

Pike Lake - Curly Leaf Pondweed Project

Year 1 Report of Plant Survey Findings

for Pike Lake and the Turtle River

This report is a product of a WDNR Aquatic Invasive Species Grant (Early Detection & Response) awarded to:

Sponsoring Association:
Rice Lake Association, Inc.
Robert Kary
2843 W Great Northern Trails Rd
Mercer, WI 54547

On behalf of:
Pike Lake Association
(Contact: Amanda Kraus)

Submitted to:
Wisconsin Department of Natural Resources
Attention: Carol Warden

Prepared by:
White Water Associates, Inc.
Dean Premo, Ph.D., Angie Stine, B.S., and Kent Premo, M.S.
429 River Lane, P.O. Box 27
Amasa, Michigan 49903
Phone: (906) 822-7889; E-mail: dean.premo@white-water-associates.com



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Introduction

The recent discovery of the aquatic invasive species (AIS) curly-leaf pondweed (*Potamogeton crispus*) in Pike Lake and the Turtle River (upstream of Pike Lake) motivated a group of Pike Lake stakeholders to organize around managing this aquatic nuisance plant. The group sought financial assistance for this undertaking from the Wisconsin Department of Natural Resources (WDNR) in the form of an AIS grant (Early Detection & Response). As an incipient organization, the Pike Lake group was not yet eligible for the grant but their upstream neighbor, the Rice Lake Association, acted as the sponsoring organization and received the grant. White Water Associates, Inc. was engaged to conduct biological surveys as part of the funded project on both Pike Lake and the Turtle River where it flows between the more upstream Rice Lake and Pike Lake. These surveys included (1) point-intercept aquatic plant surveys, (2) surveys for curly-leaf pondweed before and after hand-pulling conducted by volunteers, and (3) AIS surveys. The project specifies that these surveys occur at various times over a three year period (2020, 2021, and 2022). This document reports on the efforts of the first year of activities by White Water Associates.

Study Area

Pike Lake is located near the town of Mercer in Iron County, Wisconsin. It is one of several lakes that exist along the Turtle River. The portion of the Turtle River that was subject to our efforts is located from the river outlet at the southwest end of Rice Lake downstream to the inlet at the northeastern end of Pike Lake. Exhibit 1 is a topographic map of the area that includes Rice Lake, Pike Lake and the Turtle River. Pike Lake is a drainage lake of about 184 acres in surface area and with a maximum depth of 80 feet. Water transparency (Secchi depth) is typically about 7 or 8 feet. The stretch of the Turtle River that runs between Rice Lake and Pike Lake is about 2.6 miles and is generally less than 100 feet wide. It has a distinct current, but for the most part is flat water. There are three short stretches of rapids. It is most easily navigated by small watercraft such as a canoe, although larger motorized watercraft can navigate from Pike Lake about 0.5 mile upstream to the first set of rapids and in the area just downstream of Rice Lake where the river is more lacustrine in its character.

Methods

There were four specific surveys that we conducted on Pike Lake and the Turtle River during 2020: (1) pre-treatment curly-leaf pondweed survey, (2) post-treatment curly-leaf pondweed survey, (3) point-intercept aquatic plant survey, and (4) AIS meander survey.

For the pre-treatment curly-leaf pondweed survey, we did a thorough coverage meander search of the Pike Lake littoral zone and the Turtle River. All locations with curly-leaf pondweed present were characterized as to size of colony and location (GPS coordinates). Where feasible on the Turtle River, we tied surveyors ribbon nearby curly-leaf pondweed locations to make the location easy to find for the volunteer plant management team. This information was transferred in a timely manner to the volunteer team. The pre-treatment survey took place on June 1, 2 and 3, 2020.

After the volunteer hand-pulling team completed a curly-leaf pondweed management bout on the Turtle River and Pike Lake, the White Water Associates team returned for the follow-up monitoring to document the efficacy of the treatment and identify areas that might warrant a return visit. This work was conducted on June 26, 2020. Meander search was again conducted on the river and the lake littoral zone and all curly-leaf pondweed sites previously identified were visited by navigating using GPS technology. Ribbon was removed during this visit.

Surveys for all aquatic plants (native and non-native) were conducted on Pike Lake and the Turtle River using the WDNR point-intercept protocol and methodology. The White Water Associates team conducted this work on the Turtle River on June 1, 2, and 3, 2020.¹ This formal survey assessed the plant species composition on a grid of several hundred points distributed over the lake and river. Using latitude-longitude coordinates and a GPS unit, field staff navigated to the points and used a rake mounted on a pole or rope to sample plants. These plants were identified, recorded, and put into a dedicated spreadsheet for storage and data analysis. This systematic survey provides baseline plant community data about the lake and river. We anticipate repeating this survey again in 2022.

To conduct a survey for aquatic invasive species in Pike Lake, the White Water Associates team followed the *Aquatic Invasive Species Early Detection Monitoring Standard Operating Procedure* (WDNR, 2014). This procedure outlines several types of monitoring techniques, including: boat landing searches, sample site searches, targeted searches, waterflea tows and/or a Ponar dredge, and a meander search. The Pike Lake survey took place June 26, 2020. Details of this method are provided in the AIS report. The intensive meander searching conducted on the

¹ We express thanks to the WDNR aquatic plant team of Carol Warden and Susan Knight for conducting the point-intercept survey on the upper part of the Turtle River as part of their survey work on Rice Lake (June 1, 2020).

Turtle River as part of the curly-leaf pondweed work and point-intercept survey constituted a thorough search for other AIS in the stream. Biologists spent four days in this overall effort (June 1, 2, 3, and 26, 2020).

Results: Curly-leaf Pondweed Surveys (Pre and Post hand-pulling)

Within two days of completing the pre hand-pulling survey for curly-leaf pondweed White Water Associates delivered the findings to Amanda Kraus (Pike Lake Association), Robert Kary (Rice Lake Association), and Zach Wilson (Iron County Land and Water Conservation Department). Mr. Wilson coordinated the volunteers. The deliverables package included:

- A table of all curly-leaf pondweed sites documented along with notes and other information as well as summary comments (included as Exhibit 2)
- An XLS file that repeats the tabular portion of the table with latitude and longitude
- A GPX file for use in transferring latitude/longitude data to GPS unit(s)
- Four map photos of the curly-leaf pondweed locations.

After the volunteer team completed the hand-pulling of curly-leaf pondweed, White Water Associates conducted the post hand-pulling survey (June 26, 2020). We delivered the results of that survey on the same day that it was conducted. This package included the table from the pre hand-pulling survey annotated with our findings (included as Exhibit 3).

Results: Point-Intercept Plant Survey – Pike Lake

Results from the point-intercept plant survey for Pike Lake are summarized and presented in Exhibits 4, 5, and 6. The maximum depth of rooted vegetation was 7.5 feet. Of the 699 sampling points on the lake, only 95 were less than or equal to this depth and twenty-eight of those points actually had rooted vegetation. The plant community is diverse with 17 species collected at the sampling points and an additional 11 species observed. The Simpson Diversity Index is high (0.92) indicating a diverse plant community. The Floristic Quality Index for Pike Lake (26.25) also indicates a good quality plant community (this value is higher than the median value for northern lakes). Exhibit 6 is a distribution of the relative frequency of plant species in the lake and this displays the pattern of frequencies typical of a healthy plant community.

Results: Point-Intercept Plant Survey – Turtle River

Results from the point-intercept plant survey for the Turtle River are summarized and presented in Exhibits 7, 8, and 9. The maximum depth of rooted vegetation was 6.0 feet. Of the 206 sampling points on the river, 176 were less than or equal to this depth and 85 of those points actually had rooted vegetation. The plant community is diverse with 25 species collected at the sampling points and an additional 14 species observed (for a total number of species at 39). The Simpson Diversity Index is high (0.93) indicating a diverse plant community. The Floristic Quality Index for this stretch of the Turtle River (28.2) also indicates a good quality plant community. Exhibit 9 is a distribution of the relative frequency of plant species in the river and this displays the pattern of frequencies typical of a healthy plant community. It should be noted that curly-leaf pondweed had a relative frequency of 4.8%. It is anticipated that this value will be reduced over time through the hand-pulling management of this AIS.

Results: Aquatic Invasive Species Survey – Pike Lake & Turtle River

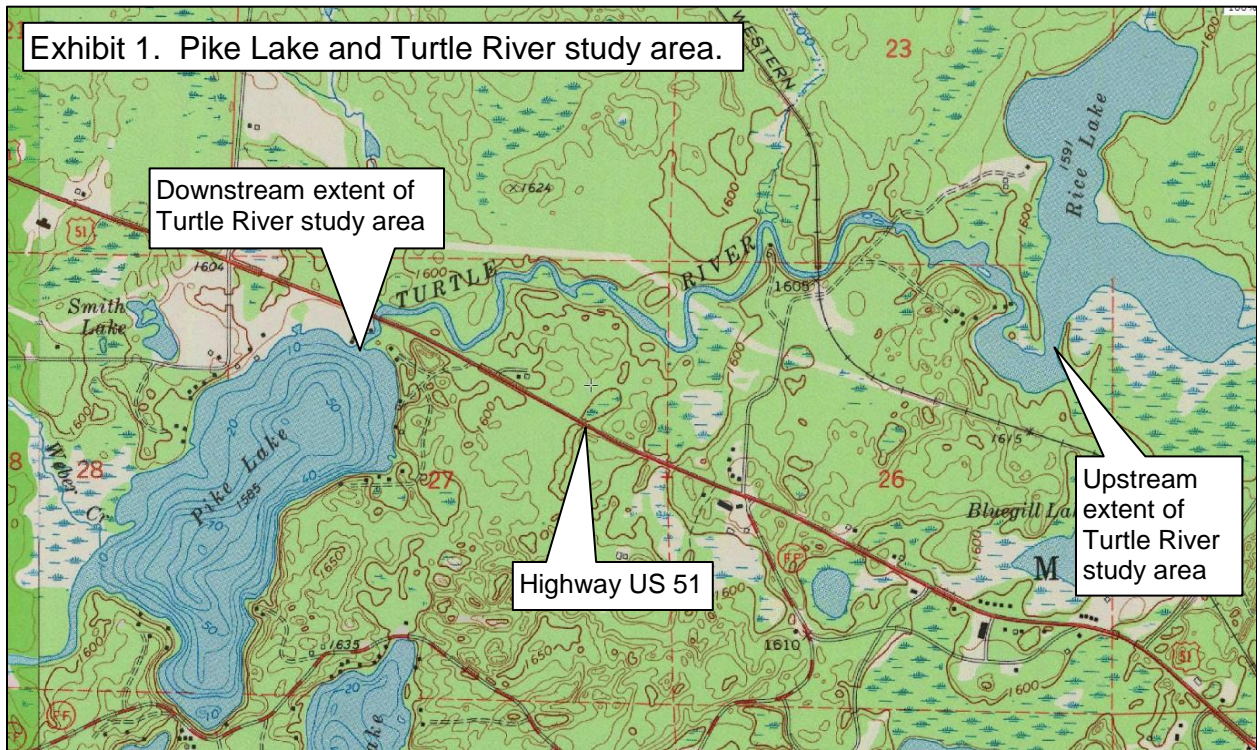
A report for the AIS survey of Pike Lake is provided as Exhibit 10 at the end of this report. Three invasive plant species were documented on Pike Lake: curly-leaf pondweed, aquatic forget-me-not, and yellow iris.

The extensive meander searching on the Turtle River and the point-intercept aquatic plant survey documented numerous curly-leaf pondweed sites (as stated previously, the locations for all were conveyed to the volunteer plant management team for subsequent hand pulling). This extensive survey effort also resulted in eight sites of the invasive reed canary grass (*Phalaris arundinacea*) (see location data in Exhibit 11). Two locations along the river (46.18050, -090.10512 and 46.18050, -090.10477) were recorded as having *Iris sp.* Since these plants were not in bloom at the time, it was not possible to confirm whether it was the native blue flag or the invasive yellow iris (*Iris pseudacorus*). The yellow iris was confirmed at locations in Pike Lake. We recommend that future monitoring be conducted to confirm whether the Turtle River iris finds were the native blue flag or the invasive yellow iris. Given the reed canary grass found in the river, this species should be monitored for possible invasion in Pike Lake.

Exhibits

Exhibits 1 through 11 are provided on the following pages of this report. A complete list of exhibits is provided in the *Table of Contents*.

Exhibit 1. Pike Lake and Turtle River study area.



Downstream extent of Turtle River study area

Highway US 51

Upstream extent of Turtle River study area

Exhibit 2. 2020 Curly-leaf Pondweed Survey on the Turtle River and Pike Lake (pre hand-pulling)

Pike Lake & Turtle River Curly-leaf Pondweed Locations Documented on June 1, 2 & 3, 2020 (source: White Water Associates)					
GPS Point	Latitude/Longitude	Rating	Location	Ribbon	Notes
3	46.179714; -90.079465	1	LB	No	one plant
4	46.179068; -90.077947	1	LB	Yes	one plant
5	46.179221; -90.077613	1	LB	No	one plant
6	46.17926; -90.07759	2	LB	No	5 or 6 plants
7	46.17935; -90.077452	1	LB	No	
8	46.179437; -90.077286	1	LB	No	one plant
9	46.179458; -90.077187	1	LB	No	two plants
10	46.179477; -90.077116	2	LB	No	
11	46.17972; -90.076806	3	LB	No	
12	46.179748; -90.076721	3	LB	No	
13	46.180273; -90.078927	1	RB	No	
14	46.182553; -90.079492	1	RB	No	3 plants about 25% of river width from River Right bank
15	46.183569; -90.081729	1	RB	No	About 33% stream width from River Right bank
16	46.184514; -90.08429	1	RB	Yes	Orange ribbon hung right over the plants
17	46.182761; -90.088671	1	LB	Yes	About 75 feet downstream of Rec Trail bridge. Orange tape in tree above
18	46.180979; -90.09442	1	LB	Yes	Ribbon tied to grass. This area has lots of <i>P. richardsonii</i> as well as CLP
19	46.180898; -90.094363	3	LB	Yes	Ribbon tied to grass. More CLP plants downstream heading to #20
20	46.18079; -90.094251	1	LB	Yes	Ribbon tied to grass.
21	46.181467; -90.096933	3	LB	No	At opening of little bay. No place to tie ribbon.
22	46.181395; -90.096331	3	RB	Yes	Ribbon in shrub at downstream end of this stand with numerous plants strung out upstream of the ribbon for about 40 feet.
23	46.181573; -90.108754	3	LB	Yes	This is a fairly large colony of CLP. Ribbon tied in tree. There is also a lot of <i>P. richardsonii</i> in vicinity.

Point	Latitude/Longitude	Notes			
No number	46.18461, -90.08596	We removed a single CLP. We did not tie a ribbon here, nor assign a GPS point number, but it could be checked at time of hand-pulling in case more CLP appear.			
PI-1	46.17906498; -90.07852734	Rake fullness rating 1. This point in close proximity to GPS Point #4			
PI-3	46.17906546; -90.0778277	Rake fullness rating 1. This point in close proximity to GPS Point #4			
PI-7	46.17930846; -90.07782804	Rake fullness rating 1			
PI-8	46.1793087; -90.07747822	Rake fullness rating 1. This point in close proximity to GPS Points #6 and #8			
PI-18	46.17955193; -90.07712874	Rake fullness rating 1			
PI-19	46.17955217; -90.07677891	Rake fullness rating 1			
PI-27	46.1797947; -90.0774789	A "visual" CLP recorded			
PI-29	46.17979517; -90.07677925	Rake fullness rating 1. This point in close proximity to GPS Points #11 and #12			
PI-34	46.18003674; -90.07887856	Rake fullness rating 1			
PI-39	46.18003794; -90.07712942	Rake fullness rating 1			
PI-45	46.18027974; -90.0788789	A "visual" CLP recorded. This point in close proximity to GPS Point #13			
PI-54	46.18052226; -90.07957891	Rake fullness rating 1			
PI-60	46.18075; -90.09427	CLP plant found on rake at PI Point 60 (Rake fullness rating 1). Corresponds to GPS Point #20			
PI-158	46.18319404; -90.08133201	CLP plant found on rake at PI Point 158 (Rake fullness rating 1)			
PI-175	46.18368; -90.08308	A "visual" CLP recorded from PI Point 175 during point-intercept survey.			
Pike Lake 1	46.16981; -90.11948	3	--	--	
Pike Lake 2	46.17077; -90.11548	2	--	--	

During the dedicated CLP survey, we logged twenty-one locations for CLP on the Turtle River (GPS Points 3 through 23) and two locations on Pike Lake (Pike Lake 1 and Pike Lake 2). For the 21 sites on the Turtle River, we flagged 8 sites with orange ribbon on which was written the GPS Point Number. Thirteen of the sites were not conducive to being flagged in this manner.

The Point-Intercept Aquatic Plant survey documented CLP at 15 PI sites. Nine of those sites were located at some distance from sites marked during the CLP survey. Six were closely associated with sites documented with the CLP survey.

For our CLP finds on the Turtle River (from the dedicated CLP survey):

- 13 sites had 1 to 4 rooted plants
- 2 sites had 5 to 10 rooted plants
- 6 sites had >11 rooted plants

On Pike Lake, one site (Pike Lake 1) had greater than 11 plants and one site (Pike Lake 2) had 5-10 plants.

On the upper part of the Turtle River (Arrowhead Resort upstream to end of our survey area), we found numerous CLP fragments (floating and un-rooted). We simply collected those without marking a location. Later, we appropriately disposed of these fragments. The fragments may have resulted from boat traffic in the area or in Rice Lake with fragments floating down the river.

Our judgment is that hand-pulling could be an effective way of managing the population of CLP in Pike Lake and the Turtle River. The population has reasonably low density and the number of colonies is also quite low. The most challenging area to treat in this way will be the upper Turtle River (the area to the east of the Arrowhead Resort) as it is a larger surface area and contains a thriving native plant community. The river between the “rock dam” rapids immediately north of Arrowhead Resort and Pike Lake will not be a difficult area to conduct hand-pulling efforts and could likely be accomplished by a team of 2-4 people working from canoe(s) in a single day. The Pike Lake population that we documented on the June 2 survey is small and would lend itself to hand-pulling in an hour or so. We recommend conducting the hand-pulling as soon as possible. The native vegetation is not advanced in growth at this time and as it develops, it will be more difficult to pull the CLP. As mentioned in the notes section of the above table, at some sites the CLP was mixed with *P. richardsonii* so care in identification is warranted. Since we are doing a follow-up CLP survey subsequent to the hand-pulling activity, we ask that the ribbon is left in place until that time (we will remove).

Exhibit 3. 2020 Curly-leaf Pondweed Survey on Pike Lake and the Turtle River - Follow-up CLP Survey

GPS Point	Latitude Longitude	Rating	Location	Ribbon	Ribbon Removed	Notes from first survey	CLP Present? (Y/N)	Notes from second survey (CLP removed, etc.)	Return Visit Recommended?
3	46.179714; -90.079465	1	LB	No		one plant	Y	Two plants present	YES
4	46.179068; -90.077947	1	LB	Yes	No	one plant	Y	Left ribbon because 5-10 CLP plants still present	YES
5	46.179221; -90.077613	1	LB	No		one plant	N		
6	46.17926; -90.07759	2	LB	No		5 or 6 plants	N		
7	46.17935; -90.077452	1	LB	No			Y	A few plants still present	YES
8	46.179437; -90.077286	1	LB	No		one plant	Y	Cluster of plants present. We pulled a few. Some remain.	YES
9	46.179458; -90.077187	1	LB	No		two plants	Y	Quite a few CLP plants between points 7 and 10	YES
10	46.179477; -90.077116	2	LB	No			Y		YES
11	46.17972; -90.076806	3	LB	No			Y	More than 10 CLP plants present	YES
12	46.179748; -90.076721	3	LB	No			Y	More than 10 CLP plants present	YES
13	46.180273; -90.078927	1	RB	No			N		
14	46.182553; -90.079492	1	RB	No		3 plants about 25% of river width from River Right bank	N		
15	46.183569; -90.081729	1	RB	No		About 33% stream width from River Right bank	N		
16	46.184514; -90.08429	1	RB	Yes	Yes	Orange ribbon hung right over the plants	N		
17	46.182761; -90.088671	1	LB	Yes	Yes	About 75 feet downstream of Rec Trail bridge. Orange tape in tree above	N		

GPS Point	Latitude Longitude	Rating	Location	Ribbon	Ribbon Removed	Notes from first survey	CLP Present? (Y/N)	Notes from second survey (CLP removed, etc.)	Return Visit Recommended?
18	46.180979; -90.09442	1	LB	Yes	Yes	Ribbon tied to grass. This area has lots of <i>P. richardsonii</i> as well as CLP	N	Three plants pulled – all seen removed.	
19	46.180898; -90.094363	3	LB	Yes	Yes	Ribbon tied to grass. More CLP plants downstream heading to #20	N		
20	46.18079; -90.094251	1	LB	Yes	Yes	Ribbon tied to grass.	N		
21	46.181467; -90.096933	3	LB	No	Yes	At opening of little bay. No place to tie ribbon.	N		
22	46.181395; -90.096331	3	RB	Yes	No	Ribbon in shrub at downstream end of this stand with numerous plants strung out upstream of the ribbon for about 40 feet.	Y	9 or more plants observed	YES
23	46.181573; -90.108754	3	LB	Yes	Yes	This is a fairly large colony of CLP. Ribbon tied in tree. There is also a lot of <i>P. richardsonii</i> in vicinity.	Y	A couple plants pulled. About 10 plants remain	YES
No number	46.18461, -90.08596	This CLP observed during PI Survey				We removed a single CLP. We did not tie a ribbon here, nor assign a GPS point number, but it could be checked at time of hand-pulling in case more CLP appear.	Y	About 15 plants present	YES
PI-1	46.17906498; -90.07852734	This CLP observed during PI Survey				Rake fullness rating 1. This point in close proximity to GPS Point #4	N		
PI-3	46.17906546; -90.0778277	This CLP observed during PI Survey				Rake fullness rating 1. This point in close proximity to GPS Point #4	Y	Near new sites (see below)	YES
PI-7	46.17930846; -90.07782804	This CLP observed during PI Survey				Rake fullness rating 1	Y	3-5 small plants	YES
PI-8	46.1793087; -90.07747822	This CLP observed during PI Survey				Rake fullness rating 1. This point in close proximity to GPS Points #6 and #8	Y	3-5 small plants	YES

GPS Point	Latitude Longitude	Rating	Location	Ribbon	Ribbon Removed	Notes from first survey	CLP Present? (Y/N)	Notes from second survey (CLP removed, etc.)	Return Visit Recommended?
PI-18	46.17955193; -90.07712874	This CLP observed during PI Survey				Rake fullness rating 1	Y	Small plant, deep	YES
PI-19	46.17955217; -90.07677891	This CLP observed during PI Survey				Rake fullness rating 1	Y	Small plant, deep	YES
PI-27	46.1797947; -90.0774789	This CLP observed during PI Survey				A "visual" CLP recorded	N		
PI-29	46.17979517; -90.07677925	This CLP observed during PI Survey				Rake fullness 1. In close proximity to Points #11 & #12	Y	Tried to remove	YES
PI-34	46.18003674; -90.07887856	This CLP observed during PI Survey				Rake fullness rating 1	N		
PI-39	46.18003794; -90.07712942	This CLP observed during PI Survey				Rake fullness rating 1	N		
PI-45	46.18027974; -90.0788789	This CLP observed during PI Survey				A "visual" CLP recorded. In close proximity to Point #13	N		
PI-54	46.18052226; -90.07957891	This CLP observed during PI Survey				Rake fullness rating 1	N		
PI-60	46.18075; -90.09427	This CLP observed during PI Survey				CLP plant found on rake at PI Point 60 (Rake fullness 1). Corresponds to Point #20	N		
PI-158	46.18319404; -90.08133201	This CLP observed during PI Survey				CLP plant found on rake at PI Point 158 (Rake fullness 1)	N	One plant present, but removed.	
PI-175	46.18368; -90.08308	This CLP observed during PI Survey				A "visual" CLP recorded from PI Point 175 during PI survey.	N		
Missed Site	46.18356 - 90.080363	This site observed by Zach and crew during the hand-pulling.				The plants were close to shore and short. Shallow water in a silty bottom back bay.	Y	More than 20 plants remain, thick bed	YES
New Site	46.17923; - 90.07784	This site observed during our June 26 follow-up visit					Y	4-5 plants (short plants, deep)	YES
New Site	46.17913; - 90.07799	This site observed during our June 26 follow-up visit					Y	10 plants	YES
New Site	46.17904; - 90.07790	This site observed during our June 26 follow-up visit					Y	10 plants	YES

Pike Lake CLP Points

Pike Lake CLP 1 (EXISTING POINT) – On June 26, 2020, White Water staff hand-pulled 15+ small plants. ***This site needs return visit.***

Pike Lake CLP 2 (EXISTING POINT) – CLP 2, CLP 3, & CLP 4 are close in proximity. On June 26, White Water staff hand-pulled 3 plants

Pike Lake CLP 3 (NEW POINT: 46.17072; -90.11538). On June 26, White Water staff hand-pulled CLP 4 plants.

Pike Lake CLP 4 (NEW POINT: 46.17066; -90.11539) - Observed 8 plants, but did not pull. ***This area of CLP 2, 3, & 4 needs return visit.***

Pike Lake CLP 5 (NEW POINT: 46.17190; -90.11990) – On June 26, White Water staff observed and hand-pulled 15+ plants at this site.

Exhibit 4. Summary statistics for the 2020 point-intercept aquatic plant surveys for Pike Lake.

Summary Statistic	Value	Notes
Total number of sites on grid	699	Total number of sites on the original grid (not necessarily visited)
Total number of sites visited	287	Total number of sites where the boat stopped, even if much too deep to have plants.
Total number of sites with vegetation	28	Total number of sites where at least one plant was found
Total number of sites shallower than maximum depth of plants	95	Number of sites where depth was less than or equal to the maximum depth where plants were found. This value is used for Frequency of occurrence at sites shallower than maximum depth of plants.
Frequency of occurrence at sites shallower than maximum depth of plants	29.47	Number of times a species was seen divided by the total number of sites shallower than maximum depth of plants.
Simpson Diversity Index	0.92	A nonparametric estimator of community heterogeneity. It is based on Relative Frequency and thus is not sensitive to whether all sampled sites (including non-vegetated sites) are included. The closer the Simpson Diversity Index is to 1, the more diverse the community.
Maximum depth of plants (ft.)	7.50	The depth of the deepest site sampled at which vegetation was present.
Number of sites sampled with rake on rope	15	
Number of sites sampled with rake on pole	163	
Average number of all species per site (shallower than max depth)	0.51	
Average number of all species per site (vegetated sites only)	1.71	
Average number of native species per site (shallower than max depth)	0.51	Total number of species collected. Does not include visual sightings.
Average number of native species per site (vegetated sites only)	1.71	Total number of species collected including visual sightings.
Species Richness	17	Total number of species documented at sampled sites
Species Richness (including visuals)	28	Total number of species documented at sampled sites and seen in the vicinity of sample sites
Floristic Quality Index (FQI)	26.25	A metric that evaluates the closeness that the plant community is to that of undisturbed conditions.

Exhibit 5. Plant species recorded and distribution statistics for the 2020 Pike Lake aquatic plant survey.

Common name	Scientific name	Frequency of occurrence at sites less than or equal to maximum depth of plants	Frequency of occurrence within vegetated areas (%)	Relative Frequency (%)	Number of sites where species found	Number of sites where species found (including visuals)	Average Rake Fullness
Water horsetail	<i>Equisetum fluviatile</i>	6.3	21.4	12.5	6	19	1
Bur-reed	<i>Sparganium sp.</i>	6.3	21.4	12.5	6	11	1
Coontail	<i>Ceratophyllum demersum</i>	5.3	17.9	10.4	5	5	1
Spatterdock	<i>Nuphar variegata</i>	4.2	14.3	8.3	4	16	1
Clasping-leaf pondweed	<i>Potamogeton richardsonii</i>	4.2	14.3	8.3	4	29	1
Wild celery	<i>Vallisneria americana</i>	4.2	14.3	8.3	4	9	1
Common waterweed	<i>Elodea canadensis</i>	3.2	10.7	6.3	3	4	1
Northern water-milfoil	<i>Myriophyllum sibiricum</i>	3.2	10.7	6.3	3	4	1
Fern pondweed	<i>Potamogeton robbinsii</i>	3.2	10.7	6.3	3	4	1
Creeping spikerush	<i>Eleocharis palustris</i>	2.1	7.1	4.2	2	13	1
Common bladderwort	<i>Utricularia vulgaris</i>	2.1	7.1	4.2	2	3	1
Muskgrasses	<i>Chara sp.</i>	1.1	3.6	2.1	1	1	1
Freshwater sponge	Freshwater sponge	1.1	3.6		1	6	1
Pickerelweed	<i>Pontederia cordata</i>	1.1	3.6	2.1	1	4	1
Alpine pondweed	<i>Potamogeton alpinus</i>	1.1	3.6	2.1	1	1	1
Leafy pondweed	<i>Potamogeton foliosus</i>	1.1	3.6	2.1	1	1	1
White water crowfoot	<i>Ranunculus aquatilis</i>	1.1	3.6	2.1	1	1	1
Small bladderwort	<i>Utricularia minor</i>	1.1	3.6	2.1	1	1	1
Hardstem bulrush	<i>Schoenoplectus acutus</i>				Visual	25	Hardstem bulrush
Carex utriculata	<i>Carex utriculata</i>				Visual	10	Carex utriculata
White water lily	<i>Nymphaea odorata</i>				Visual	9	White water lily
Variable pondweed	<i>Potamogeton gramineus</i>				Visual	7	Variable pondweed
Large-leaf pondweed	<i>Potamogeton amplifolius</i>				Visual	6	Large-leaf pondweed
Watershield	<i>Brasenia schreberi</i>				Visual	5	Watershield

Broad-leaved cattail	<i>Typha latifolia</i>				Visual	3	Broad-leaved cattail
Marsh cinquefoil	<i>Comarum palustre</i>				Visual	2	Marsh cinquefoil
Needle spikerush	<i>Eleocharis acicularis</i>				Visual	1	Needle spikerush
Iris sp.	<i>Iris sp.</i>				Visual	1	Iris sp.
Common reed	<i>Phragmites australis</i>				Visual	1	Common reed
	<i>Gratiola aurea</i>				Boat		
	<i>Iris sp.</i>				Boat		
	<i>Persicaria amphibia</i>				Boat		
	<i>Potamogeton crispus</i>				Boat		
	<i>Rumex brittanica</i>				Boat		

Frequency of occurrence within vegetated areas (%): Number of times a species was seen in a vegetated area divided by the total number of vegetated sites.

Potamogeton crispus (Curlyleaf pondweed) is a non-native invasive species

Exhibit 6. Pike Lake aquatic plant occurrences for 2020 point-intercept survey data.

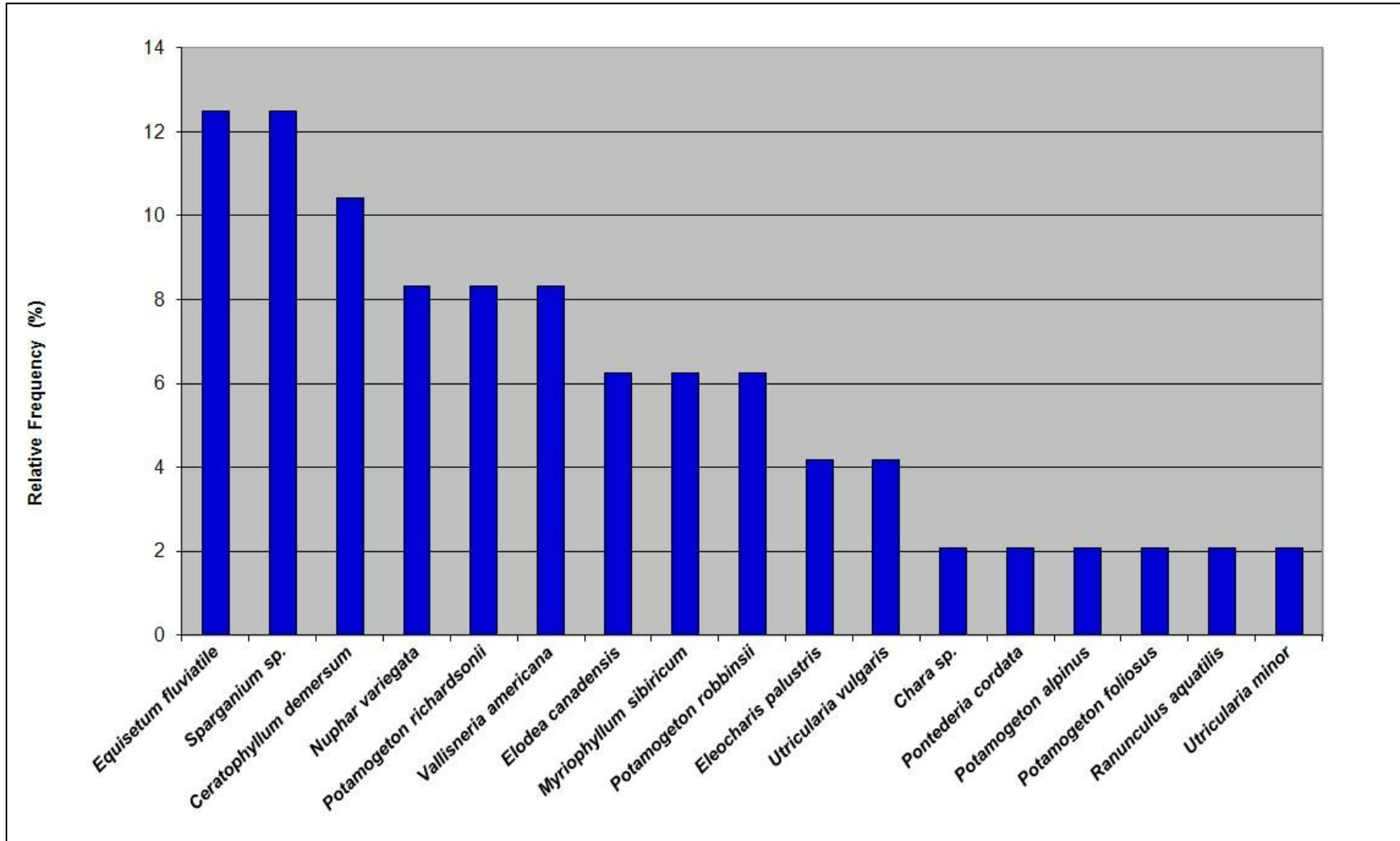


Exhibit 7. Summary statistics for the 2020 point-intercept aquatic plant surveys for Turtle River.

Summary Statistic	Value	Notes
Total number of sites on grid	206	Total number of sites on the original grid (not necessarily visited)
Total number of sites visited	183	Total number of sites where the boat stopped, even if much too deep to have plants.
Total number of sites with vegetation	85	Total number of sites where at least one plant was found
Total number of sites shallower than maximum depth of plants	176	Number of sites where depth was less than or equal to the maximum depth where plants were found. This value is used for Frequency of occurrence at sites shallower than maximum depth of plants.
Frequency of occurrence at sites shallower than maximum depth of plants	48.30	Number of times a species was seen divided by the total number of sites shallower than maximum depth of plants.
Simpson Diversity Index	0.93	A nonparametric estimator of community heterogeneity. It is based on Relative Frequency and thus is not sensitive to whether all sampled sites (including non-vegetated sites) are included. The closer the Simpson Diversity Index is to 1, the more diverse the community.
Maximum depth of plants (ft.)	6.0	The depth of the deepest site sampled at which vegetation was present.
Number of sites sampled with rake on rope	0	
Number of sites sampled with rake on pole	183	
Average number of all species per site (shallower than max depth)	1.31	
Average number of all species per site (vegetated sites only)	2.72	
Average number of native species per site (shallower than max depth)	1.25	Total number of species collected. Does not include visual sightings.
Average number of native species per site (vegetated sites only)	2.65	Total number of species collected including visual sightings.
Species Richness	25	Total number of species documented at sampled sites
Species Richness (including visuals)	39	Total number of species documented at sampled sites and seen in the vicinity of sample sites
Floristic Quality Index (FQI)	28.2	A metric that evaluates the closeness that the plant community is to that of undisturbed conditions.

Exhibit 8. Plant species recorded and distribution statistics for the 2020 Turtle River aquatic plant survey.

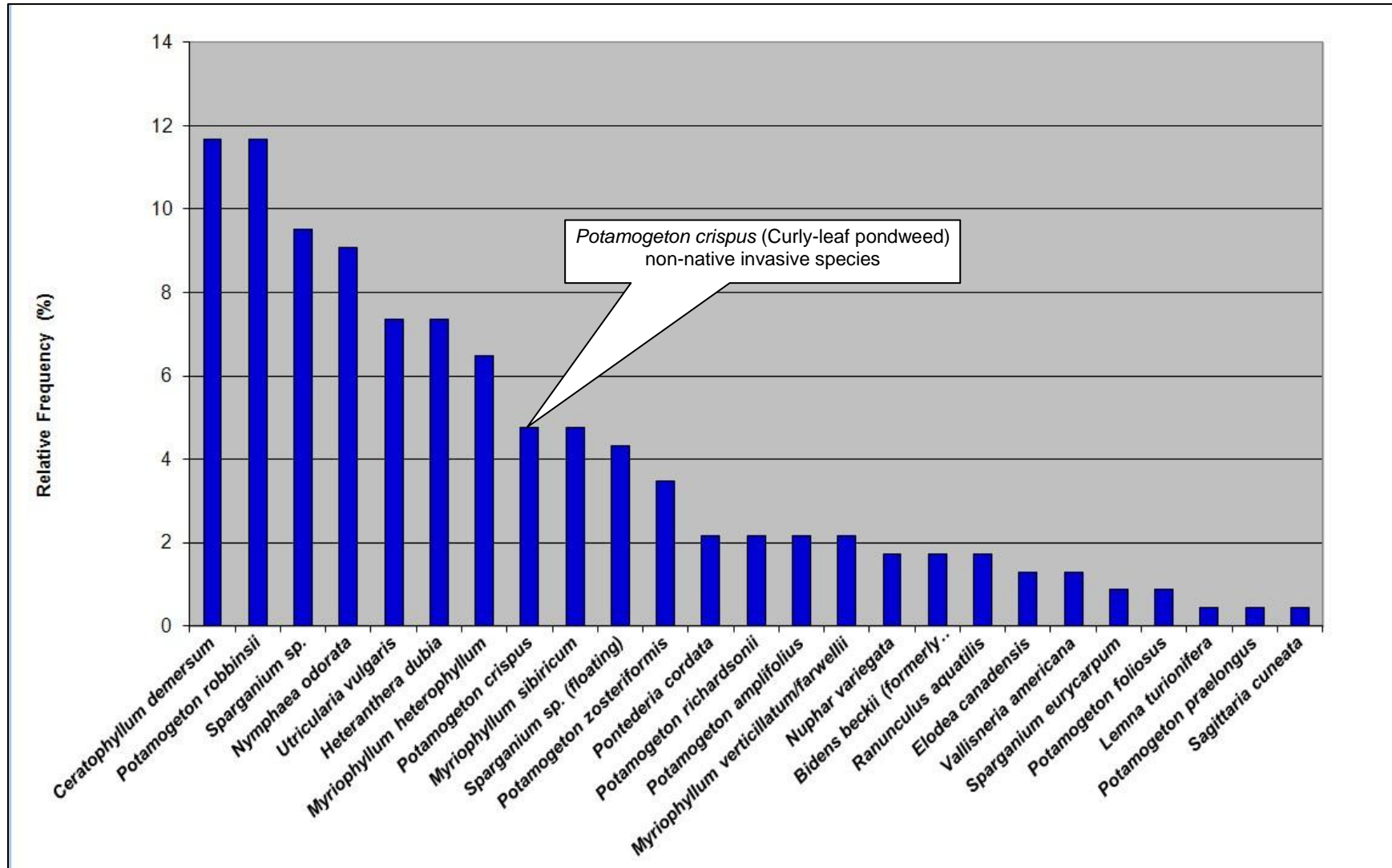
Common name	Scientific name	Frequency of occurrence at sites less than or equal to maximum depth of plants	Frequency of occurrence within vegetated areas (%)	Relative Frequency (%)	Number of sites where species found	Number of sites where species found (including visuals)	Average Rake Fullness
Coontail	<i>Ceratophyllum demersum</i>	15.3	31.8	11.7	27.0	31.0	1.0
Fern pondweed	<i>Potamogeton robbinsii</i>	15.3	31.8	11.7	27.0	31.0	1.3
Bur-reed	<i>Sparganium</i> sp.	12.5	25.9	9.5	22.0	29.0	1.0
White water lily	<i>Nymphaea odorata</i>	11.9	24.7	9.1	21.0	58.0	1.0
Common bladderwort	<i>Utricularia vulgaris</i>	9.7	20.0	7.4	17.0	25.0	1.1
Water star-grass	<i>Heteranthera dubia</i>	9.7	20.0	7.4	17.0	17.0	1.0
Various-leaved water-milfoil	<i>Myriophyllum heterophyllum</i>	8.5	17.6	6.5	15.0	15.0	1.0
Curly-leaf pondweed	<i>Potamogeton crispus</i>	6.3	12.9	4.8	11.0	15.0	1.0
Northern water-milfoil	<i>Myriophyllum sibiricum</i>	6.3	12.9	4.8	11.0	11.0	1.0
	<i>Sparganium</i> sp. (floating)	5.7	11.8	4.3	10.0	45.0	1.0
Flat-stem pondweed	<i>Potamogeton zosteriformis</i>	4.5	9.4	3.5	8.0	11.0	1.0
Pickerelweed	<i>Pontederia cordata</i>	2.8	5.9	2.2	5.0	24.0	1.2
Clasping-leaf pondweed	<i>Potamogeton richardsonii</i>	2.8	5.9	2.2	5.0	14.0	1.0
Large-leaf pondweed	<i>Potamogeton amplifolius</i>	2.8	5.9	2.2	5.0	12.0	1.0
	<i>Myriophyllum verticillatum/farwellii</i>	2.8	5.9	2.2	5.0	5.0	1.6
Spatterdock	<i>Nuphar variegata</i>	2.3	4.7	1.7	4.0	12.0	1.0
Water marigold	<i>Bidens beckii</i> (formerly <i>Megalodonta</i>)	2.3	4.7	1.7	4.0	7.0	1.0
White water crowfoot	<i>Ranunculus aquatilis</i>	2.3	4.7	1.7	4.0	4.0	1.0
Common waterweed	<i>Elodea canadensis</i>	1.7	3.5	1.3	3.0	7.0	1.0
Wild celery	<i>Vallisneria americana</i>	1.7	3.5	1.3	3.0	5.0	1.0
Common bur-reed	<i>Sparganium eurycarpum</i>	1.1	2.4	0.9	2.0	9.0	1.0
Leafy pondweed	<i>Potamogeton foliosus</i>	1.1	2.4	0.9	2.0	4.0	1.0
	<i>Lemna turionifera</i>	0.6	1.2	0.4	1.0	2.0	1.0
White-stem pondweed	<i>Potamogeton praelongus</i>	0.6	1.2	0.4	1.0	1.0	1.0
Arum-leaved arrowhead	<i>Sagittaria cuneata</i>	0.6	1.2	0.4	1.0	1.0	1.0
	<i>Freshwater sponge</i>	7.4	15.3		13.0	14.0	1.0

	<i>Filamentous algae</i>	1.7	3.5		3.0	3.0	1.0
	<i>Carex utriculata</i>				Visual	16	
Water horsetail	<i>Equisetum fluviatile</i>				Visual	10	
Creeping spikerush	<i>Eleocharis palustris</i>				Visual	6	
Watershield	<i>Brasenia schreberi</i>				Visual	5	
Three-way sedge	<i>Dulichium arundinaceum</i>				Visual	3	
Small duckweed	<i>Lemna minor</i>				Visual	3	
Hardstem bulrush	<i>Schoenoplectus acutus</i>				Visual	2	
Marsh cinquefoil	<i>Comarum palustre</i>				Visual	1	
Needle spikerush	<i>Eleocharis acicularis</i>				Visual	1	
Slender waterweed	<i>Elodea nuttallii</i>				Visual	1	
Reed canary grass	<i>Phalaris arundinacea</i>				Visual	1	
	<i>Sparganium</i> sp. (erect)				Visual	1	
Broad-leaved cattail	<i>Typha latifolia</i>				Visual	1	
Creeping bladderwort	<i>Utricularia gibba</i>				Visual	1	
	<i>Carex utriculata</i>				Boat		
	<i>Elatina minima</i>				Boat		
	<i>Galum palustre</i>				Boat		
	<i>Iris</i> sp.				Boat		
	<i>Lemna turionfera</i>				Boat		
	<i>Schoenoplectus subterminalis</i>				Boat		

Frequency of occurrence within vegetated areas (%): Number of times a species was seen in a vegetated area divided by the total number of vegetated sites.

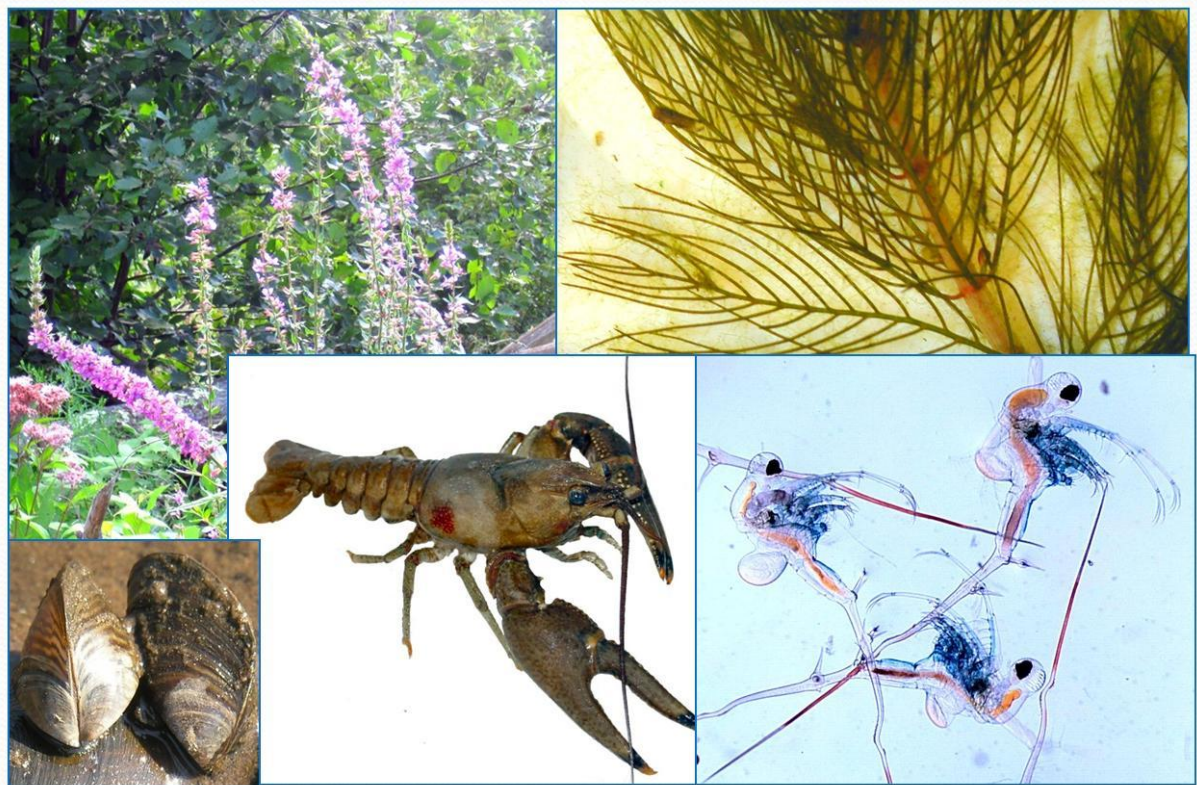
Potamogeton crispus (Curlyleaf pondweed) is a non-native invasive species

Exhibit 9. Turtle River aquatic plant occurrences for 2020 point-intercept survey data.



Pike Lake (Iron County, Wisconsin) Aquatic Invasive Species Report

This report is a product of a WDNR Aquatic Invasive Species Grant (Early Detection & Response) awarded to Rice Lake Association of Mercer, Wisconsin (acting as the sponsoring organization for Pike Lake Association)



INTRODUCTION

White Water Associates, Inc. has been retained by the Rice Lake Association, Inc. through a Wisconsin Department of Natural Resources (WDNR) Early Detection and Rapid Response Grant for lake consulting services on Pike Lake (Iron County, Wisconsin). Some tasks for this grant focused on aquatic invasive species (AIS). Efforts are intended to increase the understanding of AIS as well as native species in Pike Lake. This work prepares the Pike Lake stakeholders to conduct actions that serve lake health. As part of this effort White Water staff monitored Pike Lake for AIS using WDNR protocol. This approach assesses the lake as to its vulnerability to AIS and documents aquatic invasive plant and animal species as detected.

AQUATIC INVASIVE SPECIES EARLY DETECTION MONITORING

In order to determine if other aquatic invasive species (AIS) were present in study areas, biologists followed the *Aquatic Invasive Species Early Detection Monitoring Standard Operating Procedure* (WDNR, 2014). This procedure outlines several types of monitoring techniques, including: boat landing searches, sample site searches, targeted searches, waterflea tows and/or a Ponar dredge, and a meander search. The Pike Lake survey took place June 26, 2020.

Five sites around the lake shoreline were thoroughly searched and a meander search was conducted while traveling from one site to another. Rugger's Lodge boat landing was surveyed for 30 minutes by checking the dock and walking 200 feet of shoreline. The other four shoreline sites were randomly selected and are identified in Exhibit 1 and 2. Snorkeling was used to search for AIS at a few locations but due to poor visibility and tannic-stained water it wasn't used at every location. A long rake was used to collect any suspicious aquatic plants for closer inspection and identification. A D-net was used to collect invertebrate animals to look for AIS. Any invasive species observed were recorded. In the event of a new AIS record, specimens are collected for verification.

The spiny water flea is an aquatic invasive zooplankton that is found in a few lakes in Wisconsin. This species can be monitored by way of plankton tow nets or by an examination of sediment for waterflea exoskeleton fragments. In Pike Lake, a zooplankton net was used to collect a zooplankton sample at three locations in the lake and a composite sample was

created (Exhibit 1 and 3). The sample was brought back to the lab to look for spiny water fleas under magnification. None were found.

One aquatic invasive species (curly-leaf pondweed) was known to be present in Pike Lake prior to this survey. During the survey, two additional invasive plants were observed: (1) yellow iris (*Iris pseudacorus*) and (2) aquatic forget-me-not (*Myosotis scorpioides*). Site 1 had no AIS present. Sites 2 and 3 had curly-leaf pondweed. Site 4 had yellow iris present at a rating of 2. Rigger's boat landing had yellow iris. A yellow iris voucher was collected and pressed and confirmed by Dr. Freckmann (U.W. Steven's Point Herbarium) October, 2020. The yellow iris was found at seven total locations during the survey. It should be noted that we collected reed canary grass from the Turtle River immediately upstream for Pike Lake (confirmed by Dr. Freckmann). Because of this upstream source, this species should be monitored for its occurrence on Pike Lake. A meander search was conducted in between sites on Pike Lake. Exhibit 1 displays locations of sightings for yellow iris (YI), curly-leaf pondweed (PLCLP), and aquatic forget-me-not (AFMN).



Exhibit 2. AIS Survey on Pike Lake 6/26/2020.			
Density (1-5), and live (L) or dead (D).			
Site	Latitude	Longitude	Species found
1	46.17484	-090.11407	None
2	46.17066	-090.11540	Curly-leaf pondweed (1)(L)
3	46.16979	-090.11536	Curly-leaf pondweed (1)(L)
4	46.17909	-090.11728	Yellow Iris (2)(L)
BL	46.18066	-090.11055	Yellow Iris (1)(L)
AFMN1	46.17095	-090.11535	Aquatic forget-me-not (1)(L)
AFMN	46.16887	-090.11574	Aquatic forget-me-not (1)(L)
PLCLP3	46.17072	-090.11538	Curly-leaf pondweed (1)(L)
PLCLP5	46.17190	-090.11990	Curly-leaf pondweed (1)(L)
YI1	46.17909	-090.11643	Yellow iris (1)(L)
YI2	46.17914	-090.11614	Yellow iris (1)(L)
YI3	46.17990	-090.11390	Yellow iris (1)(L)
YI4	46.18036	-090.11363	Yellow iris (1)(L)
YI5	46.17178	-090.11923	Yellow iris (1)(L)

Exhibit 3. Spiny Water Flea Zooplankton Samples from Pike Lake			
Date: 6/26/2020	GPS Coordinates		Depth of sample (feet)
1	46.17089	-090.11732	25
2	46.17429	-090.11990	25
3	46.17946	-090.11402	25

Curly-leaved pondweed (*Potamogeton crispus*) is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia. It was accidentally introduced to the US waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves are all submersed and alternate with no leaf stalks; oblong, still, translucent leaves (4-10 cm long, 5-10 mm wide) have distinctly wavy edges with fine teeth and 3 main veins (WDNR, 2021) The plant usually drops to the lake bottom by early July. Exhibit 4 is a sample of curly-leaf pondweed that was pulled from Pike Lake.

The yellow iris (*Iris pseudacoris*) is a perennial aquatic plant native to Europe, western Asia and North Africa. It was first introduced to North America in the 1800s as an ornamental plant. Over time, the plant has spread too many wetlands and proliferated to the detriment of native plants and animals. Yellow iris is present on numerous Wisconsin lake margins and the Wisconsin Department of Natural Resources has listed this species as “Restricted” which prevents its sale, transfer, transportation and intentional cultivation. Yellow iris can reduce habitat needed by fish and waterfowl (Thomas, 1980). A yellow iris was located along the shoreline at Pike Lake (Exhibit 5).

Aquatic forget-me-not (*Myosotis scorpioides*) quickly crowd out native plant species and is able to form large monocultures, especially in situations where it is in or near a stream (WDNR, 2019). This plant is restricted in Wisconsin. The aquatic forget-me-not was found at two locations on Pike Lake. A sample was not collected but a photo was captured at one location (Exhibit 6).

Reed canary grass (*Phalaris arundinacea*) grass has been found in nearly every county in Wisconsin. It is on the *Restricted* species list. It forms dense, monocultured stands in wetland and riparian areas (Czarapata, 2005). It reproduces by spreading rhizomes, and seeds (Czarapata, 2005). It is one of the first grasses to sprout in the spring, increasing its chances of out-competing other plants.

Exhibit 4. Photo of hand-pulled curly-leaf pondweed, Pike Lake, 2020 (Photo by Angie Stine).



Exhibit 5. Photo of the yellow iris along the shoreline, Pike Lake, 2020 (Photo by Angie Stine).



Exhibit 6. Photo of the aquatic forget-me-not along the shoreline, Pike Lake, 2020 (Photo by Angie Stine).



Pike Lake stakeholders are the first line of defense when it comes to protecting the lake from introduction and establishment of AIS. Early detection and action are critical. The Wisconsin DNR has a very informative website on aquatic invasive species: <https://dnr.wi.gov/topic/Invasives/>.

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Exhibit 11. Point-intercept (PI) locations nearest observations of Reed Canary Grass

PI Sampling Point	Type of Observation	Latitude	Longitude
48	Boat Survey*, Voucher specimen	46.18050	-90.10512
50	Boat Survey	46.18051	-90.09532
56	Boat Survey	46.18074	-90.10966
99	Boat Survey	46.18172	-90.10337
101	Boat Survey	46.18172	-90.09707
104	Boat Survey	46.18196	-90.10652
137	Boat Survey	46.18271	-90.08028
156	Visual**	46.18319	-90.08308

* A "boat survey" observation records the nearest point-intercept sampling point.

** A "visual observation" is recorded if it is within 6 feet of point-intercept point.