Determination of Potential Phosphorus Contribution from *Potamogeton crispus* – Lake Wapogasset and Bear Trap Lake, PolkCounty WI

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Prepared for: Lake Wapogasset/Bear Trap Sanitary District

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Introduction

Lake Wapogasset and Bear Trap Lake, Polk County WI both have a long history of eutrophication issues. Each year substantial blue-green algae blooms occur in late July through September. As a result, extensive research has been conducted about the nutrient loading of the lakes. Lake Wapogasset has two large tributaries in addition to extensive development around both lakes. Internal loading has been determined to be significant in both lakes. Since the nutrient loading is so diverse, management has been a challenge. Several years ago, an aluminum sulfate (alum) treatment was conducted. This treatment helped at first, but failed within the next year.

Since this failure, the Lake Wapogasset/Bear Trap Lake Sanitary District has been evaluating all management practices to help mitigate the substantial algae blooms. In 2008 and 2009, during the development of an aquatic plant management plan, it was determined that there is large and dense coverage of *Potamogeton crispus* (curly leaf pondweed or CLP) in both lakes. In recent years a few studies have indicated the potential for phosphorus loading from CLP. These loading amounts have been found to be as high as 20% of the summer phosphorus load[1]. Since Bear Trap Lake and Lake Wapogasset have such dense coverage, it was determined that the phosphorus contribution of CLP should be measured.

Methods

The CLP beds were mapped in 2009. This map was used to determine the location and area of any bed of CLP that had a mean density greater than "2" (based upon the Wisconsin DNR plant survey protocol) and with the CLP plant apex at or near the water surface. For this study, one sample point was made within the middle portion of each of these beds. A total of 39 tissue samples (one from each bed) were analyzed for % dry mass and total phosphorus.

The sampling procedure involved the use of a double tined "thatch" rake. The rake was lowered and spun by the handle 3 times to insure all plant material was collected and that the same area was sampled in each location. All plants were removed from the rake and only CLP was retained. The CLP plants were rinsed, cleaned (to remove encrustation on plants[2]) and spun for one minute in a salad spinner. This was to remove extraneous water. The plant material was then weighed and recorded. A sub-sample was then taken, bagged and then sent to the University of Wisconsin forage analysis laboratory in Marshfield Wisconsin. Here the dry weight mass was determined as well as the phosphorus content of the plant tissue.

Using the dry mass and phosphorus content, the amount of dry biomass of CLP was calculated and the total amount of phosphorus in the CLP of the entire lake was determined.

Results

[1] James, W.F., J.W. Barko, H.L. Eakin, and P.W. Sorge. 2002. Phosphorus budget and management strategies for an urban Wisconsin lake. Lake and Reserv. Manage. 18(2): 149-163

[2] Craig Roesler from Wisconsin DNR stated in a review of CLP nutrient loading that encrustation may cause a wide variation of phosphorus values in CLP plants.

The mapping of CLP in 2009 showed approximately 78 acres of dense CLP coverage in Lake Wapogasset and Bear Trap Lake combined. Figure 1 shows that map.

Figure 1: Lake Wapogasset CLP beds-mapped 2009 and Sample Sites for nutrient analysis (*).

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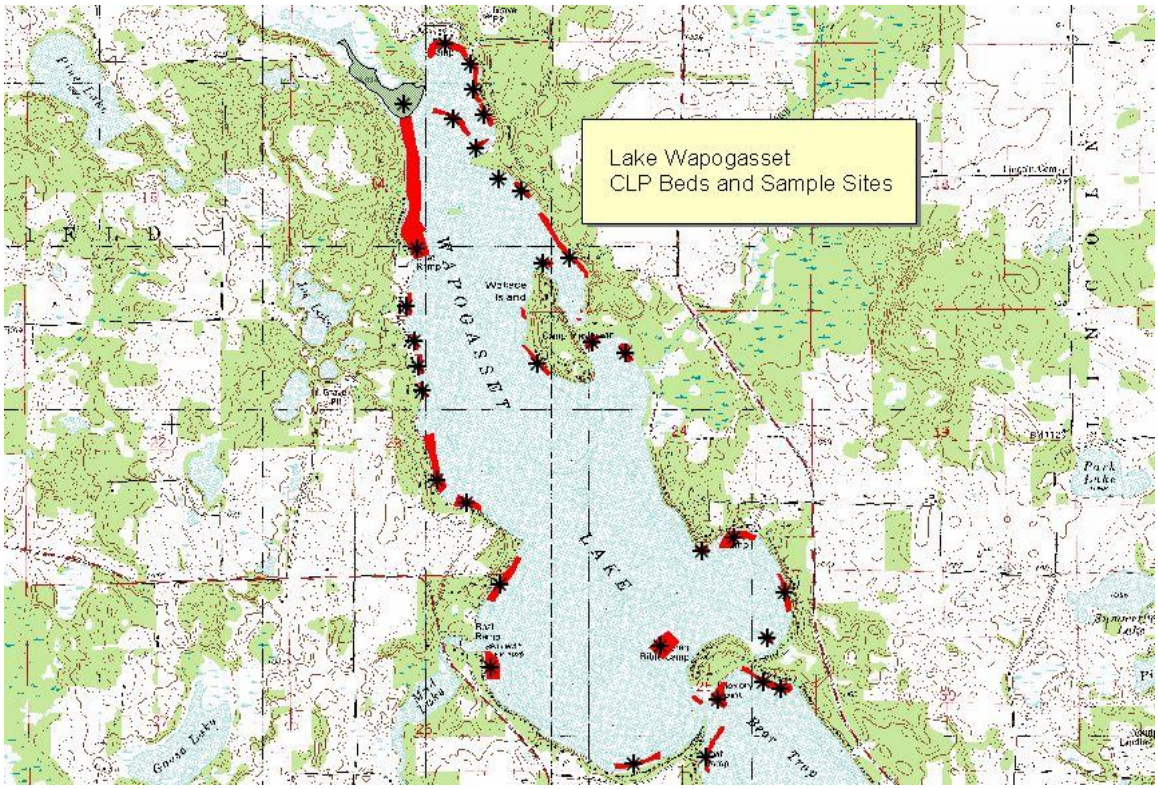
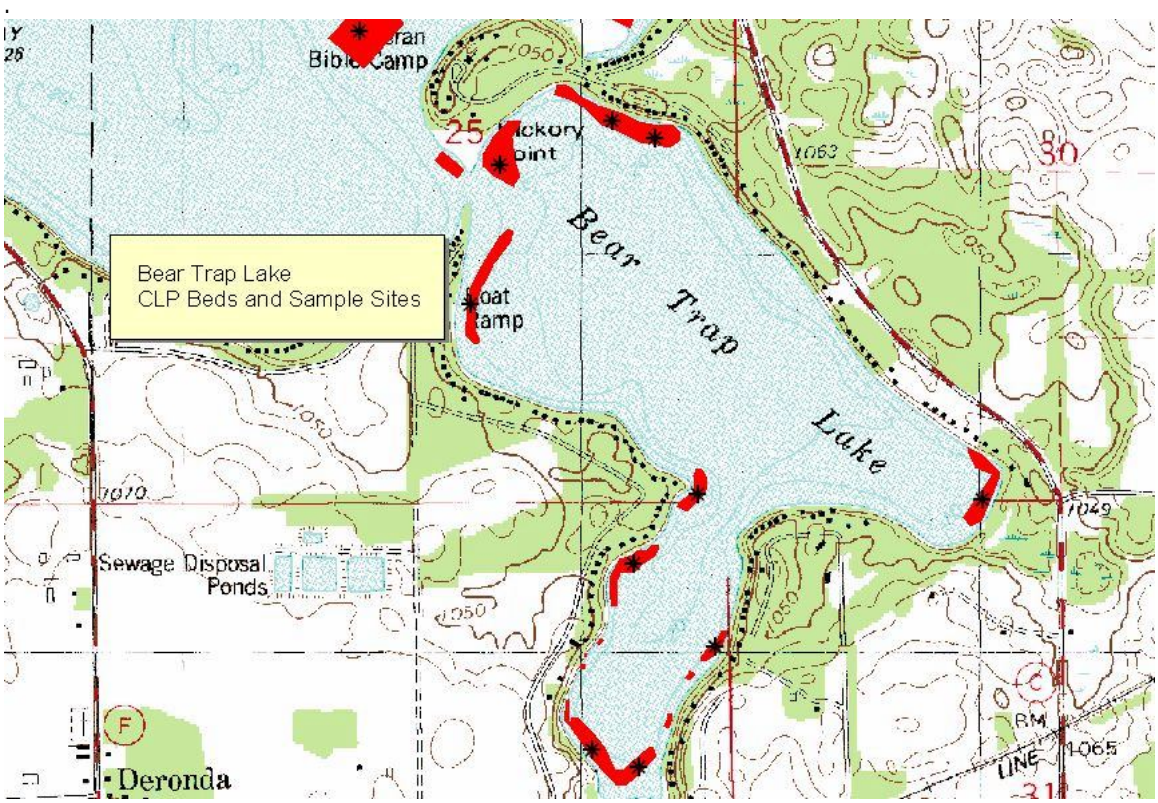


Figure 2: Bear Trap Lake and South Lake Wapogasset CLP beds-mapped 2009 (•).



It should be mentioned that the coverage in 2010 was less extensive than is 2009, but all beds were present and sampled. The beds were not remapped in 2010.

Table 1 shows the summary of the CLP mass and phosphorus values from the laboratory analysis from all 54 samples.

Table 1: CLP sample data from Lake Wapogasset and Bear Trap Lake

Analysis	Lake Wapogasset	Bear Trap Lake
Mean % dry mass	9.07%	8.89%
Mean Tissue phosphorus	3.3 mg P/g of CLP tissue	3.3 mg P/g of CLP tissue
Mean wet biomass of CLP	194.02 g CLP tissue/sample	174.65 g CLP tissue/sample
Mean dry biomass of CLP	17.6 g dry CLP tissue/sample	15.53 g dry CLP tissue/sample

Table 2 shows the whole lake calculations based upon the tissue analysis and the 2009 coverage map.

Table 2: CLP phosphorus load separated by lake

Values	Lake Wapogasset	Bear Trap Lake
Area of CLP (m2)	225158	47882
Mean g of P/m^2	0.57	0.51
Kg of P from CLP	128.34	24.42
% total P budget	4.60%	5.70%

Summary

According to the results of the CLP phosphorus loading, the contribution in Lake Wapogasset is 4.6%. In Bear Trap Lake it is 5.7%. This makes up a fairly significant portion of the total phosphorus loading for Bear Trap Lake especially.[3] This is assuming that all of the phosphorus that is contained in the CLP tissue, is released into the water column. This may not be a safe assumption, as the senescence of CLP may not be completed until much later in the summer. Also, the sediment could possibly absorb some of the phosphorus released as the plant sinks to the bottom. Since a lake nutrient system is so dynamic, there is really no way to know how much of this P is available for algae uptake[4]. However, this same scenario applies to other phosphorus sources so a comparison to the total load needs to be used to determine the potential significance of the CLP phosphorus load.

[3] Based on a comparison to the most recent nutrient loading amounts (2008).

[4] In a study conducted in Bone Lake in 2010, it was found only 21.3% of the phosphorus available in the CLP tissue was released into the water column and available for uptake.