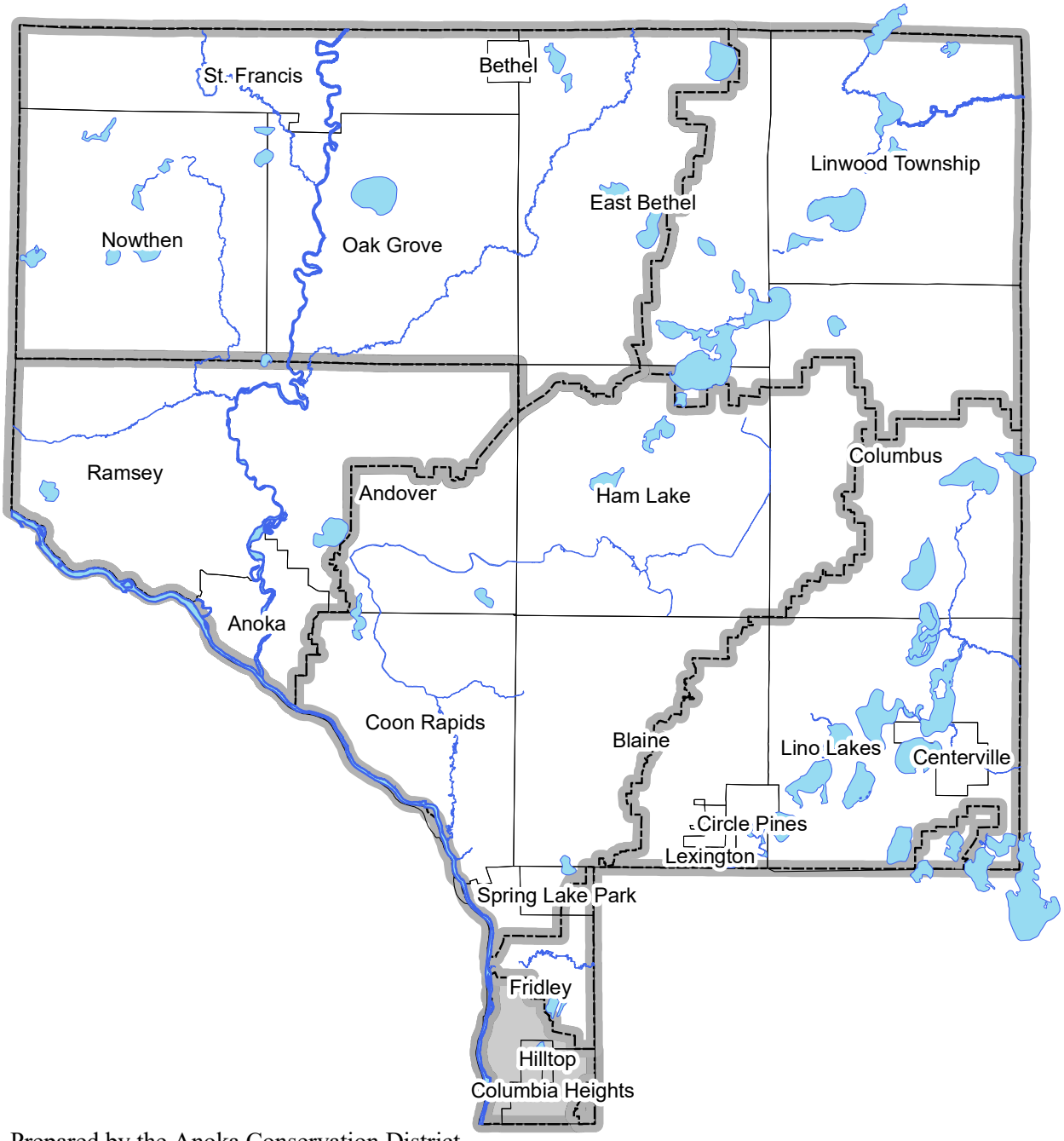
Excerpt from the 2023 Anoka Water Almanac

CHAPTER 7: MISSISSIPPI WATERSHED



Prepared by the Anoka Conservation District

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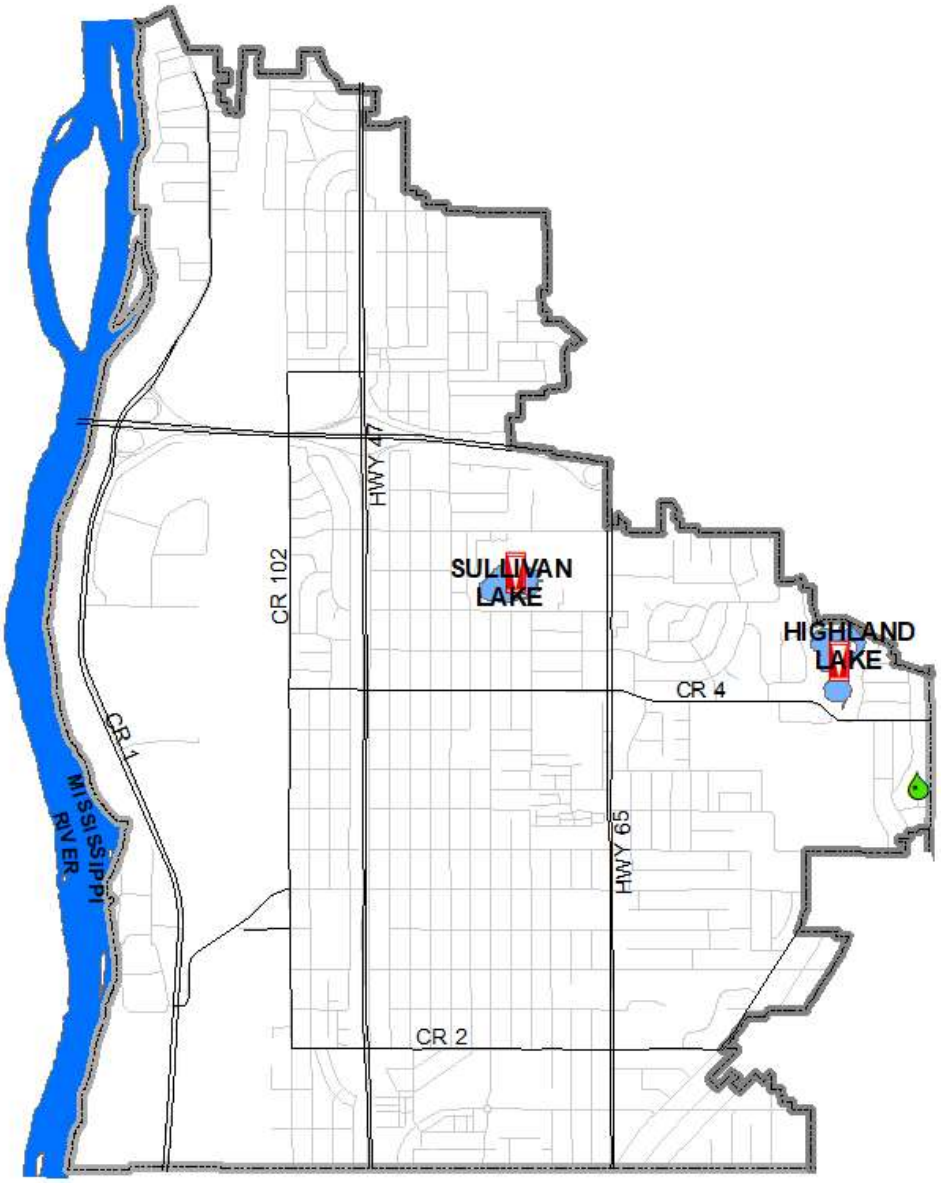
RECOMMENDATIONS

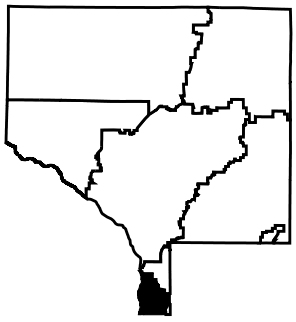
- Continue to monitor water levels on Highland and Sullivan Lakes annually.
- Continue to monitor water quality on Highland and Sullivan Lakes every third year.
- Implement practices identified in Subwatershed Retrofit Assessment reports previously prepared identify and rank water quality improvement projects. Completed reports include Southern Columbia Heights and Northeast Minneapolis Stormwater Retrofit Analysis (2014) and Highland and Sullivan Lakes Stormwater Retrofit Analysis (2019).

WATER MONITORING SITES: MISSISSIPPI WATERSHED



2023 Monitoring Sites

- Lake Levels
- Anoka County Weather



LAKE LEVELS

Partners: MWMO, ACD, MN DNR, volunteers

Description: Water level monitoring in lakes. Current year's, as well as historical data is available on the Minnesota DNR website using the "LakeFinder" feature (www.dnr.mn.us.state\lakefind\index.html). Ordinary High Water Levels (OHW) are listed for each lake on the graph below. Any work performed below this elevation requires a DNR permit.

Purpose: To provide understanding of lake hydrology, including the impact of climate and water budget changes. These data sets are useful for regulatory, building/development, and lake management decisions.

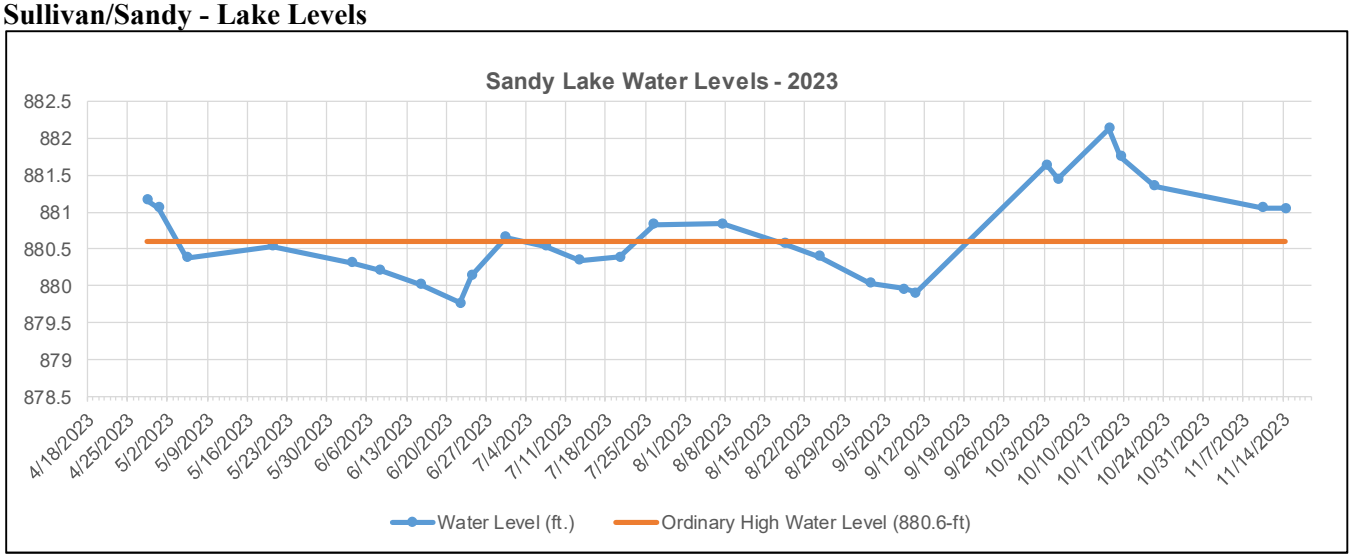
Locations: Sullivan/Sandy Lake, Highland Lake

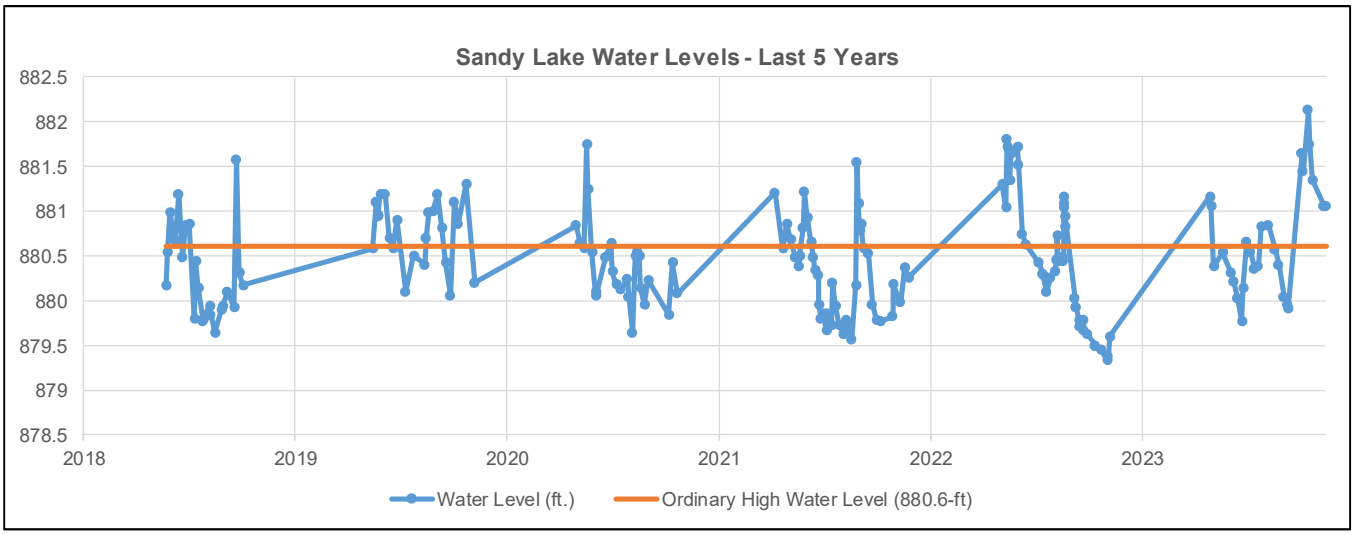
Results: **Sullivan/Sandy.** In 2023, Sullivan water levels ranged 2.36 feet. It largely stayed within water levels commonly observed in most years, despite summer 2023 drought. However, in mid-October the water level briefly rose to its highest level ever observed since records began in 1992. Water levels on Sullivan Lake typically fluctuate rapidly, bouncing by half a foot in response to individual rainfall events. This is due to the volume of stormwater directed to the lake compared to the small basin size.

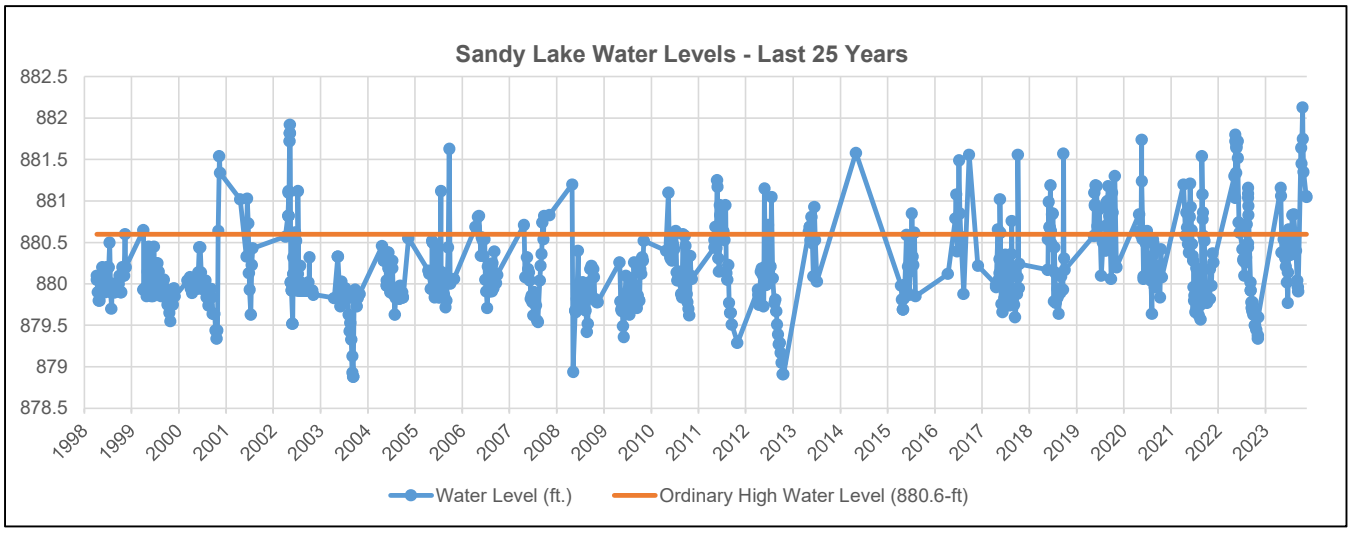
Highland. Water levels in Highland Lake fluctuated 0.51 feet during 2023. Water levels were within the range observed in many years, but also had some readings on the lower end of that range due to drought.

Highland and Sullivan Lake each have controlled outlet structures in place which help manage water levels and help control how high water elevations can reach in order to prevent flooding.

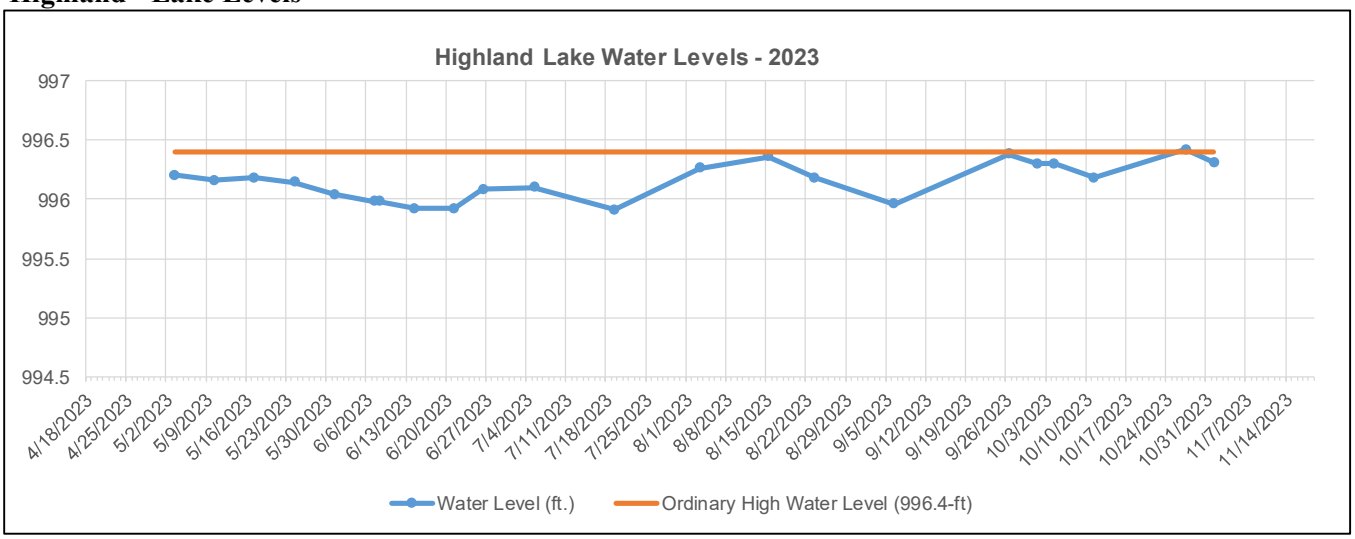
Sullivan/Sandy - Lake Levels

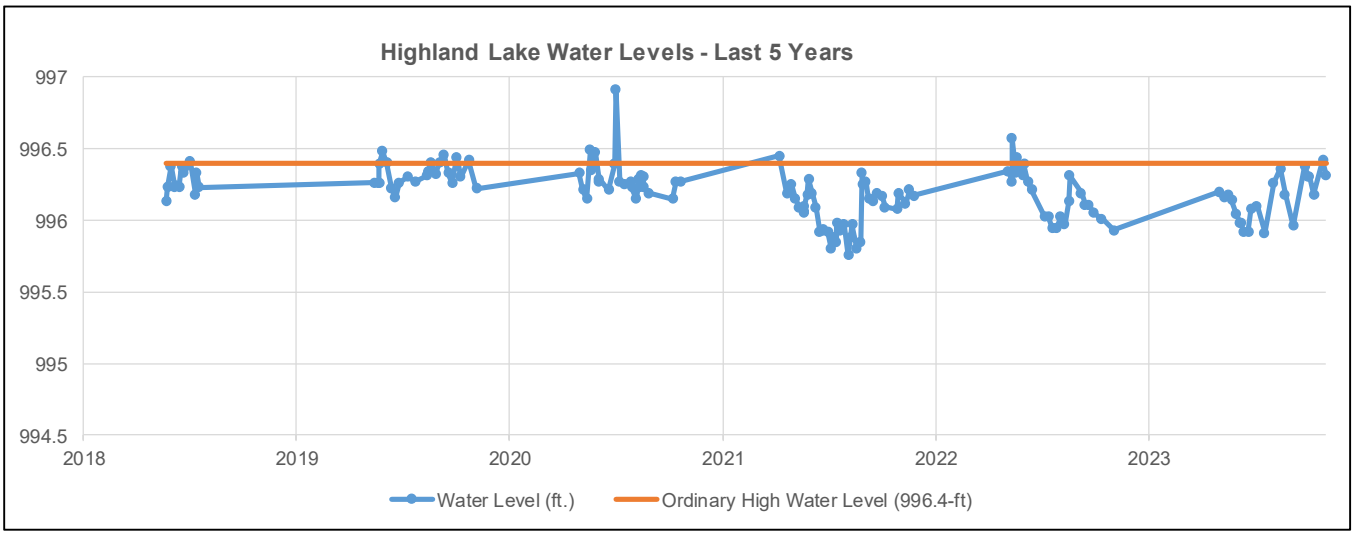


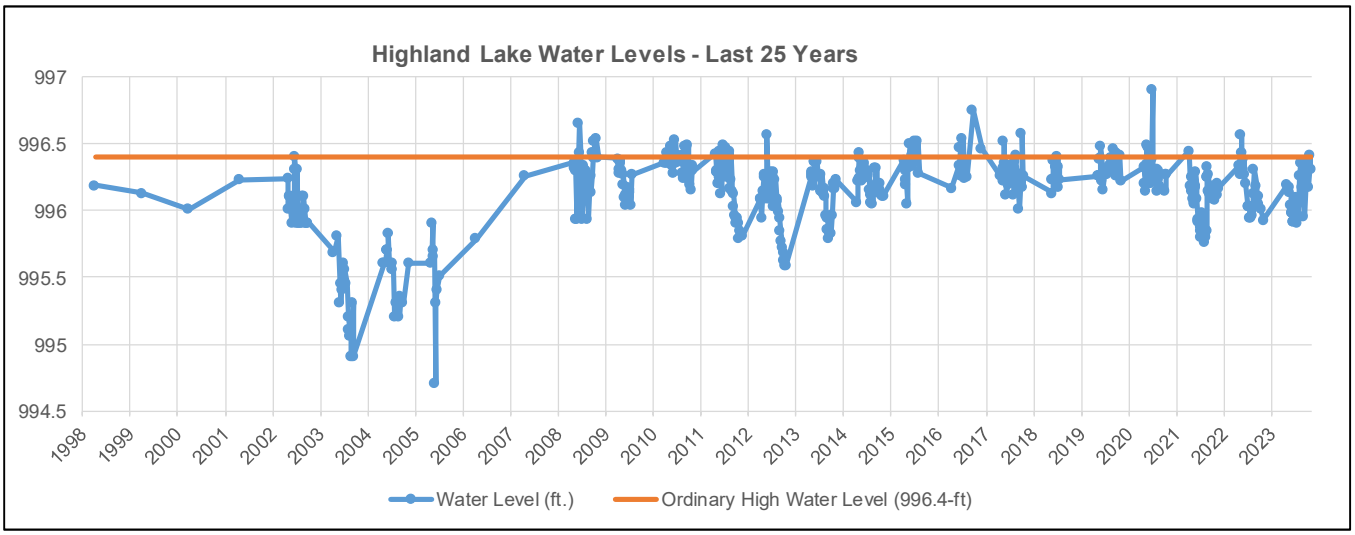




Highland - Lake Levels







HIGHLAND LAKE AQUATIC VEGETATION REPORT

Lake Survey Information

Lake: Highland (DOW #02007900)

Lake Surface Area: 14.6 acres

Waterbody Type: Shallow Lake/ Open - Water Wetland; Natural

City: Columbia Heights

Date of Survey: June 27, 2023

Observers: Breanna Keith (Anoka SWCD); Matt Udermann (Anoka SWCD)

Author[s]: Vegetation survey and corresponding report prepared by ACD at the request of Anoka County Parks. For questions, contact Breanna Keith at Breanna.keith@anokaswcd.org or Quinn Palar at Quinn.Palar@co.anoka.mn.us

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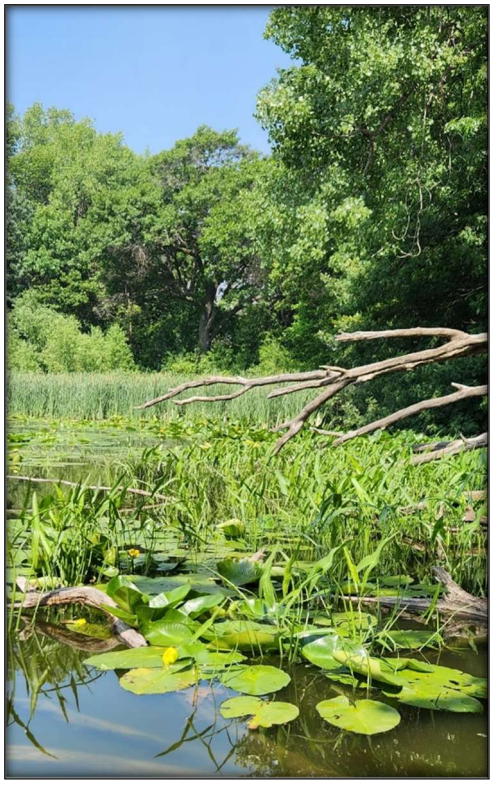
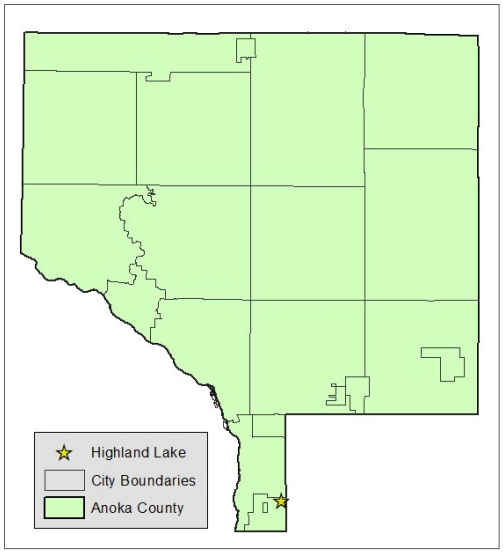
Summary



Anoka County Parks contracted ACD to complete an aquatic vegetation survey for Highland Lake in Columbia Heights, MN to identify the abundance and species composition of submersed, floating, and emergent plants. The survey revealed that this lake is heavily dominated by the native water lily *Nuphar variegata*, which shades out much of the lakebed and restricts the growth of submersed vegetation. In the open, lily-free water that is present, *Chara* (a genus of macroalgae), *Potamogeton crispus* (curly-leaf pondweed; an invasive submersed plant), and five native submersed plants (including an uncommon pondweed species) were detected; all occur in generally low densities and at depths shallower than 2.5 feet. Cattails and Broad-leaf Arrowhead are the dominant emergent plants present, both of which occur intermittently in patches along the lake's margins. This report details these findings and discusses the role aquatic vegetation plays in shallow lake and wetland systems.

Background



Highland Lake is a small, shallow lake embedded in an urban watershed and bordered by a popular park and trail system in Columbia Heights, MN (*Figure 1*). It contains a soft and silty bottom, turbid water, and dense floating vegetation covering the majority of the water's surface. Stormwater runoff generated within the lake's 140-acre drainage area is conveyed to outfalls along the shoreline via storm sewer networks. Highland Lake is listed by the MPCA as impaired for both aquatic recreation and nutrients, with total phosphorus concentrations averaging 2-4 times the state standard for shallow lakes (60 g/L). Recreation on the lake is minimal because it is not suitable for swimming and lacks a formal public boat launch.

Local residents and park-goers have expressed concern about the abundance of dense vegetation (primarily floating lily pads) present in Highland Lake. It is natural for shallow lakes and wetlands to contain many aquatic plants (submersed, floating, and/or emergent) due to the nutrient and sunlight- rich conditions produced by shallow water. Even so, vegetation management may be warranted in some situations, such as when abundant invasive plants are negatively impacting the ecosystem.

Note on Seasonal Conditions

In the month leading up to this vegetation survey, all of Anoka County was experiencing moderate drought conditions and temperatures well above average for June. Prior to that, the region experienced heavy spring flooding following a winter of record-breaking snowfall. These abnormal conditions may have impacted the aquatic plant community in Highland Lake. However, water levels and lily pad abundance at the time of this survey were similar to those observed in previous years.

Survey Design

A point-intercept survey comprised of equally-spaced survey points (~two points per acre) was originally developed for Highland Lake using Geographic Information Systems (GIS). However, very dense lily pad coverage hindered the ability to navigate to all points. This survey structure also produced gaps in sampling coverage across the limited lily-free spaces where submersed vegetation is able to grow. So, field staff collected aquatic plant data from as many of the point-intercept survey points as possible, and then collected data from additional points as needed to capture the submersed plant community in areas with reduced lily coverage. Altogether, submerged and floating plant data was collected from a total of 28 survey points (see Appendices for all survey maps).

Data Collection

A canoe was used to navigate to survey points. Submersed vegetation samples were collected by throwing and dragging a double-sided rake for approximately 1.5 meters along the lakebed. Live plants on the rake were identified to the species level and assigned a total biomass ranking based on rake fullness (a scale of zero [no plants] to three [plants covering greater than 75% of the rake]). Floating-leaf plants were also assessed at each survey point by placing a square 1-meter quadrat on the starboard side of the canoe's bow, identifying species present within it, and assigning a biomass ranking based on floating- leaf coverage within the quadrat (a scale of zero [no plants] to three [floating leaves covering greater than 75% of the water's surface]). Emergent vegetation was assessed by documenting the location of emergent stands and identifying plants that were accessible along the outer edges. Water depth was measured at each point to the nearest ½ ft., and three secchi depth readings were taken: one each in the northern, central, and southern parts of the lake

Findings

Water Clarity and Depth

Table 1 provides a summary of water depth data collected across survey points. REMINDER: Vegetation sampling efforts, and therefore depth readings, were skewed towards water lily-free areas where submersed vegetation was present. Comprehensive lake-wide depth metrics may differ.

Table 1. Depth data collected across vegetation survey

Measurement	Value
Maximum Depth	3.5 ft.
Average Depth	2 ft.
Maximum Depth Submersed Vegetation Observed	2.5 ft.
Maximum Depth Floating Vegetation Observed	3 ft.

Secchi depth measurements ranged from 1.2 – 1.6 feet, with clarity decreasing slightly from north to south. The lake bottom is very silty, and these fine sediments quickly disperse into the water column when disturbed.

Floating Vegetation

The native water lily *Nuphar variegata* (commonly known as Bullhead or Variegated Yellow Pond Lily) is the dominant aquatic plant in Highland Lake, and the only rooted floating species detected in this survey. Its floating leaves occupy approximately 85% of the lake's surface, typically growing so densely that they overlap or even rise above each other (*Figure 2*), shading out the water underneath entirely. *Nuphar variegata* is common in Minnesota and grows in quiet shallow waters with mucky bottoms. Water lilies spread through rhizomes underneath the sediment and are often abundant in nutrient-rich ponds and lakes with shallow water throughout. Common duckweed (*Lemna minor*), a free-floating plant, was also detected in Highland Lake but generally in low quantities amongst the stands of emergent vegetation. See Appendix A for a map of floating vegetation prevalence and abundance.

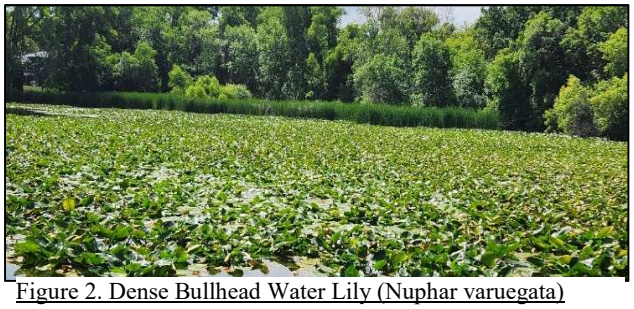


Figure 2. Dense Bullhead Water Lily (Nuphar varuegata) growth in Highland Lake.

Submersed Vegetation

Prevalence

Overall, there is a low abundance of submersed vegetation on Highland Lake. This is likely due to two primary factors: turbid (cloudy) water conditions and the widespread coverage of dense lily pads, each of which reduce sunlight reaching the lakebed and restrict the growth of submersed plants. Submersed plants were not detected at any points containing a floating vegetation biomass rating of 3, or at water depths exceeding 2.5 feet. They are most prevalent in the shallow, lily-free patches of water around the edges of the lake and its islands.

Biomass

Submersed vegetation density was low (biomass rating = 1) at 70% of the points where submersed plants were detected. Samples at these locations often consisted of only one to a few strands of vegetation retrieved by the rake, and were common in areas with some lily pad coverage (floating biomass rating = 1 or 2). The densest patches of submersed vegetation are most common along the lake's northwestern shoreline and near its islands. The narrow-leaf pondweed *Potamogeton vaseyi* generally occurred in the highest densities relative to other species detected (*Figure 3*). See Appendix B for a map of submersed vegetation abundance.

Species

Five submersed plant species and one macro algae were detected in Highland Lake. Species richness is generally low throughout the lake, with most survey locations containing 1-2 different species. See Table 2 for a breakdown of each species' prevalence and Appendix C for a map of species richness across survey points. Three pondweed species (Curly-leaf, Sago, and Vasey's) were often found growing alongside each other. Slender Naiad was detected alongside Characeae, and Spiny Hornwort was most common underneath light lily pad coverage. Notable finds are described below.

Table 2. Species prevalence across points where submersed vegetation was detected (20/28 total survey points)

Species	**% Occurrence Across Points with Submersed Vegetation Detected**
Potamogeton vaseyi (Vasey's Pondweed)	60%
Stuckenia pectinata (Sago Pondweed)	55%
Potamogeton crispus (Curly-leaf Pondwed)	25%
Najas flexilis (Slender Naiad)	10%
Ceratophyllum echinatum (Spiny Hornwort)	20%
Family Characeae (a macro algae; commonly called muskgrass or stonewort)	15%

Curly-leaf Pondweed (*Potamogeton crispus*): This is a prohibited invasive species in Minnesota which often grows in dense mats and outcompetes native aquatic vegetation *(Figure 2).* It was detected along Highland Lake's northern and western shorelines (Appendix D), but is present at low densities and often growing alongside Vasey's Pondweed. Curly-leaf pondweed growth was reduced in many metro area lakes this year due to heavy snow cover and late ice-off, so its growth in Highland Lake may typically be more abundant.

Vasey's Pondweed (*Potamogeton vaseyi*):

This is a narrow-leaf pondweed species which does not have existing herbarium or MNDNR survey records for Anoka County and is otherwise uncommon in the Twin Cities Metro Area. It was the most common submersed plant found in Highland Lake, occasionally growing in dense clusters (*Figure 3*). The leaves of Vasey's Pondweed are very fragile and thus susceptible to disturbance from boats or wave action; this may be one reason that it's able to persist in Highland Lake. Identification was confirmed with staff from the MN Biological Survey.

P. crispus (left) and dense P. vaseyi growth (right) detected in Highland Lake

Emergent Vegetation

Figure 1. Emergent plants Sagittaria latifolia (left) and Typha spp. (right) observed in highland lake.

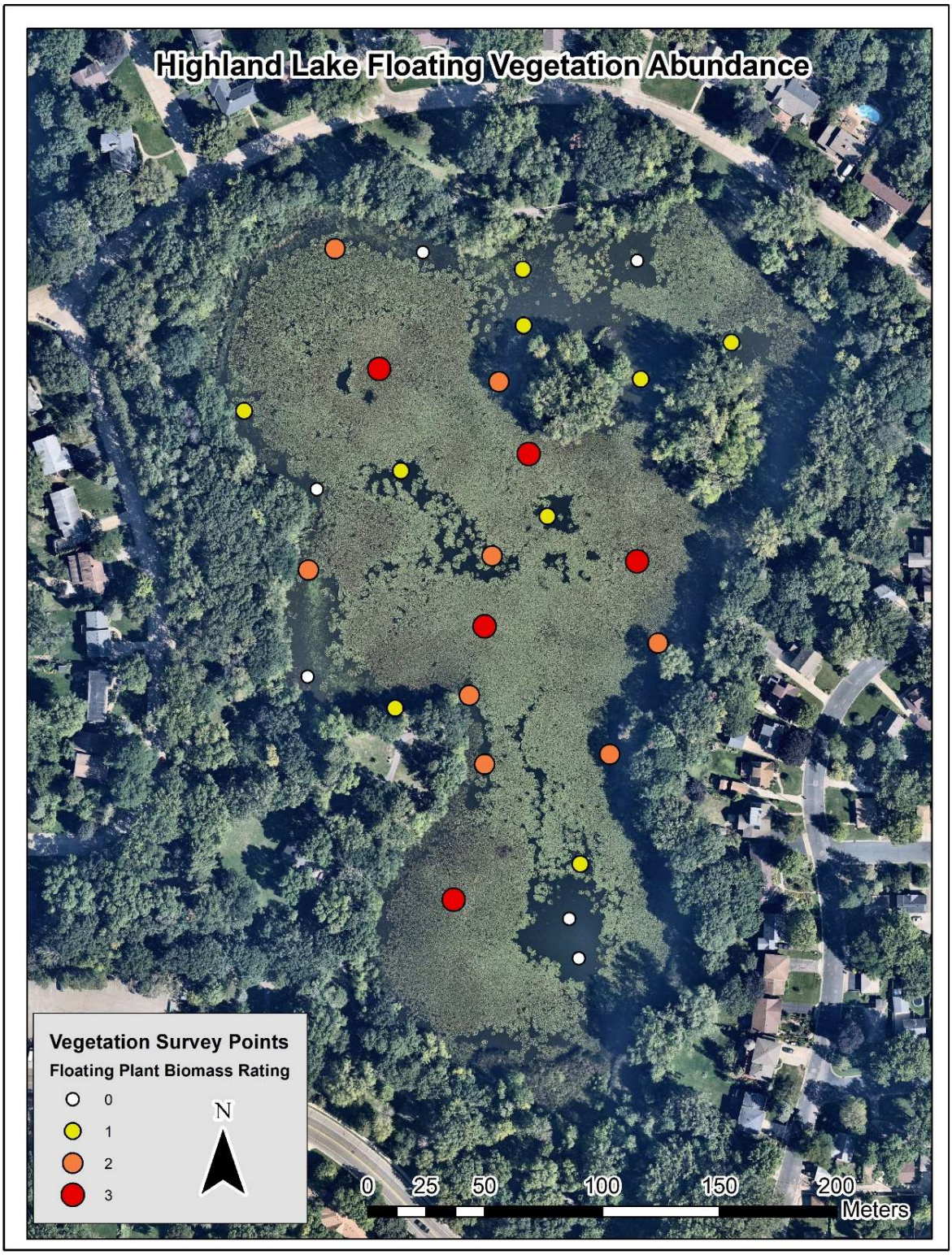
Cattails (*Typha spp.*) are the dominant emergent plant on Highland Lake. They occupy approximately 1/3 of the shoreline in dense but generally narrow fringes less than 50 feet wide. The dense growth patterns and flower characteristics of these cattails indicate that they are likely *Typha x glauca*, which is a hybrid of the native broad-leaved cattail and invasive narrow-leaved cattail. However, DNA analysis is typically needed to confirm the identification of this species. Hybrid cattails are increasingly common in lakes and wetlands, especially in those receiving nutrient-rich runoff. They often expand rapidly in shallow water via underground growth, choking out other aquatic vegetation in the process.

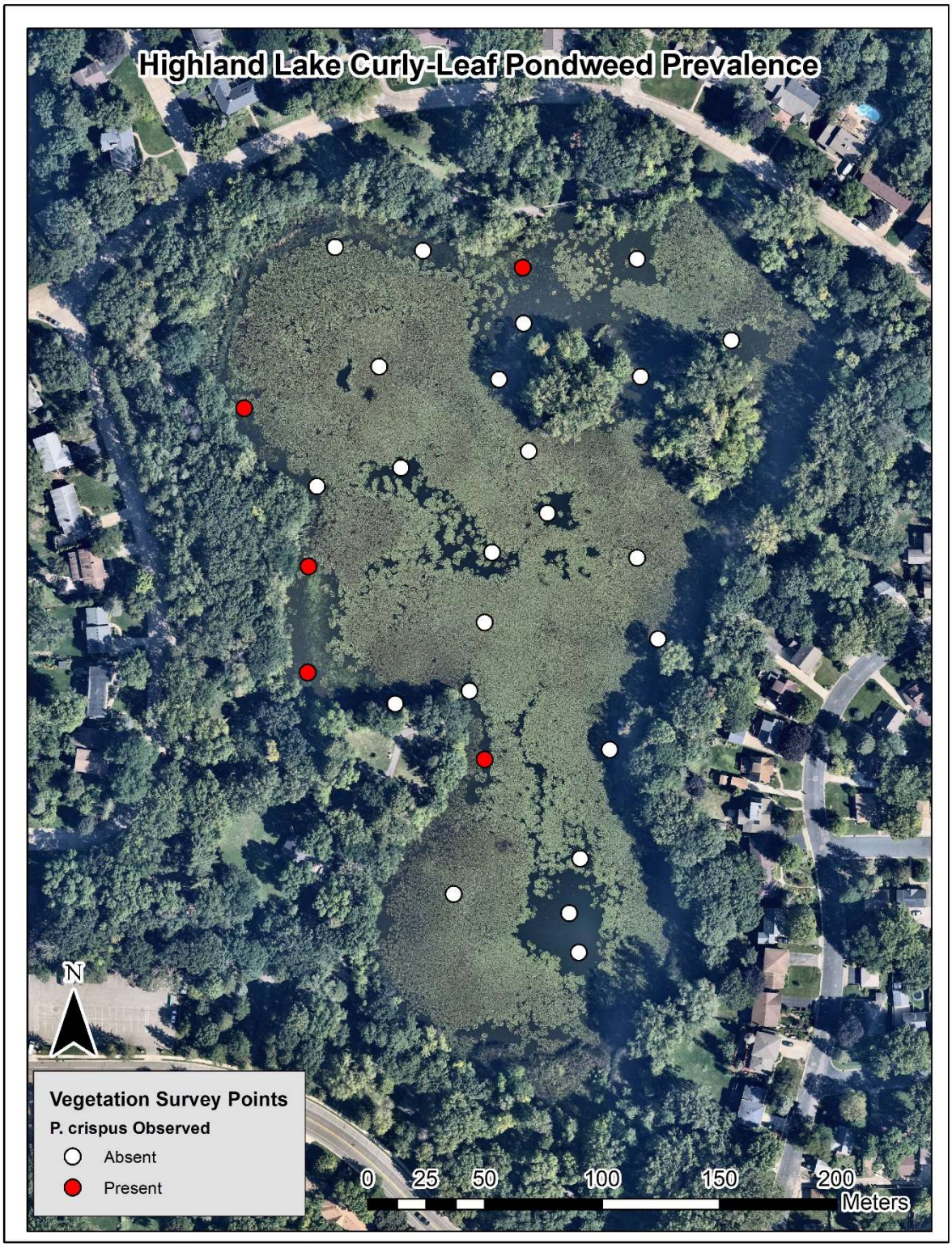
Broadleaf Arrowhead (*Sagittaria latifolia*) is present in small clusters along approximately 5% of the lake's shoreline. This emergent plant is native and common in Minnesota's aquatic ecosystems. The remainder of the lake's shoreline lacks emergent vegetation, instead containing a narrow zone of exposed sediment which quickly transitions to riparian shrubs upslope. See Appendix E for a map of emergent vegetation distribution.

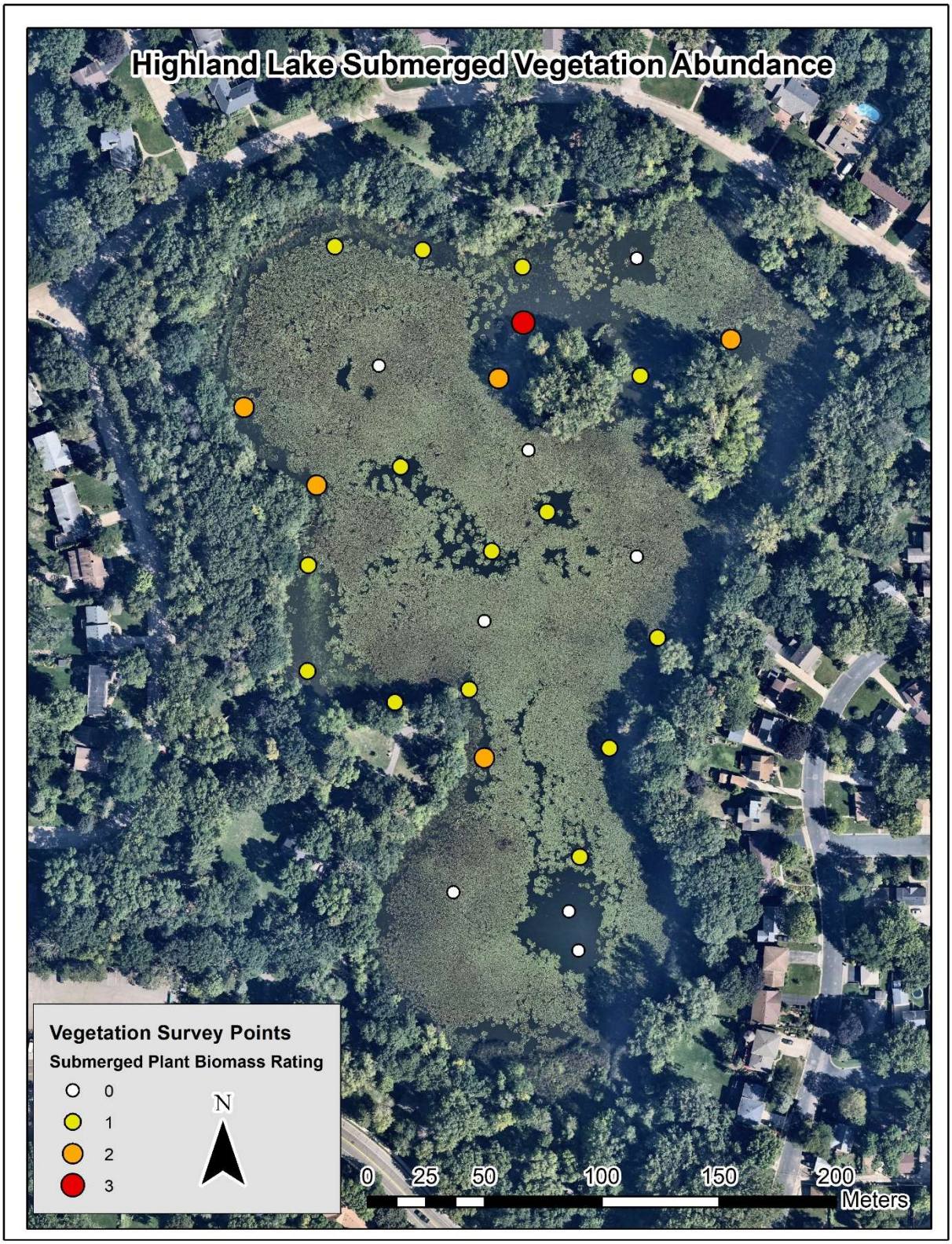
Discussion

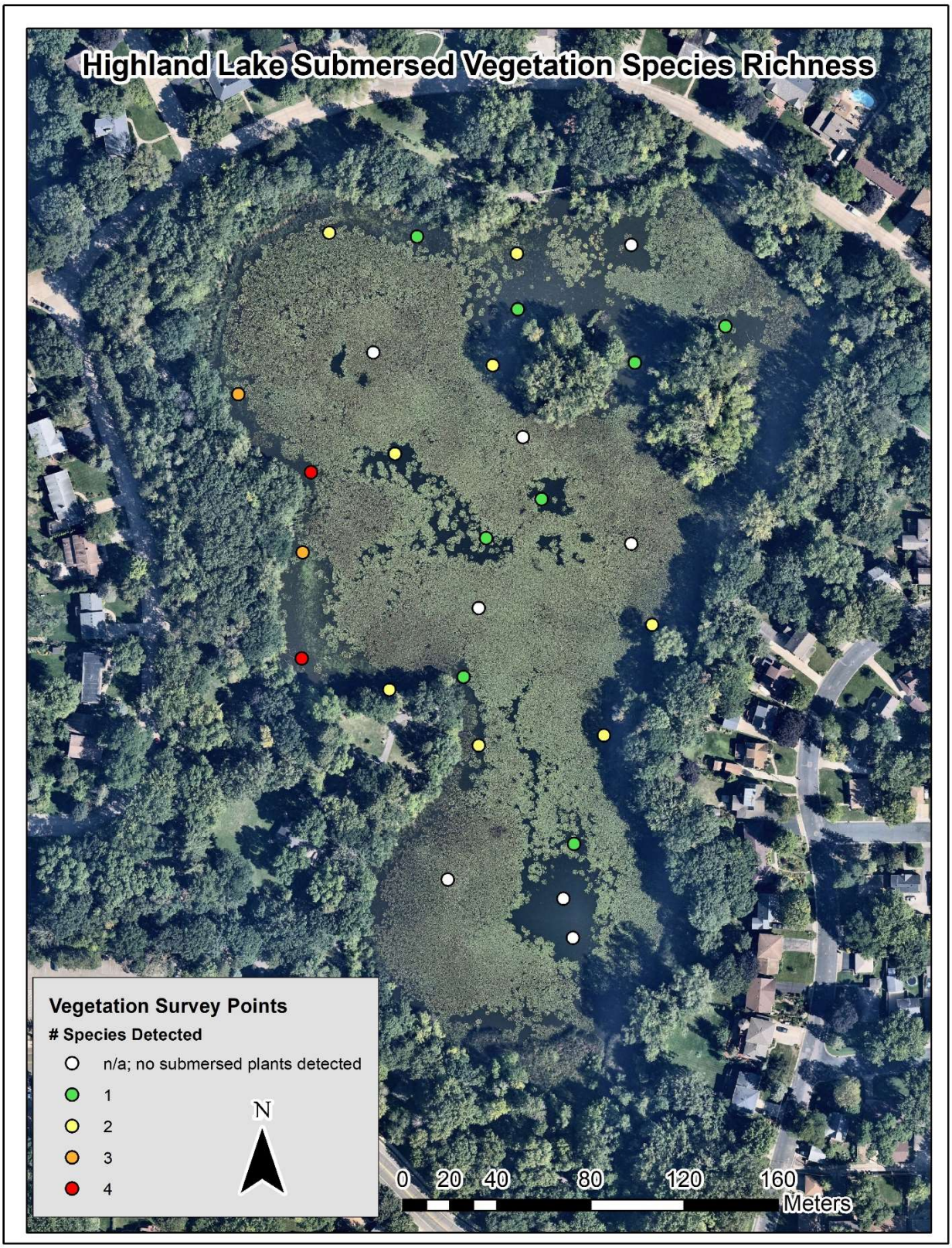
Despite its poor water quality and impairment status, Highland Lake supports several native aquatic plants. It also contains the invasive Curly-leaf Pondweed and (likely) hybrid cattail, but both were observed in low densities at the time of this survey. The widespread and dense growth of water lilies is likely due to the presence of their ideal growing conditions throughout the lake (quiet shallow water and soft, nutrient-rich sediments).

Aquatic plants provide food and habitat for fish and many wildlife species, both aquatic and terrestrial. They also improve water quality by holding bottom sediments in place, consuming nutrients, and releasing oxygen. Aquatic vegetation is generally most abundant in shallow water where sunlight is accessible, which is why waterbodies with shallow water throughout, like Highland Lake, often contain many floating, submersed, and emergent plants.


Highland Lake Floating Vegetation Abundance
Vegetation Survey Points
Floating Plant Biomass Rating
0
1
2
3
N
0
25
50
100
150
200
Meters


Highland Lake Curly-Leaf Pondweed Prevalence
N
Vegetation Survey Points
P. crispus Observed
Absent
Present
0
25
50
100
150
200
Meters


Highland Lake Submerged Vegetation Abundance
Vegetation Survey Points
Submerged Plant Biomass Rating
0
1
2
3
N
0
25
50
100
150
200
Meters


Highland Lake Submersed Vegetation Species Richness
Vegetation Survey Points
Species Detected
n/a; no submersed plants detected
1
2
3
4
N
0 20 40 80 120 160
Meters


Highland Lake Emergent Vegetation Abundance
N
Broadleaf Arrowhead Cluster
Cattail Stand
0
25
50
100
150
200
Meters