1.0 INTRODUCTION

Berry Lake is a 209-acre seepage lake in Oconto and Menominee Counties with a maximum depth of 27 feet and a mean depth of 8 feet (Figure 1.0-1). This mesotrophic lake has a small watershed when compared to the size of the lake. Berry Lake contains approximately 60 native plant species, of which charophytes and naiads are typically the most common aquatic plant species.

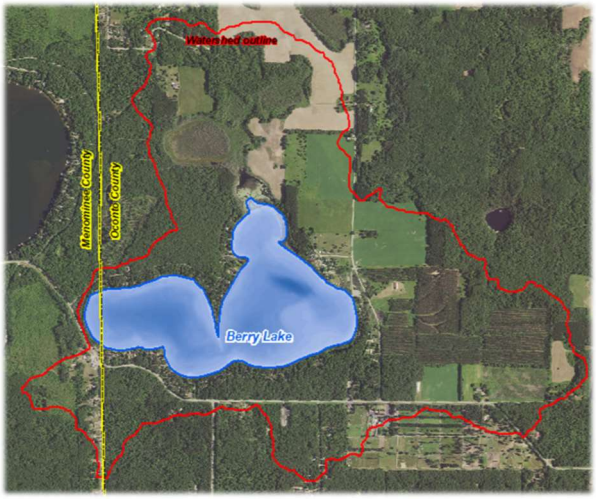


Figure 1.0-1. Berry Lake, Oconto and Menominee Counties.

Eurasian watermilfoil (*Myriophyllum spicatum*; EWM) was first documented in the lake in 2007. Due to distinct features of the EWM's morphology, WDNR staff suspected that at least a portion of the EWM in Berry Lake may be a hybrid, a genetic cross between EWM and the indigenous northern water milfoil (*Myriophyllum sibiricum*). Plant samples were sent to the Annis Water Resources Institute at Grand Valley State University in Michigan for DNA analysis in 2010. Their results confirmed that the single watermilfoil sample sent in was a hybrid strain (HWM).

A cooperative research project between WDNR, Onterra, and Grand Valley State University (transitioned to Montana State University) systematically collected invasive milfoil samples from Berry Lake as part of 2015-2017 point-intercept surveys. The goal was to determine the relative composition of EWM and HWM within the lake, and potentially even understand the strains (aka biotype) of the populations. The study results indicate that both pure strain EWM and hybrid watermilfoil populations exist in the lake. This report will refer to the overall invasive watermilfoil population of Berry Lake as "HWM."

As a seepage lake lacking inlets and outlets, Berry Lake is subjected to dramatic fluctuations in water levels driven by regional climactic factors including rainfall and snow melt. Water levels in the Great Lakes region have been tied to a roughly 10-13 year oscillation (Watras et al. 2014). A USGS gauge station was installed on Berry Lake around July 1, 2013 and continually collected data until July 1, 2025 (Figure 1.0-1). These data have shown that water levels increased in the lake by about five feet since 2013 and peaked in 2020. In recent years water levels have trended lower, down nearly four feet since 2020. The impact that the water level fluctuations may have on the aquatic plant populations in Berry Lake is difficult to determine. Overall, some species likely struggle to adapt to the changing water levels, while other species may thrive in the natural disturbance.

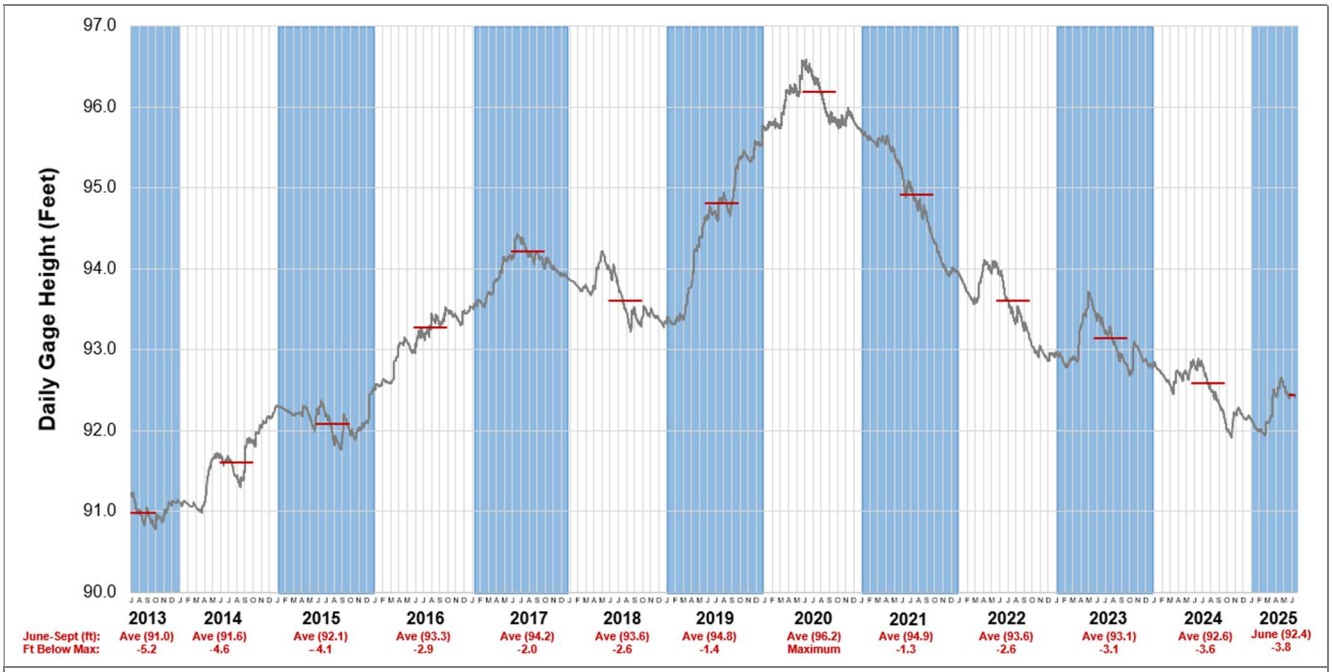


Figure 1.1-1. Berry Lake water levels from 2013-2026. Created using online data from USGS. Annual average summer (June 1-September 30) water levels shown in red lines for each year, with how that average summer dataset compares to the 2020 average summer water level displayed below each year.

1.1 HWM Management & Planning

The Berry Lake Property Owners (BLPOA) Association conducted annual 2,4-D spot treatment from 2007-2012 with a goal to reduce the overall HWM population within the lake. Targeting small spots with herbicides of that time, such as 2,4-D, proved largely ineffective at producing multi-year EWM/HWM population reductions and this strategy was abandoned.

The BLPOA finalized a *Comprehensive Lake Management Plan (CLMP)* for Berry Lake in 2015. The 2015 CLMP focused on periodically conducting whole-lake 2,4-D treatments with the goal of multi-year HWM population reductions. The BLPOA conducted a whole-lake 2,4-D treatment in spring 2018, but this treatment was not as effective as anticipated, attributed to the fact that a large component of the invasive watermilfoil population in the lake was HWM as opposed to pure-strain EWM.

In general, hybrid watermilfoil (*M. spicatum* x *sibiricum*) typically has thicker stems, is a prolific flowerer, and grows much faster than pure-strain EWM (LaRue, Zuellig, Netherland, Heilman, & Thum, 2012). These conditions may likely contribute to this plant being particularly less susceptible to 2,4-D control strategies (Glomski & Nehterland, 2010), (Poovey, Slade, & Netherland, 2007), (Nault, et al., 2018).

The BLPOA transitioned away from 2,4-D for their 2020 management approach, adopting a relatively new herbicide sold under the trade name of ProcellaCOR. ProcellaCOR (florpyrauxifen-benzyl) was selected due to its perceived increased efficacy on watermilfoil compared to other herbicides, and its narrower range of native aquatic species impacted by this chemistry. An eastern basin ProcellaCOR treatment conducted in 2020 provided 3-4 summers of reduced HWM in that basin. The BLPOA attempted to target HWM within the western basin treatment in spring 2022, but the relatively small spot

treatment did not hold sufficient herbicide concentration exposure time to result in effective HWM control, and wind conditions during and shortly after the application may have been a contributing factor.

With changes in technologies and what is considered a Best Management Practice (BMP) for EWM/HWM management, the BLPOA used this new information to update their *Aquatic Plant Management Plan* (Nov 2023). The 2023 *APM Plan* discusses their desire for staggered eastern vs western whole-basin treatments (not in the same year) in an effort to protect the native plant community, particularly native dicots like bladderworts which are abundant in this system. However, the progression of the EWM population in 2024 following a failed grant application for funding led the BLPOA to adopt a whole-lake treatment in 2025 as opposed to their preferred staggered basin approach.

As of January 1, 2025, the Berry Lake Community District (BLCD) was formed and has taken the responsibility for carrying out lake protection, management, and enhancement activities on Berry Lake.

1.2 2024 HWM Monitoring & Management Strategy Development

With the help of Onterra, the BLCD successfully received a WDNR AIS Control grant to contribute around 75% of the cost of a 2025 herbicide management action and post treatment monitoring in 2025-2026.

The proposed 2025 whole-lake ProcellaCOR treatment was designed to target 28.7 acres with direct application to reach a potential lake-wide concentration of 0.9 ppb of active ingredient (ai). . The original dosing strategy attempted to balance strategies commonly employed in southern WI (whole-lake target of 1.0-1.25 ppb ai) with what is commonly used in the north (0.7-0.8 ppb ai). Having multiple strains of EWM and HWM documented within the lake, the regional WDNR conveyed concern for a marginally low dosing strategy as it relates to potential herbicide tolerance. In lakes that contain both EWM and HWM, concern exists that the more-easily controlled EWM component of a lake's invasive milfoil population may be controlled by an herbicide treatment, but the slightly less-susceptible HWM component will survive, rebound in a short period of time, and then comprise a larger proportion of the invasive milfoil population. A revised strategy was created with application site dosing consistent with spot treatments (5.0-6.5 PDU/acre-ft), but also incorporate basin-wide and lake-wide targets roughly between 1.0 and 1.15 ppb ai (Map 1).

The BLCD's treatment monitoring plan is consistent with the 2023 APM Plan, consisting of a three-year cycle of whole-lake point-intercept surveys and Late Season HWM Mapping Surveys during the 1) *year before treatment* 2024, 2) *year of treatment* 2025, and 3) *year after treatment* 2026, as well as in situ herbicide concentration monitoring during the days and weeks following treatment. This report is the first report deliverable for ACEI-369-25, with the final deliverable occurring during the winter after the 2026 *year after monitoring* has been completed.

1.3 Pretreatment Confirmation and Refinement Survey

BLCD volunteers collected numerous temperature profiles in May, helping determine the ideal time for Onterra's pretreatment survey and ultimately the herbicide application. Onterra ecologists completed the pretreatment confirmation and refinement survey on May 30, 2025. Parameters such as plant growth stage, water temperature, and water depth were investigated to confirm the final treatment strategy. During this visit, Onterra staff delivered the equipment and supplies related to the herbicide concentration monitoring efforts being completed by BLCD volunteers.

Based upon the water temperature profiles collected by Onterra and BLCD, stratification was determined to be weak, likely not strong enough to limit vertical herbicide mixing within Berry Lake (Figure 1.3-1). The pH was 8.8 at each 2-ft depth interval down to 15 feet, where it dropped off to 7.6.

Photograph 1.3-1. HWM plants observed during May 30 2025 pretreatment survey on Berry Lake. Photos by Onterra.

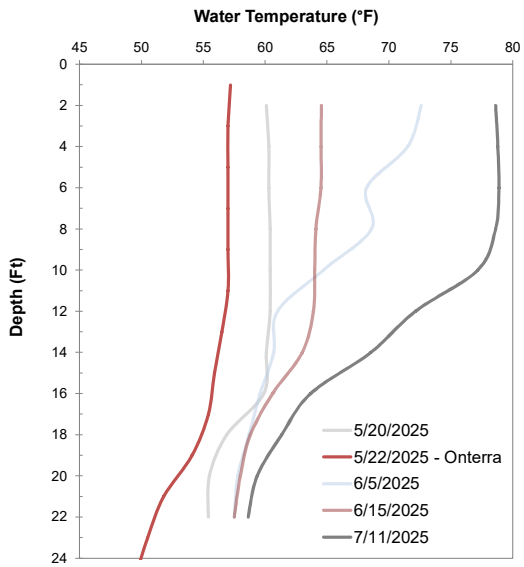


Figure 1.3-1. Temperature profiles on Berry Lake. Data collected by BLCD volunteers unless otherwise noted.

This survey was conducted using a combination of survey methods (visual, rake tows, submersible camera), but largely consisted of visual observations as most of the HWM was visible from the surface. HWM plants were robust with green growth at the tips (apical meristems) indicating a sufficient growth stage for herbicide absorption (Photograph 1.3-1). Based upon the condition of the plants, Onterra indicated that the treatment was ready to take place as soon as applicator logistics allow and final approval from WDNR is obtained. The herbicide application was completed on June 10, 2025, by Aquatic Plant Management, LLC. The applicator noted west winds of 2.5 mph at the start of treatment.

2.0 2024 MONITORING RESULTS

It is important to note that two types of aquatic plant surveys are discussed in the subsequent materials: 1) point-intercept surveys and 2) EWM mapping surveys. Overall, each survey has its strengths and weaknesses, which is why both are utilized in different ways as part of this project.

The point-intercept aquatic plant survey provides a standardized way to gain quantitative information about a lake's aquatic plant population through visiting predetermined locations and using a rake sampler to identify all the plants at each location (Photograph 2.0-1). The survey methodology allows comparisons to be made over time, as well as between lakes. The point-intercept survey is most often applied at the whole-lake scale. The whole-lake point-intercept survey has been conducted annually on Berry Lake since 2007 and are discussed in Section 2.1.

Photograph 2.0-1. Point-intercept survey on a WI lake. Photo credit Onterra.

Photograph 2.0-2. EWM mapping survey on a WI lake. Photo credit Onterra.

While the point-intercept survey is a valuable tool to understand the overall plant population of a lake, it does not offer a full account (census) of where a particular species exists in the lake. EWM/HWM grows high in the water column, which can cause recreation and navigation impediments. This factor allows it to typically be mapped through surface observation. During an EWM/HWM mapping survey, the entire littoral area of the lake is surveyed through visual observations from the boat (Photograph 2.0-2). Field crews may supplement the visual survey by deploying a submersible camera along with periodically doing rake tows. The HWM 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 attributed a density rating based upon a five-tiered scale from *highly scattered* to *surface matted*. Point-based techniques were applied to EWM locations that were considered as *small plant colonies* (<40 feet in diameter), *clumps of plants*, or *single or few plants*. Late-Season HWM mapping surveys have been conducted annually on Berry Lake since 2013 and are discussed in Section 2.2.

2.1 Quantitative Monitoring: Whole-lake Point-Intercept Survey

Using the data collected from the point-intercept surveys, an estimate of occurrence of each plant species can be determined. The occurrence of aquatic plant species is displayed as the *littoral frequency of occurrence*. Displayed as a percentage, the littoral frequency of occurrence is used to describe how often each species occurred in the sampling locations that were within the maximum depth of plant growth (littoral zone). Figure 2.1-1 compares the littoral frequency of occurrence of aquatic plant species from the 2024 and 2025 point-intercept surveys. For comparison purposes, the occurrences of morphologically similar species are lumped within the analysis. A full table of the point-intercept data are included as Appendix A.

Dicot (broadleaved) plant species are generally more impacted by herbicides with similar chemistry to ProcellaCOR (i.e. auxin hormone mimics). Watershield, common bladderwort, and coontail were all found to be less than 2% in 2024 and were also reduced to zero during the *year of treatment,* although their low general abundance factored into these changes not all being statistically valid (Figure 2.1-1). More prevalent dicot species such as northeastern bladderwort and white water lily populations remained relatively stable following the spring 2025 treatment.

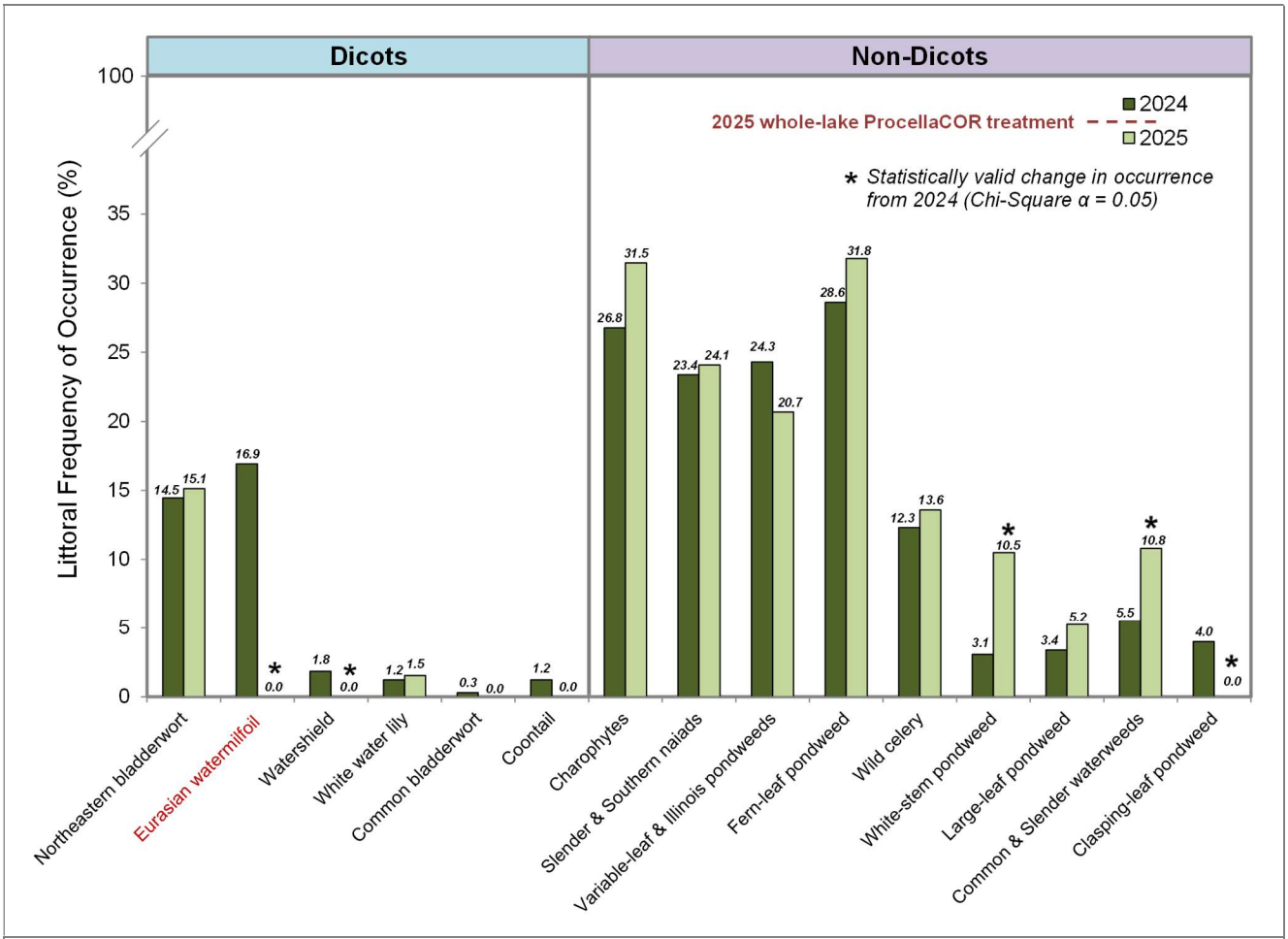


Figure 2.1-1. Littoral Frequency of Occurrence of select aquatic plants from an 2024-2025 point-intercept surveys in Berry Lake.

While some slight population fluctuations were noticed within the non-dicot plant species, overall stability was noted within this grouping. Common waterweed populations exhibited a statistically valid increase. White-stem pondweed had notable population increases while clasping-leaf pondweed exhibited a decrease. These species have somewhat similar morphology, therefore the changes observed may be in part an artifact of differing opinions in field identification between the years. A replication of this survey is planned to occur during 2025 which will evaluate the aquatic plant population dynamics in this site during the *year after treatment*.

During the 2024 *year before the treatment* point-intercept survey, HWM was found at 16.9% of the littoral sampling locations and reduced to 0% during the *year of treatment* (Figure 2.1-2). This 100% decrease in occurrence aligns with expectations for whole-lake ProcellaCOR treatments. The 2025 whole-lake ProcellaCOR treatment has yielded the greatest level of HWM reduction compared to all previous herbicide management actions on Berry Lake. As discussed during the planning stages of this treatment, understanding the level of HWM control achieved from the 2025 whole-lake treatment hinges on the magnitude of EWM rebound in the summers after the treatment.

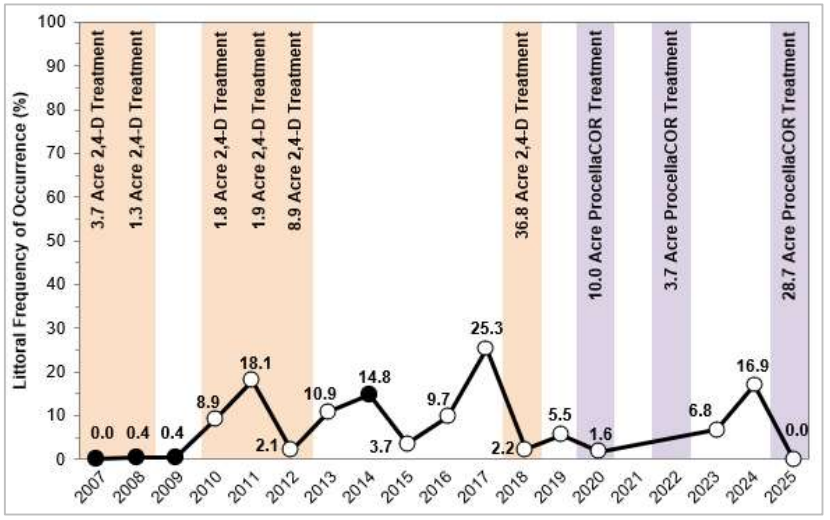


Figure 2.1-2. Berry Lake HWM littoral frequency of occurrence. Open circles represent a statistically valid change from previous survey.

Photograph 2.0-1. Hybrid watermilfoil. Photo credit Onterra.

Figure 2.1-3 displays littoral frequency of occurrence of all aquatic plants from summer point-intercept surveys completed between 2007-2025 on Berry Lake. Aquatic plants have been found at 74-92% of the littoral sampling locations during this period. The last three survey years have remained very consistent at 78-79%. While the 2025 point-intercept survey had a very slight reduction in overall vegetation littoral frequency of occurrence compared to 2024, the number or sample locations with native plants actually increased from 253 in 2024 to 254 in 2025.

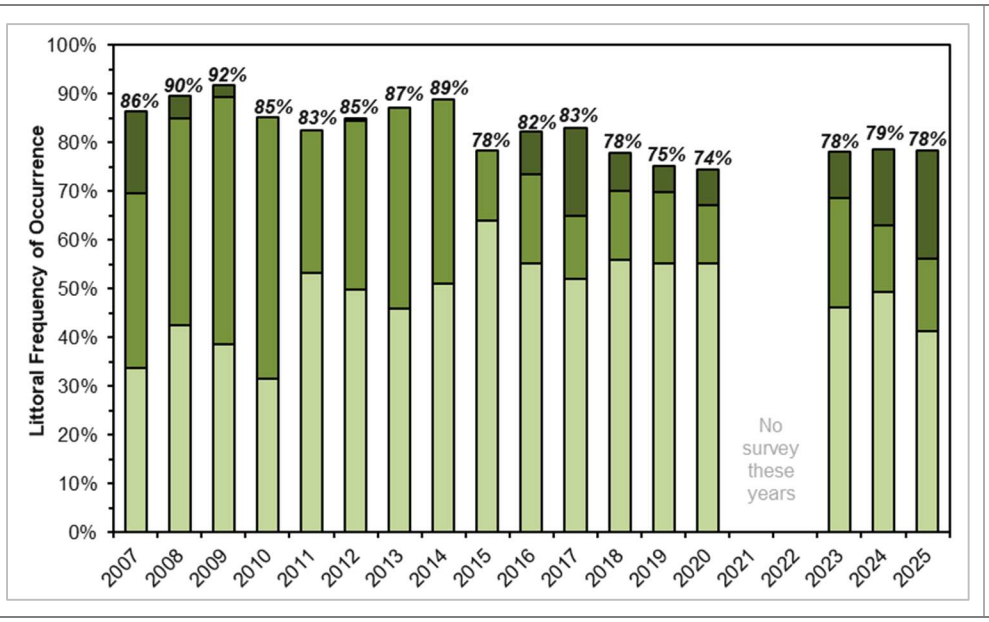


Figure 2.1-3. Berry Lake aquatic vegetation rake fullness ratings within littoral areas. Created using data from mid- to late-summer point-intercept surveys.

Another metric that assesses the native plant community in the lake over time is through comparing the average number of native plant species per sampling location from the point-intercept surveys. In some instances, higher species richness per sampling location can indicate complexity of the aquatic plant community, whereas other times it can indicate a high number of disturbance-tolerant species present. Lake managers largely look at the stability of this metric over time to understand changes in the overall aquatic plant community. This metric was highest in 2012-2013, large declines being observed from 2013 to 2015 when no herbicide management occurred (Figure 2.1-4). This metric has remained relatively stable since.

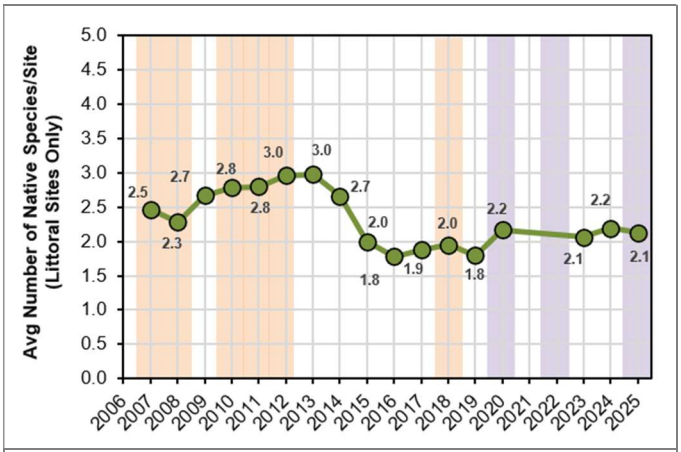


Figure 2.1-4. Number of native species per sampling location. Created using data from mid- to late-summer point-intercept surveys.

2.2 Qualitative Monitoring: HWM Mapping Surveys

Late-season HWM mapping surveys have been conducted annually on Berry Lake using a consistent methodology by Onterra since 2013. Figure 2.2-1 displays the acres of HWM mapped during the annual late-season mapping surveys. It is important to note that Figure 2.2-1 only accounts for HWM that is mapped with area-based mapping (polygons) and does not account for any occurrences mapped with point-based attributes such as *single plants*, *clumps of plants*, or *small plant colonies*.

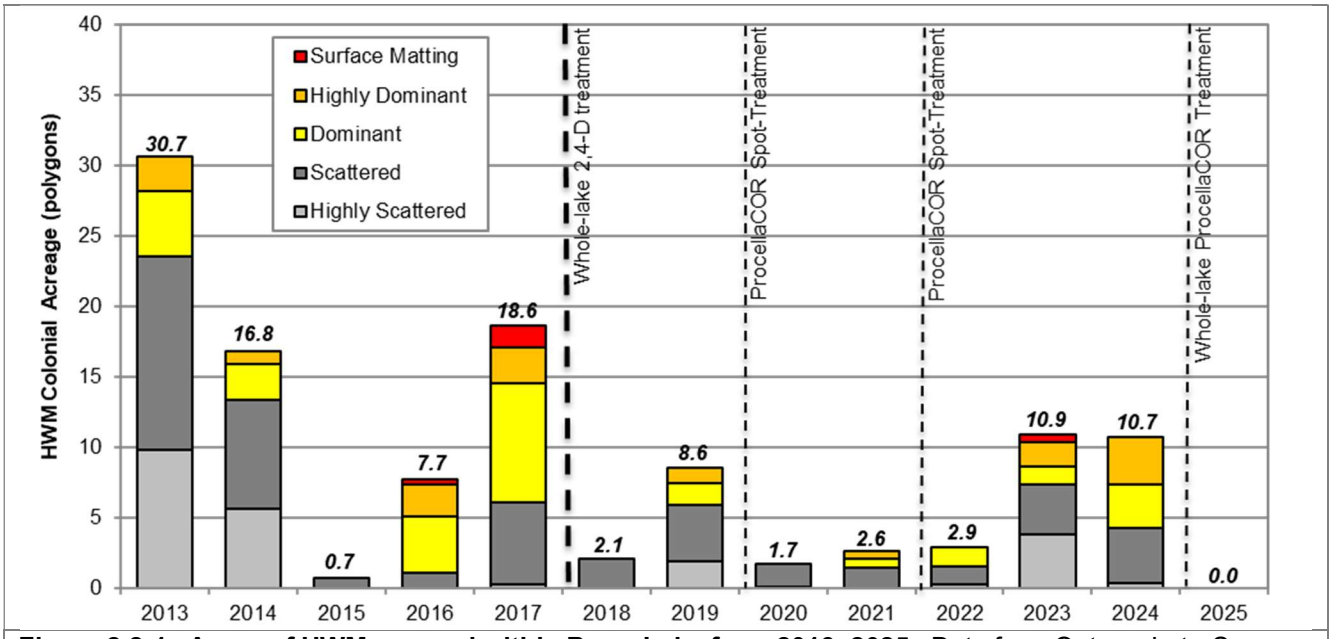


Figure 2.2-1. Acres of HWM mapped within Berry Lake from 2013–2025. Data from Onterra Late-Summer HWM Mapping Surveys.

Approximately 11 acres of colonized HWM was delineated during the 2024 Late-Season HWM mapping Survey, of which 7.5 acres was *dominant* or greater density that has the capacity to impact navigation and recreational use. During the meander-based 2025 HWM mapping survey, no HWM was detected

from surface viewing (Map 2). Submersible cameras were also deployed in areas of previously dense HWM colonies, with no HWM being detected during those investigations as well.

2.3 Herbicide Concentration Monitoring

The herbicide concentration monitoring plan associated with the treatment was developed by Onterra and the WDNR, with the intent of gaining sufficient data to aid in understanding the concentrations of herbicide that were achieved after treatment. Samples were collected at four sites within Berry Lake following treatment – two within direct application areas (B1 and B4), and one site located outside the treatment areas in each of the two basins (B2 and B3) where herbicide was not directly applied. A copy of the herbicide concentration monitoring plan and table of the results are included as Appendix B. All samples were collected by BLCD volunteers and upon completion of the sampling, were shipped to the Wisconsin State Lab of Hygiene for analysis. The WSLH has lower detection limits for florpyrauxifen-benzyl (0.5 ppb vs 0.6 ppb) and florpyrauxifen acid (0.48 ppb vs 1.5 ppb) compared to EPL Bioanalytic which was used in prior years.

The active ingredient of ProcellaCOR is florpyrauxifen-benzyl (FPB). Following herbicide application, concentrations of FPB are initially high within the lake and immediately start to degrade (Figure 2.3-1). Based upon Onterra's experience with whole-lake ProcellaCOR treatments, FPB typically degrades below detection limits in 7-14 days after treatment (DAT). FPB degrades into a number of derivate chemicals including the acid metabolite (florpyrauxifen acid, FP acid). Albeit to a lesser degree, the acid metabolite has herbicidal properties and continues to impact EWM and other sensitive plant species, which is why testing is directed towards it. As a product of FPB degradation, FP acid concentrations typically peak around 7-14 DAT following whole-lake treatments, often earlier in lakes with higher pH. The degradation of FP acid into inert components is less predictable than for FPB, with concentration often being below detection limits by 30-40 DAT but may persist out to 70 DAT or longer on some systems.

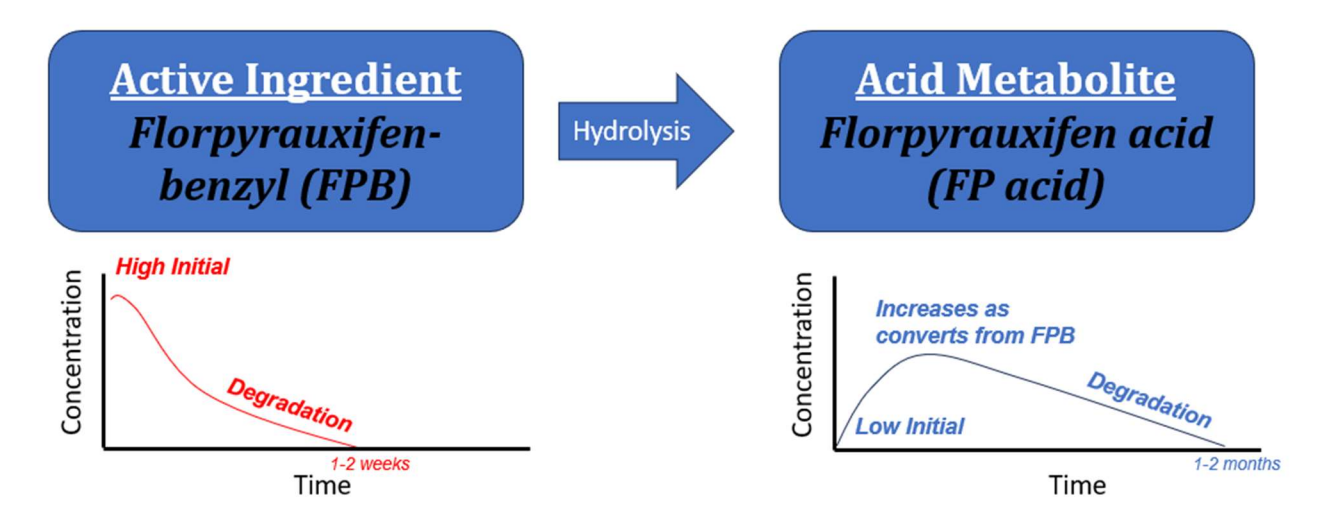


Figure 2.3-1. Schematic of ProcellaCOR degradation. Created by Onterra.

Please note that each PDU/acre-ft is equivalent to 1.926 ppb, so the application rate of 5.0 and 6.5 PDU/acre-ft in application areas is 9.3 and 12.5 ppb, respectively. The top frame of Figure 2.3-2 displays the concentrations of the active ingredient in ProcellaCOR (florpyrauxifen-benzyl, FPB) from the three

monitoring locations located within Berry Lake, two within application areas and one in the center of the West lake basin and one in the center of the East lake basin.

As anticipated, FPB concentrations were highest within the first few sampling intervals after treatment. At 3 hours after treatment (HAT), the FPB concentration in an herbicide application site B4 was 4.3 ppb and increased to 5.2 ppb at 9 HAT. The FPB concentration at 3 HAT in Site B1, also an herbicide application site, was 0.3 ppb and peaked at 9 hours after treatment when it reached 0.5 ppb. The average concentration of all sites at the first sampling interval (3 HAT) was 1.16 ppb increasing to 1.46 by 9 HAT, relatively similar to the projected whole-lake concentration of 1.0-1.15 ppb ai.

FPB concentrations reached a uniform concentration in all four sampling locations around 1 DAT at 0.3 ppb, indicating whole-lake mixing had occurred in the first 24 hours after treatment. In whole-wide treatments that Onterra has monitored to date, measured whole-lake concentrations usually fall below calculated levels (often around half) as the herbicide is rapidly absorbed by aquatic plants and converted to acid form. The concentrations observed during the 2025 Berry Lake whole-lake ProcellaCOR treatment were slightly less than expected, potentially due to the high pH of surface waters. FPB concentrations had degraded to near detection limits at 7 DAT and were below detection limits in all samples collected at 14 DAT and all subsequent intervals out to 70 DAT.

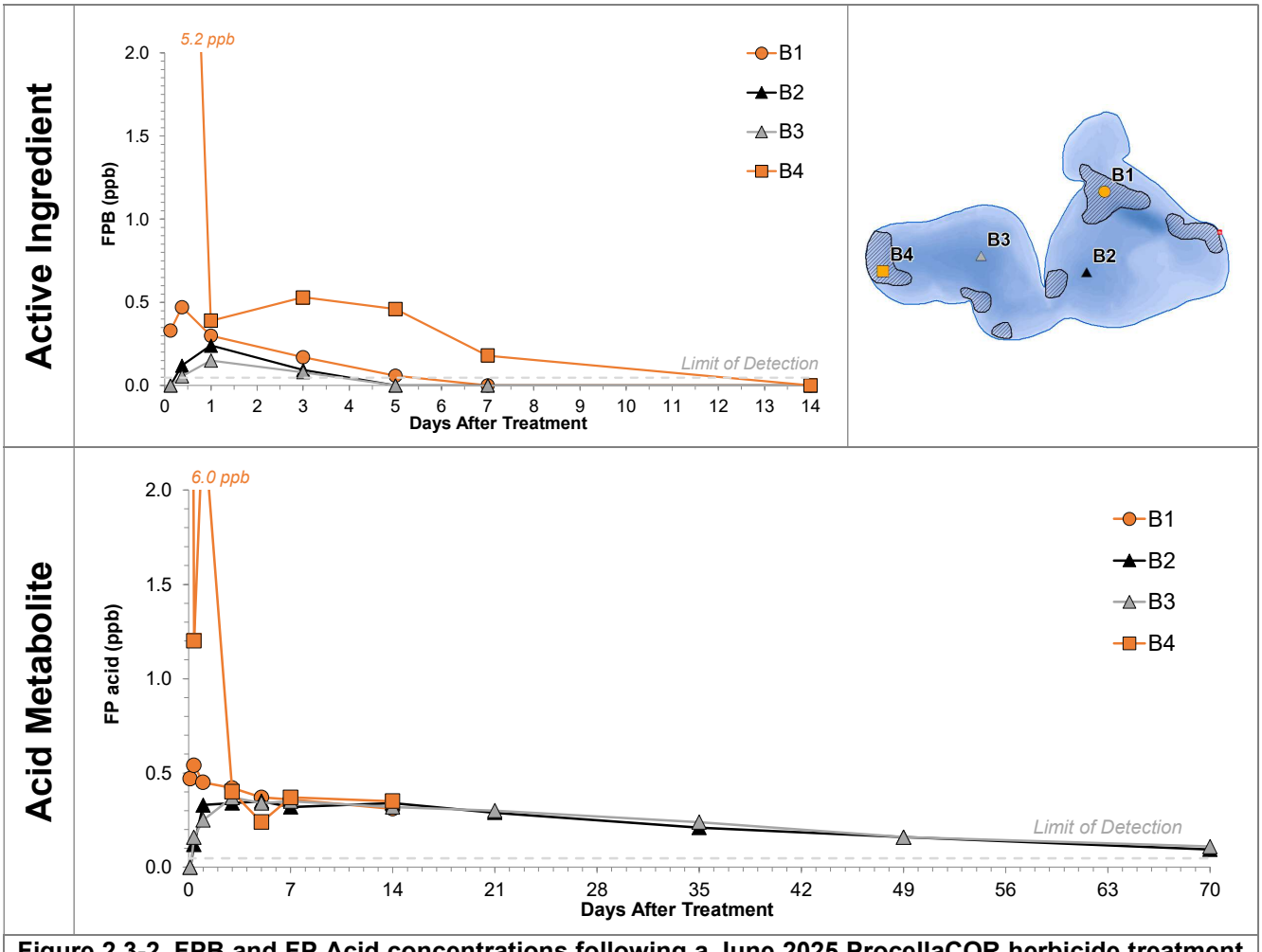


Figure 2.3-2. FPB and FP Acid concentrations following a June 2025 ProcellaCOR herbicide treatment in Berry Lake. Limit of detection = 0.05 ppb.

The bottom frame of Figure 2.3-2 shows the concentrations of the acid metabolite (florpyrauxifen acid, FP acid) within Berry Lake. Corresponding to the high FPB concentrations within Site B4, higher FP acid concentrations were also observed in the early sampling intervals of this site. Lake-wide FP acid concentrations were uniform by approximately 3 DAT, with a slow and steady degradation observed out to 70 DAT. Although similar persistence has been observed in a few other whole-lake ProcellaCOR treatments, the persistence of FP acid in Berry Lake during this treatment falls on the longer end of the reported range.

3.0 CONCLUSIONS & DISCUSSION

The 2025 HWM management and monitoring strategy was implemented as planned for Berry Lake. Measured herbicide concentrations from Berry Lake in 2025 largely aligned with expectations for FPB and FP acid, although variable concentrations were observed in the first few sampling intervals between application sites. The high pH of Berry Lake was thought to degrade the active ingredient (FPB) more rapidly into the acid metabolite (FP acid) than some other waterbodies. Ultimately, the measured FPB concentrations were maintained above the detection limit for at least 7 DAT. Concentrations were below detection limits at the 14 DAT sampling interval and all subsequent monitoring events. The acid metabolite (FP acid) concentrations were maintained above 0.1 ppb through 70 days after treatment, very similar to treatments on other similar waterbodies with similar pH (Kettle Moraine and Forest lakes, Fond du Lac County).

The initial result of the herbicide treatment shows a high level of HWM control with no HWM located during any of the professional monitoring efforts during the months following treatment. As observed on Berry Lake in the past, some herbicide treatments have shown initially favorable results, but rapid HWM rebound has occurred as soon as the *year after treatment* and therefore the management effort fell short of expectations. Continued monitoring in 2026 and beyond are required to get a full understanding of treatment efficacy and longevity.

The native plant community of Berry Lake responded much more favorably than past whole-lake herbicide treatments. Prominent species within the lake had little to no change in populations, although a few low-abundance dicot species did yield population declines. Continued monitoring in 2026 will be valuable in assessing the overall aquatic plant population in association with the spring 2025 herbicide treatment.

3.1 2026 HWM Monitoring Strategy

Based upon Onterra's experience with successful whole-lake ProcellaCOR treatments, the first detected post treatment HWM occurrences typically occur during the late-summer of the *year after treatment*. A Late-Season HWM mapping survey is planned to take place in 2026 to determine the extent to which the herbicide treatment met control expectations of population reductions extending through the *year after treatment*. Berry Lake riparians are asked to report any HWM findings during 2026 to the BLCD.

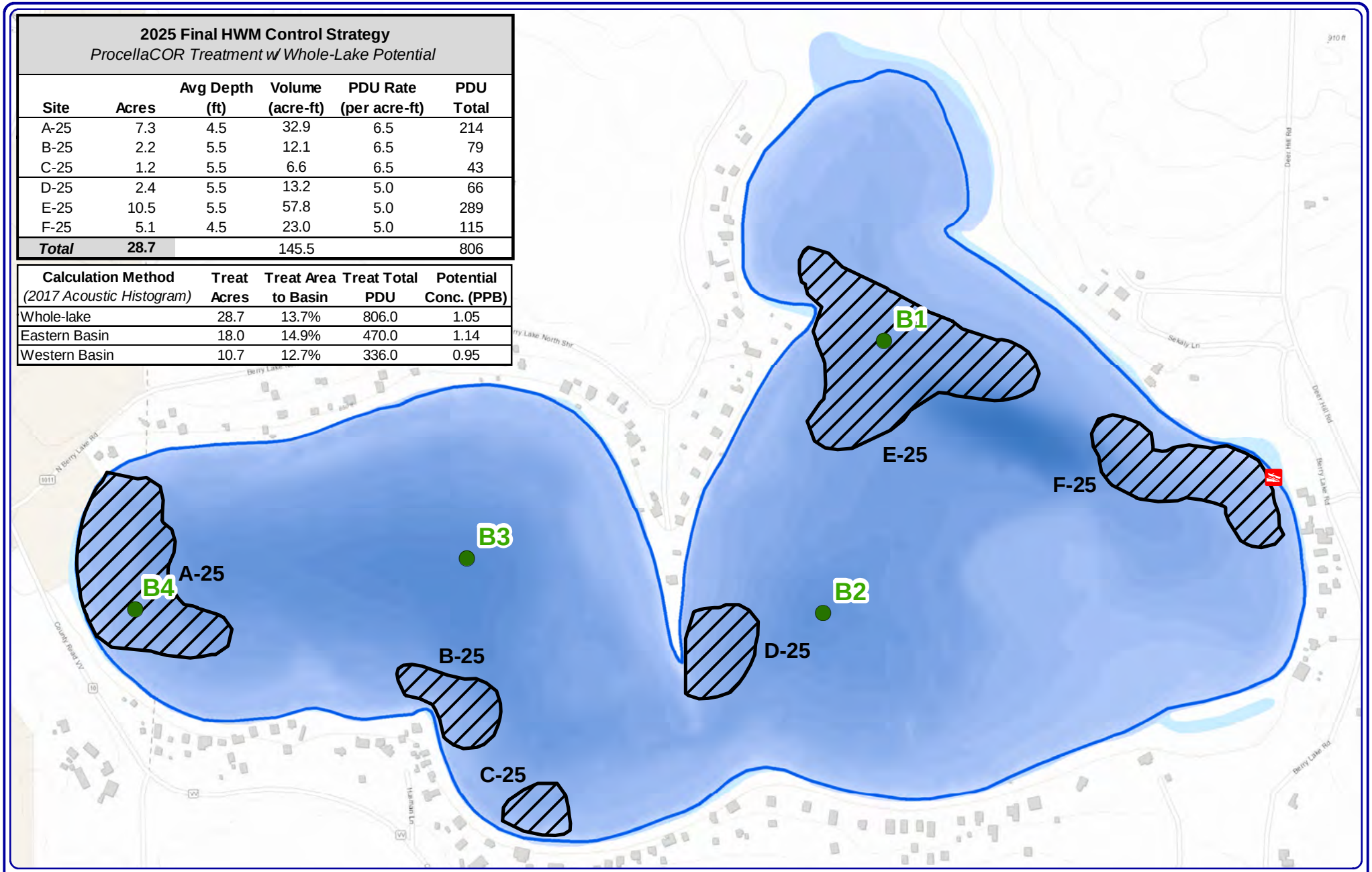
The aquatic plant community of Berry Lake will be assessed through a comparison of plant populations determined through the whole-lake point-intercept survey. The 2026 survey will be compared primarily to the 2024 (*pretreatment)* and 2025 (*year of treatment*) surveys to evaluate changes in the plant community surrounding the timeframe of the whole-lake treatment.

2025 Final HWM Control Strategy

ProcellaCOR Treatment w/ Whole-Lake Potential

Site	Acres	Avg Depth (ft)	Volume (acre-ft)	PDU Rate (per acre-ft)	PDU Total
A-25	7.3	4.5	32.9	6.5	214
B-25	2.2	5.5	12.1	6.5	79
C-25	1.2	5.5	6.6	6.5	43
D-25	2.4	5.5	13.2	5.0	66
E-25	10.5	5.5	57.8	5.0	289
F-25	5.1	4.5	23.0	5.0	115
Total	**28.7**		145.5		806

Calculation Method *(2017 Acoustic Histogram)*	Treat Acres	Treat Area to Basin	Treat Total PDU	Potential Conc. (PPB)
Whole-lake	28.7	13.7%	806.0	1.05
Eastern Basin	18.0	14.9%	470.0	1.14
Western Basin	10.7	12.7%	336.0	0.95



N W E S

570

Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Basemap: ESRI AGOL
Bathymetry: Onterra, 2017
Aquatic Plant Survey: Onterra, 2024
Map Date: May 30, 2025 - EJH

Project Location in Wisconsin

Legend

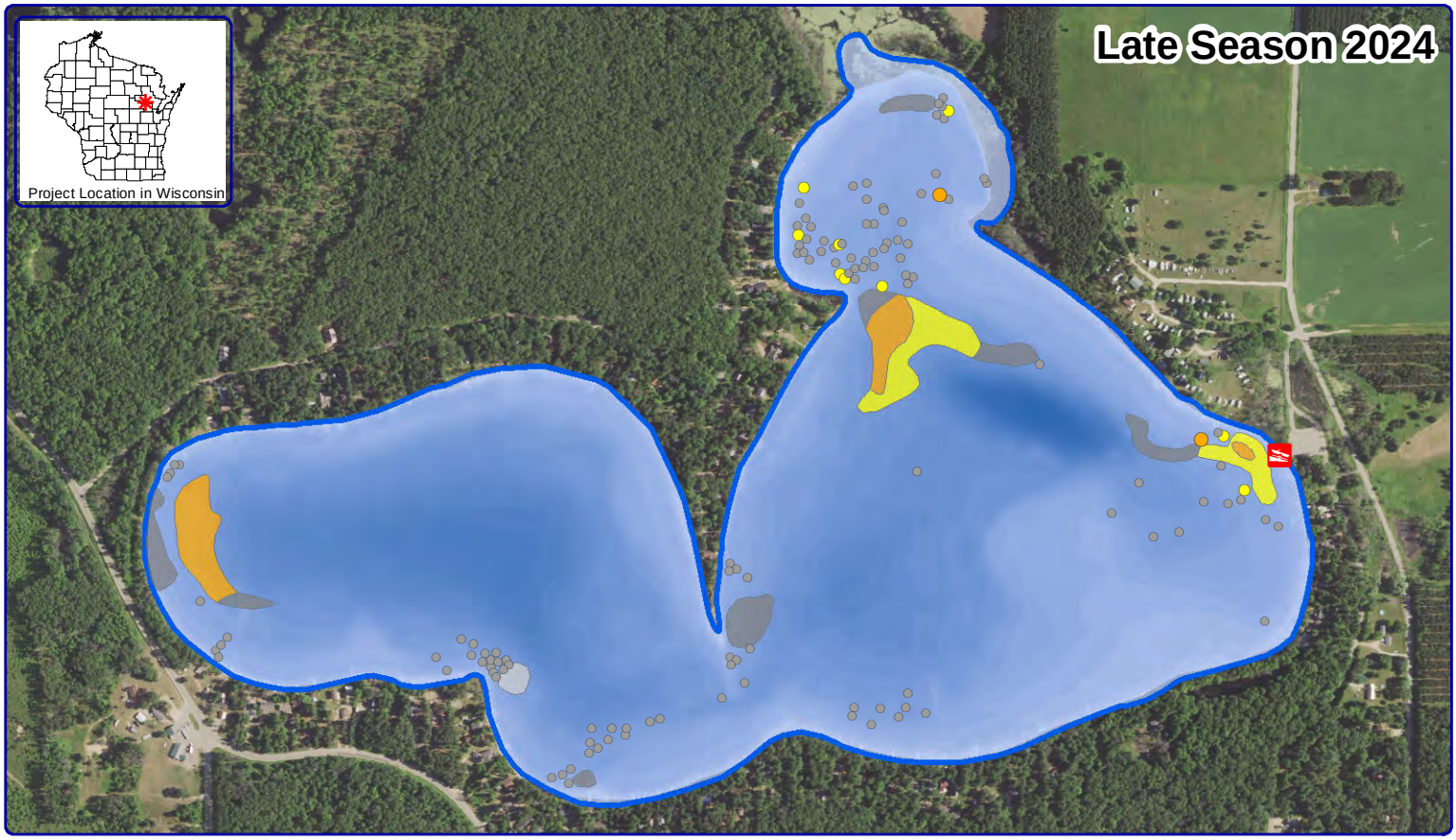
- Herbicide Concentration Monitoring Location
- 2025 Final Herbicide Application Area

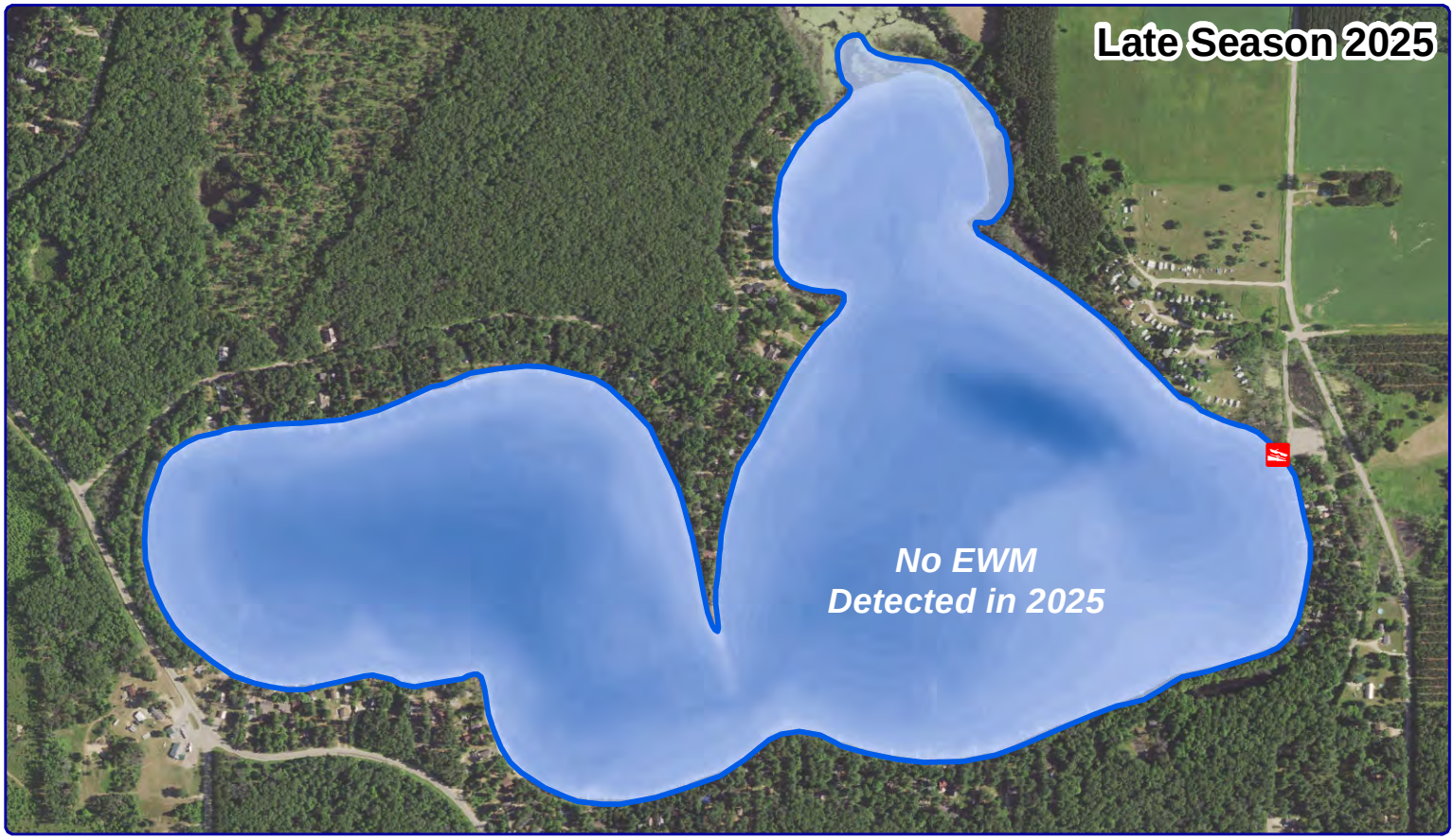
Map 1

Berry Lake

Oconto County, Wisconsin

2025 Final HWM Control Strategy





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Feet

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Sources
Basemap: ESRI
Bathy and Hydro: WDNR, Digitized by Onterra
Aquatic Plants: Onterra, 2024 & 2025
Orthophotography: NAIP, 2022
Map Date: December 1, 2025 - RMF

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting *(None)*
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- Public Boat Landing

Map 2
Berry Lake
Oconto and Menominee Counties, Wisconsin
2024 vs 2025
Late Season HWM
Mapping Survey Results

A

APPENDIX A

Point Intercept Aquatic Plant Survey Data Matrix

Appendix A
2007-2025 Point-Intercept Survey Data Matrix

			LFOO (%)																
	Scientific Name	Common Name	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2023	2024	2025
Dicots	*Utricularia resupinata*	Northeastern bladderwort	27.7	26.0	28.1	19.6	17.4	20.3	21.8	24.8	21.5	26.1	20.1	21.3	22.2	24.3	17.9	14.5	15.1
	Myriophyllum spicatum	Eurasian watermilfoil	0.0	0.4	0.4	8.9	18.1	2.1	10.9	14.8	3.7	9.7	25.3	2.2	5.5	1.6	6.8	16.9	0.0
	Brasenia schreberi	Watershield	3.9	1.9	2.8	3.0	3.9	7.2	6.8	5.7	6.7	6.5	6.8	5.6	4.8	3.2	4.0	1.8	0.0
	Utricularia gibba	Creeping bladderwort	0.0	5.8	1.2	2.1	2.8	5.8	2.7	1.0	1.3	0.6	1.0	2.8	1.6	0.0	5.2	0.0	0.3
	Nymphaea odorata	White water lily	0.6	0.4	0.0	0.0	1.1	1.0	1.7	1.7	1.3	0.0	0.3	0.9	1.9	1.3	2.5	1.2	1.5
	Myriophyllum sibiricum	Northern watermilfoil	1.6	2.3	2.0	5.1	6.4	1.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Utricularia vulgaris	Common bladderwort	0.0	0.0	0.0	0.0	0.4	0.7	0.7	0.3	0.3	1.0	0.6	4.1	3.9	3.2	0.6	0.3	0.0
	Myriophyllum tenellum	Dwarf watermilfoil	0.6	0.4	1.2	0.4	0.4	1.0	1.0	0.3	1.3	0.3	1.0	2.2	1.3	0.0	0.9	0.0	0.0
	Utricularia intermedia	Flat-leaf bladderwort	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	0.3	0.3	1.6	1.6	0.6	0.6	0.0	0.0
	Utricularia geminiscapa	Twin-stemmed bladderwort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	1.9	0.6	0.0	0.0	0.9	0.3
	Utricularia minor	Small bladderwort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.6	0.0	0.6	0.0
	Ceratophyllum demersum	Coontail	0.0	0.0	0.0	0.4	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.6	0.0	1.2	0.0
	Nuphar variegata	Spatterdock	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Bidens beckii	Water marigold	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ranunculus aquatilis	White water crowfoot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Non-dicots	*Chara & Nitella*	Charophytes	33.5	37.6	41.1	46.4	39.0	37.1	38.8	33.2	26.9	18.4	24.4	30.9	25.7	26.2	27.5	26.8	31.5
	Chara spp.	Muskgrasses	32.3	36.0	39.9	45.1	38.3	36.1	37.4	32.2	26.6	16.5	21.8	30.6	25.7	24.9	27.5	21.2	30.9
	Najas flexilis & N. guadalupensis	Slender & Southern naiads	30.3	33.3	41.5	41.7	42.6	34.4	37.8	41.3	23.6	20.6	20.8	11.3	14.8	25.2	23.8	23.4	24.1
	Potamogeton gramineus & P. illinoensis	Variable-leaf & Illinois pondweeds	33.5	16.7	33.2	30.2	36.2	40.2	44.6	35.2	9.4	17.1	23.4	24.1	17.7	29.7	22.5	24.3	20.7
	Potamogeton robbinsii	Fern-leaf pondweed	21.6	24.8	32.0	26.0	24.5	31.3	27.9	26.2	19.2	20.6	18.5	21.3	18.0	17.4	24.7	28.6	31.8
	Potamogeton gramineus	Variable-leaf pondweed	14.8	7.0	22.9	27.2	24.8	29.6	34.7	30.9	9.4	14.2	16.9	18.8	14.1	24.0	18.5	20.3	19.8
	Najas guadalupensis	Southern naiad	0.0	0.0	0.0	39.6	36.9	30.9	33.7	36.9	17.8	18.1	15.6	9.7	10.3	18.9	17.6	17.5	19.1
	Vallisneria americana	Wild celery	10.6	15.1	17.4	13.6	11.0	18.6	19.4	21.8	16.2	11.3	9.4	7.5	9.3	11.0	14.5	12.3	13.6
	Potamogeton praelongus	White-stem pondweed	18.4	13.2	18.6	23.8	18.4	21.6	19.7	23.8	16.8	16.8	14.6	3.4	2.9	2.2	7.1	3.1	10.5
	Najas flexilis	Slender naiad	30.3	33.3	41.5	2.6	5.7	3.4	4.1	5.7	7.4	2.6	5.2	1.6	4.8	7.9	6.5	5.8	4.9
	Potamogeton illinoensis	Illinois pondweed	23.9	11.6	15.4	4.7	17.0	24.7	22.4	7.7	0.0	3.2	7.8	6.6	3.5	9.5	5.2	4.9	1.2
	Potamogeton amplifolius	Large-leaf pondweed	15.8	14.3	9.1	5.5	9.9	9.6	13.6	8.4	5.1	1.6	6.2	1.9	0.3	2.2	1.2	3.4	5.2
	Elodea canadensis & E. nuttallii	Common & Slender waterweeds	0.6	1.2	2.0	0.4	0.4	0.3	0.0	0.3	0.3	0.0	0.0	0.3	0.0	0.0	1.2	5.5	10.8
	Elodea canadensis	Common waterweed	0.6	1.2	2.0	0.4	0.4	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	1.2	5.5	10.8
	Nitella spp.	Stoneworts	6.1	1.6	1.2	3.0	1.8	1.7	1.4	1.3	0.3	2.3	2.6	0.9	0.0	1.9	0.0	5.5	0.6
	Eleocharis acicularis	Needle spikerush	0.0	0.4	0.0	1.3	2.1	0.7	1.4	0.0	0.3	0.3	0.0	4.1	1.3	0.6	1.5	0.0	0.0
	Potamogeton pusillus	Small pondweed	0.0	0.0	2.0	3.4	1.1	0.3	1.7	1.3	0.0	0.6	0.3	0.0	0.6	0.9	1.2	0.9	0.0
	Stuckenia pectinata	Sago pondweed	1.0	1.9	2.0	1.3	0.4	2.1	2.7	0.3	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Potamogeton richardsonii	Clasping-leaf pondweed	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	4.0	0.0
	Schoenoplectus pungens	Three-square rush	0.0	0.0	0.0	0.0	1.4	0.3	1.4	2.3	0.0	0.0	1.0	0.0	0.3	0.0	0.0	0.0	0.0
	Schoenoplectus acutus	Hardstem bulrush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	1.0	1.3	0.3	0.0	0.0
	Sagittaria sp. (rosette)	Arrowhead sp. (rosette)	1.6	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.3	0.3
	Juncus pelocarpus	Brown-fruited rush	0.3	0.0	0.8	0.9	0.4	0.0	0.3	0.7	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3
	Potamogeton natans	Floating-leaf pondweed	0.0	0.0	0.4	0.0	0.0	0.0	0.3	0.0	0.0	0.6	0.0	0.0	0.3	0.6	0.6	0.0	0.3
	Potamogeton strictifolius	Stiff pondweed	0.6	0.0	0.0	0.4	0.7	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	Potamogeton zosteriformis	Flat-stem pondweed	0.3	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.6	0.3	0.0	0.0
	Fissidens spp. & Fontinalis spp.	Aquatic Moss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9	0.0	0.0	0.0	0.0	0.0
	Eleocharis palustris	Creeping spikerush	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.3	0.0	0.0	0.0	0.0
	Schoenoplectus tabernaemontani	Softstem bulrush	0.0	0.0	0.0	0.0	0.4	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Isoetes spp.	Quillwort spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.6	0.0	0.0	0.0
	Eriocaulon aquaticum	Pipewort	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0
	Lysimachia terrestris	Bulbil loosestrife	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sparganium sp.	Bur-reed sp.	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pontederia cordata	Pickerelweed	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
	Elodea nuttallii	Slender waterweed	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Potamogeton X scoliophyllus	Large-leaf X Illinois pondweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Alisma spp.	Water plantain sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	Typha spp.	Cattail spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sparganium eurycarpum	Common bur-reed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	Persicaria amphibia	Water smartweed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
	Lemna minor	Lesser duckweed	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Elatine minima	Waterwort	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0

B

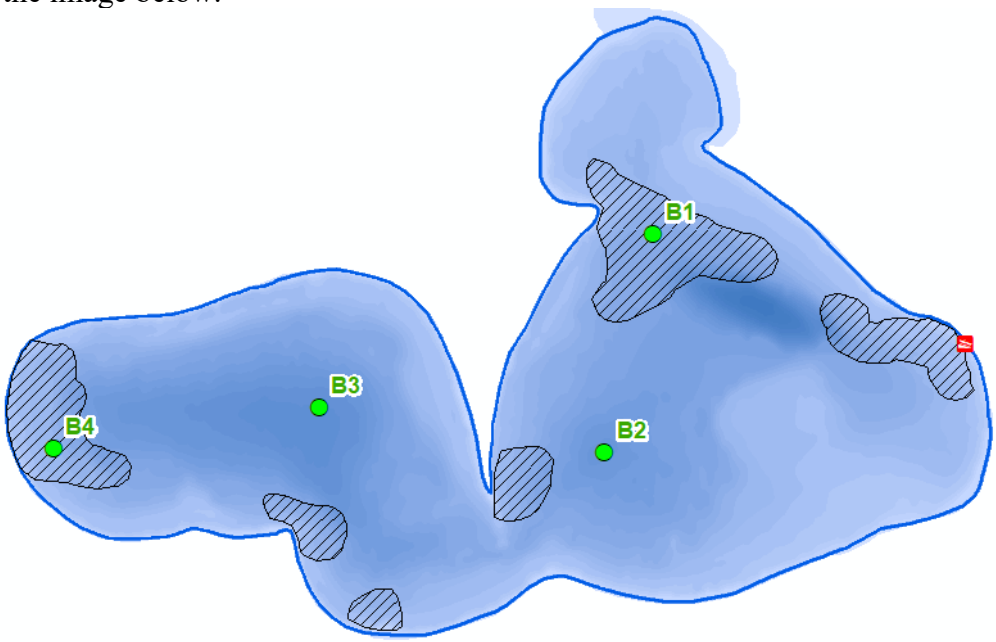
APPENDIX B

Herbicide Concentration Monitoring

- **ProcellaCOR Sample Plan**
- **ProcellaCOR Results Table**

Berry Lake, Oconto County (WBIC: 418300)
2025 Herbicide Sample Plan
Onterra, LLC

Berry Lake, located in Oconto County, is a 209-acre seepage lake that has a maximum depth of approximately 27 feet. Florpyrauxifen-benzyl (ProcellaCOR™) is proposed to be applied to 28.7 acres in early-summer 2025 to control Eurasian watermilfoil. Herbicide concentration sampling will be conducted to monitor the herbicide concentrations in the days and weeks following the application. Water samples will need to be collected at the sites and depths listed below. Coordinates are in decimal degrees. Locations of each sampling site are displayed with green circles on the image below.



Berry Lake Herbicide Sample Sites					
Site Label	Site Description	Station ID	Latitude	Longitude	Sample Depth
B1	Application Area East	10053776	44.89145	-88.476598	Integrated (0-6 feet)
B2	East Basin Center	10051047	44.88824	-88.477703	Integrated (0-6 feet)
B3	West Basin Center	10051049	44.88897	-88.48365	Integrated (0-6 feet)
B4	Application Area West	10056216	44.88843	-88.489212	Integrated (0-6 feet)

Please note that a single sample is to be collected before the treatment as a 'blank' for the lab analysis. Please collect the pre-treatment sample the day before treatment occurs. After the herbicide application is completed, additional samples will need to be collected at specific time intervals throughout the project and are listed in the table below. Sample collection intervals are listed either as Hours After Treatment (HAT) or Days After Treatment (DAT). Direct communication between the water sample collector and the herbicide applicator is necessary to ensure the collector is prepared to begin three hours after treatment is completed. If a sample cannot be collected at the interval listed below, please collect the sample as soon as possible and record the change.

Sampling Interval Matrix (X indicates sample to be collected)				
	Sampling Sites			
Interval	B1	B2	B3	B4
Pre-Treatment		X		
3 HAT	X	X	X	X
9 HAT	X	X	X	X
24 HAT	X	X	X	X
3 DAT	X	X	X	X
5 DAT	X	X	X	X
7 DAT	X	X	X	X
14 DAT	X	X	X	X
21 DAT		X	X	
35 DAT		X	X	
49 DAT		X	X	
70 DAT		X	X	
HAT = Hours After Treatment *DAT = Days After Treatment*				

All water samples will be collected using a six-foot integrated sampler (Photo 1). A video tutorial demonstrating the proper sample collection methodology is available on Onterra's YouTube web page: click here. Please review the *water sample handling instructions* provided by the Wisconsin State Lab of Hygiene for detailed instructions of the sample collection procedure.

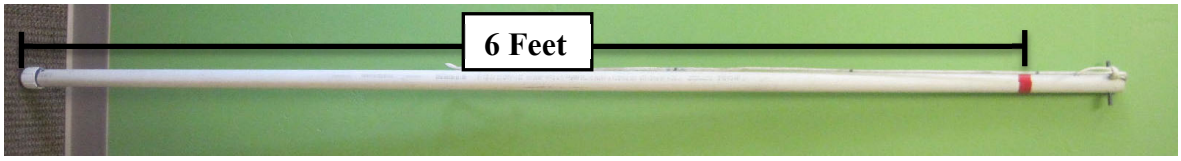


Photo 1. 6-foot Integrated sampling device constructed of PVC tubing.

Onterra will provide all the necessary supplies, equipment, and training to the volunteer(s) collecting the samples. Onterra has a limited supply of handheld GPS units and six-foot integrated sampler devices available to loan out for the duration of the sampling upon request. All other materials, including sampling bottles with labels, a composite water collection bottle and sampling data sheets will be provided.

If you have any questions, please reach out to one of the contacts listed below.

Project specifics, logistics and sampling methods	Shipping
Todd Hanke **Aquatic Ecologist, Onterra, LLC** **thanke@onterra-eco.com** **Office (920) 338-8860**	**Wisconsin State Lab of Hygiene** **(608)-224-6271**

FPB in Water Sample Handling Instructions

Sampling Kit Components

The florpyrauxifen-benzyl (FPB) sampling kits provided by the Wisconsin State Lab of Hygiene (WSLH) include:

- Cardboard box with Styrofoam cooler inside used to ship samples and supplies. This Styrofoam cooler will be re-used to ship samples back to the lab. *If placing a large request for sampling kits, supplies maybe be shipped in a larger cooler or in multiple coolers.*
- 30 mL amber vials containing 1 mL of 1:50 Formic Acid:H_2O as a preservative. Vials will have a Globally Harmonized System (GHS) and a sample label. There will be one amber vial for each sample taken with a couple extra in case any break during transit. See link to the Safety Data Sheet (SDS) for the formic acid: https://www.slh.wisc.edu/formic-acid-2-sds-2025/.
- 20 mL clear glass vials. There will be one clear glass vial for each sample taken with a couple extra in case any break during transit.
- Styrofoam vial holder(s).
- Large, plastic bag; this bag will be used to contain the samples and ice for return shipping.
- Zip tie(s) to secure the large plastic bag using a 'goose neck' (instructions below).
- WSLH Sampling Data Sheet(s) in a Ziploc bag; these sheets will be completed in the field when samples are collected.
- Orange address sticker.

The picture below is representative of the contents to be included in the FPB sampling kit (disregard the PFAS text on the Styrofoam cooler lid): cardboard box with Styrofoam cooler inside, WSLH Sampling Data Sheet in Ziploc bag, vials with black and white caps, Styrofoam vial holder, and (yellow) zip ties.

Sampling Instructions

All samples, including the pre-treatment blank, should be taken using the integrated sampling steps outlined below. This method uses an integrated sampler and a composite water collection bottle.

Sampling will include one pre-treatment sample followed by those included in the sampling plan reviewed and approved by the regional DNR Biologist. The pre-treatment blank serves as a baseline for lake water before any herbicide application and must be collected the day prior to the FPB treatment. While the pre-treatment blank can be taken anywhere on the lake, it is typically collected at one of the designated sampling sites or at the lake's "deep hole" location.

1. Locate the WSLH Sampling Data Sheet(s) provided by the WSLH in the Ziploc bag.
    a. It is important to use a separate WSLH Sampling Data Sheet for each sampling interval that you monitor (i.e., there will be multiple sites on one data sheet).
    b. The pre-treatment blank will use its own WSLH Sampling Data Sheet.
    c. On each WSLH Sampling Data Sheet the Lake Name, County, Account Number, DNR User ID, Grant Number, WBIC, and test requested (e.g., FPB) will be prepopulated by DNR/WSLH personnel.
    d. The person taking the sample should fill out the Collector Name and Phone Number, and all information requested in the table on the bottom portion of the sampling sheet. Specifically, in each row, write the Site Name, SWIMS Station ID, Hours After Treatment (HAT), Sample Depth, Date, Time, Water Temperature (in Celsius), and Wind Direction and Speed.

2. Upon arrival to each sampling site, rinse the integrated sampler and composite water collection bottle three times with lake water before each sample collection.

3. Take the water sample from the opposite side of the boat as you rinsed. Slowly lower the integrated sampler vertically so that it is 6 feet deep (which is typically marked with a line on the integrated sampler). After reaching a depth of 6-foot, slowly pull the sampler up vertically. If the sampling location is shallower than 6 feet, lower the sampler into the water column so that it remains at least 1 foot above the lake sediment bottom.

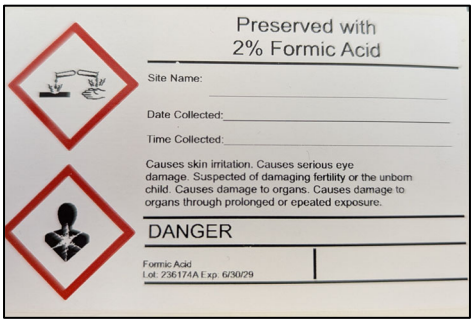
4. Empty the contents of the integrated sampler into the composite water collection bottle by pushing the ball valve end against the bar installed across the mouth of the bottle – this pops the ball valve up and releases water from the integrated sampler.

5. Gently mix the water in the composite water collection bottle. Then, carefully pour it into the 20mL **clear** glass vial until it is half full. Swirl the water around the vial gently and then return the rinse water to the lake. Repeat this rinsing process three times at the sampling site.

6. Gently mix the water in the composite bottle once more, then pour it into the 20 mL **clear** glass vial to fill it up all the way.

7. Pour the water in the 20 mL **clear** glass vial into the 30 mL **amber** vial. Cap the **amber** vial securely and invert it twice to ensure the preservative is properly mixed.
    a. Samples collected in the **amber** vials should be temporarily stored in a cooler with ice and then refrigerated until shipped.
    b. Transferring the water from the clear vial into the amber vial prevents overfilling and losing the premeasured preservative.

8. Using a permanent marker, write the name of sampling site and sampling interval (e.g., 9 HAT), followed by the date the sample was collected (MM/DD/YY) and the collection time (e.g., 18:35) on the GHS label of the **amber** vial. See example of GHS label below.



9. Once all sampling is complete, the vials and field sheets need to be prepared to be shipped back to the lab.
    a. Place the large, plastic bag in the Styrofoam cooler.
    b. Ensure samples are tightly capped and place them in the Styrofoam vial holder and then in the large, plastic bag.
    c. Add plenty of wet ice to the large, plastic bag and close it. Then, tie the top of the bag into a gooseneck, and secure with the zip tie so the ice water does not leak out. **See the back of the field sheet for how to properly gooseneck the bag.**
    d. Place the completed field sheets in the Ziploc bag and place on top of the samples in the **amber** vials. Discard any remaining 20 mL **clear** vials.

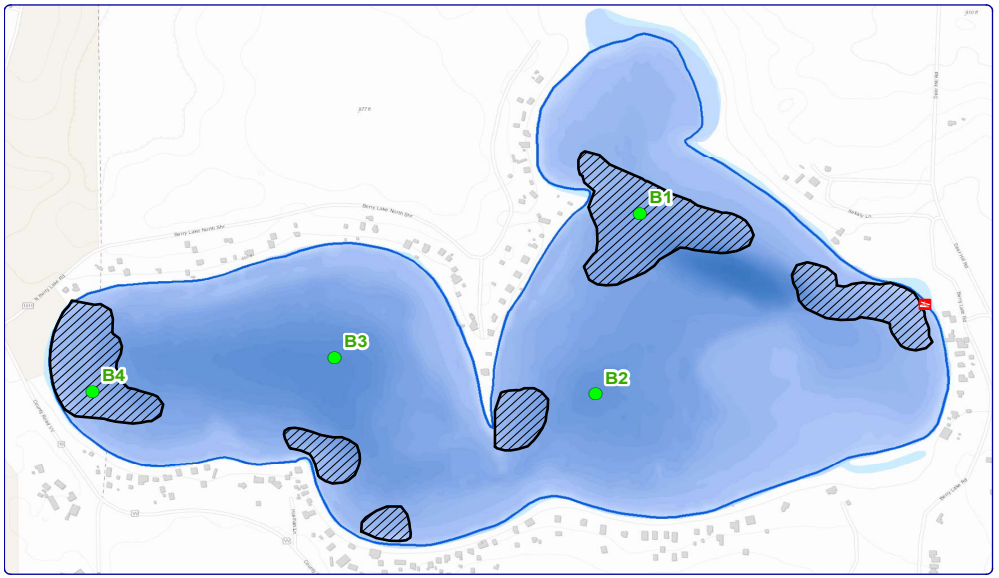
10. On the outside of the cardboard box, there is a sticker labeled “Packed on Ice”. Mark the type of sample you are returning to the lab.

11. Ship the samples using overnight delivery (e.g., Speedy, UPS, or FedEx) to the address on the orange sticker in the sampling kit.
    e. Samples should not be shipped on a Friday, but rather refrigerated and shipped on the following Monday.
    f. Alternatively, samples can be dropped off in person Monday – Friday, 7:45am to 4:30pm to the WSLH front office; see orange sticker for address.
    g. Contact the lab at (608) 224-6271 with any questions.

Prelminary 2025
Herbicide Concentration Data
Berry Lake - 10/16/2025

Active Ingredient Florpyrauxifen-benzyl (ng/mL)				
	Sampling Sites			
Interval	B1	B2	B3	B4
Pre-Treatment		<0.050		
3 HAT	0.33	<0.050	<0.050	4.30
9 HAT	0.47	0.12	0.06	5.20
24 HAT	0.30	0.24	0.15	0.39
3 DAT	0.17	0.09	0.08	0.53
5 DAT	0.06	<0.050	<0.050	0.46
7 DAT	<0.050	<0.050	<0.050	0.18
14 DAT	<0.050	<0.050	<0.050	<0.050
21 DAT		<0.050	<0.050	
35 DAT		<0.050	<0.050	
49 DAT		<0.050	<0.050	
70 DAT		<0.050	<0.050	
HAT = Hours After Treatment *DAT = Days After Treatment*				

Acid Metabolite Florpyrauxifen (ng/mL)				
	Sampling Sites			
Interval	B1	B2	B3	B4
Pre-Treatment		<0.048		
3 HAT	0.47	<0.048	<0.048	6.00
9 HAT	0.54	0.12	0.16	1.20
24 HAT	0.45	0.33	0.25	2.40
3 DAT	0.42	0.34	0.37	0.40
5 DAT	0.37	0.35	0.34	0.24
7 DAT	0.36	0.32	0.35	0.37
14 DAT	0.31	0.34	0.32	0.35
21 DAT		0.29	0.30	
35 DAT		0.21	0.24	
49 DAT		0.16	0.16	
70 DAT		0.09	0.11	
HAT = Hours After Treatment *DAT = Days After Treatment*				



Data Compiled from WI State Lab of Hygiene Analysis