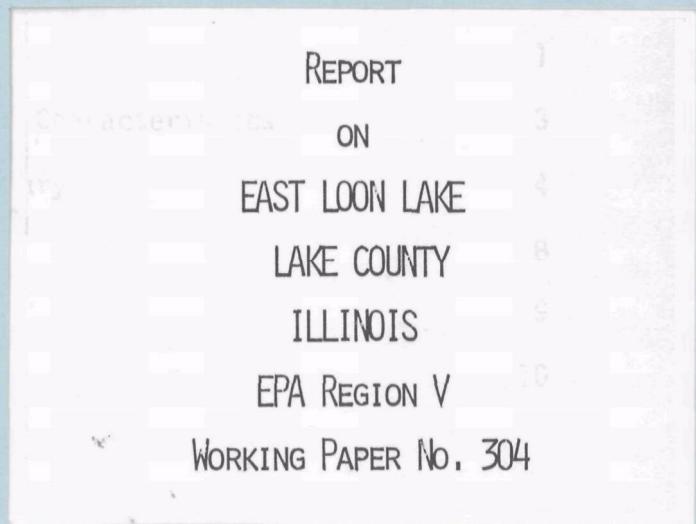


**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL EUTROPHICATION SURVEY  
WORKING PAPER SERIES**



**CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON  
and  
ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA**

REPORT  
ON  
EAST LOON LAKE  
LAKE COUNTY  
ILLINOIS  
EPA REGION V  
WORKING PAPER No. 304

WITH THE COOPERATION OF THE  
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY  
AND THE  
ILLINOIS NATIONAL GUARD  
JUNE, 1975

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## F O R E W O R D

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

### OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

### ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

- a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.
- b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.
- c. With such a transformation, an assessment of the potential for eutrophication control can be made.

### LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Illinois Environmental Protection Agency for professional involvement and to the Illinois National Guard for conducting the tributary sampling phase of the Survey.

Dr. Richard H. Briceland, Director of the Illinois Environmental Protection Agency; and Ronald M. Barganz, State Survey Coordinator, and John J. Forneris, Manager of Region III, Field Operations Section of the Division of Water Pollution Control, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

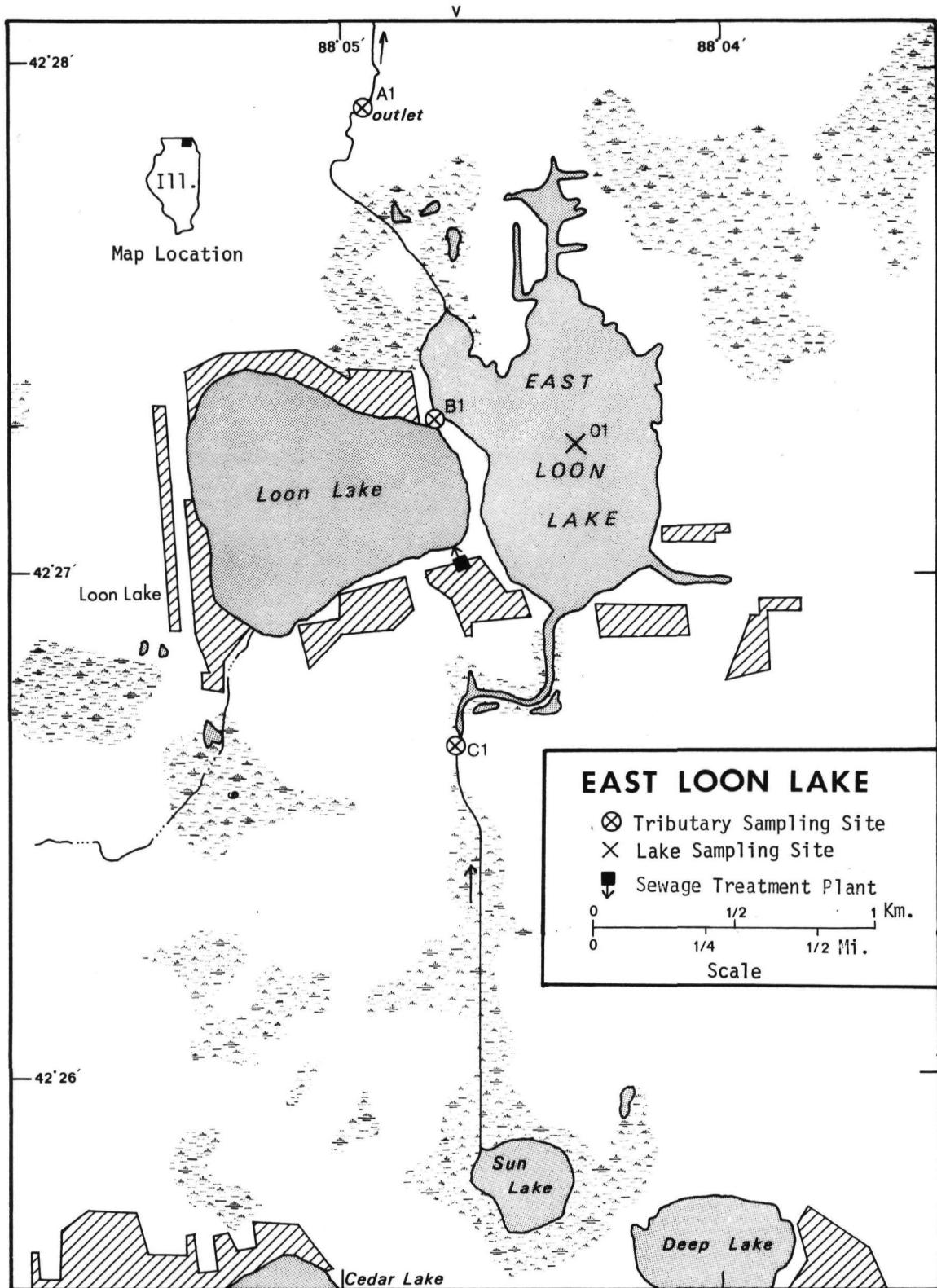
Major General Harold R. Patton, the Adjutant General of Illinois, and Project Officer Colonel Daniel L. Fane, who directed the volunteer efforts of the Illinois National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

## NATIONAL EUTROPHICATION SURVEY

## STUDY LAKES

STATE OF ILLINOIS

| <u>LAKE NAME</u> | <u>COUNTY</u>          |
|------------------|------------------------|
| Baldwin          | Randolph               |
| Bloomington      | McLean                 |
| Carlyle          | Bond, Clinton, Fayette |
| Cedar            | Lake                   |
| Charleston       | Coles                  |
| Coffeen          | Montgomery             |
| Crab Orchard     | Jackson, Williamson    |
| Decatur          | Macon                  |
| DePue            | Bureau                 |
| East Loon        | Lake                   |
| Fox              | Lake                   |
| Grass            | Lake                   |
| Highland Silver  | Madison                |
| Holiday          | LaSalle                |
| Horseshoe        | Madison                |
| Long             | Lake                   |
| Lou Yaeger       | Montgomery             |
| Marie            | Lake                   |
| Old Ben Mine     | Franklin               |
| Pistakee         | Lake, McHenry          |
| Raccoon          | Marion                 |
| Rend             | Franklin, Jefferson    |
| Sangchris        | Christian              |
| Shelbyville      | Moultrie, Shelby       |
| Slocum           | Lake                   |
| Springfield      | Sangamon               |
| Storey           | Knox                   |
| Vandalia         | Fayette                |
| Vermilion        | Vermilion              |
| Wee-Ma-Tuk       | Fulton                 |
| Wonder           | McHenry                |



## EAST LOON LAKE

STORET NO. 1757

### I. INTRODUCTION

Because of the lack of gradient and the diffuse drainage through the marsh areas around East Loon Lake, the U.S. Geological Survey could not provide flow data for the tributaries to the lake. For this reason, it is not possible to determine the overall nutrient loadings to the lake. Only one known point source indirectly impacts the lake. Therefore, this report primarily relates to lake sampling data, although all of the data obtained during the Survey are included in the appendices.

### II. CONCLUSIONS

#### A. Trophic Condition:

Survey data indicate that East Loon Lake is eutrophic. Based on an index of six water quality parameters, East Loon Lake ranked fifth in overall trophic quality among the 31 Illinois water bodies sampled in 1973\*. Nine of the lakes had less median total phosphorus, six had less and one had the same median dissolved phosphorus, none had less median inorganic nitrogen, 14 had less mean chlorophyll a, and only one lake had a greater mean Secchi disc transparency. Depletion of dissolved oxygen with depth occurred in August, 1973.

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\* See Appendix A.

Survey limnologists noted that macrophytes occupied about 60% of the shoreline shallows and reported a blue-green algal bloom in October.

B. Rate-Limiting Nutrient:

A differential change in primary nutrients occurred in the assay sample between the time of collection and the beginning of the assay, and the results are not representative of conditions in the lake at the time the sample was taken. However, the lake data indicate nitrogen limitation at all sampling times.

C. Nutrient Sources:

It is estimated that the Moody Youth Camp contributed 45 kg of total phosphorus and 140 kg of total nitrogen to Loon Lake during the sampling year. If it is assumed that no sedimentation or biological assimilation occurred in Loon Lake, the point-source loading rate to East Loon Lake would be only 0.07 g/m<sup>2</sup>/yr. Therefore, it does not seem likely that the Moody Youth Camp contributes significantly to the phosphorus load to East Loon Lake.

As noted above, tributary flow data are not available, and non-point nutrient loads cannot be calculated.

### III. LAKE AND DRAINAGE BASIN CHARACTERISTICS<sup>†</sup>

#### A. Lake Morphometry<sup>††</sup>:

1. Surface area: 0.67 kilometers<sup>2</sup>.
2. Mean depth: 1.8 meters.
3. Maximum depth: >6.4 meters.
4. Volume:  $1.229 \times 10^6$  m<sup>3</sup>.
5. Mean hydraulic retention time: 89 days (based on outflow).

#### B. Tributary and Outlet:

(See Appendix C for flow data)

##### 1. Tributaries -

| <u>Name</u>            | <u>Drainage area (km<sup>2</sup>)*</u> | <u>Mean flow (m<sup>3</sup>/sec)*</u> |
|------------------------|--|---------------------------------------|
| None measured or gaged |  |                                       |

##### 2. Outlet -

|                      |        |      |
|----------------------|--------|------|
| Unnamed Stream (A-1) | 25.9** | 0.16 |
|----------------------|--------|------|

#### C. Precipitation\*\*\*:

1. Year of sampling: 112.2 centimeters.
2. Mean annual: 83.3 centimeters.

<sup>†</sup> Table of metric conversions--Appendix B.

<sup>††</sup> Forneris, 1973.

<sup>\*</sup> For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".

<sup>\*\*</sup> Includes area of lake.

<sup>\*\*\*</sup> See Working Paper No. 175.

#### IV. LAKE WATER QUALITY SUMMARY

East Loon Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at a single station on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was collected for phytoplankton identification and enumeration; and a similar sample was collected for chlorophyll a analysis. During the first visit, a single 18.9-liter depth-integrated sample was taken for algal assays. The maximum depth sampled was 6.4 meters.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR EAST LOON LAKE  
STORET CODE 1757

| PARAMETER        | 1ST SAMPLING (5/9/73) |       |        | 2ND SAMPLING (8/7/73) |       |        | 3RD SAMPLING (10/16/73) |       |        |
|------------------|-----------------------|-------|--------|-----------------------|-------|--------|-------------------------|-------|--------|
|                  | 1 SITES               |       |        | 1 SITES               |       |        | 1 SITES                 |       |        |
|                  | RANGE                 | MEAN  | MEDIAN | RANGE                 | MEAN  | MEDIAN | RANGE                   | MEAN  | MEDIAN |
| TEMP (C)         | 13.9 - 14.0           | 13.9  | 13.9   | 14.8 - 25.7           | 21.4  | 23.2   | 16.0 - 16.0             | 16.0  | 16.0   |
| DISS OXY (MG/L)  | 9.8 - 9.9             | 9.8   | 9.8    | 0.0 - 6.8             | 3.3   | 3.2    | 8.6 - 8.6               | 8.6   | 8.6    |
| CNDCTVY (MCROMO) | 465. - 480.           | 472.  | 470.   | 442. - 499.           | 475.  | 483.   | 354. - 355.             | 354.  | 354.   |
| PH (STAND UNITS) | 8.2 - 8.3             | 8.3   | 8.3    | 7.2 - 8.6             | 7.9   | 8.0    | 8.6 - 8.6               | 8.6   | 8.6    |
| TOT ALK (MG/L)   | 173. - 174.           | 174.  | 174.   | 171. - 200.           | 179.  | 173.   | 165. - 167.             | 166.  | 166.   |
| TOT P (MG/L)     | 0.047 - 0.049         | 0.048 | 0.048  | 0.036 - 0.396         | 0.154 | 0.092  | 0.085 - 0.089           | 0.087 | 0.088  |
| ORTHO P (MG/L)   | 0.016 - 0.019         | 0.017 | 0.017  | 0.011 - 0.317         | 0.101 | 0.037  | 0.018 - 0.036           | 0.027 | 0.026  |
| N02+N03 (MG/L)   | 0.060 - 0.070         | 0.067 | 0.070  | 0.060 - 0.160         | 0.122 | 0.135  | 0.020 - 0.030           | 0.027 | 0.030  |
| AMMONIA (MG/L)   | 0.050 - 0.060         | 0.053 | 0.050  | 0.060 - 2.090         | 0.697 | 0.320  | 0.050 - 0.060           | 0.053 | 0.050  |
| KJEL N (MG/L)    | 0.900 - 1.200         | 1.033 | 1.000  | 1.400 - 3.200         | 2.025 | 1.750  | 1.300 - 1.600           | 1.433 | 1.400  |
| INORG N (MG/L)   | 0.110 - 0.130         | 0.120 | 0.120  | 0.120 - 2.240         | 0.820 | 0.460  | 0.070 - 0.090           | 0.080 | 0.080  |
| TOTAL N (MG/L)   | 0.960 - 1.270         | 1.100 | 1.070  | 1.460 - 3.350         | 2.147 | 1.890  | 1.320 - 1.630           | 1.460 | 1.430  |
| CHLRPYL A (UG/L) | 12.1 - 12.1           | 12.1  | 12.1   | 28.0 - 28.0           | 28.0  | 28.0   | 26.8 - 26.8             | 26.8  | 26.8   |
| SECCHI (METERS)  | 1.5 - 1.5             | 1.5   | 1.5    | 1.4 - 1.4             | 1.4   | 1.4    | 0.9 - 0.9               | 0.9   | 0.9    |

## B. Biological characteristics:

## 1. Phytoplankton -

| <u>Sampling Date</u> | <u>Dominant Genera</u>  | <u>Algal units per ml</u>                           |
|----------------------|---|---|
| 05/09/73             | 1. <u>Dinobryon sp.</u><br>2. <u>Flagellates</u><br>3. <u>Fragilaria sp.</u><br>4. <u>Anabaena sp.</u><br>5. <u>Cryptomonas sp.</u><br>Other genera             | 1,108<br>1,041<br>860<br>588<br>271<br><u>951</u>   |
|                      | Total   | 4,819   |
| 08/07/73             | 1. <u>Lyngbya sp.</u><br>2. <u>Arthospira sp.</u><br>3. <u>Merismopedia sp.</u><br>4. <u>Microcystis sp.</u><br>5. <u>Oscillatoria sp.</u><br>Other genera      | 3,981<br>1,175<br>682<br>492<br>417<br><u>3,110</u> |
|                      | Total   | 9,857   |
| 10/16/73             | 1. <u>Aphanizomenon sp.</u><br>2. <u>Melosira sp.</u><br>3. <u>Microcystis sp.</u><br>4. <u>Gomphosphaeria sp.</u><br>5. <u>Cryptomonas sp.</u><br>Other genera | 2,110<br>361<br>216<br>180<br>108<br><u>669</u>     |
|                      | Total   | 3,644   |

## 2. Chlorophyll a -

| <u>Sampling Date</u> | <u>Station Number</u> | <u>Chlorophyll a (<math>\mu\text{g/l}</math>)</u> |
|----------------------|-----------------------|---|
| 05/09/73             | 01                    | 12.1  |
| 08/07/73             | 01                    | 28.0  |
| 10/16/73             | 01                    | 26.8  |

### C. Limiting Nutrient Study:

A differential change in phosphorus and nitrogen occurred in the assay sample between the time of collection and the beginning of the assay, and the limiting nutrient shifted from nitrogen in the lake ( $N/P = 7/1$ ) to phosphorus in the sample ( $N/P = 16/1$ ). Consequently, the assay results are not indicative of conditions in the lake at the time the sample was collected.

The lake data indicate nitrogen limitation at all sampling times. The mean inorganic nitrogen to orthophosphorus ratios were 8 to 1 or less, and nitrogen limitation would be expected.

V. NUTRIENT LOADINGS  
 (See Appendix E for data)

For the determination of nutrient concentrations, the Illinois National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of March and April when two samples were collected. Sampling was begun in June, 1973, and was completed in April, 1974.

Through an interagency agreement, outlet flow estimates for the year of sampling and a "normalized" or average year were provided by the Illinois District Office of the U.S. Geological Survey. However, flows could not be determined for the tributaries (see page 1).

The Moody Youth Camp did not participate in the Survey, and nutrient loads were estimated at 1.134 kg P and 3.401 kg N/capita/year.

A. Waste Source\*:

| <u>Name</u>      | <u>Pop.<br/>Served</u> | <u>Treatment</u> | <u>Mean Flow<br/>(m<sup>3</sup>/d)</u> | <u>Receiving<br/>Water</u>     |
|------------------|------------------------|------------------|--|--------------------------------|
| Moody Youth Camp | 100                    | sand filter      | 37.8**                                 | Loon Lake to<br>East Loon Lake |

\* Barganz, 1975 (camp is operational about five months per year).

\*\* Estimated at 0.3785 m<sup>3</sup>/capita/day.

## VI. LITERATURE REVIEWED

Barganz, Ronald M., 1975. Personal communication (Moody Youth Camp wastewater treatment facilities). IL Env. Prot. Agency, Springfield.

Forneris, John J., 1973. Personal communication (lake morphometry). IL Env. Prot. Agency, Springfield.

VII. APPENDICES

APPENDIX A

LAKE RANKINGS

## LAKE DATA TO BE USED IN RANKINGS

| LAKE<br>CODE | LAKE NAME              | MEDIAN<br>TOTAL P | MEDIAN<br>INORG N | 500-<br>MEAN SEC | MEAN<br>CHLORA | 15-<br>MIN DO | MEDIAN<br>DISS ORTHO P |
|--------------|------------------------|-------------------|-------------------|------------------|----------------|---------------|------------------------|
| 1703         | LAKE BLOOMINGTON       | 0.050             | 5.730             | 464.667          | 26.200         | 14.800        | 0.020                  |
| 1706         | LAKE CARLYLE           | 0.084             | 1.270             | 477.889          | 17.367         | 11.000        | 0.032                  |
| 1708         | LAKE CHARLESTON        | 0.160             | 4.680             | 490.667          | 12.000         | 8.400         | 0.065                  |
| 1711         | COFFEEN LAKE           | 0.032             | 0.260             | 456.222          | 7.700          | 14.900        | 0.012                  |
| 1712         | CRAB ORCHARD LAKE      | 0.082             | 0.200             | 482.222          | 59.867         | 13.800        | 0.013                  |
| 1714         | LAKE DECATUR           | 0.129             | 3.750             | 479.571          | 43.000         | 14.500        | 0.062                  |
| 1725         | LONG LAKE              | 0.704             | 1.190             | 482.667          | 49.333         | 8.800         | 0.398                  |
| 1726         | LAKE LOU YAEGER        | 0.186             | 1.600             | 489.583          | 10.662         | 11.400        | 0.076                  |
| 1727         | LAKE MARIE             | 0.098             | 0.370             | 467.667          | 39.533         | 14.700        | 0.057                  |
| 1733         | PISTAKEE LAKE          | 0.203             | 0.370             | 485.667          | 75.867         | 7.000         | 0.062                  |
| 1735         | REND LAKE              | 0.071             | 0.210             | 471.500          | 23.533         | 12.700        | 0.012                  |
| 1739         | LAKE SHELBYVILLE       | 0.062             | 3.290             | 461.333          | 17.161         | 14.800        | 0.019                  |
| 1740         | SILVER LAKE (HIGHLAND) | 0.226             | 0.970             | 489.500          | 5.822          | 14.800        | 0.057                  |
| 1742         | LAKE SPRINGFIELD       | 0.108             | 3.265             | 483.385          | 13.013         | 10.800        | 0.059                  |
| 1748         | VERMILION LAKE         | 0.109             | 4.695             | 481.500          | 31.150         | 14.200        | 0.050                  |
| 1750         | WONDER LAKE            | 0.426             | 0.890             | 486.000          | 98.533         | 7.800         | 0.132                  |
| 1751         | LAKE STORY             | 0.072             | 2.510             | 459.333          | 17.250         | 14.800        | 0.021                  |
| 1752         | DEPUE LAKE             | 0.438             | 4.050             | 490.000          | 58.833         | 7.600         | 0.276                  |
| 1753         | LAKE SANGCHRIS         | 0.050             | 1.970             | 475.417          | 19.292         | 14.500        | 0.009                  |
| 1754         | LAKE HOLIDAY           | 0.167             | 3.135             | 485.167          | 51.217         | 7.200         | 0.046                  |
| 1755         | FOX LAKE               | 0.219             | 0.375             | 486.167          | 63.850         | 8.800         | 0.083                  |
| 1756         | GRASS LAKE             | 0.301             | 0.820             | 481.000          | 83.500         | 5.900         | 0.093                  |
| 1757         | EAST LOON LAKE         | 0.076             | 0.120             | 450.000          | 22.300         | 14.900        | 0.018                  |
| 1758         | SLOCUM LAKE            | 0.865             | 0.200             | 487.333          | 221.100        | 5.800         | 0.362                  |
| 1759         | CEDAR LAKE             | 0.029             | 0.170             | 400.333          | 5.767          | 12.800        | 0.013                  |
| 1761         | LAKE WEMATUK           | 0.069             | 1.770             | 466.333          | 7.967          | 14.500        | 0.031                  |
| 1762         | RACCOON LAKE           | 0.106             | 0.310             | 484.333          | 19.217         | 13.800        | 0.020                  |
| 1763         | BALDWIN LAKE           | 0.044             | 0.140             | 461.167          | 11.333         | 13.200        | 0.007                  |

LAKE DATA TO BE USED IN RANKINGS

| LAKE<br>CODE | LAKE NAME              | MEDIAN<br>TOTAL P | MEDIAN<br>INORG N | 500-<br>MEAN SEC | MEAN<br>CHLORA | 15-<br>MIN DO | MEDIAN<br>DISS ORTHO P |
|--------------|------------------------|-------------------|-------------------|------------------|----------------|---------------|------------------------|
| 1764         | LAKE VANDALIA          | 0.116             | 0.480             | 478.111          | 11.276         | 14.800        | 0.023                  |
| 1765         | OLD BEN MINE RESERVOIR | 0.930             | 0.205             | 478.333          | 31.433         | 11.200        | 0.575                  |
| 1766         | HORSESHOE LAKE         | 0.127             | 0.705             | 482.833          | 182.250        | 6.800         | 0.018                  |

## PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

| LAKE<br>CODE | LAKE NAME              | MEDIAN<br>TOTAL P | MEDIAN<br>INORG N | 500-<br>MEAN SEC | MEAN<br>CHLORA | 15-<br>MIN DO | MEDIAN<br>DISS ORTHO P | INDEX<br>NO |
|--------------|------------------------|-------------------|-------------------|------------------|----------------|---------------|------------------------|-------------|
| 1703         | LAKE BLOOMINGTON       | 88 ( 26)          | 0 ( 0)            | 80 ( 24)         | 47 ( 14)       | 13 ( 2)       | 68 ( 20)               | 296         |
| 1706         | LAKE CARLYLE           | 63 ( 19)          | 40 ( 12)          | 63 ( 19)         | 63 ( 19)       | 63 ( 19)      | 53 ( 16)               | 345         |
| 1708         | LAKE CHARLESTON        | 37 ( 11)          | 7 ( 2)            | 0 ( 0)           | 77 ( 23)       | 77 ( 23)      | 27 ( 8)                | 225         |
| 1711         | COFFEEN LAKE           | 97 ( 29)          | 77 ( 23)          | 93 ( 28)         | 93 ( 28)       | 2 ( 0)        | 92 ( 27)               | 454         |
| 1712         | CRAB ORCHARD LAKE      | 67 ( 20)          | 90 ( 27)          | 43 ( 13)         | 20 ( 6)        | 42 ( 12)      | 85 ( 25)               | 347         |
| 1714         | LAKE DECATUR           | 40 ( 12)          | 13 ( 4)           | 53 ( 16)         | 33 ( 10)       | 30 ( 8)       | 32 ( 9)                | 201         |
| 1725         | LONG LAKE              | 7 ( 2)            | 43 ( 13)          | 40 ( 12)         | 30 ( 9)        | 72 ( 21)      | 3 ( 1)                 | 195         |
| 1726         | LAKE LOU YAEGER        | 30 ( 9)           | 37 ( 11)          | 7 ( 2)           | 87 ( 26)       | 57 ( 17)      | 23 ( 7)                | 241         |
| 1727         | LAKE MARIE             | 60 ( 18)          | 68 ( 20)          | 73 ( 22)         | 37 ( 11)       | 23 ( 7)       | 42 ( 12)               | 303         |
| 1733         | PISTAKEE LAKE          | 27 ( 8)           | 68 ( 20)          | 23 ( 7)          | 13 ( 4)        | 90 ( 27)      | 32 ( 9)                | 253         |
| 1735         | REND LAKE              | 77 ( 23)          | 80 ( 24)          | 70 ( 21)         | 50 ( 15)       | 53 ( 16)      | 92 ( 27)               | 422         |
| 1739         | LAKE SHELBYVILLE       | 83 ( 25)          | 17 ( 5)           | 83 ( 25)         | 70 ( 21)       | 13 ( 2)       | 73 ( 22)               | 339         |
| 1740         | SILVER LAKE (HIGHLAND) | 20 ( 6)           | 47 ( 14)          | 10 ( 3)          | 97 ( 29)       | 13 ( 2)       | 42 ( 12)               | 229         |
| 1742         | LAKE SPRINGFIELD       | 53 ( 16)          | 20 ( 6)           | 33 ( 10)         | 73 ( 22)       | 67 ( 20)      | 37 ( 11)               | 203         |
| 1748         | VERMILION LAKE         | 50 ( 15)          | 3 ( 1)            | 47 ( 14)         | 43 ( 13)       | 37 ( 11)      | 47 ( 14)               | 227         |
| 1750         | WONDER LAKE            | 13 ( 4)           | 50 ( 15)          | 20 ( 6)          | 7 ( 2)         | 80 ( 24)      | 13 ( 4)                | 103         |
| 1751         | LAKE STORY             | 73 ( 22)          | 27 ( 8)           | 90 ( 27)         | 67 ( 20)       | 13 ( 2)       | 63 ( 19)               | 333         |
| 1752         | DEPUE LAKE             | 10 ( 3)           | 10 ( 3)           | 3 ( 1)           | 23 ( 7)        | 83 ( 25)      | 10 ( 3)                | 139         |
| 1753         | LAKE SANGCHRIS         | 88 ( 26)          | 30 ( 9)           | 67 ( 20)         | 57 ( 17)       | 30 ( 8)       | 97 ( 29)               | 369         |
| 1754         | LAKE HOLIDAY           | 33 ( 10)          | 23 ( 7)           | 27 ( 8)          | 27 ( 8)        | 87 ( 26)      | 50 ( 15)               | 247         |
| 1755         | FOX LAKE               | 23 ( 7)           | 63 ( 19)          | 17 ( 5)          | 17 ( 5)        | 72 ( 21)      | 20 ( 6)                | 212         |
| 1756         | GRASS LAKE             | 17 ( 5)           | 53 ( 16)          | 50 ( 15)         | 10 ( 3)        | 97 ( 29)      | 17 ( 5)                | 244         |
| 1757         | EAST LOON LAKE         | 70 ( 21)          | 100 ( 30)         | 97 ( 29)         | 53 ( 16)       | 2 ( 0)        | 77 ( 23)               | 399         |
| 1758         | SLOCUM LAKE            | 3 ( 1)            | 87 ( 26)          | 13 ( 4)          | 0 ( 0)         | 100 ( 30)     | 7 ( 2)                 | 210         |
| 1759         | CEDAR LAKE             | 100 ( 30)         | 93 ( 28)          | 100 ( 30)        | 100 ( 30)      | 50 ( 15)      | 85 ( 25)               | 528         |
| 1761         | LAKE WEMATUK           | 80 ( 24)          | 33 ( 10)          | 77 ( 23)         | 90 ( 27)       | 30 ( 8)       | 57 ( 17)               | 367         |
| 1762         | RACCOON LAKE           | 57 ( 17)          | 73 ( 22)          | 30 ( 9)          | 60 ( 18)       | 42 ( 12)      | 68 ( 20)               | 330         |
| 1763         | BALDWIN LAKE           | 93 ( 28)          | 97 ( 29)          | 87 ( 26)         | 80 ( 24)       | 47 ( 14)      | 100 ( 30)              | 504         |

## PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

| LAKE<br>CODE | LAKE NAME              | MEDIAN<br>TOTAL P | MEDIAN<br>INORG N | 500-<br>MEAN SEC | MEAN<br>CHLORA | 15-<br>MIN DO | MEDIAN<br>DISS ORTHO P | INDEX<br>NU |
|--------------|------------------------|-------------------|-------------------|------------------|----------------|---------------|------------------------|-------------|
| 1764         | LAKE VANDALIA          | 47 ( 14)          | 60 ( 18)          | 60 ( 18)         | 83 ( 25)       | 13 ( 2)       | 60 ( 18)               | 323         |
| 1765         | OLD BEN MINE RESERVOIR | 0 ( 0)            | 83 ( 25)          | 57 ( 17)         | 40 ( 12)       | 60 ( 18)      | 0 ( 0)                 | 240         |
| 1766         | HORSESHOE LAKE         | 43 ( 13)          | 57 ( 17)          | 37 ( 11)         | 3 ( 1)         | 93 ( 28)      | 80 ( 24)               | 313         |

## LAKES RANKED BY INDEX NOS.

| RANK | LAKE CODE | LAKE NAME              | INDEX NO |
|------|-----------|------------------------|----------|
| 1    | 1759      | CEDAR LAKE             | 528      |
| 2    | 1763      | BALDWIN LAKE           | 504      |
| 3    | 1711      | COFFEEN LAKE           | 454      |
| 4    | 1735      | REND LAKE              | 422      |
| 5    | 1757      | EAST LOON LAKE         | 399      |
| 6    | 1753      | LAKE SANGCHRIS         | 369      |
| 7    | 1761      | LAKE WEMATUK           | 367      |
| 8    | 1712      | CRAB ORCHARD LAKE      | 347      |
| 9    | 1706      | LAKE CARLYLE           | 345      |
| 10   | 1739      | LAKE SHELBYVILLE       | 339      |
| 11   | 1751      | LAKE STORY             | 333      |
| 12   | 1762      | RACCOON LAKE           | 330      |
| 13   | 1764      | LAKE VANDALIA          | 323      |
| 14   | 1766      | HORSESHOE LAKE         | 313      |
| 15   | 1727      | LAKE MARIE             | 303      |
| 16   | 1703      | LAKE BLOOMINGTON       | 296      |
| 17   | 1742      | LAKE SPRINGFIELD       | 283      |
| 18   | 1733      | PISTAKEE LAKE          | 253      |
| 19   | 1754      | LAKE HOLIDAY           | 247      |
| 20   | 1756      | GRASS LAKE             | 244      |
| 21   | 1726      | LAKE LOU YAEGER        | 241      |
| 22   | 1765      | OLD BEN MINE RESERVOIR | 240      |
| 23   | 1740      | SILVER LAKE (HIGHLAND) | 229      |
| 24   | 1748      | VERMILION LAKE         | 227      |
| 25   | 1708      | LAKE CHARLESTON        | 225      |
| 26   | 1755      | FOX LAKE               | 212      |
| 27   | 1758      | SLOCUM LAKE            | 210      |
| 28   | 1714      | LAKE DECATUR           | 201      |

LAKES RANKED BY INDEX NOS.

| RANK | LAKE CODE | LAKE NAME   | INDEX NO |
|------|-----------|-------------|----------|
| 29   | 1725      | LONG LAKE   | 195      |
| 30   | 1750      | WONDER LAKE | 183      |
| 31   | 1752      | DEPUE LAKE  | 139      |

## APPENDIX B

### CONVERSIONS FACTORS

## CONVERSION FACTORS

Hectares  $\times$  2.471 = acres

Kilometers  $\times$  0.6214 = miles

Meters  $\times$  3.281 = feet

Cubic meters  $\times$   $8.107 \times 10^{-4}$  = acre/feet

Square kilometers  $\times$  0.3861 = square miles

Cubic meters/sec  $\times$  35.315 = cubic feet/sec

Centimeters  $\times$  0.3937 = inches

Kilograms  $\times$  2.205 = pounds

Kilograms/square kilometer  $\times$  5.711 = lbs/square mile

## **APPENDIX C**

### **TRIBUTARY FLOW DATA**

## TRIBUTARY FLOW INFORMATION FOR ILLINOIS

10/23/75

LAKE CODE 1757 EAST LOON LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 25.9

| TRIBUTARY | SUB-DRAINAGE<br>AREA(SQ KM) | NORMALIZED FLOWS(CMS) |      |      |      |      |      |      |      |      |      |      |      | MEAN |
|-----------|-----------------------------|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|           |                             | JAN                   | FEB  | MAR  | APR  | MAY  | JUN  | JUL  | AUG  | SEP  | OCT  | NOV  | DEC  |      |
| 1757A1    | 25.9                        | 0.16                  | 0.25 | 0.31 | 0.31 | 0.24 | 0.21 | 0.12 | 0.06 | 0.04 | 0.04 | 0.07 | 0.08 | 0.16 |
| 1757ZZ    | 0.0                         | 0.0                   | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |

## SUMMARY

|                               |      |                  |      |
|-------------------------------|------|------------------|------|
| TOTAL DRAINAGE AREA OF LAKE = | 25.9 | TOTAL FLOW IN =  | 0.0  |
| SUM OF SUB-DRAINAGE AREAS =   | 0.0  | TOTAL FLOW OUT = | 1.91 |

NOTE \*\*\* PART OF FOX CHAIN OF LAKES

## MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|-----------|-------|------|-----------|-----|------|-----|------|-----|------|
|           |       |      |           |     |      |     |      |     |      |
| 1757A1    | 6     | 73   | 0.07      | 2   | 0.07 |     |      |     |      |
|           | 7     | 73   | 0.03      | 7   | 0.07 |     |      |     |      |
|           | 8     | 73   | 0.02      | 18  | 0.01 |     |      |     |      |
|           | 9     | 73   | 0.03      | 9   | 0.02 |     |      |     |      |
|           | 10    | 73   | 0.04      | 14  | 0.07 |     |      |     |      |
|           | 11    | 73   | 0.04      | 4   | 0.04 |     |      |     |      |
|           | 12    | 73   | 0.07      | 2   | 0.03 |     |      |     |      |
|           | 1     | 74   | 0.08      | 6   | 0.03 |     |      |     |      |
|           | 2     | 74   | 0.08      | 10  | 0.07 |     |      |     |      |
|           | 3     | 74   | 0.09      | 18  | 0.07 | 24  | 0.05 |     |      |
|           | 4     | 74   | 0.10      | 3   | 0.08 | 30  | 0.14 |     |      |

## **APPENDIX D**

### **PHYSICAL and CHEMICAL DATA**

STORET RETRIEVAL DATE 75/10/23

175701  
42 27 18.0 088 04 25.0  
EAST LOON LAKE  
17097 ILLINOIS

| DATE<br>FROM<br>TO | TIME<br>OF<br>DAY | DEPTH<br>FEET | WATER<br>TEMP<br>CENT | 00010<br>DO<br>MG/L | 00300<br>TRANSP<br>SECCHI<br>INCHES | 00077<br>CNDCTVY<br>FIELD<br>MICROMHO | 00094<br>NH3-N<br>CACO3<br>MG/L | 00400<br>PH<br>SU | 00410<br>ALK<br>CACO3<br>MG/L | 00610<br>TOTAL<br>MG/L | 11EPALES<br>3               |                                     | 2111202<br>0018 FEET DEPTH           |  | 00671<br>PHOS-DIS<br>ORTHO<br>MG/L P |
|--------------------|-------------------|---------------|-----------------------|---------------------|-------------------------------------|---------------------------------------|---------------------------------|-------------------|-------------------------------|------------------------|-----------------------------|-------------------------------------|--------------------------------------|--|--------------------------------------|
|                    |                   |               |                       |                     |                                     |                                       |                                 |                   |                               |                        | 00625<br>TOT KJEL<br>N MG/L | 00630<br>NO2&NO3<br>N-TOTAL<br>MG/L | 00671<br>PHOS-DIS<br>ORTHO<br>MG/L P |  |                                      |
| 73/05/09           | 14 20             | 0000          | 14.0                  |                     | 60                                  | 480                                   | 8.20                            | 174               | 0.060                         | 1.200                  | 0.070                       | 0.016                               |                                      |  |                                      |
|                    | 14 20             | 0006          | 13.9                  | 9.9                 |                                     | 470                                   | 8.30                            | 173               | 0.050                         | 0.900                  | 0.060                       | 0.017                               |                                      |  |                                      |
|                    | 14 20             | 0014          | 13.9                  | 9.8                 |                                     | 465                                   | 8.30                            | 174               | 0.050                         | 1.000                  | 0.070                       | 0.019                               |                                      |  |                                      |
|                    |                   |               |                       |                     |                                     | 499                                   | 8.60                            | 171               | 0.130                         | 1.700                  | 0.120                       | 0.011                               |                                      |  |                                      |
| 73/08/07           | 11 55             | 0000          | 25.6                  | 6.8                 | 54                                  | 498                                   |                                 |                   |                               |                        |                             |                                     |                                      |  |                                      |
|                    | 11 55             | 0005          | 25.7                  |                     |                                     | 494                                   | 8.50                            | 171               | 0.060                         | 1.400                  | 0.060                       | 0.014                               |                                      |  |                                      |
|                    | 11 55             | 0008          | 25.6                  | 6.3                 |                                     | 483                                   |                                 |                   |                               |                        |                             |                                     |                                      |  |                                      |
|                    | 11 55             | 0010          | 23.2                  |                     |                                     | 464                                   | 7.50                            | 175               | 0.510                         | 1.800                  | 0.160                       | 0.061                               |                                      |  |                                      |
|                    | 11 55             | 0015          | 19.8                  | 0.1                 |                                     | 442                                   |                                 |                   |                               |                        |                             |                                     |                                      |  |                                      |
|                    | 11 55             | 0020          | 14.9                  |                     |                                     | 443                                   | 7.20                            | 200               | 2.090                         | 3.200                  | 0.150                       | 0.317                               |                                      |  |                                      |
|                    | 11 55             | 0021          | 14.8                  | 0.0                 |                                     | 354                                   | 8.60                            | 167               | 0.050                         | 1.600                  | 0.030                       | 0.026                               |                                      |  |                                      |
|                    |                   |               |                       |                     |                                     | 355                                   | 8.60                            | 165               | 0.050                         | 1.300                  | 0.020                       | 0.018                               |                                      |  |                                      |
| 73/10/16           | 15 15             | 0000          | 16.0                  |                     | 36                                  | 354                                   | 8.60                            | 166               | 0.060                         | 1.400                  | 0.030                       | 0.036                               |                                      |  |                                      |
|                    | 15 15             | 0005          | 16.0                  | 8.6                 |                                     |                                       |                                 |                   |                               |                        |                             |                                     |                                      |  |                                      |
|                    | 15 15             | 0015          | 16.0                  | 8.6                 |                                     |                                       |                                 |                   |                               |                        |                             |                                     |                                      |  |                                      |

| DATE<br>FROM<br>TO | TIME<br>OF<br>DAY | DEPTH<br>FEET | PHOS-TOT<br>MG/L P | 00665<br>CHLRPHYL<br>A<br>UG/L | 32217 |  |
|--------------------|-------------------|---------------|--------------------|--------------------------------|-------|--|
|                    |                   |               |                    |                                |       |  |
| 73/05/09           | 14 20             | 0000          | 0.047              | 12.1                           |       |  |
|                    | 14 20             | 0006          | 0.048              |                                |       |  |
|                    | 14 20             | 0014          | 0.049              |                                |       |  |
| 73/08/07           | 11 55             | 0000          | 0.036              | 28.0                           |       |  |
|                    | 11 55             | 0008          | 0.068              |                                |       |  |
|                    | 11 55             | 0015          | 0.116              |                                |       |  |
|                    | 11 55             | 0021          | 0.396              |                                |       |  |
| 73/10/16           | 15 15             | 0000          | 0.089              | 26.8                           |       |  |
|                    | 15 15             | 0005          | 0.085              |                                |       |  |
|                    | 15 15             | 0015          | 0.088              |                                |       |  |

## **APPENDIX E**

### **TRIBUTARY DATA**

STORET RETRIEVAL DATE 75/10/23

1757A1  
 42 27 52.0 088 04 55.0  
 UNNAMED STREAM  
 17097 7.5 ANTIOTH  
 O/E LOON LAKE  
 BRDG ON GRIMM RD .75 MI SE OF ANTIOTH  
 11EPALES 2111204  
 4 0000 FEET DEPTH

| DATE<br>FROM<br>TO | TIME<br>OF<br>DAY | DEPTH<br>FEET | 00630<br>N02&N03 | 00625<br>TOT KJEL | 00610<br>NH3-N | 00671<br>PHOS-DIS | 00665<br>PHOS-TOT |
|--------------------|-------------------|---------------|------------------|-------------------|----------------|-------------------|-------------------|
|                    |                   |               | MG/L             | MG/L              | MG/L           | MG/L P            | MG/L P            |
| 73/06/02           | 15                | 15            | 0.036            | 2.100             | 0.052          | 0.035             | 0.075             |
| 73/07/07           | 10                | 20            | 0.032            | 2.700             | 0.078          | 0.034             | 0.095             |
| 73/08/18           | 11                | 30            |                  | 2.700             | 0.130          | 0.039             | 0.085             |
| 73/09/09           | 14                | 50            | 0.019            | 7.700             | 0.154          | 0.034             | 0.080             |
| 73/10/14           | 12                | 00            | 0.035            | 1.300             | 0.044          | 0.025             | 0.095             |
| 73/12/02           | 11                | 15            | 0.124            | 2.800             | 0.140          | 0.016             | 0.045             |
| 74/01/06           | 13                | 30            | 0.252            | 2.300             | 0.400          | 0.016             | 0.030             |
| 74/02/10           |                   |               | 0.740            | 1.400             | 0.165          | 0.045             | 0.105             |
| 74/03/18           | 12                | 00            | 0.330            | 3.500             | 0.080          | 0.005             | 0.035             |
| 74/03/24           |                   |               | 0.252            | 3.000             | 0.185          | 0.015             | 0.045             |
| 74/04/03           | 13                | 45            | 0.140            | 1.200             | 0.030          | 0.005             | 0.020             |
| 74/04/30           | 07                | 50            | 0.168            | 1.400             | 0.040          | 0.050             | 0.110             |

STORET RETRIEVAL DATE 75/10/23

175781  
42 27 15.0 088 04 45.0  
LOON/E LOON LK CONNECTION  
17 7.5 ANTIOCH  
T/E LOON LAKE  
BANK BETWEEN LKS AT END OF N PENINSULA  
11EPALES 2111204  
4 0000 FEET DEPTH

| DATE<br>FROM<br>TO | TIME<br>OF<br>DAY | DEPTH<br>FEET | 00630<br>NO2&N03<br>N-TOTAL<br>MG/L | 00625<br>TUT KJEL<br>N<br>MG/L | 00610<br>NH3-N<br>TOTAL<br>MG/L | 00671<br>PHOS-DIS<br>ORTHO<br>MG/L P | 00665<br>PHOS-TOT<br>MG/L P |
|--------------------|-------------------|---------------|-------------------------------------|--------------------------------|---------------------------------|--------------------------------------|-----------------------------|
| 73/06/02           | 14 50             |               | 0.014                               | 2.850                          | 0.063                           | 0.007                                | 0.025                       |
| 73/07/07           | 10 05             |               | 0.010K                              | 1.200                          | 0.017                           | 0.007                                | 0.020                       |
| 73/08/18           | 11 10             |               |                                     | 2.200                          | 0.069                           | 0.014                                | 0.030                       |
| 73/09/09           | 14 45             |               | 0.021                               | 6.800                          | 0.220                           | 0.011                                | 0.040                       |
| 73/10/14           | 13 20             |               | 0.011                               | 0.750                          | 0.028                           | 0.007                                | 0.030                       |
| 73/11/04           | 13 10             |               | 0.030                               | 1.300                          | 0.138                           | 0.008                                | 0.030                       |
| 73/12/02           | 13 30             |               | 0.104                               | 2.200                          | 0.088                           | 0.008                                | 0.025                       |
| 74/01/06           | 15 00             |               | 0.176                               | 0.900                          | 0.064                           | 0.008                                | 0.020                       |
| 74/02/10           |                   |               | 0.550                               | 1.700                          | 0.115                           | 0.020                                | 0.060                       |
| 74/03/18           | 12 03             |               | 0.288                               | 3.600                          | 0.125                           | 0.010                                | 0.040                       |
| 74/03/24           |                   |               | 0.200                               | 1.500                          | 0.210                           | 0.045                                | 0.095                       |
| 74/04/03           | 13 30             |               | 0.208                               | 1.400                          | 0.025                           | 0.005K                               | 0.005K                      |
| 74/04/30           | 06 35             |               | 0.200                               | 1.100                          | 0.025                           | 0.025                                | 0.085                       |

K VALUE KNOWN TO BE  
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/23

1757C1  
 42 26 40.0 088 04 40.0  
 UNNAMED STREAM  
 17 7.5 ANTIOTH  
 T/E LOON LAKE  
 BRDG ON LOON LK RD .5 MI ESE OF LOON LK  
 11EPALES 2111204  
 4 0000 FEET DEPTH

| DATE<br>FROM<br>TU | TIME<br>OF<br>DAY | DEPTH<br>FEET | 00630<br>NO2&NO3<br>N-TOTAL<br>MG/L | 00625<br>TOT KJEL<br>N<br>MG/L | 00610<br>NH3-N<br>TOTAL<br>MG/L | 00671<br>PHOS-DIS<br>ORTHO<br>MG/L P | 00665<br>PHOS-TOT<br>MG/L P |
|--------------------|-------------------|---------------|-------------------------------------|--------------------------------|---------------------------------|--------------------------------------|-----------------------------|
| 73/06/02           | 14 05             |               | 0.147                               | 3.200                          | 0.120                           | 0.115                                | 0.175                       |
| 73/07/07           | 10 00             |               | 0.032                               | 4.050                          | 0.160                           | 0.147                                | 0.710                       |
| 73/08/18           | 11 00             |               | 0.540                               | 6.800                          | 0.540                           | 0.173                                | 1.050                       |
| 73/09/09           |                   |               | 2.000                               |                                | 3.100                           | 0.385                                | 2.750                       |
| 73/10/14           | 12 59             |               | 0.250                               | 1.750                          | 0.042                           | 0.025                                | 0.070                       |
| 73/11/04           | 13 20             |               | 0.890                               | 1.200                          | 0.060                           | 0.009                                | 0.035                       |
| 73/12/02           |                   |               | 0.840                               | 1.300                          | 0.028                           | 0.008                                | 0.020                       |
| 74/01/06           | 15 16             |               | 1.010                               | 1.000                          | 0.184                           | 0.012                                | 0.025                       |
| 74/02/10           |                   |               | 0.740                               | 6.850                          | 0.155                           | 0.082                                | 0.855                       |
| 74/03/18           | 14 01             |               | 0.340                               | 3.500                          | 0.090                           | 0.010                                | 0.045                       |
| 74/03/24           |                   |               | 0.840                               | 2.700                          | 0.390                           | 0.040                                | 0.175                       |
| 74/04/03           | 13 00             |               | 0.360                               | 1.700                          | 0.045                           | 0.015                                | 0.055                       |
| 74/04/30           | 06 30             |               | 0.360                               | 1.100                          | 0.040                           | 0.015                                | 0.065                       |