Beecher Lake AIS Control Project

(ACEI-073-10.1)

Final Report

Marinette Co. LWCD
1926 Hall Avenue
Marinette, WI 54143

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PROJECT AREA

Beecher Lake is located in the Township of Beecher (T36N, R20E, S28) in Marinette County, Wisconsin. The lake actually consists of two separate lakes, Beecher Lake and Upper Lake that are connected by a narrow channel. Locally the combined lakes are referred to as Beecher Lake. The lakes drains to the Pike River, an Outstanding Resource Water and State designated Wild River (figure 1).

The Upper Lake basin covers 21 acres with a maximum depth of 18 feet. The Beecher Lake basin covers 35 acres with a maximum depth of 47 feet. A dam on the outlet of Beecher Lake maintains a head of six feet and controls the water level in both basins. Water quality is typically good with moderate to darkly stained water and low phosphorus concentrations. A water quality study conducted in 1996-97 found the lakes consistently in the mesotrophic range.

AQUATIC PLANT COMMUNITY & INVASIVE SPECIES

Beecher Lake has a well-developed and diverse aquatic plant community with an average floristic quality index of 34.7. The maximum rooting depth varies from 7 to 12 feet due to variations in water level and water clarity. Water clarity varies considerably from year-to-year based on the volume of tannin stained runoff from the lakes 2,800 acre watershed.

Eurasian Water Milfoil (EWM) was discovered in Beecher and Upper Lakes in June 2007. Plant samples were collected and verified by the Freckman herbarium at UW-Stevens Point. A cursory survey of the lake in October 2007 found EWM was primarily limited to the Beecher lake basin with moderate to dense stands covering more than 6.5 acres.

AQUATIC PLANT MANAGEMENT EFFORTS

In response to the discovery of EWM, the Beecher Lake District applied for and received Wisconsin AIS Control Grant funding in

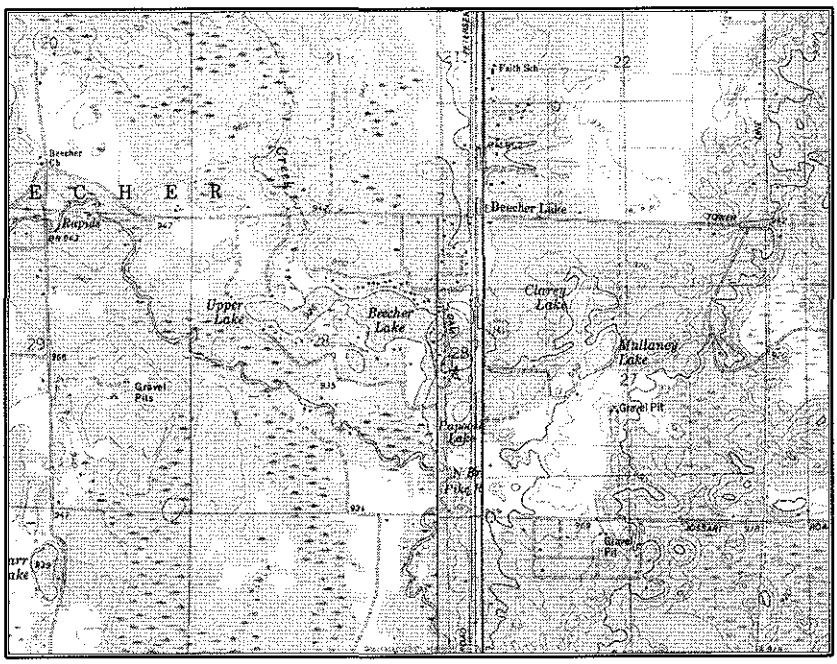

Figure 1. Beecher and Upper Lakes

March 2008 to develop an aquatic plant management plan to address the newly discovered EWM infestation. Concurrent with the EWM planning efforts the District worked with the DNR and Marinette County Land & Water Conservation Division (LWCD) to treat EWM in the spring of 2008 and 2009.

The WDNR approved Aquatic Plant Management Plan for Beecher Lake was completed in January 2010. The plan calls for the selective control of Eurasian water milfoil and restoration of the native plant community. Recommendations included modification of the Beecher Lake dam to allow for periodic winter drawdown of Beecher and Upper Lakes to achieve long-term control of EWM. In the interim the plan recommended the use of early-season herbicide treatment with 2,4-D to selectively control EWM along with hand pulling to control scattered EWM.

PROJECT GOALS AND OBJECTIVES

The aquatic Invasive Species Control Gant (ACEI-073-10.1) was awarded to the Beecher Lake District in 2010 with the goal of implementing the recently approved EWM management plan for Beecher and Upper Lakes.

The proposal called for implementing a four-year multi-faceted strategy to prevent Eurasian water milfoil domination in Beecher Lake and preserve the diverse aquatic plant community. The approved EWM management strategy included the judicious use of selective aquatic herbicides, a winter drawdown to evaluate its effectiveness as a management tool, hand pulling of isolated plants, and the use of biocontrol agents where applicable. Routine aquatic plant monitoring was included to track changes in the frequency and density of EWM and evaluate impacts to the native plant community.

PROJECT RESULTS

All elements of the project have been completed as proposed. As is typical, unforeseen events and variations in the effectiveness of management activities required deviations from the original schedule and changes to the EWM management program.

Aquatic Plant Monitoring

Whole-lake point-intercept surveys of both lake basins were conducted in the summer of 2008, 2013, and 2014 according to WDNR protocols using 100 foot (30 meter) point spacing. More intensive surveys of four representative areas were conducted in 2010, 2011 and 2012 using a 50-foot (15 meter) point spacing to document the effects of winter drawdown on the lakes aquatic plant community.

All aquatic plant survey data was input into EXCEL spreadsheets provided by the Wisconsin DNR to evaluate aquatic plant surveys. The spreadsheets were modified to calculate total aquatic plant and individual species frequency and abundance by depth and sediment type. Aquatic plant survey data was also entered into GIS and used to create distribution maps for each plant species.

Areas supporting dense EWM were mapped in the fall of each year to track changes in the community and help plan for subsequent herbicide treatments. GIS shape files of all EWM reconnaissance data were created for mapping and analysis.

Aquatic plant survey and mapping data can be found in Appendix A. All aquatic plant data has been transmitted electronically to the WDNR.

Aquatic Plant Genetic Testing

Samples of milfoil rom Beecher and Upper Lakes were genetically tested in 2008, 2013, and 2014. Results indicate that the EWM in both lake basins has not hybridized with northern watermilfoil (*M. sibeicum*) or Whorled watermilfoil (*M. verticillatum*), both of which are native to Beecher and Upper Lakes and can still be found in some areas.

Winter Drawdown

Since the Beecher Lake dam does not have gates or valves for water level control, it was decided to use siphons to conduct the drawdown. The siphon tubes are constructed using 6-inch pvc pipe and fittings available at most hardware or plumbing supply stores (see figure 2). A two-inch pipe with a ball valve is fitted at highest point for the purpose of priming the siphon. The intake pipe is fitted with an anti-backflow valve and a wire basket to prevent trash from entering the siphon. It was necessary to hold the intake at least a foot below the surface to prevent a vortex from forming and allowing air into the siphon. Strips of rigid foam insulation were zip-tied to the intake pipes to provide flotation. The intake pipes are fastened

Figure 2. Siphons are constructed using 6" PVC pipe and fittings.

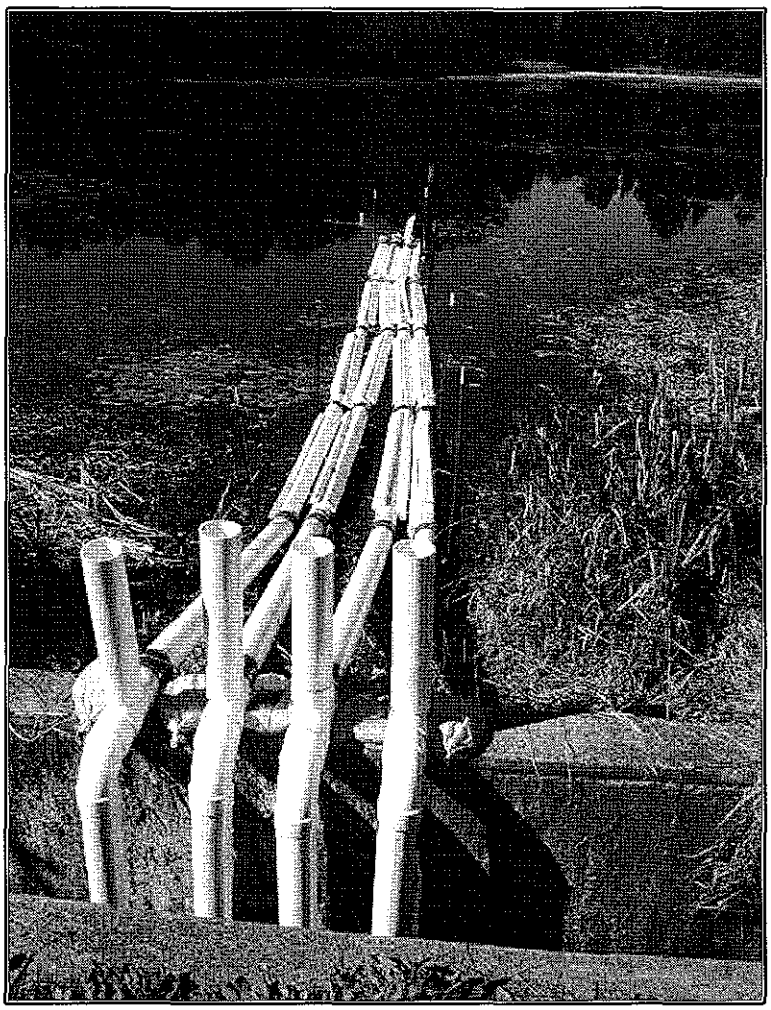

Figure 3. Siphons installed at the Beecher Lake Dam.

together using rubber couplers so they remain flexible as the water level drops and can be extended as needed. To prime the siphon, a tight fitting expansion plug is installed on the outlet end and water is pumped through the 2" priming pipe until the siphon is completely full of water. After filling, the ball valve on the priming pipe is closed and the plug is removed from the outlet.

A single siphon tube was installed in Beecher Lake in the summer of 2010 to demonstrate proof-of-concept. The test was successful and a drawdown of the lake using four siphon tubes was attempted in September 2010. Good progress was made until a late September storm dropped nearly 4.5 inches of rain on the surrounding area. The drawdown attempt was abandoned on October 5, 2010 when it became obvious that the drawdown could not be completed in a timely manner.

A second attempt was made in 2011 with the installation of four 80-foot long siphons on August 27 (figure 3). The water level fell rapidly and three siphons were extended to 120 feet on September 9. The lake elevation if front of the dam was 4.4 feet below full pool on September 18 (figure 4). By early October the water level was 5.0 feet below full pool, where it was maintained by two siphons. Both siphons were removed on December 28 and the lake was allowed to begin refilling. Water levels in the lake rose slowly throughout the winter, returning to normal before the lake was even ice-free in the spring.

While the siphons worked well during warm weather, they were difficult to maintain during the winter as the pipes became encased in ice and frozen mud. While continuous flow did prevent ice formation in the pipes, any interruption in flow during sub-zero

Figure 4. Five foot water level drawdown at the Beecher Lake Dam.

weather allows the intake pipes to freeze solid in a matter of hours. These factors severely limit the utility of siphons for winter drawdown purposes.

Unfortunately, while the drawdown initially appeared to be successful, it failed to achieve the expected water level reduction in Beecher and Upper Lakes. The Beecher Lake dam is located on Beecher Creek approximately 1300 feet downstream from the lake outlet. While the siphons did lower the water level near the dam, a build-up of sediment in the creek bed between the dam and the lake prevented the main body of the lake from draining sufficiently. A survey of the dewatered lake bed in December showed that the water level near the dam was 5 feet below full pool while 1,300 feet away, the water level in the main body of Beecher Lake was only 2.5 feet below full pool.

The winter of 2011/12 was also exceptionally warm and frost penetration was less than three inches in most areas before snow effectively insulated the sediment. As a result, acceptable EWM control was not achieved in most areas of the lake. In fact, a detailed aquatic plant survey showed a 94% increase in the frequency of EWM following the winter drawdown (figure 5). The one exception was the south arm of the lake near the dam. Here the drawdown was complete and the sediment was exposed for a much longer period of time. In this area EWM control was nearly complete and recolonization has been slow.

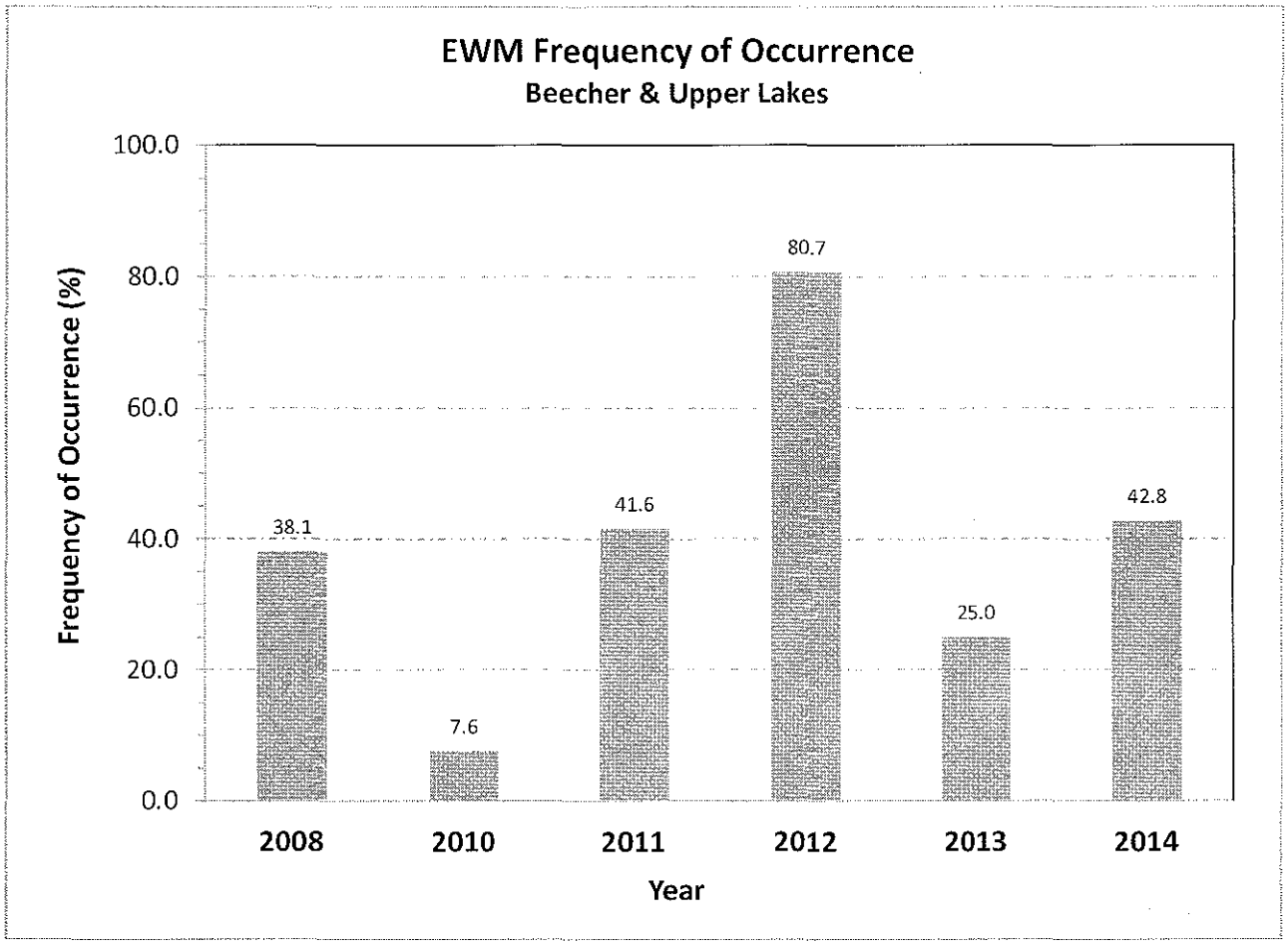

Figure 5. Annual changes in EWM frequency of occurrence.

The drawdown did have a noticeable impact on several native plant species. Dominant species including coontail (Ceratophyllum demersum), stonewort (Nitella sp.), flat-leaf bladderwort (Utricularia intermedia) and creeping bladderwort (Utricularia gibba) all saw significant declines in frequency of occurrence. Bushy pondweed (Najas flexilis), muskgrass (Char a sp.) and variable pondweed (Potamogeton graminaeus) experienced significant increases in frequency. Many of the small pondweeds experienced slight increases as well.

Aquatic Herbicide Use

Shortly after its discovery in June, 2007 approximately 6.5 acres moderate to dense EWM was mapped along the north and east shores of the Beecher Lake basin. By the fall of 2007 EWM had expanded to cover nearly 9.5 acres. Over the next several years, multiple herbicide treatments were conducted with mixed results (figure 5).

2008

In June of 2008 nearly 14.6 acres was treated with Navigate 2,4-D at a rate of 100 lbs/acre. Due to an early spring and scheduling conflicts with the applicator, the treatment occurred later than desired and EWM had already reached the surface. Success was limited and a whole-lake point intercept survey conducted in August found EWM at 39% of sample points shallower than the maximum rooting depth. A significant amount of herbicide damage was noted. Fall EWM reconnaissance showed 13 acres of dense EWM.

2009

An early season treatment of 14.6 acres was conducted in the spring of 2009 using Navigate 2,4-D at a rate of 150 lbs/acre. This treatment was much more successful than the previous year and dense EWM declined by more than 55 percent to 5.8 acres. Significant reductions in EWM frequency and density were also seen in areas that were not treated.

A lake-wide decline in watershield (*Brassenia schreberi*) was also noted in the fall of 2009. The decline in watershield was confirmed in 2010 with a 25% decline in frequency of occurrence. By 2011 watershield had declined by nearly 78% from its high in 2009. In hindsight, it appears the 2009 "spot treatment" resulted in an unintended whole-lake treatment. A back calculation shows an estimated lake-wide 2,4-D concentration of 381 ug/l ae, which is higher than the target concentration in subsequent whole-lake treatments.

2010

2010 was the first year of the AIS control project. In early spring approximately 5.8 acres of EWM was treated with Navigate 2,4-D at a rate of 150 lbs/acre. A partial lake survey completed in late summer showed that, as a result of aggressive management, EWM frequency of occurrence fell to 7.6%, an 80% reduction from its high in 2008.

The first winter drawdown was attempted in the winter of 2010/2011 as discussed above.

2011

No herbicide treatment was conducted in 2011 and EWM expanded significantly, with frequency of occurrence increasing from 7.6% to 41.6%. The expansion was not even however and all of the increase came from the Beecher Lake basin.

A winter drawdown for EWM control was completed in the winter of 2011/12.

2012

In an effort to evaluate the previous winter drawdown, an herbicide application was not scheduled for the spring of 2012. Unfortunately, as discussed above, unforeseen technical issues and uncooperative weather greatly reduced drawdown effectiveness and EWM expanded significantly.

An aquatic plant survey conducted in late August showed that EWM frequency of occurrence had increased to 83.5%. By the fall of 2012 dense EWM covered more than 12 acres of the lakes surface.

2013

In an attempt to control the rapidly expanding EWM population, a whole-lake treatment using Dow DMA-4 (liquid 2,4-D) was conducted on May 17, 2013. The herbicide was applied to the EWM infested areas with a lake wide target concentration of 335 ug/l. Post-treatment herbicide residuals were monitored at seven different sites at 1, 2, 3, 5, 8, 10, 15, and 22 days after treatment (DAT) as part of a whole lake treatment study in a cooperative effort with the WDNR and US Army Corps of Engineers. Results show the average herbicide concentration in Upper Lake at 7 DAT was 232 ug/l. The average herbicide concentration for Beecher Lake during at 7 DAT was 377 ug/l, indicating some flushing of herbicide from the Upper Lake (upstream basin) into the Beecher Lake (downstream basin).

An aquatic plant survey conducted on July 18, 2013 showed an overall reduction in EWM frequency of occurrence of 69%. However, the results were not even distributed throughout the lakes (figure 6). Beecher Lake saw an 84% reduction in EWM while EWM

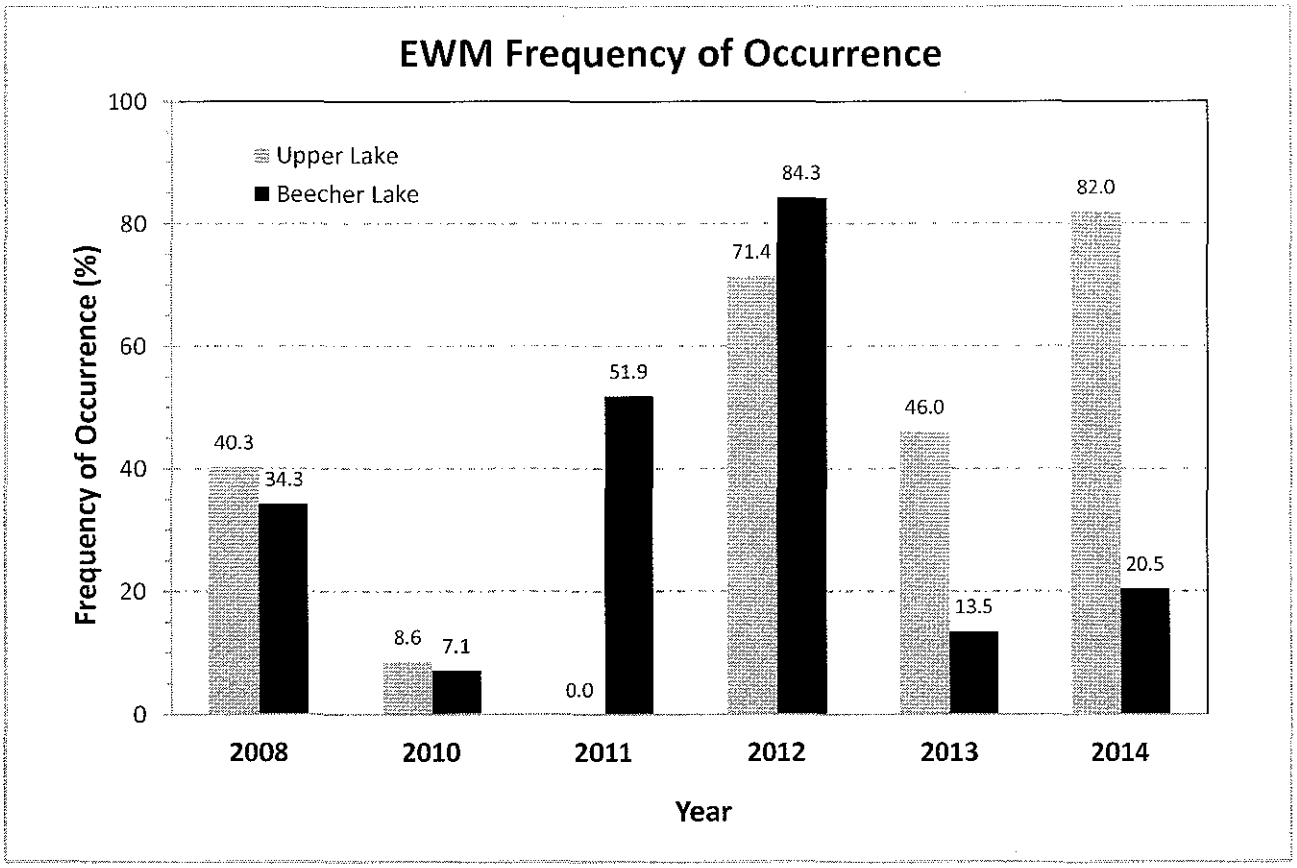

Figure 6. EWM frequency by lake basin.

frequency in Upper Lake was only reduced by 35%. While the treatment was initially viewed as a success, EWM reconnaissance in September of 2013 showed a strong resurgence in EWM growth with moderate to dense EWM beds covering more than 9.6 acres of the lake and scattered plants throughout the littoral zone.

2014

A second whole lake treatment was conducted on June 4, 2014 using Dow DMA-4 (liquid 2,4-D). The relatively late treatment date was the result of a very late start to the growing season. The target concentration was increased to 375 ug/l in an effort to get better EWM control than was seen in 2013. An aquatic plant survey conducted on August 20, 2014 showed a 71% increase in EWM frequency in the lakes. However, as in 2013, the treatment was more successful in Beecher Lake than in Upper Lake (figure 6). Like the previous year, the whole lake treatment initially appeared to be relatively successful but there was a similar resurgence of EWM in late summer.

Manual EWM Harvesting

The Marinette County LWCD received an AIS control grant (ACEI-112-12) in 2012 to fund the construction and operation of a hydraulic conveyor system for diver-assisted hydraulic harvesting of EWM. The project called for using the harvester on Little Newton, Thunder, and Beecher/Upper Lakes from 2012 through 2016. Due to construction delays the harvester was not operational until the summer of 2013.

Diver assisted hydraulic harvesting is a very precise management tool, ideal for selectively removing scattered EWM plants. However, it is also labor intensive and not well suited for managing well established populations with large dense stands of EWM.

While the harvester was used with excellent results on Little Newton and Thunder Lakes, the winter drawdown and herbicide treatments did not sufficiently reduce the EWM population to a level where hydraulic harvesting would be effective on Beecher Lake. As a result, the hydraulic harvester was not deployed on Beecher and Upper Lakes during the grant period.

Evaluate potential for milfoil Weevil control of Ewm

Biological control uses a native weevil (*Euhrychiopsis lecontei*) that feeds on native and Eurasian watermilfoil. The milfoil weevil has been suspected in the natural decline in EWM in some unmanaged lakes and has been stocked in lakes as a control method.

The project proposal called for weevil reconnaissance to assess whether the native weevils could be found in sufficient numbers to effect EWM population in Beecher and Upper Lakes. Milfoil weevil reconnaissance was completed in 2010, 2012 and 2014 along the

north and west shore of Upper Lake and near the Beecher Lake dam. Both of these areas have supported abundant EWM adjacent to shorelines with natural vegetation where milfoil weevils can overwinter. During the reconnaissance meristematic tissue and the top foot or two of actively growing plants were collected and observed with a hand lens for adult milfoil weevils and entrance/exit holes in the plant stems. No milfoil weevils were found and no collapsing or declining EWM plants were noted during the project period.

DISCUSSION & RECOMMENDATIONS

While most of the project goals were not met, the various management failures teach us a lot about the behavior of EWM in Beecher and Upper Lakes and how to manage it in the future.

Winter drawdown

It was clear from the two attempts that more work is needed before winter drawdown is a viable EWM management tool on Beecher Lake. While it is technically feasible to conduct the drawdown using only siphons, experience shows they are not effective during wet years and too difficult to maintain during the winter months.

If winter drawdown is to be used as an effective management tool, the Beecher Lake dam will need to be modified to simplify the drawdown process. The installation of a drain pipe and valve through the Beecher Lake dam will allow for maintenance-free water level control.

It will also be necessary to dredge a channel from the main body of the lake to the dam. The channel will greatly increase the maximum drawdown from the current 2.5 feet to 5.5 feet below full pool. This will expose more than 76% of the littoral zone to freezing conditions.

Aquatic herbicide use

Since the discovery of EWM in 2007, the Beecher Lake District has relied almost exclusively on the routine use of aquatic herbicides. The result of these efforts has been mixed at best. While the whole-lake treatment in 2013 resulted in the greatest measured reduction in EWM frequency (69%), that may be a product of the early aquatic plant survey which failed to measure a late-season resurgence in EWM. The 2014 whole-lake treatment resulted in a small increase in EWM.

Both whole-lake treatments resulted in better EWM control in the Beecher Lake basin and little or no control in the Upper Lake basin. This may be due to increased flushing and dilution of the herbicide. The lake inlet is located adjacent to the boat landing on the north

shore of Upper Lake. Flow from the creek likely follows the north shore of Upper Lake through the narrow channel between the two lake basins. EWM in this area of Upper Lake has consistently been difficult to control through chemical means.

The most successful herbicide treatment for EWM control was actually the 2009 "spot treatment" using Navigate 2,4-D at 150 lbs/ac. Navigate is a granular herbicide which may have resulted in the active ingredient staying in place for a longer period of time. As discussed, the 2009 treatment also resulted in an unintentional whole-lake treatment at a higher lake-wide concentration than seen in 2013 or 2014.

The routine, some might say aggressive, use of aquatic herbicides in Beecher and Upper Lakes during the last 7 years has also impacted the native plant community. Many of the small pondweeds, most notably Fries' pondweed (*Potamogeton fresii*), stiff pondweed (*P. strictifolius*), and small pondweed (*P. pusillus*) experienced significant declines along with bushy pondweed (*Najas flexilis*) and stonewort (*Nitella sp.*).

The Future of EWM management in Beecher & Upper Lakes

Experience has shown that EWM is a very aggressive invader in Beecher and Upper Lakes. Over the last seven years the Beecher Lake District has conducted five herbicide applications costing in excess of $24,000.00. Each treatment has been met with a rapid resurgence and continued expansion of EWM. As a result, the District does not feel that routine herbicide use is an effective use of their resources.

Although the 2011/12 winter drawdown was not effective at controlling EWM throughout most of the lake, it did show promise near the dam where the full drawdown was achieved. Winter drawdown has also proven effective for EWM control on local waters and elsewhere in Wisconsin. Despite the high initial cost of dredging and modifying the Beecher Lake Dam, winter drawdown still represents the best alternative for the long-term and sustainable control of EWM in Beecher and Upper Lakes.

The Beecher Lake District should apply for AIS Control Grant funding to modify the Beecher Lake Dam and dredge a channel from the dam to the main body of Beecher Lake. This project would allow the District to employ periodic winter drawdown as the primary EWM management tool and reduce or eliminate the need for aquatic herbicide use in the future.