

ROADMAP

TO A REVITALIZED

GREEN LAKE

Maintaining the beauty of central Wisconsin's Green Lake requires contributions from a variety of stakeholders in the region.

COOPERATION AMONG SEVERAL GROUPS PRODUCES A PLAN TO AID THE AGING BEAUTY.

Stephanie Prellwitz and Alison Thiel

Green Lake, located in central Wisconsin, is a treasured lake of statewide significance. Measuring 236 feet at its greatest depth, it is the deepest natural inland lake in the state whose pristine waters and diverse ecology have been revered by many.

While all lakes naturally age, human pressures and the impact of more intense and more frequent rain events can accelerate the lake aging process from centuries to decades. Reflecting such long-term degradation, in 2014 the Department of Natural Resources classified Green Lake as an impaired waterway because it does not meet optimal water-quality standards for dissolved oxygen.

A band of low dissolved oxygen consistently develops at certain lake depths

in Green Lake and has been getting more pronounced over time. The likely cause is a high concentration of phosphorus.

"Green Lake was listed as impaired because the thermocline, which is about 30 feet below the water surface, goes without oxygen for a few meters within the summer months," explained Ted Johnson, lake biologist with the DNR.

Low concentrations of dissolved oxygen at Green Lake's bottom also are being carefully monitored. Dissolved oxygen in water bodies is essential for the

survival of organisms important in lake ecosystems, from small zooplankton all the way up to large trophy fish.

Call to action

Green Lake has benefited greatly from decades of work by dedicated local entities, and in 2013 these groups worked together to develop a Lake Management Plan (LMP) to study issues facing the lake and identify recommendations for improving water quality and aquatic habitat.

The LMP team consists of government entities, local municipalities and non-profit organizations working together throughout the watershed. The team regularly partners with environmental experts, including the Nelson Institute for Environmental Studies, Delta Institute and University of Wisconsin.

Charlie Marks, administrator of the Green Lake Sanitary District (GLSD), has been involved in restoration efforts on and around Green Lake for 20 years. He emphasized the benefits of compiling past and future conservation efforts

into an official LMP. This plan represents the commitment and collaboration of the LMP team, which has led to an increase in grant awards for Green Lake restoration projects.

The LMP team is doubling down on initiatives that prioritize phosphorus reductions throughout the Green Lake watershed, including shorelines, cities and agricultural areas. The group also is coordinating research to align water-quality goals with science-based scalable solutions.

Understanding the issues

As an initial step, the Green Lake LMP team is working to better understand the mechanisms causing Green Lake's low dissolved oxygen zones and high phosphorus concentrations.

The Green Lake Association (GLA) is collaborating with the U.S. Geological Survey, DNR and other lake scientists on a three-year study to investigate the dissolved oxygen issue. The project is funded by a \$200,000 DNR Lake Protection Grant, with additional financial support by the GLSD and Geological Survey.

"This study will take into account the biological and chemical factors contributing to this phenomenon of low dissolved oxygen," Johnson said.

Ultimately, the research will develop evidence-based management strategies and phosphorus reduction requirements to achieve Green Lake's water-quality goals.

Because the lake study will take several years to complete, the LMP recognizes that phosphorus reductions are a smart preliminary plan of attack. With limited resources, efforts need to be as efficient as possible. That means prioritizing science-based solutions that target the causes instead of simply chasing after the symptoms.

Agricultural impacts

One pound of phosphorus can fuel the growth of 500 pounds of algae, so the LMP team is looking for reductions beyond the lake and into the entire 107-square-mile watershed, the likely source of much of the phosphorus found in the lake.

As an essential nutrient for plant life, phosphorus is found in fertilizers and manure. However, ineffective management of water runoff can lead to excess phosphorus entering waterways and depositing in the lake.

Several agriculturally focused projects have been gaining momentum. In Green Lake County alone, more than 100 agricultural best management practices (BMPs) have been installed in the watershed thanks to six consecutive years of grant funding from the Natural Resource Conservation Service's National Water Quality Initiative (NWQI).

This effort partners Land Conservation Department staff with farmers to install "hard" conservation practices, such as grassed waterways and retention ponds, and to implement "soft" management techniques, including cover crops and tillage practices. These practices keep nutrients and sediment on the land, upstream and out of the lake.

What makes this program even more unique is that many of the practices are installed at no cost to farmers. NWQI funds typically cover 70 percent of the cost of each of these BMPs, with the remaining expenses covered by the GLSD courtesy of a separate \$200,000 Lake Protection Grant.

"In many cases the additional cost-share money from the GLSD and DNR, which sometimes pays for the entire project, is the breaking point for implementing some of our most important BMPs," said Paul Gunderson, Green Lake County conservationist.

In exchange for free BMPs, the practices are left intact in perpetuity and are maintained by the GLSD.

The LMP team is hoping to duplicate this model in Fond du Lac County, which accounts for 41 percent of Green Lake's watershed area. In 2016, the GLSD received an additional \$200,000 Lake Protection Grant from DNR to install BMPs to divert nutrients from entering Green Lake. The GLSD and GLA are providing a local match to the grant.

Future projects that aim to prevent nutrient runoff will be guided through the GLA's Phosphorus Prioritization Plan, a recently completed project by the Delta Institute that identifies fine-scale nutrient-loading priority areas within Green Lake's watershed.

Eyeing the urban footprint

The cities of Green Lake and Ripon are located in Green Lake's watershed. As an LMP team member and economic beneficiary of a healthy lake, the City of Green Lake recognized that its participation was vital before the team approached partners further upstream who were less directly connected to the lake.

In 2015, the City of Green Lake was awarded a \$19,000 DNR Urban Non-point Source and Storm Water Grant.



The Green Lake watershed lies mostly in Green Lake and Fond du Lac counties and includes miles of streams that have been documented for erosion and buffer issues in a comprehensive study designed to prioritize restoration projects.



Interns from the Green Lake Association and Ripon College, including Ricardo Jaimes shown here, documented erosion on every mile of tributary stream in the Green Lake watershed.

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This municipality-wide initiative will identify, quantify and improve the city's urban footprint to Green Lake. Some of the proposed activities include addressing water infiltration and reviewing city ordinances to better manage storm water. The City of Green Lake, GLSD and GLA are contributing funds to pay costs not covered by the grant.

"The city has a responsibility to do our part to protect our water resources so that future generations have the same opportunities that we have now," said Green Lake Mayor Jon McConnell. "We take that obligation very seriously, and we are willing to do our part to make that happen."

Shore up shorelines

Miles of streams meander throughout the Green Lake watershed. Some sections have eroded banks that deposit sediment and nutrients into the waterway, especially during storm events like the infamous 2008 flood.

Since these stream sections are often hidden or inaccessible, the LMP team sponsored a multi-year stream inventory project. Interns from the Green Lake County Land Conservation Department (LCD), GLA and Ripon College walked every single mile of stream, documenting erosion and buffer issues every 150 feet along the stream corridor. Data were compiled into a series of maps that provided a systematic method for the Green Lake County LCD to identify and prioritize future stream restoration projects.

One recent restoration project replaced 1,700 feet of deeply eroded stream banks with gentle slopes to mimic natural systems. During future larger rain events,

stream flow will be able to expand into the floodplain and return to the channel during normal flow conditions, reducing erosion and nutrient loading to Green Lake.

A people approach

These voluntary agricultural and urban solutions are only as successful as their participants, so the LMP team is utilizing social science to build more effective conservation programs. In 2015, the GLA was awarded a \$10,000 DNR Lake Planning Grant to conduct a survey of farmers in the Green Lake area. The grant is supported by additional contributions from the GLA and GLSD.

The voluntary assessment seeks to better understand farmers' land-management decisions and ask for input on solutions that collectively benefit crops, soil health and downstream water resources.

"The best way to get conservation on the land is to work together with the farmers. Their input and knowledge guides us to find solutions that reach the same goals," Gunderson said. "In fact, knowing what they are doing or would be willing to do to conserve soil is a starting point in all our conversations."

Results of the survey will be used as the foundation of future programs and

potential incentives to increase the adoption of conservation practices in the Green Lake watershed.

Taking a wider view

Green Lake has big challenges that will require the investment of big minds. The Green Lake LMP team is reaching throughout the state, region and nation to align partnerships of unprecedented proportions.

Yet, Green Lake is not alone in its water-quality challenges. In Wisconsin, 1,437 water bodies are classified as impaired because they fail to meet optimal water-quality standards. Of those, 562 have high concentrations of phosphorus and 149 have low concentrations of dissolved oxygen.

With sufficient resources and intellectual capacity, the partners around Green Lake are embracing an opportunity to implement solutions that can become a model for lakes throughout Wisconsin and the Midwest where similar conditions exist. ❧

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Efforts such as retention ponds, stream bank restoration and grassed waterways near agricultural fields in the Green Lake watershed area help to reduce runoff into the lake.