Lower Vermillion Lake, Barron County Aquatic Plant Management Discussion

An excerpt from the larger 2023-2027 Lower Vermillion Lake Aquatic Plant Management Plan

Aquatic Plant Management Discussion

Lower Vermillion Lake supports a valuable aquatic plant community and a quality fishery valued by the lake community and the general public. The lake currently has two non-native, invasive, aquatic plant species in CLP and EWM. Both of these species can and are creating nuisance conditions and navigational impairment throughout the open water season. They can, although to date the data doesn't reflect this, out-compete native aquatic plant species for distribution and density possibly reducing diversity within the lake. The main goal of this Aquatic Plant Management Plan is to control both CLP and EWM in the lake in a sound, ecological manner that continues to support lake use, but also prevents both the invasive species and the management done to control them from causing greater harm to the native aquatic plant community.

Because EWM continues to spread within Lower Vermillion Lake, it is imperative that property owners be aware of this and that they know what EWM looks like in the water. If property owners would survey the area of the lake immediately adjacent to their docks and boat lifts on a regular basis, and then physically remove offending plants when identified, spread and establishment can be reduced.

In general, small-scale herbicide application since 2010 has helped to keep EWM in check but it has not been successful at preventing it from re-growing in treated areas as it continues to move along the shorelines from west to east, and is now well established in areas of the larger and shallower east basin. WDNR data indicates that chemically treating small areas is less effective than treating larger areas, particularly when using 2,4D or triclopyr based herbicides. While EWM in these small-scale treated areas may be knocked down for a season, it is seldom knocked out for multiple seasons.

No management using aquatic herbicides has been completed since 2020 when a spring treatment that covered 4.64 acres was completed. The 2020 chemical treatment successfully reduced the amount of EWM in the lake to just a few individual plants. As a follow-up to the successful herbicide treatment, a WDNR control of an established infestation grant was applied for and awarded starting in 2021 to complete diver removal. Diver removal was completed on several dates in in 2021, but the amount of EWM identified in the 2021 fall survey still reached 0.72 acres. As mentioned, while the divers were underwater in 2021, they discovered enough additional EWM that had not reached the surface to prompt a request for management using aquatic herbicides in 2022. This request was denied by the WDNR because the parameters of the treatment proposal did not meet the criteria that was in the existing APM Plan.

As a result, the VLA contracted with a DASH service in 2022 to provide 4 days of diver-assisted suction harvest. In these four days 168 large onion bags were filled with EWM removed from the lake (Figure 44). The total acreage covered by the DASH divers was estimated to be around 1.5 acres.

Figure 1: Onion bags full or EWM pulled from Lower Vermillion Lake

The area covered by the DASH divers does not represent that area of the lake where the EWM present actually makes it to the surface or close enough to the surface such that it can be identified in a bedmapping survey. Deep water, poor water clarity, and EWM plants that are sparsely spread through a larger area teaming with native aquatic vegetation all make it difficult to accurately map these areas.

EWM Management

From 2011 to 2022, EWM bedmapping surveys have identified on average, 8 beds of EWM per year, with a low of no beds in 2019 and 2020 when only individual points with EWM were mapped, to a high of 20 beds in 2022 (Table 10). The individual sizes of these beds ranged from <0.01 to 1.14 acres, with a mean size of 0.52 acres.

Table 1: 2011 to 2022 EWM beds based on fall bed-mapping surveys

2011 to 2022 Fall EWM Beds				
Year	# of Beds	Max Bed Size (acres)	Mean Bed Size (acres)	Beds (acres)
2011	2	0.49	0.42	0.84
2012	13	0.8	0.21	2.7
2013	5	0.43	0.14	0.71
2014	9	0.54	0.13	1.18
2015	5	0.89	0.35	1.77
2016	4	0.21	0.06	0.25
2017	7	0.09	0.05	0.31
2018	4	0.31	0.23	0.53
2019	NA	NA	NA	NA
2020	NA	NA	NA	NA
2021	10	0.25	0.07	0.72
2022	20	1.14	0.12	2.4
MEANS	**8**	**0.52**	**0.18**	**1.14**

Under the following recommendations, EWM management can and should occur when any amount of EWM is found, even just individual plants.

Physical Removal and/or DASH to Control EWM in Lower Vermillion Lake

Physical methods, including hand-pulling, rake removal, snorkel, divers, and/or diver-assisted suction harvest (DASH) can be implemented at any time for any amount of EWM. Hand-pulling rake removal, snorkel, and diver removal of EWM does not require a permit to implement. Implementation of DASH requires a mechanical harvesting permit from the WDNR. Implementing hand-pulling, rake removal, snorkel, diver, and/or DASH removal of EWM will depend only on the resources, financial and human, available to the VLA in any given year. These management alternatives can be used in any combination to remove EWM from the lake regardless of the size of the bed.

Herbicide Use to Control EWM in Lower Vermillion Lake

While it appears that since the first whole-lake PI survey in 2009, the aquatic plant community as a whole has suffered a decline in quality, it is difficult to determine if either of the invasive species in the lake or the management of those species caused this decline. The species with the greatest decline in the number of points where each was found from 2009 to 2021 are Flat-stem pondweed (-111), Northern watermilfoil (-37), Friess pondweed (-36), Coontail (-30), and Clasping-leaf pondweed (-27). While it is possible that EWM treatments using 2,4-D based herbicides could have negatively impacted Northern watermilfoil and coontail, the other three are not supposed to be impacted by the use of this herbicide. It is also possible that the three pondweeds could have been negatively impacted by the endothall based herbicide that was used to control CLP. However, chemical treatments using both of these herbicides have been limited over that time, and not completed at all since 2020. It is also difficult to determine if the amount of CLP or EWM in the lake is negatively impacting native aquatic vegetation because management actions have kept EWM below 1.0 acres in all but four of the last 12 years.

The use of aquatic herbicides in tandem with physical removal by property owners and divers, and DASH has and will continue to keep EWM at very low levels and under control on Lower Vermillion Lake. There is no undeniable proof that the use of these herbicides is having a significant negative impact on native aquatic vegetation. The use of herbicides will be limited in nature and used only when the level of EWM in a given area exceeds what is effectively managed by other means. Through careful management planning that includes abundant aquatic plant surveys, appropriate timing, and calculated herbicide application rates, the current use of aquatic herbicides can be continued without negatively impacting native aquatic vegetation, while at the same time minimizing possible negative impacts of EWM to the lake.

Herbicides that are 2,4-D or triclopyr-based, and ProcellaCOR can be used effectively to control EWM in Lower Vermillion Lake. Herbicides that are 2,4-D based have been already been used in the lake. Triclopyr and ProcellaCOR have not. With the knowledge of management using herbicides that exists right now, ProcellaCOR is likely the best alternative for all treatment areas. In larger-scale (>5 acres) applications the cost of ProcellaCOR might be somewhat restrictive so it might be feasible to consider other herbicides. Using different herbicides at different times may actually improve efficacy as there is some research that suggests EWM can build up a resistance to herbicides that are used repeatedly in the same areas at the concentrations traditionally used for submerged aquatic plant control (Poovey, 2007) (Glomski, 2010).

In general, EWM management in Lower Vermillion Lake will be based on the following criteria.

1) EWM bedmapping will be completed every year.
2) Any amount of EWM in the lake can be managed at any time if chemical management is not used.
    a. Non-chemical management actions include hand pulling, rake removal, and snorkel/scuba diver removal, and/or DASH removal.
    b. DASH is considered mechanical removal, is more expensive than diver removal, and requires a WDNR permit.

3) Chemical management of EWM may be implemented if prior year bed mapping identifies a single bed of EWM that is at least 1.0 acres in size, or if two or more smaller areas can be reasonably combined to create an area at least 1.0 acres in size.
    a. An individual bed or combination of beds can be chemically treated if it is at least 1.0 acres in size and ProcellaCOR is the intended herbicide.
    b. If 2,4-D based herbicides are to be used, the size of the treatment area must be at least 5.0 acres in size.
    c. Using herbicides on smaller areas will only be done if certain herbicides, like ProcellaCOR, are approved for smaller treatment areas by the WDNR, or if a limno-curtain is deployed during a proposed chemical treatment.

4) Herbicides applied to EWM beds that reach or exceed 10.0 acres or 10% of the littoral zone will be considered large-scale chemical treatments. With a large-scale chemical treatment, the following activities will be added in support of that treatment.
    a. Pre and post-treatment, point-intercept surveys will be completed.
    b. Herbicide concentration testing will be completed unless deemed unnecessary by the WDNR.
5) The same area will not be chemically treated with the same herbicide, two years in a row.

Curly-leaf Pondweed Management

CLP is widespread in Lower Vermillion Lake and has likely been there for many years prior to the introduction of EWM. The amount of CLP growth is highly dependent on the growing conditions each spring. For example, spring growing conditions in 2021 were exceptional for CLP in northern Wisconsin leading to more than 10.0 acres in Lower Vermillion Lake. In other years, the amount of CLP in the lake may only be a couple of acres. The density of the CLP changes with the type of growing season as well.

Because dense growth CLP is located in the same areas of Lower Vermillion Lake that EWM has been identified and treated, and because research indicates that when different herbicides are combined to manage CLP and EWM simultaneously, there can a synergistic effect that can lead to better results with lower concentrations of both herbicides Madsen et al (2010); and because reducing the amount of CLP in Lower Vermillion Lake may improve lake health, combining CLP and EWM treatments using different herbicides should be considered if resources are available. If endothall-based herbicides are planned, the area must be at least 5.0 acres in size.

Harvesting of CLP is not a recommended management action simply because of the amount of EWM present in the same areas as the most problematic CLP. Mechanical harvesting of EWM is also not a recommended management action. Mechanical harvesting, in its truest form, would only serve to increase the amount of EWM fragments already moving around in the lake.

DASH can be an effective management tool for CLP. DASH removal of both CLP and EWM could be completed if it were done earlier in June or even late May.

In general, CLP management in Lower Vermillion Lake will be based on the following criteria.

1) June bed mapping must be completed in the year prior to a planned chemical treatment.
2) Any amount of CLP in the lake can be managed at any time if chemical management is not used.
    a. Non-chemical management actions include hand pulling, rake removal, and snorkel/scuba diver removal, and/or DASH removal
    b. DASH is considered mechanical removal, is more expensive than diver removal, and requires a WDNR permit.
3) Chemical management of CLP may be completed if prior year mapping identifies any area that is ≥5.0 acres, mixed in with EWM or stand-alone.

a. A WDNR permit is required.
b. Treatment should be completed no later than late May (weather and water temperature related).
c. Endothall-based herbicides should be used.
d. Applied herbicide concentrations should be based on current research and existing lake characteristics.
e. Consecutive years of CLP management in the same area are acceptable, but not required.
    i. Multiple years of CLP management in the same areas is often recommended to reduce the number of viable turions in the sediment underneath the target areas.
f. Installation of a limno-barrier can make these treatments more effective, and may allow smaller treatments to be completed.

Overuse of Aquatic Herbicides

Concerns exist when chemical treatments using the same herbicide are done over multiple and subsequent years. Target plant species may build up a tolerance to a given herbicide making it less effective, susceptible plant species may be damaged and/or disappear from the lake (ex. water lilies), fish and other wildlife might possibly be affected, and concerns over recreational use in chemically treated water may be raised. By using several different aquatic herbicides interspersed with physical removal efforts between treatments, many of these concerns are minimized.

Aquatic Plant Management Plan

This Aquatic Plant Management Plan establishes the following goals for aquatic plant management in Lower Vermillion Lake:

1. **EWM Management.** Limit the spread of EWM and its impacts on the native aquatic plant community and lake use through environmentally responsible management methods.

2. **CLP Management.** Limit the spread of CLP and its impacts on the native aquatic plant community and lake use through environmentally responsible management methods.

3. **Education and Awareness.** Continue to educate property owners and lake users on aquatic invasive species through public outreach and education programs to help contain EWM within the lake and prevent its spread further in the lake, as well as to other water bodies.

4. **Research and Monitoring.** Develop a better understanding of the lake and the factors affecting lake water quality through continued and expanded monitoring efforts.

5. **Adaptive Management.** Follow an adaptive management approach that measures and analyzes the effectiveness of control activities and modify the management plan as necessary to meet goals and objectives.

Goal 1. EWM Management

An integrated management approach will be used to help minimize the negative impacts of EWM on native plants and water quality, and to provide relief for navigation impairment caused by EWM. The overall goal for EWM management is to minimize the number and size of EWM beds identified in a fall survey. Any EWM can be managed. When beds of EWM are at least an acre in size, the use of herbicides can be considered. EWM management options to be utilized include small-scale physical removal, diver removal, DASH, targeted use of aquatic herbicides through small and large-scale application, and possibly whole-lake/basin application of herbicide.

To monitor changes in the amount of EWM in the system, late season bed mapping surveys should be completed annually.

Pre and Post Treatment Survey and Fall Bed Mapping

Management of EWM will be based on pre- and post-treatment surveys or management readiness surveys performed by either trained VLA volunteers or resource professionals retained by the VLA. Pre and post-treatment surveys are point-intercept based. A pre-treatment survey is best completed in the year prior to the planned chemical management. Post-treatment surveys should be performed within the same year of treatment and in at least the year following treatment. If resources are available, they can be completed in more than just the year after treatment, particularly if it is expected that management impacts will last more than two years.

Management readiness surveys are visual and rake-based surveys completed prior to actual management in the same year only to determine if a given management area is ready to be treated. Ready is defined as having target plants present in sufficient quantity and growth to go through with the proposed chemical treatment. Proposed treatment areas may be modified based on the results of the readiness survey but still must follow restrictions in the WDNR-approved chemical application permit.

Pre and post treatment surveys are not required by the WDNR unless the chemically treated area covers more than 10 acres or 10% of the littoral zone or is a smaller area being funded in part by a WDNR grant. However, completing these tasks is highly recommended in any treatment program, as they provide a means to measure success. Readiness surveys provide a quick check and balance on a treatment proposal and are recommended in any year chemical treatment is to occur.

Bed mapping or reconnaissance surveys are completed in the summer or fall each year to help identify potential areas for management in the following year. These are visual and rake-based, meandering surveys of the lake's littoral zone. GPS tracking of individual plants, small clumps, and beds of EWM is completed. Using bed mapping survey data, proposed treatment maps can be created.

Herbicide Concentration Testing

Regardless of the size of a treatment area and the herbicide used for management of CLP or EWM, collecting herbicide concentration data is one way to track how the herbicide "acts" in the lake. With the presence of Northern wild rice in the lake and immediately downstream in the Vermillion River it is likely the WDNR at the request of St. Croix Tribal Resources will require concentration testing as a part of every proposed herbicide application. Concentration testing also provides a way to determine if the expected application concentrations were met and for how long a measureable amount of the herbicide remained in the water.

Goal 2. CLP Management

CLP continues to be a nuisance in Lower Vermillion Lake and has the potential to negatively impact native aquatic plants and water quality. There are likely many contributing factors to an apparent worsening of water clarity in the lake and an abundance of CLP that dies and decays in early July could be one. Dense growth CLP in certain areas of the lake also creates navigation impairment. An overall goal for CLP management in Lower Vermillion Lake is to keep the amount of CLP that can be mapped below 5.0 acres of the littoral zone in any given year. CLP management options that can be utilized include small-scale physical removal, diver removal, DASH, and targeted use of aquatic herbicides when an individual CLP bed reaches or exceeds 5.0 acres. Pre- and post-treatment aquatic plant surveys and/or readiness surveys and herbicide concentration testing will be considered under the same guidelines in place for EWM.

To monitor changes in the amount of CLP in the system, early season bed mapping surveys should be completed annually.

Other AIS will continue to be monitored for, but no specific management is recommended at this time.

Goal 3. Education and Awareness

Aquatic invasive species (AIS) can be transported via a number of vectors, but most invasions are associated with human activity. Maintaining signs and continuing watercraft inspection at the public boat landing should be done to educate lake users about what they can do to prevent the spread of AIS.

Early detection and rapid response efforts increase the likelihood that a new aquatic invasive species will be addressed successfully while the population is still localized and levels are not beyond that which can be contained and eradicated. Once an aquatic invasive species becomes widely established in a lake, complete eradication becomes extremely difficult, so attempting to partially mitigate negative impacts becomes the goal. The costs of early detection and rapid response efforts are typically far less than those of long-term invasive species management programs needed when an AIS becomes established.

It is recommended that the VLA continue to implement a proactive and consistent AIS monitoring program. At least three times during the open water season, trained volunteers should patrol the shoreline and littoral zone looking for Eurasian watermilfoil (and other species like curly-leaf pondweed, purple loosestrife, Japanese knotweed, giant reed grass, zebra mussels). Free support for this kind of monitoring program is provided as part of the UW-Extension Lakes/WDNR Citizen Lake Monitoring Network (CLMN) AIS Monitoring Program. Any monitoring data collected should be recorded annually and submitted to the WDNR SWIMS database.

Providing education, outreach opportunities, and materials to the lake community will improve general knowledge and likely increase participation in lake protection and restoration activities. It is recommended that the VLA continue to cultivate an awareness of the problems associated with AIS and enough community knowledge about certain species to aid in detection, planning, and implementation of management alternatives within their lake community. Furthermore, it is recommended that the VLA continue to tie AIS and lake health to the condition of the shoreland around the lake and the watershed of the lake. Shoreland and habitat improvement projects reduce runoff into the lake, provide greater habitat that may be more resistant to the invasion of AIS, and help maintain water quality.

Helping property owners understand how their activities impact the aquatic plants and water quality of the lakes is crucial to fostering a responsible community of lakeshore property owners. The VLA should distribute, or re-distribute informational materials and provide educational opportunities on aquatic invasive species and other factors that affect Lower Vermillion Lake. At least one annual activity (picnic at the lake, public workshop, guest speakers, etc.) should be sponsored and promoted by the VLA that is focused on AIS.

Goal 4. Research and Monitoring

Long-term data can be used to identify the factors leading to changes to water quality, such as aquatic plant management activities, changes in the watershed land use, and the response of the lakes to environmental changes. The CLMN Water Quality Monitoring Program supports volunteer water quality monitors across the state following a clearly defined schedule. In the first level of the program, Secchi disk readings are encouraged 2-3 times a month from ice out to ice on. In the CLMN expanded monitoring program, water samples are collected for analysis of TP two weeks after ice out, and once each in June, July and August. Water samples are collected and processed for chlorophyll-*a* once each in June, July, and August. Temperature profiles are encouraged anytime a Secchi reading is taken, but recommended to be done at the same time water samples for TP and chlorophyll-*a*. If the necessary equipment is available to collect dissolved oxygen profiles these are encouraged at least monthly as well.

Lower Vermillion Lake is included in the CLMN expanded monitoring program. This involvement will continue through the duration of this plan. Results of water quality monitoring should be shared with the lake community at the annual meeting, or another event, to promote a greater understanding of the lake ecosystem and potentially increase participation in planning and management.

To monitor any changes in the plant community, it is recommended that whole-lake point intercept aquatic plant surveys be completed at five-year intervals. This will allow managers to adjust the APM Plan as needed in response to how the plant community changes as a result of management and natural factors like water level.

Goal 5. Adaptive Management

This APMP is a working document guiding management actions on Lower Vermillion Lake for the next five years. This plan will follow an adaptive management approach following the IPM strategy, adjusting management actions based on

results and related data collection. This plan is therefore a living document, progressively evolving and improving to meet environmental, social, and economic goals, to increase scientific knowledge, and to foster good relations among stakeholders. Annual and end of project assessment reports are necessary to monitor progress and justify changes to the management strategy, with or without state grant funding. Project reporting will meet the requirements of all stakeholders, gain proper approval, allow for timely reimbursement of expenses, and provide the appropriate data for continued management success. Success will be measured by the efficiency and ease in which these actions are completed.

The VLA and their retainers will compile, analyze, and summarize management operations, public education efforts, and other pertinent data into an annual report each year. The information will be presented to members of the VLA, Barron County, Tribal Resources, and the WDNR and made available in hardcopy and digital format on the internet. These reports will serve as a vehicle to propose future management recommendations and will therefore be completed prior to implementing following year management actions (approximately March 31st annually). At the end of this five-year project, all management efforts (including successes and failures) and related activities will be summarized in a report to be used for revising the Aquatic Plant Management Plan.

Works Cited

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