Minnesota Pollution Control Agency

Prepared in cooperation with the
Minnesota Department of Natural Resources

Cedar Lake

Morrison County

Sentinel Lakes

Minnesota Lake ID: 49-0140
Area: 243 acres
Watershed Area: 1,280 acres
Ecoregion: North Central Hardwood Forests (NCHF)

Trophic State: Mesotrophic
Maximum Depth: 88 feet
Mean Depth: 37 feet
Mixing Status: Thermally Stratified (Dimictic)

Figure 1. Cedar Lake 3D depth contour

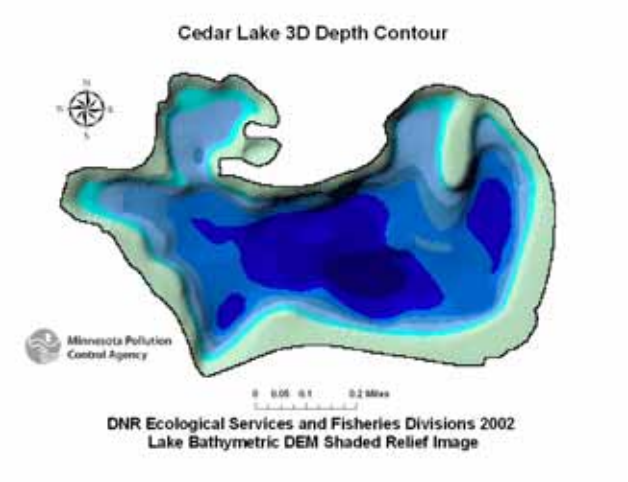

Figure 2. Cedar Lake Watershed land use

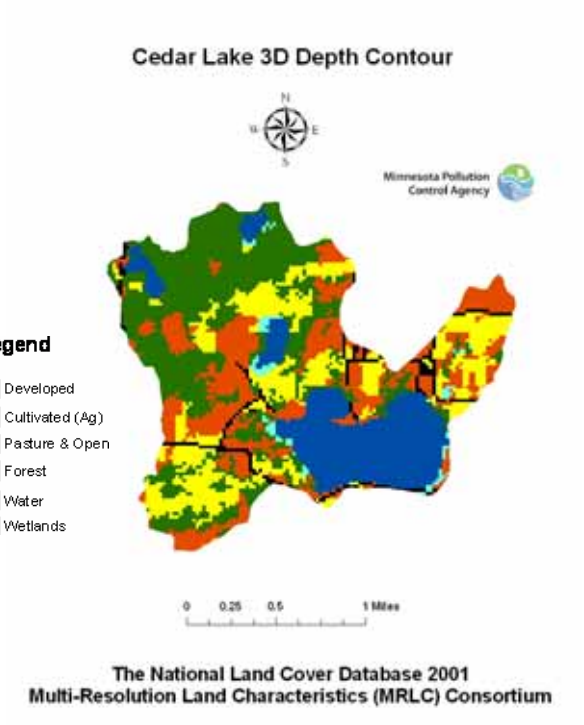

Table 1. land use compositions

Land use	Cedar Lake land use percentage	NCHF typical land use percentage
Developed	4	2 - 9
Cultivated (Ag)	20	22 - 50
Pasture & Open	22	11 - 25
Forest	34	6 - 25
Water & Wetland	20	14 - 30
Feedlots (#)	1	

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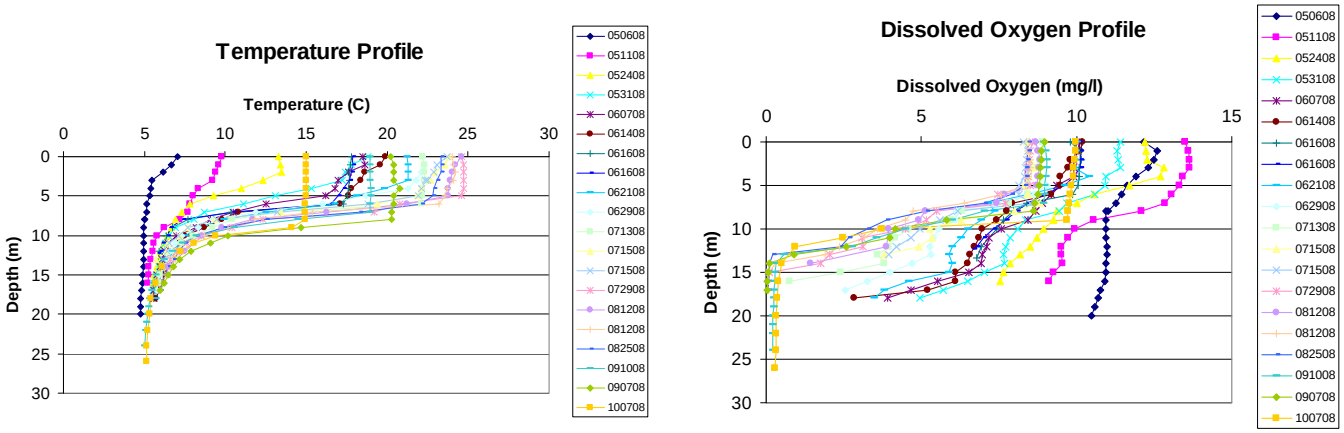
Table 2. Cedar Lake summer-mean as compared to typical range for NCHF ecoregion reference lakes MPCA data based on 1985-86 and 2008 sample collections

Parameter	Cedar Lake	NCHF
Number of reference lakes		35
Total Phosphorus (µg/L)	13	23 – 50
Chlorophyll mean (µg/L)	3.3	5 – 22
Secchi Disk (meters)	4.0	1.5 – 3.2
Total Kjeldahl Nitrogen (mg/L)	0.5	< 0.6 – 1.2
Nitrite + Nitrate-N (mg/L)	< 0.05	< 0.01
Alkalinity (mg/L)	150	75 – 150
Color (Pt-Co U)	5	10 - 20
pH (SU)	8.4	8.6 – 8.8
Chloride (mg/L)	5.9	4 – 10
Total Suspended Solids (mg/L)	1.2	2 - 6
Total Suspended Inorganic Solids (mg/L)	1.6	1 - 2
Conductivity (umhos/cm)	303	300 - 400
TN:TP ratio	38:1	25:1 - 35:1

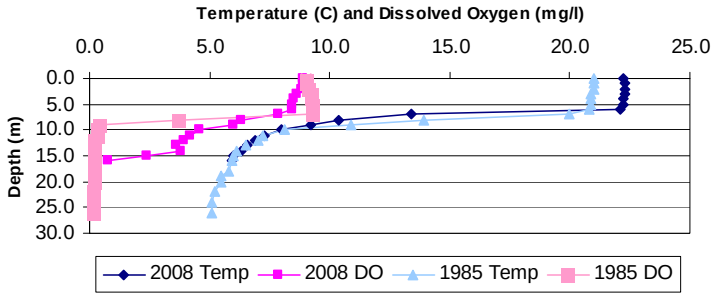
µg/L = micrograms per liter
mg/L = milligrams per liter
umhos/cm = micromhos per centimeter

Pt-Co-U = Platinum Cobalt Units
SU = Standard Units

Figure 3. Cedar Lake 2008 monthly dissolved oxygen (DO) and temperature profices



July Profiles: 1985 and 2008



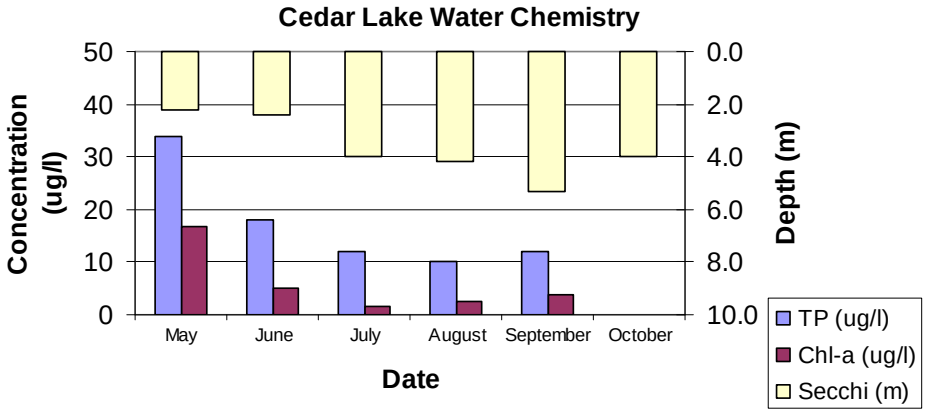
Watershed and water quality summary

Cedar Lake is a clear, deep lake located just west of Upsala, Minnesota. The lake has moderate development, limited primarily to the north and eastern shorelines. A public access was recently added in 2005, increasing access opportunities for area residents. The lake currently sees heavy recreational use from camp, park, and campground visitors (canoe, paddle boat, swimming) and moderate fishing use. Cedar Lake is one of the ecoregion reference lakes sampled by MPCA in 1985-1986.

Cedar Lake was sampled for chemistry six times during the summer of 2008 by Minnesota Pollution Control Agency (MPCA) staff. Secchi depth, temperature, and dissolved oxygen (DO) profiles were collected by both staff and volunteer monitor Jim Drill. The lake was well mixed in mid May. The lake was stratified and developed a thermocline at a depth of 5 to ten meters from June through October (Figure 3). Fall mixing had not yet been completed by October 7. In July and August below a depth of 7 meters DO dropped below the 5 mg/l necessary to support game fish. A comparison of profiles from 1985 and 2008 show a similar pattern for both temperature and dissolved oxygen (Figure 3).

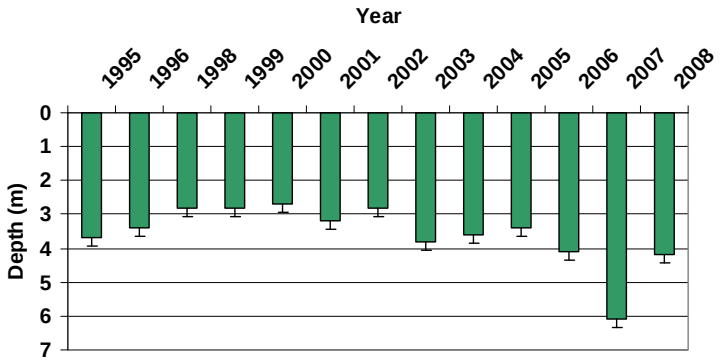
The trophic status indicators and other water quality data for Cedar Lake were within or better than the typical range for minimally impacted NCHF lakes (Table 2). Total phosphorus (TP) and chlorophyll-a (Chl-a) are high in May as a result of spring overturn and possibly a diatom bloom. TP declines over the summer as a result of algal uptake and sedimentation. Chl-a remains quite low over the summer and Secchi depth remains between 4-5 m over the summer (Figure 4).

Figure 4. 2008 Cedar Lake trophic state parameters



Long-term Secchi disk data are available from 1995 to 2008 for Cedar Lake (Figure 5). Based on this record, summer-mean Secchi typically ranges from 2.8 to 6.1 meters, which is within or exceeds (is better than) the typical range for a lake in the North Central Hardwood Forests ecoregion. Based on available data, a strong improving trend in transparency is evident on Cedar Lake.

Figure 5. Long-Term Summer-Mean Secchi Transparency



Fishery and aquatic plant survey summary

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

Species	Stocked	Abundance	Trend	Size
Walleye*	Y	Average	Introduced 2001	Large
Northern Pike*	N	Average	Stable	Large
Black Crappie	N	Low	Stable	Large
Largemouth bass	N	High	Stable	Small
Bluegill	N	Average	Stable	Small
White sucker	N	Average	Stable	Large
Cisco	N	Unknown	Unknown	Small
Yellow perch	N	Low	Stable	Small

*Management emphasis on these species

Table 4. Aquatic Plant Summary

Percent cover of aquatic plants ≤ 15ft deep:	95%
Lake depth at which most vegetation disappeared:	10ft
Number of common species (i.e., > 10% cover):	13
Infested with non-native plants:	Curly-leaf pondweed (lightly)
Frequency of Chara:	79%

Compared with the other 23 sentinel lakes, Cedar Lake is among the best in terms of habitat conditions and fish populations. Cedar harbors seven fish species intolerant to disturbance and two vegetation-dwelling species of special concern: the pugnose shiner and least darter. A “conservation” size and harvest regulation for walleye, northern pike, and black crappie implemented in 2002 combined with a population of dwarf cisco (a fatty cold-water fish), is presumably responsible for the high quality populations of the named species. Aquatic plants are diverse but dominated by Chara. Chara is an architecturally complex species that provides quality habitat for juvenile fish and sensitive species. Indeed, two nearshore species of special concern were found in Cedar Lake: the pugnose shiner, and least darter. Chara is also an important resilience mechanism in lakes that maintains high water clarity. Although curly-leaf pondweed is present in the lake, this species does not usually grow to nuisance levels in clear mesotrophic lakes like Cedar with an abundance of native species. Protective policies that limit nutrients entering the lake and the removal of aquatic plants are critical for maintaining water quality and the sensitive cisco population. . The “biotic integrity” score for Cedar was 131, which is well above average compared with other lakes of similar productivity.