Restorative Lake Sciences, LLC

March 25, 2014

Mr. Larry Nielsen, Manager
Village of Paw Paw
111 East Michigan Ave
P.O. Box 179
Paw Paw, MI 49079

Dear: Mr. Nielsen,

Since the development of a comprehensive lake management plan for Maple Lake in 2009, many recommended lake management methods and technologies have been implemented with measureable success in water quality improvements. Maple Lake is a complex aquatic ecosystem due to its riverine characteristics and appreciable loads of sediment and nutrients that enter the lake from the Paw Paw River and Briggs Pond. The placement of new technologies to reduce these loads from the two locations is recommended for 2014 (i.e. nutrient sponges and inlet buffers). Furthermore, regular bi-weekly meetings with the Maple Lake Association and Village of Paw Paw with Restorative Lake Sciences is recommended to assure that all key stakeholders are aware of each lake management method, its timing, and expected time for measureable changes. Given the rigorous data set from the past four years, it is possible to determine the efficacy of each form of management (i.e. harvesting, herbicides, aeration) if careful data collection is pursued in 2014 (as proposed by RLS) and compared to the baseline data collected prior to implementations. While there has been noted reductions in some invasive aquatic vegetation such as Curly-leaf Pondweed and Eurasian Watermilfoil, other native aquatic plants have become more prevalent. This may be due to an open-niche that the habitat once provided for the invasives prior to control of them. In regards to laminar flow aeration (inversion oxygenation), the following summary conclusions can be made based on data analysis:

1) During the 2009 lake management plan study, an average of 0.500 mg L^{-1} of total kjeldahl nitrogen (TKN) was noted among samples in what is now the "control" region and an average of 0.545 mg L^{-1} was measured in what is now the "aeration" region. In 2013, these values were 0.549 mg L^{-1} in the control region and 0.492 mg L^{-1} in the aeration region. This finding is significant because 2013 was a wet year with multiple flash rainfall events and the TKN mean was high in the control region but substantially lower in the aeration region due to the activity of the aeration system. This also signifies that the aeration system is able to process nitrogen loads from the Paw Paw River at an appreciable rate.

2) The mean total phosphorus (TP) concentration in 2009 for the "control" region was 0.019 mg L^{-1} and for the aeration region was 0.024 mg L^{-1}. Considering that 2013 was a wet year with increased runoff of nutrients, the mean value for the aeration region in 2013 was 0.029 mg L^{-1} (only slightly higher than in 2009), whereas the control region in 2013 was 0.041 mg L^{-1}. This signifies that the aeration system is also doing well at processing incoming phosphorus loads compared to the control region which does not have aeration.

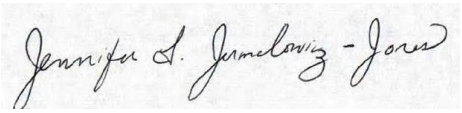
3) The mean conductivity reading in 2009 for the control region was 539 µS cm^{-1} and in the aeration region was 613 µS cm^{-1}. In 2013, the average conductivity in the control region was 520 µS $cm^{-1}$and in the aeration region was 514 µS cm^{-1}. This value also indicates that the aeration system is lowering conductivity in waters that move to the north.

4) The relative abundance in green and blue-green algae has declined in the aeration region since 2009 and diatoms have increased. In the control region, there has been only a small decline in some blue-green algae. Expansion of the aeration system may further reduce green algae in the control region. Secchi transparency has also increased in the southern basin, as 2009 readings had maximum values at 4 feet, whereas transparency in 2012-2013 was visible to the lake bottom in the aeration region but not in the control region.

5) Determination of the reductions in nuisance aquatic vegetation growth is difficult due to the many aquatic plant removal methods being conducted. Reductions in milfoil and Starry Stonewort have been noted in the aeration region. One possible way to determine efficacy of the aeration system on aquatic plant reduction in 2014 is to isolate a small test area of vegetation in the aeration region and conduct before and after scans to show changes with solely aeration.

Based on the summary conclusions above, we find that the aeration region is showing marked improvements relative to the control region and further expansion of the system may be desired (especially for nutrient reduction and improved water clarity). The findings above have also occurred in other lakes that utilize aeration systems. Peer-reviewed publications are being submitted soon for publication and will shed more light on the mechanisms of aeration.

Sincerely,
RESTORATIVE LAKE SCIENCES



Jennifer L. Jermalowicz-Jones, PhD Candidate