

**Aquatic Vegetation Survey of
Howard Lake (DOW #86-0199-00)
Wright County, Minnesota
2008**

Coontail (*Ceratophyllum demersum*),
a common submerged plant in Howard Lake.



Aquatic vegetation of Howard lake, Wright County, Minnesota, 2008

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Summary

Howard Lake is a 717 acre, nutrient rich lake in south central Minnesota. An aquatic vegetation survey was conducted in September 2008 and included 136 sample sites within the shore to 15 feet depth zone. Surveyors recorded information on water depth and vegetation at each site.

Aquatic plants occurred around the entire perimeter of the lake. Submerged plants occurred to a depth of 11 feet and were most frequent in depths of six feet and less. Within the shore to 15 feet depth zone, vegetation was present in 60 percent of the sample sites.

Eleven aquatic plant taxa were recorded including one floating-leaved and 10 submerged plants. The plant community was dominated by three turbidity tolerant species: coontail (*Ceratophyllum demersum*), Canada waterweed (*Elodea canadensis*), and the non-native Eurasian watermilfoil (*Myriophyllum spicatum*).

The non-native plant, curly-leaf pondweed (*Potamogeton crispus*), occurred in nine percent of the sample sites but an early summer survey is necessary to assess the actual abundance of this species.

Introduction

Howard Lake is located next to the City of Howard Lake in Wright County, south-central Minnesota (Figure 1). There are about 138 lakes in Wright County that are at least 50 acres in size and Howard Lake is the tenth largest with a surface area of 717 acres and five miles of shoreline.

Howard Lake is located in the North Fork of the Crow River Watershed (Figure 1) and is part of the Twelve Mile Creek minor watershed (Figure 2). It receives flow from an unnamed creek on the southeast shore and from a north inlet that is part of the county ditch network (Lindon and Heiskary 2006) (Figure 2). Water flows south out of Howard Lake and into Mallard Pass Lake, which then flows into Dutch Lake. Flow continues into Twelve Mile Creek, which then flows northeast to the North Fork of the Crow River and

Figure 1. Howard Lake in Wright County, Minnesota.

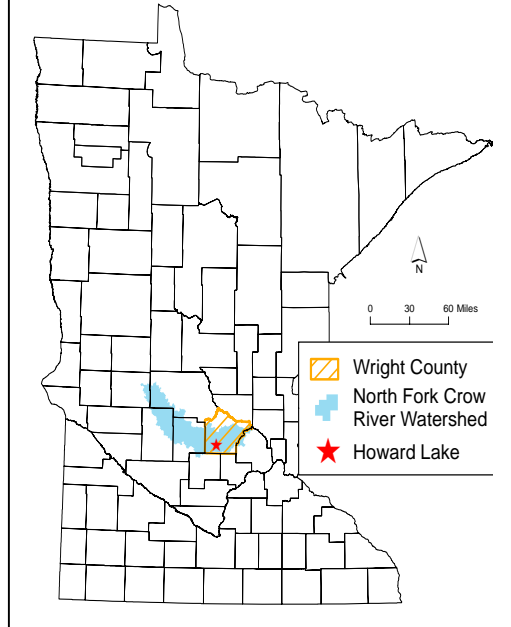
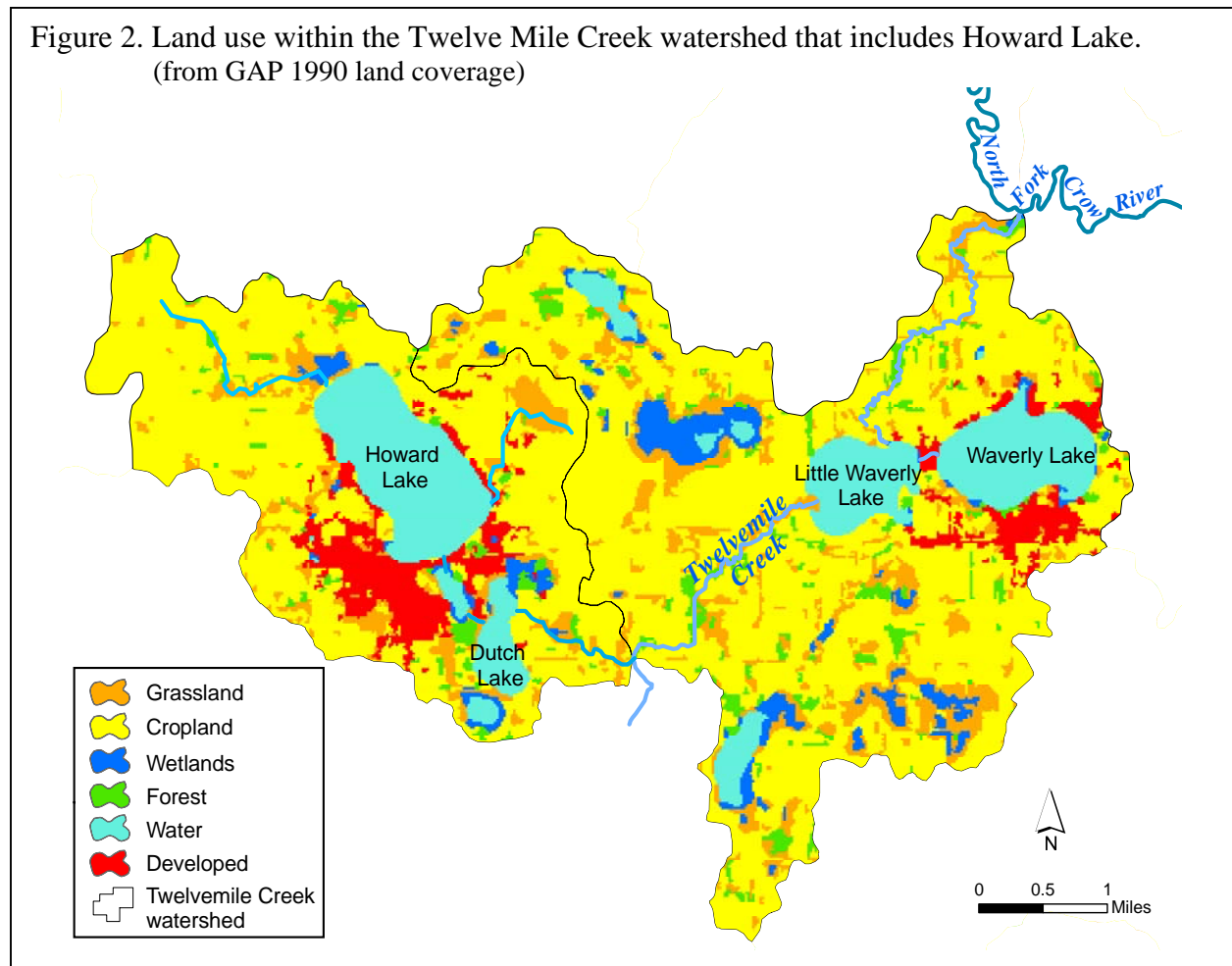


Figure 2. Land use within the Twelve Mile Creek watershed that includes Howard Lake. (from GAP 1990 land coverage)



eventually into the Mississippi River.

Howard Lake is described as eutrophic, or heavily nutrient enriched. Several factors contribute to excess nutrient levels in the lake including runoff from an agriculture dominated watershed (Figure 2), city storm water runoff, lack of native shoreline vegetation, and previous and current waste water impacts (Lindon and Heiskary 2006).

Howard Lake is bowl-shaped with a maximum depth of 39 feet. About 43 percent of the lake basin is less than 15 feet in depth (Figure 3). This shallow area that rings the lake shoreline is referred to as the [littoral zone](#). Rooted submerged plants are often common in the littoral zone if adequate sunlight reaches the lake bottom.

Water clarity is relatively low in Howard Lake and heavy summer algal growth has been reported (Lindon and Heiskary 2006). The [Secchi disc](#) (Figure 4) transparency measures the depth to which a person can see into the lake and provides a rough estimate of the light penetration into the water column. Between 2000 and 2008, summer water clarity, as measured by Secchi disc readings, ranged from 3.0 to 6.5 feet in Howard Lake (MPCA, 2009). As a general rule, sunlight can penetrate to a depth of two times the Secchi depth and aquatic plants can grow to a depth of one and half times the Secchi depth.

Based on Secchi disk measurements alone, aquatic plants might be expected to reach depths of 4.5 to 10 feet in Howard Lake. Other factors that may influence the depth of plant growth include substrate type, wind fetch, and the types of plants present.

Previous vegetation surveys of Howard Lake were conducted in

Figure 3. Depth contours of Howard Lake (10 and 15 feet contours based on 2008 data)

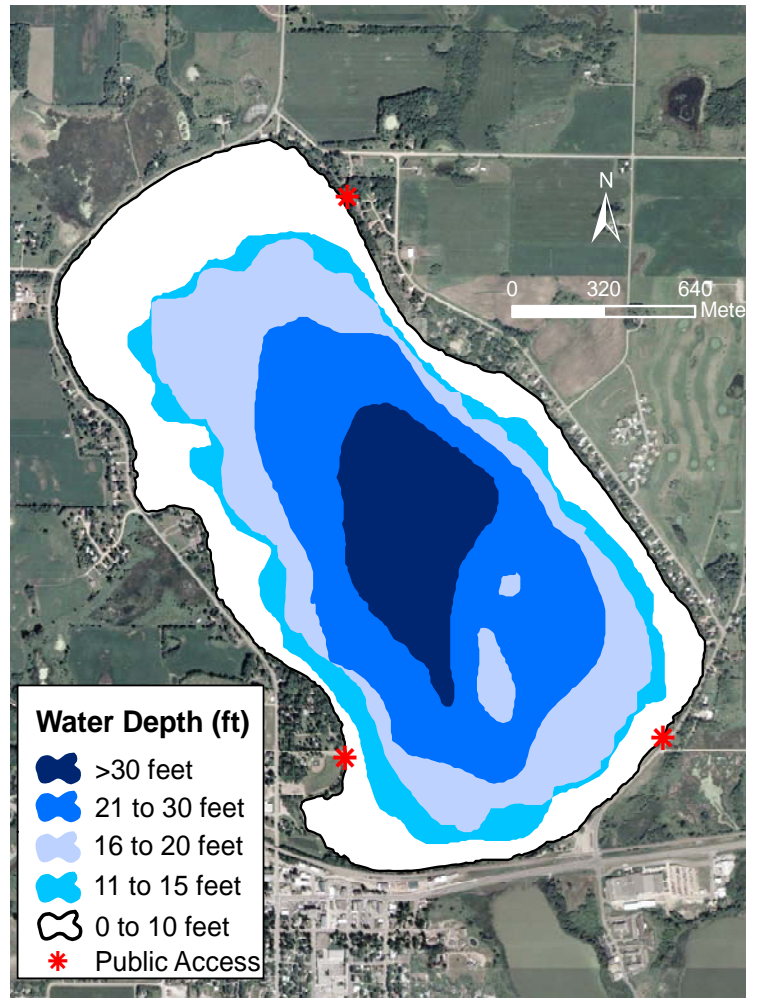


Figure 4. Measuring water clarity with a Secchi Disc



1946, 1971 and 1996 (MnDNR Fisheries Lake Files). Because these surveys were conducted in different months and survey methods used were different from the 2008 survey, the results are not directly comparable. But, general comparisons of plant rooting depth, numbers of plant types found, and relative abundance of plant types can be made.

Objectives

The purpose of this vegetation survey was to provide a quantitative description of the 2008 plant population of Howard Lake. Specific objectives included:

1. Estimate the maximum depth of rooted vegetation
2. Estimate the percent of the lake occupied by rooted vegetation
3. Record the aquatic plant taxa that occur in the lake
4. Estimate the frequency of occurrence of common taxa
5. Develop distribution maps for the common taxa

The 2008 survey focused on in-lake aquatic plants and surveyors did not record information on shoreline vegetation.

Methods

Lakewide vegetation survey

Howard Lake was surveyed on September 14, 2008. A point-intercept survey method was used and followed the methods described by Madsen (1999) and MnDNR (2008). Survey waypoints were created using a Geographic Information System (GIS) computer program and downloaded into a handheld Global Positioning System (GPS) receiver. Survey points were placed in a grid pattern and spaced 75 meters (246 feet) apart, resulting in about one survey point per acre.

Two field crews, each consisting of two surveyors and one boat, conducted the survey. In the field, surveyors determined that vegetation was sparse beyond a depth of 10 feet and therefore sampled all sites that occurred in depths less than 16 feet and only a few sites in the deeper water. A total of 141 sites were surveyed (Figure 5, Table 1).

The GPS unit was used to navigate the boat to each sample point. One side of the boat was designated as the sampling area. At each site, water depth was recorded in one-foot increments using a measured stick in water depths less than seven feet and an electronic depth finder in depths greater than eight feet.

Surveyors recorded all plant taxa found within a one square meter sample site at the pre-designated side of the boat. A double-headed, weighted garden rake, attached to a rope was used to survey vegetation not visible from the surface (Figure 6). Plant identification and nomenclature followed Crow and Hellquist (2000). Data were entered into a database and frequency of occurrence was calculated for each taxon as the number of sites in which a taxon occurred divided by the total number of sample sites. Frequency was calculated for the entire area from shore to 15 feet and sampling points were also grouped by water depth and separated into five depth zones (Table 1) for analysis.

Figure 5. 2008 vegetation survey sites on Howard Lake..

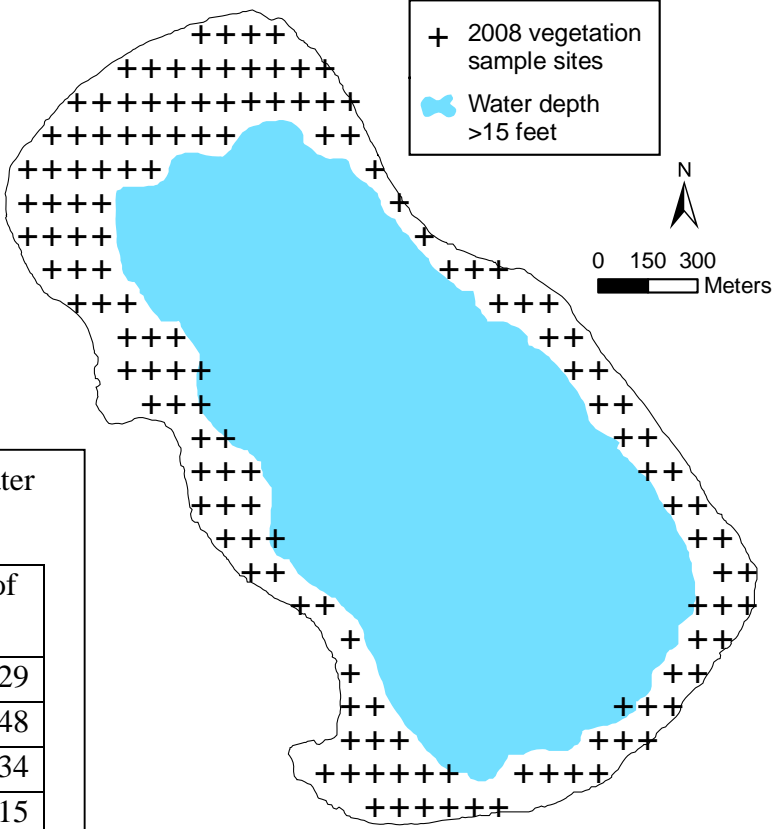
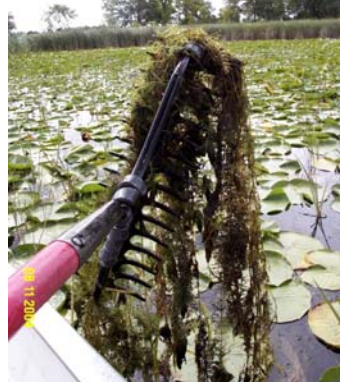


Table 1. Sampling effort by water depth.

| Water depth interval (feet) | Number of samples |
|------------------------------|-------------------|
| 0 to 3 | 29 |
| 4 to 6 | 48 |
| 7 to 9 | 34 |
| 10 to 12 | 15 |
| 13 to 15 | 10 |
| Sample sites in 0-15 ft zone | 136 |
| 16 to 20 | 5 |
| Total samples | 141 |

Figure 6. Sampling rake.



Example: In Howard there were 136 samples sites within the shore to 15 feet depth zone.

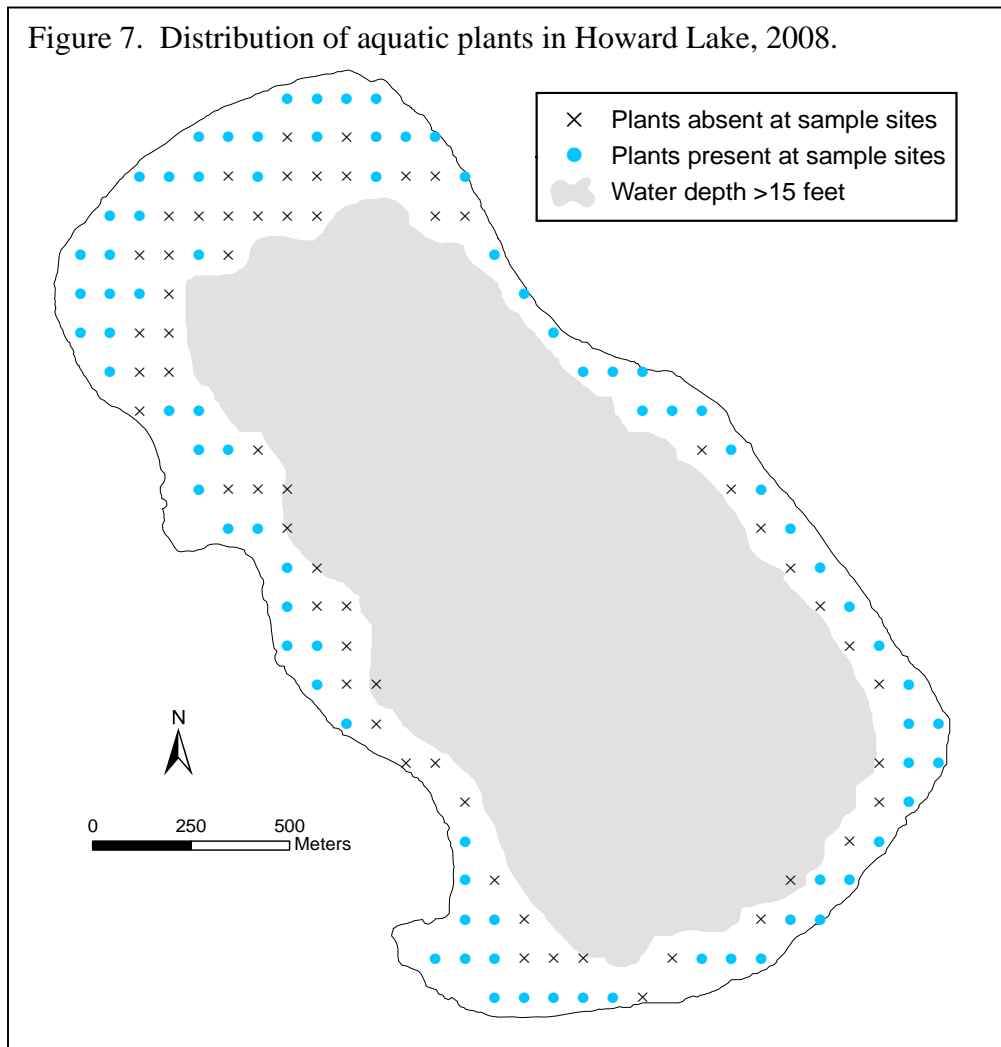
Coontail (*Ceratophyllum demersum*) occurred in 53 sites.

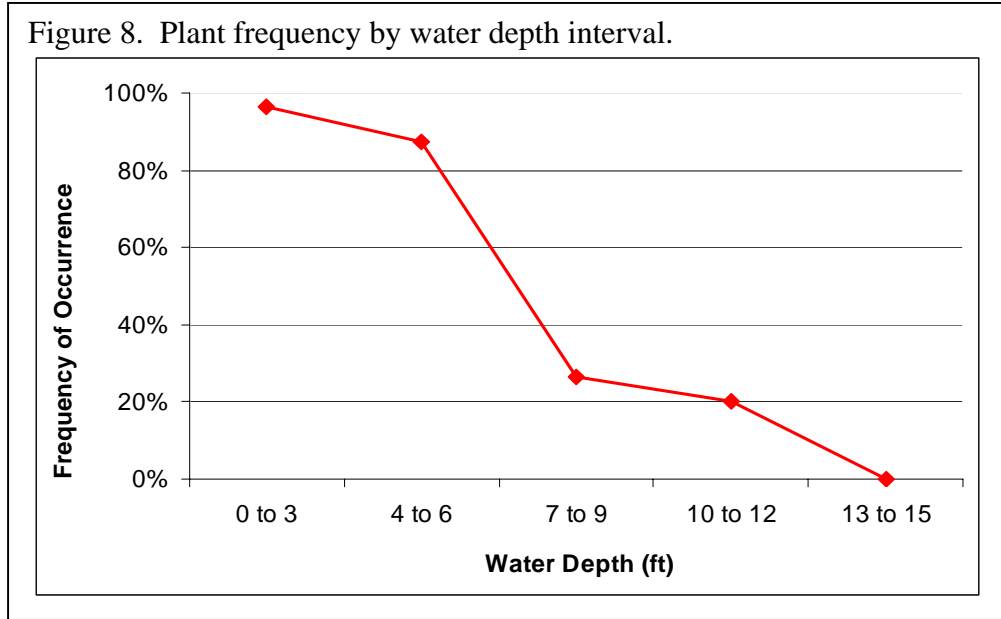
Frequency of coontail in the 0 to 15 feet depth zone of Howard Lake = $55/136 (*100) = 39\%$

Results

Distribution of aquatic plants

Aquatic plants occurred around the entire perimeter of Howard Lake and the broadest zones of vegetation occurred at the north end of the lake (Figure 7). Plants were found to a maximum depth of 11 feet and percent of vegetated sites decreased with increasing water depth (Figure 8). Within the shore to 15 feet depth zone, 60 percent of the sites contained plants. The majority of plants occurred in depths of six feet and less, and this area included about 130 acres or 18% of the lake.





Number and types of plant species recorded

A total of 11 aquatic plant species were recorded in Howard Lake including 10 submerged species and one floating-leaf species (Table 2). Two of the plant species, curly-leaf pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*), are not native to Minnesota. Floating-leaved plants were found in depths less than five feet. Most rooted submerged plants were restricted to depths of six feet and less (Figure 9). Only two submerged species occurred in depths greater than nine feet.

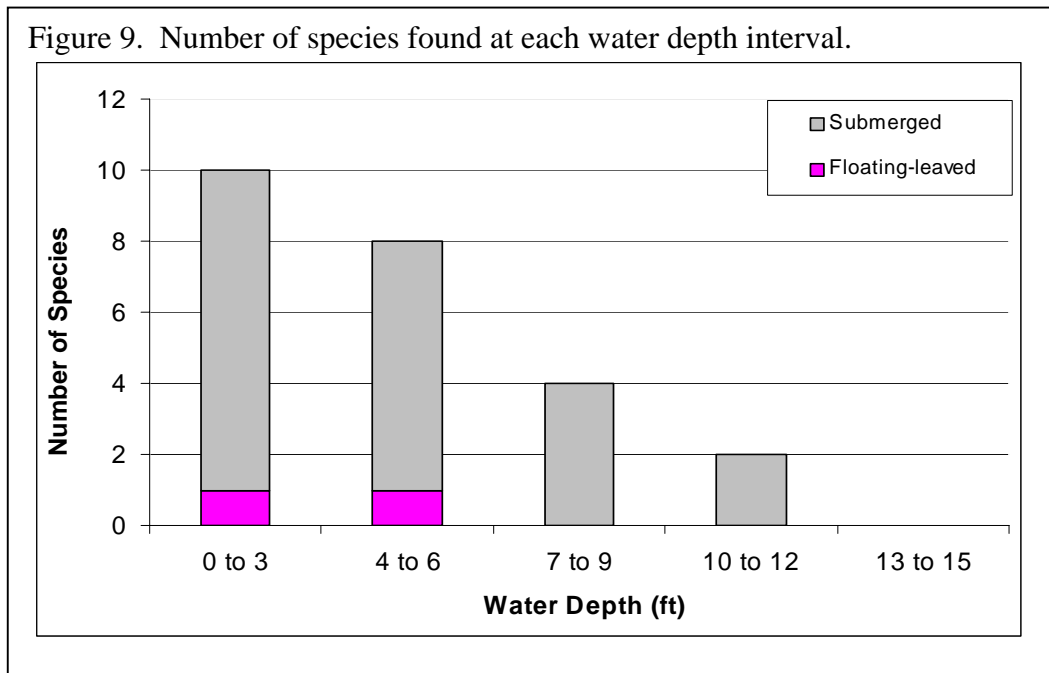


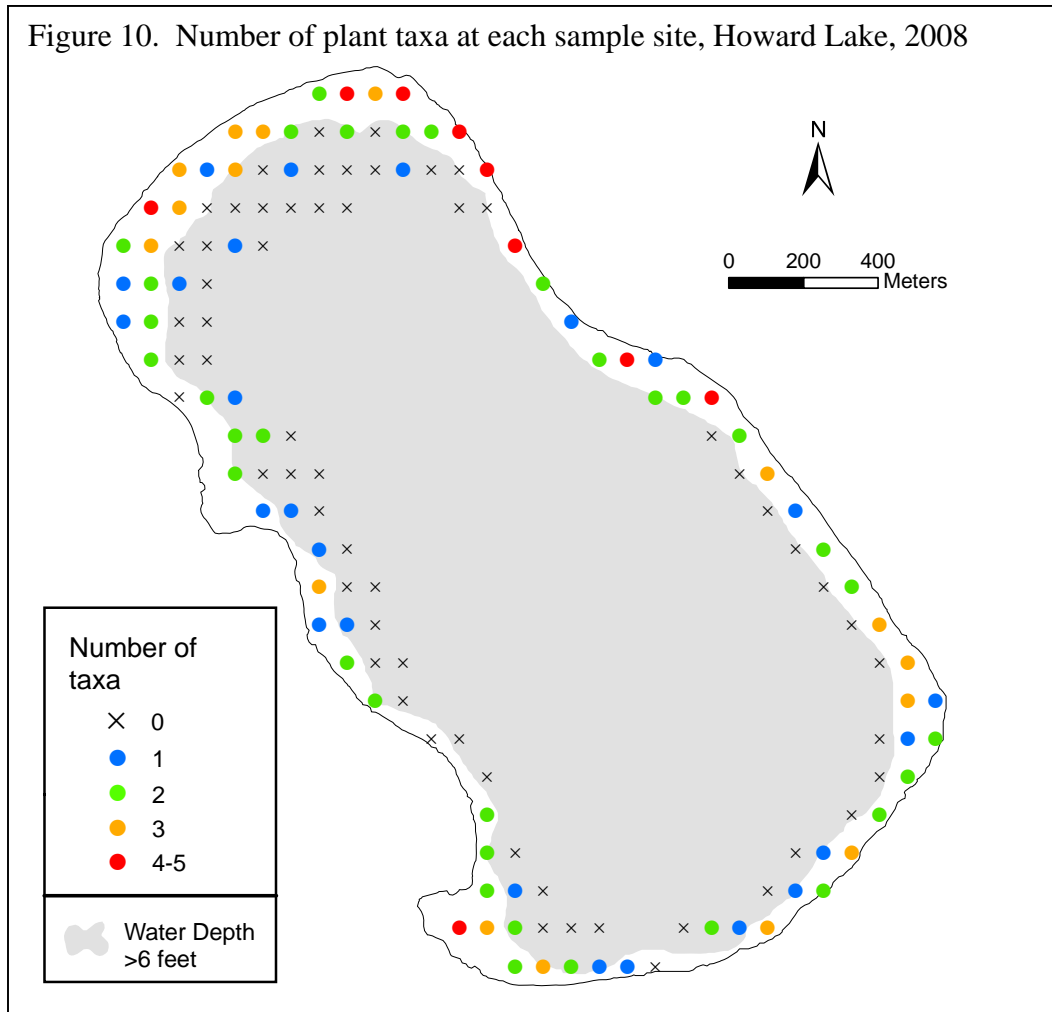
Table 2. Frequency of aquatic plants in Howard Lake Point-intercept survey, September 2008.

| Life Form | Common Name | Scientific Name | Frequency |
|-----------------|------------------------|----------------------------------|-----------|
| Submerged | Coontail | <i>Ceratophyllum demersum</i> | 39 |
| | Eurasian watermilfoil | <i>Myriophyllum spicatum</i> | 31 |
| | Canada waterweed | <i>Elodea canadensis</i> | 28 |
| | Curly-leaf pondweed | <i>Potamogeton crispus</i> | 9 |
| | Wild celery | <i>Vallisneria americana</i> | 8 |
| | Bushy pondweed | <i>Najas</i> sp. | 6 |
| | Sago pondweed | <i>Stuckenia pectinata</i> | 2 |
| | Muskgrass | <i>Chara</i> sp. | 1 |
| | Clasping-leaf pondweed | <i>Potamogeton richardsonii</i> | 1 |
| | Flat-stem pondweed | <i>Potamogeton zosteriformis</i> | 1 |
| Floating-leaved | White waterlily | <i>Nymphaea odorata</i> | 3 |

(Frequency is the percent of sample sites in which a plant taxon occurred within the shore to 15 ft water depth.) 136 sample sites.

The number of plant taxa found at each one square meter sample site ranged from zero to five, with a mean of one. Sites with the highest number of taxa occurred near shore, in water depths less than six feet, where at least 70 percent of the sites contained more than one taxon (Figure 10). In water depths greater than six feet, 83 percent of sites contained no plants and only three percent of sites contained more than one taxon.

Several submerged plants that were recorded in earlier surveys were not found in the September 2008 survey. These included four submerged taxa: Illinois pondweed (*Potamogeton illinoensis*), mud plantain (*Heteranthera dubia*), narrow-leaf pondweed (*Potamogeton* sp.), and northern watermilfoil (*Myriophyllum sibiricum*). Two emergent plants, hardstem bulrush (*Scirpus acutus*) and cattail (*Typha* sp.) were previously recorded in the lake but were not listed in the 2008 survey. With the exception of northern watermilfoil, most of these plants were present in low abundance in previous years and may have been present in 2008 but not detected.



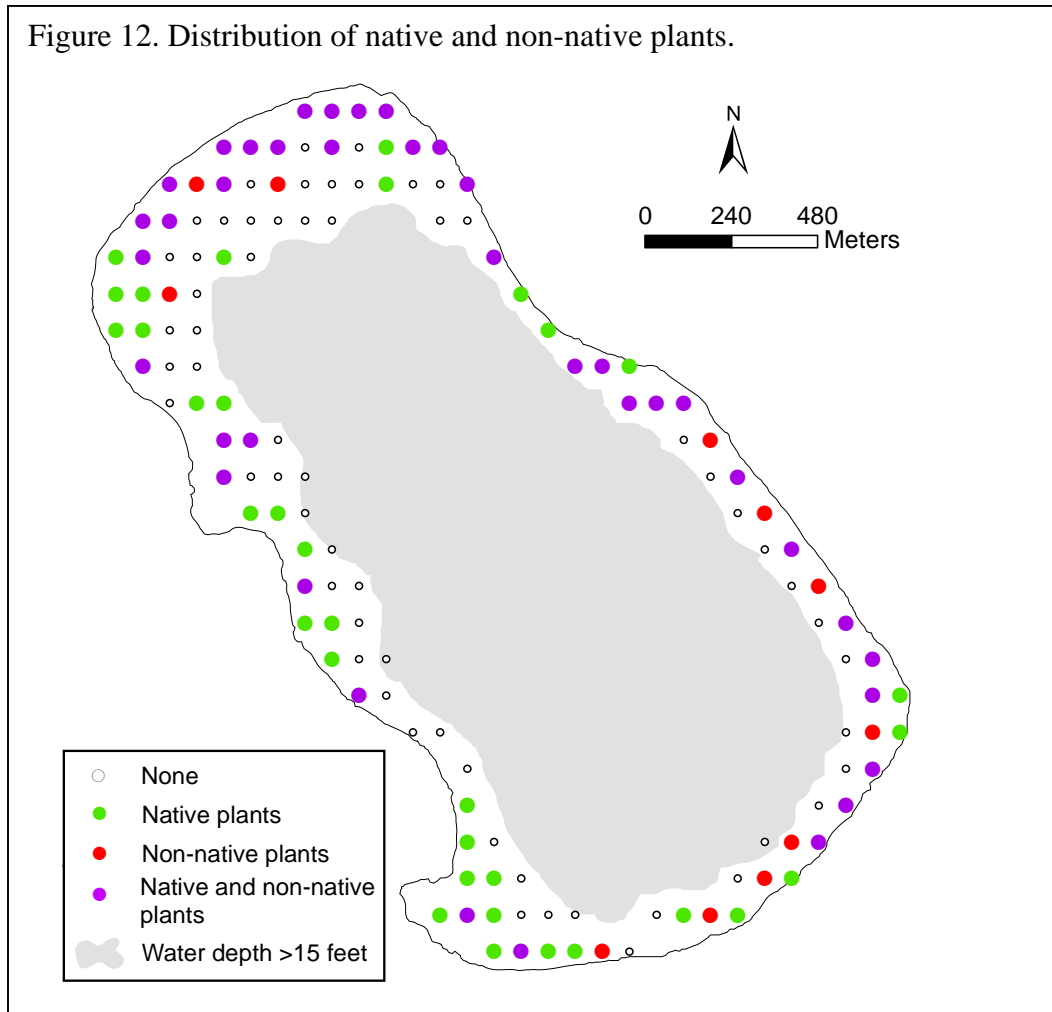
Emergent and floating-leaved plants

In 2006, DNR Fisheries biologists estimated that emergent and floating-leaf plant occupied less than 10 acres of Howard Lake (DNR Fisheries Lake Files). Cattails, bulrush and white waterlilies were found in 2006 but were not widespread in the lake. The 2008 survey did not include mapping emergent and floating-leaf plant beds. The only floating-leaf plant found in 2008 was [white waterlily](#) (*Nymphaea odorata*) (Figure 11). Waterlilies were found in the northeast and the southwest corners of the lake and were present in one percent of all survey sites (Table 2).

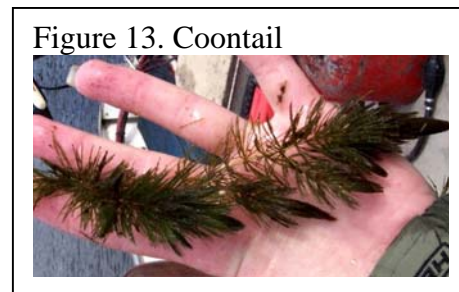
Submerged plants

Within the shore to 15 feet depth zone, submerged plants occurred in 60 percent of the Howard lake sites. A mix of native and non-native species was found in 28 percent of the sites. Twenty-four percent of the sites contained only native taxa, and eight percent contained only non-native plants (Figure 12). The three most common submerged species were coontail, Eurasian watermilfoil and Canada waterweed.





Coontail (*Ceratophyllum demersum*) (Figure 13) grows entirely submerged and its roots are only loosely anchored to the lake bottom. It is adapted to a broad range of lake conditions and is tolerant of higher turbidity and can grow in muck substrates. Coontail is perennial and can over winter as a green plant under the ice and then begins new growth early in the spring, spreading primarily by stem fragmentation. The finely divided leaves of this plant provide a home for insects valuable as fish food.



Coontail occurred in 39 percent of the Howard Lake sites (Table 2) and was the most frequent plant found in depths greater than three feet dominated from four to 12 feet water depth (Figure14). It was found around the entire perimeter of the lake (Figure 15) and was the only aquatic plant found at the maximum rooting depth of 11 feet.

Figure 14. Frequency of common plants by depth interval. Howard Lake, Sept 2008.

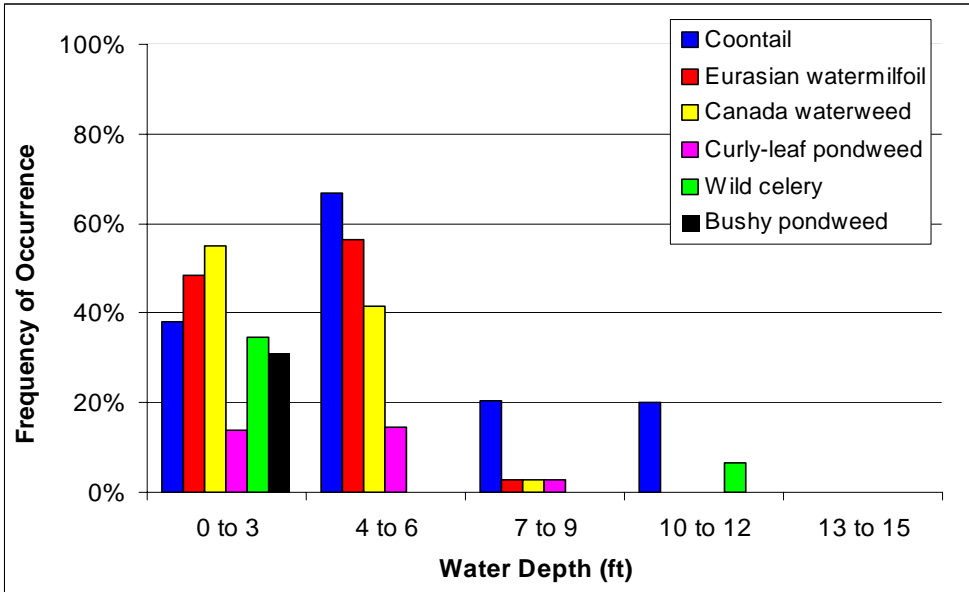
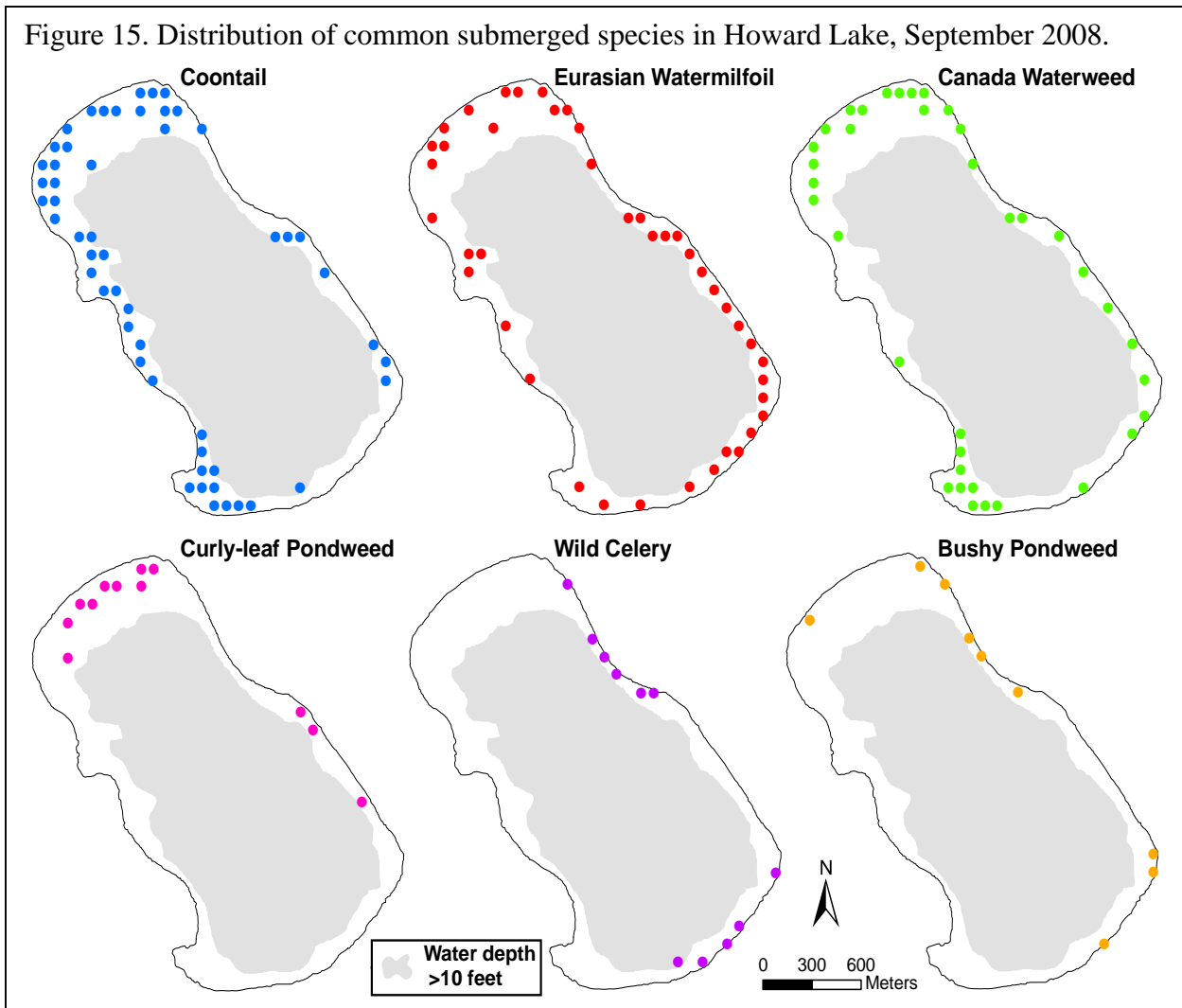


Figure 15. Distribution of common submerged species in Howard Lake, September 2008.



[Eurasian watermilfoil](#) (*Myriophyllum spicatum*) (Figure 16) is a rooted, perennial plant with finely divided leaves. The plant is primarily submerged but may produce flowers that extend above the water surface. There are several native watermilfoil plants in Minnesota, but Eurasian watermilfoil has been introduced into the state. The native look-a-like, northern watermilfoil (*Myriophyllum sibiricum*) was recorded in Howard Lake in 1996. For information on how to distinguish the non-native, Eurasian watermilfoil from the native northern watermilfoil, click here: [identification](#). Eurasian watermilfoil is adapted to survive in lower light levels than many native aquatic plants but still requires adequate light for growth.

Figure 16. Eurasian watermilfoil



The non-native species, Eurasian watermilfoil (*Myriophyllum spicatum*) was first documented in Howard Lake in 2002 and during the 2003 survey it occurred on 100% of the survey transects. In 2008, Eurasian watermilfoil was found in 30 percent of all Howard Lake survey sites (Table 2). It was found to a maximum depth of eight feet and was most frequent in depths of six feet and less (Figure 14). It occurred around the entire perimeter of the lake (Figure 15).

[Canada waterweed](#) (*Elodea canadensis*) (Figure 17) is perennial submerged species that is widespread throughout Minnesota. It is adapted to a variety of conditions and is tolerant of low light and prefers soft substrates. This species can over winter as an evergreen plant and spreads primarily by fragments.

Figure 17. Canada waterweed photo: ©Vic Ramey, 2001 Univ of FL



Canada waterweed was found in 26 percent of the Howard Lake survey sites (Table 2). It was most frequent in depths of six feet and less (Figure 14) and occurred around the entire shoreline (Figure 15).

Other submerged species found in Howard Lake occurred in less than ten percent of the sample sites (Table 2). Notable taxa included curly-leaf pondweed (*Potamogeton crispus*), water celery (*Vallisneria americana*) and bushy pondweed (*Najas* sp.).

[Curly-leaf pondweed](#) (*Potamogeton crispus*) (Figure 18) is a non-native, submerged plant that has been present in Minnesota since at least 1910 (Moyle and Hotchkiss 1945) and is now found in more than 700 Minnesota lakes (Invasive Species Program 2008). Like many native submerged plants, it is perennial but has a unique life cycle that may provide a competitive advantage over native species. Curly-leaf pondweed is actually

Figure 18. Curly-leaf pondweed



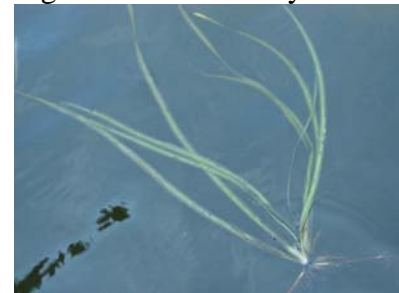
dormant during late summer and begins new growth in early fall. Winter foliage is produced and continues to grow under ice (Wehrmeister and Stuckey 1978). Curly-leaf reaches its maximum growth in May and June, when water temperatures are still too low for most native plant growth. In late spring and early summer, curly-leaf plants form structures called “turions” which are hardened stem tips that break off and fall to the substrate. Turions remain dormant through the summer and germinate into new plants in early fall (Catling and Dobson 1985).

The foliage of curly-leaf pondweed does provide some fish and wildlife habitat, but it may also create problems in some lakes, or in areas of some lakes. During its peak growth in spring, curly-leaf may reach the water surface at certain depths and create dense mats. These dense growths may compete with native vegetation and can also cause problems for recreational lake users.

Curly-leaf pondweed likely became abundant in Howard Lake sometime after 1946 (Diedrich 2006). In the 1971 survey it was recorded as “common”. A 2003 survey noted that curly-leaf pondweed grew to the surface on 151 acres and a similar 2006 survey mapped 137 acres (Diedrich 2006). The September 2008 survey was conducted after peak growth and die-back of curly-leaf pondweed. Spring or early summer surveys are often necessary to assess this species. In the September 2008 survey, curly-leaf pondweed was present in nine percent of Howard Lake survey sites and was found to a depth of seven feet (Figure 14). It was common on the north end of the lake, but was also found in three sites along the east shore (Figure 15).

[Wild celery](#) (*Vallisneria americana*) (Figure 19) is a rooted, perennial submerged plant with grass-like leaves. Wild celery occurred in eight percent of the sites between shore and 20 feet (Table 2). It occurred on the south and northeast shorelines of Howard Lake (Figure 15) and was most common in depths less than three feet (Figure 14).

Figure 19. Wild celery



[Bushy pondweed](#) (*Najas flexilis*) (Figure 20) is unique because it is one of the few annual submerged species in Minnesota and must re-establish every year from seed. The seeds and foliage of this plant are an important duck food and beds of this plant provide good fish cover. In Howard Lake, bushy pondweed occurred in six percent of the sample sites (Table 2). It was found along the northeast and southeast shorelines (Figure 15).

Figure 20. Bushy Pondweed



Discussion

The types and amounts of aquatic vegetation that occur within a lake are influenced by a variety of factors including water clarity, water chemistry, depth, substrate type and wave activity. Changes to these environmental conditions can lead to changes in the distribution, abundance and composition of the aquatic plant community. Other factors that may influence lake plants

include invasions of non-native species, changes in algae populations, predation, and direct or indirect disturbance by humans.

Notable changes have occurred in the Howard Lake submerged plant community since 1996 (Diedrich 2006). Although the non-native curly-leaf pondweed has been present in Howard Lake for several decades, the 1996 plant survey recorded a relatively diverse mix of native submerged plants. Commonly found plants included turbidity tolerant species like coontail, sago pondweed (Davis and Brinson 1980) and Canada waterweed (Nichols 1999) as well as plants less tolerant of turbidity such as northern watermilfoil and bushy pondweed (Nichols 1999). Muskgrass (*Chara* sp.), clasping-leaf pondweed (*Potamogeton richardsonii*), and northern watermilfoil (*Myriophyllum sibiricum*) were relatively common in 1996 but declined to low frequency levels or below detection level by 2006 and 2008. Diedrich (2006) noted that the absence or decline of these once common native species might indicate a problem with the health of the lake. Eurasian watermilfoil was detected in the lake in 2002, and in 2003 it was recorded on 100% of the survey transects. Its abundance remained high in 2008, when it was observed in 31% of all sites and in 53% of the shallow water (0 to 6 feet) sites.

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