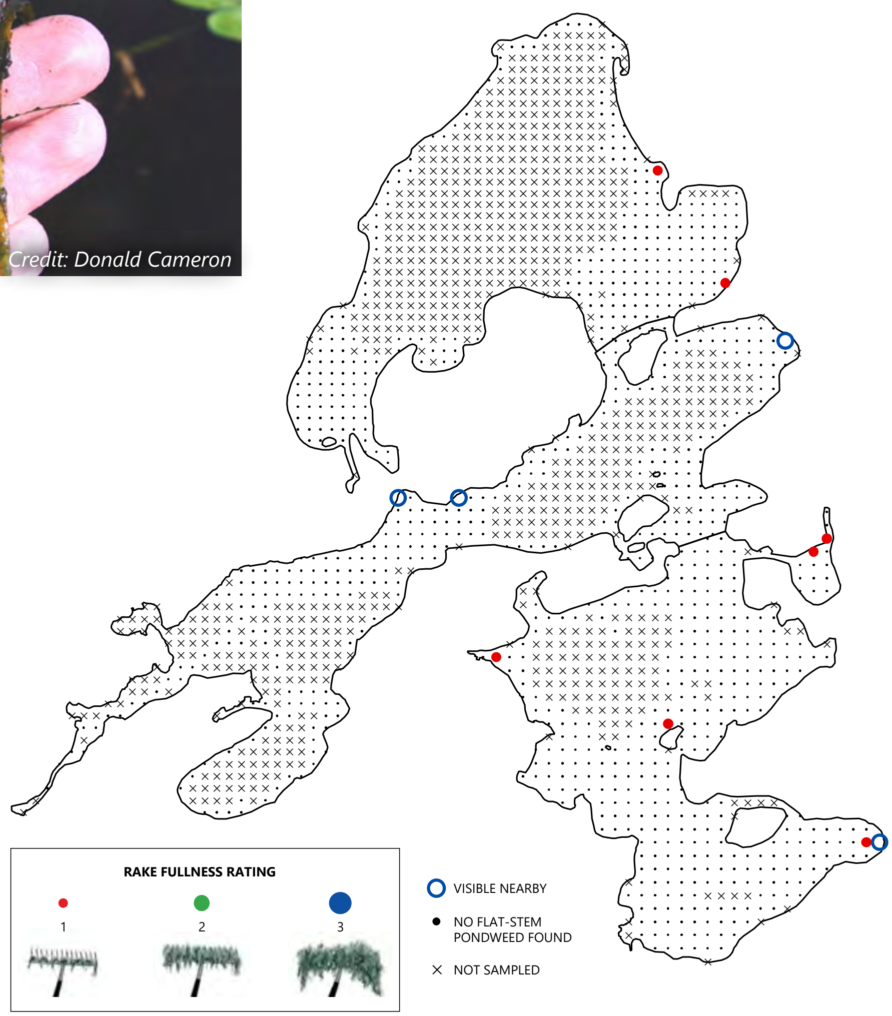
- Stems strongly flattened
- Leaves up to four to eight inches long, pointed, with a prominent midvein and many finer, parallel veins
- Stiff winter buds consisting of tightly packed ascending leaves

Flat-stem pondweed may be confused with yellow stargrass (*Heteranthera dubia*), but the leaves of yellow stargrass lack a prominent midvein.

Ecology

- Found at a variety of depths over soft sediment in lakes and streams
- Overwinters as rhizomes and winter buds
- Has antimicrobial properties
- Provides food for waterfowl, muskrat, beaver, and deer
- Provides cover for fish and aquatic invertebrates

Credit: Donald Cameron



Native

WHITE WATER CROWFOOT

Ranunculus aquatilis

Credit: Wikimedia Commons User Hans Hillewaert

Identifying Features

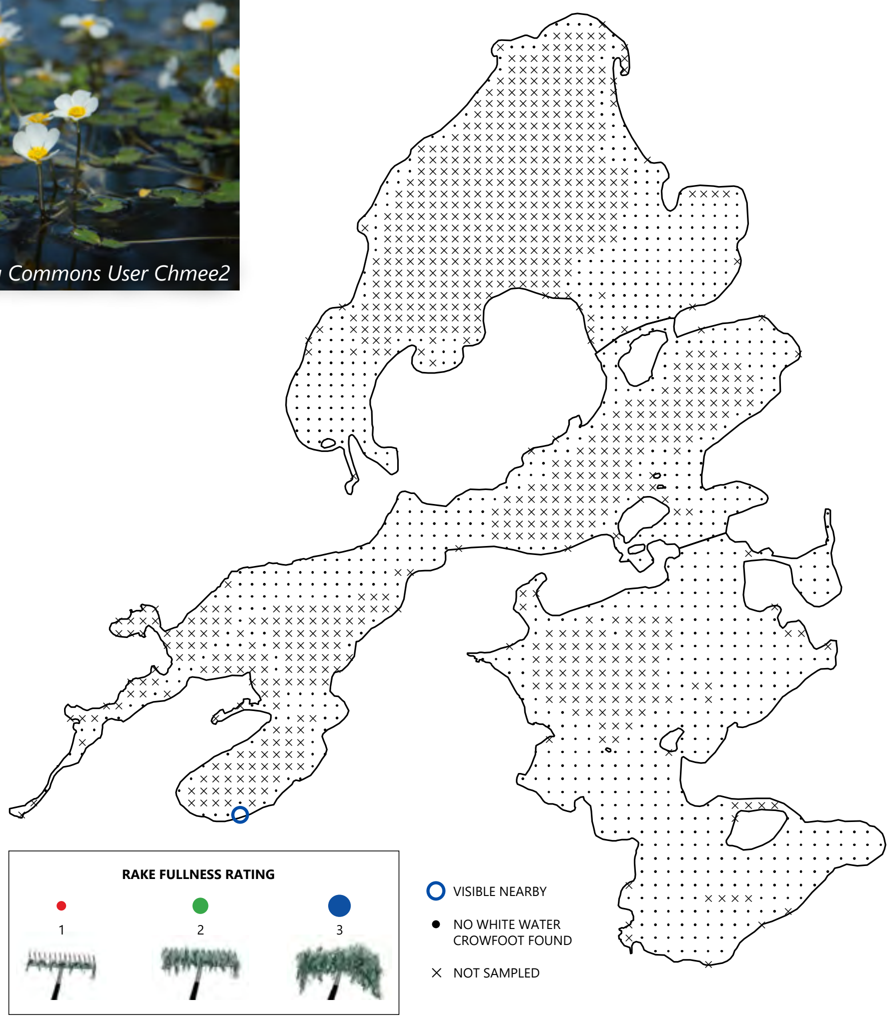
- Submersed leaves finely divided into thread-like sections, and arranged alternately along the stem
- Flowers white, with five petals
- May or may not produce floating leaves

White water crowfoot is similar to other aquatic *Ranunculus* spp. However, the latter have yellow flowers and leaf divisions that are flat, rather than thread-like.

Ecology

- Shallow water in lakes or streams, often with high alkalinity
- Often forms dense patches near springs or sand bars
- Emerges from rhizomes in the spring
- Fruit and foliage consumed by waterfowl and upland birds alike
- Habitat for invertebrates that are food for fish like trout

Credit: Wikimedia Commons User Chmee2



Native

ARUM-LEAVED ARROWHEAD

Sagittaria cuneata

Credit: Flickr User Andrey Zharkikh

Identifying Features

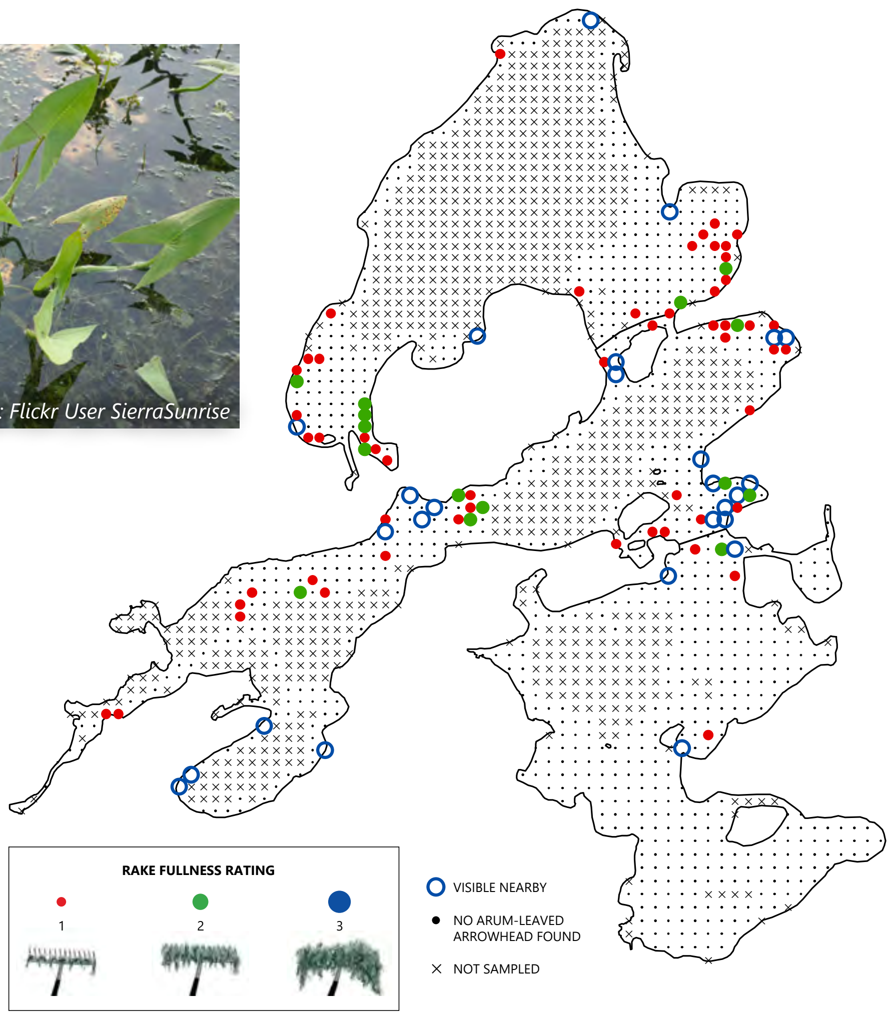
- When not submersed, produces arrow-shaped leaves on recurved (bent backward) petioles
- When submersed, produces long ribbon-like leaves that resemble the leaves of *Vallisneria americana*
- Produces arrow-shaped or elliptic floating leaves on surface of water
- Flowers with three rounded, white petals

Other arrowhead species (*S. latifolia* and *S. brevirostra*) do not produce floating leaves. *Vallisneria americana* has similar ribbon-like leaves but they are flat, not spongy at the base, and have easily visible trasversal veins (short veins perpendicular to the long viens) from bottom to tip of the leaf.

Ecology

- Streams, rivers, ditches, lakes, and streams; usually in shallow water or on wet shores
- Emerges in spring from perennial rhizomes and tubers and reproduces by seed under favorable conditions
- *Among the highest value aquatic plants for wildlife, with high-energy tubers providing important food for mammals and migratory waterfowl (another common name is "duck potato") and leaf canopies providing shade and shelter for small fish*

Credit: Flickr User SierraSunrise



Native

SAGO PONDWEED

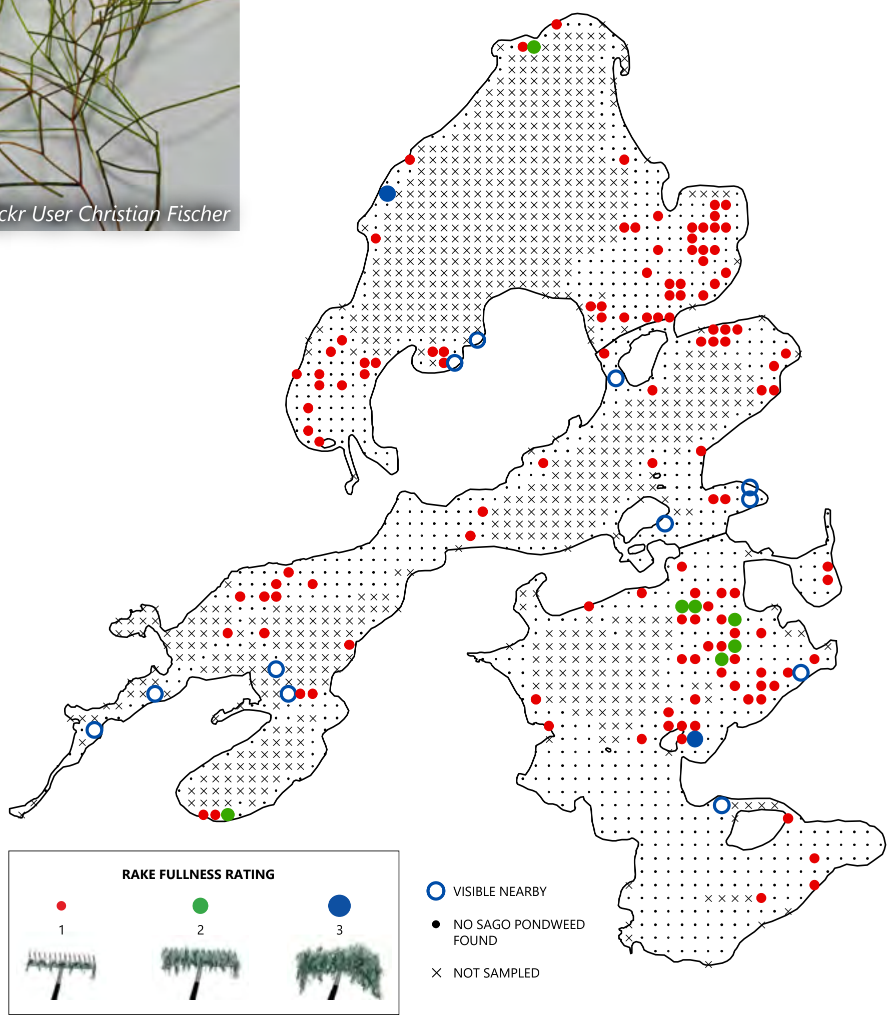
Stuckenia pectinata

Identifying Features

- Stems often *slightly zig-zagged* and forked multiple times, yielding a fan-like form
- Leaves one to four inches long, very thin, and ending in a sharp point
- Whorls of fruits spaced along the stem may appear as beads on a string

Ecology

- Lakes and streams
- Overwinters as rhizomes and starchy tubers
- Tolerates murky water and disturbed conditions
- Provides abundant fruits and tubers, which are an *important food for waterfowl*
- Provides habitat for juvenile fish



Native

COMMON BLADDERWORT
Utricularia vulgaris

Credit: Wikimedia Commons User Leonhard Lenz

Identifying Features

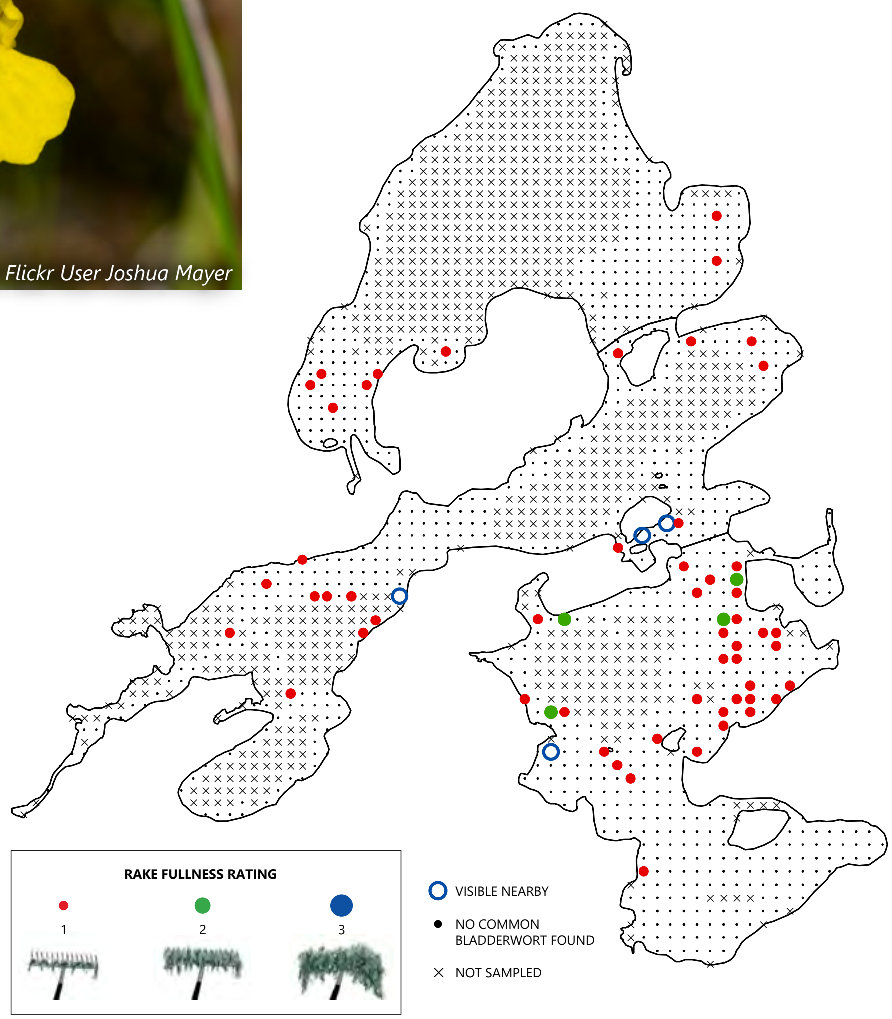
- Flowers snapdragon-like, yellow, held on stalks above the water surface
- *Producing bladders* (small air chambers on the stem) that capture prey and give buoyancy to the stem
- Stems floating (due to air bladders; branches finely divided

Several similar bladderworts occur in southeastern Wisconsin

Ecology

- Most often found in quiet shallows and along shores, but common bladderwort sometimes occurs in water several feet deep
- Provides forage and cover for a wide range of aquatic organisms
- Bladders capture and digest prey, including small invertebrates and protozoans

Credit: Flickr User Joshua Mayer



Native

WATER CELERY OR EELGRASS

Vallisneria americana

Credit: Wikimedia Commons User Fredlyfish4

Identifying Features

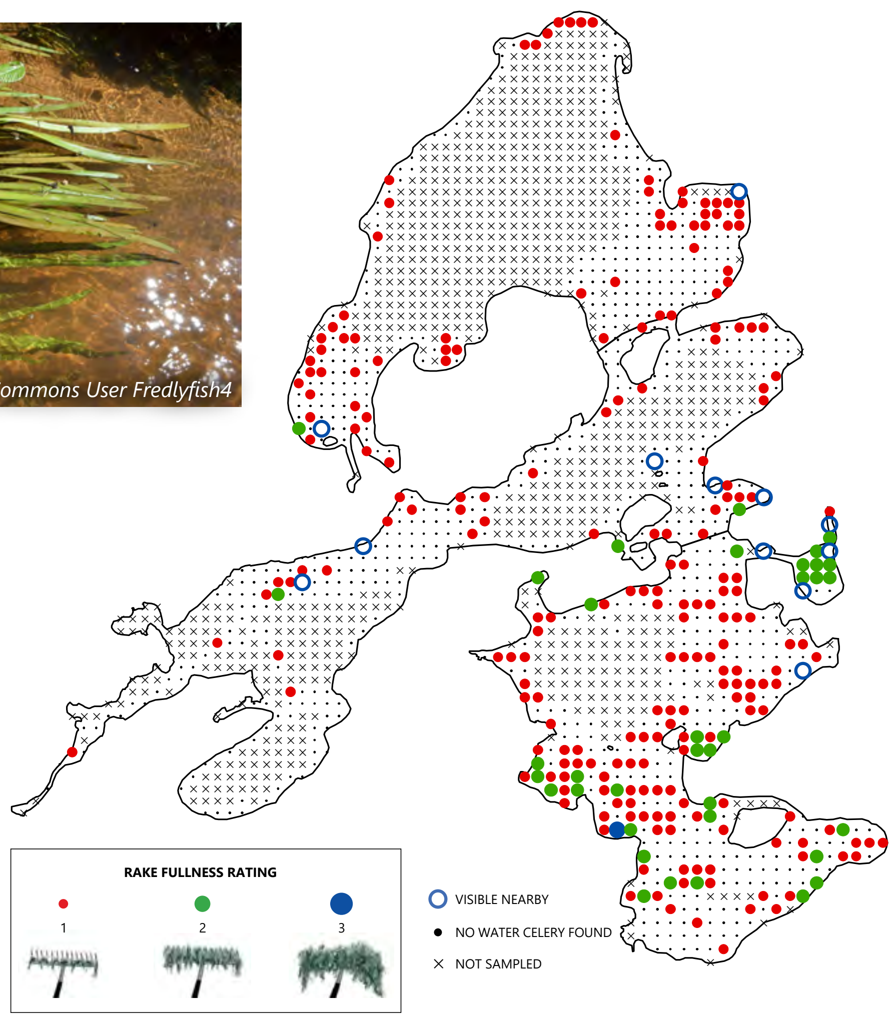
- Leaves ribbon-like, up to two meters long, with a prominent stripe down the middle, and emerging in clusters along creeping rhizomes
- Male and female flowers on separate plants, female flowers raised to the surface on spiral-coiled stalks

The foliage of eelgrass could be confused with the submersed leaves of bur-reeds (*Sparganium* spp.) or arrowheads (*Sagittaria* spp.), but the leaves of eelgrass are distinguished by their prominent middle stripe. The leaves of ribbon-leaf pondweed (*Potamogeton epihydrus*) are also similar to those of eelgrass, but the leaves of the former are alternately arranged along a stem rather than arising from the plant base

Ecology

- Firm substrates, shallow or deep, in lakes and streams
- Spreads by seed, by creeping rhizomes, and by offsets that break off and float to new locations in the fall
- All portions of the plant consumed by waterfowl; an especially important food source for Canvasback ducks
- Provides habitat for invertebrates and fish

Credit: Wikimedia Commons User Fredlyfish4



LAUDERDALE LAKES SENSITIVE AREA REPORT

APPENDIX C

Lauderdale Lakes (Walworth County, Wisconsin)
Integrated Sensitive Area Report

Assessment Dates:	June 14, 1990 - Areas 1-5 July 7 and September 2, 2004 - Areas 6-7
Number of Sensitive Areas Surveyed:	7
Site Evaluators:	1990: Jerry Collins, Water Resources Specialist Doug Welch, Fisheries Biologist Bob Wakeman, Water Resource Manager Mark Anderson, Wildlife Biologist 2004: Pam Schense, Water Resources Specialist Doug Welch, Fisheries Biologist Heidi Bunk, Lakes Biologist Jim Jackley, Wildlife Biologist Dave Heilmeier, Town of LaGrange Scott Mason, Lauderdale Lakes Management District Rick Callaway, Town of LaGrange
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General Lake Information

The Lauderdale Lakes consist of a chain of three lakes - Green, Middle, and Mill Lakes - located in north-central Walworth County (Township 4 North, Range 16 East, Sections 25-26, 34-36 and Township 3 North, Range 16 East, Sections 1-2). The Lakes have a total surface area of 807 acres with maximum depths ranging from 42-55 feet. Middle and Mill Lakes are characterized as drainage lakes, fed primarily by groundwater, precipitation, and runoff. They have no major surface inlets. Green Lake is spring fed. Lake level of the Lauderdale Lakes is controlled by a dam and weir at a single surface-water outlet, Honey Creek.

The Lauderdale Lakes serve as "all sports" lakes, withstanding intense anthropogenic pressure. The shoreline is approximately 70 percent developed, including 1,010 houses. Three public boating access sites are located on the western shores of Green and Middle Lakes and the eastern shore of Mill Lake, meeting the requirement of "adequate public access" defined by NR 1.91(11), Wis. Adm. Code. There are five private recreational facilities offering boating access to the general public (SEWRPC 2001).

The Lakes have multiple recreational uses. These include fishing, water skiing, swimming, and small craft sailing in summer months and ice fishing, cross-country skiing, ice-skating, and hunting during winter. Throughout the year, the Lakes provide natural scenic beauty and opportunities for walking and jogging, bird watching, and picnicking.

Overall, the Lauderdale Lakes have a diverse fish population, including multiple “forage” and “non-game” fish species, and several "game" species. In a 1999 survey, the Wisconsin Department of Natural Resources observed 19 fish species: northern pike, grass pickerel, longnose gar, walleyed pike, largemouth bass, yellow perch, warmouth, bluegill, pumpkinseed, green sunfish, black crappie, rock bass, golden shiner, yellow bullhead, brown bullhead, bowfin, brook silverside, white sucker, and lake chubsucker (Welch 2000).

The lake chubsucker (*Erimyzon sucetta*) is listed as a State **species of special concern** (Lyons et al. 2000). Special Concern species are those in which reduced abundance or distribution is suspected but not yet proven. The main purpose of this category is to focus attention on certain species before they become threatened or endangered. *E. sucetta* relies on dense vegetation for cover throughout its life history. Large and small beds of aquatic moss and filamentous algae are preferred for spawning between late March and early July. Young lake chubsuckers feed on copepods, cladocerans (e.g., *Daphnia*), and midge larvae. Adult lake chubsuckers prey upon these same items, as well as algae, molluscs, and both larval and adult insects. It is a valuable forage fish and fry are a preferred food of largemouth bass (Becker, 1983). In areas where lake chubsucker habitat exists, preservation is highly recommended.

Fish habitat in the Lauderdale Lakes consists mostly of aquatic vegetation. Minimal woody debris, overhanging vegetation, and fallen timber exist along the lakeshore. The lack of natural fish habitat is due to the largely developed shoreline and associated “urbanized lakefront landscapes”. Remaining undeveloped shoreline provides critical habitat for fish, reptiles, amphibians, waterfowl, and small and large mammals.

Prime wildlife habitat exists on the Lauderdale Lakes where shoreline and waterfront areas remain natural or in areas where waterfront owners kept “natural corridors” in place. During urbanization of the Lakes, most developed properties retained some large trees, conserving the canopy. However, these owners also eliminated the sub-canopy and associated shrubbery. The sub-canopy provides important nesting, feeding, and cover habitat for multiple species. Consequently, most wildlife remaining in and around the Lauderdale Lakes are urban-tolerant species. The resident mammal population includes white-tailed deer, muskrats, cottontail rabbits, and some squirrels. Songbirds, wood ducks, mallards, and Canada geese are representative avian species. The remaining undeveloped areas associated with the Lakes provide the only balanced cover for a number of wildlife species.

The Lauderdale Lakes Lake Management District is the primary sponsor for aquatic plant management goals/plans on the lakes, currently controlling nuisance plants by harvesting and chemical treatment. In past aquatic plant studies of the entire Lauderdale Lakes chain, approximately 25 plant species were observed (SEWRPC 2001). In 1990, Department surveyors observed 10 native aquatic plant species in sensitive area 1, 8 native plant species in sensitive area 2, 18 native species in sensitive area 3, 13 native species in sensitive area 4, and 10 native species in sensitive area 5. In the 2004 survey, 10 native species occurred in sensitive area 6 and 12 native species in sensitive area 7. Three exotic species were observed in these sensitive areas. Eurasian watermilfoil (*Myriophyllum spicatum*) was observed in areas 1-6. Curly-leaf pondweed (*Potamogeton crispus*) was observed in sensitive areas 2-6, and purple loosestrife (*Lythrum salicaria*) was observed in sensitive areas 6-7.

Exotic Species

Southeastern Wisconsin lakes have been invaded by aquatic exotic species, most notably zebra mussels, Eurasian watermilfoil, and purple loosestrife. Most exotic species are introduced to a waterbody anthropogenically (e.g., transient boaters). The disturbance of lake substrate from human activity (boating, plant harvesting, chemical treatments, etc.) plays a significant role in the colonization and/or expansion of exotic species, particularly exotic plants.

Eurasian watermilfoil has established itself as one of the most common and abundant plants in the Lauderdale Lakes. It occurred in all but one of the sensitive areas. Eurasian watermilfoil is one of eight milfoil species currently found in Wisconsin. It is often misidentified as one of its seven native cousins, and vice versa. In many areas within the Lakes, this non-native milfoil has established large monocultures and out competed many native plants. These dense beds of milfoil not only impede the growth of native plant species but also inhibit fish movement and create navigational problems for boaters.

The regenerative ability of Eurasian milfoil is yet another obstacle when attempting to control this species. Fragments of Eurasian watermilfoil detached by harvesting, boating, and other recreational activities can float to non-colonized areas of the lake or downstream to additional lakes in the drainage system and create new colonies. Therefore, when controlling Eurasian watermilfoil, selective chemicals and harvesting, coupled with skimming, often produces the best results. In some lakes, biological agents such as the milfoil weevil have helped suppress milfoil populations. However, the most effective "treatment" of exotic milfoil is <u>prevention</u> through public education.

Curly-leaf pondweed is another submerged, exotic species found in the Lauderdale Lakes. Like Eurasian watermilfoil, curly-leaf grows into large, homogenous stands. It also crowds out native vegetation, creates navigational problems, and limits fish movement. Also, a unique life history characteristic of curly-leaf pondweed is that the plant dies off in mid-summer, increasing nutrient availability in the water column. This often contributes to summer algal blooms and decreasing water quality.

The unusual life cycle of curly-leaf pondweed makes management difficult. The plant germinates as temperatures decrease in Fall. Curly-leaf is highly tolerant of cold temperatures and reduced sunlight, continuing to grow under lake ice and snow cover. With ice-off and increasing water temperatures in the spring, the plant produces fruit, flowers, and buds (turions). Turions are the main reproductive mechanism of curly-leaf. To control the species in lakes, the plant must be combated before turions become viable. Most plant harvesters have not started cutting when curly-leaf is most susceptible and a small window of opportunity exists for chemical treatment. Therefore, prevention through public education is once again very important.

Purple loosestrife, a hardy perennial native to Europe, was desirable primarily as an ornamental plant but also marketed for bee keeping. It was transported in soil used as ballast during shipping. Since its introduction to North America in the early 1800s, purple loosestrife has become common in gardens and wetlands, and around lakes, rivers, and roadways. The species is highly invasive and thrives in disturbed areas. Monotypic stands of purple loosestrife out compete native plants, resulting in the destruction of food, cover, and nesting sites for wildlife and fish.

Purple loosestrife most often spreads when seeds adhere to animals. Humans should be aware of picking up seeds on clothing and equipment when in the vicinity of the plant. Loosestrife can be controlled manually, biologically, or with a broad-leaf herbicide. Young plants can be pulled, but adult plants have large root structures and must be excavated with a garden fork. Biological control is most effective on large stands of purple loosestrife. Five different insects are known to feed on this plant. Four of those have been used as control agents in the United States. Of the five species, *Galerucella pusilla* and *G. calmariensis* are leaf-eating beetles; *Nanophyes brevis* and *N. marmoratus* are flower-eating beetles; and *Hylobius trasversovittatus* is a root-boring weevil. Only *N. brevis* has not been released in the United States (WDNR 2003). Lastly and most importantly, prevention through public education plays an important role in the management of this species.

Shoreland Management

Wisconsin's Shoreland Management Program, a partnership between state and local governments, works to protect clean water, habitat for fish and wildlife, and natural scenic beauty. The program establishes minimum standards for lot sizes, structural setbacks, shoreland buffers, vegetation removal, and other activities within the shoreland zone. The shoreland zone includes land within 1000 feet of lakes, 300 feet of rivers, and floodplains. Current research shows that present standards are probably inadequate for the protection of water resources (Woodford and Meyer 2003, Garn 2002). Therefore, many communities have chosen to go beyond minimum standards to ensure protection of our natural resources. This report provides management guidelines for activities within the lake and in the immediate shoreland areas. Before any recommendations in this report are completed, please check with the Department of Natural Resources and local units of government for required approvals.

A vital step in protecting our water resources is to maintain effective vegetative buffers. A shoreland buffer should extend from the water onto the land at least 35 to 50 feet. Studies have shown that buffers less than 35 feet are not effective in reducing nutrient loading. Wider buffers of 50 feet or more can help provide important wildlife habitat for songbirds, turtles, frogs, and other animals, as well as filter pollutants from runoff. In general, no mowing should occur in the buffer area, except perhaps in a viewing access corridor. The plant composition of a buffer should match the flora found in natural Wisconsin lakeshores. A buffer should include three layers - herbaceous, shrub, and tree.

In addition, the reader also should investigate other innovative ways to reduce the impacts of runoff flowing into the lake while improving critical shoreline habitat (see A. Greene 2003). This may include the use of phosphorus-free fertilizers, installing rain gardens, setting the lawnmower at a higher mower height, decreasing the area of impervious surfaces, or restoring aquatic plant communities.

Introduction

Department personnel conducted Lauderdale Lakes sensitive area designation surveys on June 14, 1990 and July 7 and September 2, 2004, following the Wisconsin Department of Natural Resources' sensitive area survey protocol. This study utilized an integrated team of DNR resource managers with input from multiple disciplines: water regulation, water chemistry, fisheries, lake biology, and wildlife.

Sensitive areas are defined in Wisconsin Administrative Code NR 107.05 (3)(i)(1) as *areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or life stage requirements, or offering water quality or erosion control benefits to the body of water*. Department resource managers determined that five areas met this definition in 1990. Two additional areas were added in 2004 (Fig. 1). Their recommendations on future management of these areas are included below.

The companion document, *Guidelines for Protecting, Maintaining, and Understanding Lake Sensitive Areas*, provides additional information to help interpret lake sensitive area reports. This document is designed to help people understand the important factors that determine the health of a lake's ecosystem. It discusses aquatic plant sensitive areas, shoreland use and lakeshore buffers, gravel and coarse rock rubble habitat, large woody cover, and various water regulation and zoning issues.

Overview of Sensitive Area Designations

Sensitive areas often have aquatic or wetland vegetation, terrestrial vegetation, gravel or rubble lake substrate, or areas that contain large woody cover (fallen trees or logs). These areas provide water quality benefits to the lake, reduce shoreline erosion, and provide habitat necessary for seasonal and/or life stage requirements of fish, invertebrates, and wildlife. A designated sensitive area alerts interested parties (i.e., DNR personnel, county zoning personnel, lake associations, etc.) that the area contains critical habitat vital to sustaining a healthy lake ecosystem or may feature an endangered plant or animal. Information presented in a sensitive area report may discourage certain permits from being approved within these sites.

Whole Lake Recommendations:

Several recommendations from Department staff pertain to the Lauderdale Lakes chain as a whole rather than to individual sensitive areas:

1. The aquatic plant community in the Lauderdale Lakes is not highly diverse outside of the sensitive areas. Native aquatic plant beds should be protected and maintained.
2. Prevent the spread of exotic species through sign postings, education, etc. and control exotic species where established.
3. Comply with State and Local Shoreland Zoning standards by maintaining no-cut buffers and setbacks, removing non-conforming structures, and limiting impervious surfaces.
4. Create shoreland buffers and maintain existing buffers, especially in areas not currently developed.
5. Monitor water quality for early detection of changes and possible degradation.

Resource Value of Sensitive Area Site 1 – Lauderdale Lakes

Sensitive area 1 is located on the southwest end of Green Lake and is unique to the Lauderdale Lakes (Fig. 2). Water lilies in the bay may shade out Eurasian watermilfoil. Eurasian watermilfoil only is present on the outer edge of the bay. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes. The substrate in the bay is muck. This area has not been the target of plant control activities.

The bay acts as a sediment and nutrient trap for the lake, enhancing water quality. Aquatic vegetation (Table 1) helps control shoreline erosion. It also provides northern pike, largemouth bass, bluegill, and forage fish (suckers and minnows) with spawning, nursery, and foraging habitat (Table 2).

The extensive development of the Lauderdale Lakes area has reduced available wildlife habitat. However, ducks, herons, bittern, songbirds, muskrat, and opossum inhabit this portion of the lake the majority of the year.

Table 1. Plants observed in sensitive area 1.

	Emergent	Submergent	Free-floating	Exotic
PRESENT (0-25% Cover)	*Typha* (cattail) *Scirpus* (bulrush) *Carex* (sedges)	*Utricularia* (bladderwort) *Ceratophyllum* (coontail) *Stuckenia pectinata* (sago pondweed) *P. praelongus* (white-stemmed pondweed)	*Nymphaea odorata* (white water lily) *Nuphar advena* (yellow water lily) *Lemna* (duckweed)	*Myriophyllum spicatum* (Eurasian watermilfoil)
COMMON (26-50% Cover)				
ABUNDANT (51-75% Cover)				
DOMINANT (76-100% Cover)				

Table 2. Sensitive area 1 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

Fish Species	Spawning	Nursery	Feeding	Protective Cover
Northern Pike	cattail	cattail, water lily, coontail, milfoil, sago	water lily, coontail, milfoil, sago	water lily, coontail, milfoil, sago
Largemouth Bass	coontail, milfoil	cattail, water lily, coontail, milfoil, sago	water lily, coontail, milfoil, sago	water lily, coontail, milfoil, sago
Rock Bass	coarse sand or gravel	cattail, water lily, coontail, milfoil, sago	sago, milfoil	sago, milfoil
Bluegill and Pumpkinseed	sand/gravel	cattail, water lily, coontail, milfoil, sago, clasping leaf	water lily, coontail, milfoil, sago, clasping leaf	water lily, coontail, milfoil, sago, clasping leaf
Black Crappie	fine gravel and sand	water lily, coontail, milfoil, sago	sago, milfoil	sago, milfoil
Yellow Perch	cattail, coontail, milfoil, sago	water lily, coontail, milfoil, sago	sago, milfoil	sago, milfoil

* Shaded rows identify fish species found in the Lauderdale Lakes but not specifically observed in this SA.

Management Recommendations for Sensitive Area #1

1. No chemical treatment will be permitted.

2. Mechanical control allowed with the following condition:
   Restrict harvesting to a 25-foot wide navigational channel from the boat launch to open water.

3. None of the following in-lake activities allowed:
   Filling
   Aquatic plant screens
   Wetland alterations
   Boardwalks
   Pea gravel/sand blankets

4. The following in-lake activities may allowed with conditions:
   Dredging only in navigational channel from boat launch.

5. Strictly enforce shoreland and wetland ordinances.

6. Efforts should be undertaken to create and enforce ordinances, and educate developers on preventing erosion. A "No-Wake Zone" should be implemented.

Resource Value of Sensitive Area Site 2 – Lauderdale Lakes

Sensitive area 2 consists of a small bay on the north shore of Middle Lake that is dominated by *Decodon* (water willow) (Fig. 3). Its quiet water and proximity to upland areas are important to the Lakes. *Decodon* acts as a buffer for runoff entering the bay. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The bay acts as a sediment and nutrient trap for the lake, enhancing water quality. The substrate is primarily silt and muck in open water areas. Aquatic vegetation helps control shoreline erosion (Table 3). It also provides northern pike, largemouth bass, and bluegill with spawning, nursery, and foraging habitat (Table 4). The bay is often not navigable by boat.

This area is not critical to fisheries in the Lakes. It is extremely important to wildlife. The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, herons, bittern, songbirds, muskrat, and opossum inhabit this portion of the lake during the majority of the year. The upland woods located west of the bay are valuable to migratory songbirds.

Table 3. Plants observed in sensitive area 2.

	Emergent	Submergent	Exotic	Algae
PRESENT (0-25% Cover)		*Vallisneria* (wild celery) *P. praelongus* (white-stemmed pondweed) *P. zosteriformis* (flat-stemmed pondweed) *Elodea* (waterweed)	*Myriophyllum spicatum* (Eurasian watermilfoil) *P. crispus* (curly-leaf pondweed)	filamentous algae
COMMON (26-50% Cover)		**Submergents** *Chara* (muskgrass)	**Free-floating** *Nuphar* (yellow water lily)	
ABUNDANT (51-75% Cover)				
DOMINANT (76-100% Cover)	*Decodon* (water willow)			

Table 4. Sensitive area 2 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

Fish Species	Spawning	Nursery	Feeding	Protective Cover
Northern Pike	*Chara*	water lily, *Chara*, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds
Largemouth Bass	milfoil	water lily, *Chara*, wild celery, milfoil	water lily, wild celery, milfoil	water lily, wild celery, milfoil
Rock Bass		water lily, *Chara*, wild celery, milfoil	milfoil	milfoil
Bluegill and Pumpkinseed		water lily, *Chara*, wild celery, milfoil	water lily, wild celery, milfoil	water lily, wild celery, milfoil
Black Crappie	*Chara*	water lily, *Chara*, wild celery, milfoil	milfoil	milfoil
Yellow Perch	milfoil	water lily, *Chara*, wild celery, milfoil	milfoil	milfoil

Management Recommendations for Sensitive Area # 2

1. No chemical treatment will be permitted.

2. No mechanical harvesting will be permitted.

3. None of the following in-lake activities allowed:

Filling	Pea Gravel/Sand Blankets
Aquatic plant screens	Dredging
Wetland alterations	Boardwalks

4. Strictly enforce shoreland and wetland ordinances.

5. Efforts should be undertaken to create and enforce ordinances, and educate developers on preventing erosion.

Resource Value of Sensitive Area Site 3 – Lauderdale Lakes

This is the largest of the sensitive areas on the Lakes, consisting of the western third of Middle Lake (Fig. 4). The area contains the greatest diversity of emergent, submergent, and floating plants within the Lakes, including wild rice. Water lilies, logs, stumps, and vegetation provide cover for fish. The abundance and diversity of native pondweed species (*Potamogeton* spp.) provide essential cover for a variety of fish species. This is excellent spawning and nursery habitat for largemouth bass, bluegill, and pumpkinseed. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The area acts as a sediment and nutrient trap for the lake, enhancing water quality. The substrate is sand, silt, and muck. The area is unique because it contains valuable spawning habitat for sunfish. Aquatic vegetation (Table 5) also provides northern pike, largemouth bass, bluegill, and forage fish with spawning, nursery, and foraging habitat (Table 6).

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, ducks, geese, herons, bittern, songbirds, muskrat, and opossum inhabit this portion of the lake during certain periods of the year. The boundaries of this sensitive area expanded between the study conducted in 1990 and the study conducted in 2004. The wild rice bed expanded to the north and the east. This change will affect 13 riparian landowners.

Table 5. Plants observed in sensitive area 3.

	Emergents	Submergents	Free-floating	Algae
PRESENT (0-25% Cover)	*Decodon* (water-willow) *Typha* (cattail) *Scirpus* (bulrush) *Carex* (sedges)	*Myriophyllum sibiricum* (northern watermilfoil) *Elodea* (waterweed), *Najas flexilis* (slender naiad) *Chara* (muskgrass) *Vallisneria* (wild celery) *Utricularia* (bladderwort)	*P. natans* (floating-leaf pondweed) *Nuphar advena* (yellow water lily) *Nymphaea* (white water lily) **Exotics** *Myriophyllum spicatum* (Eurasian watermilfoil) *P. crispus* (curly-leaf pondweed)	filamentous algae
COMMON (26-50% Cover)		*P. zosteriformis* (flat-stemmed pondweed) *Stuckenia pectinata* (sago pondweed) *P. illinoensis* (Illinois pondweed)		
ABUNDANT (51-75% Cover)	*Zizania* (wild rice)			
DOMINANT (76-100% Cover)				

Table 6: Sensitive area 3 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

Fish Species	Spawning	Nursery	Feeding	Protective Cover
Northern Pike	*Chara*	*Chara*, water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds
Largemouth Bass	milfoil sand	water lily, *Chara*, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds, woody debris	water lily, wild celery, milfoil, pondweeds, woody debris
Rock Bass		water lily, *Chara*, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil
Bluegill and Pumpkinseed	sand	water lily, *Chara*, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds
Black Crappie	*Chara* sand	water lily, *Chara*, wild celery, milfoil, pondweeds	pondweeds, milfoil, woody debris	pondweeds, milfoil, woody debris
Yellow Perch	woody debris, milfoil, pondweeds	water lily, *Chara*, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil

Management Recommendations for Sensitive Area # 3

1. Chemical treatment is not permitted except to target an infestation of an exotic species such as purple loosestrife, Eurasian water milfoil or curly leaf pondweed.

2. Restrict mechanical harvesting to a navigational channel along the developed shoreline but only after spawning activities have finished.

3. A DNR permit should not be issued for any of the following:
   - Filling
   - Aquatic plant screens
   - Dredging along the undeveloped area
   - Wetland dredging, filling or cutting
   - Boardwalks

4. The following in-lake activities may be allowed with conditions:
   - Dredging a navigational channel along the currently developed shoreline
   - Pea gravel/sand blankets along the currently developed shoreline

5. Maintain the "No-Wake Zone".

6. Recommendations regarding **local zoning** along the currently <u>undeveloped</u> shoreline:
    - Strictly enforce shoreland and wetland ordinances
    - Restrict/limit subdivision of existing undeveloped parcels
    - Require a buffer/"no touch" zone for grading projects. This buffer/"no touch" zone should be at least 200 feet from the edge of the wetland back into the (landward) upland portion of parcels.
    - Require a buffer/"no touch" zone for grading projects located along steep slopes. The zone should extend at least 200 feet from the edge of a steep slope towards the landward side of the parcel.
    - Grading proposals should be strictly examined for superior erosion control and nutrient management plans.

Resource Value of Sensitive Area Site 4 – Lauderdale Lakes

This is a shallow (<5 feet) area adjacent to a wetland on the southwestern shore of Mill Lake (Fig. 5). Large-leaf pondweed is abundant here. The aquatic plant community is not unusually valuable, except for the large-leaf pondweed (Table. 7). However, the proximity of aquatic plants to the wetland improves the overall value of this area. See Appendix 1 for a complete list of aquatic plants found in the sensitive areas of the Lauderdale Lakes.

Northern pike use the area for spawning, while the large amount of cover provides shelter for waterfowl. Aquatic vegetation provides northern pike, largemouth bass, bluegill, and forage fish with spawning, nursery, and foraging habitat (Table 8).

The wetland provides a buffer for runoff entering the lake. It traps sediment and nutrients, enhancing water quality. Aquatic vegetation helps control shoreline erosion.

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, this area is locally important as fish and wildlife habitat. Herons, bittern, songbirds, muskrat, and opossum inhabit this portion Mill Lake during the majority of the year.

Table 7. Plants observed in sensitive area 4.

	Emergents	**Submergents**	**Free-floating**
PRESENT (0-25% Cover)	*Decodon* (water-willow) *Typha* (cattail) *Scirpus* (bulrush) *Carex* (sedges)	*Elodea* (waterweed), *Najas flexilis* (slender naiad) *Chara* (muskgrass) *Vallisneria* (wild celery) *P. zosteriformis* (flat-stemmed pondweed) *P. illinoensis* (Illinois pondweed)	*Nuphar advena* (yellow water lily) *Nymphaea* (white water lily) **Exotics** *Myriophyllum spicatum* (Eurasian watermilfoil) *P. crispus* (curly-leaf pondweed)
COMMON (26-50% Cover)			
ABUNDANT (51-75% Cover)		*P. amplifolius* (large-leaf pondweed)	
DOMINANT (76-100% Cover)			

Table 8: Sensitive area 4 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

Fish Species	Spawning	Nursery	Feeding	Protective Cover
Northern Pike	*Chara*	*Chara*, water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds
Largemouth Bass	milfoil	water lily, *Chara*, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds
Rock Bass		water lily, *Chara*, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil
Bluegill and Pumpkinseed		water lily, *Chara*, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds
Black Crappie	*Chara*	water lily, *Chara*, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil, woody debris
Yellow Perch	milfoil, pondweeds	water lily, *Chara*, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil

Management Recommendations for Sensitive Area # 4

1. No chemical treatment permitted.

2. Restrict mechanical harvesting to a navigational channel extending from piers.

3. None of the following in-lake activities allowed:
   Filling
   Aquatic plant screens
   Wetland alterations
   Boardwalks
   Dredging
   Pea gravel/sand blankets

4. Strictly enforce shoreland and wetland ordinances.

5. Efforts should be undertaken to create and enforce ordinances, and educate developers on preventing erosion. A “No-Wake Zone” should be implemented.

Resource Value of Sensitive Area Site 5 – Lauderdale Lakes

This area of the Lauderdale Lakes is located between Treasure Island and the Lauderdale Country Club Golf Course (Fig. 6), in Don Jean Bay. The area has large beds of large-leaf pondweed. The pondweed bed on the extreme western shore of the island should be protected from any removal activities. There is good shoreline cover consisting of woody growth and the north side of the island is excellent for wildlife.

There is little water flow through the area and the substrate is soft muck/silt. The area acts as a sediment and nutrient trap for the lake, enhancing water quality.

Aquatic vegetation (Table 9) controls shoreline erosion and provides northern pike, largemouth bass, bluegill, and forage fish with spawning, nursery, and foraging habitat (Table 10). See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. Ducks, geese, herons, bittern, songbirds, muskrat, and opossum inhabit this portion of Mill Lake during the majority of the year.

Table 9. Plants observed in sensitive area 5.

	Emergents	Submergents	Free-floating	Algae
PRESENT (0-25% Cover)	*Typha* (cattail)	*Elodea* (waterweed) *Najas flexilis* (slender naiad) *Chara* (muskgrass) *Vallisneria* (wild celery) *P. zosteriformis* (flat-stemmed pondweed)	*P. natans* (floating-leaf pondweed) *Nuphar advena* (yellow water lily) **Exotics** *Myriophyllum spicatum* (Eurasian watermilfoil) *P. crispus* (curly-leaf pondweed)	filamentous algae
COMMON (26-50% Cover)				
ABUNDANT (51-75% Cover)				
DOMINANT (76-100% Cover)	*P. amplifolius* (large-leaf pondweed)			

Table 10: Sensitive area 5 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

Fish Species	Spawning	Nursery	Feeding	Protective Cover
Northern Pike	*Chara*	*Chara*, water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds
Largemouth Bass	milfoil	water lily, *Chara*, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds
Rock Bass		water lily, *Chara*, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil
Bluegill and Pumpkinseed		water lily, *Chara*, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds	water lily, wild celery, milfoil, pondweeds
Black Crappie	*Chara*	water lily, *Chara*, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil
Yellow Perch	milfoil, pondweeds	water lily, *Chara*, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil

Management Recommendations for Sensitive Area # 5

1. No chemical treatment permitted.

2. Restrict mechanical harvesting to a navigational channel extending from piers and only after spawning has ended. No large-leaf or floating-leaf pondweed may be harvested.

3. None of the following in-lake activities allowed:
   - Filling/dredging
   - Aquatic plant screens
   - Wetland alterations
   - Boardwalks
   - Pea gravel/sand blankets

4. Strictly enforce shoreland and wetland ordinances.

5. Efforts should be undertaken to create and enforce ordinances, and educate developers on preventing erosion. A "No-Wake Zone" should be implemented.

Resource Value of Sensitive Area Site 6 – Lauderdale Lakes

Sensitive area 6 is located on the northwest corner of Mill Lake and is unique to the Lauderdale Lakes (Figure 7). The area consists of a shallow bay with abundant *Sagittaria* (arrowhead), an emergent plant providing cover for young fish and valuable food for migratory waterfowl. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The substrate is primarily silt and muck in open water areas with more detritus along the shoreline. The bay acts as a sediment and nutrient trap for the lake, enhancing water quality. Aquatic vegetation helps control shoreline erosion (Table 11). It also provides northern pike, largemouth bass, bluegill, yellow perch, and forage fish with spawning, nursery, and foraging habitat (Table 12). The area is not favorable to bluegill spawning due to the silt present. However, submergent vegetation provides excellent sites for northern pike and yellow perch to deposit eggs.

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, this sensitive area is extremely important for wildlife. Ducks, herons, bittern, songbirds, reptiles, frogs, muskrat, mink, shrews, and voles inhabit this portion of the lake during the majority of the year. The wetland is quite diverse, containing jewelweed, boneset, sedges, sweet flag iris, mannagrass, canada bluejoint grass, marsh fern, bulrushes, bidens, great blue lobelia, blue flag iris, marsh dock, willow, dogwood, cattails, mint, marsh milkweed, arrowhead and coreopsis.

Table 11. Plants observed in the open water area of sensitive area 6.

	Emergents	**Submergents**	**Free-floating**	**Exotics**
PRESENT (0-25% Cover)	*Alisma* (water plantain) *Scirpus* (bulrush) *Decodon* (water-willow)	*Ceratophyllum* (coontail) *P. richardsonii* (clasping-leaf pondweed)	*Lemna* (duckweed) *Nuphar advena* (yellow water lily) *Nymphaea odorata* (white water lily)	*Myriophyllum spicatum* (Eurasian watermilfoil) *P. crispus* (curly-leaf pondweed) *Lythrum* (purple loosestrife)
COMMON (26-50% Cover)	*Carex* (sedges) *Typha* (cattail) *Sagittaria* (arrowhead)	*Najas flexilis* (slender naiad) *Utricularia* (bladderwort) *Vallisneria* (wild celery)		**Algae** filamentous algae
ABUNDANT (51-75% Cover)		*Chara* (muskgrass)	*Spirodela* (large duckweed)	
DOMINANT (76-100% Cover)				

Table 12. Sensitive area 6 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

Fish Species	Spawning	Nursery	Feeding	Protective Cover
Northern Pike	cattail	cattail, water lily, *Chara*, wild celery, coontail, milfoil, pondweeds	water lily, wild celery, coontail, milfoil, pondweeds	water lily, wild celery, coontail, milfoil, pondweeds
Largemouth Bass	coontail, milfoil	cattail, water lily, *Chara*, wild celery, coontail, milfoil, pondweeds	water lily, wild celery, coontail, milfoil, pondweeds	water lily, wild celery, coontail, milfoil, pondweeds
Rock Bass		cattail, water lily, *Chara*, wild celery, coontail, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil
Bluegill and Pumpkinseed		cattail, water lily, *Chara*, wild celery, coontail, milfoil, pondweeds	water lily, wild celery, coontail, milfoil, pondweeds	water lily, wild celery, coontail, milfoil, pondweeds
Black Crappie		water lily, *Chara*, wild celery, coontail, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil
Yellow Perch	cattail, coontail, milfoil, pondweeds	water lily, *Chara*, wild celery, coontail, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil

Management Recommendations for Sensitive Area #6

1. No chemical treatment, mechanical harvesting, mowing, or clear-cutting permitted in the wetland. Submergent vegetation within the existing channel (open water area only) may be harvested.

2. A DNR permit should not be issued for any of the following:
   - Filling
   - Dredging
   - Aquatic plant screens
   - Pea gravel/sand blankets
   - Wetland alterations

3. No alteration of littoral zone unless the activity improves spawning habitat.

4. Boardwalks will be permitted on a case by case basis to provide open water access only for a riparian landowner.

5. Chemical treatment is not permitted except to target an infestation of an exotic species such as purple loosestrife, Eurasian water milfoil or curly leaf pondweed.

6. Efforts should be undertaken to create and enforce shoreland and wetland ordinances, as well as educate developers on preventing erosion during construction. A "No-Wake Zone" should be implemented.

Resource Value of Sensitive Area Site 7 – Lauderdale Lakes

Sensitive area 7 consists of a shallow, sinuous waterway surrounding an island located between Middle and Mill Lakes (Figure 8). The area has a diverse plant community, including several emergent wetland species (sedges, rushes, and asters). It is unique in that it lacks Eurasian watermilfoil, an exotic species common elsewhere in the Lakes. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of the Lauderdale Lakes.

The bottom is composed of a few inches of silt with firm substrate underneath. Aquatic vegetation helps control shoreline erosion (Table 13). It also provides northern pike, largemouth bass, bluegill, yellow perch, and forage fish with spawning, nursery, and foraging habitat (Table 14). Submergent vegetation provides excellent sites for northern pike and yellow perch to deposit eggs. Limited but valuable spawning habitat is available for bass, bluegill, and pumpkinseed in substrate uncovered by the thin layer of silt.

The extensive development of the Lauderdale Lakes has reduced available wildlife habitat. However, this sensitive area is extremely important for wildlife. Ducks, herons, bittern, songbirds, reptiles, frogs, muskrat, mink, shrews, voles, and beaver inhabit this portion of the lake during the majority of the year. The island contains a high diversity of wetland plants. Plants observed include marsh fern, mannagrass, canada bluejoint, cattail, bulrush, sedges, spike rush, sweet flag, arrowhead, bidens, great blue lobelia, blue flag iris, blue vervain, marsh milkweed, water willow, goldenrod, boneset, coreopsis, willow, dogwood, and white aster.

Table 13. Plants observed in the open water area of sensitive area 7.

	Emergents	**Submergents**	**Free-floating**	**Exotics**
PRESENT (0-25% Cover)		*Chara* (muskgrass)		*P. crispus* (curly-leaf pondweed)
COMMON (26-50% Cover)	*Scirpus* (bulrush) *Eleocharis* (spike-rush) *Aster* (aster) *Acorus* (sweet flag) *Sagittaria* (arrowhead) *Typha* (cattail)			
ABUNDANT (51-75% Cover)		*Vallisneria* (wild celery) *Najas flexilis* (slender naiad) *P. zosteriformis* (flat-stemmed pondweed)	*Nymphaea odorata* (white water lily)	
DOMINANT (76-100% Cover)	*Carex* (sedges)			

Table 14: Sensitive area 7 habitat (plants and substrates) utilized by resident fish species of the Lauderdale Lakes (1999 survey).

Fish Species	Spawning	Nursery	Feeding	Protective Cover
Northern Pike	*Chara*	*Chara*, water lily, wild celery, pondweeds	water lily, wild celery, pondweeds	water lily, wild celery, pondweeds
Largemouth Bass	hard substrate	water lily, *Chara*, wild celery, pondweeds	water lily, wild celery, pondweeds	water lily, wild celery, pondweeds
Rock Bass		water lily, *Chara*, wild celery, pondweeds	pondweeds	pondweeds
Bluegill and Pumpkinseed		water lily, *Chara*, wild celery, pondweeds	water lily, wild celery, pondweeds	water lily, wild celery, pondweeds
Black Crappie	*Chara*	water lily, *Chara*, wild celery, pondweeds	pondweeds	pondweeds, woody debris
Yellow Perch	pondweeds	water lily, *Chara*, wild celery, pondweeds	pondweeds	pondweeds

Management Recommendations for Sensitive Area #7

1. No mechanical harvesting, mowing, or clear-cutting permitted.

2. Chemical treatment is not permitted except to target an infestation of an exotic species such as purple loosestrife, Eurasian water milfoil or curly leaf pondweed.

3. A DNR permit should not be issued for any of the following:

Filling	Boardwalks
Aquatic plant screens	Dredging
Wetland alterations	Pea gravel/sand blankets

4. No alteration of littoral zone unless the activity improves spawning habitat.

5. Maintain the “No-Wake” boating zone.

6. Efforts should be undertaken to create and enforce shoreland and wetland ordinances, as well as educate developers on preventing erosion during construction.

Conclusion

Seven sensitive areas have been designated. Sensitive area number 3 contains one of the highest quality shorelines in southeast Wisconsin. Development along the shoreline of each of the seven sensitive areas sensitive should be carefully studied to prevent the further loss of habitat in the Lauderdale Lakes chain. This sensitive area report identifies characteristics and management recommendations for each of the seven areas.

In Wisconsin, lakes attract many users and water quality in these lakes affects many more. The Lauderdale Lakes attract a diversity of user groups, inevitably creating conflict. An integrated approach that includes the public and all of the Lakes' governing units is essential. The objective is to create and maintain a balance between recreational use and preservation of habitat, which is essential to the Lakes' health. Improving or at least maintaining water quality in Wisconsin lakes is critical. By protecting and restoring habitat these resources will continue to provide ecosystem functions and responsible recreational opportunities for years to come.

Works Cited

Becker, G.C., 1983. Fishes of Wisconsin, *The University of Wisconsin Press*.

Borman, S., R. Korth, and J. Temte, 1997. Through the Looking Glass: A Field Guide to Aquatic Plants, *Wisconsin Lakes Partnership*.

Chapter 30, Wisconsin State Statute.

Garn, H. S. Effects of Lawn Fertilizer on Nutrient Concentration in Runoff from Lakeshore Lawns, Lauderdale Lakes, Wisconsin. USGS Water-Resources Investigations Report 02-4130, July 2002.

Greene, A. 2003. A Homeowners Guide to Native Shoreline Buffers, *Walworth County Publication.*

Lyons, J., P.A. Cochran, and D. Fago, 2000. Wisconsin Fishes 2000: Status and Distribution, *University of Wisconsin Sea Grant Institute*.

NR 1, 107, 109, Wisconsin Administrative Code.

Purple Loosestrife: What You Should Know, What You Can Do, *WDNR*, PUB-WT-276 2003.

Southeast Wisconsin Regional Planning Commission, 2001. An Aquatic Plant Management Plan for the Lauderdale Lakes.

Welch, D.E. and R. Dauffenbach, 2000. Fisheries Survey Report for the Lauderdale Lakes (WBIC 0755500), Walworth County, *WDNR*.

Woodford, J. E. and Meyer, M. W. Impact of Lakeshore Development on Green Frog Abundance. Biological Conservation 110 (2003), pp. 277-284

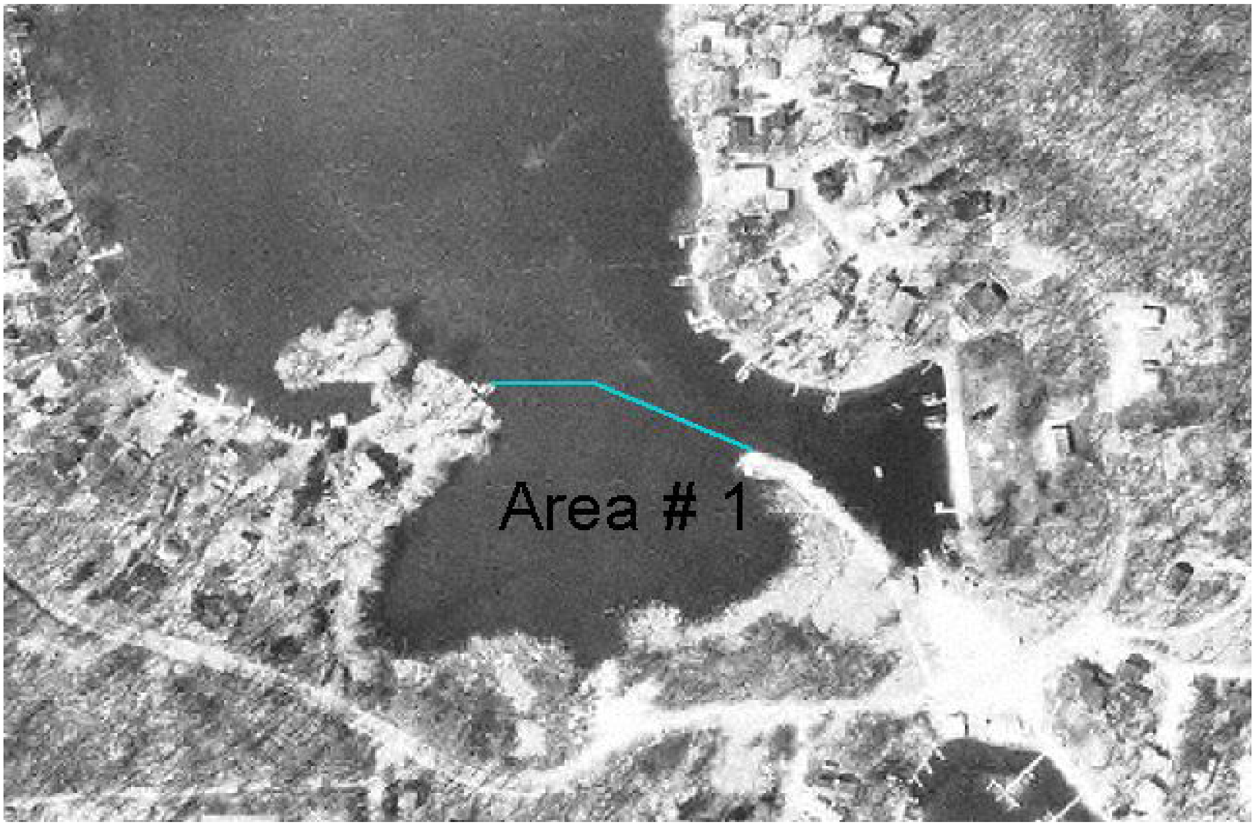
APPENDIX 1 - Aquatic plants within sensitive areas of the Lauderdale Lakes

Emergent	**Area 1**	**Area 2**	**Area 3**	**Area 4**	**Area 5**	**Area 6**	**Area 7**
Zizania (wild rice)			X				
Typha (cattail)	X		X	X	X	X	X
Scirpus (bulrush)	X		X	X		X	X
Eleocharis (spike-rush)							X
Carex (sedges)	X		X	X		X	X
Decodon (water-willow)		X	X	X		X	X
Alisma (water plantain)						X	
Sagittaria (arrowhead)						X	X
Acorus (sweet flag)						X	X
Aster (aster)						X	X
Thelypteris (marsh fern)						X	X
Glyceria (mannagrass)						X	X
Calamagrostis (Can. BG)						X	X
Bidens (Beggar Tick)						X	X
Lobelia (great blue)						X	X
Iris (Blue Flag)						X	X
Eupatorium (Boneset)						X	X
Mentha (mint)						X	
Asclepias (marsh milkweed)						X	X
Verbena (blue vervain)						X	X
Coreopsis						X	X
Impatiens (jewelweed)						X	
Rumex (marsh dock)						X	
Cornus (dogwood)						X	X
Solidago (goldenrod)							X

Submergent	**Area 1**	**Area 2**	**Area 3**	**Area 4**	**Area 5**	**Area 6**	**Area 7**
Myriophyllum sibiricum (northern watermilfoil)			X				
Chara (muskgrass)		X	X	X	X	X	X
Potamogeton amplifolius (large-leaf pondweed)				X	X		
Elodea (waterweed)		X	X	X	X		
Utricularia (bladderwort)	X		X			X	
Ceratophyllum (coontail)	X					X	
Stuckenia pectinata (sago pondweed)	X		X				
Vallisneria (wild celery)		X	X	X	X	X	X
P. zosteriformis (flat-stemmed pondweed)		X	X	X	X		X
P. illinoensis (Illinois pondweed)			X	X			
Najas flexilis (slender naiad)			X	X	X	X	X
P. praelongus (white-stemmed pondweed)	X	X					
P. richardsonii (clasping-leaf pondweed)						X	
Free-floating							
Nuphar advena (yellow water lily)		X	X	X	X	X	
Nymphaea odorata (white water lily)		X	X	X		X	X
P. natans (floating-leaf pondweed)			X		X		
Lemna (duckweed)						X	
Spirodela (large duckweed)						X	
Exotic							
Myriophyllum spicatum (Eurasian watermilfoil)	X	X	X	X	X	X	
P. crispus (curly-leaf pondweed)		X	X	X	X	X	X
Lythrum (purple loosestrife)						X	
Algae							
filamentous		X	X		X	X	

Draft

25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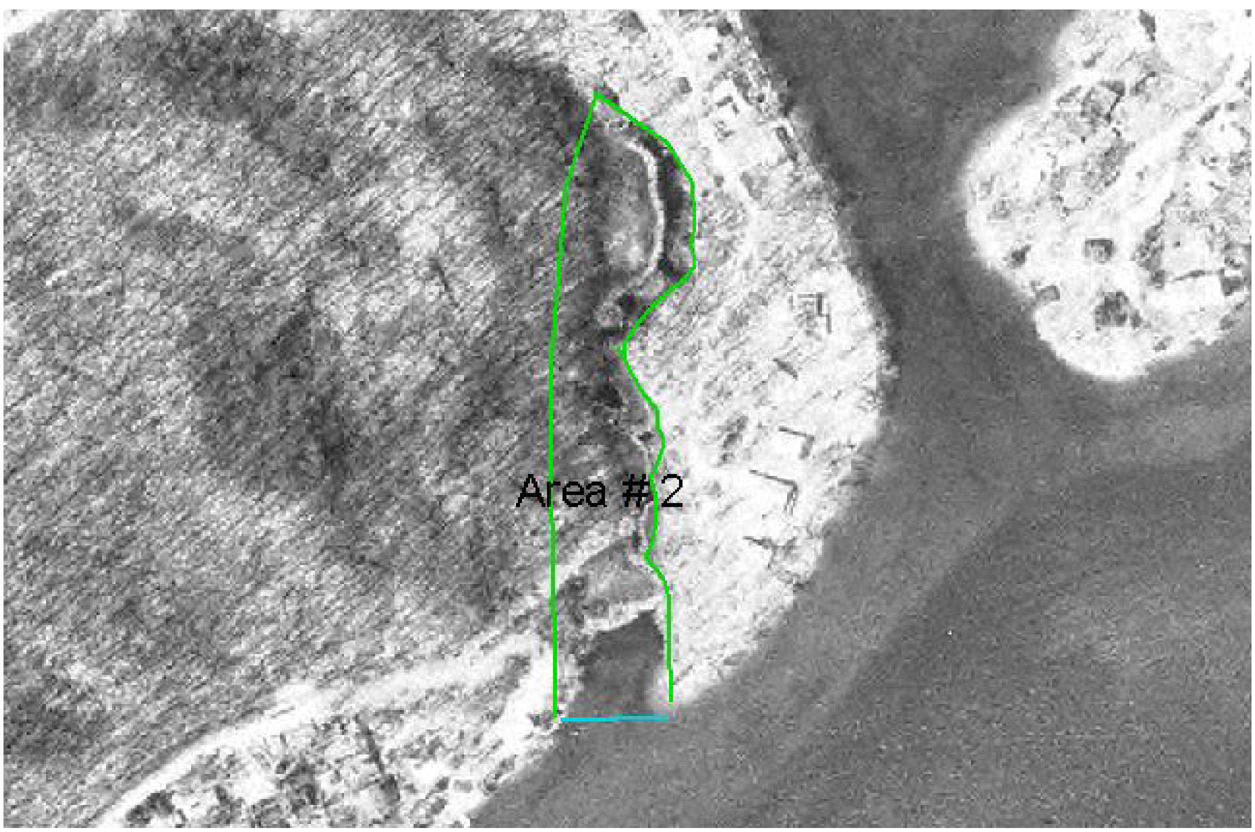
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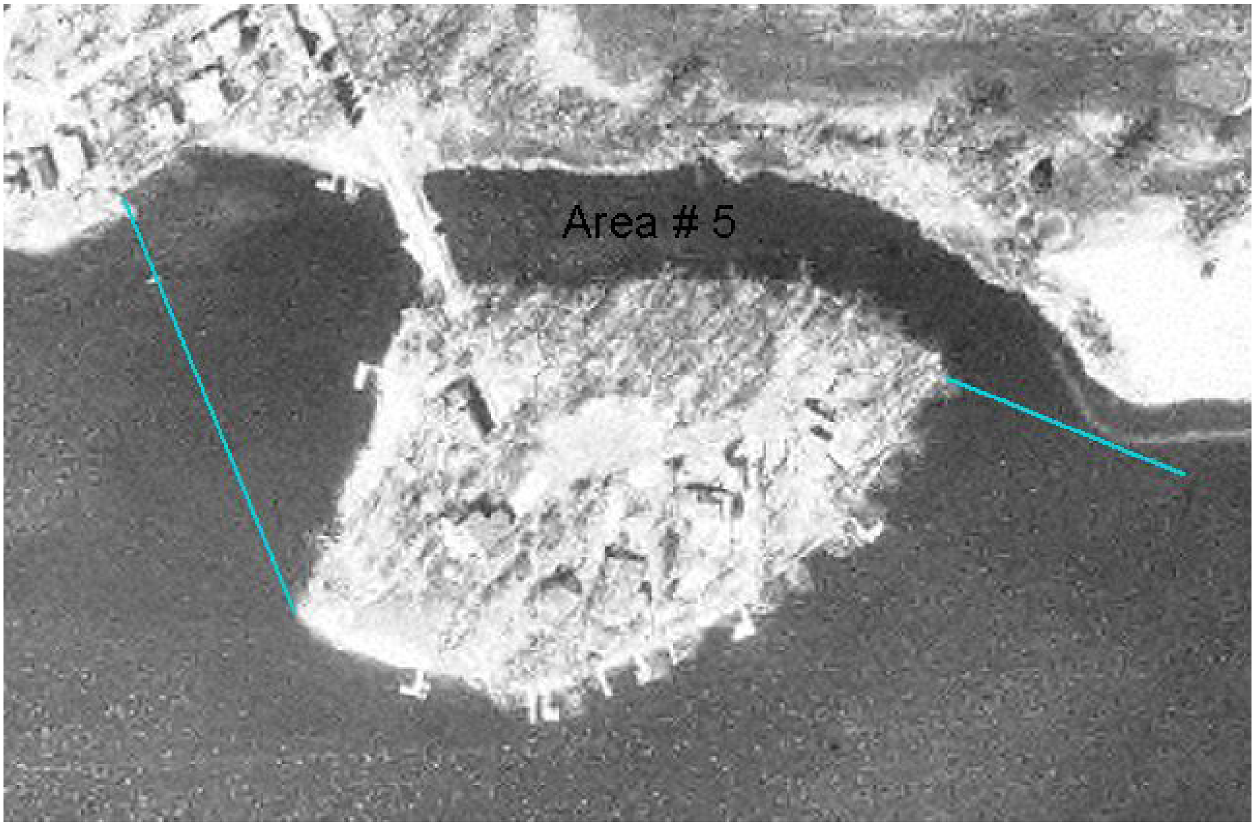
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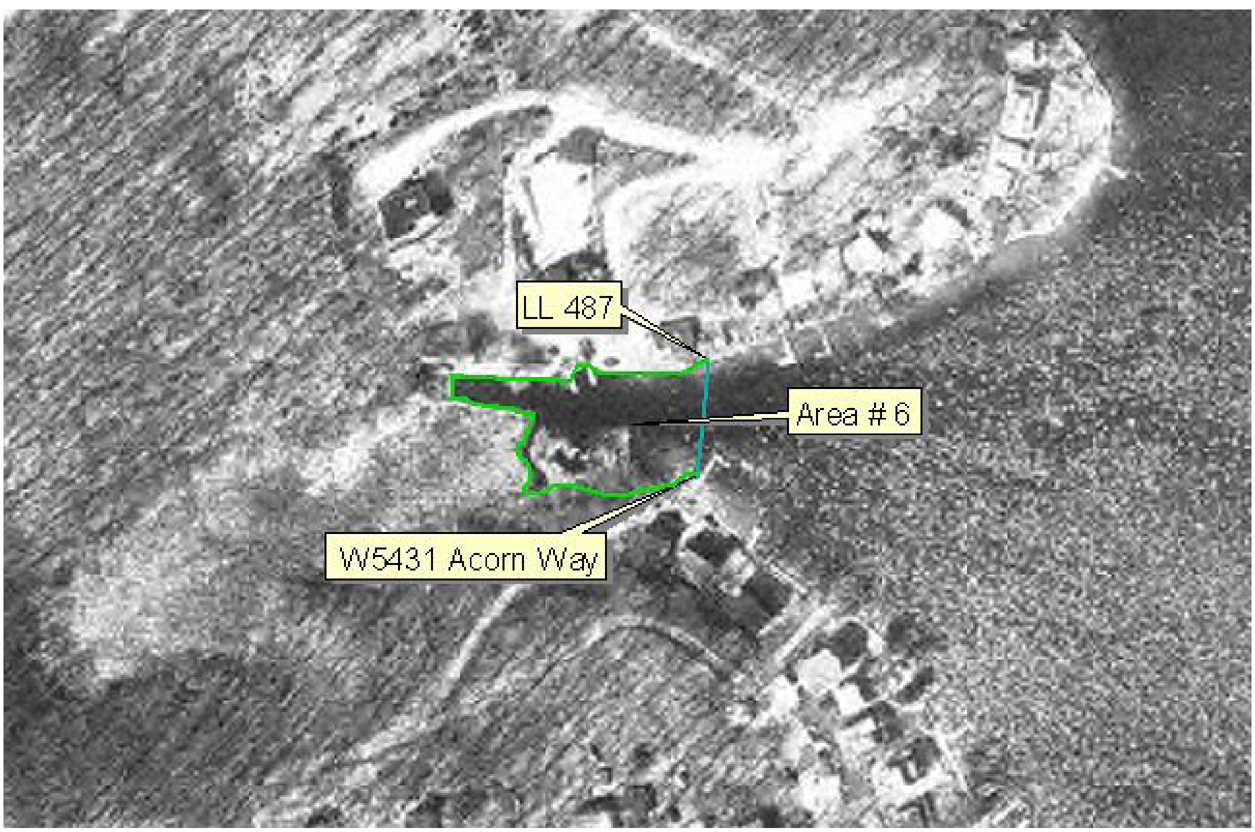
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Area # 6
W5431 Acorn Way


LL 535D (Brown House)
Area # 7
LL 528 (Green House)

MECHANICAL/MANUAL AQUATIC PLANT CONTROL PERMIT FOR LAUDERDALE LAKES

APPENDIX D

State of Wisconsin DNR Department of Natural Resources Water Permit Central Intake – attn. APM PO Box 7185 Madison, WI 53707-7185	Mechanical Aquatic Plant Control Permit

Permit Number: *SE-2020-65-8284M*
Permit Expiration Date: *12/31/2024*

Waterbody Name: Green, Middle, Mill

Waterbody # (WBIC): 755800, 755700, 755600
Fee Received: *300*
Waterbody Address: N7498 Country Club Drive Elkhorn, WI 53121

Applicant Name: Lauderdale Lakes Lake Management District
Greg Wisniewski, Jack Sorensen
Email: gwisniewski@lauderdalelakedistrict.com
Phone: 262-742-4511

Advanced Notification of Harvesting is Required

The Department has received and reviewed your application to mechanically remove up to 200 acres of aquatic plants in the Lauderdale Lakes including Green, Middle and Mill Lakes in Walworth County. Please go to this web address: https://permits.dnr.wi.gov/water/SitePages/Permit%20Search.aspx to search for and download the permit documents. Your permit application meets the minimum requirements by law and a permit is being issued with the following conditions:

- You shall follow the harvesting plan outlined on pages 58-60, page 68 and pages 70-72 of the 2020 Aquatic Plant Management Plan Update for the Lauderdale Lakes, permit application and permit conditions. Any changes to the permitted activity will require an additional permit from the Department.

- The treatment notification protocols, treatment plan, and reporting protocols shall be performed in compliance with Wisconsin Administrative Code Chapter NR 109. Noncompliance with the permit can result in enforcement actions under Wis. Stat. Chapters 23, 30 and 31 and restriction of aquatic plant management activities for subsequent years under Wisconsin Administrative code chapter NR 109. The conditions and treatment plan are required to be followed to ensure efficacy of the treatment.

- You shall notify Heidi Bunk of the Department of Natural Resources at Heidi.Bunk@wi.gov a minimum of 4 business days before harvesting each year with the date and time of the proposed first harvesting event of the year.

- There must be a minimum of 12 inches of uncut rooted plant material left on the lake bed to stabilize sediment.

- You shall not harvest in waters less than 3 feet in depth.

- You shall not harvest in the navigational channels in Sensitive Area #3 (Middle Lake) before June 30th of any given year.

- You shall not harvest in Sensitive Areas #6 or #7 before June 30th of any given year.

- You shall harvest in Sensitive Area #3 (Middle Lake) to a maximum depth of 2 feet from the surface of the water.

- You shall not harvest stands of native pondweeds or chara.

- You shall harvest in a manner to minimize accidental capture of fish. Game fish accidentally captured shall be released immediately. Attempts should be made to release all other species.

- You shall remove all harvested materials from the water immediately.

- You shall have a paper or electronic copy of this decision letter and permit with the individual conducting the harvesting during all associated harvesting events.

- You shall submit an annual report of aquatic plant material removed by weight (lbs or tons) and volume (cubic yards) and species, a detailed map of harvested areas, total acres harvested, a report detailing the non-target impacts and the species and number of fish encountered within 30 days of the last treatment to DNR APM Program.

Notice

- You shall decontaminate all project equipment used in the waterbody to minimize transport of aquatic invasive species (AIS) immediately after each use on the project site. You shall utilize best management practices: https://dnr.wi.gov/topic/Invasives/disinfection.html You shall comply with all provisions in Wis. Stat. s. 30.07 and Wis. Adm. Code s. NR 40.07 and Manual code 9183.1 For further information, please refer to the following: https://dnr.wi.gov/topic/invasives/classification.html.

- The approval of an aquatic plant management permit does not represent an endorsement of the permitted activity, but represents that the applicant has complied with all criteria of this chapter.

- Staff must be familiar with the common aquatic plant species on the Lauderdale Lakes and be able to differentiate between native and non native species.
- Disposal of the harvested aquatic plants must be located in the areas specified in the permit application and must be is accordance with any applicable county and local regulations. Plant material may not be placed in a wetland, below the ordinary high water mark of any waterway, or in a floodplain or floodway.

If you have any questions or concerns, I can be reached by email at Heidi.Bunk@wisconsin.gov.

State of Wisconsin Department of Natural Resources for the Secretary

By: Bunk, Heidi J	6/3/2020	06/03/2020
Water Resources Biologist	Date Signed	Date Mailed

Please Note:
If you believe that you have a right to challenge this decision, you should know that Wisconsin statutes and administrative rules establish time periods within which requests to review Department decisions must be filed. For judicial review of a decision pursuant to ss. 227.52 and 227.53, Wis. Stats., you have 30 days after the decision is mailed or otherwise served by the Department, to file your petition with the appropriate circuit court and serve the petition on the Department. Such a petition for judicial review shall name the Department of Natural Resources as the respondent. This notice is provided pursuant to s. 227.48(2), Wis. Stats. To request a contested case hearing pursuant to s. 227.42, Wis. Stats., you have 30 days after the decision is mailed, or otherwise served by the Department, to serve a petition for hearing on the Secretary of the Department of Natural Resources. The filing of a request for a contested case hearing is not a prerequisite for judicial review and does not extend the 30-day period for filing a petition for judicial review.