Report on Activities

Spooner Lake

Wisconsin Department of Natural Resources
Lake Management Planning Grant

LPL-914-04

June 2005

Prepared for:

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Project 3060-003

6.13.05

INTRODUCTION

Spooner Lake District applied for and received a lake management planning grant in November, 2003 (Grant Number LPL-914-04). This grant included the following objectives:

- Contract with the USGS to conduct comprehensive in-lake sampling.
- Contract with the WDNR State Lab of Hygiene to provide water quality analysis.
- Contract with Cedar Corporation to conduct:
    - o An analysis of land use, both existing and future.
    - o An analysis of soil types in the watershed.
    - o A delineation of the Spooner Lake Watershed and the various sub-watersheds in the basin.
    - o An evaluation of the work completed by the WDNR and the USGS.
    - o Development of storm water runoff coefficients (curve numbers) for the various sub-watersheds for both existing and future land use.
    - o Develop an understanding of the changes in 2002 vs. 2004lake water quality with respect to weed control measures conducted in 2002.

Attachments to this report include:

- DNR "Spooner Lake Sensitive Area Survey Report and Management Guidelines".
- USGS April 14, 2005 report, "Water Quality and Lake-Stage Data for Spooner Lake near Spooner, WI for 2004 – Data Summary".
- Cedar Corporation maps of existing and future land use, watershed delineation and soil types, curve numbers (runoff coefficient) for existing and future land use for each delineated subwatershed, and the different in runoff coefficients.

SENSITIVE AREA SURVEY

The DNR conducted the sensitive area surveys on Spooner Lake in the summer of 2000 and generated the attached report. The report designates nine areas (see map) as "sensitive" around the lakeshore and primarily in those areas adjacent to wetlands or having low human development density or desire. The areas are considered sensitive due to the numerous and varied plant and animal species present. These areas are considered prime fish habitat and spawning areas.

USGS STUDY

The USGS conducted a comprehensive sampling program in the summer of 2004 (report attached). The objective of this study is two-fold.

1. a. Collect and laboratory analyze water quality data on a comprehensive basis.

   b. Compare the data with past data collected in 2002.

   c. Define differences in the data sets.

2. Evaluate if the differences observed are due to changes in aquatic plant management methods.

The USGS report describes the lake water quality in terms of temperature, dissolved oxygen, total phosphorus concentration, chlorophyll-a population, Secchi depths, and Trophic State Indices. All indices in 2004 indicate better water quality present than in 2002. The most obvious of these is improved water clarity. The report presents the data comparison, but does not develop conclusions as to why the water quality is better in 2004 vs. 2002. However, higher concentrations of dissolved oxygen at depth and lower phosphorus concentrations are considered the principal factors for this improvement. Discussions with the USGS regarding the comparison developed two themes for the improved water quality.

1. Weather

   2002 was a warmer and sunnier year than 2004. Increased sunlight and warmer water temperatures were present early in 2002. In fact, water temperatures in 2004 rarely exceeded those of 2002 and remained linear with depth. Whereas, in 2002 temperatures developed stratification early in the summer and remained stratified (high at surface, low at depth) all summer. This suggests the lake water was well mixed in 2004 and may have contributed to improved dissolved oxygen mixing which could reduce the quantity of phosphorus released from bottom sediments as the mixing conditions persist.

2. Reduced Plant Debris

   Weed harvesting or spraying has not been completed on Spooner Lake since 2002. During this effort plant detritus not removed from the lake falls to the lake bottom and the process of decay takes place. Aerobic decay occurs quickly and is limited to available oxygen (dissolved) in the water and water saturated soils. This dissolved oxygen reduction exacerbates the low DO conditions observed in the summer in stratified lakes. The consumption of available DO does not limit decay processes which continue under anaerobic conditions. Under anaerobic conditions, certain microbes utilize phosphorus in the soils and convert it to a nutrient and release it into the water. This nutrient promotes algae growth reducing water clarity and water quality. The lack of weed harvesting and/or chemical spraying for the 2 years prior to the USGS study may, therefore, be contributing to the better water quality.

SOIL TYPES AND WATERSHED DELINEATION

Figure 1 identifies the boundaries of the immediate Spooner Lake Watershed. Activities within this watershed can directly affect the water quality of the lake. The immediate lake watershed is divided into 19 sub-watersheds. Each sub-watershed is internally draining to an outlet whether it is a swale, a stream, other water body (wetland or lake), or an internal depression.

Soil types are designated in many ways, but of particular interest in lake planning is the characteristic of soil permeability. Soil scientists classify soils as A, B, C, or D from highly permeable soils to those with low or no permeability. Soils with a greater permeability characteristically generate less runoff during precipitation and snow-melt events.

The principal soil types in the Spooner Lake Watershed are identified as A, B, and C with some D soils located in the wetland areas. This means the majority of the watersheds are characterized with permeable soils.

LAND USE

Land use in the watershed has an impact on water quality. Figures 2 and 3 identify the various land uses for existing and future land use, respectively. Much of the existing land use area is as forest and wetlands, and these areas remain constant over time with some minor changes. Watersheds O and N are on the west side of the lake and are forecast to experience the greatest changes from forested and agricultural to commercial/residential.

RUNOFF COEFFICIENTS (CURVE NUMBERS)

Understanding soil types and land use is an important function in developing a method to compare the quantity of runoff water from one local to the next. Roofs and paved surfaces (asphalt, concrete, or compacted) generate more runoff than forested areas. Scientists and engineers have developed mathematical formulas to represent runoff and these are presented as coefficients or curve numbers. The higher the value (maximum 100) the greater the runoff. Runoff coefficients have been computer for both existing (Figure 5) and future (Figure 6) land use. Comparisons of runoff coefficients can be evaluated to present an easy method to identify target areas for runoff controls as future development expands in the sub-watershed (Figure 7). This figure shows that higher runoff is anticipated in the areas of increased development (watersheds N and O). These areas will need to have storm water runoff controls in place to reduce negative water quality impacts on Spooner Lake.

Spooner Lake Integrated Sensitive Area Survey Report

Date of Survey: 29 August 2000 Number of Sensitive Areas: 9

Site Evaluators: Larry Damman, Fisheries Biologist 635-4089
Ken Jonas, Wildlife Biologist 635-4091
Mark Sundeen, Aquatic Plant Specialist 635-4074
Kurt Roblek, Water Resources Biologist 715-537-5042

Lake Sensitive Area Survey results identified nine areas that merit special protection of the aquatic habitat.

Wild rice (Zizania sp.) was documented as occurring in sensitive areas E and H. Wild rice holds an important niche in the lake ecosystem from both a human and wildlife standpoint. The stands of wild rice are small and therefore fragile. Care should be taken to allow for the increase of these small populations.

During this survey there were no documented occurrences of Purple Loosestrife. However, the threat of Purple Loosestrife is always a concern and should be dealt with immediately. Methods for control are to remove the entire plant before it produces seeds or by cutting the flower head and spraying with and approved herbicide. You should contact the Department before any of these methods are implemented.

The reader should consider that any buffer that does not extend back from the water edge at least 35' is not providing adequate protection for water quality and should be expanded to at least 35'. Local zoning ordinances and lakes classification systems have tried to provide better guidelines pertaining to buffer widths and set backs based on lake type. Landowners are encouraged to go beyond the minimum requirements laid out by zoning and consider extending buffer widths to beyond 35' and integrating other innovative ways to capture and reduce the runoff flowing off from their property while improving critical shoreline habitat. Berms and low head

retention areas can greatly increase the effective capture rate from developed portions in addition to that portion captured within the buffer.

Site conditions may dictate that a buffer has to be much wider than 35' to be effective at capturing the sediments and nutrients running off the developed portions of the shoreline. If the shoreline is steeply sloped (>7%slope) greater widths should definitely be used.

No mowing should take place within the buffer area (with the exception of a narrow access trail and small picnic area), and trees and shrubs should not be cut down even when they become old and die; because they provide important woody debris habitat within the buffer zone as well as aquatic habitat when they fall into the lake.

The following is a brief summary of the Spooner Lake sensitive area sites and the management guidelines. Also, the "Guidelines for Protecting, Maintaining, and Understanding Sensitive Areas" provides management guidelines and considerations for different lake sensitive areas (Attached).

I. Aquatic Plant Sensitive Areas

The following sensitive areas contain aquatic plant communities, which provide important fish and wildlife habitat as well as important shoreline stabilization functional values. Sensitive areas provide enough important habitat for the Spooner Lake ecosystem that conservation easements, deed restrictions, or zoning should be used to protect them. Management guidelines for aquatic plant sensitive areas are (unless otherwise specifically stated):

1. Limit aquatic vegetation removal to navigational channels no greater than 25 feet wide where necessary, the narrower the better. These channels should be kept as short in length as possible and it is recommended that people do not completely eliminate aquatic vegetation within the navigation channel; but instead only remove what is necessary to prevent fouling of propellers to provide access to open water areas. Chemical treatments should be discouraged and if a navigational channel

must be cleared, pulling by hand is preferable over mechanical harvesters where practical.

2. Prohibit littoral zone alterations covered by Wisconsin Statutes Chapter 30, unless there is clear evidence that such alterations would benefit the lake's ecosystem. Rock riprap permits should not be approved for areas that already have a healthy native plant community stabilizing the shoreline and property owners should not view riprap as an acceptable alternative in these situations.
3. Leave large woody debris, logs, trees, and stumps, in the littoral zone to provide habitat for fish, wildlife, and other aquatic organisms.
4. Leave an adequate shoreline buffer of un-mowed natural vegetative cover and keep access corridors as narrow as possible (preferable less than 30 feet or 30% of any developed lot which ever is less).
5. Prevent erosion, especially at construction sites. Support the development of effective county erosion control ordinances. The proper use of Best Management Practices (BMP's) will greatly reduce the potential of foreign materials entering the waterway (i.e. silt, nutrients).
6. Strictly enforce zoning ordinances and support development of new zoning regulations where needed.
7. Eliminate nutrient inputs to the lake caused by lawn fertilizers, failing septic systems, and other sources.
8. Manage for invasive/exotic species.

Resource Value of Site A

Sensitive area A is located at the mouth of the Yellow River above the dam. This sensitive area covers approximately 600 feet of shoreline extending out as far as 200' in shallower shoreline areas. Most of the length is dominated by a deciduous shrub/scrub wetland and an open/shallow water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average scenic beauty with minimal development.

This area provides important habitat for centrarchid (bass and panfish) and sucker species for spawning, feeding, protection and as a nursery for young.

Esocid (northern pike) will use this area for spawning, feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

Wildlife are also reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

The emergent, floating and submergent plant community structure of Sensitive area A includes: **Emergents**; arrowhead (Sagittaria sp.) and bur-reed (Sparganium sp.). **Floating leafed**; yellow pond lily (*Nuphar advena*). **Submergents**; stoneworts (Nitella sp.), white water buttercup (Ranunculus sp.), elodea, eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), water star grass (Zosterella dubia), fern leaf pondweed (Potamogeton robbinsii), white stem pondweed (P. praelongus), clasping leaf pondweed (P. richardsonii).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

Resource Value of Site B

Sensitive area B is located approximately 400 feet to the East of Sensitive area A and covers 600 feet of shoreline extending out 200 feet. Most of the length is dominated by a deciduous shrub/scrub wetland and an open/shallow water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average scenic beauty with minimal development.

This area provides important habitat for large mouth bass and northern pike. These species will use the area for spawning, feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

Wildlife are also reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

The emergent and submergent plant community structure of Sensitive area B includes: **Emergents;** soft stem bulrush (Scirpus validus), pickerelweed (Pontederia cordata). **Floating;** white water lily (Nympahaea advena). **Submergents;** eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), Naiad (Najas sp.), horned pondweed (Zannichellia palustris), pipewort (Eriocaulon sp.), arrowhead (Saggitaria sp.), floating leaf pondweed (Potamogeton natans), fern leaf pondweed (P. robbinsii), large leaf pondweed (P. amplifolius), white stem pondweed (P. praelongus), fern leaf pondweed (P. richardsonii).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

Resource Value of Site C

Sensitive area C is located on the western shore of Spooner Lake midway down the shoreline. This area covers approximately 400 feet of shoreline extending out 100 feet. Most of this length is dominated by a shrub/scrub and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has good scenic beauty with no development.

This area provides important habitat for centrarchid (panfish) and esocid (northern pike). These species will use this area for spawning, feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

Wildlife are also reliant upon this area for habitat. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area C has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** sedges (Carex sp.), arrowhead (Saggitaria sp.), pickerelweed (Pontederia cordata), cattails (Typha sp.), bur-reed (Sparganium sp.). **Floating leafed**; yellow pond lily (Nuphar advena), duckweed (Lemna sp.). **Submergents;** white water buttercup (Ranunculus sp.), elodea, eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), naiad (Najas sp.), pipewort (Eriocaulon sp.), large leaf pondweed (Potamogeton amplifolius), clasping leaf pondweed (P. richardsonii).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

Resource Value of Site D

Sensitive area D is located on the southwestern shore of Spooner Lake. This area covers approximately 1,400 feet of shoreline extending out 200 feet. Most of this length is dominated by a shrub/scrub and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area rates as outstanding for natural scenic beauty.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike will use this area for spawning. Small mouth bass and panfish will use this area for feeding and protective cover. This area also provides important habitat for forage species.

Wildlife are also reliant upon this area for habitat. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area D has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** pickerelweed (Pontederia cordata), cattails (Typha sp.). **Floating leafed**; yellow pond lily (Nuphar advena), white water lily (Nymphaea odorata). **Submergents;**

elodea, eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), naiad (Najas sp.), large leaf pondweed (Potamogeton amplifolius), white stem pondweed (P. praelongus), clasping leaf pondweed (P. richardsonii), narrow leaf pondweed (P. zosteriformis).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

Resource Value of Site E

Sensitive area E is located on the southern shore of Spooner Lake. This area covers approximately 800 feet of shoreline extending out 200 feet. Most of this length is dominated by a bog and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area rates as outstanding for natural scenic beauty.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and panfish will use this area for spawning, feeding, protection and as a nursery for young. Large mouth bass will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides extremely valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area E has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** soft stem bulrush (Scirpus validus), sedges (Cares sp.), arrowhead (Sagittaria sp.), pickerelweed (Pontederia cordata), cattails (Typha sp.), blue flag iris (Iris versicolor), wild rice (Zizania sp.). **Floating leafed;** yellow pond lily (Nuphar advena). **Submergents;** elodea, coontail (Ceratophyllum demersum), eel grass (Vallisneria americana), narrow leaf pondweed (Potamogeton zosteriformis).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

Resource Value of Site F

Sensitive area F is located on the southeastern shore of Spooner Lake. This area covers approximately 2,400 feet of shoreline extending out 150 feet. Most of this length is dominated by a bog and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has good natural scenic beauty with no development.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides extremely valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area F has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** soft stem bulrush (Scirpus validus), sedges (Carex sp.), arrowhead (Sagittaria sp.), cattails (Typha sp.). **Floating leafed;** duck weed (Lemna sp.), watermeal (Wolffia sp.), yellow pond lily (Nuphar advena), white water lily (Nymphaea odorata). **Submergents;** filamentous alga, coontail (Ceratophyllum demersum), common bladderwort (Utricularia vulgaris), eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), naiad (Najas sp.), floating leaf pondweed (Potamogeton natans), sago pondweed (P. pectinatus), large leaf pondweed (P. amplifolius), white stem pondweed (P. praelongus), clasping leaf pondweed (P. richardsonii), narrow leaf pondweed (P. zosteriformis), curly leaf pondweed (P. crispus).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

Resource Value of Site G

Sensitive area G is located on the eastern shore of Spooner Lake midway down the shoreline. This area covers approximately 500 feet of shoreline extending out 100 feet. Most of this length is dominated by a forested deciduous and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average natural scenic beauty with minimal development.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides extremely valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area G has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** soft stem bulrush (Scirpus validus), pickerelweed (Pontederia cordata), bur-reed (Sparganium sp.) **Floating leafed;** duck weed (Lemna sp.), yellow pond lily (Nuphar advena). **Submergents;** filamentous alga, northern milfoil (Myriophyllum sibiricum), large leaf pondweed (Potamogeton amplifolius), narrow leaf pondweed (P. zosteriformis).

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Resource Value of Site H

Sensitive area H is located on the eastern shore of Spooner Lake north of sensitive area F. This area covers approximately 1,100 feet of shoreline extending out 100 feet. Most of this length is dominated by a bog and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average natural scenic beauty with minimal development.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides extremely valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area H has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** soft stem bulrush (Scirpus validus), arrowhead (Sagittaria sp.), pickerelweed (Pontederia cordata), cattails (Typha sp.), common bur-reed (Sparganium sp.), giant reed grass (Phragmites australis), wild rice (Zizania sp.) **Floating leafed:** yellow pond lily (*Nuphar advena).* **Submergents:** elodea, northern milfoil (Myriophyllum sibiricum), large leaf pondweed (Potamogeton amplifolius), clasping leaf pondweed (P. richardsonii), narrow leaf pondweed (P. zosteriformis).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

Resource Value of Site I

Sensitive area I is located on the northern shore of Spooner Lake. This area covers approximately 1,200 feet of shoreline extending out 100 feet. Most of this length is dominated by a shrub/scrub wetland and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average natural scenic beauty with minimal development.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

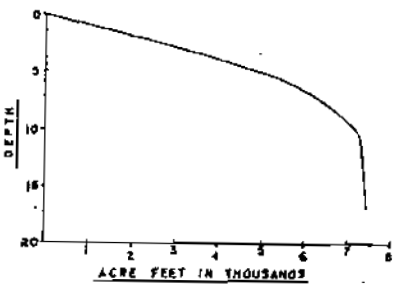
Sensitive area I has a diverse community structure of emergent and submergent aquatic plants including: **Emergents;** pickerelweed (Pontederia cordata), cattails (Typha sp.), common bur-reed (Sparganium sp.), giant reed grass (Phragmites australis). **Submergents;** elodea, eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), water stargrass (Zosterella dubia), naiad (Najas sp.), large leaf pondweed (Potamogeton amplifolius), clasping leaf pondweed (P. richardsonii), narrow leaf pondweed (P. zosteriformis).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

LAKE SURVEY MAP

SPOONER LAKE — WASHBURN COUNTY

SEC. 22,23,26 27,35 T. 39 N. R. 12 W.



B.M. TOP OF EAST CONCRETE HEADWALL OF DAM
ASSUMED ELEV. 100.00'
WATER ELEV. 97.25'

ISLANDS ARE UPLAND HARDWOOD

EQUIPMENT RECORDING SONAR MAPPED JUNE MO. 1964 YR.

WATER ELEV. 97.25

TOPOGRAPHIC SYMBOLS

- (B) Brush
- (PW) Partially wooded
- (W) Wooded
- (C) Cleared
- (P) Pastured
- (A) Agricultural
- B.M. Bench Mark
- Dwelling
- Resort
- Steep slope
- Indefinite shoreline
- Marsh
- Spring
- Intermittent stream
- Permanent inlet
- Permanent outlet
- Dam

LAKE BOTTOM SYMBOLS

P. Peat	Gr. Gravel
Mk, Muck	R. Rubble
C. Clay	Br. Boulders
M. Marl	V. Submergent vegetation
Sd. Sand	E. Emergent vegetation
Si. Silt	F. Floating vegetation

1,000' 0' 1,000' 2,000' 3,000' 4,000' 5,000'
SCALE

Access — Access with Parking — Boat Livery

Field work by B. Hoehn, M. Perkins & Salter Drawn by: R. Falco

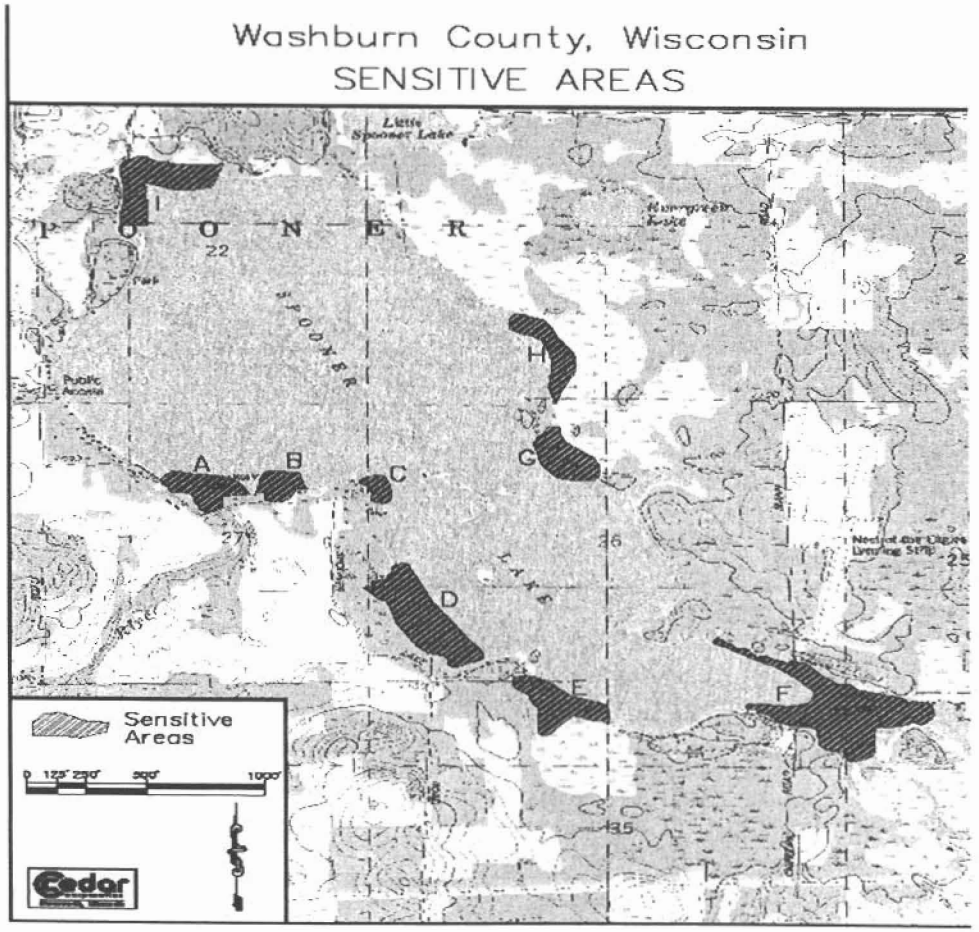
SPECIES OF FISH

	Abundant	Common	Rare
Muskie			
N. Pike	X		
Walleye			X
L.M. Bass		X	
S.M. Bass			X
Panfish	X		
Trout			

1,110.5 WITH ISLANDS

AREA 1,092.2 ACRES
UNDER 3FT. 11 %
OVER 20FT. 0 %
VOLUME 7,390.4 ACRE FT.
TOTAL ALK. 77 P.P.M.
SHORELINE 11.2 MILES
MAX. DEPTH 17 FEET

SPOONER LAKE



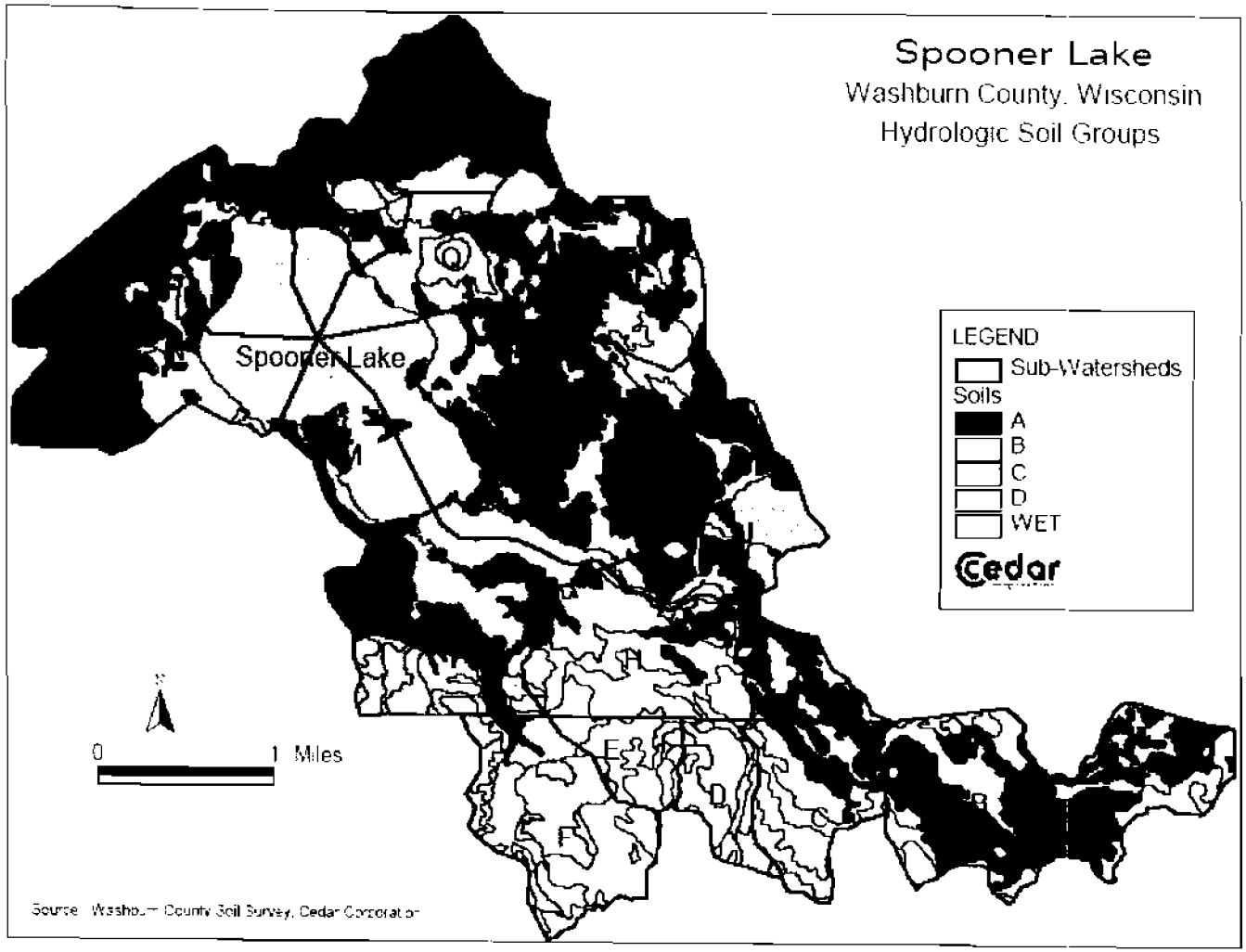

Spooner Lake
Washburn County, Wisconsin
Hydrologic Soil Groups
LEGEND
Sub-Watersheds
Soils
A
B
C
D
WET
Cedar
Spooner Lake
N
0
1 Miles
Source: Washburn County Soil Survey, Cedar Corporation

FIGURE 1

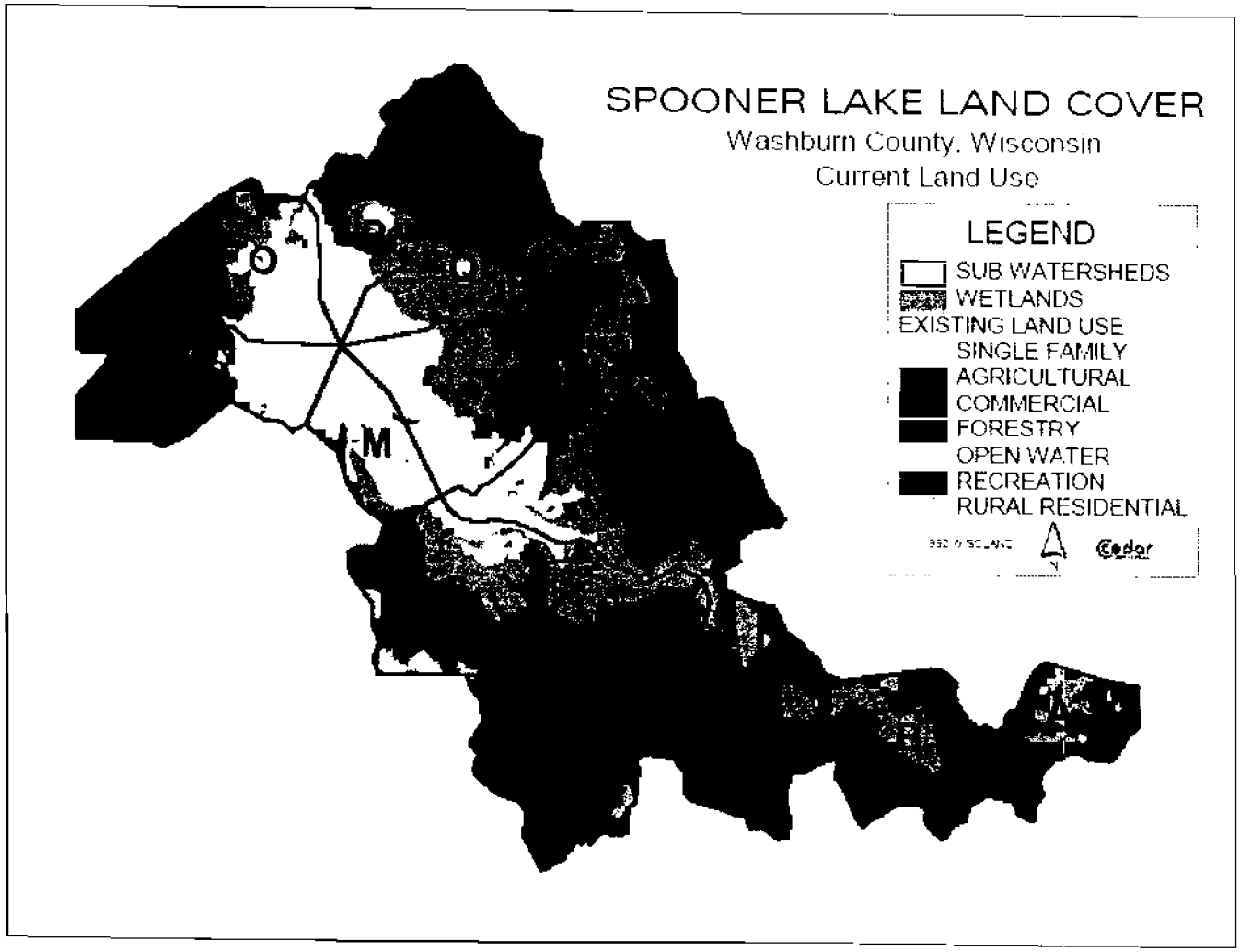

SPOONER LAKE LAND COVER
Washburn County, Wisconsin
Current Land Use
LEGEND
SUB WATERSHEDS
WETLANDS
EXISTING LAND USE
SINGLE FAMILY
AGRICULTURAL
COMMERCIAL
FORESTRY
OPEN WATER
RECREATION
RURAL RESIDENTIAL
Cedar

FIGURE 2

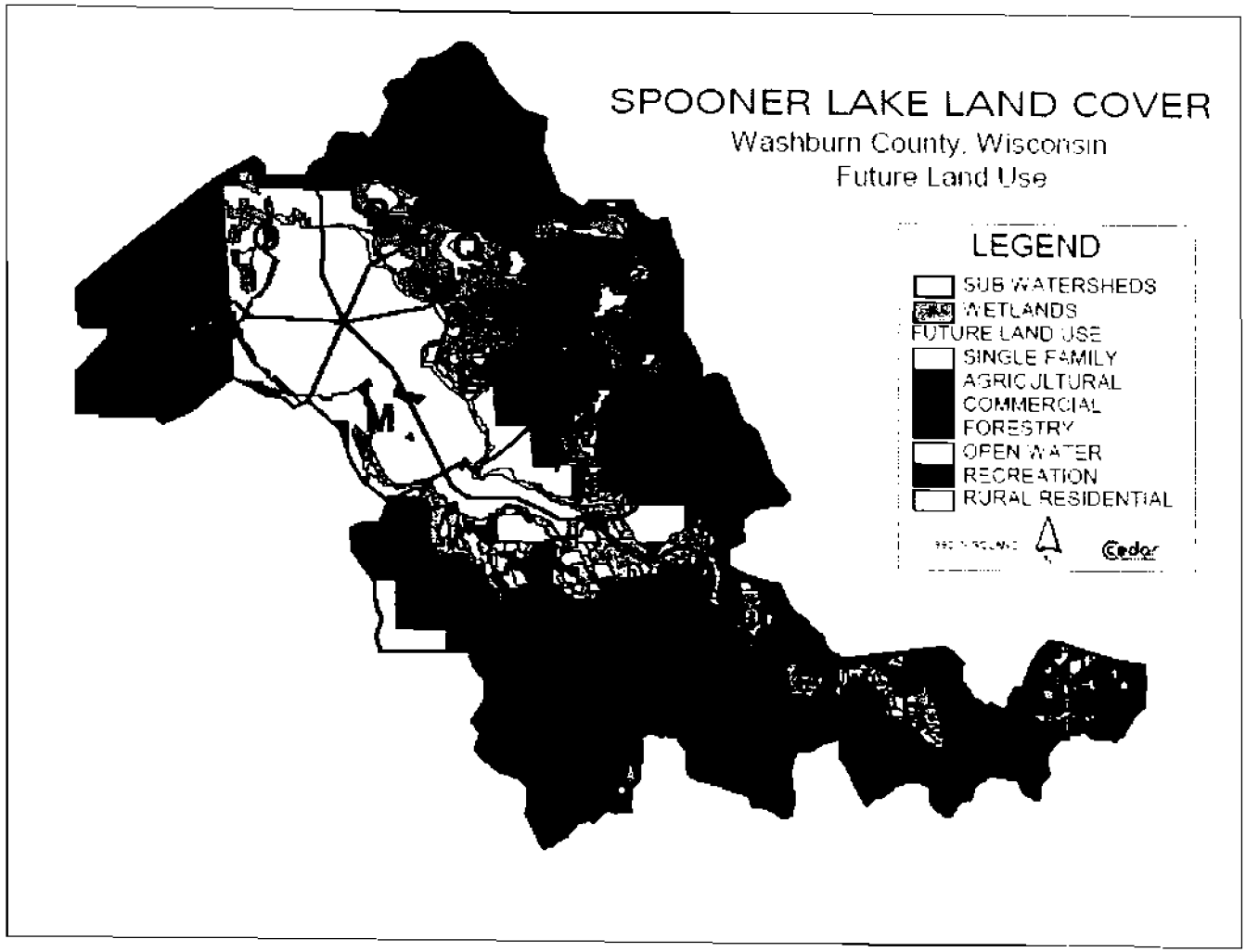

SPOONER LAKE LAND COVER
Washburn County, Wisconsin
Future Land Use
LEGEND
SUB WATERSHEDS
WETLANDS
FUTURE LAND USE
SINGLE FAMILY
AGRICULTURAL
COMMERCIAL
FORESTRY
OPEN WATER
RECREATION
RURAL RESIDENTIAL
Cedar

FIGURE 3

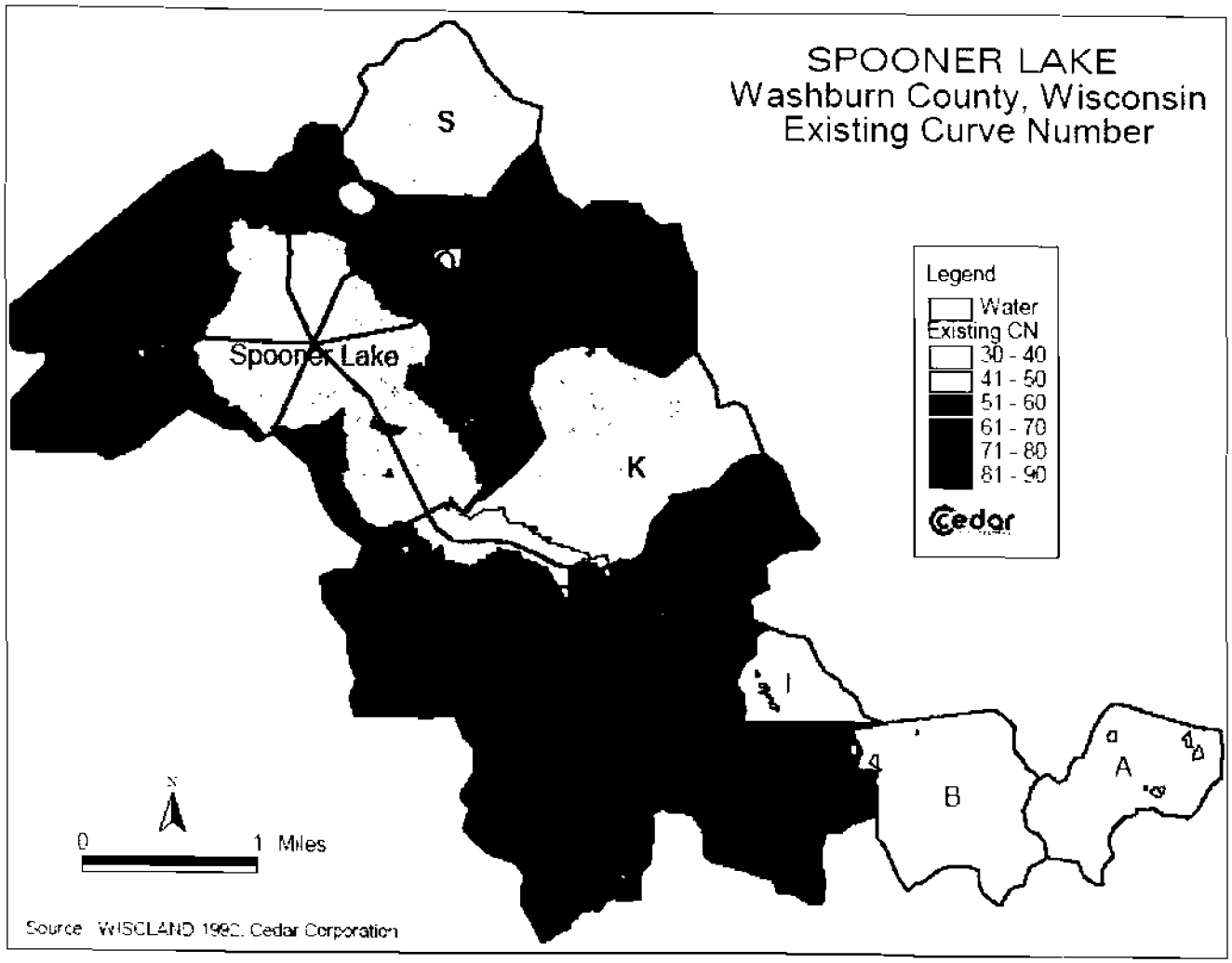

SPOONER LAKE
Washburn County, Wisconsin
Existing Curve Number
Legend
Water
Existing CN
30 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
Cedar
S
Spooner Lake
K
I
B
A
N
0
1 Miles
Source: WISCLAND 1992, Cedar Corporation

FIGURE 4

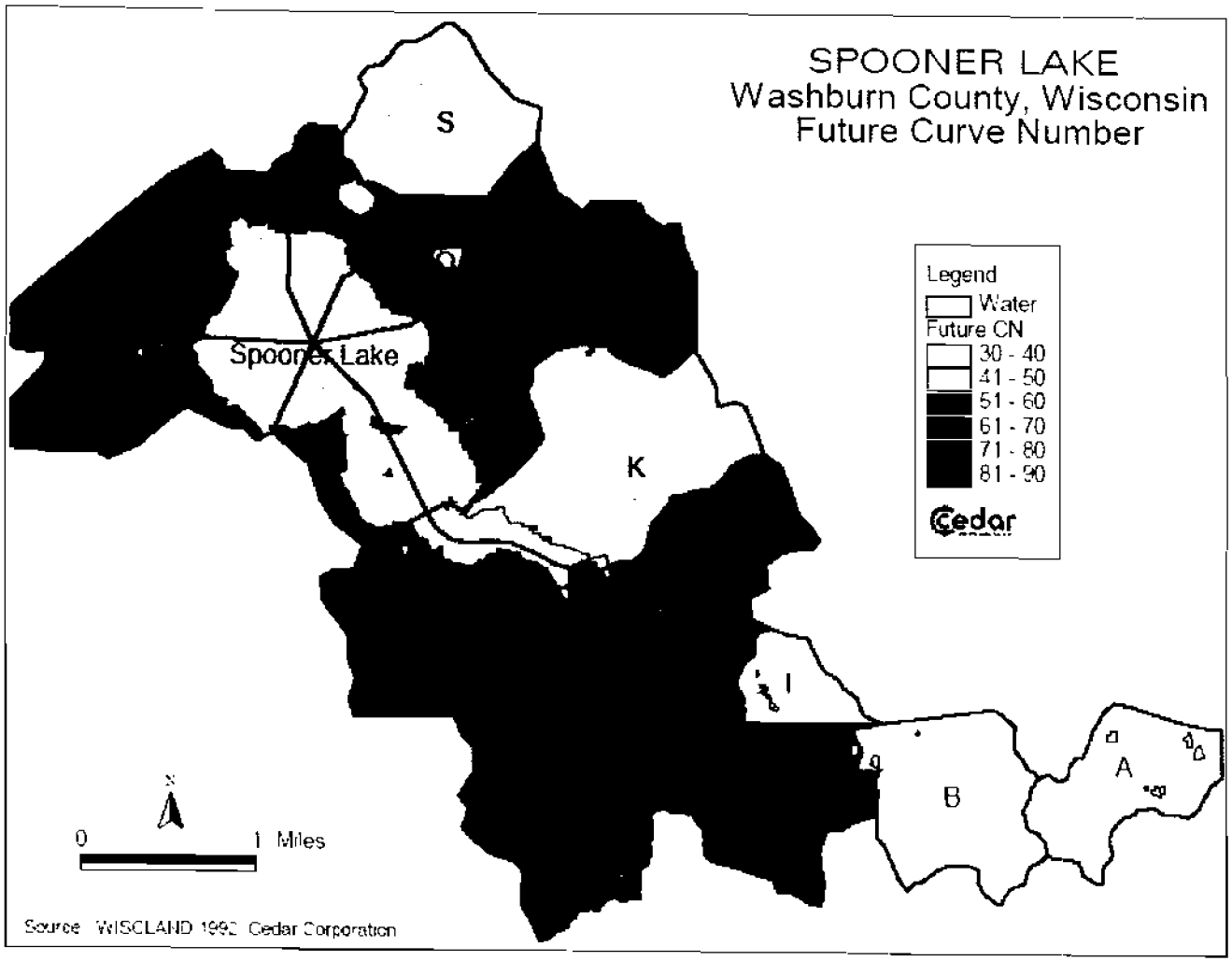

SPOONER LAKE
Washburn County, Wisconsin
Future Curve Number
Legend
Water
Future CN
30 - 40
41 - 50
51 - 60
61 - 70
71 - 80
81 - 90
Cedar
S
Spooner Lake
K
I
B
A
N
0
1 Miles
Source: WISCLAND 1992 Cedar Corporation

FIGURE 5

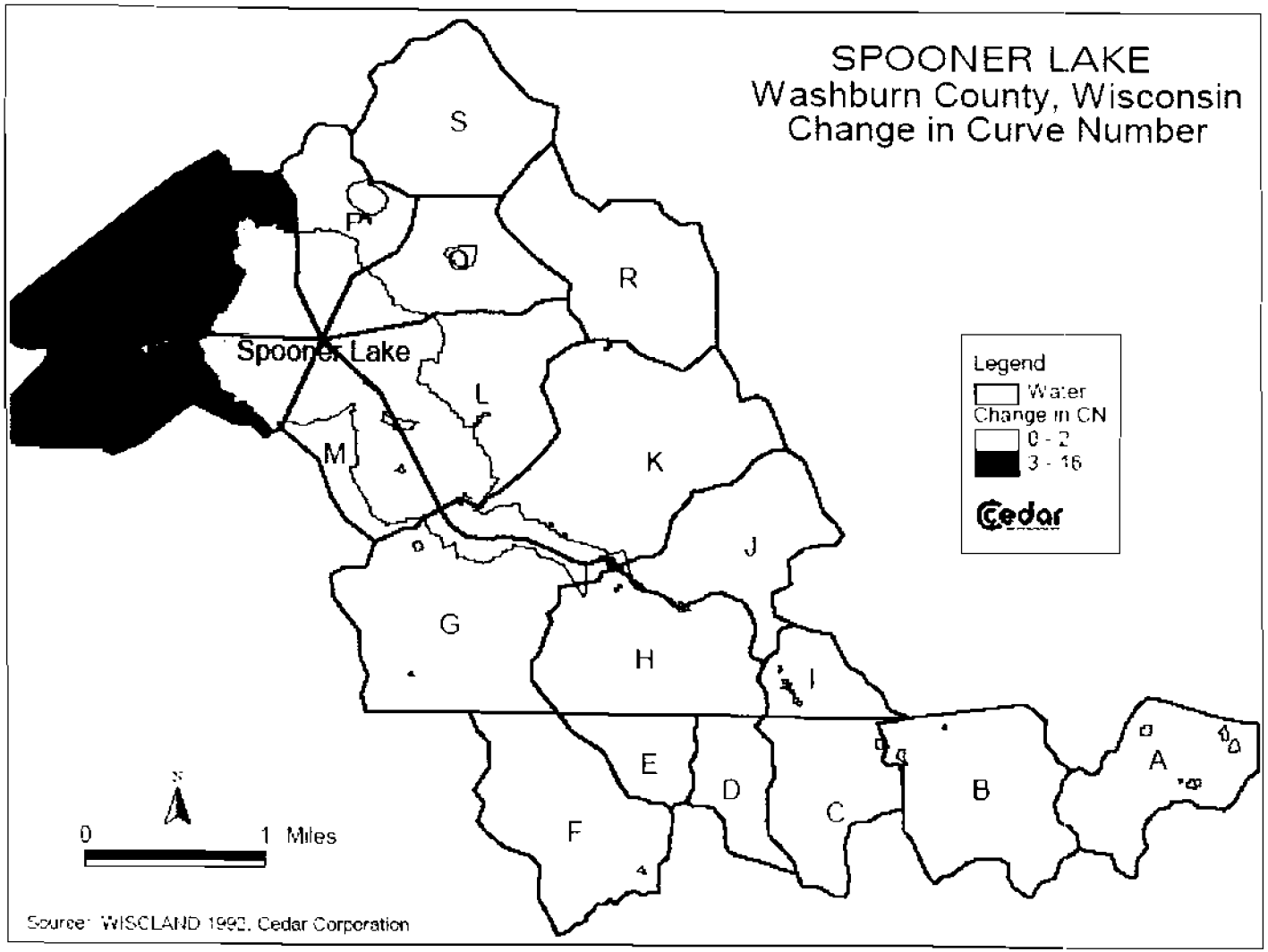

SPOONER LAKE
Washburn County, Wisconsin
Change in Curve Number
Spooner Lake
S
P
R
L
M
K
J
G
H
I
E
D
C
B
A
F
Legend
Water
Change in CN
0 - 2
3 - 16
Cedar
0
1 Miles
Source: WISCLAND 1992, Cedar Corporation

FIGURE 6

Water Quality and Lake-Stage Data for Spooner Lake near Spooner, Wisconsin for 2004

Data Summary

This summary contains all data that were collected by US Geological Survey for Spooner Lake District as part of the program that was partially funded by Wisconsin Department of Natural Resources Lake Planning Grant LPL-914. The monitoring in 2004 was a follow-up to monitoring that was done in 2002 and 2003, which was partially funded by Lake Planning Grant LPL-814. In 2002 considerable macrophyte control spraying was done. No macrophyte spraying was done in 2004. A primary purpose of the 2004 monitoring was to obtain data to compare conditions in the lake during a year with no spraying with conditions in 2002.

All data collected in 2004 are included in this summary. Some of the data collected in 2002 and 2003 are included in selected graphs and tables to facilitate comparison of conditions between years.

United States Geological Survey
Madison, Wisconsin

Prepared by
W.J. Rose

April 14, 2005

Lake description and sampling locations:

Spooner Lake is classified as a drainage lake, having one main inlet (Crystal Brook) and an outlet (Yellow River). The average depth of the lake is 7 feet and maximum depth is 17 feet, and surface area is 1092 acres ("Wisconsin Lakes" Wisconsin Department of Natural Resources, PUB-FH-800, 2001). The Lake's watershed area, including the lake, is 31.1 square miles, (Drainage Area Data for Wisconsin Streams", Henrich and Daniel, 1983, USGS Open-File Report 83-933).

Two sites in the lake were sampled for water quality. Lake stage was measured at the dam at the lake's outlet. Locations of these sites are shown in Figure 1.

Lake water quality:

Lake-depth profiles:

Vertical profiles of water temperature, dissolved oxygen, pH, and specific conductance are typical of those for a shallow lake. Profile data in Tables 1 indicate alternate periods of thermal stratification and mixing at the deep-hole sampling site. As shown in the graphs in figure 2 there was strong oxygen stratification and oxygen depletion in the lower 10 feet at the deep-hole sampling site by late summer of 2002 and little depletion in 2004. There was little oxygen depletion at the southeast sampling site in 2002 and in 2004 (table 2).

2004 chemical constituents:
Chemical constituent values for sampling dates in 2004 for both the Deep-Hole and Southeast sites are listed in tables 3 and 4. Differences in values for near-surface and near-bottom samples generally were small, as would be expected given the relatively mixed conditions in 2004.

Trophic-state indices:

Three common measures of water quality, which are used as indices, are concentrations of near-surface total phosphorus and chlorophyll a, and Secchi depth. These data are given in tables 5 and 6 and graphed in figures 3-6. The data for all three indices indicate significant decline in quality from June through August 2002 at the deep-hole site. However, a similar decline in quality did not occur at the deep-hole site in 2004. Water quality at southeastern sampling site in 2004, as indicated by these indices, was similar to that of 2002.

Trophic status:
Another means of assessing the nutrient, or trophic, status of a lake is to compute trophic state indices (TSIs). The TSIs were developed to place phosphorus and chlorophyll a concentration and Secchi depth data on a common scale. TSI equations for Wisconsin Lakes developed by Lillie and others in "Trophic State Index

Equations and regional predictive equations for Wisconsin Lakes," WDNR Management Findings, no. 35, 1993. These data are summarized in tables 5 and 6 and graphed in figure 7 show water quality conditions in Spooner Lake to be solidly in the eutrophic range in 2002. However, by late summer 2004, conditions at the deep-hole site were borderline mesotrophic-to-eutrophic.

Lake Stage:

Lake stage was measured by USGS personnel at sampling visits to the lake and more frequently by a local observer (Joe Banick). Observed lake stages ranged from 6.75 ft to 7.30 ft (table 7and fig. 8)

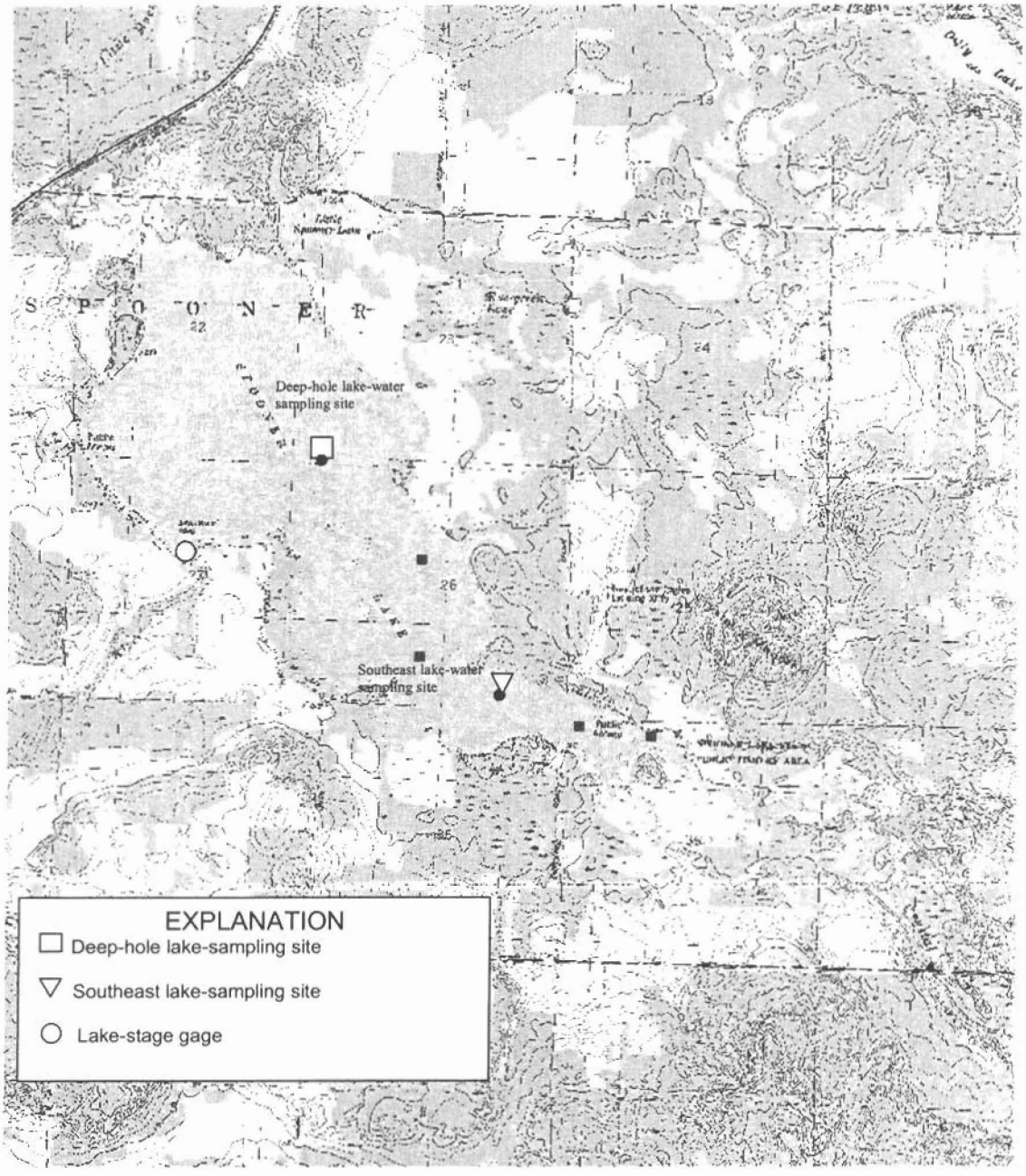


Figure 1. Locations of lake water-quality sampling sites and lake-stage gage in Spooner Lake near Spooner, Wisconsin.

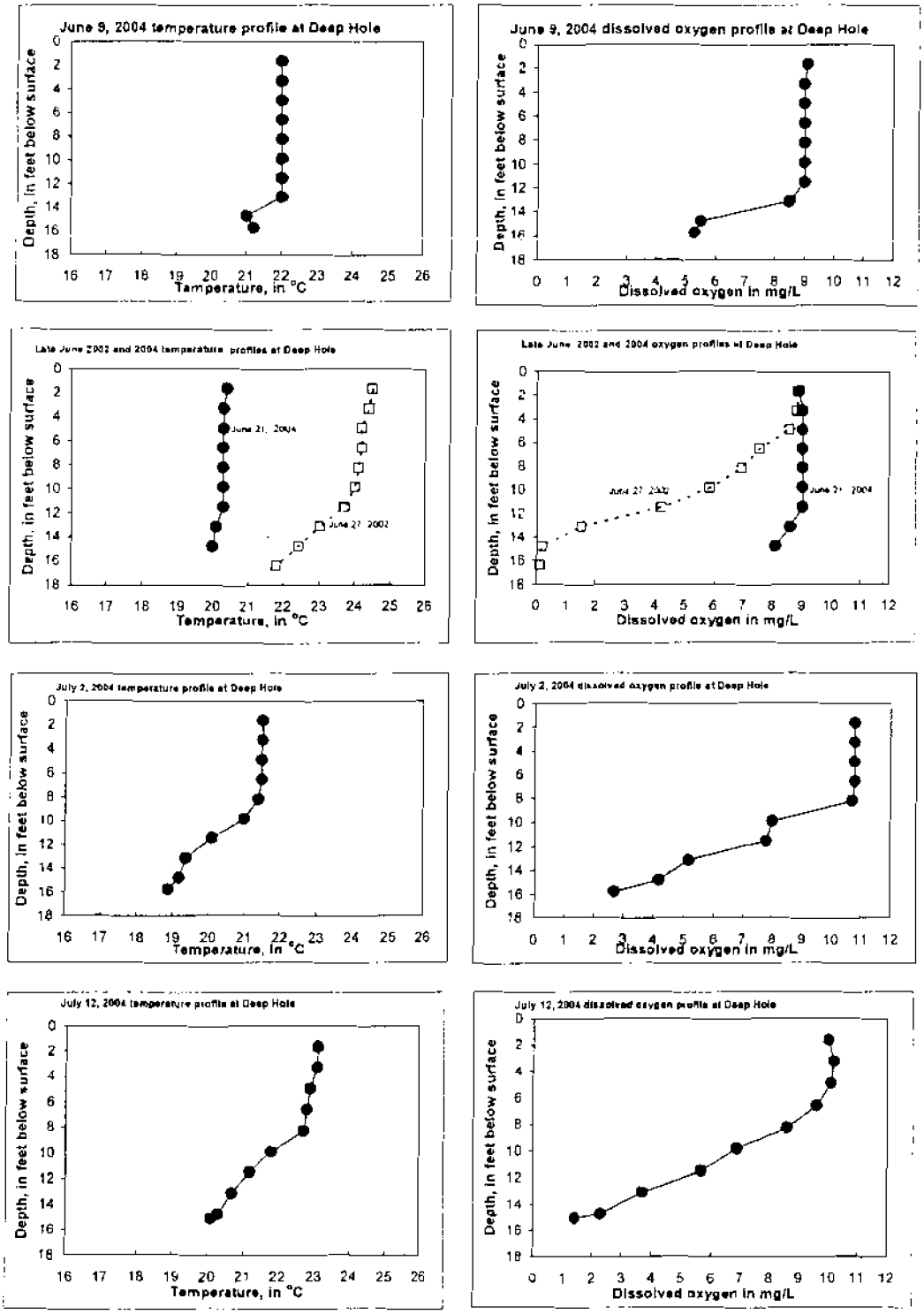


Figure 2. Temperature and dissolved oxygen profiles for Spooner Lake, Deep-Hole Site, 2002 and 2004.

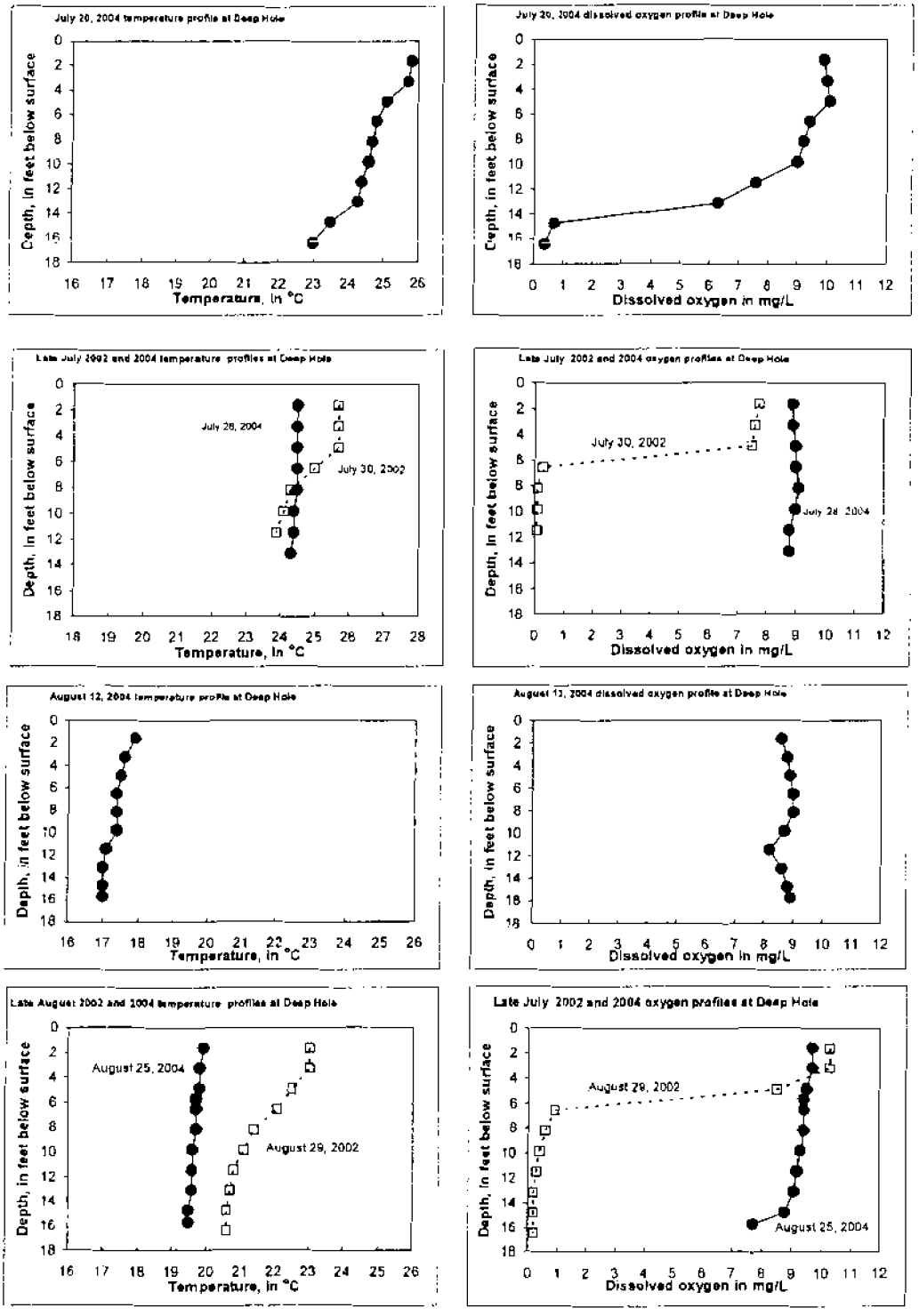


Figure 2. Temperature and dissolved oxygen profiles for Spooner Lake, Deep-Hole Site, 2002 and 2004--cont.

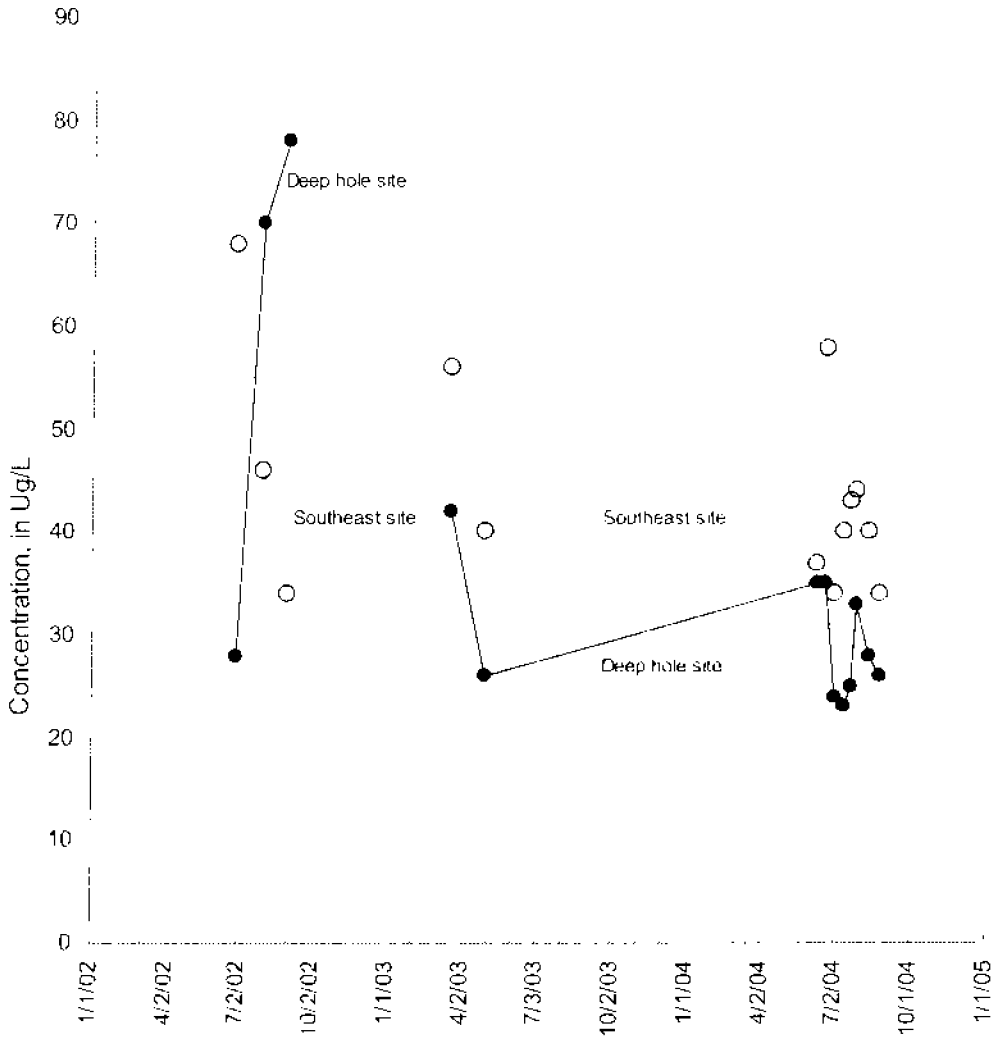


Figure 3. Total phosphorus concentrations for Spooner Lake, June 2002 – August 2004.

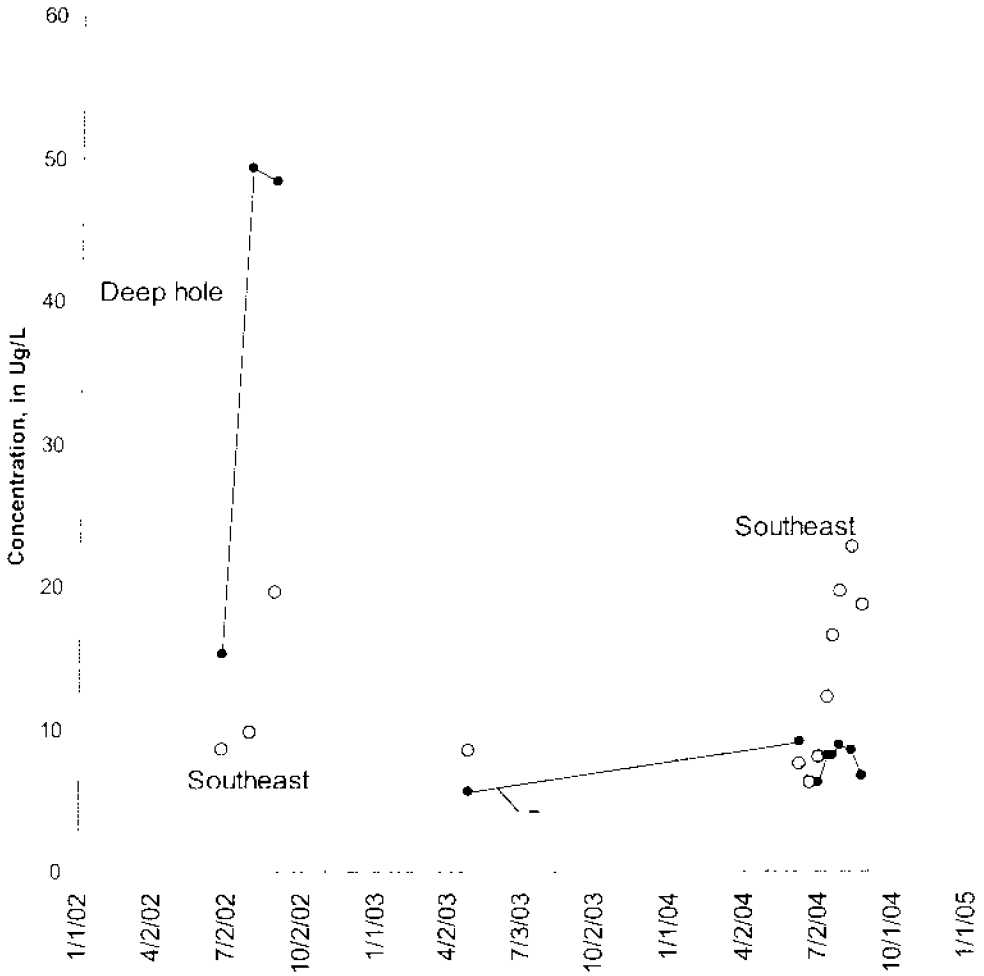


Figure 4. Chlorophyll a concentrations for Spooner Lake, June 2002 – August 2004.

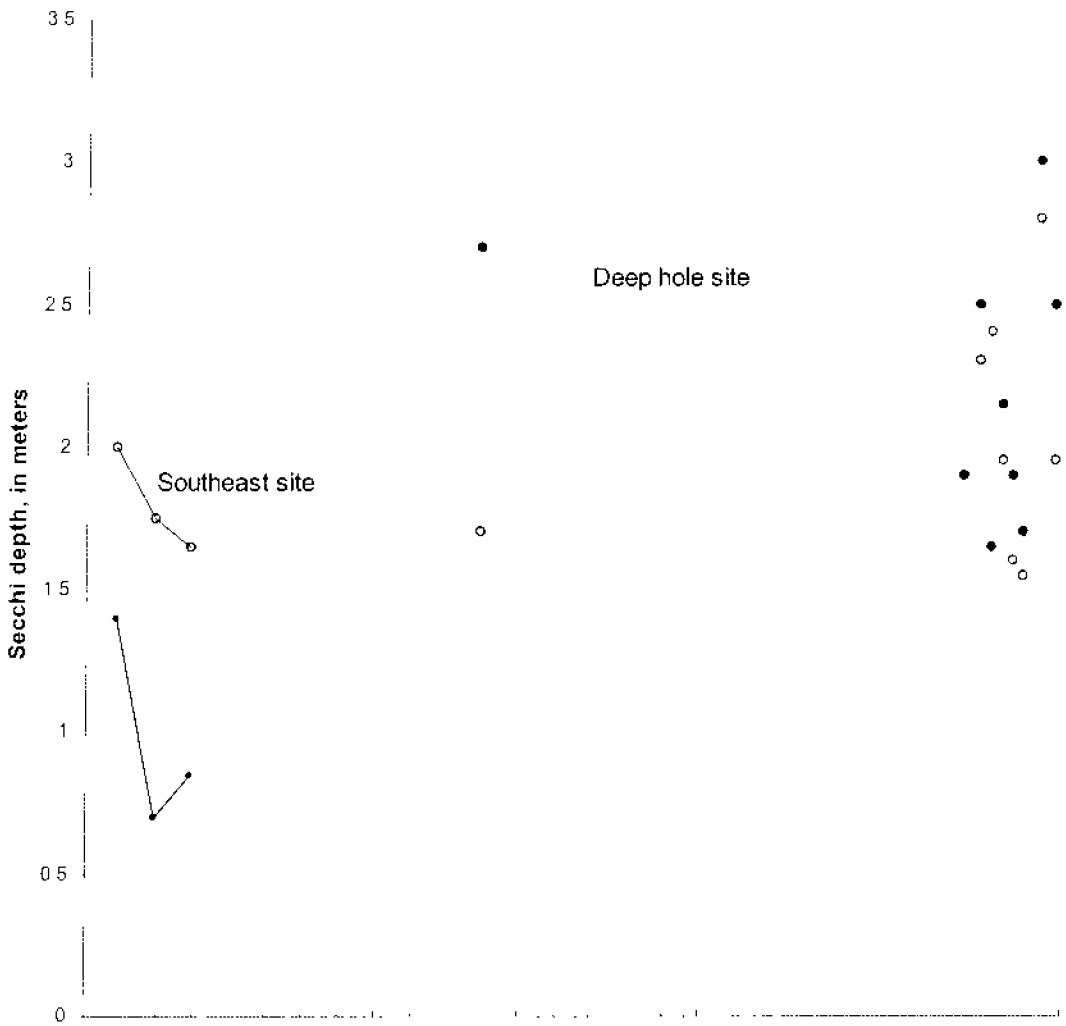


Figure 5. Secchi depths for Depths for Spooner Lake, June 2002 – August 2004.

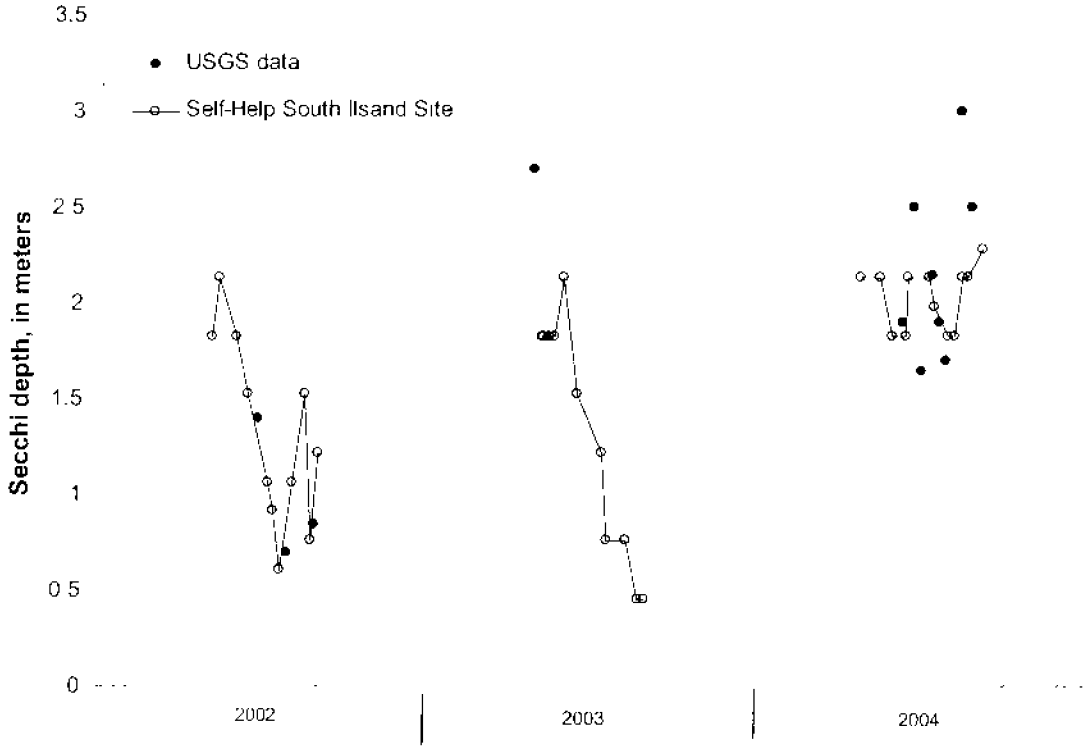


Figure 6. Water clarity (secchi depth) for USGS Southeast Site Self-Help South Island Site, Spooner Lake, 2002 - 2004.

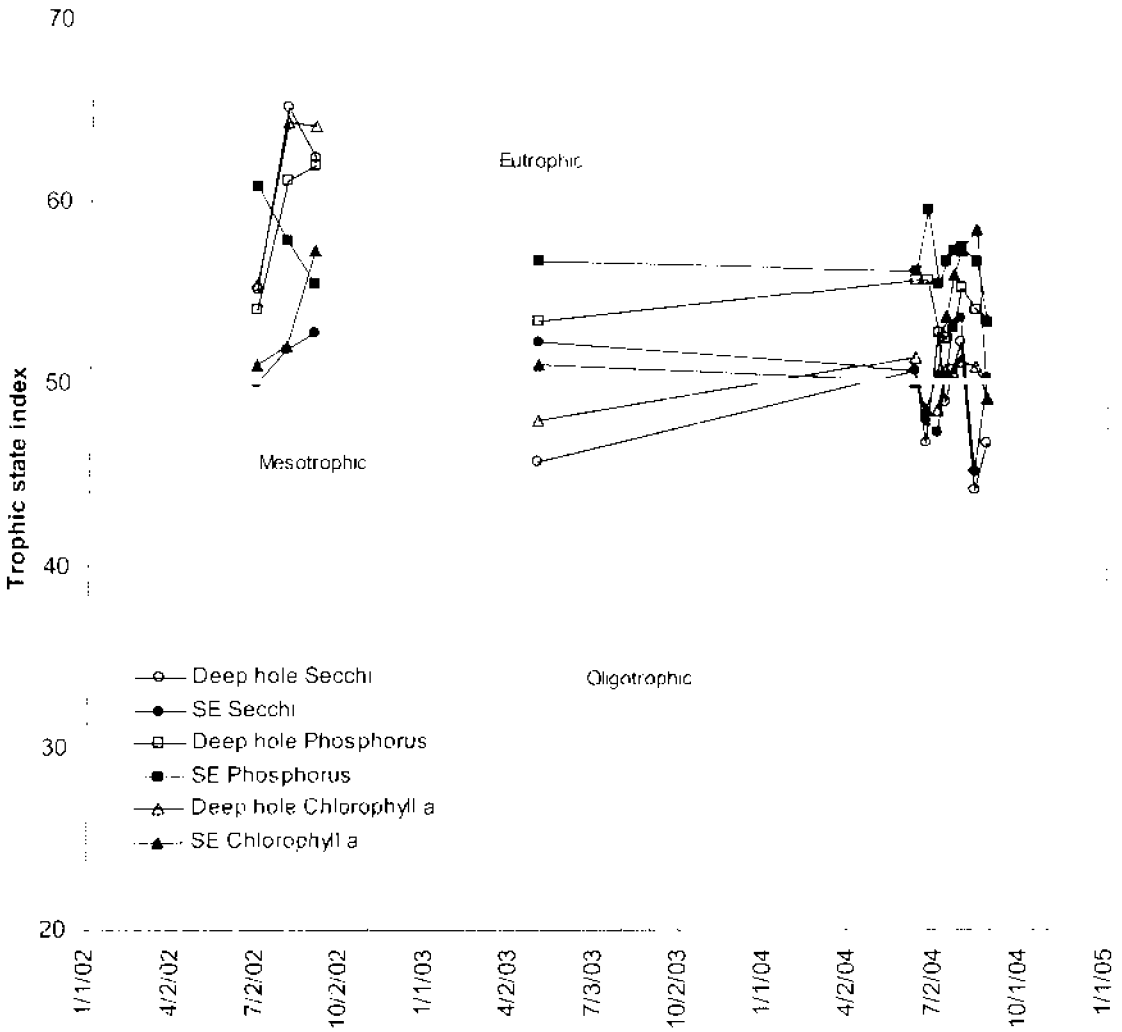


Figure 7. Trophic State Indices for Spooner Lake, June 2002 – August 2004.

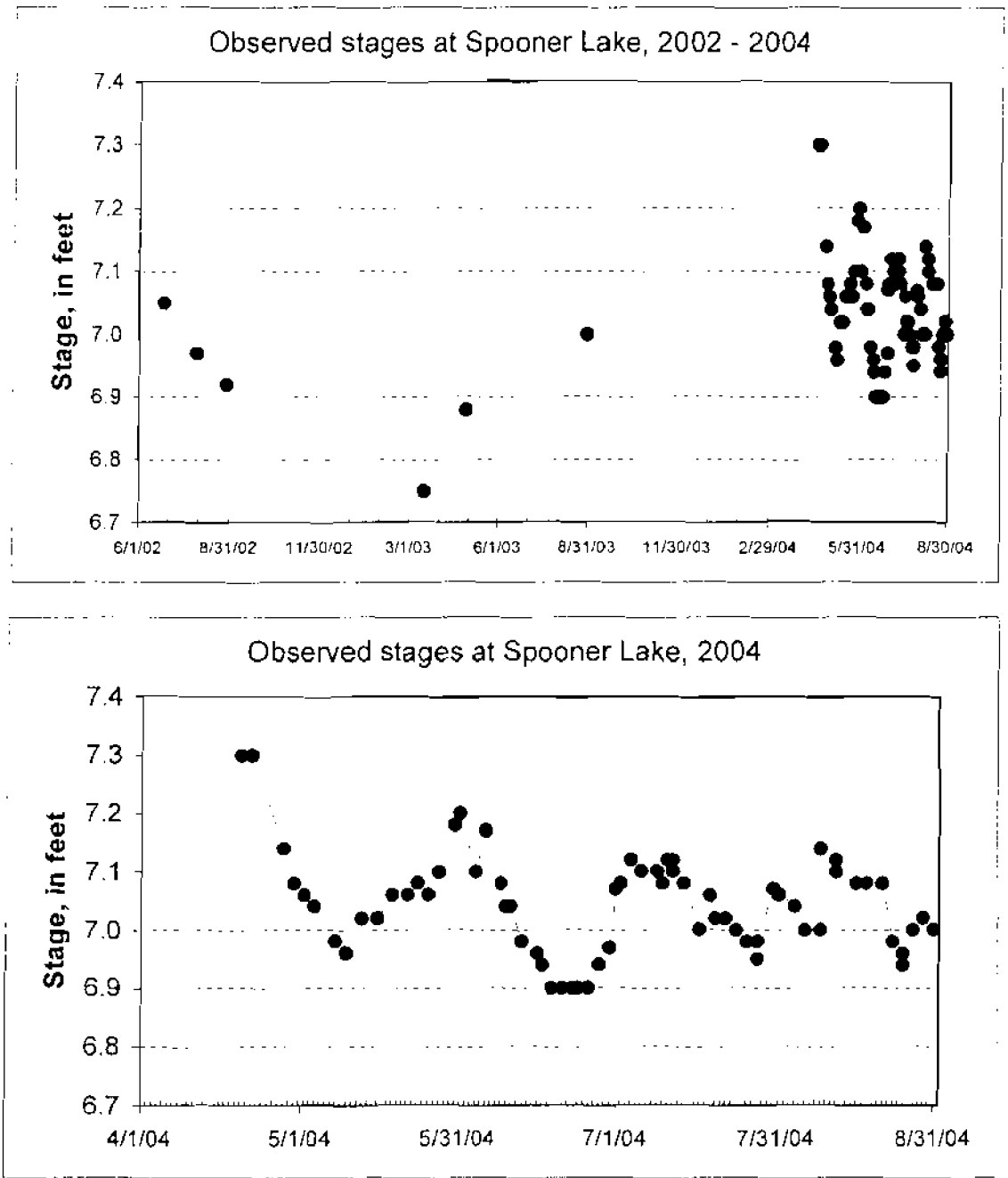


Figure 8. Observed stages at Spooner Lake near Spooner, 2002 -2004.

Table 1. Depth profiles of dissolved oxygen, pH, specific conductance, and temperature at Spooner Lake, Deep-Hole Site, 2004

Date	Depth (meters)	Dissolved oxygen (mg/L)	pH	Specific conductance (S/cm)	Temperature (°C)
6/9/2004	0.5	9.1	8.0	179	22.0
	1	9.0	8.0	179	22.0
	1.5	9.0	8.1	179	22.0
	2	9.0	8.1	179	22.0
	2.5	9.0	8.1	179	22.0
	3	9.0	8.1	179	22.0
	3.5	9.0	8.1	179	22.0
	4	9.5	8.1	179	22.0
	4.5	5.5	7.6	185	21.0
	4.8	5.3	7.6	185	21.2
6/21/2004	0.5	8.9	8.6	184	20.4
	1	9.0	8.6	183	20.3
	1.5	9.0	8.6	183	20.3
	2	9.0	8.6	184	20.3
	2.5	9.0	8.6	183	20.3
	3	9.0	8.6	183	20.3
	3.5	9.0	8.6	183	20.3
	4	8.6	8.5	184	20.1
	4.5	8.1	8.4	185	20.0
7/2/2004	0.5	10.8	8.4	184	21.5
	1	10.8	8.7	183	21.5
	1.5	10.8	8.7	184	21.5
	2	10.8	8.7	184	21.5
	2.5	10.7	8.7	184	21.4
	3	8.0	8.4	190	21.0
	3.5	7.8	8.2	189	20.1
	4	5.2	8.0	193	19.4
	4.5	4.2	7.8	193	19.2
	4.8	2.7	7.6	198	18.9
7/12/2004	0.5	10.0	8.8	176	23.1
	1	10.2	8.8	176	23.1
	1.5	10.1	8.8	175	22.9
	2	9.6	8.8	176	22.8
	2.5	8.6	8.6	176	22.7
	3	6.9	8.3	180	21.8
	3.5	5.7	8.1	182	21.2
	4	3.7	7.8	184	20.7
	4.5	2.3	7.6	185	20.3
	4.6	1.4	7.6	188	20.1

Table 1. Depth profiles of dissolved oxygen, pH, specific conductance, and temperature at Spooner Lake, Deep-Hole Site, 2004--continued.

Date	Depth (meters)	Dissolved oxygen (mg/L)	pH	Specific conductance (µS/cm)	Temperature (°C)
7/20/2004	0.5	9.9	8.8	169	25.8
	1	10.0	8.8	171	25.7
	1.5	10.1	8.8	171	25.1
	2	9.4	8.8	171	24.8
	2.5	9.2	8.7	171	24.7
	3	9.0	8.7	172	24.6
	3.5	7.6	8.6	172	24.4
	4	6.3	8.5	175	24.3
	4.5	0.7	8.0	187	23.5
	5	0.4	7.7	192	23.0
7/28/2004	0.5	8.9	8.7	169	24.5
	1	8.9	8.7	170	24.5
	1.5	9.0	8.8	170	24.5
	2	9.0	8.8	170	24.5
	2.5	9.1	8.8	170	24.5
	3	9.0	8.8	170	24.4
	3.5	8.8	8.8	169	24.4
	4	8.8	8.8	169	24.3
8/12/2004	0.5	8.6	7.7	153	17.9
	1	8.8	8.3	153	17.6
	1.5	8.9	8.5	152	17.5
	2	9.0	8.8	152	17.4
	2.5	9.0	8.8	152	17.4
	3	8.7	8.8	152	17.4
	3.5	8.2	8.7	153	17.1
	4	8.6	8.7	152	17.0
	4.5	8.8	8.8	151	17.0
	4.8	8.9	8.8	151	17.0
8/25/2004	0.5	9.7	9.0	152	19.9
	1	9.7	9.1	152	19.8
	1.5	9.5	9.1	152	19.8
	1.75	9.4	9.1	152	19.7
	2	9.4	9.1	152	19.7
	2.5	9.4	9.1	152	19.7
	3	9.3	9.0	153	19.6
	3.5	9.2	9.0	152	19.6
	4	9.1	9.1	153	19.6
	4.5	8.8	9.0	153	19.5
	4.8	7.7	9.0	154	19.5

Table 2. Depth profiles of dissolved oxygen, pH, specific conductance, and temperature at Spooner Lake, Southeast Site, 2004

Date	Depth (meters)	Dissolved oxygen (mg/L)	pH	Specific conductance (µS/cm)	Temperature (°C)
6/9/2004	0.5	9.9	8.5	177	22.2
	0.75	9.9	8.5	177	22.2
	1.0	9.9	8.5	177	22.2
	1.25	10.2	8.5	177	22.2
	1.5	10.0	8.5	177	22.2
	1.75	10.1	8.5	177	22.2
	2.0	10.1	8.5	177	22.2
	2.25	10.1	8.5	177	22.2
	2.5	9.5	8.4	178	22.1
6/21/2004	0.5	8.3	8.3	190	20.6
	0.75	8.3	8.3	190	20.6
	1.0	8.3	8.3	190	20.6
	1.25	8.4	8.3	190	20.6
	1.5	8.4	8.3	190	20.6
	1.75	8.4	8.3	190	20.6
	2.0	8.4	8.3	190	20.5
	2.25	8.4	8.4	190	20.5
	2.4	8.4	8.4	190	20.5
7/2/2004	0.5	11.7	8.8	191	22.3
	0.75	11.7	8.8	191	22.3
	1.0	11.8	8.8	191	22.3
	1.25	11.8	8.8	191	22.2
	1.5	11.8	8.8	191	22.2
	1.75	11.8	8.8	191	22.2
	2.0	9.9	8.6	195	22.0
	2.25	9.5	8.6	196	21.9
	2.3	8.1	8.4	200	21.7
7/12/2004	0.5	9.6	8.4	194	23.5
	0.75	9.7	8.3	195	23.3
	1.0	9.3	8.3	196	23.1
	1.25	10.0	8.2	199	22.4
	1.5	9.9	8.2	199	22.2
	1.75	9.2	8.0	203	21.5
	2.0	6.8	7.7	206	21.1
	2.2	1.7	7.6	207	21.1

Table 2. Depth profiles of dissolved oxygen, pH, specific conductance, and temperature at Spooner Lake, Southeast Site, 2004--continued

Date	Depth (meters)	Dissolved oxygen (mg/L)	pH	Specific conductance (8S/cm)	Temperature (°C)
7/20/2004	0.5	10.0	8.5	197	26.0
	0.75	10.2	8.6	196	25.8
	1.0	9.9	8.6	195	24.9
	1.25	9.2	8.5	196	24.7
	1.5	8.6	8.4	201	24.6
	1.75	8.7	8.1	204	24.0
	2.0	8.3	8.0	206	23.7
	2.25	6.6	7.8	209	23.5
	2.5	5.6	7.8	209	23.5
7/28/2004	0.5	9.1	8.4	201	23.6
	0.75	9.0	8.4	201	23.6
	1.0	9.1	8.4	201	23.6
	1.25	9.2	8.4	201	23.6
	1.5	9.3	8.4	201	23.6
	1.75	9.3	8.4	201	23.6
	2 0	9.2	8.4	201	23.6
	2.20	8.7	8.3	202	23.6
8/12/2004	0.5	8.2	7.9	197	17.5
	0.75	8.4	7.9	197	17.3
	1.0	9.0	8.0	195	17.0
	1.25	9.1	8.0	195	16.8
	1.5	9.0	8.1	195	16.7
	1.75	8.3	8.0	196	16 5
	2.0	8.0	7.9	196	16.5
	2 25	7.7	7.9	196	16.5
	2.4	7.5	7.8	196	16.5
8/25/2004	0.5	9.6	8.3	200	20.2
	0.75	9.6	8.4	200	20.1
	1.0	9.6	8.4	200	20.1
	1.25	9.6	8.4	200	20.0
	1.5	9.2	8.4	200	19.9
	1.75	8.7	8.3	201	19.9
	2.0	7.0	8.2	204	19.8
	2.2	7.0	8.0	204	19.8

Table 3. Water-quality data for Deep-Hole Site at Spooner Lake near Spooner, Wisconsin, 2004

Date	6/9/2004		6/21/2004		7/2/2004		7/12/2004	
Lake stage (ft)	7.08		6.90		7.08		–	
Secchi-depth (m)	1.9		2.5		1.7		2.2	
Depth of sample (m)	0.5	4.5	0.5	4	0.5	4.5	0.5	4
Chlorophyll a, phytoplankton (µg/L)	9.1	–	–	–	6.2	--	8.2	--
Water temperature (°C)	22.0	21.0	20.4	20.1	21.5	19.2	23.1	20.7
Specific conductance (µS/cm)	179	185	184	184	184	193	176	184
pH	8.0	7.8	8.6	8.5	8.4	7.8	8.8	7.8
Dissolved oxygen (mg/L)	9.1	5.5	8.9	8.6	10.8	4.2	10.0	3.7
Phosphorus, total (as P, mg/L)	0.035	0.031	0.035	0.043	0.024	0.033	0.023	0.027

Date	7/20/2004		7/28/2004		8/12/2004			8/25/2004	
Lake stage (ft)	7.02		6.95		7.12			6.40	
Secchi-depth (m)	1.9		1.7		3.0			2.5	
Depth of sample (m)	0.5	4.5	0.5	4	0.5	3.5	4.5	0.5	4.5
Chlorophyll a, phytoplankton (µg/L)	8.1	--	8.8	--	8.5	--	--	6.7	--
Water temperature (°C)	25.8	23.5	24.5	24.3	17.9	17.1	17.0	19.9	19.5
Specific conductance (µS/cm)	169	187	169	169	153	153	151	152	153
pH	8.8	8.0	8.7	8.8	7.7	8.7	8.8	9.0	9.0
Dissolved oxygen (mg/L)	9.9	0.7	8.9	8.8	8.6	8.2	8.8	9.7	8.8
Phosphorus, total (as P, mg/L)	0.025	0.031	0.033	0.033	0.028	0.028	0.026	0.026	0.026
Phosphorus, ortho, dissolved (as P)	--	--	0.003	--	--	--	--	--	--
Nitrogen, NO_2 + NO_3, diss. (as N)	--	--	<0.019	--	--	--	--	--	--
Nitrogen, ammonia, dissolved (as N	--	--	<0.015	--	--	--	--	--	--
Nitrogen, amm. + diss., total (as N)	--	--	0.52	--	--	--	--	--	--

Table 4. Water-quality data for Southeast Sampling Site at Spooner Lake near Spooner, Wisconsin, 2004

Date	6/9/2004		6/21/2004		7/2/2004		7/12/2004	
Lake stage (ft)	7.08		6.90		7.08		7.10	
Secchi-depth (m)	1.9		2.3		2.4		2.0	
Depth of sample (m)	0.5	2	0.5	2.2	0.5	2	0.5	2
Chlorophyll a, phytoplankton (µg/L)	7.6	--	6.2	--	8.1	--	12.2	--
Water temperature (°C)	22.2	22.2	20.6	20.5	22.3	22.0	23.5	21.1
Specific conductance (µS/cm)	177	177	190	190	191	195	194	206
pH	8.5	8.5	8.3	8.4	8.8	8.6	8.4	7.7
Dissolved oxygen (mg/L)	9.9	10.1	8.3	8.4	11.7	9.9	9.6	6.8
Phosphorus, total (as P, mg/L)	0.037	0.036	0.058	0.050	0.034	0.033	0.040	0.037

Date	7/20/2004		7/28/2004		8/12/2004		8/25/2004	
Lake stage (ft)	7.02		6.95		7.12		6.94	
Secchi-depth (m)	1.6		1.6		2.8		1.9	
Depth of sample (m)	0.5	2	0.5	2	0.5	2.2	0.5	1.8
Chlorophyll a, phytoplankton (µg/L)	16.5	--	19.6	--	22.7	--	18.7	--
Water temperature (°C)	26.0	23.7	23.6	23.6	17.5	16.5	20.2	19.9
Specific conductance (µS/cm)	197	206	201	201	197	196	200	201
pH	8.5	8.0	8.4	8.4	7.9	7.9	8.3	8.3
Dissolved oxygen (mg/L)	10.0	8.3	9.1	9.2	8.2	7.7	9.6	8.7
Phosphorus, total (as P, mg/L)	0.043	0.044	0.044	0.041	0.040	0.046	0.034	0.032

Table 5. Water clarity and water-quality analyses and their associated Trophic State Indices (TSI) for Spooner Lake, Deep Hole Site

Date	Secchi Disk			Sampling	Total Phosphorus			Chlorophyll a		Dissolved Ortho-phosphate Phosphorus
	Depth (meters)	Depth (feet)	TSI	Depth (meters)	Conc (mg/L)	Conc. (ug/L)	TSI	Conc (ug/L)	TSI	Conc (mg/L)
6/27/02	1.4	4.6	55	0.5	0.028	28	54	15.3	55	--
7/30/02	0.7	2.3	65	0.5	0.070	70	61	49.3	64	0.004
8/29/02	0.85	2.8	62	0.5	0.078	78	62	48.4	64	--
3/18/03	--	--	--	0.5	0.042	42	57		--	--
4/29/03	2.7	8.9	46	0.5	0.026	26	53	5.68	48	--
6/9/04	1.9	6.2	51	0.5	0.035	35	56	9.11	52	--
6/21/04	2.5	8.2	47	0.5	0.035	35	56		--	--
7/2/04	1.65	5.4	53	0.5	0.024	24	53	6.19	49	--
7/12/04	2.15	7.1	49	0.5	0.023	23	52	8.18	51	--
7/20/04	1.9	6.2	51	0.5	0.025	25	53	8.12	51	--
7/28/04	1.7	5.6	52	0.5	0.033	33	55	8.83	51	0.003
8/12/04	3.0	9.8	44	0.5	0.028	28	54	8.49	51	--
8/25/04	2.5	8.2	47	0.5	0.026	26	53	6.67	49	--

Table 6. Water clarity and water-quality analyses and their associated Trophic State Indices (TSI) for Spooner Lake, Southeast Site

Date	Secchi Disk			Sampling	Total Phosphorus			Chlorophyll a		Dissolved Ortho-phosphate Phosphorus
	Depth (meters)	Depth (feet)	TSI	Depth (meters)	Conc. (mg/L)	Conc (ug/L)	TSI	Conc. (ug/L)	TSI	Conc (mg/L)
6/27/2002	2	6.6	50	0.5	0.068	68	61	8.57	51	--
7/30/2002	1.75	5.7	52	0.5	0.046	46	58	9.84	52	--
8/29/2002	1.65	5.4	53	0.5	0.034	34	56	19.6	57	--
3/18/2003	--	--	--	0.5	0.056	56	59	--	--	--
4/29/2003	1.7	5.6	52	0.5	<0.04	40	57	8.52	51	--
6/9/2004	1.9	6.2	51	0.5	0.037	37	56	7.55	50	--
6/21/2004	2.3	7.5	48	0.5	0.058	58	60	6.18	49	--
7/2/2004	2.4	7.9	47	0.5	0.034	34	56	8.06	51	--
7/12/2004	1.95	6.4	50	0.5	0.04	40	57	12.2	54	--
7/20/2004	1.6	5.2	53	0.5	0.043	43	57	16.5	56	--
7/28/2004	1.55	5.1	54	0.5	0.044	44	58	19.6	57	--
8/12/2004	2.8	9.2	45	0.5	0.04	40	57	22.7	58	--
8/25/2004	1.95	6.4	50	0.5	0.034	34	56	18.7	57	--

Table 7. Observed stages at Spooner Lake near Spooner, Wisconsin, 2002 - 2004

[**Bold** entries made by USGS personnel, other entries by Joe Banick of Lake District]

Date	Time	Stage [Staff gage on dam] (feet)	Remarks
6/27/2002		**7.05**	
7/30/2002		**6.97**	
8/29/2002		**6.92**	
3/18/2003		**6.75**	
4/29/2003		**6.88**	
8/31/2003	**1600**	**7.00**	
4/10/2004			Ice out today
4/20/2004	1530	7.30	Heavy rain on 4/18/04
4/22/2004	1230	7.30	
4/28/2004	7.14	7.14	
4/30/2004	1800	7.08	
5/2/2004	1730	7.06	Water is crystal clear
5/4/2004	1000	7.04	
5/8/2004	1330	6.98	
5/10/2004	1900	6.96	Rained on 5/9/04
5/13/2004	1405	7.02	Heavy rain today & 5/12/04
5/16/2004	1430	7.02	Rained on 5/15/04
5/19/2004	1000	7.06	
5/22/2004	1000	7.06	Water is crystal clear today
5/24/2004	1930	7.08	Rained all day on 5/23/04
5/26/2004	1000	7.06	
5/28/2004	2030	7.10	Rained all night 5/2/04--water high
5/31/2004	1830	7.18	Rained all day 5/30/04
6/1/2004	1500	7.20	
6/4/2004	1630	7.10	No rain since last recording.
6/6/2004	1300	7.17	Rained all day on May 5, 2004 (probably 6/5/04)--lake has been high all spring
6/9/2004	**1040**	**7.08**	**2.36 ft from top of dam bracked to where chain attaches on left sid of dam to top of I-beam**
6/10/2004	1100	7.04	No rain prior to this
6/11/2004	1000	7.04	No rain prior to this
6/13/2004	1100	6.98	Light rain on 6/12/04.
6/16/2004	1030	6.96	Light rain today
6/17/2004	1100	6.94	No rain--lake is lower than normal
6/19/2004	1830	6.90	No rain--lake is lower than normal
6/21/2004	1000	6.90	No rain--called County about dam being low.
6/21/2004	**1145**	**6.90**	**(tape-down to top of board = 2.36 ft.)**
6/23/2004	1330	6.90	No rain (called county again--Hyw Dept wants dam's at official marks set by railroad 100 years ago--96 8, this is too low for our lake for 2004)
6/24/2004	1300	6.90	
6/26/2004	1200	6.90	
6/28/2004	1100	6.94	No rain (count placed board in dam to slightly raise level)
6/30/2004	1400	6.97	No rain (water up slightly)

Table 7. Observed stages at Spooner Lake near Spooner, Wisconsin, 2002 - 2004--continued

[Bold entries made by USGS personnel, other entries by Joe Banick of Lake District]

Date	Time	Stage [Staff gage on dam] (feet)	Remarks
7/1/2004	1100	7.07	Rained quite hard on 6/30/04
7/2/2004	**0810**	**7.08**	**New board has been installed. 2.38 ft form top of I-beam to top of chained bracket)**
7/4/2004	1000	7.12	Rained over night on 7/3/04 Lake looks good so far as algae--lake growth of curley leaf pond weed at mouth of Crystal Brook.
7/6/2004	1100	7.10	
7/9/2004	0930	7.10	Water above normal--rained on and off for two days
7/10/2004	1030	7.08	Water above normal--lake looks good
7/11/2004	1530	7.12	Rained very heavy during night
7/12/2004	1100	7.12	
7/12/2004	**1110**	**7.10**	**2.35 from bracket to board**
7/14/2004	1800	7.08	
7/17/2004	1130	7.00	No rain last few days
7/19/2004	1200	7.06	Very heavy rain this morning
7/20/2004	**1040**	**7.02**	**3 boards, 2.35 ft TD to bracket**
7/22/2004	1130	7.02	No rain (Lake is staying in good shape so far this year. One algae bloom--very sight sor far Water turning a little green on east side.
7/24/2004	1230	7.00	No rain
7/26/2004	1730	6.98	
7/28/2004	**0850**	**6.95**	**5 boards, TD to bracket = 2.35 from top of I-beam.**
7/28/2004	1530	6.98	
7/31/2004	1330	7.07	Rained on the 29th & 30th. To bring up the height on the dam. Lake water is still very clear with little algae.
8/1/2004	1530	7.06	Lake has held up well this year.
8/4/2004	1330	7.04	No rain since the lastt reading, lake is clear and cloudy in other parts of the lake.
8/6/2004	1400	7.00	On my side, the north shore, is showing a lot of filamentous algae growth for the first time this year
8/9/2004	1300	7.00	
8/9/2004	**1750**	**7.14**	
8/12/2004	**1205**	**7.12**	**TD from top of I-beam to chain bracket = 2.35 ft.**
8/12/2004	1400	7.10	Rained Tues & Weds., 10th & 11th.
8/16/2004	1430	7.08	Rained this morning. Lake water is as clear as I've ever seen it this time of the year, 6 ft deep.
8/18/2004	1300	7.08	
8/21/2004	1100	7.08	
8/23/2004	1300	6.98	No rain--lake water clear
8/25/2004	**0840**	**6.94**	**TD from top of I-beam to chain bracket = 2.35 ft. - 0.7 ft of water over boards**
8/25/2004	1400	6.96	No rain.
8/27/2004	1300	7.00	One inch of rain on the 26th.
8/29/2004	1500	7.02	Rain night before.
8/31/2004	1300	7.00	Dam has been between 6.96 and 7.00 for most of the summer, which is a good setting for our lake. Water is still very clear