

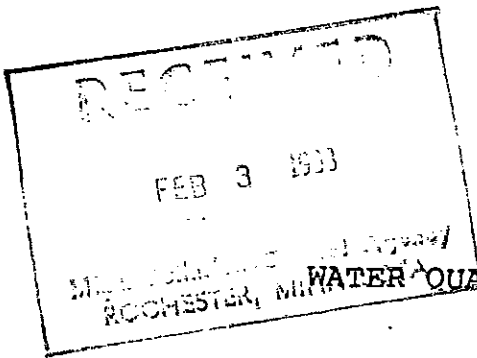
Rice Co



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WATER QUALITY EVALUATION
IN
RICE COUNTY, MINNESOTA
1972

October, 1972

By

National Biocentric, Inc.
2233 Hamline Avenue North
St. Paul, Minnesota 55113

This report was compiled through the cooperation of the Rice County Lake Owners Clubs, the Rice County Board of Health and Sanitation and the Rice County Board of Commissioners.

We wish to thank National Biocentrics Inc., and the people listed above for their interest and cooperation.

Introduction

During 1972 National Biocentric, Inc. developed a basic testing program for the evaluation of midwestern lakes and streams. The design of sampling procedures, selection of sampling locations, selection of tests to be conducted and testing methods was the result of contributions by our own staff scientists, consultants and publications and reviews of open literature.

A particular concern was to conduct those tests that could provide the maximum amount of meaningful management information to lake associations, county officials, state agencies, industries and others. The entire testing program, of course, was designed to be conducted within the budget limitations of the sponsor. Toward this end, therefore, the philosophy of providing a program that would conduct the important tests on as large a number of lakes as possible was adopted. We make no claim that this program has measured all parameters which could conceivably be important on each particular lake. Upon review of this data it may be found desirable to conduct tests of additional parameters on certain lakes.

The results of this program will provide sponsors with a preliminary evaluation of a large number of lakes and sites on those lakes on which to base their water management decisions. It is anticipated that these basic tests will be conducted on a yearly basis for several years to provide not only

a firm baseline of water quality but also to determine the direction of the progressive changes that are occurring.

On many of these lakes, pollution abatement procedures have not been instituted. In others meaningful abatement programs have been initiated. The results of this evaluation identify certain lakes where new or expanded pollution abatement programs are needed.

Selection of Tests

A considerable effort was made to identify those individual measures of water quality which provided the maximum amount of water quality management information. A recent study on development of a water quality index served as an important basis for selection of specific tests and development of the index used in this report.* The water quality index was derived by using an iterative Delphi Method developed by Rand Corporation. A panel of 142 persons with expertise in water quality management was asked to consider and rank in importance 35 different measures of water quality. This specialized decision making technique resulted in the selection of nine important parameters of water quality.

This report on water quality of lakes and streams utilizes essentially the same list of parameters developed in the report discussed above. We have omitted measurements of total solids and evaluated total rather than fecal coliforms for reasons of economy. Where appropriate we have determined the temperature and oxygen depth profile and added measures of conductivity.

* Brown, R.M., N.I. McClellan, R.A. Deininger and R.G. Tozer, "A Water Quality Index - Do We Dare?" presented at the National Symposium on Data and Instrumentation for Water Quality Management (July 1970), sponsored by the Conference of State Sanitary Engineers, University of Wisconsin, Madison.

Water Quality Measurements

Water Depth: Water depths in the lake were taken with a sonar device.

Secchi Disc: Secchi disc readings determine the visual clarity of waters. The readings are obtained by lowering a standard 20 cm (8 inch) diameter disc with alternate black and white quarters into the water to determine the maximum depth at which it can be seen from the surface.

Temperature and Dissolved Oxygen Profiles: Temperature and oxygen measurements were taken at five foot intervals in the lake. When sudden changes occurred measurements were taken at 2½ foot intervals. The profiles indicate either a uniform distribution of oxygen and temperature from the surface to the bottom or disclose a particular depth at which there is a sudden decrease in both temperature and oxygen content. Temperature measurements were taken by lowering a direct reading thermister probe. Oxygen measurements were taken by lowering the selective ion probe of a galvanic cell oxygen analyzer.

B.O.D.: Biochemical oxygen demand is an estimate of the amount of organic matter available for microbial decomposition and oxidation in the sample. It is determined indirectly by incubating a sample of water and measuring the loss of oxygen content following five days incubation.

Available Phosphates: Available phosphate was determined on the water passing through a filter. Available phosphates are a measure of the phosphorous readily available for utilization by plants and animals. Phosphates are essential for growth of plant and animal organisms and are often the limiting nutrient that determines the maximum plant and algae populations that the lake or stream can support.

Ammonia: Ammonia was determined by direct messlerization. Interfering substances are removed by precipitation and ammonia is determined on the resulting clear solution. Ammonia is a product of decomposition and sometimes accepted as chemical evidence of animal discharges. Some plants can utilize ammonia directly as a source of nitrogen supplying one of the essential nutrients.

pH: pH is the logarithm of the reciprocal of the hydrogen ion concentration. It is a measure of the acidity or alkalinity of a solution. pH 7 is neutral.

Conductivity: Conductivity is a measure of total ions present in waters. It gives no indication of the nature of the substances in the solution. An increase or decrease in concentration of these substances will be reflected by an increase or decrease in conductivity. Conductivity is determined by the amount of electric current conveyed through the water.

Total Coliform: To determine total coliform, water samples are incubated in selective media for 48 hours. Coliform data are recorded as most probable number per 100 ml. Coliform organisms are an indication of human or animal waste discharges.

Water Quality Index

Each of the lakes in the testing program was evaluated for ten parameters as follows:

1. depth
2. secci disc
3. temperature
4. dissolved oxygen
5. B.O.D.
6. available phosphate
7. ammonia
8. pH
9. conductivity
10. total coliform

The significance of each of these parameters in the overall measure of water quality in the lake has been discussed in a previous section.

To develop a simplified method of comparing the several lakes, we have developed a water quality index. The water quality index is based on assigning a water value number based on each of the parameters that were measured.

Measurements Included in the Water Quality Index

Water quality relationship numbers associated with each of the measured parameters are presented in Tables 1-6 as follows:

Table 1	Secci disc measurements
Table 2	B.O.D. measurements
Table 3	Available phosphate measurements
Table 4	Ammonia measurements
Table 5	pH measurements
Table 6	Total coliform

Water quality values were determined from the graphs as follows:

1. Secci disc: The maximum secci disc reading taken at the time of the year when the average secci disc readings were the lowest was used. This reading was generally taken during the month of August. In some of the lakes in Northern Minnesota, the lowest secci disc readings were obtained in June/July.
2. B.O.D.: The highest B.O.D. value obtained during any of the sampling times or in any sampling site was used to obtain the water quality value number.
3. Available phosphate: The highest available phosphate value obtained during any of the sampling times or in any sampling site was used to obtain the water quality value number.
4. Ammonia: The highest ammonia value obtained during any of the sampling times or in any sampling site was used to obtain the water quality value number.
5. pH: As can be seen from Table 5, extremely high or low pH values were given lower quality index numbers. The most extreme pH measurement was used to determine the water quality value.
6. Total Coliform: The highest number of coliforms observed during any sampling time or site was used to determine the water quality value.

Water quality values for the six parameters discussed above were averaged to obtain a comprehensive water quality index.

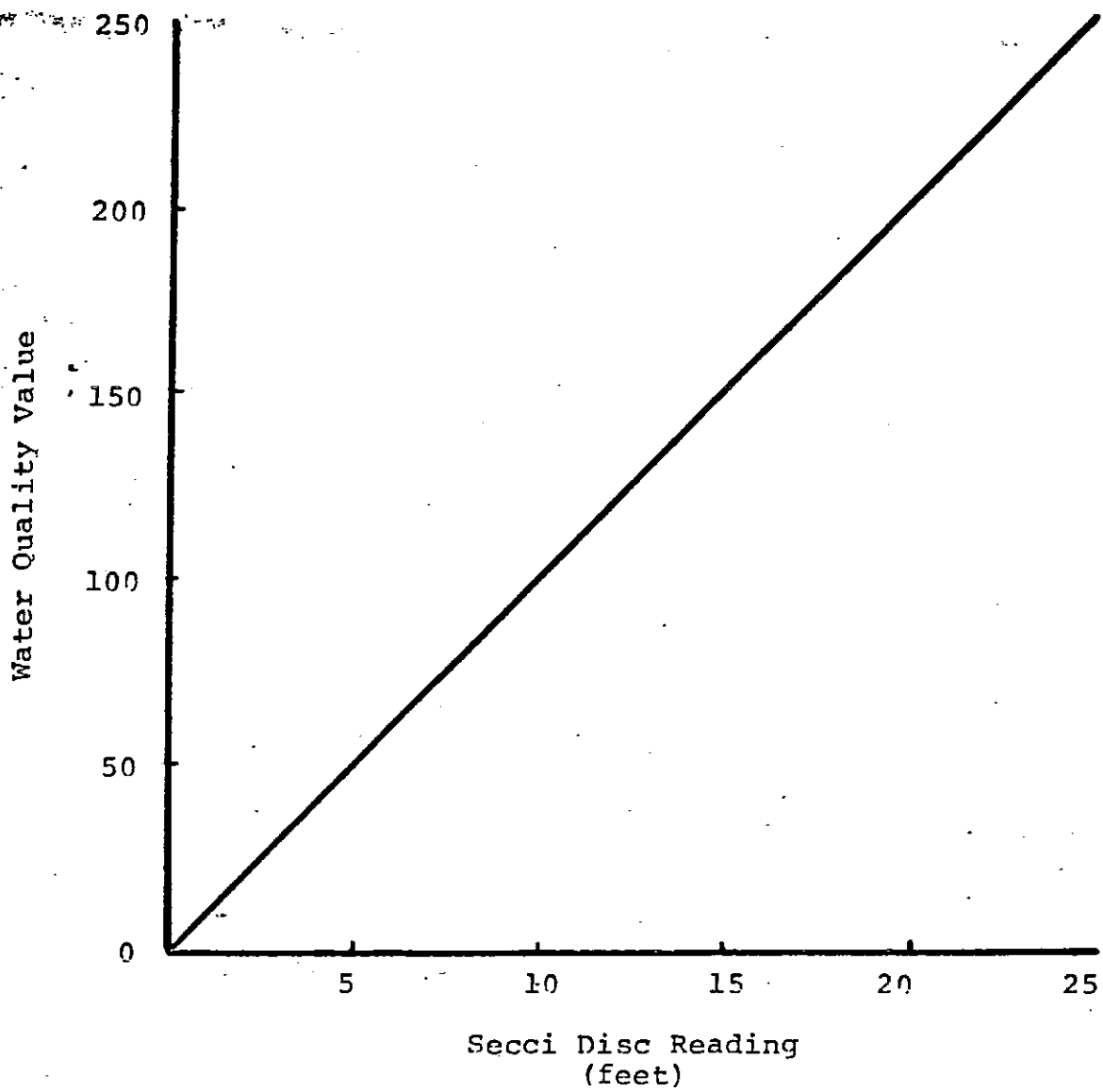


Table 1: Water Quality Value Associated with Secci Disc Measurements

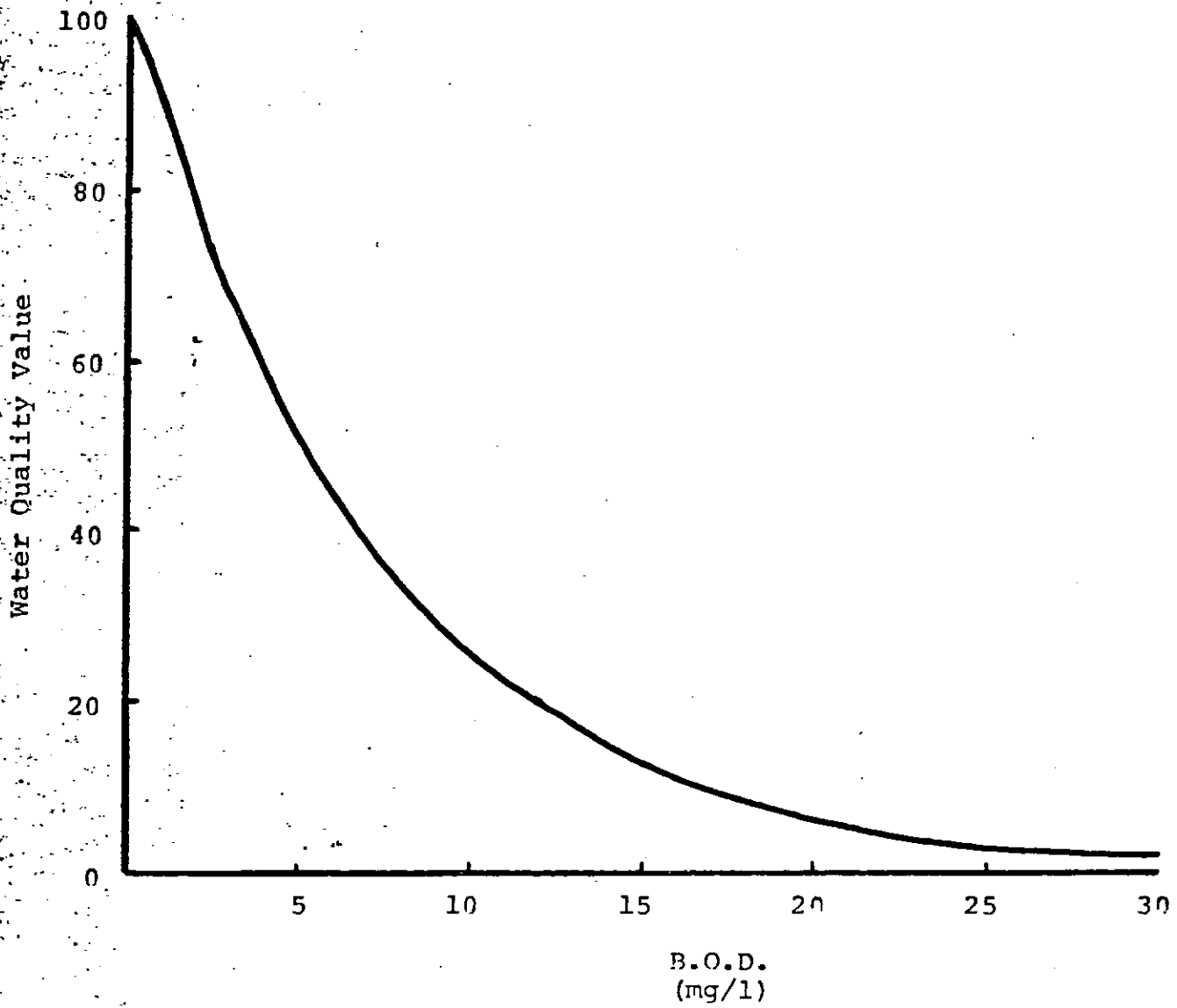


Table 2: Water Quality Value Associated with B.O.D. Measurements

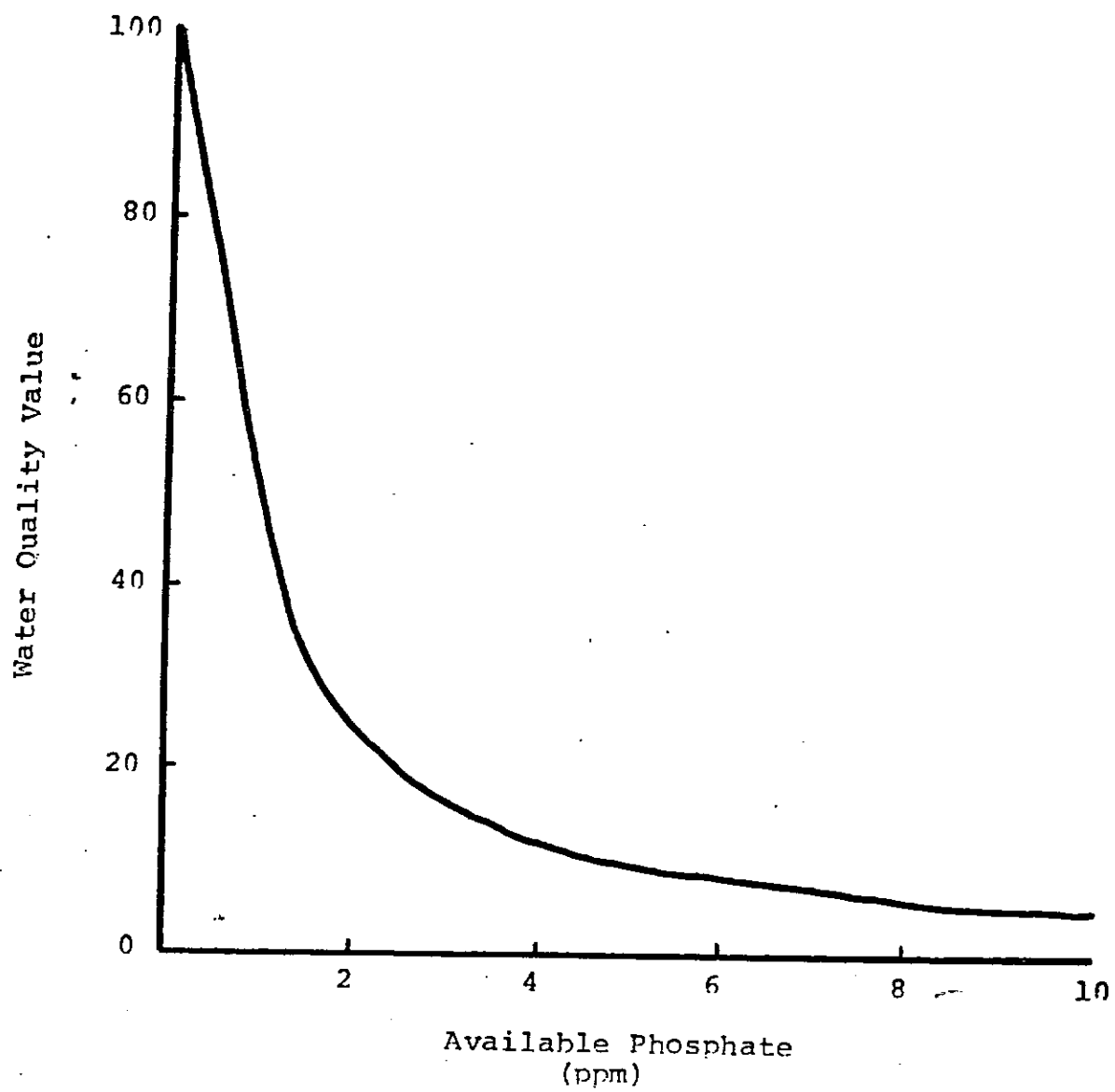


Table 3: Water Quality Value Associated with Available Phosphate Measurements

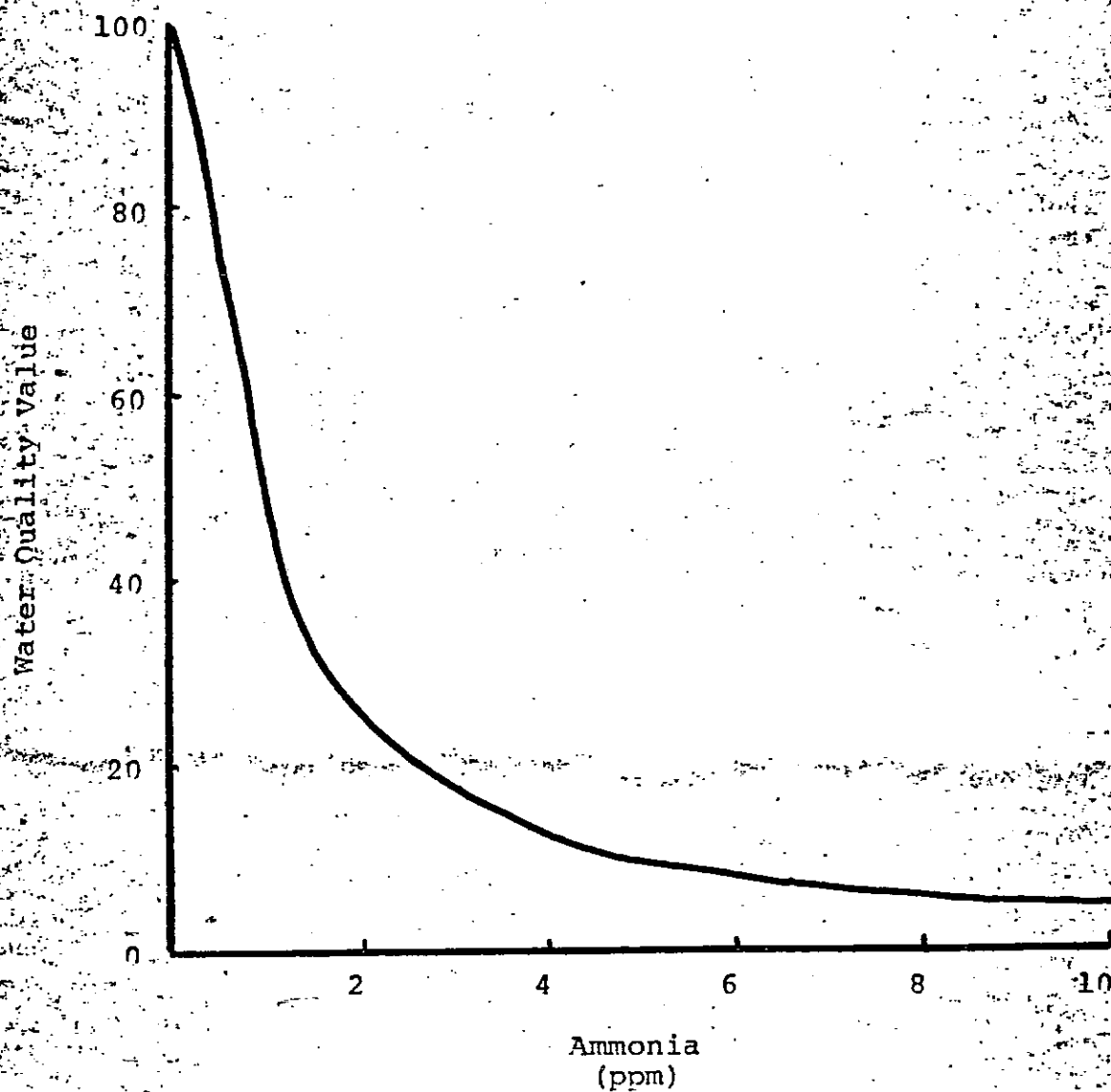


Table 4: Water Quality Value Associated with Ammonia Measurements

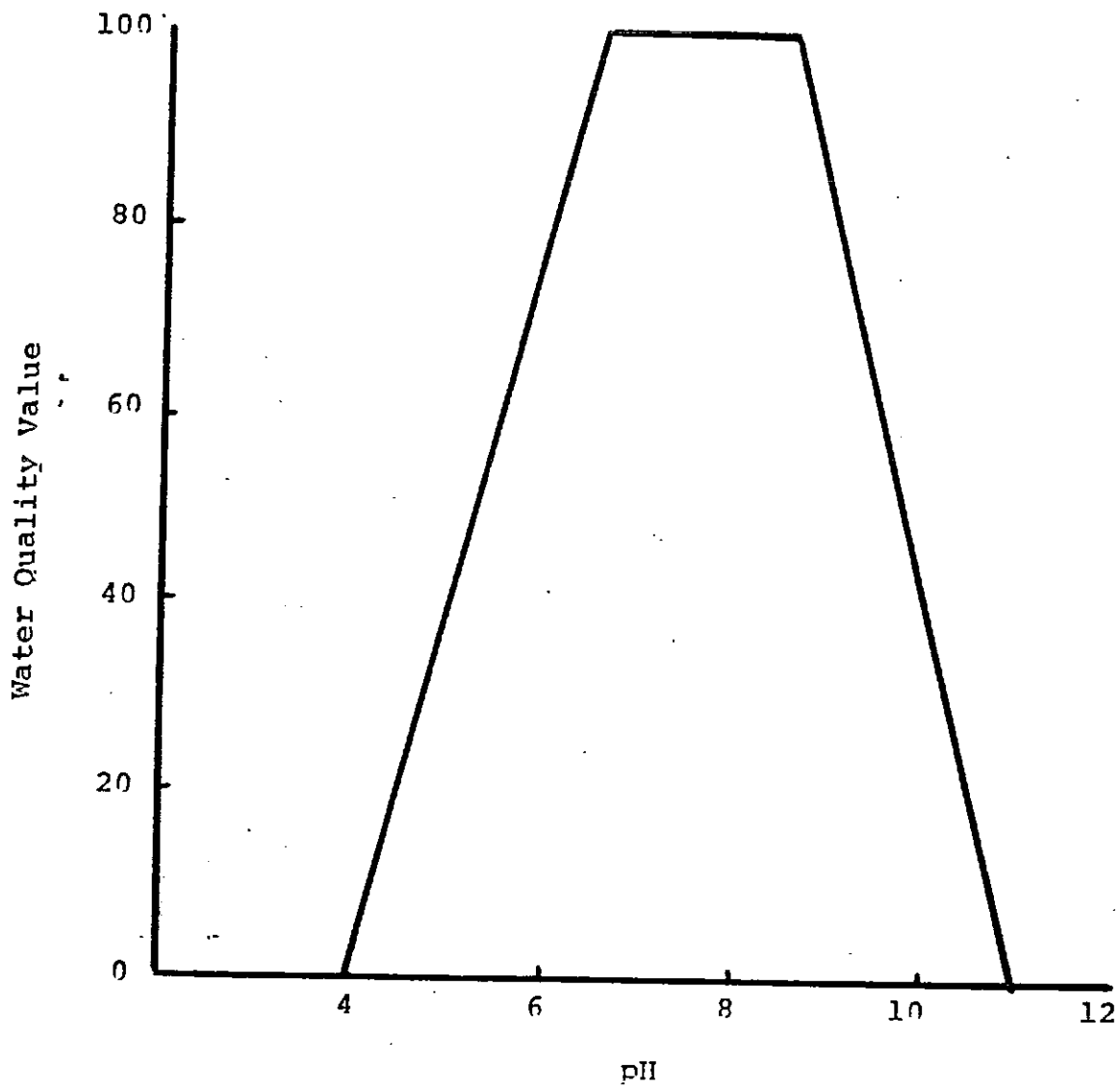


Table 5: Water Quality Values Associated with pH Measurements

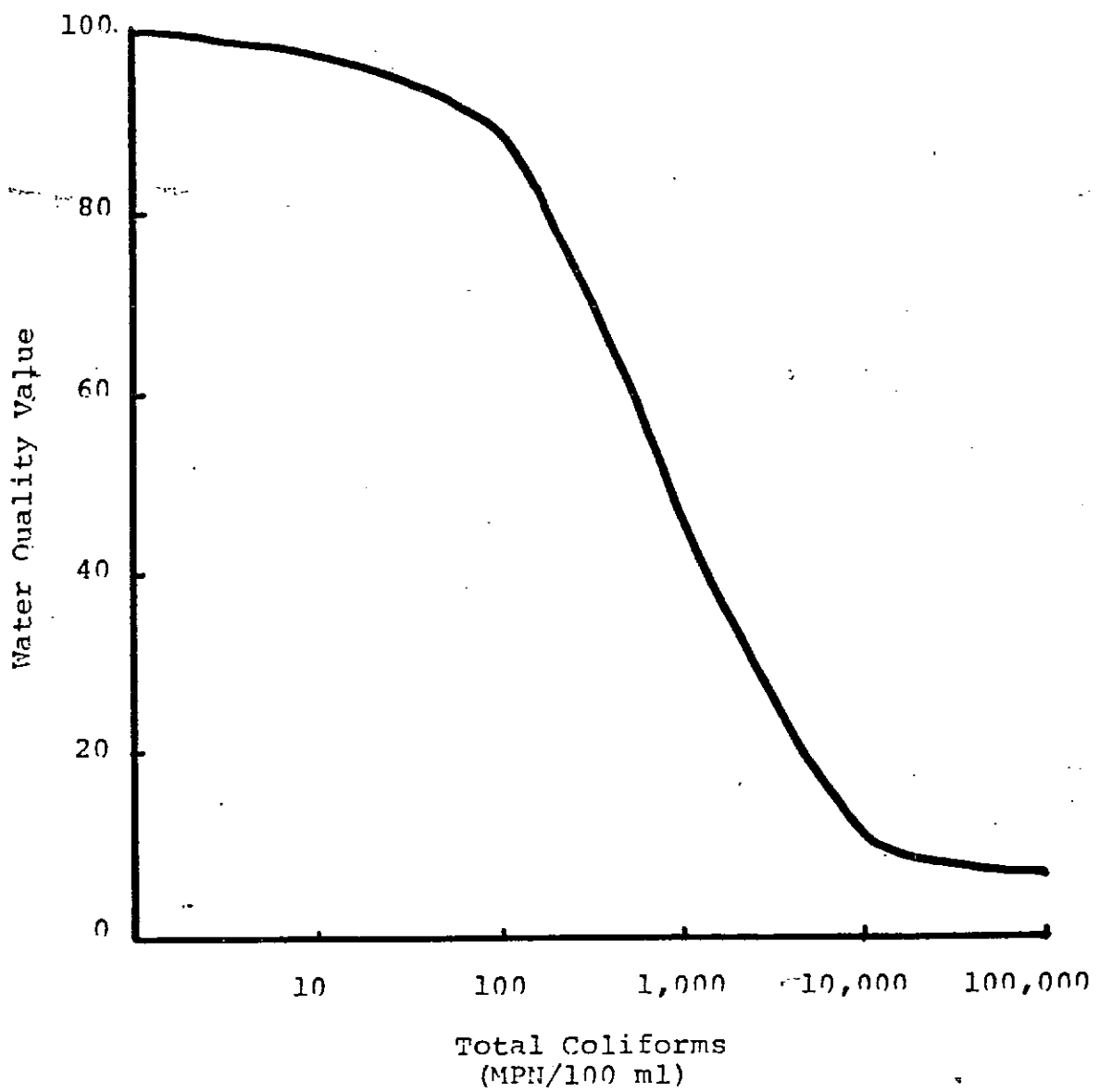


Table 6: Water Quality Value Associated with Total Coliform Measurement

Measurements Not Directly Included in the Water Quality Index

Depth: The depth of the lake was determined at the point of sampling and the point of sampling was selected to identify sources of pollution, the depths that were measured were frequently shallow. Water depth was therefore not included in the water quality index. The samples were usually taken at a point about 50 to 500 feet from shore.

Ice Thickness: Ice thickness was not measured on all lakes. Where it was measured it was greatly dependent upon the date of sampling and could not be used in comparison of lakes.

Temperature Profile: Water temperatures of greater than 85°F were considered as potentially representing a different ecosystem. Our index was established to reflect a significant decrease in water quality when temperatures greater than 85° (MPCA Standards) were observed. The maximum temperature observed was less than 85°. Based on temperature considerations all lakes evaluated were determined to fall within the acceptable range. This consideration was part of the justification for subjecting the lakes to a comparison based on a uniform water index.

Dissolved Oxygen: The critical time for measurement of dissolved oxygen in upper midwest lakes was considered to be after extended ice coverage. After extended periods of ice cover, oxygen content is usually at its lowest point. During this program we were unable to attain uniform measures of oxygen content representing this critical period on all lakes.

Of particular interest is the measure of temperature and oxygen taken at various depths in the lake. While these measurements did not enter into the index value, they were presented in graphic form to aid in water quality evaluation.

Conductivity: Because of the geographical range and differences in mineral content of the soils, the measures of conductivity were not included in the water quality index. Within a particular region or within a lake, differences in conductivity can be indicative of concentrated run-off or pollutional discharges.

Distribution of Water Quality Index Numbers

Water quality values varied from 41 to 104. The distribution of water quality index values for 55 lakes is presented in Table 1. The median water quality index value for all lakes is 67.

The water quality index numbers for the lakes evaluated in this program in 1972 fit into six general groupings. Table 1 presents the number of lakes in each of the six categories and the range in water quality index values associated with each of those six categories. In addition, the range of value for each of the parameters measured is presented in Table 2.

Table 1 presents a compilation of data from 55 lakes on which uniform data base was obtained in 1972. The lakes are distributed geographically from northern Minnesota to southern Minnesota and from central Minnesota to northwestern Wisconsin. No attempt is made to claim these lakes represent all lakes in the region.

It is interesting to note that the lakes classified in A' and A groups both represent lakes of exceptionally high quality. The range of values for each of the parameters that were measured is generally similar. The striking difference, however, is the greatly enhanced water clarity (secci disc readings) of the A' group. In these exceptional lakes we were able to see an eight inch black and white disc at depths of 17 to 23 feet. The A category of lakes, while similar in most of the parameters, had secci disc readings of approximately half that of the A' group.

The intermediate classes of lakes, the B and C groups were characterized by generally higher nutrient and B.O.D. levels. The secci disc readings ranged from three to ten feet. An individual lake in this group would be seriously downgraded because of one or more nutrient or B.O.D. readings approaching the MPCA standards.

It is particularly interesting to note that in the lakes of intermediate quality, the B and C groups, many of the lakes still have relatively clear water. They do however have one or more site in which the nutrient or B.O.D. levels are extraordinarily high. These individually high measurements should be taken as a warning sign that the lake is potentially subject to greater nutrient accumulation and resulting degradation of water quality.

In view of the previous assessment that the lakes classified in the B and C group are potentially subject to more serious degradation, it is worthwhile to look at the lakes in the D and E groups. Many of these lakes have similar phosphate, ammonia and B.O.D. measurements as in the B and C group. In most instances, there are more sites in which the nutrient levels are high. In all instances visual clarity, as measured by secci disc readings, is very poor.

Table 1: Distribution of Lake Water Quality Index Numbers

Category	Water Quality Index Numbers	Crow Wing	Dakota	Itasca	Ramsey	Rice	Washington	Wisconsin	Total
A ⁰	94-104			xxxx			x		5
A	84-93			xxx			x		4
B	72-83			xxxxxx	xxxx		x	x	12
C	58-71	x		xxxxxxxx	xxxxxxxx	xxxx	x		22
D	51-57				xxx	xx	x		6
E	40-50		x		x	xxx	x		6
Total		1	1	21	16	9	6	1	55

Table 2: Range of Parameters

	Secchi Disc	B.O.D.	Phosphate	Ammonia	Coliform
A	23' - 17'	1.36 - 2.50	.18 - .50	.56 - .96	93 - 2400
A'	9'6" - 14'2"	1.54 - 2.3	.12 - .43	.58 - .69	43 - 1100
B	6'1" - 10'	2.2 - 7.5	.215 - .975	.382 - 1.2	23 - 2400
C	1'10" - 10'10"	2.6 - 13.3	.133 - .931	.57 - 1.412	75 - 2400
D	10" - 3'4"	6.0 - 15.4	.350 - .914	.647 - 1.75	240 - 2400
E	1'3" - 2'7"	5.3 - 12.2	.40 - 1.475	1.113 - 1.828	1100 - 2400

RICE COUNTY

Overview

The water quality of lakes in Rice County ranged from intermediate to poor. The best lakes in Rice County would be Fox and Myzaska Lakes. The lakes in Rice County, because of their southern location, are subject to longer periods of warm temperature which allows greater decay and longer periods of plant growth during the season.

The poorest quality lakes in Rice County are Circle, Union, and Cannon. The poorer quality lakes in Rice County have higher levels of phosphate and ammonia than the better quality lakes in the county.

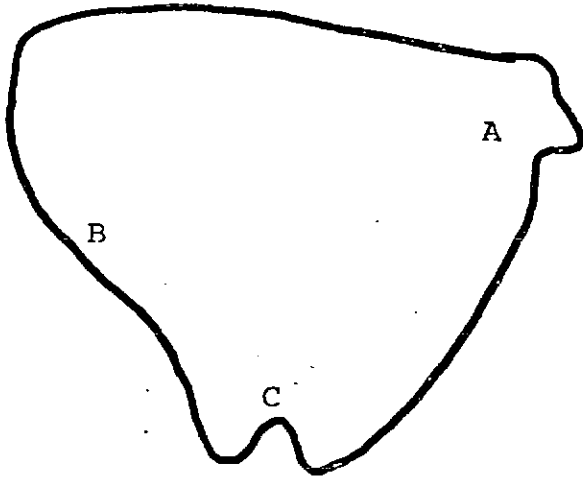
All of the lakes in Rice County have relatively poor water clarity. In the late summer, readings of greater than 3½ feet were seldom found. This is contrasted to some of the better lakes in the state where secchi disc readings of greater than 20 feet were found throughout the evaluation period. Increased urbanization and development around the lakes in Rice County will no doubt exert greater pressures on these lakes and result in accelerated deterioration in water quality.

Many of the bad spots in the lakes in Rice County can be attributed to run-off either urban or agricultural and with a possibility of inadequate septic systems. The specific areas mentioned should be looked at carefully and attempts made to correct situations that are considered to be unsatisfactory.

The River System in Rice County, consisting of the Cannon River, the Straight River and Heath Creek, appear to be greatly influenced by the presence of municipalities along their banks. Nutrient levels and coliform bacteria levels in the Straight River from its entrance into Rice County to its junction with the Cannon in Faribault are quite high. The nutrient and bacteria levels of the Cannon River before it reaches Faribault are not as high as the Straight River. From the junction of the Cannon and the Straight to Northfield where it leaves the County, the nutrient and bacteria levels are very high. The presence of high levels of coliform bacteria are indicators of the presence of human or animal wastes. The municipal

treatment facilities in the towns located along this river system should be given attention from the standpoint of adequacy of treatment.

FOX LAKE
RICE COUNTY



Sampling Sites

A - N.E. Corner

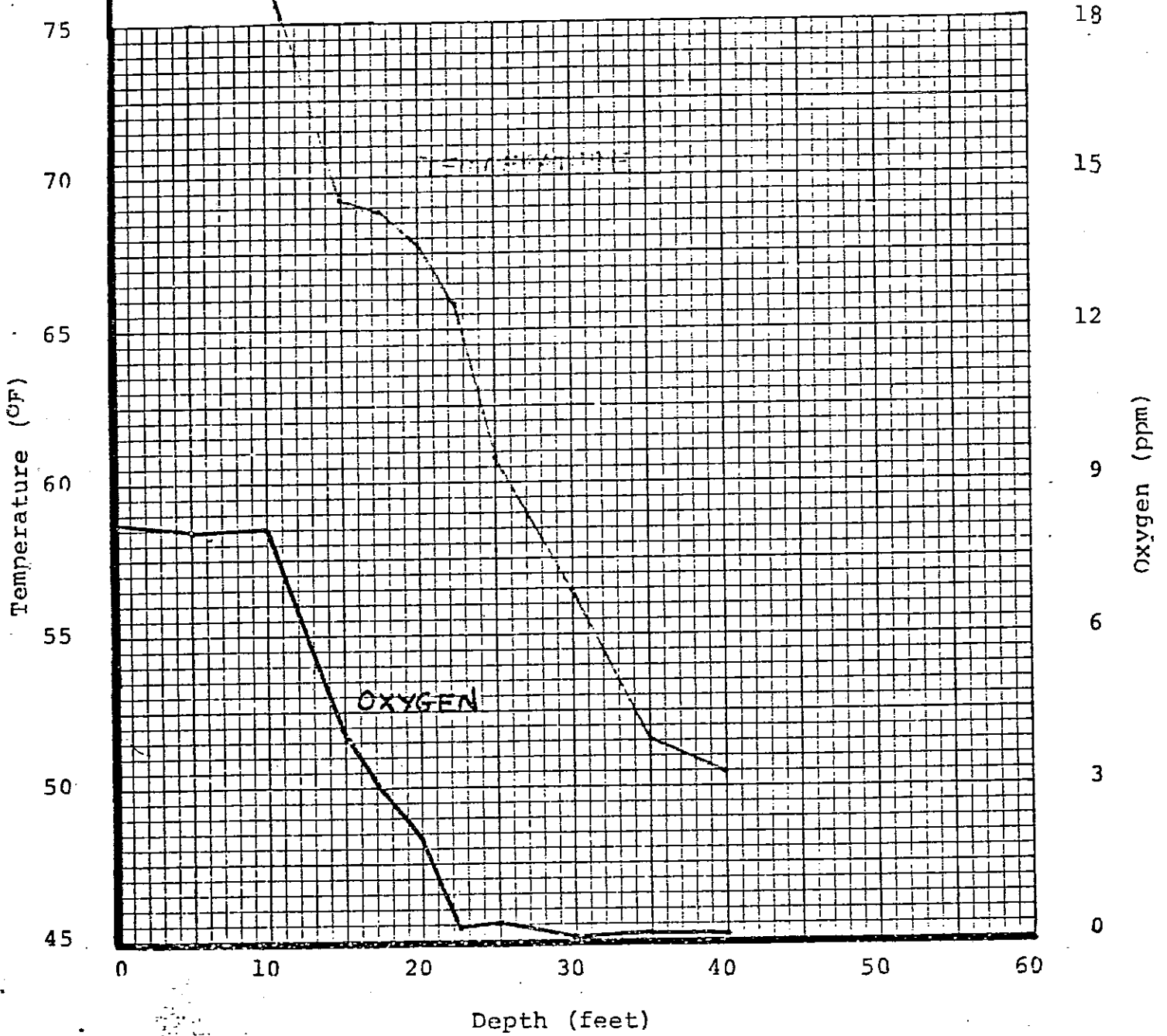
B - N.W. Corner

C - South end (near public
access)

Fox Lake is the lake with the highest water quality index in Rice County. Water clarity, as reflected by secci disc readings of $3\frac{1}{2}$ feet, indicate that an algae bloom was present during most of the summer. B.O.D. readings were generally low except for the sample taken at the north east corner during the winter sampling period. There was also a high ammonia level recorded at the north east corner in early spring. Attention should be given to the north east corner of this lake with attempts made to identify sources and stop their contribution to the lake. The coliform levels were not of the magnitude that would cause concern from the public health standpoint. There was a sharp decrease in both temperature and dissolved oxygen at depths greater than ten feet.

TEMPERATURE/OXYGEN PROFILE

Fox



Lake Fox 66-0029
 County Rice

Water Quality Index 69

Site	Date		
	2/25	6/7	8/22

Site	Date		
	2/25	6/7	8/22

Depth

	2/25	6/7	8/22
A	26'	8'10"	5'
B	6'	21'4"	8'
C	12'	29'	8'
Ave.	14'8"	19'9"	7'

Phosphate

	2/25	6/7	8/22
A	.439	.222	.161
B	.293	.229	.242
C	.244	.244	.134'
Ave.	.325	.231	.179

Secci Disc

	2/25	6/7	8/22
A	--	4'6"	3'3"
B	--	5'9"	3'6"
C	--	4'6"	3'8"
Ave.	--	4'11"	3'6"

Ammonia

	2/25	6/7	8/22
A	.492	.765	.105
B	.662	.609	.129
C	.500	.672	.201
Ave.	.551	.682	.145

Temperature

	2/25	6/7	8/22
A	34.7	70.7	77.0
B	33.8	71.2	77.9
C	34.7	72.5	77.3
Ave.	34.4	71.5	77.3

pH

	2/25	6/7	8/22
A	6.6	8.3	--
B	7.7	8.0	--
C	7.5	8.1	--
Ave.	7.3	8.1	--

Dissolved Oxygen

	2/25	6/7	8/22
A	9.6	13.8	7.8
B	9.6	10.1	7.4
C	7.4	10.4	7.8
Ave.	8.9	11.4	7.7

Conductivity

	2/25	6/7	8/22
A	--	280	395
B	--	280	390
C	--	280	380
Ave.	--	280	388

B.O.D.

	2/25	6/7	8/22
A	1.3	4.9	3.1
B	1.2	1.2	2.5
C	1.3	1.4	3.0
Ave.	1.3	2.5	2.9

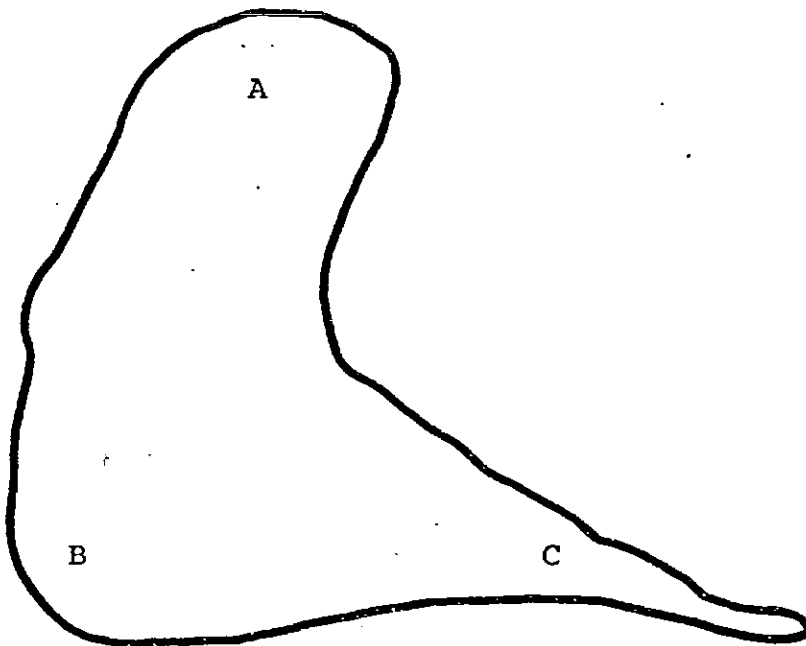
Coliform

	2/25	6/7	8/22
A	3	23	43
B	4	7	150
C	93	43	240
Ave.	33	24	144

cont ↓

2 dates

MYZASKA LAKE
RICE COUNTY



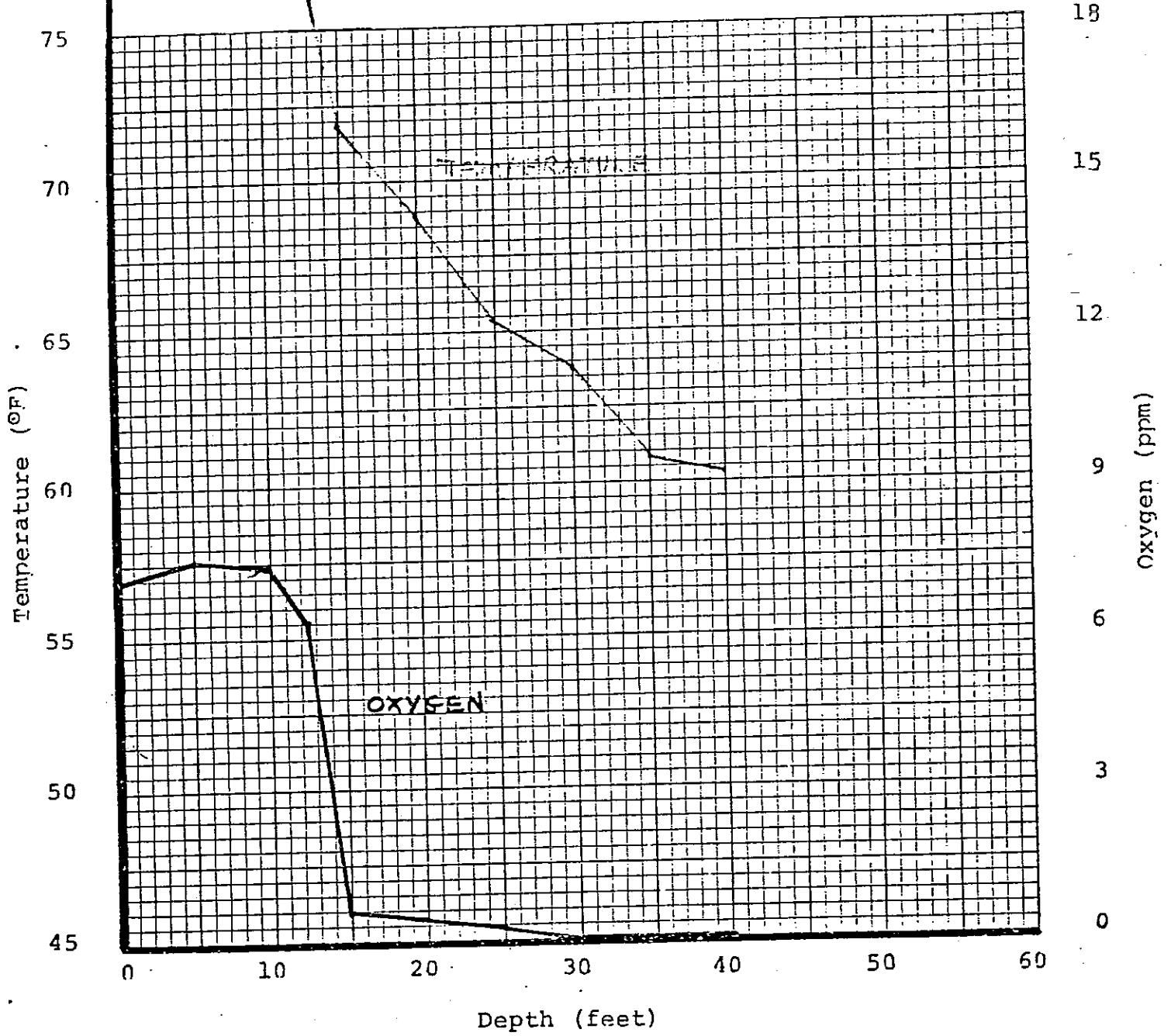
Sampling Sites

- A - North end
- B - S.W. Corner
- C - S.E. Corner

Myzaska is in that group of lakes with intermediate water quality. Water clarity, as reflected by secci disc readings, indicate that algal blooms were present during most of the summer. B.O.D. readings except for the north part of the lake in the late summer were quite low. Phosphate and ammonia levels were in general intermediate. There was noted a high phosphate and ammonia level at the south east sampling site at the winter sampling time. This area may receive a lot of run-off. Levels of coliform bacteria were below the point at which they would be of concern. There was a sharp decrease in dissolved oxygen and temperature between 12½ and 15 feet in Myzaska Lake with an absence of dissolved oxygen at depths greater than 15 feet.

TEMPERATURE/OXYGEN PROFILE

Myzaska



Lake Mvzaska
 County Rice

Water Quality Index 68

	Date		
Site	2/25	6/7	8/22

	Date		
Site	2/25	6/7	8/22

Depth

A	10'	9'4"	6'
B	9'	5'	5'
C	6'	9'	11'
Ave.	8'	7'9"	7'

Phosphate

A	.220	.222	.188
B	.105	.133	.161
C	.317	.133	.134
Ave.	.244	.163	.161

Secchi Disc

A	--	4'	2'3"
B	--	5'	3'2"
C	--	5'10"	2'6"
Ave.	--	4'11"	2'11"

Ammonia

A	.279	.570	.193
B	.183	.508	.161
C	.316	.523	.120
Ave.	.259	.534	.161

Temperature

A	34.7	73.76	75.56
B	34.7	72.50	76.10
C	33.8	70.16	78.26
Ave.	34.4	72.14	76.64

pH

A	7.7	8.7	--
B	7.6	8.5	--
C	7.5	8.7	--
Ave.	7.6	8.6	--

Dissolved Oxygen

A	2.59	11.02	5.50
B	5.55	11.31	7.63
C	5.76	11.58	7.26
Ave.	4.63	11.30	6.80

Conductivity

A	--	268	275
B	--	250	274
C	--	288	272
Ave.	--	260	274

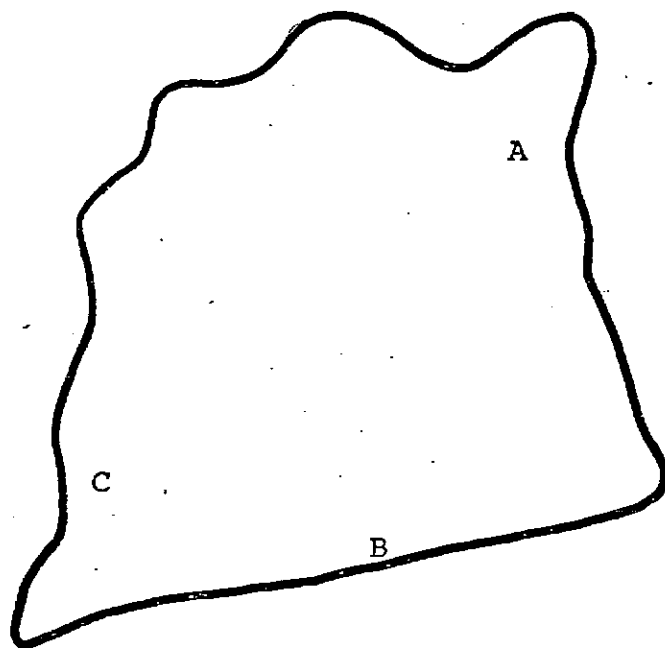
B.O.D.

A	1.24	.20	7.67
B	1.26	2.64	2.59
C	1.23	1.56	3.00
Ave.	1.24	1.47	4.42

Coliform

A	3	4	15
B	3	93	75
C	3	23	43
Ave.	3	40	44

FRENCH LAKE
RICE COUNTY



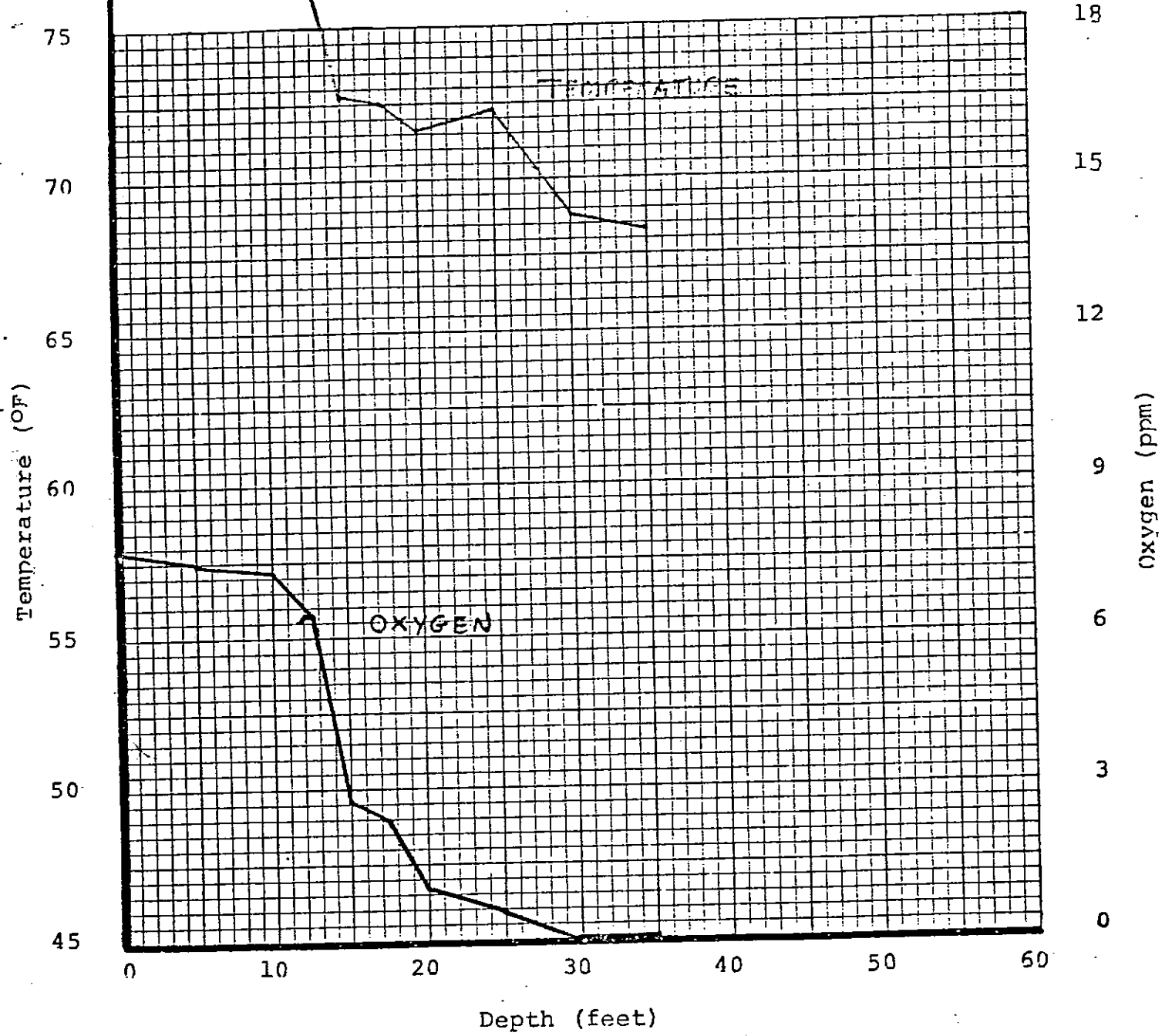
Sampling Sites

- A - N.E. Corner (low land)
- B - South side
- C - S.W. Corner

French Lake is in that group of lakes with intermediate water quality. Water clarity reflects that an extensive algal bloom was occurring in the late summer. The B.O.D. levels increased sharply in the late summer over the earlier two sampling periods. Phosphate levels were quite low except for the sample taken in the south west corner during the winter sampling period. This sample may reflect a source of nutrient material in the lake. The ammonia levels decreased over the summer period. Coliforms were starting to approach the level where they would be of concern. The sample taken in the north east corner had more coliform bacteria than the other samples taken during both the spring and summer periods. There was a decrease in oxygen at depths greater than 10 feet.

TEMPERATURE/OXYGEN PROFILE

French



Lake French
 County Rice

Water Quality Index 63

	Date		
Site	2/25	6/7	8/22

	Date		
Site	2/25	6/7	8/22

Depth

A	3'	4'2"	4'
B	6'	14'6"	5'
C	4'6"	12'10"	5'
Ave.	4'6"	10'6"	5'

Phosphate

A	.170	.133	.161
B	.170	.133	.134
C	.293	.133	.134
Ave.	.211	.133	.142

Secci Disc

A	--	4'2"	1'10"
B	--	10'6"	1'10"
C	--	7'8"	1'10"
Ave.	--	9'1"	1'10"

Ammonia

A	.764	.530	.193
B	.676	.515	.145
C	.735	.656	.080
Ave.	.728	.570	.139

Temperature

A	32.9	72.5	78.26
B	33.8	73.4	76.46
C	33.8	72.5	75.74
Ave.	33.5	72.8	76.82

pH

A	7.5	8.0	--
B	7.4	8.1	--
C	7.3	8.0	--
Ave.	7.4	8.0	--

Dissolved Oxygen

A	8.46	10.75	7.00
B	8.46	9.59	7.72
C	4.61	9.37	8.01
Ave.	7.18	9.90	7.58

Conductivity

A	--	290	251
B	--	280	252
C	--	280	250
Ave.	--	283	251

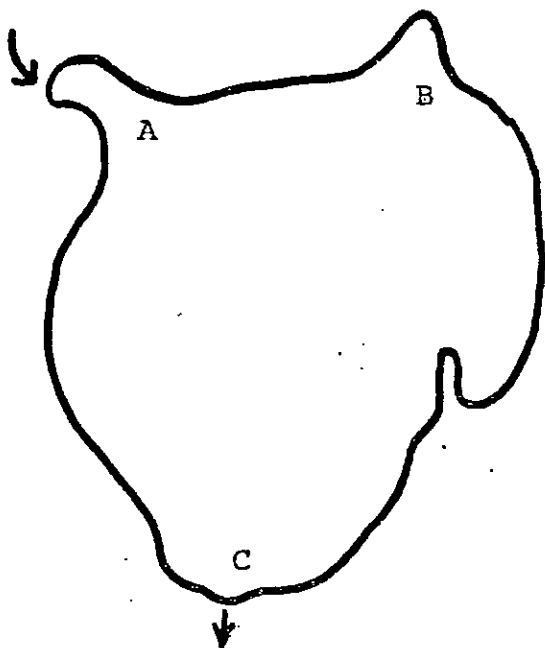
B.O.D.

A	1.21	1.79	5.21
B	1.23	.92	6.24
C	1.29	.88	5.80
Ave.	1.24	1.20	5.75

Coliform

A	3	93	460
B	3	3	93
C	3	9	240
Ave.	3	35	264

SHIELDS LAKE
RICE COUNTY



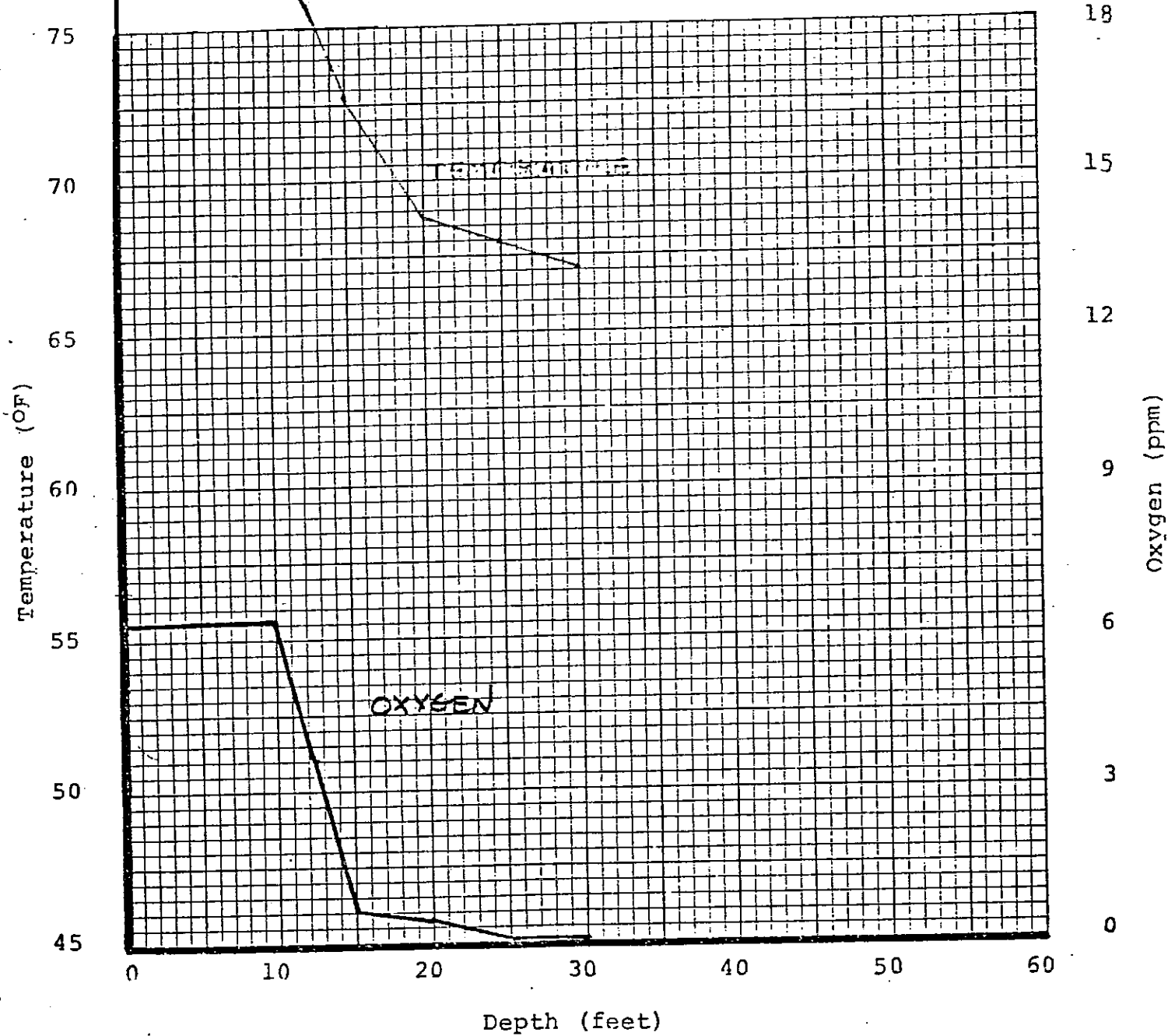
Sampling Sites

- A - N.W. Corner at inlet creek
- B - North Bay
- C - South end near Cannon River outlet

Shields Lake is in that group of lakes with intermediate water quality. A decrease in water clarity was noted between the spring and summer sampling time. B.O.D. levels increased sharply at the late summer sampling time, reflecting the presence of organic matter. Phosphate levels, while not extremely high, were higher than some of the other lakes in Rice County and remained high throughout the summer. Of particular interest is the phosphate level in the sample taken in the north bay. This level was higher than other samples from Shields Lake in both the winter and spring sampling times. Ammonia levels were quite high, greater than one ppm in the winter sampling time and while they did decrease, were still quite high at the late summer. Coliform levels were not at the level where they would generate a lot of concern. There was a sharp decrease in temperature and dissolved oxygen at depths greater than ten feet. The high conductivity readings and high ammonia levels on Shields Lake suggest that run-off, possibly containing high mineral content, may be a significant contributor to Shields Lake.

TEMPERATURE/OXYGEN PROFILE

Shields



Lake Shields
 County Rice

Water Quality Index 60

Site	Date		
	2/25	6/7	8/22

Site	Date		
	2/25	6/7	8/22

Depth

A	11'	11'6"	4'
B	10'	11'9"	7'
C	9'	10'3"	2'
Ave.	10'	11'2"	4'

Phosphate

A	.293	.267	.242
B	.341	.422	.296
C	.293	.244	.296
Ave.	.309	.311	.278

Secci Disc

A	--	4'9"	2'11"
B	--	4'8"	2'10"
C	--	6'8"	1'6"
Ave.	--	5'4"	2'5"

Ammonia

A	1.433	.804	.547
B	1.235	.804	.217
C	1.323	.469	.490
Ave.	1.330	.692	.418

Temperature

A	33.8	74.30	75.92
B	33.8	75.20	77.36
C	33.8	71.24	72.68
Ave.	33.8	73.58	75.32

pH

A	7.3	8.5	--
B	7.3	8.4	--
C	7.4	8.4	--
Ave.	7.3	8.4	--

Dissolved Oxygen

A	6.15	9.64	5.13
B	6.92	9.81	6.94
C	5.38	9.54	7.23
Ave.	6.15	9.66	6.43

Conductivity

A	--	355	318
B	--	350	318
C	--	345	318
Ave.	--	350	318

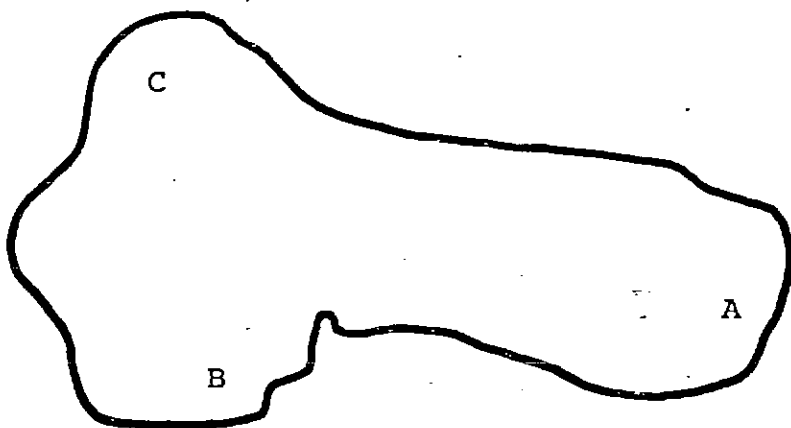
B.O.D.

A	1.28	.39	7.33
B	1.26	.73	5.67
C	1.24	.23	6.50
Ave.	1.26	.45	6.50

Coliform

A	3	15	240
B	3	23	240
C	43	15	93
Ave.	16	18	191

ROBERDS LAKE
RICE COUNTY



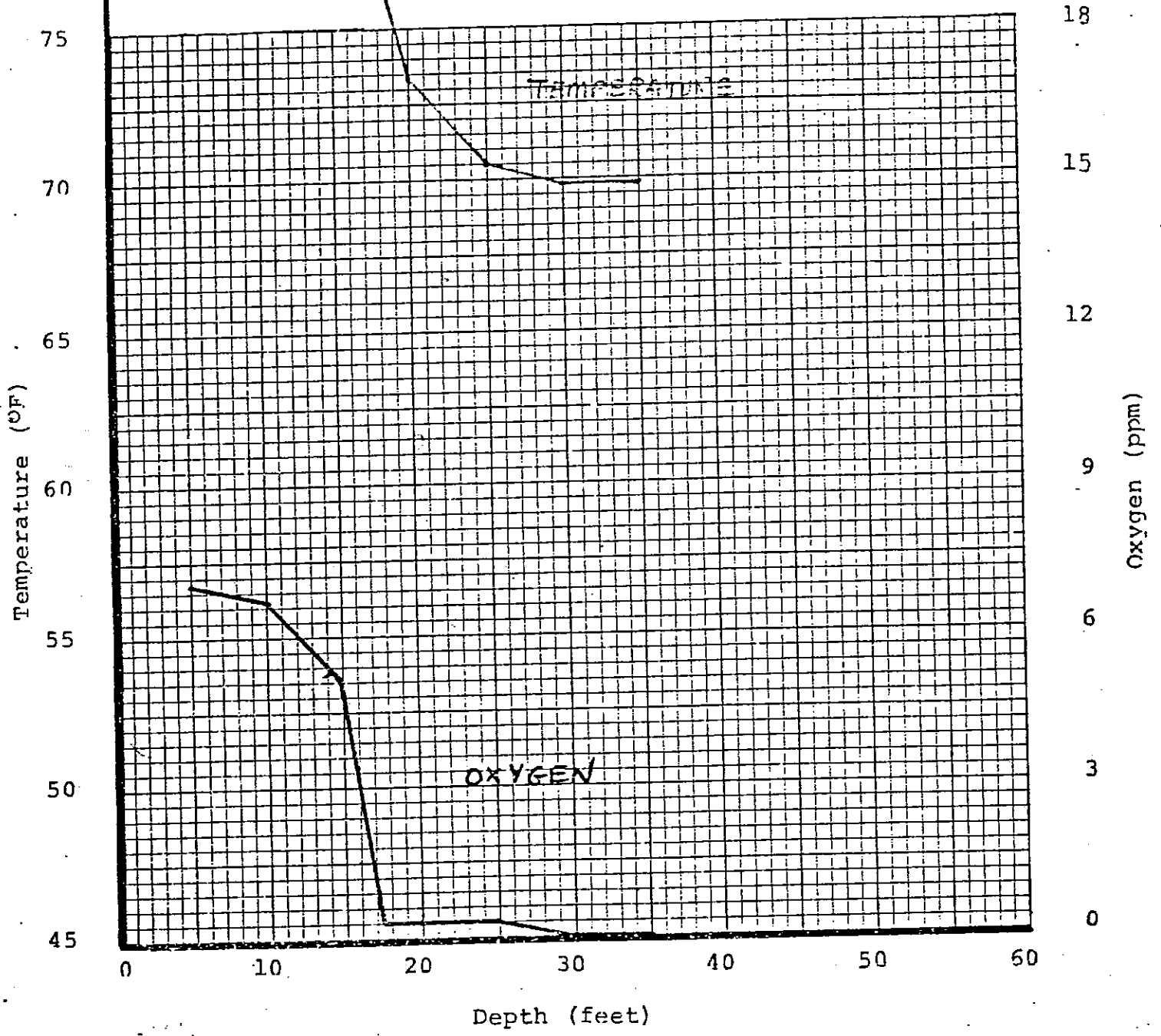
Sampling Sites

- A - East end (swimming beach)
- B - S.W. Bay
- C - N.W. Bay

Roberds Lake is in that group of lakes which have poor water quality. The secci disc readings in Roberds Lake reflect the presence of Algal blooms during most of the warm season. B.O.D. levels in the summer were quite high compared to the earlier sampling times, particularly in the south west bay of Roberds Lake. The sample taken there in the late summer had a B.O.D. reading of 15 mg/l, strongly suggesting the presence of organic matter. The levels of phosphate in Roberds Lake were quite high. It is of interest to note that they were higher in the late summer than they were in the spring. This is not the usual situation with phosphorous in lakes in Minnesota. The ammonia levels were quite high. One particular sample taken in the north west bay during the late summer was much higher than the other samples taken at that time. The levels of coliform bacteria were not at a level which would cause great concern, however, during the spring and summer sampling times, the north west bay did have more coliform bacteria than the other two sampling sites. There was a sharp decrease in both temperature and dissolved oxygen at depths greater than 15 feet.

TEMPERATURE/OXYGEN PROFILE

Roberds



Lake Roberds

County Rice

Water Quality Index 55

Site	Date		
	2/25	6/7	8/22

Site	Date		
	2/25	6/7	8/22

Depth

A	10'	9'	9'
B	6'	10'2"	6'
C	5'4"	7'	6'
Ave.	7'1"	8'9"	7'

Phosphate

A	.488	.222	.457
B	.415	.222	.430
C	.415	.222	.457
Ave.	.439	.222	.448

Secchi Disc

A	--	7'	2'9"
B	--	7'6"	2'7"
C	--	3'	3'4"
Ave.	--	5'10"	2'11"

Ammonia

A	1.544	.812	.289
B	1.624	.695	.217
C	1.617	.750	.517
Ave.	1.595	.752	.341

Temperature

A	34.7	73.4	81.1
B	34.7	73.4	79.2
C	35.6	72.3	78.1
Ave.	35.0	73.0	79.5

pH

A	7.5	8.3	--
B	7.5	8.3	--
C	7.5	8.5	--
Ave.	7.5	8.4	--

Dissolved Oxygen

A	8.2	10.6	5.8
B	7.4	9.1	7.3
C	7.9	10.7	5.0
Ave.	7.8	10.1	6.0

Conductivity

A	--	260	266
B	--	265	250
C	--	265	263
Ave.	--	263	263

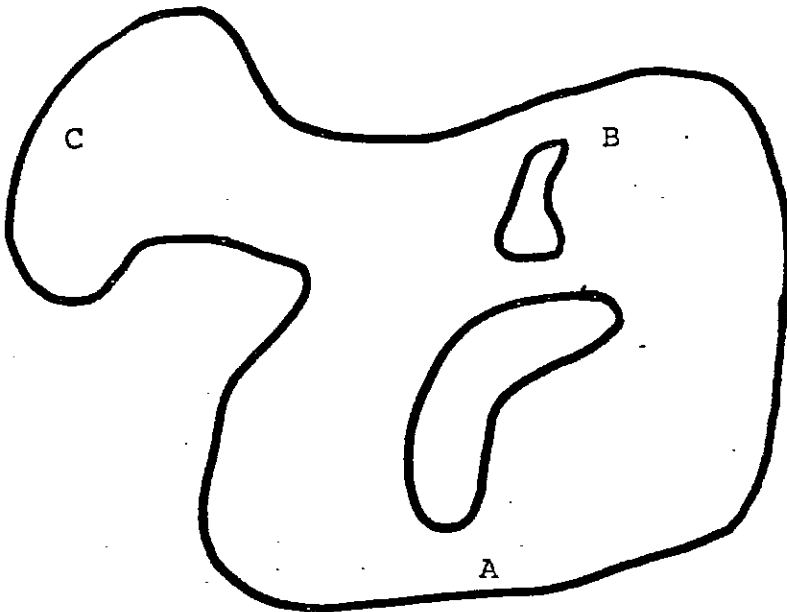
B.O.D.

A	1.2	1.3	8.0
B	1.2	.2	15.4
C	1.3	3.1	5.1
Ave.	1.2	1.5	9.5

Coliform

A	3	9	43
B	3	43	43
C	3	93	240
Ave.	3	48	109

CEDAR LAKE
RICE COUNTY

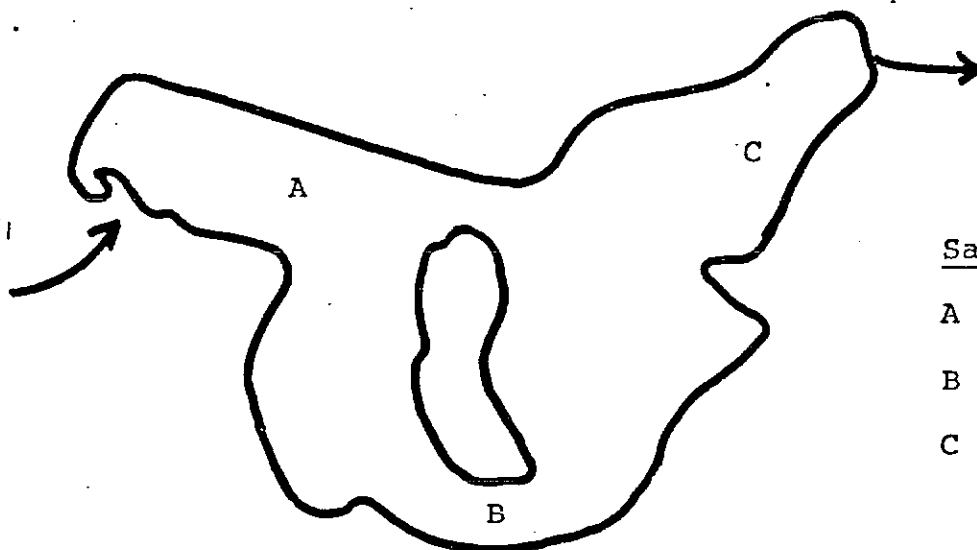


Sampling Sites

- A - South end
- B - North east
- C - N.W. Bay near outlet

Cedar Lake is in that group of lakes with poor water quality. Secci disc readings reflect the presence of an algae bloom throughout the warm season. B.O.D. levels were high throughout the sampling time particularly in the early spring. Phosphate levels were intermediate, of particular interest is the sample taken in the north west bay, at all times this sample had more phosphate than the other two sites in the lake. Ammonia levels were quite high. The north west bay had much higher levels of ammonia than did other sites in the lake. Coliform levels in the north east part of the lake and the north west part of the lake were at the level that would cause concern from the public health standpoint. These samples were taken in the winter and may reflect sources of animal or human waste into the lake at these points. The dissolved oxygen and temperature decreased sharply at depths greater than ten feet. The dissolved oxygen was essentially zero at depths greater than 15 feet in Cedar Lake.

CIRCLE LAKE
RICE COUNTY



Sampling Sites

- A - Northwest arm
- B - South end
- C - North east corner
(near Wolf Creek outlet)

Circle Lake is in that group of lakes with poor water quality. The secci disc readings reflect the presence of an algal bloom throughout the warm season. B.O.D. levels were particularly high in the late summer. The north west arm of Circle Lake had a higher B.O.D. reading in the spring than the other sites on the lake. Levels of phosphate were quite high throughout the entire evaluation period. Ammonia levels were also high throughout the year. Levels of coliform bacteria were at the level which would cause concern from the public health standpoint. The sample taken at the north east corner near the Wolf Creek outlet in the late summer was particularly high. There was no decrease in temperature or dissolved oxygen with increasing depths in Circle Lake. Circle Lake is a shallow lake and the wave action may cause resuspension of bottom material and may be responsible for the high levels of nutrients throughout the sampling period.

Lake Cedar
 County Rice

Water Quality Index 53

	Date		
Site	2/25	6/7	8/22

	Date		
Site	2/25	6/7	8/22

Depth

A	7'	7'6"	7'
B	5'4"	5'	11'
C	4'1"	4'	6'
Ave.	5'6"	5'6"	8'

Phosphate

A	.300	.200	.134
B	.292	.250	.134
C	.439	.275	.161
Ave.	.374	.242	.143

Secci Disc

A	--	2'8"	3'
B	--	3'	2'8"
C	--	2'6"	2'4"
Ave.	--	2'9"	2'8"

Ammonia

A	.735	.406	.184
B	.809	.529	.184
C	1.580	.507	.161
Ave.	1.041	.481	.176

Temperature

A	35.6	72.5	79.16
B	34.7	75.2	81.32
C	34.7	77.0	80.60
Ave.	35.0	74.9	80.36

pH

A	7.5	8.6	--
B	7.6	8.4	--
C	7.5	8.5	--
Ave.	7.5	8.5	--

Dissolved Oxygen

A	10.0	14.06	6.44
B	7.77	12.16	5.46
C	4.44	13.02	6.03
Ave.	7.40	13.08	5.98

Conductivity

A	--	230	230
B	--	235	230
C	--	240	230
Ave.	--	235	230

B.O.D.

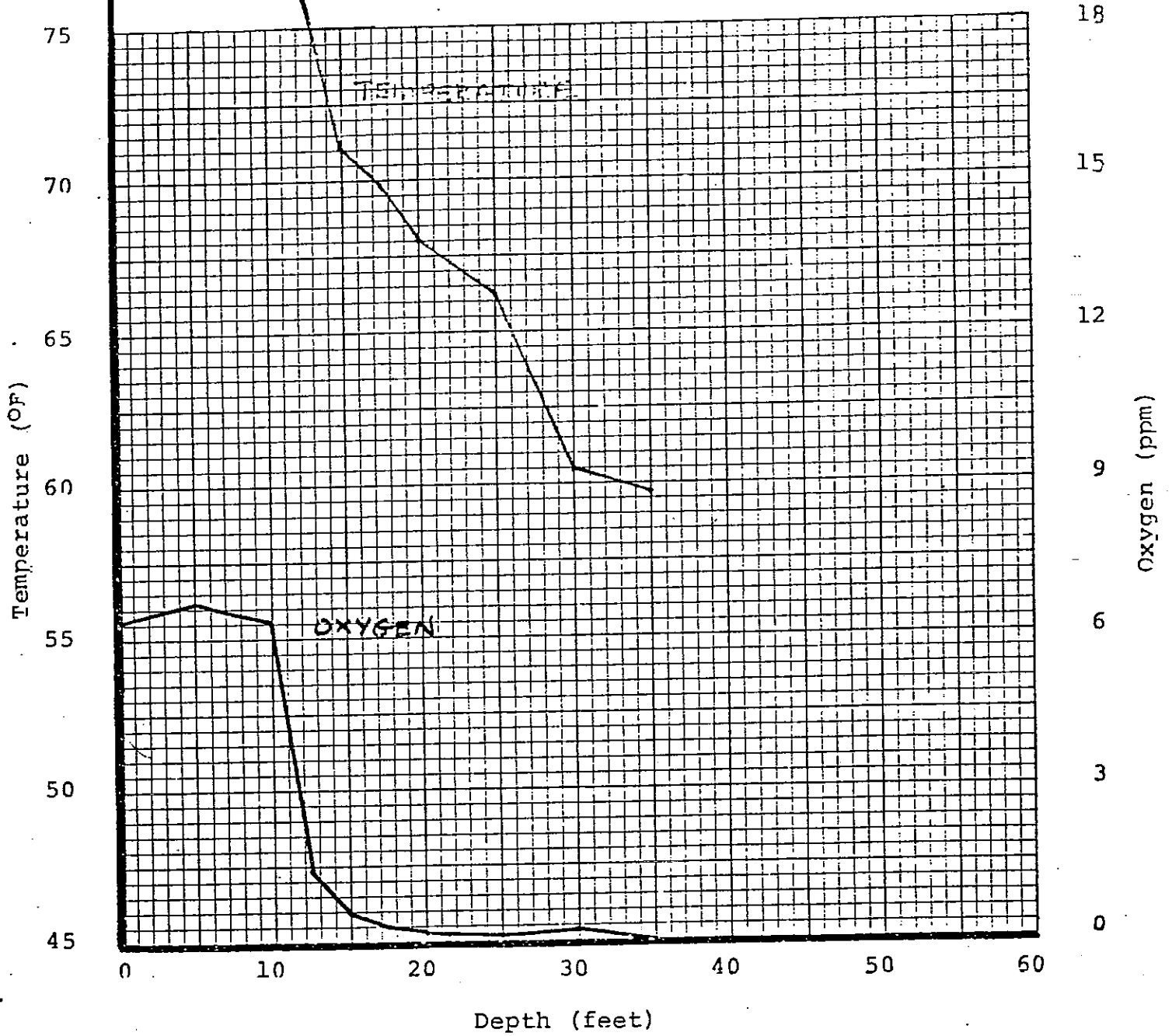
A	3.07	6.36	3.79
B	3.27	4.31	3.63
C	2.00	5.16	4.53
Ave.	2.78	5.28	3.98

Coliform

A	240	43	240
B	2400	93	240
C	1100	93	93
Ave.	1247	76	191

TEMPERATURE/OXYGEN PROFILE

Cedar



Lake _____ Union _____
 County _____ Rice _____

Water Quality Index 46

	Date		
Site	2/25	6/7	8/14

	Date		
Site	2/25	6/7	8/14

Depth

A	3'3"	6'10"	6'
B	3'9"	4'10"	6'2"
C	5'	6'9"	5'
Ave.	4'	5'6"	5'9"

Phosphate

A	1.049	.578	.349
B	.659	.600	.376
C	.683	.533	.349
Ave.	.797	.570	.358

Secci Disc

A	--	1'6"	1'10"
B	--	1'8"	1'6"
C	--	1'7"	1'5"
Ave.	--	1'7"	1'7"

Ammonia

A	1.339	.910	.546
B	.970	.922	.956
C	1.103	.992	.570
Ave.	1.137	.941	.691

Temperature

A	35.6	75.2	77.0
B	36.5	76.1	77.0
C	36.5	74.8	76.1
Ave.	36.2	75.4	76.7

pH

A	7.3	8.6	10.0
B	7.7	8.6	9.8
C	7.5	8.7	10.0
Ave.	7.5	8.6	9.9

Dissolved Oxygen

A	1.5	13.6	17.4
B	1.0	14.1	14.5
C	3.6	12.9	16.9
Ave.	2.0	13.5	16.3

Conductivity

A	--	310	318
B	--	300	312
C	--	340	318
Ave.	--	317	316

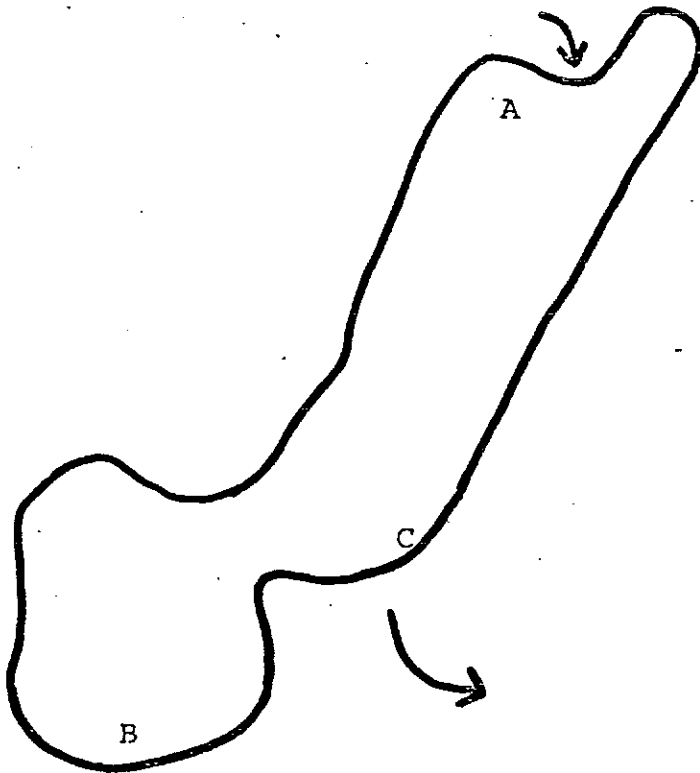
B.O.D.

A	1.2	6.3	3.8
B	1.3	5.3	4.7
C	1.2	4.4	4.2
Ave.	1.2	5.3	4.2

Coliform

A	3	23	3
B	23	9	9
C	3	15	3
Ave.	10	16	5

UNION LAKE
RICE COUNTY



Sampling Sites

- A - North end
- B - South east corner
(near Union Creek outlet)
- C - South west corner (near
Union Creek inlet)

The secci disc readings in Union Lake reflect the presence of an algal bloom throughout the spring and summer periods. B.O.D. levels were high in the early spring and intermediate in the late summer. Phosphate levels were quite high throughout the season, of particular interest is the sample taken in the north end of Union Lake at the winter sampling time. Ammonia levels were quite high throughout the period of this evaluation. The pH levels of Union Lake were high during the late summer sampling period. Levels of coliform bacteria were not of the magnitude which would cause concern from the public health standpoint. The shallow nature of Union Lake and subsequent resuspension of bottom material may be responsible for the high nutrient levels found in this evaluation.

Lake _____ Circle _____
 County _____ Rice _____

Water Quality Index 48

	Date		
Site	2/25	6/7	8/22

	Date		
Site	2/25	6/7	8/22

Depth

A	3'3"	4'	10'
B	8'2"	7'2"	5'
C	10'3"	9'	9'
Ave.	7'3"	6'9"	8'

Phosphate

A	.610	.399	.726
B	.585	.311	.726
C	.512	.466	.673
Ave.	.569	.392	.708

Secchi Disc

A	--	11"	1'3"
B	--	2'1"	1'3"
C	--	2'4"	1'3"
Ave.	--	1'9"	1'3"

Ammonia

A	1.764	.883	1.302
B	1.514	.757	1.423
C	1.367	.937	1.246
Ave.	1.548	.850	1.324

Temperature

A	33.8	76.6	77.9
B	34.7	75.4	77.9
C	34.7	71.6	78.8
Ave.	34.4	74.5	78.2

pH

A	7.5	8.4	--
B	7.5	8.5	--
C	7.4	8.7	--
Ave.	7.5	8.5	--

Dissolved Oxygen

A	3.1	9.7	5.3
B	3.0	10.0	5.3
C	3.7	10.5	5.0
Ave.	3.3	10.1	5.2

Conductivity

A	--	320	390
B	--	285	390
C	--	270	390
Ave.	--	292	390

B.O.D.

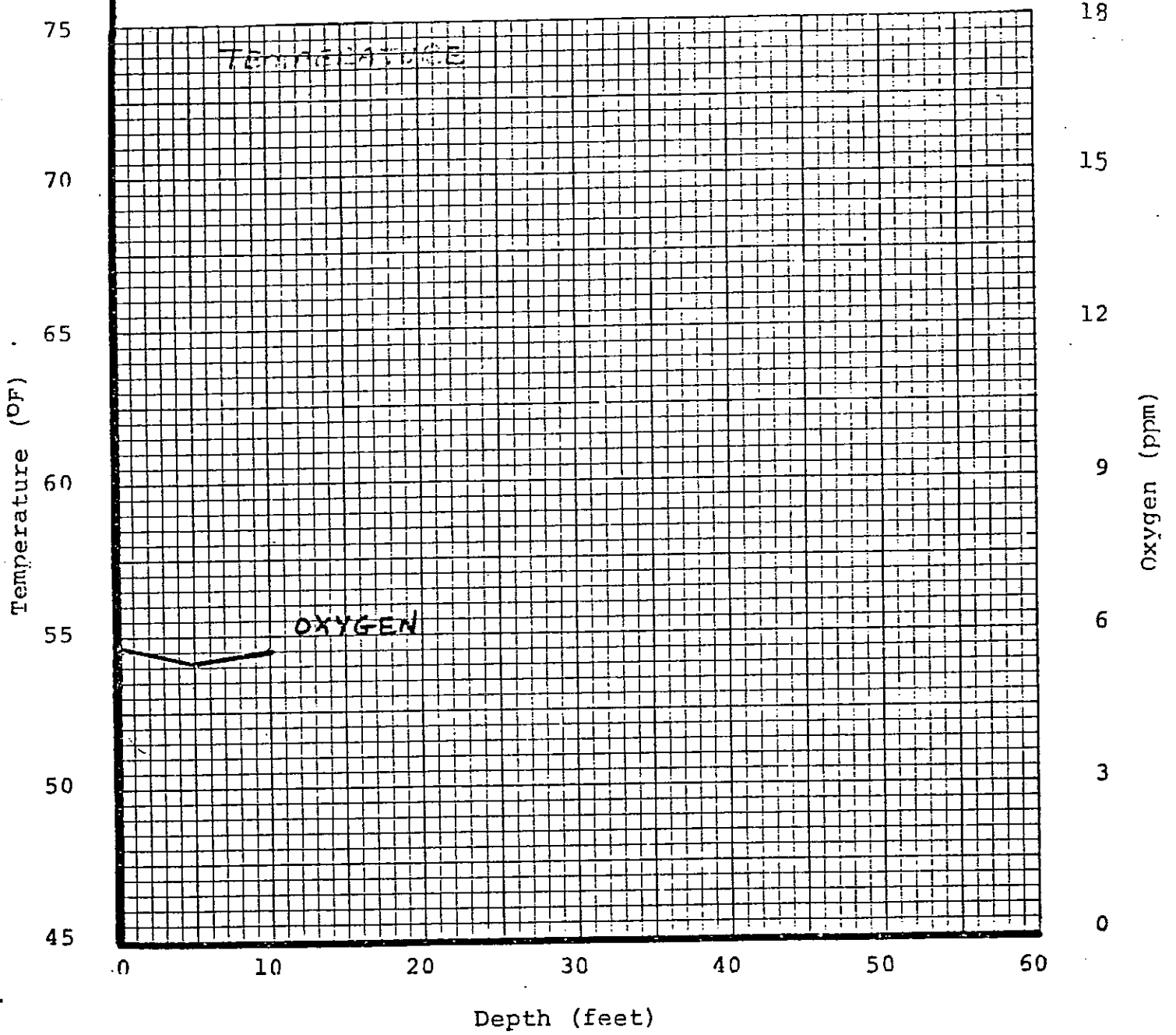
A	1.3	4.1	5.6
B	1.2	2.7	5.4
C	1.2	2.6	5.7
Ave.	1.2	3.1	5.6

Coliform

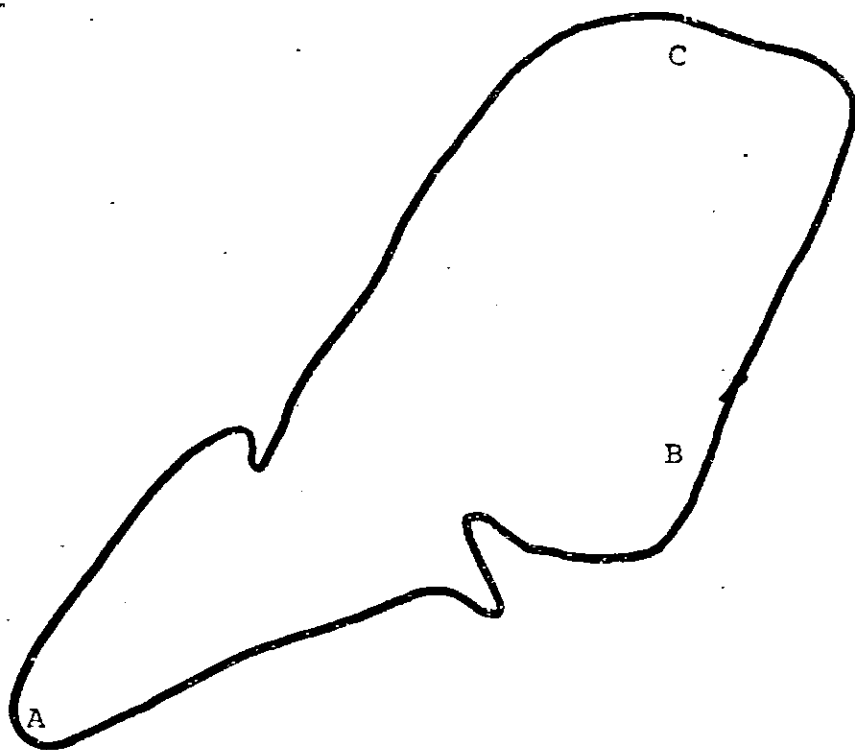
A	3	93	240
B	3	240	150
C	4	4	2400
Ave.	3	112	930

TEMPERATURE/OXYGEN PROFILE

Circle



CANNON LAKE
RICE COUNTY



Sampling Sites

- A - Inlet near Warsaw
- B - Beach on S.E. side
- C - Bridge between Cannon and Wells Lakes

Cannon Lake represents the lake with the poorest water quality in Rice County. Water clarity as reflected by secci disc readings of less than one foot indicate that algal blooms were extensive in this lake. Early summer temperatures of greater than 80° were recorded. B.O.D. levels were quite high in the spring, possibly as a result of material carried down the river and deposited in Cannon Lake. A particularly high B.O.D. level was found in the sample taken near the bridge between Cannon and Wells Lakes in the early summer. Phosphate levels were quite high, particularly the sample taken off the swimming beach during the winter. Ammonia levels were quite high though they did decrease later on in the summer. Of particular interest is the sample taken off the swimming beach area in the winter and in the spring. Coliform levels were relatively high throughout the period of this evaluation, the highest level recorded near the bridge on the outlet of Cannon Lake in the late summer. The conductivity levels in Cannon Lake were higher than any other lake in Rice County. This reflects the presence of minerals in the lake, possibly as a result of run-off and other sources having high mineral content.

River System in Rice County

The water quality in the Cannon and Straight River Systems in Rice County is poor. A map showing sampling sites on the river system is included at the end of this report. The river system was characterized by high nutrients and the presence of coliform bacteria. B.O.D. levels reached values as high as 12 mg/l, phosphate levels as high as seven ppm and ammonia levels as high as 12 ppm were recorded. Coliform bacteria levels as high as 72,000 were recorded and conductivity levels as high as 1600 were recorded for this river system.

The river system in Rice County seems to be greatly influenced by the presence of the municipalities along its banks. The Cannon River, as it goes through Morristown, increases in the level of coliforms found in its water. The levels of coliform bacteria and the nutrient levels decrease until the river reaches Cannon Lake. At the outfall of Cannon Lake there is again an increase in the nutrient material and there is a sharp increase after the Straight River joins Cannon in downtown Faribault. The Straight River has quite high levels of nutrients and bacteria all the way from the point where it enters Rice County until it joins with the Cannon River in Faribault. There is a sharp increase in phosphate, ammonia and B.O.D. levels just before the Straight River joins the Cannon, possibly due to the presence of municipal treatment facilities for the city of Faribault, just above this sampling point. The levels of nutrients and bacteria remain quite high from the junction of the Cannon and the Straight until the Cannon leaves the county in Northfield.

The nutrient and bacteria levels in Heath Creek are very high near the source of the Creek in Lonsdale. These levels decrease as the creek goes through Union Lake and onto the Cannon River in Northfield. The nutrient levels in Heath Creek are still quite high at the point of junction with the Cannon River in Northfield.

The data from the river system reflect the impact of municipalities on the watershed system in Rice County. Attention should be given to the adequacy of the municipal treatment facility now in operation with emphasis on their contribution to the water quality of the river system.

Lake Cannon
 County Rice

Water Quality Index 44

Site	Date		
	2/25	6/7	8/14

Site	Date		
	2/25	6/7	8/14

Depth

A	6'	4'6"	1'9"
B	5'3"	7'	3'
C	10'	7'	4'
Ave.	7'1"	6'2"	3'

Phosphate

A	.610	.450	.538
B	.829	.625	.403
C	.610	.675	.645
Ave.	.683	.583	.529

Secchi Disc

A	--	1'	1'8"
B	--	10"	11"
C	--	1'2"	2'2"
Ave.	--	1'	1'7"

Ammonia

A	1.352	.478	.474
B	1.632	1.355	.064
C	1.007	.920	.321
Ave.	1.330	.918	.286

Temperature

A	35.6	81.5	77.00
B	32.9	71.6	80.60
C	33.8	73.4	79.52
Ave.	34.1	75.5	79.04

pH

A	7.1	8.1	8.2
B	7.4	7.7	8.2
C	7.5	6.6	8.3
Ave.	7.3	7.5	8.2

Dissolved Oxygen

A	5.35	12.18	8.55
B	7.30	6.37	11.44
C	6.15	12.84	11.46
Ave.	6.27	10.46	10.48

Conductivity

A	--	404	420
B	--	410	455
C	--	370	495
Ave.	--	395	457

B.O.D.

A	1.28	9.23	3.47
B	1.62	6.82	7.36
C	2.15	12.20	3.59
Ave.	1.68	9.42	4.81

Coliform

A	150	150	460
B	240	23	240
C	460	39	1100
Ave.	383	71	600

<u>Site</u>	<u>Location</u>
A	Cannon River above Morristown
B	Cannon River below Morristown
C	Inlet of Cannon Lake
D	Outflow of Cannon Lake
E	Cannon River near mill in Faribault
F	Cannon River before junction with Straight River
G	Straight River wher it enters Rice County
H	Straight River off highway 90 bridge
I	Straight River South of Faribault
J	Straight River before junction with Cannon River
K	Cannon River after junction with Straight River
L	Cannon River at Park
M	Cannon River at bridge below Dundas
N	Cannon River where it leaves County at Northfield
O	Heath Creek south of Lansdale
P	Heath Creek in Northfield

River System
 County Rice

Date
 Site | 2/25 | 6/7 | 8/22

Depth

A	2'6"	1'	11"
B	2'0"	1'	4'1"
C	5'3"	4'6"	1'9"
D	6'	7'	4'
E	8"	6"	1'
F	18"	--	1'
G	3'	3'	2'10"
H	--	1'6"	1'10"
I	--	3'	--
J	3'	--	3'
K	--	--	2'
L	--	--	3'
M	--	--	3'6"
N	3'	--	--
O	2'	1'	--
P	2'	--	--

Date
 Site | 2/25 | 6/7 | 8/22

Secci Disc

A	--	--	--
B	--	--	2'3"
C	--	1'	1'8"
D	--	1'2"	2'2"
E	--	--	--
F	--	--	--
G	--	11"	1'9"
H	--	10"	--
I	--	9"	--
J	--	--	--
K	--	--	--
L	--	--	--
M	--	--	3'6"
N	--	--	--
O	--	--	--
P	--	--	--

Site | 2/25 | Date 6/7 | 8/22

Temperature

A	32.9	79.5	81.50
B	32.9	81.3	78.80
C	32.9	79.5	77.00
D	35.6	73.4	79.52
E	35.6	80.04	76.10
F	34.7	82.2	87.80
G	32.9	78.8	82.40
H	--	99.5	83.30
I	--	80.0	--
J	36.5	79.5	86.00
K	--	--	86.90
L	32.9	75.2	83.84
M	32.9	77.9	84.20
N	32.9	77.0	80.96
O	32.9	75.2	69.80
P	32.9	75.2	80.60

Dissolved Oxygen

A	6.15	11.27	6.85
B	7.30	10.43	6.32
C	7.30	12.18	8.55
D	5.35	12.84	11.46
E	10.00	9.69	7.69
F	11.85	7.53	8.03
G	9.23	8.94	8.81
H	--	9.90	10.18
I	--	8.88	--
J	11.29	10.54	8.60
K	--	--	8.22
L	10.00	9.08	6.13
M	8.08	8.29	10.13
N	3.84	8.79	7.30
O	7.30	8.59	--
P	7.69	9.43	8.76

Site | 2/25 | Date 6/7 | 8/22

B.O.D.

A	2.70	6.02	3.80
B	1.50	6.85	3.26
C	1.62	9.23	3.47
D	1.28	12.20	3.59
E	2.35	5.18	3.50
F	3.95	7.14	5.13
G	4.66	3.81	1.09
H	--	2.90	2.66
I	--	2.30	--
J	10.30	5.41	1.29
K	--	--	5.29
L	3.33	5.97	--
M	4.26	3.23	2.64
N	3.59	3.04	2.27
O	6.93	10.42	--
P	1.00	8.73	7.35

Phosphate

A	.586	.500	.753
B	.634	.475	.780
C	.829	.450	.538
D	.610	.675	.645
E	.756	.425	.457
F	.732	.550	.484
G	.829	.725	.645
H	--	.550	.538
I	--	.725	--
J	1.756	.700	.430
K	--	--	.511
L	.878	.725	.564
M	1.122	.675	.618
N	.780	.700	1.802
O	7.027	1.844	4.411
P	.659	1.050	.780

Site | 2/25 | Date 6/7 | 8/22

Ammonia

A	1.926	.493	1.760
B	1.499	.478	1.053
C	1.632	.478	.474
D	1.352	.920	.321
E	.919	.731	.820
F	.941	.659	.603
G	1.558	.370	.466
H	--	.341	.506
I	--	.485	--
J	2.212	.623	.329
K	--	--	.570
L	1.073	.609	.570
M	1.889	.485	.265
N	.867	.507	.184
O	12.495	.562	.603
P	.794	.638	.498

Site | 2/25 | Date 6/7 | 8/22

Conductivity

A	--	370	450
B	--	404	600
C	--	410	420
D	--	370	495
E	--	382	490
F	--	383	650
G	--	920	900
H	--	980	990
I	--	890	--
J	--	1600	900
K	--	--	495
L	--	770	850
M	--	730	800
N	---	700	710
O	--	--	800
P	--	500	370

pH

A	7.3	8.6	8.0
B	7.6	8.4	8.0
C	7.4	8.1	8.2
D	7.1	6.6	8.3
E	7.0	--	8.0
F	7.4	8.1	8.1
G	7.6	7.8	8.0
H	--	7.8	8.3
I	--	7.8	--
J	7.5	7.7	8.5
K	--	--	8.1
L	6.8	7.8	7.8
M	7.3	8.0	8.1
N	7.5	7.7	7.8
O	7.3	--	6.8
P	7.6	7.8	7.9

Coliform

A	43	1100	43
B	2400	460	72400
C	240	150	460
D	150	39	1100
E	93	460	460
F	240	2400	1100
G	2400	2400	2400
H	--	2400	1100
I	--	1100	--
J	2400	2400	460
K	--	--	1100
L	2400	2400	2400
M	2400	2400	2400
N	2400	2400	2400
O	10000	240	43000
P	2400	2400	2400

The following is from John B. Moyle
 Assistant Director
 Division of Game & Fish
 State of Minn.

Comparison of Secchi disk reading and dissolved oxygen levels in some Rice County lakes,
 June 1972 as compared with summer analyses during 1947-58 period

Lake	Secchi disk--feet		Dissolved oxygen surface - 3 feet		Dissolved oxygen 8-20 feet		Depth--feet	
	Mean June '72	Summer 1947-58	Mean June '72	Summer 1947-58	Mean June '72	Summer 1947-58	Maximum	Median
Union	1' 6"	1' 0"	13.5	13.5	-	3.1	9	about 4
Circle	1' 11"	0' 6"	10.1	-	-	-	6	11
Fox	4' 11"	3' 0"	11.4	13.5	11.2	13.9	48	16
Roberds	5' 10"	8' 6"	10.4	5.8	9.5	5.5	43	12
French	7' 5"	11' 3"	9.9	6.8	9.2	6.0	56	15
Mazaska	4' 11"	7' 2"	11.3	15.1	11.2	5.5	46	about 15
Shields	5' 6"	8' 10"	9.2	7.4	10.1	7.3	35	9
Cedar	2' 8"	2' 9"	13.1	6.2	11.1	-	40	12
Cannon	0' 8"	2' 5"	10.4	8.1	9.3	5.2	15	10

RICE COUNTY BOARD OF HEALTH
 COURT HOUSE FARBULT, MINN.

DATE _____ INSPECTOR _____

J.B.M.
 8/11/72

FILE COPY

Lake Survey Report

Roberds (Roberts) Lake
Pice County

I. Introduction

Lake Name, Number and Location

Roberds (2-12); T. 110; R. 21; Sec. 15, 16, 21, 22;
near Faribault.

Dates of Field Work

Mapping: August 12, 1955.
Lake Survey: July 7-12, 1955.

Problem

Re-survey to provide up-to-date information.

Survey Request

District Fisheries Supervisor

Previous Surveys and Investigations

June, 1950, general survey.
July, 1940, partial lake survey.
June and August, 1938, minor investigation.

II. Lake and Drainage Basin Characteristics

Lake Area and Depth

Area: 608 acres (Gazetteer)

Maximum Depth: 43 feet; average (median) depth: 12 feet;
about 85 percent of the lake is shallower
than 15 feet.

Inlet and Flow

Unnamed creek from French Lake - S. 21; R. 21W; T. 110N;
S. W. corner of lake; no flow.

Outlet and Flow

Unnamed creek to Cannon Lake - S. 22; R. 21W; T. 110N;
S. E. corner of lake; no flow.

Dams

A type "C" dam at the outlet held a 1.5 foot head of water.

Benchmark and Lake Level

The benchmark is a spike in an oak tree 25 feet southwest
of the boathouse at the Roberd's Lake Resort. The water level
of the lake was 5.0 feet below the benchmark at the time of
the survey.

Water Level Fluctuations

The stage of the lake is normal and there is apparently little fluctuation. However, in 1949-50-51, the lake was low. The lake level was variable because of irregular operation of dam. A dam, 4 inches higher, was constructed in 1952. Level has been constant since then.

Nature and Use of Watershed

The watershed is mostly all privately owned farm land with some cover of mixed hardwoods - mostly oak.

Nature and Use of Shoreline

On the lake were counted 2 resorts, 183 cottages and about 200 boats. A public access has been established on the west end of the lake (section 16).

III. Physical and Chemical Characteristics

Turbidity and Color

Color: brown, possibly from decaying algae.
Secchi disk: 8.5 feet.

Temperature

Temperature range: surface 78°F. to 63°F. at 40 feet.
Limits of thermocline: 30 to 35 feet.

Dissolved Oxygen

	<u>p.p.m.</u>
Surface	5.8
Above thermocline (20 feet)	5.5
Below thermocline (40 feet)	0.0

There is not enough oxygen below the thermocline to support fish life.

Water Quality

Chemical analysis of surface water sample collected from the center of the lake on July 10, 1955:

	<u>p.p.m.</u>
Total alkalinity	145.0
Sulphate ion	16.0
Total phosphorus	0.279
Total nitrogen	2.47

Roberts Lake is a hardwater lake of high fertility.

IV. Biological Characteristics

Aquatic Plants

Aquatic plants almost totally lacking in the lake proper-- occasional pondweed fringe. Reeds on "grass" islands in middle of the lake.

Fishes Present

The common shiner, Notropis cornutus, and fathead minnow, Pimephales promelas, not listed in the 1950 survey report, were found in the 1955 survey.

Indices Of Fish Abundance

Species	Gillnets - 7 Sets		250-Foot Experimental Net		
	Number	Number Per Lift	Statewide Median	Pounds Per Lift	Statewide Median
Common sucker	4	0.57	1.56	0.97	2.23
Carp	1	0.14	-	1.40	-
Black bullhead	58	8.29	-	4.5	-
Northern pike	2	0.29	2.17	1.27	4.60
White bass	227	32.43	-	16.33	-
Yellow perch	936	133.71	9.00	32.97	1.73
Walleye	1	0.14	3.55	0.34	4.74
Largemouth bass	1	0.14	-	0.09	-
Bluegill	27	3.86	-	1.04	-
Black crappie	603	86.14	-	22.1	-
Sheepshead	179	25.57	9.42	20.47	3.98
			101.48		

Species	Trapnets - 12 Pots		5 Double-pot		2 Single-pot	
	Number	Number Per Lift	Statewide Median	Pounds Per Lift	Statewide Median	
Carp	45	3.75	2.00	13.48	7.30	
Black bullhead	99	8.25	1.80	4.11	.90	
Brown bullhead	4	0.33	1.50	0.29	1.25	
Yellow bullhead	1	0.08	1.60	0.03	1.20	
White bass	83	6.92	2.33	4.62	.98	
Yellow Perch	2	0.17	-	0.04	-	
Pumpkinseed	4	0.33	2.00	0.08	.40	
Bluegill	95	7.92	7.50	2.87	1.95	
White crappie	1	0.08	1.20	0.03	.24	
Black crappie	445	37.18	2.80	16.58	1.23	
Sheepshead	4	0.33	-	0.36	-	

Length-Frequency Distribution

	Black Bullhead	White Bass	Yellow Perch	Bluegill	Black Crappie
5.0				1	
5.5				1	
6.0				7	
6.5				18	
7.0			12	35	13
7.5			24	18	38
8.0	1		26	17	41
8.5	6		35	3	7
9.0	20	1	3		
9.5	43	2			
10.0	22	19			

Length - Frequency Distribution (continued)

	Black Bullhead	White Bass	Yellow Perch	Bluegill	Black Crappie
10.5	7	46			
11.0	1	3			
11.5		1			
12.0		1			
12.5		2			
13.0					1
13.5		1			
14.0		1			
14.5		6			
15.0		7			
15.5		6			
16.0		4			

Fish Age-Class Distribution

Species	Sample Size	Subsample Size	Age Class									
			I	II	III	IV	V	VI	VII	VIII	IX	
Yellow Perch	76	25		21	4							
Bluegills	75	25		21	4							
Black Crappie	76	24		22	1		1					

Fish Age and Growth

Mean Calculated Length At Time Of Last Annulus Formation.

Age Groups

Species	I (N)	II (N)	III(N)	IV (N)	V (N)	VI (N)
Yellow Perch		6.6(21)	8.3(4)			
Bluegills		5.1(21)	6.4(4)			
Black Crappies		6.6(22)	-			

The preceding tables indicate: (1) populations of perch, sheepshead, carp, bullheads, white bass, and black crappie are well above average; bluegills are about average in abundance; and others are low in numbers; (2) growth rates for perch, bluegills and crappies were faster than normal. A large 1954 walleye stocking did not show up in the catch probably because they were still too small in size to be taken in the gillnets. A winterkill in 1955-56 has probably changed the fish population structure considerably.

Fish Spawning Conditions and Success

Spawning Conditions

Northern pike - fair - two areas at western parts of lake.
Walleye - lacking - the only area noted was the gravel cover on the two "grass" islands in the middle of the lake.
Centrarchids - good - apparently good along the entire shoreline.

Spawning Success

The shoreline was seined at four places and a total of 2/3 acre covered. Numbers of fish taken are as follows:

Species	Fish Per Shoreline Acre
Common Shiner	45
Spottail Shiner	42
Largemouth Bass	6
Bluegill	8370
Black Crappie	29

Fish Parasites and Diseases

No unusual parasitism noted during a cursory examination.

V. Evidence of Erosion or Pollution

Several beaches are subjected to wave erosion. Some pollution possible from the areas used for pasturing.

VI. History of Lake Conditions and Fishing

From Past Investigations

Comparison with the 1950 survey, the 1955 report reveals an increase in total alkalinity of about 23 p.p.m. No thermocline was present during the 1950 survey - 6.6 p.p.m. of dissolved oxygen were found at a depth of 4 1/2 feet. During the 1955 survey there was a thermocline with limits at 30 to 35 feet-- no dissolved oxygen was found at 40 feet.

From Local Report

Fishing for the 1955 season was reported as "good". Fishes most commonly caught include: white bass, crappies, perch, bluegills, bullheads, largemouth bass, northern pike, and walleyes. Bullheads and crappies are reported to be smaller in size than those taken in 1949-51, but the sunfish are bigger. Generally good fishing was reported for the past few years. A winterkill was reported for 1955-56.

VII. Record of Past Management

Fish Stocking

The stocking record for the past ten years:

Year	Northern Pike	Walleye	L.M. BASS	Sunfish	Crappies
1946	30,000 fry 116 adult			15 adult	60 adult
1948	60,000 fry		1,616 fgl.		
1949	50,000 fry 2,070 fgl.			148 adult	240 adult
1951			1,305 fgl.		
1952	1,207 adult		2,120 fgl.	735 adult	7,174 adult
1953			1,000 fgl.	3,000 fgl.	
1954	60 adult	85,305 fgl.	3,750 fgl.		
1955	6,840 fgl.				

Fish Removal

1946	Carp	3,535 lbs.	Permit-seine
1947-48	Carp	900 "	S. C.
1949-50	Carp	10,635 "	S. C.
1950-51	Carp	7,046 "	S. C.
1951-52	Carp	3,000 "	S. C.
1952-53	Carp	35,858 "	Con.
	Buffalo	121 "	"
	Sheepshead	322 "	"
1953-54	Carp	32,868 "	"
	Buffalo	2,407 "	"
	Sheepshead	1,989 "	"
1954-55	Carp	70,282 "	"
	Buffalo	8,846 "	"
	Sheepshead	12,146 "	"
1954	Northern Pike	61 adults	Fish Prop.

Special Regulations

Open to promiscuous fishing 1955-56.

Closed to: darkhouse spearing 1949-50, 50-51.

angling 1949-50.

northern pike 1947

commercial minnows 1951-1953

minnows 1945-1951

spawning beds 1945-1954

Special Projects and Activities

A cooperative pond was used for largemouth bass in 1952.

The lake is treated annually with copper sulphate for control of algae by a local organization.

VIII. Lake Classification
Ecological Classification
Rough fish - bass - panfish

Management Classification
Bass - panfish - northern pike - walleye.

IX. Summary and Discussion

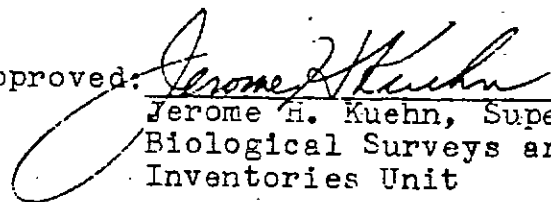
Because there is no natural reproduction of walleyes in this lake, artificial stocking is necessary if a walleye population is to be maintained. The low northern pike population must be bolstered either by stocking or preferably by spawning site improvement. An increase in the number of northern pike would help control the perch populations.

X. Credits and Signatures

Field Work By:
Alan Rick
John R. Coleman

Laboratory Work and Preliminary Report By:
Albert Farnham
Donald Woods

Classifications and Recommendations By:
Donald Woods
District Fisheries Biologist

Approved: 
Jerome H. Kuehn, Supervisor
Biological Surveys and
Inventories Unit

Date: August 24, 1956

LAKE SURVEY ABSTRACT
Roberts (Roberts) Lake (2-12)

Rice County

T. 110; R. 21; Sec. 15, 16, 21, 22; near Faribault.

Dates of Field Work: Mapping - August 12, 1955.

Lake Survey - July 7-12, 1955.

Roberts Lake was surveyed in 1955 to provide up-to-date information for management of the fish populations in the lake. It had been surveyed in 1950 and minor investigations have been made in 1938 and 1940.

The lake and drainage basin characteristics are as follows: Its area is 608 acres; maximum depth, 43 feet; average depth, 12 feet; and 85% of the area is shallower than 15 feet. One inlet from French Lake enters the lake with no flow recorded at the time of the survey. The outlet is a small creek that leads to Cannon Lake but had no flow. The water level had been relatively constant since the new construction was completed on the dam in 1952. The watershed is all privately owned farm land with some cover of mixed hardwoods. Two resorts, 183 cottages, and about 200 boats were counted. A public access is available on the west end of the lake.

The physical and chemical conditions are as follows: The fairly brown water was quite clear at the time of the survey. The temperature ranged from 78 degrees at the surface to 63 degrees at 40 feet. There is not sufficient oxygen for fish life below 30 feet.

To determine the condition of the fish population 7 gillnet and 12 trapnet sets were made. The catch appeared as follows: perch, sheepshead, carp, bullheads, white bass, and black crappie were well above average in numbers, bluegills were average in abundance; and suckers, northern pike, walleye, largemouth bass were low in numbers. Growth rates were found to be faster than normal for perch, bluegills, and crappies. The winter kill in 1955-56 has probably changed the fish population structure considerably.

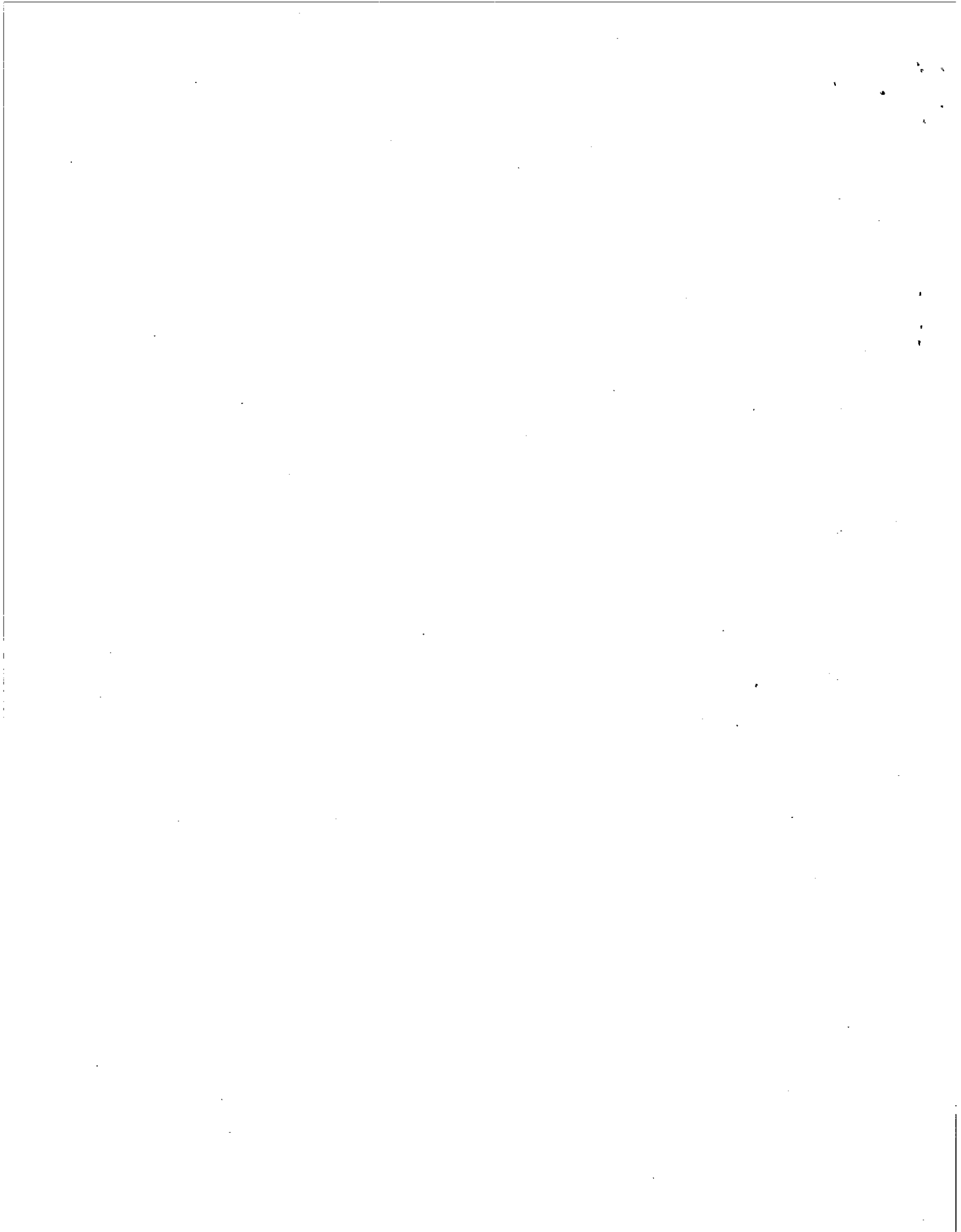
Spawning conditions were found good for sunfish, fair for northern pike, but lacking for walleye. Great numbers of bluegill and some largemouth bass, crappie fingerlings were taken in seining hauls made along the shore.

Fishing was reported as good during 1955 and for several years prior.

Over the past ten years northern pike, walleye, largemouth bass, sunfish, and crappies have been stocked. Walleyes were stocked in large numbers only in 1954. During the same time

rough fish removal have removed carp, buffalo, and sheepshead each winter. Up to 70 thousand pounds of carp have been removed in one year (1954-1955). The removal of buffalo and sheepshead has been rather small.

This lake which is a natural rough fish-bass-pan fish type of lake will be managed as a bass-pan fish-northern pike-walleye lake and will require artificial stocking to maintain the walleye population. Improvement of natural spawning of the northern pike will be stressed.



Rice County

