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Big Green Lake - Is it Impaired?

The Wisconsin Department of Natural Resources (WI DNR) applies specific water quality criteria to all Wisconsin lakes, Big Green Lake included, to determine if the water body in question should be classified as "impaired". These criteria are used to measure the relative health of our water resources in the state, and subsequently, used to guide management actions. The water quality criteria for Big Green Lake are outlined below:

Phosphorus	Dissolved Oxygen	Chlorophyll
≤15µg/L	>5mg/L	<20µg/L during 95% of the time

The above parameters have been monitored for several years on Green Lake through a partnership with the WI DNR, United States Geological Survey (USGS) and the Green Lake Sanitary District (GLSD). Below are the results of that monitoring over the past 5 years, allowing us to determine if Green Lake meets the criteria applied to our lake by the WI DNR:

Phosphorus	Dissolved Oxygen	Chlorophyll
17.2µg/L	<5 mg/L *	4µg/L

*measured below 5mg/L at mid-depth and in deepest areas of the lake
Note: 1µg/L = 1 parts/billion and 1 mg/L = 1 parts/million

By comparing the criteria against the monitoring results, there is some divergence. More specifically, the divergence involves the dissolved oxygen (DO) and phosphorus (P) for Big Green Lake. The Chlorophyll complies with the recommended criteria. When the criteria are exceeded, the lake can be designated as impaired (as it pertains to the criteria for that specific parameter). Because of this, the GLSD Board, in the spring of 2013, met with WI DNR to discuss the potential water quality impairment of Big Green Lake. In short, although our lake was on the bubble as far as the lake's primary nutrient, phosphorus, there was potential for having Big Green Lake listed as **"impaired" for *low dissolved oxygen levels.***

The Dissolved Oxygen Issue

The WI DNR explained to us that our lake does meet the threshold for listing Big Green as "Impaired for Low DO". Although DO is typically in abundance within most of the lake, there can be a low DO deficiency in a narrow band at the lake's thermocline. The thermocline is where the warm upper layer of water meets the lower cold layer of water, typically at about 30+ feet deep during the summer months. This deficit is of concern because aquatic organisms, especially fish, require sufficient DO to stay alive. Although the low DO remains within a narrow band of 10 feet or so during late summer, there is concern with respect to its cause and potential for expansion.

Consequently, Big Green Lake has been designated as impaired for low DO. Lakes designated as "impaired" in Wisconsin typically have greater funding opportunities from government agencies to help understand and alleviate the identified problem. Furthermore, having the State identify our lake as impaired further enables all parties to identify specific strategies and solutions for returning our water body to acceptable water quality. We have already made significant strides (DNR approved Big Green Lake Management Plan – February 2013) in identifying the necessary steps to get our lake off the impairment list and our efforts will continue until our delisting goal is met.

Although our LMP Team is aware of our low DO impairment (we know that it is happening), we do not believe we have a solid understanding of why it's happening with certainty at this point in time. Therefore, we are in the process of working with experts to determine which data/information and tools would be best suited for helping us to clarify the reasons behind our low DO situation and what has to be done to alleviate the problem.

Our lake partnership team is committed to Big Green Lake and understands the negative connotation associated with the impairment status. We accept the short-term negative implications (i.e. "Impairment Label") in order to do the right things (funding with corrective strategies & solutions) which will preserve our lake long-term.

The Phosphorus Issue

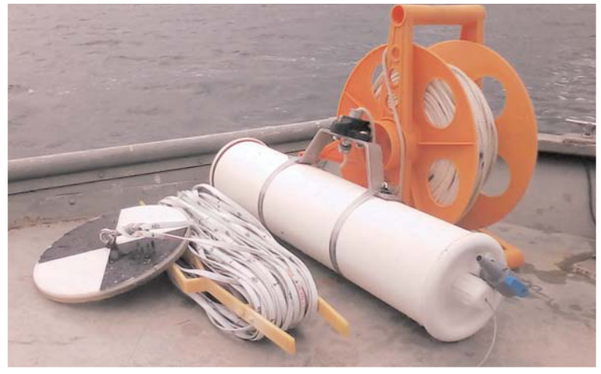
Big Green Lake is not presently listed as "impaired" for phosphorus (P). Although the 17.2µg/L concentration is above the 15µg/L impairment criteria, confidence limits caused by the variability in P concentrations actually fall slightly below the 15µg/L so our lake does not met the impairment criteria as it pertains to P. Despite the "non-impairment" determination for P, the primary concern for our lake continues to be too much phosphorus and it is possible the lake could be listed as impaired for P in the future. P has been and remains the problem nutrient for Big Green Lake. You can think of P as fertilizer being applied to a healthy lawn, you don't need to add fertilizer to a healthy lawn. Too much P in a lake causes unwanted and excessive plant and algal growth. We also believe P is directly tied to our current impairment of low DO near the thermocline. In summary, P is the gorilla in the room and the vast majority of our Lake Management Plan (LMP) is aimed directly at reducing P. We have been aggressively targeting reductions in P entering the lake. We believe there is good science supporting our "domino effect". By aggressively trying to reduce P input to the lake, the other lake water quality indicators (DO, water clarity, chlorophyll) should also improve.

Sometimes it is helpful to look around the State to gain a perspective on what's happening with other water bodies. We are not alone in our struggles with P, it is the same concern facing most of the lakes in our area and around the State. For example, our neighboring Lake Winnebago has a summer average P concentration of 95µg/L which is almost 6 times more P than in our lake. Lake Mendota in Madison has a summer average P concentration of about 55µg/L which translates into more than 3 times more P than in our lake.

Current Status of Big Green Lake Water Quality

The U.S. Geological Survey (USGS), in cooperation with the GLSD, continues to monitor the water quality of Big Green Lake using very consistent, reliable and rigorous sampling protocols that enable the water quality of the lake to be regularly evaluated. Overall, the water quality of Big Green Lake in 2014 was relatively similar over the past few years, with a few subtle changes.

Water clarity throughout the lake continued to improve slightly, with the summer average clarity reaching the best it has been since records started in 1986. In 2014, the average secchi depth from June through August was 21 ft. The chlorophyll a concentration (amount of algae in the lake) was about the same as recent past years - average concentration of 5µg/L.



Over the past 5 years, Big Green Lake had a summer average ***secchi depth of 17 feet, phosphorus concentration of 17.2µg/L, and chlorophyll a concentration of 4µg/L.*** *Based on these values, Big Green Lake would be classified as a Mesotrophic lake (moderately productive) with respect to phosphorus and chlorophyll a concentrations, and oligotrophic (very low productivity) based on water clarity. Although the average phosphorus concentration in 2014 and over the past 5 to 10 years was slightly above* 15µg/L *(the criteria threshold for a lake with trout), the lake is not considered by WI DNR at this time to be impaired for phosphorous, because of annual variability in P concentration.*

Note: The information in the 3 paragraphs above was provided independently by the USGS. Moving forward, the GLSD will continue to utilize the USGS for our lake's water quality monitoring. We believe it is helpful to have an independent arm doing this monitoring work to provide consistent and reliable data. This establishes a baseline record for the lake which is critical moving forward as we measure the effectiveness of our Lake Management Plan (LMP).

Question: So what do all the numbers mean?

Answer: Our lake's measured water quality signifies that we are currently at or slightly above acceptable water quality standards as defined by the State. On an annual basis, variability in P, DO, and water clarity are significant and this variability needs to be considered when interpreting water quality results or listing the lake for impairments. From a "big picture perspective", we are fortunate to have such an outstanding lake and it's our job (LMP Team) to not just be satisfied with maintaining it, but rather, to aggressively work to improve it.

Question: How can we continue to improve the water quality of Big Green Lake?

Answer: The short answer is simple – Implement our LMP.
For specific details on the LMP for Big Green Lake, click on the link below:

https://docs.google.com/file/d/0B5Q-00Y3148YVVKVk5JcFVMVDA/edit?usp=sharing

Some of the current projects and activities for reducing Phosphorus to the lake include:

1. 75+ Best Management Practices – estimated to reduce P input by over 3,000+ pounds annually
2. Restoration of County K Estuary - estimated to reduce P input by over 1,000+ pounds annually
3. Harvest more aquatic plants – estimated to reduce P by over 500+ pounds annually
4. Treat or reduce urban storm water – P reduction yet to be determined

Question: What is our goal for the lake in the short-term versus the long-term?

Answer: Big Green Lake has a flushing rate of 20+ years which means we are dealing with a huge volume of water (second largest in the State behind only Lake Winnebago). This means that changes in water quality occur very slowly even as significant improvements are made throughout the watershed (reductions to Phosphorus inputs). So in the short-term, even small incremental changes in the summer average concentration of 1µg/L or 2µg/L would be validation that the LMP is working. Our long-term goal is for Big Green Lake to be removed from the impairment list with respect to P and DO.

With an issue as important as "Lake Impairment", you can expect the GLSD and our LMP Team to make this issue our #1 priority moving forward. All ideas, strategies and solutions are on the table (ongoing LMP revisions). Our short-term goals (next 3 to 5 years) will be to "move the needle in the right direction", in other words, protect the lake and continue to foster all incremental positive water quality improvements. Our long-term goal (next 10 to 20 years) involves meeting ALL WATER QUALITY CRITERIA as defined by the WI DNR which obviously implies removal from the impaired list. The GLSD believes we are well-positioned to get the lake removed from the impaired list by implementing our LMP and we will meet our short and long-term goals for Big Green Lake.

GLSD Updated Website — WWW.GLAKESD.COM

Please take a few moments to visit the Green Lake Sanitary District's updated website which can be found at WWW.GLAKESD.COM . In addition to the very important lake impairment article in this newsletter, the District's website contains other important information on a multitude of other lake programs and related activities.

Feel free to tell us (GLSD Board and Staff) what your think or share your concerns relating to other issues or topics that you believe aren't being properly addressed, we are always happy and willing to discuss your concerns at a date and time convenient to you, our customer.