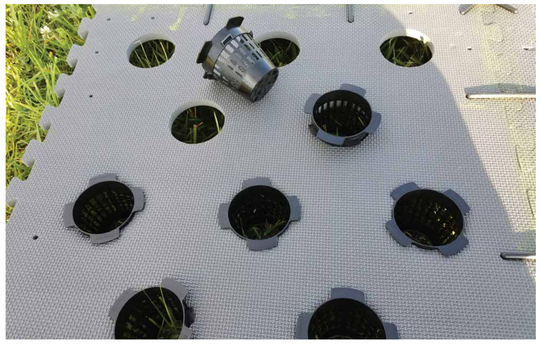
Floating Treatment Wetlands to Reduce Nutrient Load in an Algae Covered Pond

Levi McKercher
University of Nebraska,
Lincoln, NE

Tiffany Messer
University of Kentucky,
Lexington, KY

Steven Comfort
University of Nebraska,
Lincoln, NE

Phillip B. Liescheski
Teledyne ISCO,
Lincoln, NE



On the morning of June 23, 2020, a group of volunteer students from University of Nebraska met at the Densmore pond in front of the Cooper YMCA in Lincoln, NE. They assembled and launched a floating wetland island of flowers native to Nebraska. The pond, being in the city, suffers from a high load of nutrients, like Nitrogen and Phosphorus. It is overgrown with a thick layer of algae. It is hoped that this floating garden will reduce the nutrient load and control the growth of algae in the pond.

Ponds and lakes in the Midwestern United States are vulnerable to eutrophic conditions from high nutrient concentrations. The high nutrient content stimulates the overgrowth of algae which may deplete the dissolved oxygen content of the pond water, thus leading to foul odors, impaired visual aesthetic, and fish kills. Floating treatment wetlands (FTWs) are an innovative wetland design for nutrient removal from nonpoint sources and provide a unique in-situ treatment system. The premise of the design is to place wetland plants on a floating mat in nutrient sensitive ponds/lakes. During the summer of 2020, the first floating treatment wetland in Nebraska was installed at a small pond (~1 acre) in Lincoln. The objectives of this project are to determine the appropriate size of a full-scale floating treatment wetland coupled with lanthanum applications for nitrate-N and phosphate-P removal during the establishment year. The floating treatment wetland comprised approximately 5% of the pond surface area. Nutrient concentrations are currently being assessed at various locations around the lake and wetland to assess nutrient differences based on proximately to the floating treatment wetland compared to influent concentrations collected using a Teledyne ISCO 6712 sampler. This study will provide new insight for identifying nutrient removal potential and sizing recommendations for full-scale floating treatment wetlands containing plant species native to the Midwest. Findings from this study will aide in retrofitting floating treatment wetlands based on internal and incoming nutrient loading and proximity to the wetland.

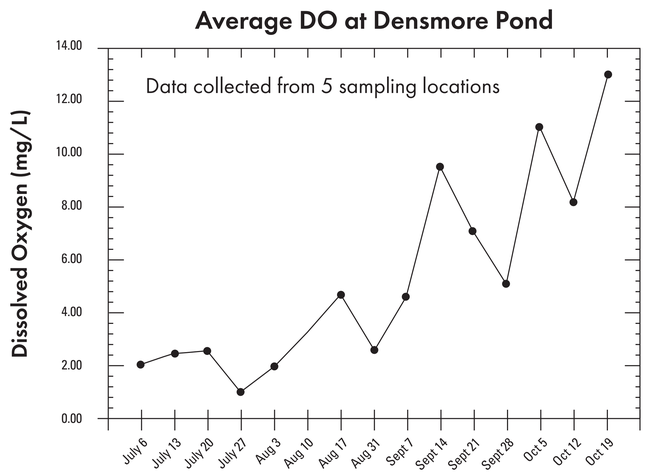
The floating infrastructure material is obtained from Beemats Floating Wetlands: www.beemats.com. One hundred Beemats are used with 1,000 biodegradable cups to hold the vegetation. The Beemats are puzzle cut mats held together by nylon connectors and Armacell adhesive for reinforcement. The vegetation is obtained from the Nebraska State Arboretum. They include: Softstem Bulrush, Swamp Milkweed, Obedient Plant, Joe-Pye Plant, Southern Blue Flag Iris, Monkey Flower and New England Aster, to name only a few. A thousand individual plants are grown in total.

Year 1–Nutrient Uptake Performance by Floating Treatment Wetland

Sum of N uptake by FTW (g)	Sum of P uptake by FTW (g)	Sum of K uptake by FTW (g)
184.631	9.765	160.514

This table shows the amount of nitrogen, phosphorus, and potassium removed from the Densmore pond via FTW plant uptake during the first four months of treatment. Another nitrogen removal pathway provided by FTWs is denitrification, which is where nitrate in the water column is converted to dissolved elemental nitrogen gas that leaves the waterbody via volatilization.

As this figure shows, the average dissolved oxygen concentration within the Densmore Pond increased throughout the growing season after the treatment was initiated.



The following images display the Densmore Pond on 5 July 2020 (above), two weeks into the treatment period, and 14 September 2020 (below), twelve weeks into the treatment period. A significant reduction of algal coverage occurred over the 10-week period.