Meadow Lake Aquatic Vegetation Assessment Report

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I. PURPOSE

Management of aquatic vegetation and algae is a common practice in lakes, streams and reservoirs and are often conducted to address impacts to navigation and recreational uses from an overabundance of aquatic vegetation. Excessive aquatic plant growth interferes with nearly all forms of recreation and causes many biological problems. For example, thick canopies of plants at the water surface impede exchange of gases between the air and water, thereby contributing to nighttime dissolved oxygen depletion and large daily pH fluctuations. Dense growths can also cause desirable plants to decline and can eliminate quality spawning and nursery habitats for fish and other aquatic species. For example, production of desirable sport fish (e.g., largemouth bass) is maximized at intermediate levels of plant cover and biomass.

Meadow Lake is an 18 acre spring fed private lake located in Bloomfield Township, MI. It has an average depth of 4.1 feet and a maximum depth of 21 feet. Surrounding the lake are lakefront homes that are part of the Meadowlake Farms Civic Association. Owned by the association is a one acre island located in the north section of the lake and is used for a wide variety of social and recreational functions. In recent years, vegetation growth, especially of invasive species, has overtaken the lake and reduced the aesthetic and recreational quality of the lake. In an effort to improve the aforementioned quality potentials of the lake, the Meadow Lake Improvement Board enlisted the services of ECT scientists to assess the vegetation growth occurring in Meadow Lake and to provide management recommendations to control the over-growth of invasive plants.

II. METHODS

Before sampling was conducted, Meadow Lake was divided into standardized sampling units called Aquatic Recorded Observation Sites (AROS). These observational units of equal area allow for standardized quantification of the lake for known parameters. Typically the AROSs are geo-referenced to aid in accurate data collection in the field. To ensure adequate sampling of the entire water body, AROS units typically cover the

shoreline as well as areas leading out from the shore towards deeper water, in an effort to characterize how plant communities change based on substrate, depth, wave action, and other variables that govern plant growth in an aquatic system. Meadow Lake was separated into 92 AROS units.

Two site visits took place on Meadow Lake to assess the aquatic vegetation community – one in the summer of 2013 and one in the summer of 2014. On both visits, ECT scientists conducted visual surveys from a boat and noted the observed density, coverage, and species of aquatic vascular plants within each AROS. Surveys included both visual observations through the water column or on the surface, as well as employing the use of a sampling rake to drag along the bottom and uproot obstructed or hidden vegetation. Observations were recorded on a field spreadsheet. For densitiy observations, each species present was assigned a qualifier of A through D based on observed density within the AROS, A being sparse and D being dense. Both site visits occurred late in the summer after aquatic herbicide applications had been implemented by the Meadowlake Farms Civic Association.

III. RESULTS

A total of 16 different aquatic plant species were identified during the site (Table 1). The number of species present within each AROS unit ranged from 1-9, with white waterlilly and starry stonewort being the most frequently observed species. Starry stonewort and chara were dense throughout many sections of the lake (Figure 1), however; some instances contained isolated patches rather than large beds of the plant. Other common plants identified in smaller abundances included whorled watermilfoil, thin leaf pondweed, and sago pondweed. Despite this, many of these species occurred in isolated sections of the lake and were not widely distributed. For instance, thin leaf pondweed and whorled milfoil were found only in the southern and southwestern sections of the lake.

Most of the aquatic vegetation observed was located along the AROS units that followed the shoreline. However, white water lily and starry stonewort were abundant in the

offshore units almost exclusively. Additionally, there were many instances where free-floating fragments of vegetation were observed on the lake bottom. This is likely an indication of plant death caused by aquatic herbicide applications.

Table 1.

List of aquatic vascular plant species observed during site visits to Meadow Lake, Bloomfield Township, Oakland County, MI in 2012 and 2013.

Common Name	Scientific Name
Curly leaf pondweed	*Potamogeton crispus*
Chara	*Chara spp.*
Thin leaf pondweed	*Potamogeton pusillus*
Flat stem pondweed	*Potamogeton zosteriformis*
Native milfoil	*Myriophyllum spp.*
Whorled watermilfoil	*Myriophyllum verticillatum*
Various leaf watermilfoil	*Myriophyllum spp.*
Coontail	*Ceratophyllum demersum*
Sago pondweed	*Stuckenia pectinata*
Starry stonewort	*Nitellopsis obtusa*
White water lily	*Nymphaea odorata*
Yellow water lily	*Nuphar lutea*
Small duckweed	*Lemna valdiviana*
Cattail	*Typha spp.*
Iris	*Iris spp.*
Purple loosestrife	*Lythrum salicaria*

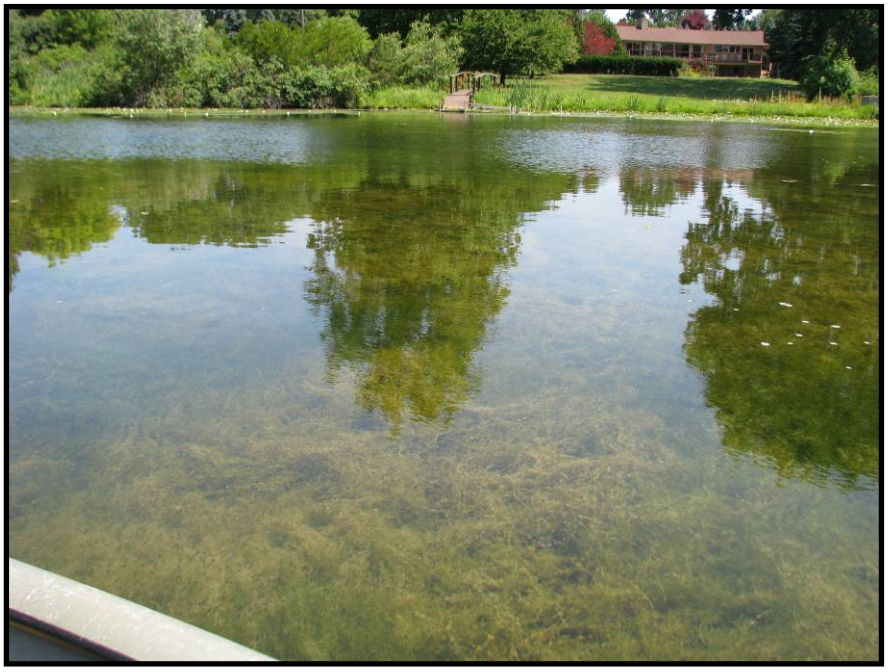

Figure 1.
Typical starry stonewort beds that were prevalent in many areas of Meadow Lake during sampling surveys.

Figure 2.
Extensive starry stonewort and charophyte growth occurring in Meadow Lake during sampling surveys.

IV. CONCLUSIONS & RECOMMENDATIONS

Current aquatic herbicide applications are controlling aquatic macrophyte abundance in Meadow Lake. However, it may be too frequent or too high of chemical concentrations are being used. This professional opinion is based on the low density and distribution of desirable native aquatic macrophytes. The current low density of desirable native aquatic macrophytes reduce habitat quality and limits fish and wildlife production.

Current aquatic herbicide applications are not effectively chara and starry stonewort. Chara and starry stonewort are still widely prevalent within many sections of the lake, covering extensive areas of the lake bottom. Chara is a common algal form in groundwater fed lakes that typically covers extensive bottom areas in such systems due to its use of minerals present at high concentrations in the water of groundwater fed lakes. Stonewort, on the other hand, is not native to Michigan lakes and has become a more common aquatic vegetation management problem. With continued growth of starry stonewort, the plant can become widespread and fill the entire water column of the lake at times. This creates major problems by destroying fish habitat (spawning, nursery, and cover) and desirable native aquatic macrophytes. It also creates low dissolved oxygen that can cause fish kills.

Before future management plans should be implemented, ECT recommends the management board consider the properties of Meadow Lake's watershed dynamics. While the lake does appear to receive groundwater, a vast majority of the water inflow comes from urban and municipal sources (for example, sewer overflow into upstream water bodies and surface runoff that flows directly into the lake) at certain times of the year. This surface water source contains very high nutrients loads (i.e., mass of phosphorous and nitrogen) which promotes high growth rates for aquatic vegetation and algae. Because these nutrient loads enter the lake during wet weather events, the nutrients accumulate in the sediments and build up over time, further complicating effective vegetation management (e.g., the use of herbicides). This poses a major challenge when attempting to effectively manage overgrown aquatic vegetation. The

source of nutrients into the lake should be addressed before other lake improvement activities are implemented.

Based on ECT's observations and the conclusions drawn above, ECT recommends three further courses of action:

1) The lake management board should reduce treatment for submerged vascular aquatic vegetation to twice per year, in order to promote growth of desirable vegetation while maintaining a favorable density. The treatments should be conducted in early June and again in mid August, and should be focused rather than broadly applied. The plants that should be targeted include Eurasian watermilfoil, curly leaf pondweed, and specific areas of concern to residents (e.g., dense growth around docks that impede boating access). If possible some near-shore areas should not be treated to allow desirable native macrophytes to colonize, thereby providing isolated areas of optimal fish and wildlife habitat.
2) Because the current treatment practices seem to ineffectively control starry stonewort, ECT recommends the management board hire an independent firm to test the effectiveness of the copper sulfate ($CuSO_4$) treatment on starry stonewort within Meadow Lake and recommend other potential treatment approaches.
3) Finally, ECT recommends whole-lake restoration. Nutrients stored within the soil from long-term buildup may reduce the effectiveness of vegetation management attempts. Furthermore, it may now be impossible to effectively manage starry stonewort given its extensive colonization of the lake. Whole-lake restoration should include dewatering of the lake, mechanical dredging and grading to remove the high-nutrient sediments, shaping of the lake bottom to improve habitat, and disposal of dredged sediment. Following dredging, habitat structures should be installed at sites within the lake that would provide spawning, nursery, cover, and feeding sites. Habitat structures could include, but are not limited to, gravel/sand substrate, woody debris (i.e. logs), vegetation, and variable lake contours (e.g., shelfs/flats, dropoffs, etc.).