U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

REPORT

ON

LAKE CANADOHTA

CRAWFORD COUNTY

PENNSYLVANIA

EPA REGION III

WORKING PAPER No. 416

PACIFIC NORTHWEST ENVIRONMENTAL RESEARCH LABORATORY

An Associate Laboratory of the

NATIONAL ENVIRONMENTAL RESEARCH CENTER - CORVALLIS, OREGON

and

NATIONAL ENVIRONMENTAL RESEARCH CENTER - LAS VEGAS, NEVADA

☆GPO—697-032

REPORT
ON
LAKE CANADOHTA
CRAWFORD COUNTY
PENNSYLVANIA
EPA REGION III
WORKING PAPER NO. 416

WITH THE COOPERATION OF THE
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
AND THE
PENNSYLVANIA NATIONAL GUARD

JUNE, 1975

CONTENTS

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 nation-wide 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 Pennsylvania Department of Environmental Resources for professional involvement and to the Pennsylvania National Guard for conducting the tributary sampling phase of the Survey.

Walter A. Lyon, Director of the Bureau of Water Quality Management, Richard M. Boardman, Chief of the Division of Water Quality, and James T. Ulanoski, Aquatic Biologist of the Division of Water Quality, 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.

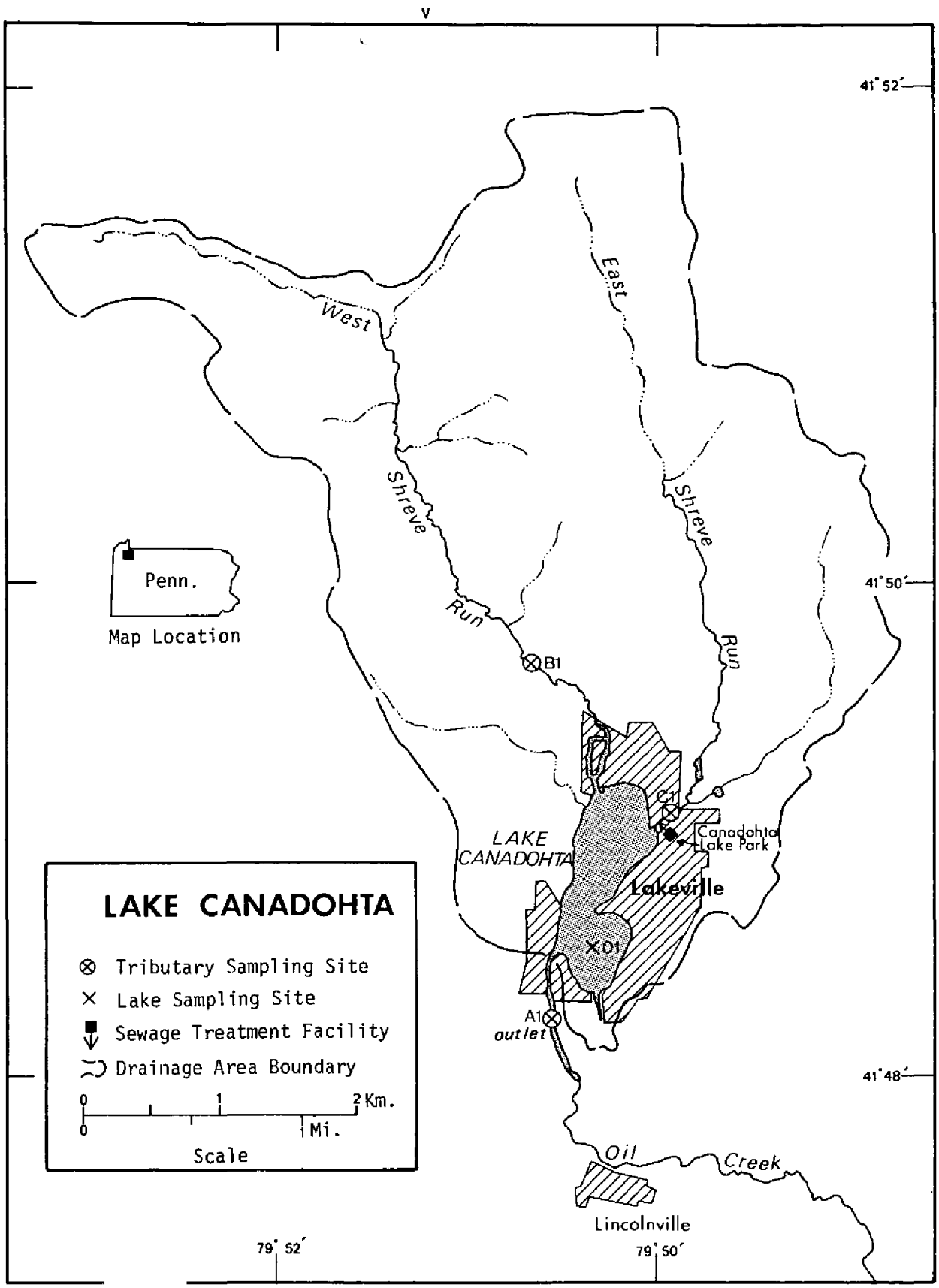
Major General Harry J. Mier, Jr., the Adjutant General of Pennsylvania, and Project Officer Major Ronald E. Wickard, who directed the volunteer efforts of the Pennsylvania National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF PENNSYLVANIA

LAKE NAME	COUNTY
Allegheny Reservoir	McKean, Warren, PA; Cattaraugus, NY
Beaver Run Reservoir	Westmoreland
Beltzville	Carbon
Blanchard Reservoir	Centre
Canadohta	Crawford
Conneaut	Crawford
Conewago (Pinchot)	York
Greenlane	Montgomery
Harveys	Luzerne
Indian	Somerset
Naomi	Monroe
Ontelaunee	Berks
Pocono	Monroe
Pymatuning Reservoir	Crawford, PA; Ashtabula, OH
Shenango River Reservoir	Mercer
Stillwater	Monroe
Wallenpaupack	Pike, Wayne


41° 52′
41° 50′
41° 48′
79° 52′
79° 50′
West
East
Shreve
Run
Shreve
Run
Penn.
Map Location
B1
C1
LAKE
CANADOHTA
Canadohta
Lake Park
Lakeville
X01
A1
outlet
Oil
Creek
Lincolnville
LAKE CANADOHTA
⊗ Tributary Sampling Site
× Lake Sampling Site
Sewage Treatment Facility
Drainage Area Boundary
0 1 2 Km.
0 1 Mi.
Scale

LAKE CANADOHTA*

STORET NO. 4221

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Lake Canadohta is eutrophic. It ranked eighth in overall trophic quality when the 17 Pennsylvania lakes sampled in 1973 were compared using a combination of six lake parameters**. Eight lakes had less median total phosphorus, one had less and three had the same median dissolved phosphorus, none had less and one had the same median inorganic nitrogen, 13 had less mean chlorophyll a, and seven had greater mean Secchi disc transparency. Near depletion of dissolved oxygen with depth occurred in July, 1973.

Survey limnologists reported higher aquatic plants along the shore, but no algae blooms were evident.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Lake Canadohta was phosphorus limited at the time the sample was collected (04/20/73). The lake data indicate phosphorus limitation in July as well but nitrogen limitation in October.

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* Table of metric conversions--Appendix A.
** See Appendix B.

C. Nutrient Controllability:

1. Point sources--The estimated phosphorus load contributed by the Canadohta Lake Park sewage treatment plant amounted to 2.8% of the total reaching Lake Canadohta during the sampling year, and shoreline septic tanks were estimated to have contributed nearly 26% of the total load. However, in a previous study, personnel of the Pennsylvania Department of Environmental Resources found that many of the 500 or so septic tank systems were malfunctioning (Boardman, 1975); and, in view of the lack of agreement between the indicated trophic state and the relatively low phosphorus loading rate, it is likely the estimated septic tank contribution is too low.

The present phosphorus loading rate of 0.78 $g/m^2/yr$ is less than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic rate but is more than his suggested oligotrophic rate; i.e., is a mesotrophic rate (see page 13). Because Lake Canadohta is phosphorus limited at least part of the time, and because it is presently eutrophic, all phosphorus inputs to the lake should be minimized to the greatest practicable extent to slow the aging of this lake.

2. Non-point sources--Over 71% of the total phosphorus input to Lake Canadohta was contributed by non-point sources during the

sampling year. West Shreve Run accounted for 44.4%, East Shreve Run contributed 18.5%, and the ungaged tributaries contributed an estimated 6.5% of the total phosphorus load.

The phosphorus export rates of East Shreve Run and West Shreve Run were relatively low (see page 12) and compare well with the exports of the two tributaries of nearby Conneaut Lake* (22 and 31 $kg/km^2/yr$).

* Working Paper No. 417.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 0.69 kilometers^2.
2. Mean depth: 8.8 meters.
3. Maximum depth: 14.3 meters.
4. Volume: 6.072 x 10^6 m^3.
5. Mean hydraulic retention time: 100 days.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
West Shreve Run	10.0	0.2
East Shreve Run	7.7	0.2
Minor tributaries & immediate drainage -	2.0	0.4
Totals	19.7	0.8

2. Outlet -

Oil Creek	20.4**	0.7

C. Precipitation***:

1. Year of sampling: 116.0 centimeters.
2. Mean annual: 102.8 centimeters.

† Ulanoski, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Lake Canadohta 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 5.2 meters.

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

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR LAKE CONANDOTHA
STORET CODE 4221

	1ST SAMPLING (4/26/73)			2ND SAMPLING (7/27/73)			3RD SAMPLING (10/ 5/73)		
	1 SITES			1 SITES			1 SITES		
PARAMETER	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN
TEMP (C)	86.0 - 90.0	88.7	88.0	14.7 - 25.0	21.6	25.0	17.5 - 17.5	17.5	17.5
DISS OXY (MG/L)	9.4 - 10.5	10.0	9.9	0.9 - 8.0	4.4	4.4	8.6 - 8.6	8.6	8.6
CNDCTVY (MICROMO)	120. - 140.	130.	130.	96. - 117.	110.	116.	108. - 108.	108.	108.
PH (STAND UNITS)	11.4 - 12.4	11.9	11.9	6.7 - 8.5	7.8	8.2	7.4 - 7.5	7.4	7.4
TOT ALK (MG/L)	24. - 26.	25.	25.	43. - 46.	44.	44.	37. - 39.	38.	38.
TOT P (MG/L)	0.018 - 0.019	0.018	0.018	0.019 - 0.040	0.027	0.022	0.026 - 0.026	0.026	0.026
ORTHO P (MG/L)	0.005 - 0.005	0.005	0.005	0.005 - 0.006	0.005	0.005	0.006 - 0.011	0.008	0.008
NO2+NO3 (MG/L)	0.130 - 0.140	0.133	0.130	0.040 - 0.080	0.060	0.060	0.020 - 0.030	0.025	0.025
AMMONIA (MG/L)	0.020 - 0.030	0.023	0.020	0.030 - 0.080	0.053	0.050	0.040 - 0.040	0.040	0.040
KJEL N (MG/L)	0.200 - 0.400	0.300	0.300	0.500 - 0.600	0.533	0.500	0.800 - 0.800	0.800	0.800
INORG N (MG/L)	0.150 - 0.170	0.157	0.150	0.070 - 0.160	0.113	0.110	0.060 - 0.070	0.065	0.065
TOTAL N (MG/L)	0.330 - 0.540	0.433	0.430	0.540 - 0.680	0.593	0.560	0.820 - 0.830	0.825	0.825
CHLRPYL A (UG/L)	21.8 - 21.8	21.8	21.8	23.3 - 23.3	23.3	23.3	12.4 - 12.4	12.4	12.4
SECCHI (METERS)	1.2 - 1.2	1.2	1.2	1.8 - 1.8	1.8	1.8	1.8 - 1.8	1.8	1.8

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
04/20/73	1. Asterionella	28,496
	2. Dinobryon	2,556
	3. Synedra	301
	4. Microcystis	301
	5. Flagellates	150
	Other genera	677
	Total	32,481
07/27/73	1. Cryptomonas	469
	2. Oscillatoria	390
	3. Flagellates	136
	4. Microcystis	45
	5. Sphaerocystis (?)	45
	Other genera	98
	Total	1,183
10/05/73	1. Fragilaria	2,342
	2. Anabaena	215
	3. Aphanocapsa	204
	4. Flagellates	124
	5. Blue-green filament	113
	Other genera	182
	Total	3,180

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
04/20/73	01	21.8
07/27/73	01	23.3
10/05/73	01	12.4

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.012	0.220	0.2
0.050 P	0.062	0.220	6.7
0.050 P + 1.0 N	0.062	1.220	19.2
1.0 N	0.012	1.220	0.1

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Lake Canadohta was moderate at the time the sample was collected (04/20/73). The addition of only phosphorus produced a significant increase in yield, but no such increase occurred with the addition of only nitrogen. Therefore, limitation by phosphorus is indicated.

The lake data further substantiate phosphorus limitation during April and July. The mean N/P ratios were 31/1 and 23/1, respectively. Limitation by nitrogen in October is indicated by a mean N/P ratio of 8/1.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Pennsylvania 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 February and March when two samples were collected. Sampling was begun in May, 1973, and was completed in April, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Pennsylvania District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were calculated using mean annual concentrations and mean annual flows. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient loads, in kg/km^2/year, at stations B-1 and C-1 and multiplying the means by the ZZ area in km^2.

The operator of the Canadohta Lake Park wastewater treatment plant 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 Sources:

1. Known muncipal -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Canadohta Lake Park*	variable	act. sludge	17.5	Lake Canadohta

2. Known industrial - None

* Treatment plant questionnaire.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
West Shreve Run	240	44.4
East Shreve Run	100	18.5
b. Minor tributaries & immediate drainage (non-point load) -	35	6.5
c. Known municipal STP's -		
Canadohta Lake Park*	15	2.8
d. Septic tanks** -	140	25.9
e. Known industrial - None	-	-
f. Direct precipitation*** -	10	1.9
Total	540	100.0

2. Outputs -

Lake outlet - Oil Creek 375

3. Net annual P accumulation - 165 kg.

* Estimate based on 25 persons per day for 6 months.
** Estimate based on 500 lakeshore dwellings (Boardman, 1975); see Working Paper No. 175.
*** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
West Shreve Run	8,930	33.3
East Shreve Run	9,605	35.8
b. Minor tributaries & immediate drainage (non-point load) -	2,140	8.0
c. Known municipal STP's -		
Canadohta Lake Park*	45	0.2
d. Septic tanks** -	5,330	19.9
e. Known industrial - None	-	-
f. Direct precipitation*** -	745	2.8
Total	26,795	100.0

2. Outputs -

Lake outlet - Oil Creek	33,530

3. Net annual N loss - 6,735 kg.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
West Shreve Run	24	893
East Shreve Run	13	1,247

* Estimate based on 25 persons per day for 6 months.
** Estimate based on 500 lakeshore dwellings (Boardman, 1975); see Working Paper No. 175.
*** See Working Paper No. 175.

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.78	0.24	38.8	loss*

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Lake Canadohta:

"Dangerous" (eutrophic rate)	1.08
"Permissible" (oligotrophic rate)	0.54

* There was an apparent loss of nitrogen during the sampling year. This may have been due to nitrogen fixation in the lake, solubilization of previously sedimented nitrogen, recharge with nitrogen-rich ground water, unknown and unsampled point sources discharging directly to the lake, or underestimation of the nitrogen load from Canadohta Lake Park.

V. LITERATURE REVIEWED

Boardman, Richard M., 1975. Personal communication (shoreline dwellings at Lake Canadohta). PA Dept. of Env. Resources, Harrisburg.

Ulanoski, James, 1975. Personal communication (lake morphometry). PA Dept. of Env. Resources, Harrisburg.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VII. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

LAKE RANKINGS

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4224	LAKE NAOMI	445
2	4220	BELTZVILLE DAM	423
3	4222	HARVEY'S LAKE	413
4	4228	STILLWATER LAKE	401
5	4227	POCONO LAKE	389
6	4223	INDIAN LAKE	388
7	3641	ALLEGHENY RESERVOIR	385
8	4229	LAKE WALLENPAUPACK	371
9	4221	CANADOHTA LAKE	369
10	4219	BEAVER RUN RESERVOIR	360
11	4204	CONNEAUT LAKE	307
12	4226	PINCHOT LAKE	256
13	4213	PYMATUNING RESERVOIR	206
14	4216	SHENANGO RIVER RESERVOIR	157
15	4225	ONTELAUNEE DAM	101
16	4201	BLANCHARD RESERVOIR	85
17	4207	GREENLANE DAM	53

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

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P	INDEX NO
3641	ALLEGHENY RESERVOIR	56 (9)	38 (6)	63 (10)	100 (16)	69 (11)	59 (8)	385
4201	BLANCHARD RESERVOIR	13 (2)	13 (2)	25 (4)	31 (5)	3 (0)	0 (0)	85
4204	CONNEAUT LAKE	44 (7)	63 (10)	69 (11)	56 (9)	34 (5)	41 (6)	307
4207	GREENLANE DAM	6 (1)	6 (1)	19 (3)	13 (2)	3 (0)	6 (1)	53
4213	PYMATUNING RESERVOIR	0 (0)	72 (11)	6 (1)	0 (0)	100 (16)	28 (4)	206
4216	SHENANGO RIVER RESERVOIR	19 (3)	44 (7)	13 (2)	6 (1)	47 (7)	28 (4)	157
4219	BEAVER RUN RESERVOIR	94 (15)	19 (3)	88 (14)	81 (13)	19 (2)	59 (8)	360
4220	BELTZVILLE DAM	88 (14)	25 (4)	94 (15)	94 (15)	34 (5)	88 (13)	423
4221	CANADOHTA LAKE	50 (8)	97 (15)	56 (9)	19 (3)	59 (9)	88 (13)	369
4222	HARVEY'S LAKE	63 (10)	81 (13)	100 (16)	63 (10)	47 (7)	59 (8)	413
4223	INDIAN LAKE	100 (16)	31 (5)	75 (12)	75 (12)	19 (2)	88 (13)	388
4224	LAKE NAOMI	81 (13)	88 (14)	44 (7)	69 (11)	88 (14)	75 (12)	445
4225	ONTELAUNEE DAM	25 (4)	0 (0)	0 (0)	44 (7)	19 (2)	13 (2)	101
4226	PINCHOT LAKE	31 (5)	56 (9)	31 (5)	38 (6)	81 (13)	19 (3)	256
4227	POCONO LAKE	38 (6)	97 (15)	50 (8)	88 (14)	75 (12)	41 (6)	389
4228	STILLWATER LAKE	72 (11)	72 (11)	38 (6)	25 (4)	94 (15)	100 (16)	401
4229	LAKE WALLENPAUPACK	72 (11)	50 (8)	81 (13)	50 (8)	59 (9)	59 (8)	371

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P
3641	ALLEGHENY RESERVOIR	0.016	0.380	414.250	3.700	13.800	0.006
4201	BLANCHARD RESERVOIR	0.064	1.300	453.143	15.187	14.900	0.046
4204	CONNEAUT LAKE	0.023	0.185	402.000	7.567	14.600	0.007
4207	GREENLANE DAM	0.066	1.475	460.222	24.011	14.900	0.020
4213	PYMATUNING RESERVOIR	0.070	0.180	467.750	56.333	7.700	0.008
4216	SHENANGO RIVER RESERVOIR	0.058	0.340	463.555	26.800	14.500	0.008
4219	BEAVER RUN RESERVOIR	0.009	0.835	384.833	5.183	14.800	0.006
4220	BELTZVILLE DAM	0.010	0.815	362.444	4.856	14.600	0.005
4221	CANADOHTA LAKE	0.020	0.130	436.000	19.167	14.100	0.005
4222	HARVEY'S LAKE	0.015	0.160	338.000	5.967	14.500	0.006
4223	INDIAN LAKE	0.008	0.520	400.222	5.211	14.800	0.005
4224	LAKE NAOMI	0.014	0.135	443.333	5.533	8.000	0.005
4225	ONTELAUNEE DAM	0.040	2.150	470.667	11.783	14.800	0.011
4226	PINCHOT LAKE	0.027	0.245	453.000	13.950	11.500	0.008
4227	POCONO LAKE	0.024	0.130	438.800	4.980	13.200	0.007
4228	STILLWATER LAKE	0.015	0.180	449.000	18.233	7.900	0.004
4229	LAKE WALLENPAUPACK	0.015	0.250	394.583	9.617	14.100	0.006

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR PENNSYLVANIA 1/27/75

LAKE CODE 4221 CANADOHTA LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 20.4

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
422141	20.4	0.80	0.95	1.33	1.08	0.62	0.51	0.40	0.27	0.28	0.48	0.99	1.08	0.74
422181	10.0	0.18	0.22	0.34	0.28	0.08	0.05	0.03	0.01	0.01	0.04	0.24	0.25	0.16
4221C1	7.7	0.19	0.23	0.40	0.26	0.11	0.08	0.05	0.03	0.03	0.07	0.23	0.25	0.16
422122	2.7	0.51	0.51	0.40	0.54	0.42	0.40	0.31	0.23	0.24	0.37	0.51	0.57	0.42

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 20.4
SUM OF SUB-DRAINAGE AREAS = 20.4
TOTAL FLOW IN = 8.84
TOTAL FLOW OUT = 8.87

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
422141	5	73	0.85	19	0.37				
	6	73	0.59	16	0.25				
	7	73	0.31	16	0.07				
	8	73	0.16	18	0.42				
	9	73	0.04	22	0.03				
	10	73	0.20	20	0.10				
	11	73	0.65	10	0.28				
	12	73	0.58	9	0.45				
	1	74	1.05	12	0.40				
	2	74	0.54	9	0.40				
	3	74	1.47	16	1.44				
	4	74	1.36	16	0.62				
422181	5	73	0.14	19	0.02				
	6	73	0.07	16	0.01				
	7	73	0.02	16	0.0				
	8	73	0.00	18	0.03				
	9	73	0.0	22	0.0				
	10	73	0.00	20	0.0				
	11	73	0.09	10	0.01				
	12	73	0.04	9	0.04				
	1	74	0.25	12	0.03				
	2	74	0.13	9	0.03				
	3	74	0.37	16	0.15				
	4	74	0.23	16	0.15				

TRIBUTARY FLOW INFORMATION FOR PENNSYLVANIA 1/27/75

LAKE CODE 4221 CANADOHTA LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4221C1	5	73	0.18	19	0.04				
	6	73	0.10	16	0.02				
	7	73	0.03	16	0.00				
	8	73	0.01	18	0.06				
	9	73	0.0	22	0.0				
	10	73	0.02	20	0.00				
	11	73	0.12	10	0.03				
	12	73	0.12	9	0.06				
	1	74	0.27	12	0.05				
	2	74	0.08	9	0.05				
	3	74	0.45	16	0.68				
	4	74	0.34	16	0.17				
4221Z2	9	73	0.04	22	0.03				
	10	73	0.18	20	0.27				
	11	73	0.45	10	0.24				
	12	73	0.45	9	0.34				
	1	74	0.51	12	0.31				
	2	74	0.40	9	0.31				
	3	74	0.45	16	0.11				
	4	74	0.51	16	0.51				
	5	74	0.51	19	0.31				
	6	74	0.42	16	0.22				
	7	74	0.26	16	0.07				
	8	74	0.14	18	0.34				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 73/01/27

422101
41 48 32.0 079 50 22.0
LAKE CONANDOTHA
42039 PENNSYLVANIA

11EPALES
3

2111202
0021 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/20	14	20 0000	58.0	10.8	48	120		24	0.020	0.200K	0.130	0.005
	14	20 0004	56.0	9.9		130	12.40	25	0.020	0.300	0.130	0.005
	14	20 0016	50.0	4.4		140	11.40	26	0.030	0.400	0.140	0.005
73/07/27	15	45 0000	25.0		72	116	8.50	44	0.080	0.600	0.080	0.005
	15	45 0005	25.0	8.0		117	8.20	43	0.050	0.500	0.060	0.005
	15	45 0017	14.7	0.9		96	6.70	46	0.030	0.500	0.040	0.006
73/10/05	15	00 0000	17.5	8.6	72	108	7.40	37	0.040	0.800	0.030	0.011
	15	00 0016	17.5	8.6		108	7.50	39	0.040	0.800	0.020	0.006

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/20	14	20 0000	0.018	21.6
	14	20 0004	0.018	
	14	20 0016	0.019	
73/07/27	15	45 0000	0.019	23.3
	15	45 0005	0.022	
	15	45 0017	0.043	
73/10/05	15	00 0000	0.020	12.4
	15	00 0016	0.020	

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 75/02/03

422141
41 49 40.0 079 50 30.0
OIL CREEK
42089 CRAWFORD CO HWY
U/CANADOHTA LAKE
RD 20031 BRDG .4 MI DOWNSTREAM OF LAKE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/14	17	00	0.012	1.800	0.052	0.005K	0.010
73/06/14	17	40	0.028	4.700	0.140	0.005K	0.025
73/07/16	10	15	0.072	1.680	0.046	0.005K	0.015
73/08/18	14	30	0.060	0.690	0.027	0.006	0.015
73/09/22	14	30	0.017	0.480	0.016	0.006	0.030
73/10/26	13	30	0.010K	0.550	0.008	0.019	
73/12/10	14	47	0.160	1.300	0.062		0.015
73/12/27	13	36	0.240	1.600	0.080	0.005K	0.020
74/01/27	10	30		0.500	0.100	0.008	0.008
74/02/11	14	30	0.400	0.400	0.075	0.005K	0.005
74/02/12	13	35	0.400	0.700	0.070	0.005K	0.015
74/03/18	09	35	0.400	0.700	0.025	0.005K	0.025
74/03/31	17	55	0.390	1.200	0.085	0.005	0.020
74/04/16	13	14	0.264	1.500	0.035	0.005	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

422161
41 48 10.0 079 50 35.0
W SHREVE RUN
42 CRAWFORD CO HWY
T/CANADOHTA LAKE
RD 20139 BRDG 1.25 MI N OF LAKEVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/14	17	45	0.017	1.400	0.056	0.011	0.030
73/06/14	17	10	0.034	3.400	0.160	0.022	0.070
73/10/26	13	15	0.029	1.130	0.029	0.052	0.135
73/12/10	14	20	0.048	0.400	0.028	0.012	0.025
73/12/27	13	26	0.504	1.000	0.064	0.008	0.060
74/01/27	10	25	0.650	1.700	0.148	0.005K	0.010
74/02/11	14	20	0.352	0.600	0.040	0.005K	0.010
74/02/12	14	03	0.290	1.000	0.095	0.005K	0.020
74/03/18	09	45	0.420	0.400	0.015	0.005	0.020
74/03/31	18	03	0.504	0.900	0.080	0.005K	0.017
74/04/16	13	06	0.100	0.700	0.035	0.010	0.025

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4221C1
41 49 02.0 079 49 59.0
E SHREVE RUN
42 CRAWFORD CO HWY
T/CANADOHTA LAKE
SEC RD BRDG NEAR MOUTH OF STREAM
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	17 50		0.160	2.400	0.046	0.005K	0.005K
73/06/14	17 50		0.273	2.600	0.086	0.005K	0.015
73/07/16	10 30		0.340	0.520	0.027	0.005K	0.010
73/08/18	14 45		0.240	1.700	0.072	0.007	0.030
73/09/22	14 50		0.120	0.290	0.022	0.006	0.010
73/10/26	13 45		0.220	0.900	0.042	0.021	0.165
73/12/10	14 50		0.430	0.200	0.016	0.005K	0.005
73/12/27	14 15		0.920	1.200	0.040	0.008	0.030
74/01/27	10 45		0.740	0.600	0.032	0.005K	0.010
74/02/11	14 40		0.610	1.000	0.040	0.005K	0.005K
74/02/12	13 47		0.504	0.700	0.040	0.005K	0.010
74/03/14	09 25		0.570	0.400	0.035	0.005	0.010
74/03/31	17 05		0.830	1.000	0.075	0.005K	0.015
74/04/16	13 23		0.336	0.400	0.025	0.005	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED