WHITE WATER ASSOCIATES, INC.
429 River Lane, Amasa, Michigan 49903

Attention: Kent Palmquist
Email: kbpalm@att.net

Subject: **2017 Algae Mats on Hagerman Lake**

May 18, 2017

White Water Associates, Inc. has been retained as the lake management consultant to the Hagerman Lake Property Owners Association. On May 16, 2017, Erik Strom, Executive Director of Covenant Point Bible Camp, contacted White Water to express concerns from stakeholders regarding floating vegetation mats that were accumulating in Hagerman Lake bays.

On the evening of May 16th, White Water Aquatic Biologist Angie Stine and a co-worker visited Hagerman Lake. Using a boat they searched bays and found algae mats that had surfaced and accumulated on the windward edge of the bays. Photos were taken and displayed below as Exhibits 1, 2, and 3. Location: N46.23499 W088.45473.

Exhibit 1.

Exhibit 2.

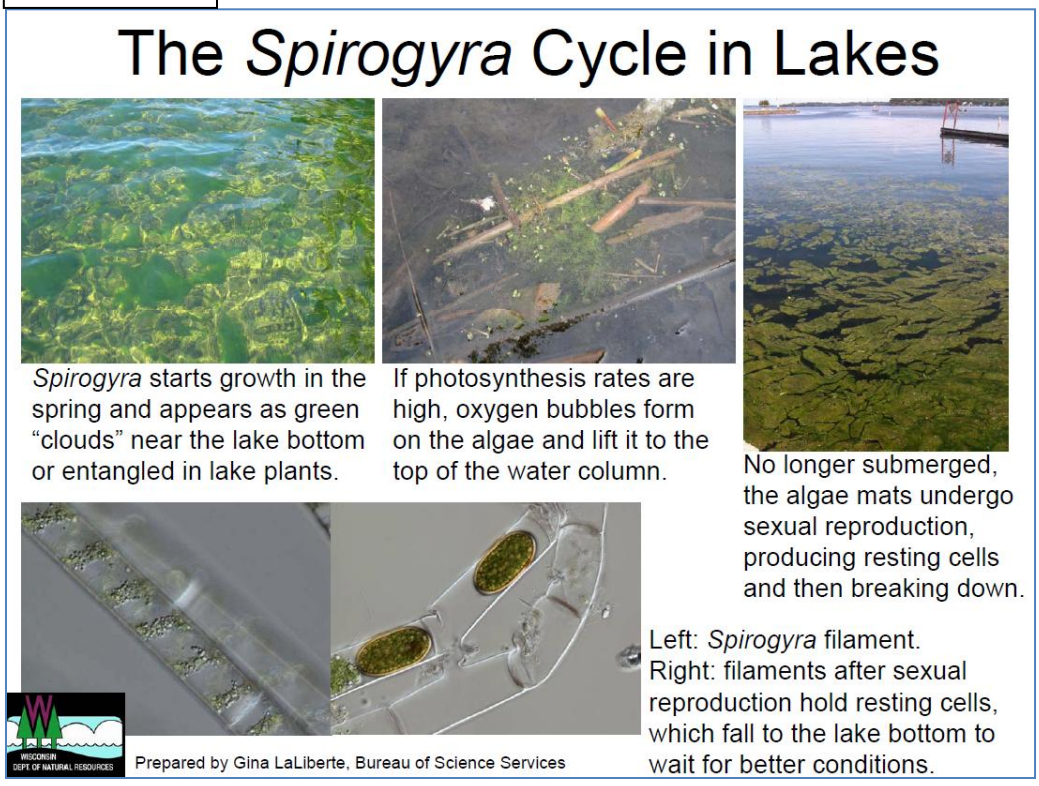
Exhibit 3.

Angie Stine suspected that the mats were comprised of filamentous algae that had surfaced because of spring conditions and accumulated due to wind activity. To confirm this observation, Stine contacted algae expert, Gina Laliberte (Wisconsin DNR) and provided photos.

In a May 17 email, Laliberte stated:

> Given the timing of this bloom and your description of it as "slimy," I think you are seeing *Spirogyra* or one of its relatives (*Mougeotia* or *Zygnema*) in Hagerman Lake. These algal genera grow as unbranched filaments, and they secrete pectin which makes them feel slippery."
>
> This is a typical time of year for *Spirogyra* blooms to appear. They start growing on lake bottoms, and as they hit peak photosynthesis rates in clear water, oxygen bubbles accumulate in the filaments and buoy them to the surface. They become more noticeable at the surface, especially when the filaments mat together and start to break down (see Exhibit 4, the *Spirogyra* Cycle in Lakes). The mats will probably dissipate in a few weeks as other plants and algae grow in the lake. *Spirogyra* and its relatives are not harmful. They can be an aesthetic nuisance as the mats break down and decompose (they can get pretty smelly in warm weather) and I wouldn't recommend swimming through them as bacterial levels may be elevated in the immediate vicinity of the decomposing mats.

Exhibit 4.



In more than 80% of Wisconsin's lakes, phosphorus is the key nutrient affecting the amount of algae and plant growth. If phosphorus levels are high, excessive aquatic plant growth can occur. Phosphorus originates from a variety of sources, many of which are related to human activities. Major sources include human and animal

wastes, soil erosion, detergents, septic systems and runoff from farmland or lawns (Shaw et al., 2004). Phosphorus provokes complex reactions in lakes. An analysis of phosphorus often includes both soluble reactive phosphorus and total phosphorus. Soluble reactive phosphorus dissolves in the water and directly influences plant growth (Shaw et al., 2004). Its concentration varies in most lakes over short periods of time as plants take it up and release it. Total phosphorus is considered a better indicator of a lake's nutrient status than soluble reactive phosphorus because its levels remain more stable (Shaw et al., 2004). Total phosphorus includes soluble phosphorus and the phosphorus in plant and animal fragments suspended in lake water. Phosphorus concentration on a lake is often higher in spring as spring turnover of the lake mixes the deeper waters that contain more phosphorus with the surface. Ideally, soluble reactive phosphorus concentrations should be 10 µg/L or less at spring turnover to prevent summer algae blooms (Shaw et al., 2004). A concentration of total phosphorus below 20 µg/L for lakes should be maintained to prevent nuisance algal blooms (Shaw et al., 2004).

Hagerman Lake total phosphorus (Table 1) values are considered "good to very good," and are similar to Northeast region Wisconsin values. Currently, White Water is sampling phosphorus every other year in Hagerman Lake in September. In June 2009, White Water Associates investigated an algae bloom report on Hagerman Lake (see Table 1). The phosphorous concentration was elevated on that inspection. It would be beneficial to increase the frequency of phosphorus sampling in Hagerman Lake. This will be accomplished with the Association's involvement with the Cooperative Lake Monitoring Program (CLMP). A total phosphorus sample was collected by Mike Bukovitz (CLMP) April 19th, 2017 and one will be collected in the range of August 24-28. The surface total phosphorus in the 2013 and 2015 monitoring were below the detection limit (< 10 µg/L) (Table 1).

Table 1. Hagerman Lake total phosphorus measurements.

Date	Phosphorus concentration (µg/L)	Comments
5/1/2007	11	Sample collected 6 inches below surface
5/1/2007	17	Sample collected at 26 feet
5/1/2007	22	Sample collected at 50 feet
8/8/2007	9	Sample collected 6 inches below surface
8/8/2007	14	32 foot depth
8/8/2007	99	47 foot depth – Value is high.
6/26/2009	70	Sample collected at 6"; with an algae bloom present
9/28/2010	20	Sample collected 6 inches below surface
8/15/2013	Non Detect (< 10 µg/L)	Value was below detection limit
9/9/2015	Non Detect (< 10 µg/L)	Sample collected 6 feet below surface
9/9/2015	20	Sample collected at 50 feet
Northeast Wisconsin	19	Average phosphorus for Northeast Wisconsin Lakes
All Wisconsin	25	Average phosphorus for all Wisconsin lakes

The values for phosphorus and chlorophyll “a” were quite low in September 2015. This combined with the high Secchi reading would suggest a classification of oligotrophic. This is consistent with past readings and indicates that Hagerman Lake has high water quality.

Aquatic algae are a natural part of lakes ecology. Algae are important food source for zooplankton which provides food for fish. Algae mats provide cover for small animals such as insects, snails, and scuds. Despite these ecological benefits, large algae blooms can cause aesthetic or recreational impacts. These blooms can be minimized by limiting the flow of nutrients into the lake. Hagerman Lake stewards can help reduce the accumulation of phosphorous in the lake by:

- Reducing or eliminating fertilizer use on lawns;
- Maintaining septic systems properly;
- Redirecting nutrient-rich runoff away from the lake; and
- Maintaining a vegetative buffer strip along the shoreline to filter runoff.

A conductivity survey could be conducted along the shoreline of Hagerman Lake at the end of the summer to determine if any particular area of the lake shore may be contributing more nutrients into the lake. Lake conductivity studies are sometimes conducted to determine if there are faulty septic systems or other pollution sources present that could be delivering excess nutrients into a lake. Low values of conductivity are characteristic of high-quality, oligotrophic (low nutrient) lake waters.

We appreciate the opportunity to serve the Hagerman Lake Property Owners Association. If there are any questions about this report or special need of services, please contact us at your convenience.

Literature Cited:

Shaw, B. Mechenich, C, and Klessig, L. 2004. *Understanding Lake Data (G3582).* Board of Regents of the University of Wisconsin System. Madison, WI.

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