

Lake Puckaway Management Planning Project

December 2015 Update

Submitted by: Dan Cibulka, Onterra, LLC

With the help of a Lake Management Planning Grant from the Wisconsin Department of Natural Resources (WDNR), the Lake Puckaway Protection & Rehabilitation District (LPPRD) is working to update a lake management plan for Lake Puckaway. The lake management plan will contain historic and current data from the lake as well as provide guidance for management by integrating stakeholder perceptions and goals with what is ecologically beneficial and feasible for the ecosystem. With the WDNR replacing the Princeton Dam in 2018, the plan will also examine water level management, which is to be incorporated into the new dam's operating order.

As described further below, numerous field studies were carried out upon the lake during 2015. As much data analysis is still occurring, this update intends to bring the LPPRD and other stakeholders up-to-date on the scientific studies that have occurred, provide some initial observations on the ecology of the lake and project a rough timeline for the remaining portions of this planning project.

2015 Field Studies

In April of 2015, Onterra staff had their first glimpse of the lake with a water quality sampling visit. Water quality was sampled throughout the summer of 2015, during a fall mixing period and will also be examined for under-ice conditions during February of 2016. Lake Puckaway was listed first in 2010 on the State of Wisconsin's Impaired Waters 303(d) list. The 303(d) designation is a list of waterbodies that do not meet water quality standards. In the case of Lake Puckaway, the lake is included on this list due to high total phosphorus levels and water column turbidity. Figure 1 displays the total phosphorus concentrations collected from the past five years (including data collected within this study in 2015) from the western and eastern basin of the lake.

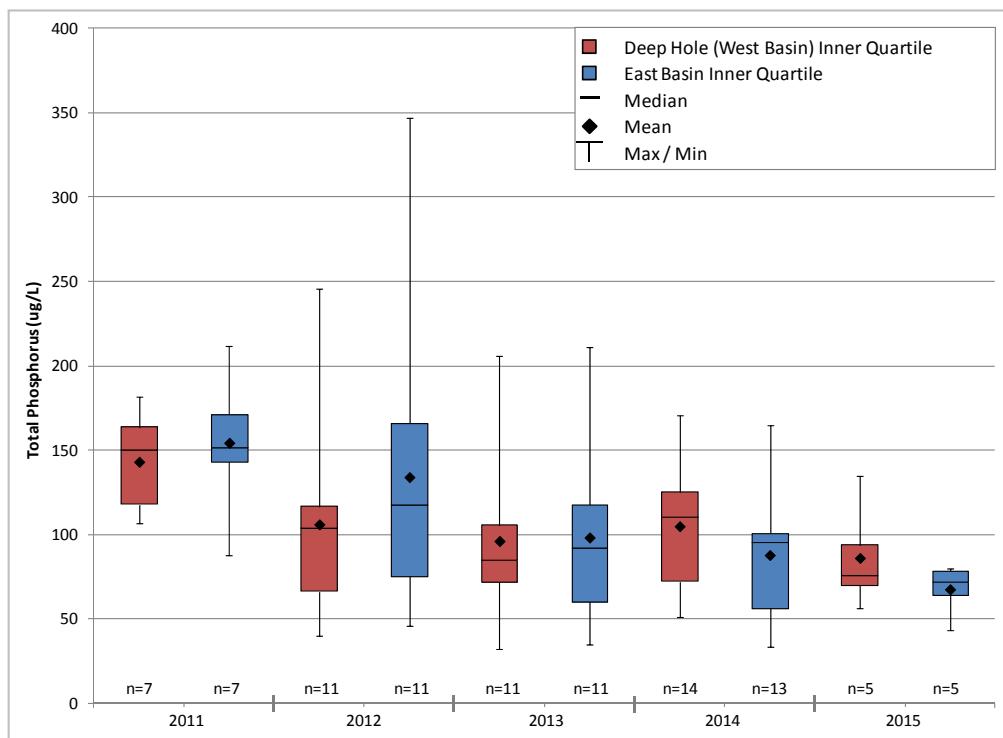


Figure 1. Total phosphorus box-plots, Lake Puckaway, 2011-2015. Data indicate concentrations from the west basin (red) and east basin (blue) from 2011-2015.

The data in Figure 1 indicate much variability in the phosphorus data set; for example, the maximum concentration in 2012 was measured at 347 ug/L in the east basin, while a minimum concentration of 32 ug/L was measured in the west basin that next year (2013). For context, the total phosphorus Recreational Use threshold that the 303(d) methodology utilizes for lakes similar to Lake Puckaway is 40 ug/L. So, it is apparent that the concentrations in the lake often exceed this threshold. Concentrations may change greatly over the course of the summer due to a number of factors, including external sources such as rainfall and river flow conditions, and internal sources such as rough fish dynamics, water chemistry flux and aquatic plant community growth. These variables and their complexity will be discussed thoroughly within the Lake Puckaway Management Plan report.

All aquatic plant surveys were conducted as scheduled, first with a visit to the lake in mid June 2015 to complete the Early Season Aquatic Invasive Species (ESAIS) survey. This survey's purpose is to search the lake for invasive species that reach their peak growth during this time (curly-leaf pondweed and pale yellow iris). On July 20-21, Onterra ecologists visited the lakes to complete the point-intercept survey. This is a grid-based survey designed to sample aquatic plants within the lake. A third aquatic plant survey, the community mapping survey, was completed that next day (July 22). The purpose of this survey is to map the floating-leaf and emergent species that are found within the lake and are typically underestimated in the point intercept survey. Finally, during an August 31 visit, Onterra staff mapped Eurasian water milfoil within the lake.

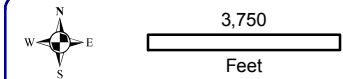
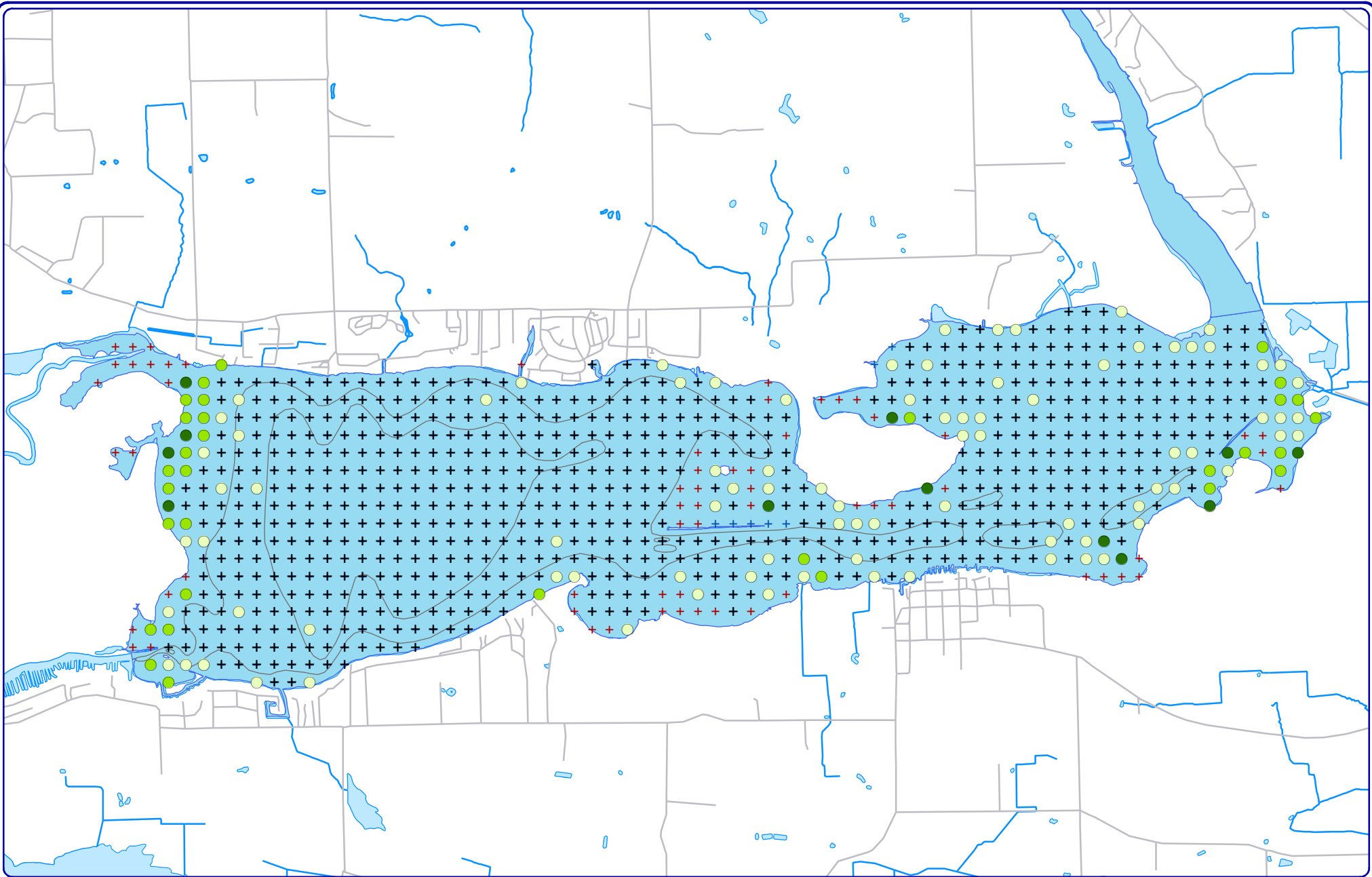
A total of 31 aquatic plants were found in Lake Puckaway, 24 during the point-intercept survey and 7 more species found incidentally. During the point-intercept survey plants were found growing to a depth of 5 ft., however the majority of submergent plant growth was between 1 and 2.5 feet of depth. Map 1 displays the location of aquatic plants amongst point-intercept sampling locations. In all, 19% of the lake's littoral zone (plant growing zone) held aquatic plants.

Remaining steps

In addition to the ecological data collected from Lake Puckaway, sociological data will be collected from the people in the LPPRD. This is currently being approached in the form of a stakeholder survey, which was developed by Onterra staff and the LPPRD Board of Directors. A postcard advertising the survey will be distributed to all property owners, with instructions to navigate to an online survey website or contact a contractor for a paper copy of the survey. Data collected through this survey will be integrated within the management plan to provide an indication of stakeholder knowledge on the lake ecosystem and concerns they have regarding the lakes management.

On December 10, 2015, the LPPRD submitted a Phase II planning grant to the WDNR to fund the remaining portions of the study. This grant would fund completion of the ecological studies, which include 2016 water quality monitoring, an in-lake wave and erosion modeling exercise and integration of fisheries data from WDNR staff. A larger portion of this grant would fund the implementation of a Lake Puckaway Communication Plan. This plan would allow for great transparency during the management planning process through sharing of information on the LPPRD website, news articles, social media updates, etc. The communication would keep all Lake Puckaway stakeholders knowledgeable about the ecological studies, project meetings, and more.

During next summer, several meetings will be held to share the results of the study with the public. Additionally, forums will be held and moderated by a professional facilitator on planning for a water level management plan, which would be incorporated following the construction of the new Princeton Dam. Stakeholder participation will be crucial to the success of the project, so please join us during these 2016 meetings and do not hesitate to ask questions.



Onterra LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Hydro and Roads: WDNR
 Bathymetry: WDNR, digitized by Onterra
 Aquatic Plant Survey: Onterra, 2015
 Map Date: December 10, 2015
 Filename: Puckaway_TRFPI.mxd



Project Location in Wisconsin

Legend

- 2015 Total Rake Fullness**
- + No Vegetation
 - ⊕ Total Rake Fullness = 1
 - Total Rake Fullness = 2
 - Total Rake Fullness = 3
 - ⊕ Too Deep
 - + Non-navigable/Temporary Obstacle

Map 1

Lake Puckaway
 Green Lake County, Wisconsin

**2015 PI Survey:
 Vegetation Distribution**