



State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Lake Michigan District Headquarters
Division of Environmental Protection
P.O. Box 3600
Green Bay, Wisconsin 54303

L. P. Voigt
Secretary

April 28, 1972

IN REPLY REFER TO: 3610-1

Dr. Fred A. Knauf
1420 North Third Street
Sheboygan, Wisconsin 53081

Dear Dr. Knauf:

Enclosed is a report on the lake survey conducted on Cedar Lake last summer.

Please feel free to contact this office if I can be of further service.

Very truly yours,

DEPARTMENT OF NATURAL RESOURCES
Division of Environmental Protection

Ronald K. Krueger
District Biologist

RKK:jp
enc.

cc: Ken Christopherson, Manitowoc County Zoning Administrator
Olaf Vale, Sanitarian, Division of Health, Dept. of Health & Soc. Services
Bureau of Standards and Surveys
Paul Schultz, Fish Manager - Plymouth
Pat Cline - Staff Specialist-Fish and Game

A SHORELINE AND WATER QUALITY EVALUATION OF CEDAR LAKE IN MANITOWOC COUNTY

On August 19, 1971, a shoreline and water quality survey was conducted on Cedar Lake at the request of Dr. Fred A. Knauf, Chairman of Sanitary District No. 1. Present during the investigation were Kenneth G. Christopherson, Manitowoc Zoning Administrator; Dr. Knauf; Olaf Vale, Sanitarian with the Wisconsin Division of Health; Dominic DeAmicis, District Engineer for the Department of Natural Resources; several other members of the sanitary district; and this writer.

Cedar Lake is a moderately fertile lake with a history of cyclic water level fluctuations. At the time of the survey, the lake level was extremely low, offering an excellent opportunity for detection of faulty septic systems through visual observations. Such observations, along with bacteriological sampling, disclosed no obvious faulty systems. Soils adjacent to Cedar Lake appear to be adequate for absorption from septic systems. However, effluents from older systems installed prior to the adoption of county zoning and sanitary codes may, during wet periods, be reaching the lake. The introduction of dyes in such systems is the best method of detection. *

Seasonal and residential development, including a Boy Scout camp, on the lake appears to be about 60 to 70 percent, assuming full development is one dwelling per hundred feet of shoreline. The recent mobile home development situated behind Ray's Tavern-Supper Club no doubt adds to the recreational demands of the lake. The agricultural area on the western shore of the southeast lobe of Cedar Lake, while insuring against further residential development, may, during wet periods contribute nutrients to the lake.

Vegetation in the lake is moderate to heavy in the shallow areas. Nutrient determinations on samples collected during the survey are moderate. Apparently, the nutrient uptake by rooted vegetation is great enough to prevent nuisance algae blooms. The Secchi visibility disc could be observed at the seven foot depth, indicating that planktonic production was moderate at the time of the survey. ✓

Fish management records from past years indicate that bass, panfish, and northern pike dominate the fishery and that moderate fishing pressure produces good catches of these species. These records also suggest that Cedar Lake is not suitable for walleye habitat. Further information concerning the fishery can be obtained from Paul Schultz, Fish Manager at Plymouth.

An attempt to categorize Cedar Lake as to the present trophic condition and resource value has been made using the chart included in this report. The determinations on the chart are generalizations made by one investigator and should be treated as such. This evaluation is of no scientific value, but is merely one man's observations expressed in terms which may be understood by persons with little knowledge of the technical nature of eutrophication. The term "none" used in the chart is relative to the other terms and should be regarded as meaning negligible in most cases. Undesirable fish includes both rough fish and stunted fish.

RECOMMENDATIONS

The Sanitary District may elect to start a program of dying septic systems, particularly older, less modern systems to be sure that effluents from these systems are not reaching the lake. Nutrients are a lake's worst enemy. An overabundance of nutrients accelerates the eutrophication (aging) process of the lake and can lead to excessive weed growths and algae blooms.

The county zoning administrator or sanitarian might be called upon to help set up such a program and should be notified of any positive results.

Large motor boat traffic should be restricted to large open water areas since the nutrient release from shallow, silty areas and low, unstable shoreline areas is enhanced by the turbulence and wakes created by large motors. Such restrictions are often unpleasant for those who enjoy pleasure boating and water skiing, but will prolong the life of the lake and enhance other recreational uses. Generally the Town government will act on such proposals made by the Lake Association or Sanitary District.


Cedar Lake has undergone substantial development. Measures should be taken to discourage further development of both the water front and back lots.

The nutrient balance in Cedar Lake is a delicate one. Large-scale mechanical or chemical treatment for aquatic weed growths should be discouraged. Any minor nuisance conditions that might now occur would be dwarfed by the nuisance likely to develop from algae blooms, if weeds were eliminated and nutrients were taken up by planktonic forms.

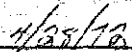
Cultivation within 100 feet of the water in the farm field south of the lake should be discouraged. The planting of trees and shrubs in this area would add to the aesthetics of the lakeshore and help to eliminate further nutrient enhancement.

SUMMARY

Cedar Lake is a mesotrophic lake best suited for the recreational uses of fishing, small boating, and, in some areas, swimming. Deep, open water areas are limited in shape and area, thus the lake is not particularly suitable for large boats and water skiing. Rooted vegetation and planktonic algae growths have not yet reached nuisance proportions; the recommendations offered above would delay occurrence of such conditions by retarding man's influence upon the eutrophication process. Further investigation by this office will attempt to determine the effects of well water introduction on lake levels and water quality.



Ronald K. Krueger
District Biologist



Date

THE TROPIC EVOLUTION OF A LAKE

All lakes are subject to evolution from a sterile, oligotrophic lake to a fertile, eutrophic lake. This aging process is known as eutrophication. If eutrophication is caused by the natural chain of events, and not interfered with by man's endeavors, water quality and recreational values will usually deteriorate at a negligible rate. In general, oligotrophic and early mesotrophic lakes are more suitable for swimming, boating, and trophy fishing. Late mesotrophic and eutrophic lakes produce larger populations of smaller fish and are more highly valued as waterfowl habitat, but water clarity, bottom type, and profuse vegetation might interfere with the recreational value as a swimming and boating lake.

If there were such a thing as a typical lake, the characteristics in the chart below might help to describe the life cycle of a lake. An attempt has been made to interpret the age of the lake surveyed in this report using these criteria.

Trophic age of a lake	OLIGOTROPIC		MESOTROPIC		EUTROPIC		BOG	
Available nutrient concentration	None	Low	Moderate		High			
Water clarity	High		Moderate		Low			
Solid shoreline	All	Over 80%	Over 50%	Over 30%	Under 30%			
Production of aquatic vegetation	None	Light	Moderate	*	Heavy			
Algae production	None		Light	* Moderate	Heavy			
Desirable fish production	None	Light	Moderate	Heavy	* Moderate	None		
Undesirable fish production	None	Light	Moderate	Heavy	V. Heavy	None		
Probability of winterkill	None		Slight		* Moderate	High		
birth of the lake								Death of the lake
Approximate trophic age of lake			X					
Other near by lakes					X		Wilke Lake	

Collected by PK + DLD
Sample Description center of SE side of Cedar Lake 1/2 N below surface
Field No. 17

Send Report To:

Department of Natural Resources
Division of Environmental Protection
Region III Office

CITY	1768 Main Street
WISCONSIN	Green Bay, Wisconsin 54302

Statistical & Record Card No.	0 1	Temp. (°C) Field	23°C
Collection Date	7 1 9 7 1	D.O. (mg/l) Field	8.6
Time	12:55	pH (su) Field	8.4
Collection Site: Co. <u>Menomonie</u>	11 12	BOD Estimate	3
Town <u>Ellsworth</u>	13 14	MFFCC Estimate	
Range	15 16 17	5-Day BOD (mg/l)	3.5
Sec.	18 19	Total Solids mg/l	85 84 88
DB <u>Menomonie</u>	20 21	Sus. Solids mg/l	85 87 88
Sub Basin I	22 23 24	Vol. Sus. Solids mg/l	88 90 94
II	25 26	*Fecal Coliform	72 73 74 75 76
III	27 28	*Samples for both water chemistry and water bacteriology should be submitted in separate bottles.	
IV	29 30	Statistical & Record Card No.	0 2
V	31 32	Entries 3-49 Same as Card 01	
Mt. From Mouth	33 34 35 36 37	Total Org. N mg/l	1.10
Water Location L-O, Mid-5, Rt.-9	38	NO ₂ -N + NO ₃ -N mg/l	<.5
Depth in Meters 0-Surf., 9-Interface	0.5	NH ₃ -N mg/l	0.6 1.1
Flow CFS	40 41 42 43 44	Total Phosphorus mg/l	0.0 0.1
Laboratory Sample No.	45 46 47 48 49	Alkalinity, Total (CaCO ₃) mg/l	1.2 2.2
Date Received	50 51 52 53 54	Hardness mg/l	1.2 5
Date Reported	JUL 30 71 - 7	Color su	88 89 90
	JUL 20 71 05676	Chlorides mg/l	77 78
		Additional Analysis:	
		Iron = 0.12 mg/l	
		Cobalt = 23. [V] Magnesium <.04	
		Sulfate = 4	
		Thymol = 18 m/l pH = 8.8	

S. L. Isham, M.D., Director
Wisconsin State Laboratory of Hygiene
Madison, Wisconsin 53706

Collected by PK + DLD
Sample Description center of SE side of Cedar Lake 1/2 N off bottom
Field No. 18

Send Report To:

Department of Natural Resources
Division of Environmental Protection
Region III Office

CITY	1768 Main Street
WISCONSIN	Green Bay, Wisconsin 54302

Statistical & Record Card No.	0 1	Temp. (°C) Field	23°C
Collection Date	7 1 9 7 1	D.O. (mg/l) Field	8.6
Time	12:45	pH (su) Field	8.4
Collection Site: Co. <u>Menomonie</u>	11 12	BOD Estimate	3
Town <u>Ellsworth</u>	13 14	MFFCC Estimate	
Range	15 16 17	5-Day BOD (mg/l)	2
Sec.	18 19	Total Solids mg/l	82 84 88
DB <u>Menomonie</u>	20 21	Sus. Solids mg/l	82 87 88
Sub Basin I	22 23 24	Vol. Sus. Solids mg/l	85 90 94
II	25 26	*Fecal Coliform	72 73 74 75 76
III	27 28	*Samples for both water chemistry and water bacteriology should be submitted in separate bottles.	
IV	29 30	Statistical & Record Card No.	0 2
V	31 32	Entries 3-49 Same as Card 01	
Mt. From Mouth	33 34 35 36 37	Total Org. N mg/l	0.9 0
Water Location L-O, Mid-5, Rt.-9	38	NO ₂ -N + NO ₃ -N mg/l	<.5
Depth in Meters 0-Surf., 9-Interface	4.5	NH ₃ -N mg/l	0.6 1.1
Flow CFS	40 41 42 43 44	Total Phosphorus mg/l	0.0 0.1
Laboratory Sample No.	45 46 47 48 49	Alkalinity, Total (CaCO ₃) mg/l	1.2 4
Date Received	50 51 52 53 54	Hardness mg/l	1.3 5
Date Reported	JUL 30 71 - 7	Color su	88 89 90
	JUL 20 71 05676	Chlorides mg/l	77 78
		Additional Analysis:	
		Iron = 0.08 mg/l	
		Cobalt = 21. [V] Magnesium <.04	
		Sulfate = 4	
		Thymol = 19 m/l pH = 8.8	

S. L. Isham, M.D., Director
Wisconsin State Laboratory of Hygiene
Madison, Wisconsin 53706

Collected by RK + PJD
 Sample Description Center of E. Side of Cedar Lake 1/2 mi above surface
 Field No. 2A

Send Report To:
 Department of Natural Resources
 Division of Environmental Protection
 Region III Office
 CITY Green Bay, Wisconsin ZIP CODE 54302
 1768 Main Street

Statistical & Record Card No.	0 1	Temp. (°C) Field	23
Collection Date	0 7 1 9	D.O. (mg/l) Field	8.1
Time	1:30	pH (su) Field	8.4
Collection Site: Co. <u>Manitowish</u>	11 12	BOD Estimate	3
Town <u>Ellings</u>	13 14	MFCC Estimate	
Range	15 16 17	5-Day BOD (mg/l)	2
Sec.	18 19	Total Solids mg/l	83 84 85
DB <u>Manitowish</u>	20 21	Sus. Solids mg/l	68 69 70
Sub Basin I	22 23 24	Vol. Sus. Solids mg/l	88 89 90
II	25 26	*Fecal Coliform	72 73 74 75 76
III	27 28	*Samples for both water chemistry and water bacteriology should be submitted in separate bottles.	
IV	29 30	Statistical & Record Card No.	0 2
V	31 32	Entries 3-49 Same as Card 01	
Mi. From Mouth	33 34 35 36 37	Total Org. N mg/l	0.94
Water Location L=O, Mid=5, Rt.=9	38	NO ₃ -N + NO ₂ -N mg/l	3.5
Depth in Meters 0=Surf., 9=Interface	0.5	NH ₃ -N mg/l	0.03
Flow CFS	40 41 42 43 44	Total Phosphorus mg/l	0.03
Laboratory Sample No.	45 46 47 48 49	Alkalinity, Total (CaCO ₃) mg/l	123.8
Date Received	JUL 30 71 - 7	Hardness mg/l	88 89 87
Date Reported	JUL 20 71 05679	Color su	88 89 78
		Chlorides mg/l	71 1/2
		Additional Analysis:	
			pH = 8.8

S. L. Inhorn, M.D., Director
 Wisconsin State Laboratory of Hygiene
 Madison, Wisconsin 53708

Collected by RK + PJD
 Sample Description Center of E. Side of Cedar Lake 1/2 mi above surface
 Field No. 2B

Send Report To:
 Department of Natural Resources
 Division of Environmental Protection
 Region III Office
 CITY Green Bay, Wisconsin ZIP CODE 54302
 1768 Main Street

Statistical & Record Card No.	0 1	Temp. (°C) Field	22
Collection Date	0 7 1 9	D.O. (mg/l) Field	8.5
Time	1:25	pH (su) Field	8.4
Collection Site: Co. <u>Manitowish</u>	11 12	BOD Estimate	3
Town <u>Ellings</u>	13 14	MFCC Estimate	
Range	15 16 17	5-Day BOD (mg/l)	3
Sec.	18 19	Total Solids mg/l	83 84 85
DB <u>Manitowish</u>	20 21	Sus. Solids mg/l	68 69 70
Sub Basin I	22 23 24	Vol. Sus. Solids mg/l	88 89 90
II	25 26	*Fecal Coliform	72 73 74 75 76
III	27 28	*Samples for both water chemistry and water bacteriology should be submitted in separate bottles.	
IV	29 30	Statistical & Record Card No.	0 2
V	31 32	Entries 3-49 Same as Card 01	
Mi. From Mouth	33 34 35 36 37	Total Org. N mg/l	1.04
Water Location L=O, Mid=5, Rt.=9	38	NO ₃ -N + NO ₂ -N mg/l	3.5
Depth in Meters 0=Surf., 9=Interface	0.5	NH ₃ -N mg/l	0.03
Flow CFS	40 41 42 43 44	Total Phosphorus mg/l	0.03
Laboratory Sample No.	45 46 47 48 49	Alkalinity, Total (CaCO ₃) mg/l	122.6
Date Received	JUL 30 71 - 7	Hardness mg/l	88 89 87
Date Reported	JUL 20 71 05678	Color su	88 89 78
		Chlorides mg/l	71 1/2
		Additional Analysis:	
			pH = 8.8

S. L. Inhorn, M.D., Director
 Wisconsin State Laboratory of Hygiene
 Madison, Wisconsin 53708

Collected by RK & DAD
 Sample Description 3' out from Kraus property on Cedar Lake
 Field No. B

Collected by RK & DAD
 Sample Description east side of island at dock Cedar Lake
 Field No. A

Report To:
 Department of Natural Resources
 Division of Environmental Protection
 Region III Office
 CITY 1768 Main Street
 WISCONSIN Green Bay, Wisconsin 54302

Send Report To:
 Department of Natural Resources
 Division of Environmental Protection
 Region III Office
 CITY 1768 Main Street
 WISCONSIN Green Bay, Wisconsin 54302

Statistical & Record Card No.	0 1 2	Temp. (°C) Field	55 51
Collection Date	8 7 1 9 7 1	D.O. (mg/l) Field	82 83 84
Time	1:45	pH (su) Field	88 88 87
Collection Site: Co. <u>Manitowish</u>	11 12	BOD Estimate	
Town <u>Sullivan</u>	13 14	MFFCC Estimate <u>< 200</u>	
Range	15 16 17	5-Day BOD (mg/l)	88 88 88 81 82
Sec.	18 19	Total Solids mg/l	88 88 88
Sub Basin I	20 21	Sus. Solids mg/l	88 87 88
II	22 23 24	Vol. Sus. Solids mg/l	88 88 88
III	25 26	*Fecal Coliform	72 75 74 75 78
IV	27 28	*Samples for both water chemistry and water bacteriology should be submitted in separate bottles.	
V	29 30	Statistical & Record Card No.	0 2
From Mouth	31 32	Entries 3-49 Same as Card 01	
Water Location L=O, Mid=5, Rt.=9	35	Total Org. N mg/l	80 81 81
Depth in Meters 0=Surf., 9=Interface	0	NO ₃ -N + NO ₂ -N mg/l	88 88 88
Flow CFS	40 41 42 43 44	NH ₃ -N mg/l	88 87 88
Laboratory Sample No.	45 47 48 49	Total Phosphorus mg/l	88 88 81
Date Received		Alkalinity, Total (CaCO ₃) mg/l	88 88 84
Date Reported		Hardness mg/l	88 88 87
		Color su	88 88 78
		Chlorides mg/l	71 72
		Additional Analysis:	

Statistical & Record Card No.	0 1 2	Temp. (°C) Field	55 51
Collection Date	8 7 1 9 7 1	D.O. (mg/l) Field	82 83 84
Time	1:15	pH (su) Field	88 88 87
Collection Site: Co. <u>Manitowish</u>	11 12	BOD Estimate	
Town <u>Sullivan</u>	13 14	MFFCC Estimate <u>< 200</u>	
Range	15 16 17	5-Day BOD (mg/l)	88 88 88 81 82
Sec.	18 19	Total Solids mg/l	88 88 88
Sub Basin I	20 21	Sus. Solids mg/l	88 87 88
II	22 23 24	Vol. Sus. Solids mg/l	88 88 88
III	25 26	*Fecal Coliform	72 75 74 75 78
IV	27 28	*Samples for both water chemistry and water bacteriology should be submitted in separate bottles.	
V	29 30	Statistical & Record Card No.	0 2
From Mouth	31 32	Entries 3-49 Same as Card 01	
Water Location L=O, Mid=5, Rt.=9	35	Total Org. N mg/l	80 81 82
Depth in Meters 0=Surf., 9=Interface	0	NO ₃ -N + NO ₂ -N mg/l	88 88 88
Flow CFS	40 41 42 43 44	NH ₃ -N mg/l	88 87 88
Laboratory Sample No.	45 47 48 49	Total Phosphorus mg/l	88 88 81
Date Received		Alkalinity, Total (CaCO ₃) mg/l	88 88 84
Date Reported		Hardness mg/l	88 88 87
		Color su	88 88 78
		Chlorides mg/l	71 72
		Additional Analysis:	

JUL 20 71 05 48

JUL 20 71 05 90

JUL 21 71 5

L. Inhorn, M.D., Director
 Wisconsin State Laboratory of Hygiene
 Madison, Wisconsin 53706

L. Inhorn, M.D., Director
 Wisconsin State Laboratory of Hygiene
 Madison, Wisconsin 53706

STREAM CHEMISTRY
& BACTERIOLOGY

Collected by R. H. DAP
 Sample Description East Bay, near proposed well site Cedar Lake
 Field No. C

Send Report To:

Department of Natural Resources
 Division of Environmental Protection
 Region III Office
 CITY Green Bay, Wisconsin ZIP CODE 54302
 WISCONSIN 1768 Main Street

Statistical & Record Card No.	0 1	Temp. (°C) Field	85 81
Collection Date	0 7 1 9 7 1	D.O. (mg/l) Field	82 82 84
Time	4:55	pH (su) Field	89 88 87
Collection Site: Co. <u>Waushara</u>	11 12	BOD Estimate	<100
Town <u>Kellowna</u>	13 14	MFFCC Estimate	
Range	16 16 17	5-Day BOD (mg/l)	88 88 88 81 82
Sec.	18 18	Total Solids mg/l	89 84 88
DB <u>Waushara</u>	20 21	Sus. Solids mg/l	88 87 88
Sub Basin I	22 23 24	Vol. Sus. Solids mg/l	89 78 71
II	25 26	*Fecal Coliform	72 78 72 78 78
III	27 28	*Samples for both water chemistry and water bacteriology should be submitted in separate bottles.	
IV	29 30	Statistical & Record Card No.	0 2
V	31 32	Entries 3-49 Same as Card 01	
MI. From Mouth	35 34 38 36 37	Total Org. N mg/l	80 81 82
Water Location L=0, Mid=5, Rt.=9	38	NO ₃ -N + NO ₂ -N mg/l	81 82 88
Depth in Meters 0=Surf., 9=interface	39	NH ₃ -N mg/l	88 87 88
Flow CFS	40 41 42 43 44	Total Phosphorus mg/l	89 88 81
Laboratory Sample No.	48 47 48 49	Alkalinity, Total (CaCO ₃) mg/l	82 83 84
Date Received		Hardness mg/l	85 85 87
Date Reported		Color su	88 88 78
		Chlorides mg/l	73 72
		Additional Analysis:	

JUL 20 71 05488

S. L. Inhorn, M.D., Director
 Wisconsin State Laboratory of Hygiene
 Madison, Wisconsin 53706
 JUL 2 71 5

