## INTRODUCTION

Boulder Lake, Oconto County, is a 370-acre spring lake with a maximum depth of 11 feet (Photo 1). A majority of the shoreline is privately owned with the exception of a portion that is owned by the US Forest Service, which includes a campground, swimming beach, and boat ramp on the south shore. The lake receives significant recreational use during the summer months. The primary citizen-based organization leading management activities on Boulder Lake is the Boulder Lake Private Home Association (BLPHA).



Photo 1. Boulder Lake, Oconto County, WI.

Eurasian watermilfoil (*Myriophyllum* spicatum; EWM) was first discovered in Boulder Lake in 2012. Following this discovery, the BLPHA secured grant funds through the Wisconsin Department of Natural Resources (WDNR) to initiate a monitoring and control plan. In the fall of 2012, the BLPHA contracted with an aquatic herbicide applicator to target the newly discovered EWM in the lake. An herbicide treatment of 2.7 acres was conducted in the fall of 2012 in the northeast corner of the lake. Surveys conducted in the spring of 2013 determined that the EWM levels in the lake were too low to warrant control with herbicides and instead a hand-removal effort with continued monitoring was recommended. Hand-removal of EWM took place in 2013 and 2014, with no EWM being located during surveys conducted in 2015 and continued monitoring being recommended to ensure the EWM population remained low. Hand-removal of EWM has taken place every year from 2012 to 2017 by BLPHA volunteers in a proactive effort to control EWM.

The BLPHA contracted with Onterra to conduct a meander-based EWM mapping survey in 2017. During this survey, it was again determined that the EWM populations were too small for herbicides to be effective so hand-removal efforts were recommended for 2018.

In January 2018, the BLPHA was awarded an AIS-EDR grant through the WDNR to coordinate EWM hand-harvesting control efforts, both professional- and volunteer-based, and evaluate their efficacy through the end of 2019. For a number of factors, COVID-19 included, the final year of project was delayed. This report discusses the monitoring and control actions completed during the final year (2021) of this project. This project provides the final deliverable for AIRR-231-18.



## 2021 EWM MANAGEMENT AND MONITORING STRATEGY

Based upon the previous EWM mapping data, the EWM population of Boulder Lake was quite dense in certain locations, but these locations were relatively small (< 1 acre) and in the center of the lake where they would be most exposed to water movement. Based upon Onterra's experience, these parameters are the most difficult to overcome for an herbicide treatment to be successful. After several years of contracted hand-harvesting/DASH, the BLPHA wanted to attempt an herbicide treatment strategy while WDNR grant funds were still available.

Working with an herbicide applicator company, the BLPHA considered a few herbicide strategies and the potential for combining with a barrier curtain. The logistics of having the BLPHA construct barrier curtains in time for a spring 2021 treatment were too great, so they pursued an herbicide with a reportedly lower concentration and exposure time (CET) requirement than other herbicides like 2,4-D. Following consultation with Onterra and SePRO, an expanded buffer around the target EWM colonies and a higher dose were determined to be warranted. Map 1 reflects the final ProcellaCOR<sup>™</sup> strategy with an application rate of 5.0 PDU's over each site totaling 2.4 acres.

The herbicide application was completed on June 18, 2021 between 5:15 and 6:30 am by Schmidt's Aquatic, LLC. The applicator noted light winds (2-3 mph) and a surface water temperature of 74°F at the time of the treatment. Wind speed and wind gust data were accessed from the nearest station in Shawano, WI, which is approximately 30 miles to the south. Wind speeds increased around 10 am with wind gusts of 10-15 mph reported.



https://www.wunderground.com/dashboard/pws/KWISHAWA17/graph/2021-06-18/2021-06-18/daily



## LATE-SUMMER EWM PEAK-BIOMASS SURVEY RESULTS

Onterra conducted a 2021 Late-Summer EWM mapping survey to assess the effectiveness of the herbicide treatment during the *year-of-treatment*. The EWM mapping survey offers a full account (census) of where a particular species exists in the lake. During the EWM mapping survey, the entire littoral area of the lake is surveyed through visual observations from the boat (Photo 2). Field crews supplement the visual survey by deploying a submersible camera along with periodically doing rake tows. The EWM population is mapped using sub-meter GPS technology by using either 1) point-based or 2) area-based methodologies. Large colonies >40 feet in diameter are mapped using polygons (areas) and are 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* (<35 feet in diameter), *clumps of plants*, or *single or few plants*.



Photo 2. EWM mapping survey on a Waushara County, WI lake. Photo credit Onterra.

The Late-Summer EWM Peak-Biomass Survey was conducted on Photo credit Onterra. August 20, 2021 to qualitatively assess the herbicide management efforts as well as to understand the peak growth (peak-biomass) of the EWM population throughout the lake and to consider management options for the following year. Due to the expansive littoral zone, the entirety of Boulder Lake was systematically meandered and EWM populations were mapped by using the same methodology described above. Survey crews supplemented the survey with a submersible camera when applicable to investigate priority locations including areas that were in deeper water depths. Conditions during the late-summer survey were noted as excellent with sunny skies and calm winds. With the exceptionally clear water in Boulder Lake, the majority of the EWM population could be observed visually from the bow of the survey boat.

The results of the late-summer survey are displayed on Map 1, with the majority of the EWM being located within the treatment site A-21 and in front of the Echo Valley Resort boat landing. Figures 1 and 2 display a comparison of the two 2021 treatment sites from before treatment (June 2019) to after treatment (August 2021).

Site A-21 contained numerous *clumps* of EWM as well as a couple *single or few plants* and *small plant colonies* during the June 2019 survey (Figure 2, left frame). After the 2021 ProcellaCOR<sup>TM</sup> treatment, a decrease in EWM was observed within the site in the late-summer survey with a few *clumps of plants* identified in the site, one *single or few plants*, and two *small plant colonies* (Figure 2, right frame).





A *clump of plants* and a small *highly dominant* colony was located in site B-21 in the early-summer 2019 survey (Figure 3, left frame). Following the 2021 ProcellaCOR<sup>TM</sup> treatment during the summer of 2021, several *single or few plants* and one *clump of plants* remained present in the site at the time of the 2021 late-summer survey (Figure 3, right frame).



## CONCLUSIONS AND DISCUSSION

The 2021 ProcellaCOR<sup>TM</sup> spot treatments targeting EWM that were undertaken in Boulder Lake fell short of suppression expectations. EWM reductions were observed within the treatment sites, with some EWM rebound occurring in late-August. The treatments likely provided seasonal relief for part of the summer but did not provide longer-term control. The small size and exposed nature of these treatment sites are factors that often lead to insufficient herbicide concentrations and exposure times (CETs). Typically, a single treatment site of less than 3 acres, particularly in an off-shore and exposed part of a lake, is extremely difficult to hold herbicide concentrations and exposure times sufficient to be effective. While ProcellaCOR has proven effective in challenging situations on other systems, the parameters of these treatments were too difficult to overcome.

The 2021 footprint and density of the EWM population has remained about the same and almost entirely within the same areas as located during the early-summer 2019 survey. The EWM population in Boulder Lake remains isolated to a few locations in the lake with only one area large/dense enough to use area-based mapping methods near the resort boat landing observed with a *scattered* density rating. The current EWM population is likely not having any recreational or ecological impacts to the lake, with concerns for expansion being the largest motivation for continued management by the BLHPA.

At current levels, no areas of EWM in Boulder Lake are appropriate for traditional herbicide control techniques as the areas are too small and too exposed in the lake to be effective. Contracted hand-harvesting and DASH efforts are typically employed for EWM populations of this level, but at a higher amount of effort than employed in the past on Boulder Lake. This increased effort becomes costly, even more expensive than herbicide management techniques that some lake groups feel are more effective than hand-harvesting.

As was discussed prior to the 2021 treatment, the BLPHA may consider continued investigation of herbicide treatment in combination with a barrier curtain. Although these research trials have typically taken place with an economical-priced herbicide like 2,4-D, the 2021 trial treatments on Boulder Lake proved the difficulty of these treatment scenarios and would justify an herbicide with reportedly shorter CET requirements. At the time of this writing, florpyrauxifen-benzyl (ProcellaCOR<sup>TM</sup>), a combination of 2,4-D/endothall (Chinook®), and a combination of diquat/endothall (Aquastrike<sup>TM</sup>) are examples of herbicides with reported short exposure time requirements that are employed for invasive watermilfoil control in Wisconsin. Along with a few stipulations related to visibility of the curtain, a WDNR permit is not required for temporary placement of a barrier curtain so long as access is not denied to any part of the system and the curtain is in place for no more than 96 hours. Barrier curtain construction it typically conducted by the lake group, requiring advance planning efforts.

Volunteer based hand-removal efforts are encouraged and should be considered depending on the volunteer's abilities and availabilities. Areas most appropriate for a volunteer-based removal effort include isolated *single plants* that are located closer to shore in shallower water that can be reached relatively easily by wading into the lake or using snorkeling gear.

There are WDNR AIS grant funds available to assist lake groups with EWM management and monitoring activities. To be eligible to apply for grants that provide cost share for AIS control and monitoring, "a current plan has a completion date of no more than 5 years prior to submittal of the recommendation for approval. The department may determine that a longer lifespan is appropriate for a



given management plan if the applicant can demonstrate it has been actively implemented and updated during its lifespan. However, a point-intercept survey of the aquatic plant community conducted within 5 years of the year an applicant applies for a grant is required." It is important to note that even if the Plan and point-intercept survey were completed within the last five years, the lake groups sill needs to receive determination of eligibility at least 60 days prior to the grant application deadline. Separate from organizational eligibility, this step is confirming that the project seeking grant funding is specifically supported and discussed within the lake group's management plan. For instance, if the management plan does not outline the use (how/why/when) of barrier curtains as an aspect of EWM management, the lake group is not eligible for a grant to fund a treatment with a barrier curtain.

With the assistances of UW Steven's Point as a part of an Oconto County-led effort, the BLPHA is currently engaged in a management planning process. Historically the function of county-led planning projects has been to provide a solid base management plan with supplemental and focused aquatic plant management plans being developed subsequently by the lake group often with help from a private consulting firm.



