

1.0 INTRODUCTION

The Unified Lower Eagle River Chain of Lakes Commission (ULERCLC) has been the successful recipient of Wisconsin Department of Natural Resources (WDNR) Aquatic Invasive Species (AIS) Control Grants since 2007 as they conduct a project aimed at reducing the Eagle River Chain of Lake's (Figure 1). Eurasian watermilfoil (*Myriophyllum spicatum*; EWM) population. This report specifically discusses the monitoring and control activities conducted during 2018. The chain-wide results will be presented first, followed by results from each lake individually. Additional information regarding the management and monitoring actions completed from 2008-2017 can be found in their respective annual reports.

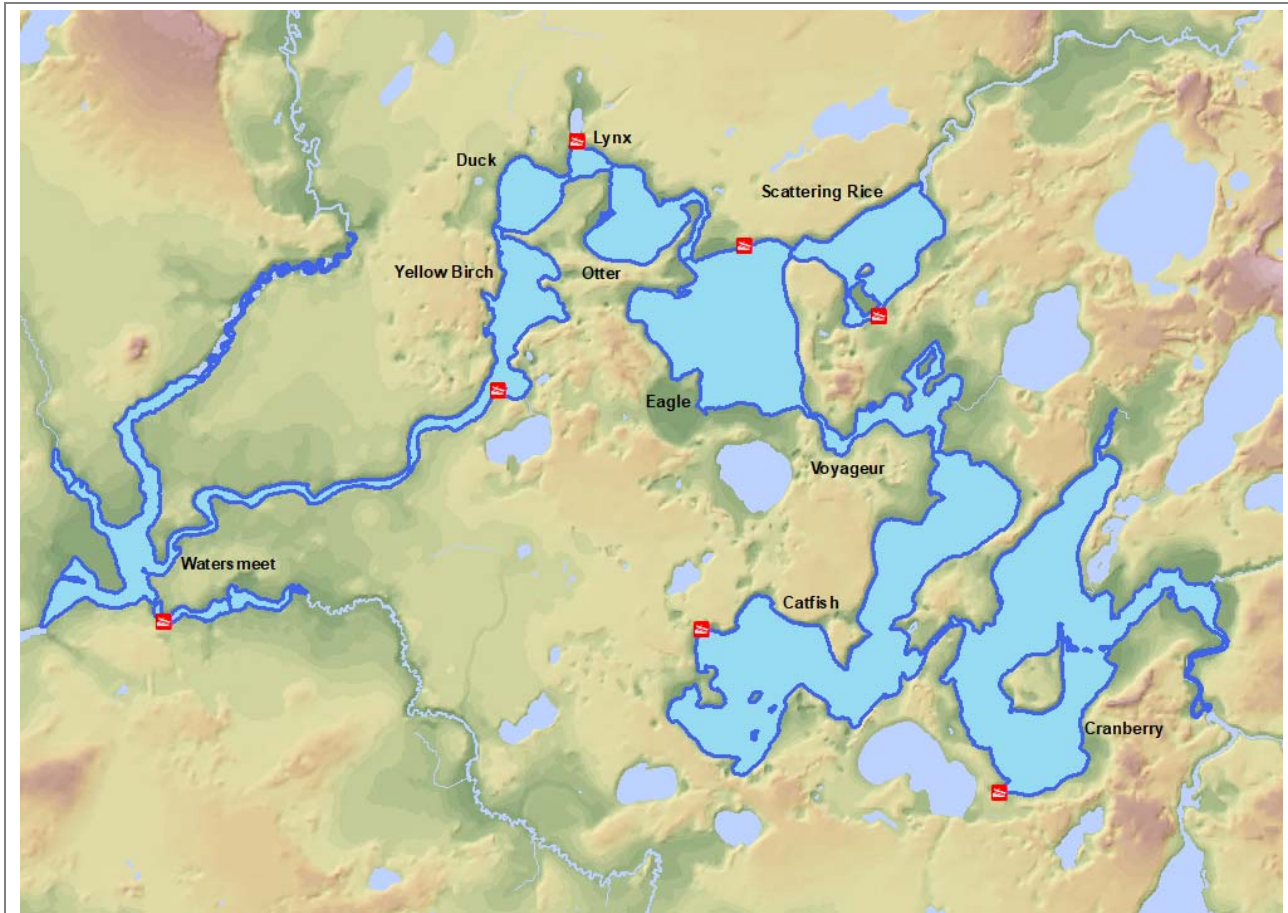


Figure 1. Lower Eagle River Chain of Lakes, Vilas-Oneida Counties.

2.0 2018 CHAIN-WIDE EWM CONTROL STRATEGY RESULTS

Onterra ecologists have conducted annual Late-Season EWM Mapping Surveys on the Eagle River Chain of Lakes since 2005. An objective of this survey is to understand the peak growth (peak-biomass) of the EWM population in the system at a fine enough scale to direct and access management actions. An approach that utilizes a combination of volunteer- and professional-based surveys ensures the entire littoral area of the chain is accessed through visual observations from the boat (Photo 1). Onterra field crews ultimately map all discovered EWM populations using sub-meter GPS technology by using either 1) point-based or 2) area-based methodologies (i.e. colonized EWM). Large colonies >40 feet in diameter are mapped using polygons (areas) and were qualitatively attributed a density rating based upon a five-tiered scale from *highly scattered* to *surface matting*. Point-based techniques were applied to AIS locations that were considered as *small plant colonies* (<40 feet in diameter), *clumps of plants*, or *single or few plants*.

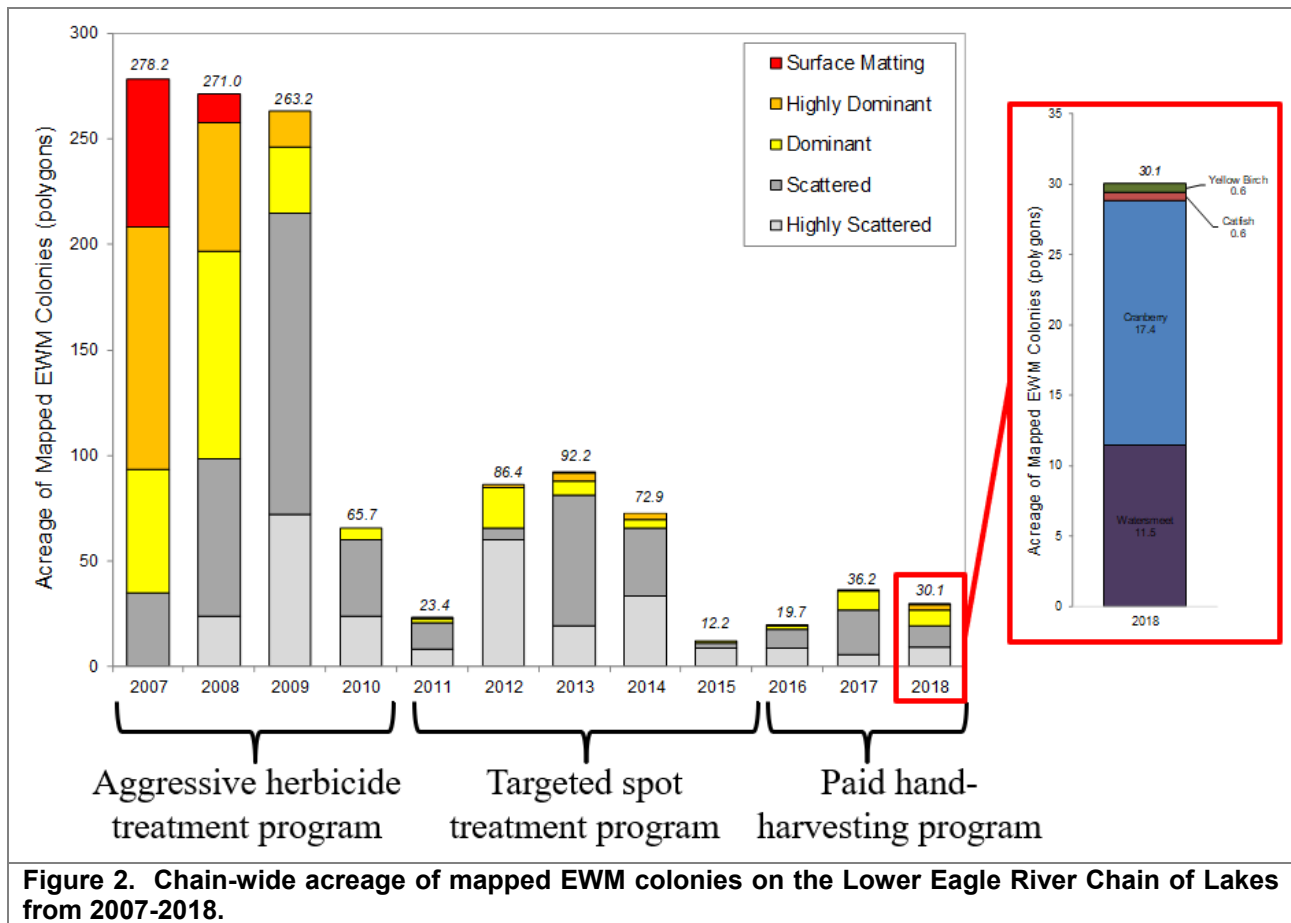


Photo 1. EWM mapping survey on Cloverleaf Lakes, Shawano County. Photo credit Onterra.

Figure 2 shows the acreage of colonized EWM as well as the distribution of each density rating. Please note that this figure only represents only the acreage of mapped EWM polygons, not EWM mapped within point-based methodologies (*single or few plants*, *clumps of plants*, or *small plant colonies*). Over this same timeframe, the ULERCLC has coordinated active management of EWM.

From 2007 to 2010, an aggressive herbicide treatment program occurred consisting of strategically targeted herbicide spot treatments and a few whole-lake or whole-basin herbicide treatments. A more directed herbicide spot treatment strategy occurred from 2011 to 2015, where additional lessons were learned in invasive milfoil management. During this timeframe, the ULERCLC was an active participant in a Cooperative Research and Development Agreement (CRADA) between the WDNR and U.S. Army Corps of Engineers Research and Development Center that coupled field-collected herbicide concentration data with professional monitoring to understand efficacy, selectivity, and longevity of chemical control strategies.

During this project, the ULERCLC found that some of the herbicide treatments during this time period were not as effective as previous control strategies. Ongoing studies stemming from this project indicate that in small spot treatments, the herbicide dissipates too rapidly to cause EWM mortality if traditional weak-auxin systemic herbicides like 2,4-D are used. Even in some cases where larger treatment areas can be constructed, their narrow shape or exposed location within a lake may result in insufficient herbicide concentrations and exposure times for long-term control. With this knowledge, more efficacious herbicide spot treatment strategies were implemented in the latter years of this phase of management. In 2015, the EWM population of the Eagle River Chain of Lakes was arguably at its lowest levels in over a decade, with just over 12 acres of colonized EWM being documented chain-wide (Figure 2).



In approximately 2015, the ULERCLC developed a working treatment strategy where consideration for herbicide application would be given to areas of EWM if they met a specific threshold (i.e. trigger). This evolved benchmark is currently understood as:

colonized (polygons) areas of EWM, with preference to areas of *dominant* or greater densities, that have a size/shape/location where management is anticipated to be effective

Based upon this established herbicide treatment strategy, no areas of EWM in the Lower Eagle River Chain of Lakes have met this threshold since 2015 and no treatments have occurred since.

The areas of EWM that exist within the chain were too small to be effectively controlled using herbicide spot treatment techniques. These areas are also below levels that cause are believed to cause measurable ecological impacts to the system and below levels that cause impediments to navigation or recreation by lake users. It was important to the ULERCLC to not abandon management completely and simply wait for EWM populations to reach levels that are again applicable for herbicide control. The ULERCLC enacted a strategy that balanced a level of EWM population tolerance while targeting other locations with experimental hand-harvesting approaches.

In 2016, experimental traditional hand-harvesting was implemented by professionals in Voyageur Lake in an effort to control small, low-density colonies of EWM. This initial hand-removal effort in 2016 was largely successful, and this effort was expanded in 2017 to include traditional hand-harvesting in areas of Voyageur and Watersmeet Lakes. Also in 2017, hand-harvesting utilizing a

diver-assisted suction harvesting (DASH) methodology occurred in two areas of Scattering Rice Lake.

Diver Assisted Suction Harvest (DASH) is a form of hand-removal which involves divers removing target plants (i.e. EWM) and feeding them into a suctioned hose for delivery to the deck of the harvesting vessel. They do not simply vacuum the area to remove the plants as that would result in the removal of sediment and non-target native plants which would be considered suction dredging (requires elaborate permitting). The DASH system is thought to be more efficient than manual removal alone as the diver does not have to go to the surface to deliver the pulled plants to someone on a boat. The DASH system also is theorized to cause less fragmentation, as the plants are immediately transported to the surface using the vacuum technology.

Based upon the results observed in 2017, a preliminary DASH strategy was designed over the winter of 2017/2018 for areas of Scattering Rice, Watersmeet, and Yellow Birch lakes for 2018. During the 2018 Early-Season AIS Survey (ESAIS), the mapping of the EWM within proposed hand-harvesting areas were refined and a final hand-harvesting strategy was derived. Onterra provided the hand-harvesting firm with the spatial data from the ESAIS Survey to coordinate the removal efforts. As is discussed specifically within the Yellow Birch, Scattering Rice, and Watersmeet lakes' individual results sections, the hand-harvesting actions occurred over six days in August.

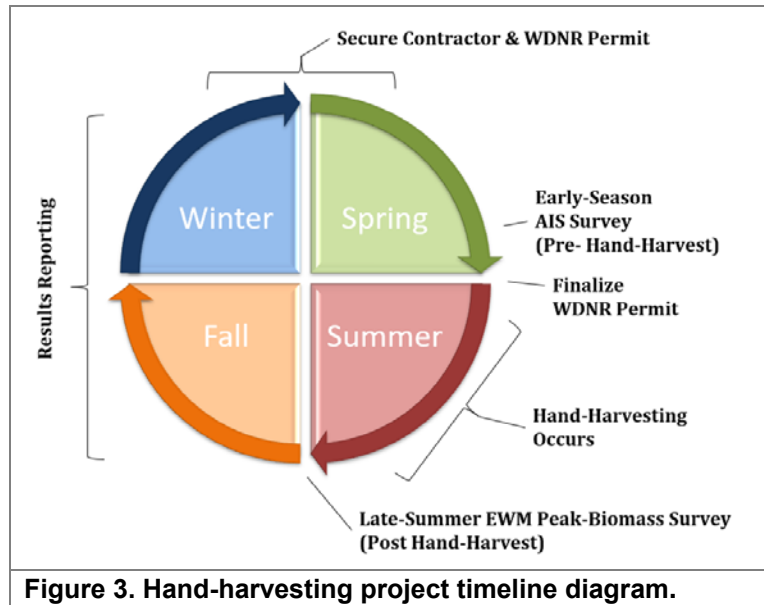


Figure 3. Hand-harvesting project timeline diagram.

Overall, 2018 saw a slight decrease in EWM polygon acreage on a chain-wide basis (Figure 2). While EWM population reductions were observed within a number of the targeted hand-harvesting sites, other areas of the chain that were not actively management also observed EWM population reductions. It has been acknowledged that the conditions of the Eagle River Chain of Lakes, particularly low water clarity, may be more of a driver of the AIS population trajectory in some years than management efforts themselves.

It is believed the decline in water clarity within the Lower Eagle River Chain is the result of a number of years with above-average precipitation since 2010. The increase in precipitation may have resulted in increased phosphorus loading to the chain, increasing algal production and reducing water clarity. The increased precipitation may have also increased the amount of dissolved humic substances within the chain, increasing the stained appearance and decreasing water clarity.

Like in past years, the majority of the EWM acreage mapped in 2018 (96%) was located in Cranberry and Watersmeet Lakes. The EWM within these lakes is largely located in channelized areas where water flow is higher. Past herbicide treatments conducted in these areas revealed it is difficult to achieve the needed concentration and exposure time to achieve EWM mortality. While the 2015

herbicide treatment in the Cranberry Channel achieved control beyond one year, assessments in 2017 and 2018 have revealed EWM rebound within this area.

3.0 2019 PRELIMINARY CHAIN-WIDE EWM CONTROL STRATEGY

The EWM population of the Eagle River Chain of Lakes continues to consist of locations mapped with point-based methods or mapped with low-density colonies. Slightly higher density EWM populations were documented from the upstream section of the Wisconsin River from Watersmeet Lake and the upstream channel leading into Cranberry Lake. The high flows in the Wisconsin River make reaching EWM control goals unlikely unless alternative herbicides that may be more effective in short exposure situations are implemented. At the current size and density of the EWM populations within Watersmeet Lake, moving forward with these more experimental strategies are not being considered.

Based upon the 2018 Late-Season EWM Mapping Survey, the EWM population within the upstream Cranberry Channel exceeded the trigger for conducting the appropriate pretreatment data for potential treatment during the spring of 2019. This included the collection of sub-sample point-intercept aquatic vegetation over this area to serve as a pretreatment dataset.

Following a period of review, the ULERCLC has elected not to pursue an herbicide control program in 2019 on this area. While of greater population size and density than the trigger, the EWM population did not increase in density over the past year and remains at a level that ULERCLC believes can be tolerated. The 2015 channel-wide 2,4-D treatment resulted in a reduced EWM population for approximately 3 summers after treatment. It is important to note that an advanced understanding of water flows took place during that treatment, including manipulation of the upstream dam at Burnt Rollways to additionally slow water exchange. In some years, water flows caused by precipitation and snowmelt in the watershed may compromise the ability for a similarly effective treatment to take place.

The ULERCLC may consider herbicides that require short exposure times (diquat, florpyrauxifen-benzyl [ProcellaCOR™], etc.) or herbicide combinations (diquat/endothall, 2,4-D/endothall, etc.) for future treatment of this area to increase the longevity of success. Again in 2019, the ULERCLC will implement the collection of pretreatment sub-sample point-intercept survey data in this location to be aligned for potential herbicide treatment if that option is perused.

No other areas of EWM within the chain meet or exceed the threshold developed for implementing herbicide control actions. Based on the results of the 2018 professional hand-harvesting program, the ULERCLC would like to build upon the positive strides gained in 2018 through increasing the amount of professional hand-harvesting effort devoted to EWM control during the 2019 growing season. The ULERCLC also believes that greater EWM population management strides, particularly in Watersmeet Lake, may be achieved by implementing the strategy earlier in the growing season (early June) when EWM and native plants are at an earlier growth stage.

A preliminary hand-harvesting EWM control strategy for 2019 includes considering all 2018 DASH hand-harvesting sites for implementation again in 2019 (Figure 4). Based upon the results of the Early-Season AIS Survey, areas will be potentially added, omitted, or revised. Onterra will provide the hand-harvesting firm with the spatial data from the early-July survey to aid the removal efforts.

Following the hand removal efforts, a Late-Season EWM Peak Biomass Survey will qualitatively assess the hand harvesting efforts (Figure 3).

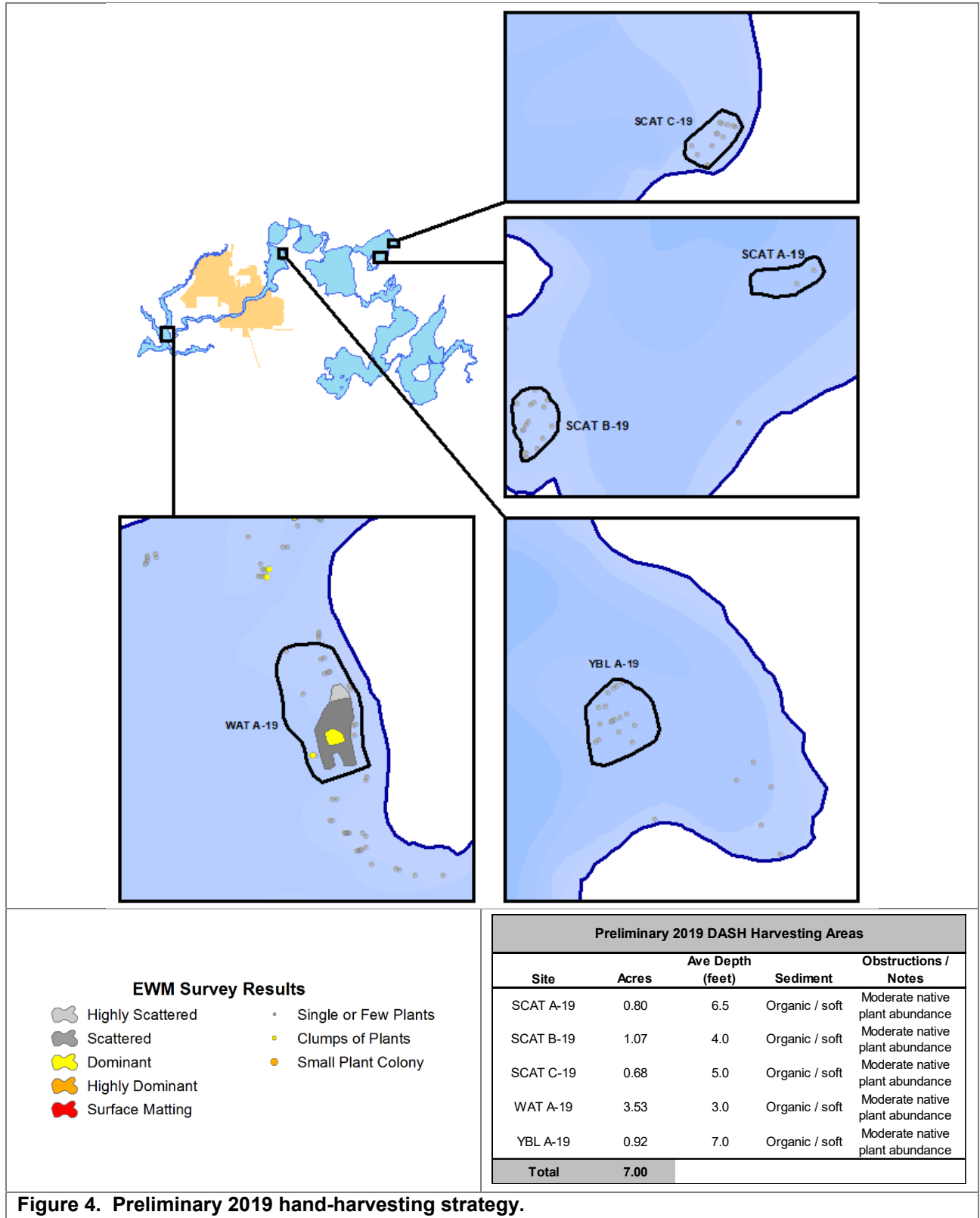


Figure 4. Preliminary 2019 hand-harvesting strategy.

4.0 INDIVIDUAL LAKE SECTIONS

The remainder of this report will focus on 2018 EWM monitoring and control strategy assessments (if applicable) on a lake-by-lake basis. Some of the text may seem redundant if one reads each lake section. However, this is intentional to ensure the information is portrayed to those who just read the chain-wide sections and their individual lake-specific section.

4.5 Scattering Rice Lake Summary and Conclusions

The largest decreases in the EWM population of Scattering Rice occurred during the 2010 whole-lake 2,4-D treatment. Following some EWM population rebound, a low-acreage herbicide spot treatment occurred during the spring of 2014.

While the EWM was found to have expanded slightly since 2014, it did not expand to a level which met the predefined threshold for consideration of implementing herbicide control strategies. However, most of the EWM consisted of two, small isolated colonies that were believed to be suitable candidates for removal via the Diver Assisted Suction Harvest (DASH) system in 2017. A total of 216 pounds of EWM were harvested from Scattering Rice Lake in 2017 by DASH methods. While this harvesting decreased the EWM populations targeted and DASH was deemed successful, these same harvesting areas still contained colonized EWM, so DASH was proposed again for 2018 in Scattering Rice Lake, with the addition of one more harvesting site.

As has occurred in past years, the EWM population in Scattering Rice Lake was mapped professionally during Onterra's 2018 Early-Season AIS (ESAIS) and Late-Season EWM Peak-Biomass surveys. During the ESAIS survey, the entire littoral zone of the Lower Eagle River Chain of Lakes was searched for EWM by Onterra field staff. Completion of an ESAIS survey presents numerous advantages. Typically, the water is clearer during the early summer allowing for more effective viewing of submersed plants. While not at their peak growth stage (peak biomass), EWM plants are higher in the water column than most native plants during this time of year which increases the chances that even low-density and isolated EWM occurrences would be located.

The results from the ESAIS survey were loaded onto specific ULERCLC GPS units, and trained volunteers were tasked with searching and mapping EWM in areas where Onterra did not locate it during the ESAIS survey. Prior to the Late-Season EWM Peak-Biomass Survey, the volunteer mapping data were provided to Onterra. During the Late-Season EWM Peak-Biomass Survey, Onterra ecologists revisited and refined areas of EWM mapped during the Early-Season AIS Survey as well as any areas marked by volunteers.

During the 2018 ESAIS Survey in Scattering Rice Lake, the areas proposed for the DASH harvesting were refined. Site A-18 contained four *clumps of plants* and numerous *single or few plants*. Site B-18 contained a 1.08-acre area of *dominant EWM*, as well as a *clump of plants* and many *single or few plant* occurrences around it. Site C-18 contained one *small plant colony*, two *clumps of plants*, and several *single or few plants* around them. A total of 2.59 acres was permitted for DASH harvesting in Scattering Rice Lake in 2018. More *single or few plants* and *clumps of plants* were marked during the 2018 ESAIS survey, mostly along the northeastern shore.

The ULERCLC contracted with DASH, LLC to conduct professional DASH harvesting of EWM in 2018. DASH, LLC conducted harvesting activities in sites A-18, B-18, and C-18 on August 20-23, spending a total of 23.5 hours actively harvesting EWM and removing approximately 472 pounds from Scattering Rice Lake (Table 1). Details of the professional DASH harvesting conducted in 2018 as reported by DASH, LLC are included with this report as an appendix.

Table 1. Scattering Rice Lake, 2018 DASH harvesting activities

DASH, LLC		
Site	Man-Hours	Pounds Harvested (EWM*)
A-18	5.5	40
B-18	16.0	412
C-18	2.0	20
Totals	23.5	472

* Calculated based off of an estimated 10% non-target harvest reported by DASH, LLC

During the 2018 Late-Season EWM Peak-Biomass Survey, only *single or few plant* occurrences were located during the survey (Figure 8; Scattering Rice Lake – Map 1). The majority of the EWM found was located south of the island and in portions of the northeastern side of the lake.

The areas where DASH was implemented saw a 100% decrease in EWM colonial acreage (polygon-mapped areas) between pre- and post-harvesting (Figure 8). Site A-18 decreased to only two *single or few plant* occurrences. Site B-18 which had a *dominant* colony during the ESAIS survey decreased to *single or few plant* occurrences. And in site C-18, no EWM was found at all during the EWMPB survey. Overall, the level of EWM in all three harvesting sites was reduced following harvesting, indicating the implementation of DASH was successful in these areas.

These three areas would be considered for hand-harvesting with DASH methodologies again in 2019 pending the results of the 2019 ESAIS Survey Results.

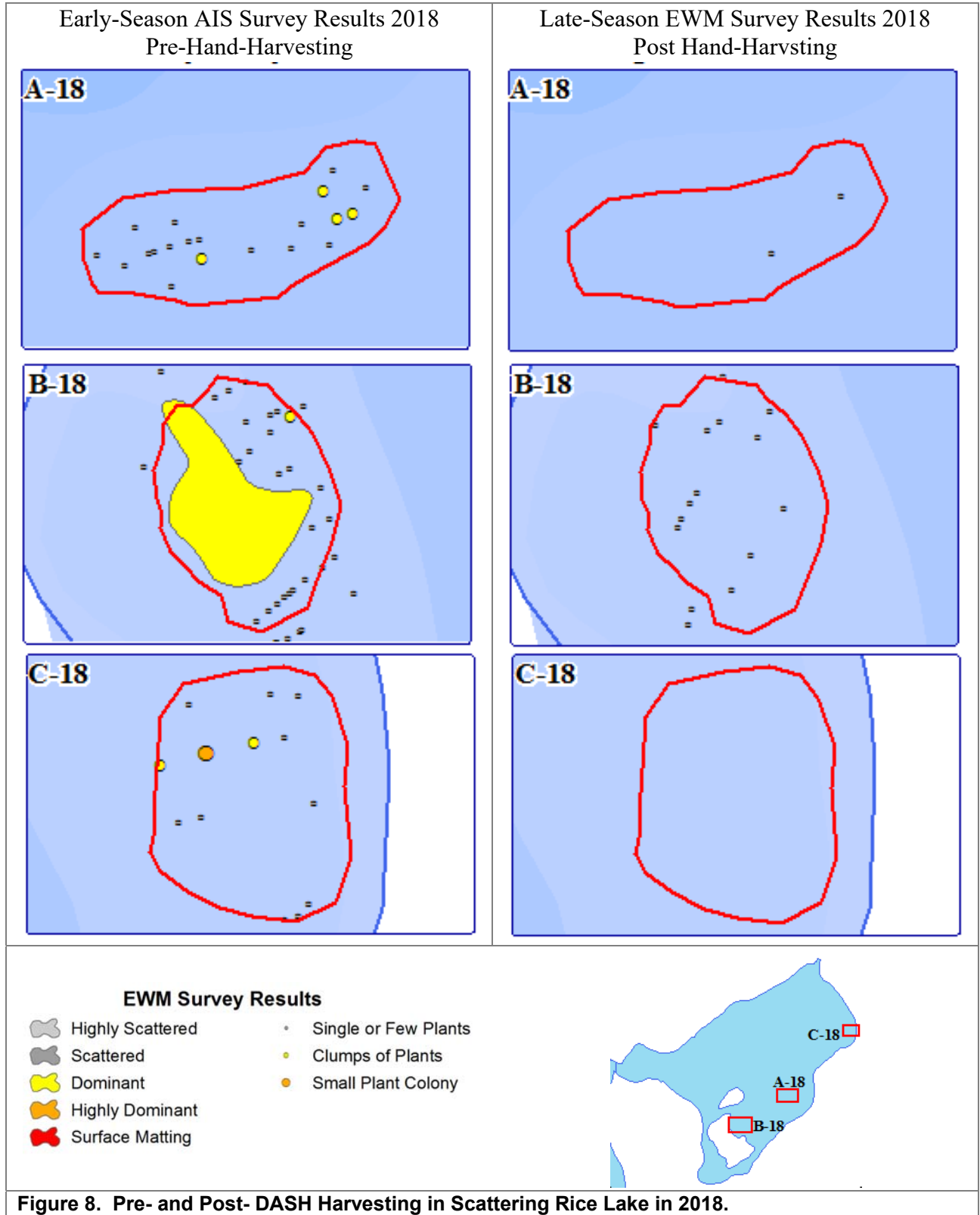
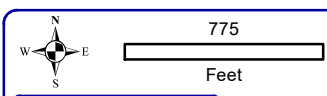
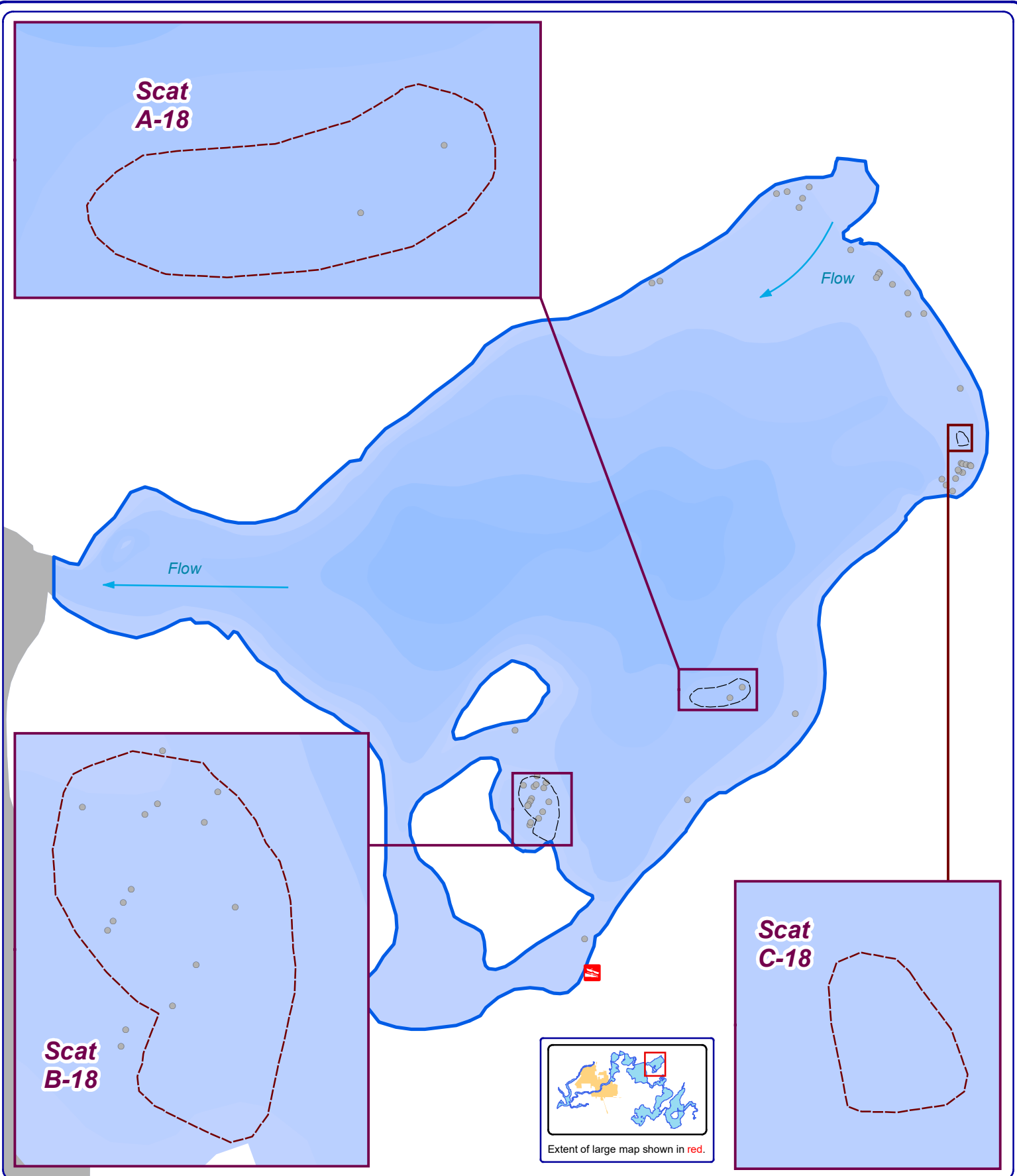


Figure 8. Pre- and Post- DASH Harvesting in Scattering Rice Lake in 2018.



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Sources:
 Roads and Hydro: WDNR
 Bathymetry: WDNR, Onterra digitized
 Aquatic Plants: Onterra, 2018
 Map Date: October 19, 2018 JMB
 Filename: ScatteringRice_EWMPB_2018.mxd

- Legend**
- 2018 EWM PB Survey (September 2018)**
- Highly Scattered (*None found*)
 - Scattered
 - Dominant (*None found*)
 - Highly Dominant (*None found*)
 - Surface Matting (*None found*)
 - Single or Few Plants
 - Clumps of Plants
 - Small Plant Colony
 - 2018 Final Professional Hand-Harvest Work Area

Scattering Rice - Map 1
 Vilas County, Wisconsin
2018 EWM PB
Survey Results



2018 DASH SUMMARY

Eagle River Chain of Lakes, Vilas County

Scattering Rice Lake

Diver Assisted Suction Harvesting (DASH) of Eurasian Water Milfoil (EWM) took place on August 20, 21, 22, 23, 2018 on Scattering Rice Lake, Vilas Co., Wisconsin. A survey performed by Onterra, LLC confirmed the locations of EWM on 2.59 acres in three areas that were targeted for harvest. The attached map was provided by Onterra, LLC. All areas were exclusively targeted for EWM.

August 20, 2018

Area SCAT A-18, was harvested for EWM using the DASH barge with one diver on hookah air supply and another person on the barge collecting the material in mesh bags. The wind was at calm, waves were calm, air temp was 70 degrees working at a depth of 7 feet.

Area SCAT A-18: 3 hours with a total of 20 lbs. of material harvested (approx. 10% non-target plants)

August 21, 2018

Areas SCAT A-18, C-18 & B-18, were harvested for EWM using the DASH barge with one diver on hookah air supply and another person on the barge collecting the material in mesh bags. The wind was 12 mph, waves were choppy, air temp was 65 degrees working at a depth of 4 feet.

Area SCAT A-18: 2.5 hours with a total of 20 lbs. of material harvested (approx. 10% non-target plants)

Area SCAT C-18: 2 hours with a total of 20 lbs. of material harvested (approx. 10% non-target plants)

Area SCAT B-18: 2 hours with a total of 36 lbs. of material harvested (approx. 10% non-target plants)

August 22, 2018

Area SCAT B-18, was harvested for EWM using the DASH barge with one diver on hookah air supply and another person on the barge collecting the material in mesh bags. The wind was at calm, waves were calm, air temp was 60 degrees working at a depth of 4 feet.

Area SCAT B-18: 7 hours with a total of 252 lbs. of material harvested (approx. 10% non-target plants)

August 23, 2018

Area SCAT B-18, was harvested for EWM using the DASH barge with one diver on hookah air supply and another person on the barge collecting the material in mesh bags. The wind was at calm, waves were calm, air temp was 65 degrees working at a depth of 4 feet.

Area SCAT B-18: 7 hours with a total of 124 lbs. of material harvested (approx. 10% non-target plants)

Procedures used during the DASH operations

The lake bed was not removed or redistributed by the suction efforts. A float was used to suspend the suction nozzle off of the lake bed.

All harvested materials were placed in onion type mesh bags, drained, weighed, evaluated for plant species, and transferred to the designated plant disposal site.

Any plant fragments not retained in the bags were skimmed from the lake surface by using a pool pole/net.

Table 1 shows the acreage, lbs. harvested, time spent and lbs. per hour.

Table 1

Site	Acreage	Lbs. Harvested	Time	Lbs. / Hour
A-18	0.82	20	3	6.6
A-18	0.82	20	2.5	8
C-18	0.69	20	2	10

B-18	1.08	36	2	18
B-18	1.08	252	7	36
B-18	1.08	124	7	17.7
Total	2.59	472	23.5	20.0

Area GPS Coordinates

Area SCAT A-18: 45.93.785 / -89.18.317

Area SCAT B-18: 45.93.598 / -89.18.888

Area SCAT C-18: 45.94.179 / -89.17.834