

Minnesota Lake ID: 01-0142

Area: 907 acres

Watershed Area: 24,721 acres

Ecoregion: Northern Lakes and Forests (NLF)

Trophic Status: Mesotrophic

Maximum Depth: 48 ft (NB) 24 (SB)

Mean Depth: 24.3 ft (NB) 9.1 (SB)

Mixing Status: Thermally Stratified (Dimictic)



Figure 1. Hill Lake, North Basin (NB) and South Basin (SB) 3D depth contour



DNR Ecological Services & Fisheries Divisions 2002
Lake Bathymetric DEM Shaded Relief Image

Figure 2. Hill Lake watershed land use

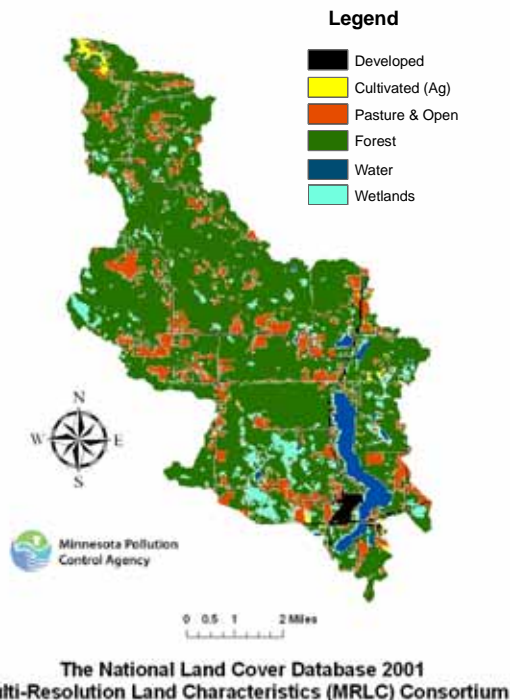


Table 1. Land use composition

Land use	Hill Lake land use percentage	NLF typical land use percentage
Developed	3	0 – 7
Cultivated (Ag)	1	<1
Pasture & Open	13	0 – 6
Forest	75	54 – 87
Water & Wetland	9	14 – 31
Feedlots (#)	0	

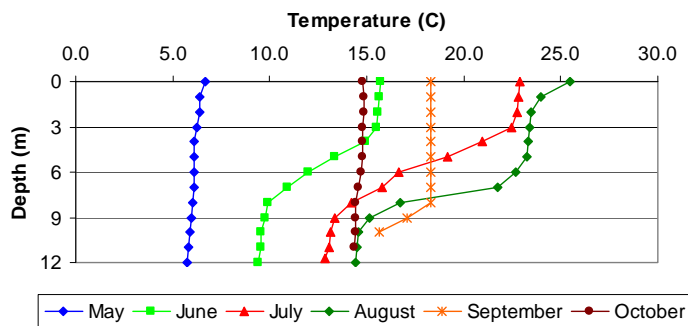
**Table 2. Hill Lake 2008 as compared to typical range for NLF ecoregion reference lakes
MPCA data based on 2008 sample collection**

Parameter	Hill Lake NB	Hill Lake SB	NLF
Number of reference lakes	-	-	32
Total Phosphorus (µg/L)	26	37	14 – 27
Chlorophyll mean (µg/L)	7	11	4 – 10
Secchi Disk (feet)	10.5	7.5	8 -15
(meters)	3.2	2.3	2.4 – 4.6
Total Kjeldahl Nitrogen (mg/L)	0.6	-	0.4 – 0.75
Alkalinity (mg/L)	150	-	40 – 140
Color (Pt-Co U)	12.5	-	10 – 35
pH (SU)	7.9	8.1	7.2 – 8.3
Chloride (mg/L)	6.5	-	0.6 – 1.2
Total Suspended Solids (mg/L)	1.6	-	<1 – 2
Total Suspended Inorganic Solids (mg/L)	0.3	-	<1 - 2
Conductivity (umhos/cm)	317	297	50 – 250
TN:TP ratio	25:1	-	25:1 - 35:1

µg/L = micrograms per liter	Pt-Co-U = Platinum Cobalt Units
mg/L = milligrams per liter	SU = Standard Units
umhos/cm = micromhos per centimeter	

Figure 3. Hill Lake (NB) 2008 temperature and dissolved oxygen (DO) profiles

Hill Lake (NB) 2008 Temperature Profile



Hill Lake (NB) 2008 Dissolved Oxygen Profile

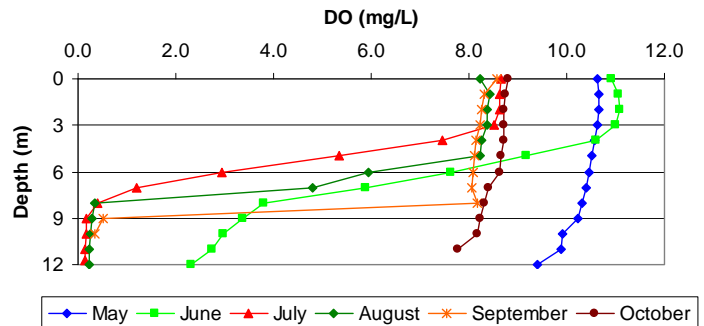


Figure 4. Hill Lake (NB) Summer-mean secchi transparencies

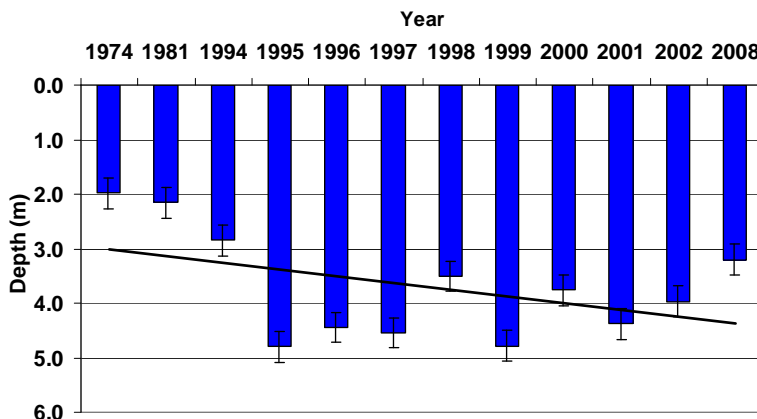
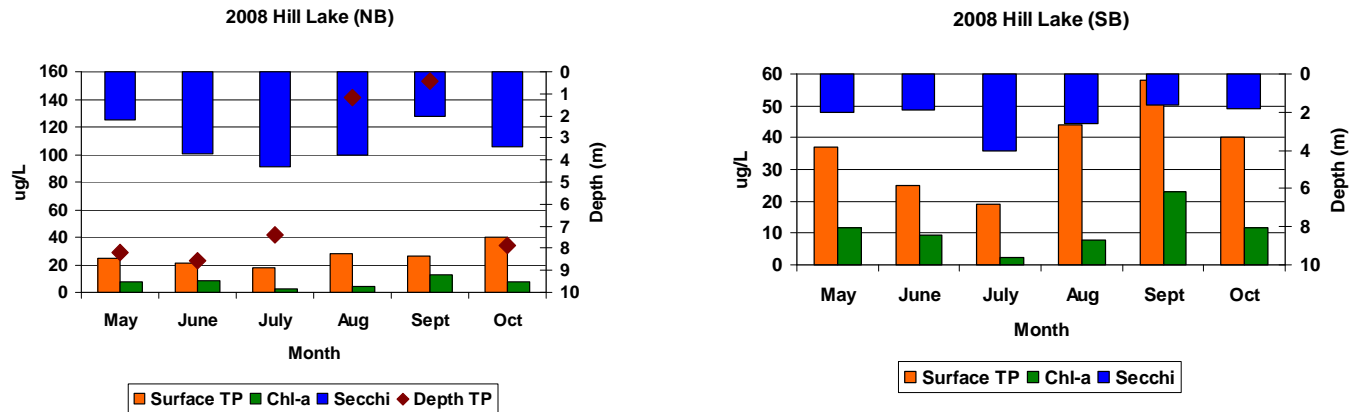


Figure 5. Hill Lake (NB & SB) total phosphorus (TP), chlorophyll-a (Chl-a), and secchi



Watershed and water quality summary

Hill Lake is one of the larger lakes in Aitkin County at 907 acres and is located just east of Hill City. The lake has a maximum depth of 48 feet with two distinct basins divided by Highway 200. Mean depth is estimated at approximately 21.8 feet. The main (north) basin is 674 acres with an average depth of 24.3 feet and the south basin is 143 acres with an average depth of 9.1 feet.

Both basins of Hill Lake were sampled for chemistry six times during the summer of 2008 by Minnesota Pollution Control Agency (MPCA) staff. Secchi depth, temperature, and DO profiles were collected by both staff and volunteer monitor, Mr. Paul Bauer, through the Citizen Lake Monitoring Program (CLMP). The NB was well mixed in the spring and fall with a thermocline developing in June and July below 3 meters. The thermocline went below 6 meters in August (Figure 3). During the summer months below a depth of approximately 6 - 7 meters DO dropped below the 5 mg/L necessary to support game fish.

The trophic status indicators and other water quality data for the NB of Hill Lake fell within, but near the top of the typical range for, minimally impacted NLF lakes (Table 2). TP and chl-a were normal at each sample event with the exception of 28 ug/L TP in August and 12.8 ug/L Chl-a in September. Chl-a shows good correspondence to TP and water clarity decreases over the summer as Chl-a increases (Figure 5).

Trophic status indicators for the SB exceeded the typical range found in the NLF (Table 2). TP was above the typical range in the spring and fall, and fell within the range in June and July. Chl-a was also above the typical range in the spring and fall, but was within the typical range from June through August. The highest TP (58 ug/L) and Chl-a (22.8 ug/L) levels of the season were observed in September. Summer Secchi for both the NB and SB follow the pattern of TP and Chl-a levels. Elevated TP in the SB may be a function of both external loading (from its direct watershed) and internal recycling that is common in shallow lakes. The drain point for the entire watershed is located within the SB.

Hill Lake has 12 summers of Secchi data; however, it is a discontinuous record so it makes trend detection a bit uncertain. Secchi data for the NB reveals an improvement in clarity in recent years as compared to pre-1994 measurements (Figure 4); however, for the period 1995-2008 there appears to be a decline in transparency. Continued measurement of Secchi through the CLMP will be important for future trend detection on Hill Lake.

Fishery and aquatic plant survey summary

Surveys of the “integrity” of the fish community during summer 2008 showed Hill supports a moderately diverse fish community with a range of species tolerant, neutral, and intolerant to watershed disturbances, including one vegetation-dwelling species of special concern (least darter). Hill is primarily managed for walleye, through supplemental fry stocking and the last gillnet survey from 2005 showed that walleye were relatively abundant and of average size. When northern pike were last surveyed with gillnets in 2005, abundance was average, but pike size was above the 75 percentile compared with other lakes in Hill’s lake class. Perch, an important forage fish, were abundant in the 2005 survey. No gear targeted walleye, white sucker, or yellow perch in 2008. Gill net assessments are planned for 2009 and 2010. Largemouth bass surveyed by electrofishing in 2008 indicated higher abundance than in 2005. The “biotic integrity” score for Hill was 104, which is average compared with other lakes of similar productivity. With regards to aquatic plant community composition, Hill has

two very distinct basins. In the clearer north basin, plant biomass in summer 2008 occupied about a third of the water volume in depths of up to 15 feet, but as Figure 6 demonstrates, plant biovolume was much higher in depths less than 5 feet. In the north basin, plants were diverse and Chara, a plant that provides quality fish habitat and is important for maintaining high water clarity, is relatively abundant. In the more turbid south basin, compared with the north basin, plants did not grow as deep and we observed fewer species, including Chara. Hill is infested with the non-native curly-leaf pondweed, but this plant generally becomes a nuisance only in highly productive waters.

Table 3. Focal species captured during recent surveys and their size and abundance compared with other lakes in its lake class

Species	Stocked	Abundance	Size
Walleye*	Y	High	Average
Northern Pike	N	Average	Large
Black Crappie	N	Low	Average
Largemouth bass	N	Average	Average
Bluegill	N	Low	Average
White sucker	N	Average	Average
Yellow perch	N	High	Average

*Management emphasis on this species

Table 4. Aquatic plant summary

	NB	SB
Percent cover of aquatic plants ≤ 15ft deep	91%	55%
Lake depth at which most vegetation disappeared	13.2ft	10.3ft
Number of common species (i.e., ≥ 10% cover)	13	6
Frequency of <i>Chara</i>	41%	3%
Infested w/ non native plant (Lightly)	Curly-leaf pondweed	Curly-leaf pondweed

Figure 6. Aquatic vegetation biovolume (percent of water column occupied by vegetation) assessed on Hill Lake with hydroacoustics during August 2008

