Evaluation of *Myriophyllum spicatum* (EWM) Management Using Diver Assisted Suction Harvest (DASH)

Cedar Lake, Polk/St. Croix Counties, Wisconsin

Sept. 2018

Data collection and analysis provided by: Ecological Integrity Service, LLC-Amery, Wisconsin

In July and August 2018, DASH (Diver Assisted Suction Harvest) was employed to reduce/control stands of *Myriophyllum spicatum*-Eurasian watermilfoil (EWM) in Cedar Lake. The areas that were harvested were based upon pre-harvest surveys conducted in areas that have historically been managed in the past using herbicide. Due to the lack of success with herbicide (2,4-D and Diquat/Endothallwere used on different occasions with limited reduction), herbicide use was ceased for 2018.

Prior to July 25 2018 (late June and July 21, EWM was surveyed with the intention of determining the best areas to utilize DASH. Those areas were outlined for the DASH team so that it would direct them into the EWM area needed to be reduced. The DASH team has latitude to remove within the area as they were able to observe the EWM that could be most efficiently removed. Figure 1 shows the map that was provided to the DASH team. Table 1 summarizes the frequency and density of the EWM observed prior to DASH to help determine the effectiveness of the DASH management method.

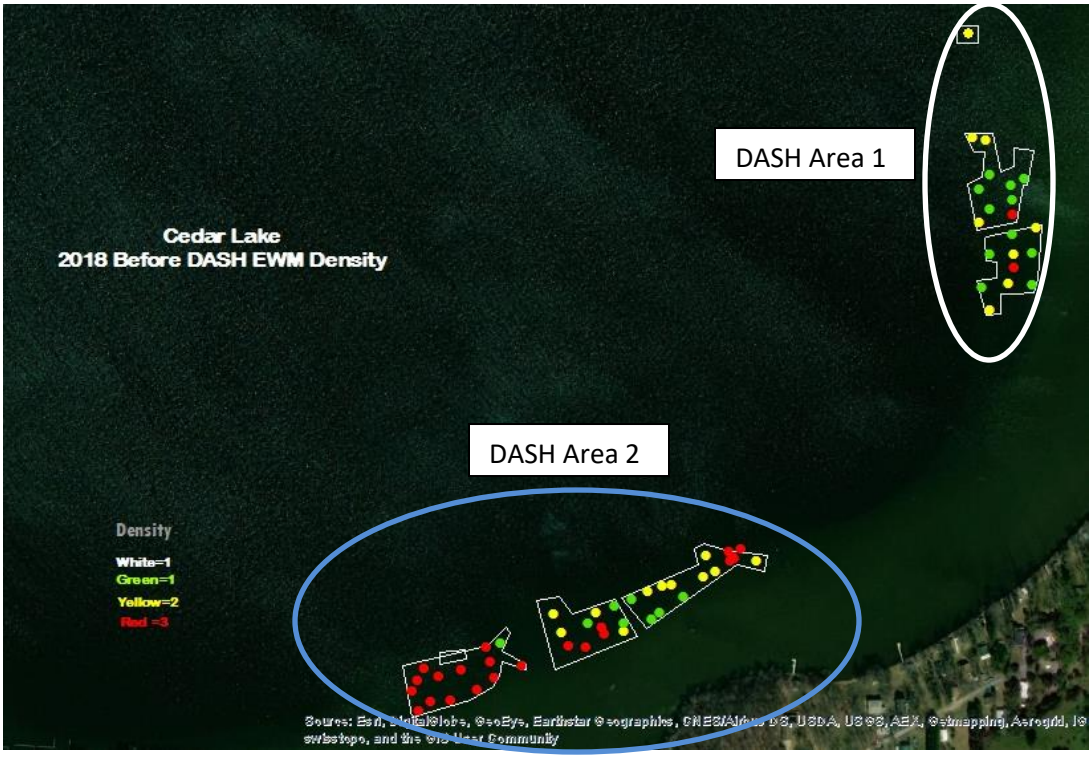

Figure 1: Map of designated DASH areas with EWM density observed at recorded sample sites prior to DASH.

The area that is circled in white was the recommended starting point for DASH in July (since it was unknown how much could be effectively removed). This was rationalized based upon the fact that this area was not comprised of beds of EWM, but rather scattered clumps with large space between the clumps. The assumption was that this area would be most effective for DASH. Also, the area circled in white is also a newly established area with EWM, with the original EWM discovery within the blue circled area (which also has received three herbicide treatments since the original EWM discovery).

A subsequent DASH removal occurred in August. The DASH team was directed into the area circled in blue, where the EWM was denser and constituted some beds within the delineated area.

DASH Site	Pre DASH Freq.	Pre DASH mean Density	Post DASH Freq.	Post DASH mean Density
Area 1	100%	1.57	38.1%	0.43
Area 2	100%	2.31	71.8	1.28
Both Areas	100%	2.05	60.0%	0.98

Table 1: Frequency and density data from before and after DASH implantation.

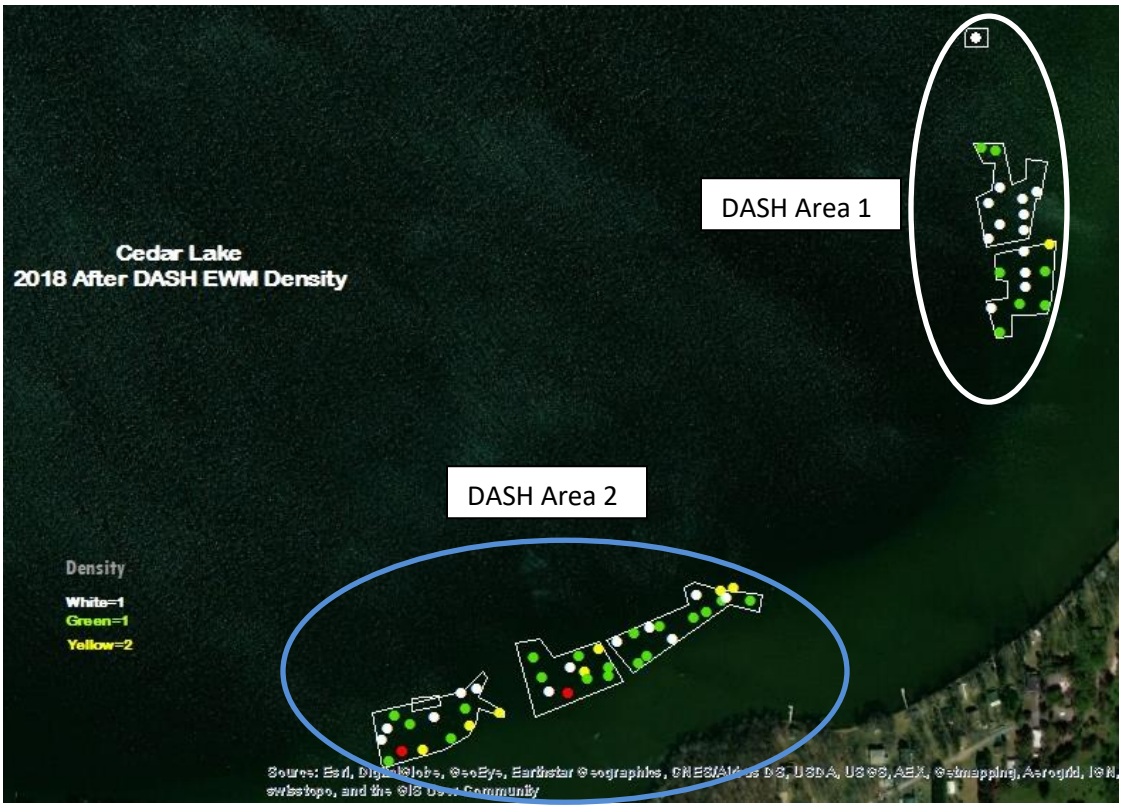

Figure 2: Post DASH EWM density map.

The post DASH evaluation was conducted on Sept. 16. As the pre and post DASH data shows, both areas resulted in reductions in frequency and density. Area 1 had less EWM remaining than Area 2, which suggests that this lower density area ended with better results. Prior to DASH in Area 2, many areas had EWM near or at the surface. After DASH there was little or no EWM near or at the surface as the area was examined. Qualitatively, Area 2 was vastly improved in surface/near surface coverage, although fairly dense EWM remained after removal. It is logical that a more dense area is harder to mitigate with DASH since it is more difficult to isolate the EWM. Even though a large amount may be removed, there remain dense areas around the removal area, that can continue to grow and reduce effectiveness. In areas such as Area 1, it is much easier to remove nearly the entire clump of EWM that is isolated from the native plants, thus reducing the return of EWM growth.

Table 2 shows that more EWM was removed from Area 1 than in Area 2 (based upon wet mass). Area 1 was harvested three days, July 24-26. Area 2 was harvested for two days, August 23 and 14.

Area	Date DASH conducted	Total Lbs of EWM removed
1	7/24, 7/25, 7/26	10 270
2	8/13, 8/14	8475
Combined		18 745

Table 2: Total pounds of EWM removed at each DASH area (wet mass) as reported by DASH contractor.

Long-term Management Results

A sample point grid surrounding historic EWM locations was established to evaluate long term EWM management. Some sample points were added to the grid in 2018 to account for additional EWM in the eastern portion of the EWM area. The sample grid was evaluated on Sept. 16.

The southern bed had higher frequency and density in 2018 than in 2017, showing an increase in EWM in 2018, even after DASH use was increased. No herbicide was used in 2018, although the herbicide treatment in 2017 didn't reduce EWM.

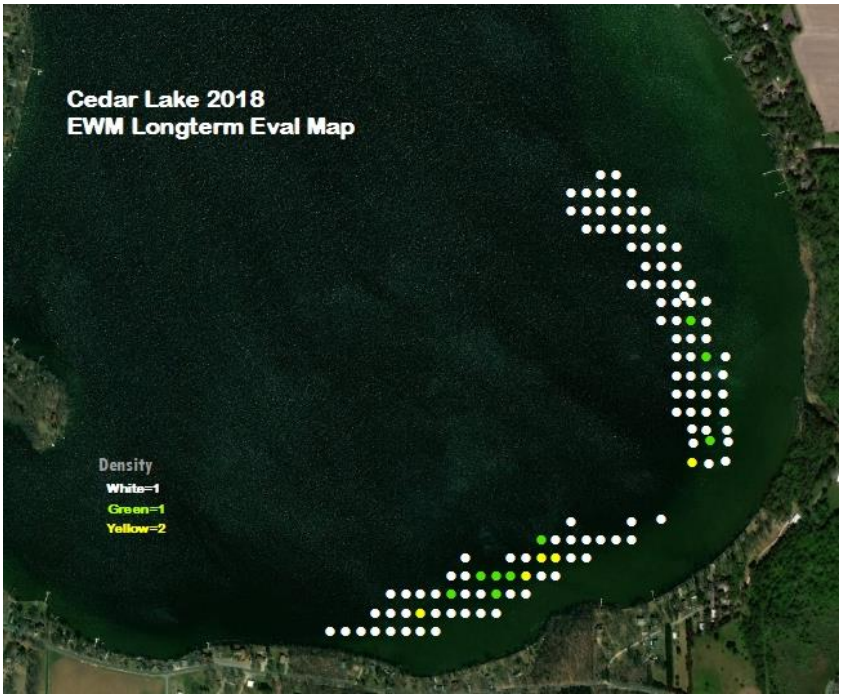

Figure 3: Long term evaluation map with sample grid encompassing EWM mgt. area-fall 2018.

There was also some EWM growth added in the sample grid in the eastern portion of the assessment area. This area was not treated in 2017 and some limited hand pulling occurred in 2017. In 2018, DASH teams harvested this area for two days and did reduce the EWM quite extensively, but the EWM has expanded somewhat from 2018.

Year	*Frequency of EWM*	*Mean Density of EWM*
2017	7.03%	0.086
2018	11.7% (10.9% with exact 2017 grid)	0.16

Table 2: Frequency and density data in long term management point grid.

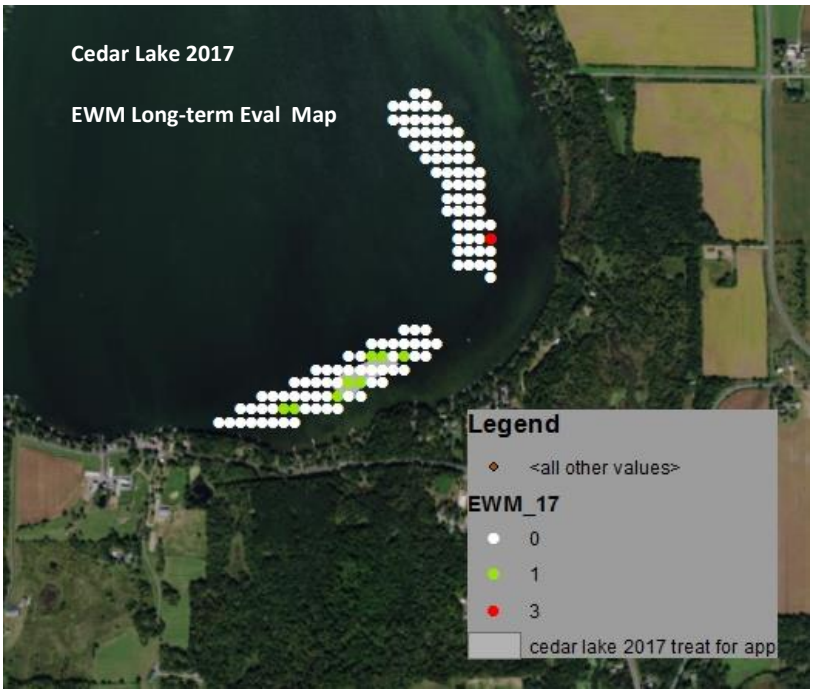

Figure 4: Long term sample grid results from 2017.

Volunteer monitors assisted with finding EWM in other locations around Cedar Lake. Figure 5 shows the map of those locations (pink dots). The two locations on the western side have white dots adjacent to indicate that the professional surveyor could not locate the EWM at these locations, which indicate that it was likely only a plant or two and not a clump. These locations can be used to help make future management decisions and areas that need to be added to the professional monitoring.

Figure 5: Volunteer monitoring EWM locations, July and August 2018.

Figure 6 shows the final density of EWM and the volunteer EWM sites along with previous treatment borders in the southern area of EWM (original discovery). This was used to evaluate future management recommendations. As this map shows, this area has spread to the west of the original treatment area.

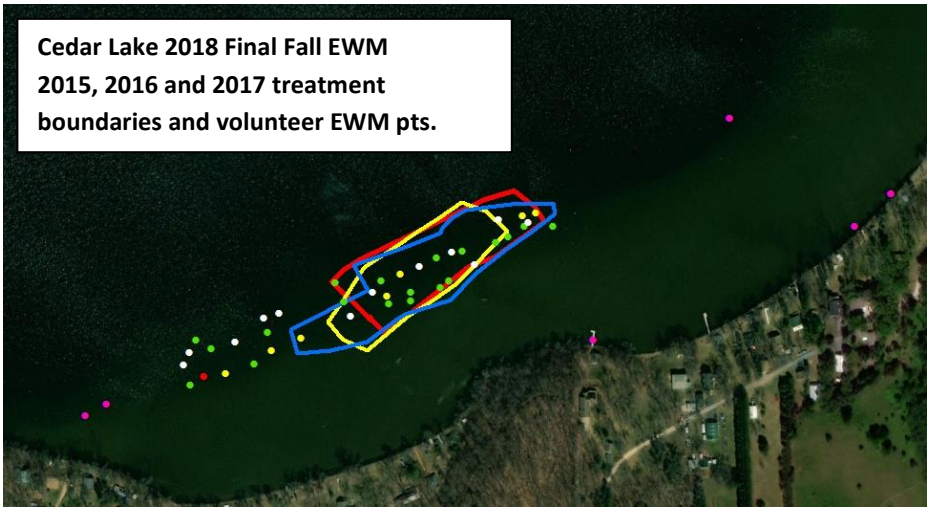

Figure 6: Fall 2018 EWM density in southern bed with previous herbicide application borders for reference.

Management considerations-2019

Herbicide has been applied on three occasions using 2,4-D the first two times (2015 and 2016) and Diquat/Endothall in the last application (2017). The first application in 2015 was successful in reducing EWM, with the last two not at all. It was decided, based upon the fall 2017 EWM growth that DASH would be utilized to manage the EWM. It is suspected that the location of the EWM bed makes it susceptible to wind/currents after application, reducing the contact time which is needed for the herbicide to be effective.

The EWM expanded in coverage and density in the early summer, which created a challenge for using DASH solely to manage the EWM. The eastern area (Area 1) was reduced in frequency and density significantly. The southern area (Area 2), has a large amount of EWM remaining (frequency and density were reduced). It is evident that DASH can be effective for individual, isolated EWM clumps as in the case of Area 1. DASH does not appear to be effective in high density, bigger bed areas such as Area 2. Even if density is reduced, which may help reduce fragmentation and spreading, the adjacent EWM can just regrow in the area reduced. DASH is too labor intensive and would be very expensive to reduce to the desired level in the denser areas such as Area 2.

For future consideration, if the contact time of an herbicide or a different herbicide is available that may be more effective, herbicide use should be considered for 2019. Based upon the EWM present in fall 2018, the EWM growth would be too wide spread and dense for effective DASH management in Area 2. The southern bed (Area 2) should be considered for herbicide use. Area 1, may be considered, but would be more aggressive approach as the EWM is low in frequency and density in this area. Area 1 would likely need DASH harvest if no herbicide is applied to this area in 2019.

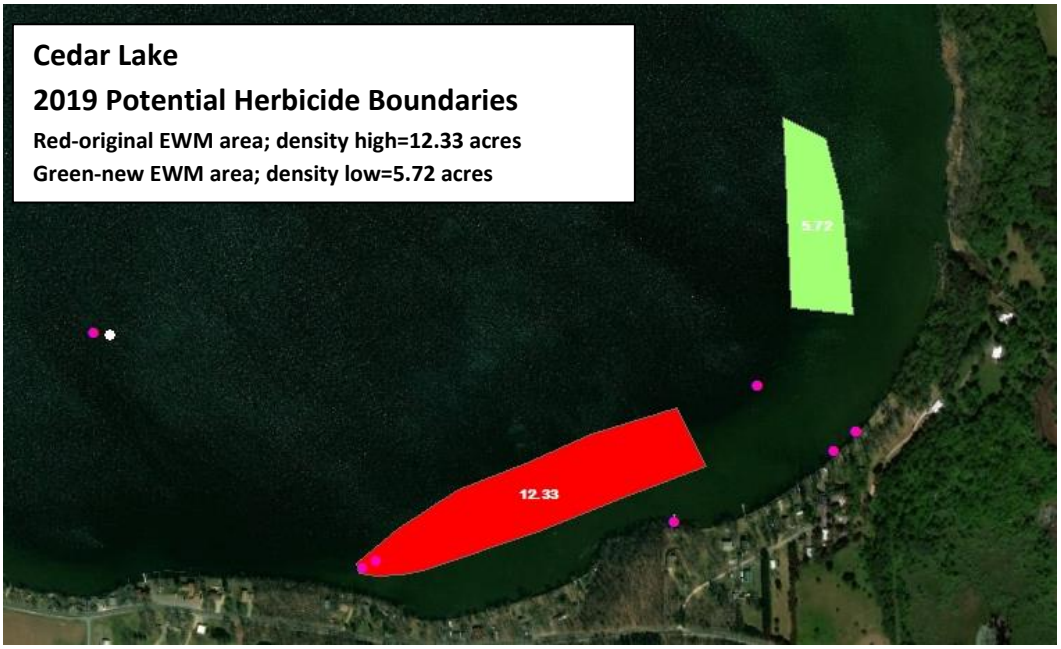

Figure 7: Potential herbicide areas for 2019 with area listed in middle of delineated bed.

Figure 7 is a map of the two beds that were delineated based upon the fall 2018 survey. The red bed (12.33 acres) is of high priority for herbicide treatment (if a more effective method/herbicide is available). The green area requires more discussion.

The EWM locations along the southern shoreline the volunteer monitor located in 2018 are all in approximately 12-18" of water depth (as reported by monitor). These can easily be hand pulled as long as done carefully with no fragmentation, which can lead to spread.