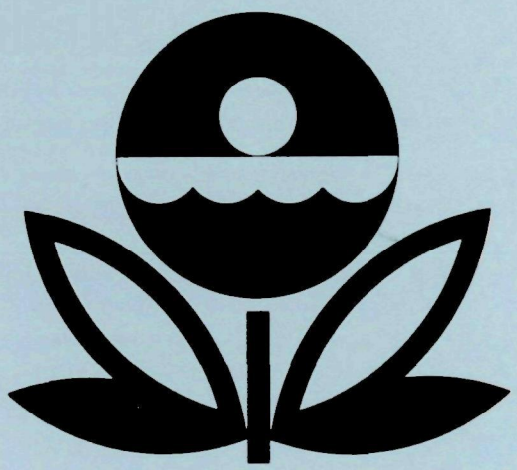
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



REPORT

ON

NELSON RESERVOIR

PHILLIPS COUNTY

MONTANA

EPA REGION VIII

WORKING PAPER No. 798

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPORT
ON
NELSON RESERVOIR
PHILLIPS COUNTY
MONTANA
EPA REGION VIII
WORKING PAPER No. 798

WITH THE COOPERATION OF THE
MONTANA DEPARTMENT OF HEALTH & ENVIRONMENTAL SCIENCES
AND THE
MONTANA NATIONAL GUARD

MAY, 1977

CONTENTS

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater 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.

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U.S. Environmental Protection Agency) express sincere appreciation to the Montana Department of Health and Environmental Sciences for professional involvement, to the Montana National Guard for conducting the tributary sampling phase of the Survey, and to those Montana wastewater treatment plant operators who voluntarily provided effluent samples.

The staff of the Water Quality Bureau 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.

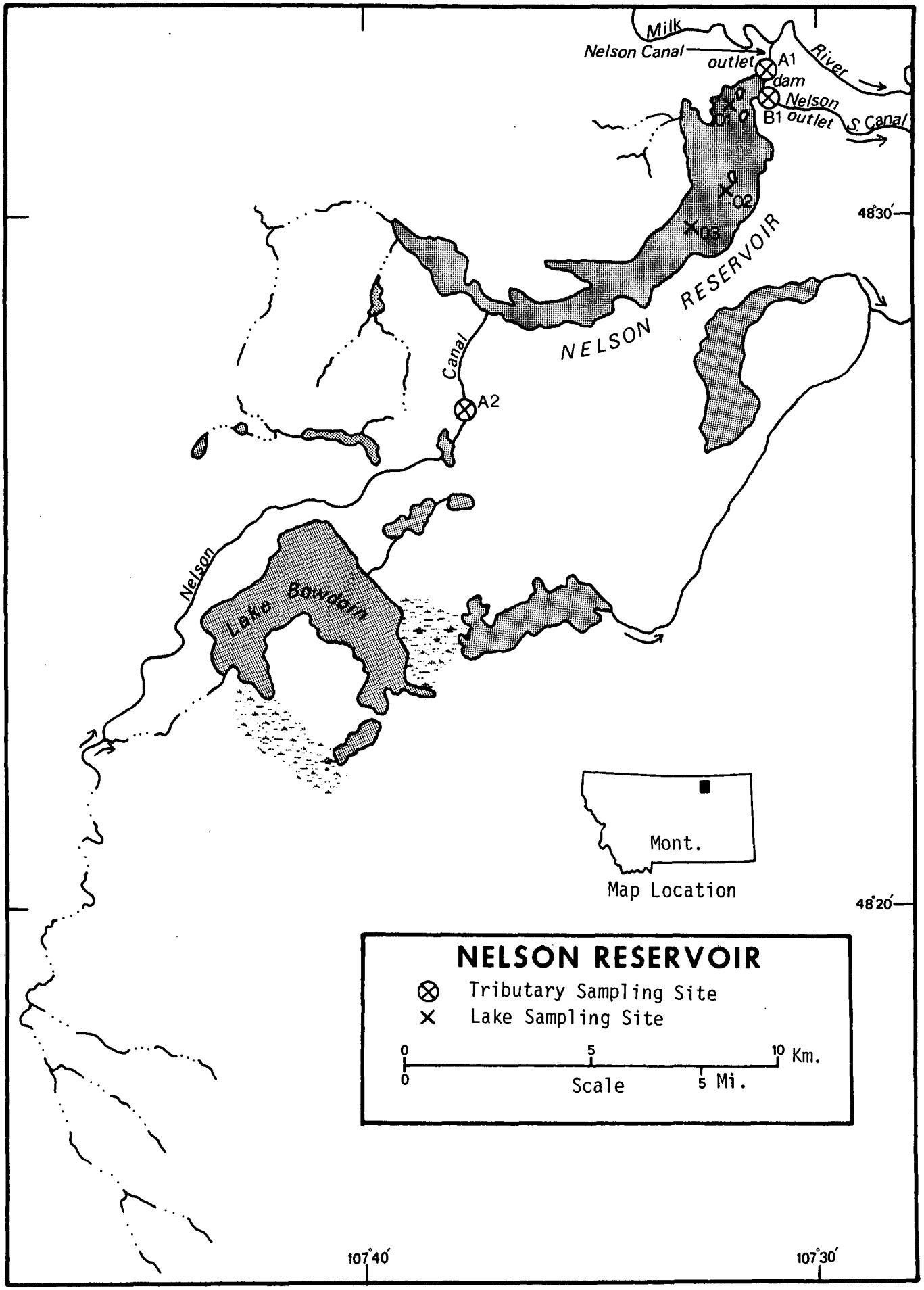
Major General John J. Womack, the Adjutant General of Montana, and Project Officer Major William Yeager, who directed the volunteer efforts of the Montana National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES AND RESERVOIRS

STATE OF MONTANA

LAKE NAME	COUNTY
Canyon Ferry	Broadwater, Lewis and Clark
Clark Canyon	Beaverhead
Flathead	Flathead, Lake
Georgetown	Deer Lodge, Granite
Hebgen	Gallatin
Koocanusa	Lincoln, MT; British Columbia, Can.
Mary Ronan	Lake
McDonald	Flathead
Nelson	Phillips
Seeley	Missoula
Swan	Lake
Tally	Flathead
Tiber	Liberty, Toole
Tongue River	Big Horn
Whitefish	Flathead
Yellowtail	Carbon, Bighorn, MT; Bighorn, WY


Milk
Nelson Canal
outlet
A1
dam
River
Nelson
B1 outlet
S. Canal
48°30'
NELSON RESERVOIR
Canal
A2
Nelson
Lake Bowdoin
Mont.
Map Location
48°20'
NELSON RESERVOIR
Tributary Sampling Site
Lake Sampling Site
0
5
10 Km.
0
Scale
5 Mi.
107°40'
107°30'

NELSON RESERVOIR

STORET NO. 3009

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Nelson Reservoir is eutrophic. It ranked twelfth in overall trophic quality when the 15 Montana lakes and reservoirs sampled in 1975 were compared using a combination of six water-quality parameters*. Ten of the water bodies had less median total phosphorus, seven had less median dissolved orthophosphorus, nine had less median inorganic nitrogen, 13 had less mean chlorophyll a, and 13 had greater mean Secchi disc transparency. Depression of dissolved oxygen with depth occurred at station 2 in July.

Survey limnologists noted abundant submerged macrophytes during the July sampling and an algal bloom in September.

B. Rate-Limiting Nutrient:

The algal assay results are not considered representative of conditions in the reservoir at sampling time due to significant changes in nutrients in the samples during shipment from the field to the laboratory.

The reservoir data indicate nitrogen limitation at all sampling stations and times, with the exception of station 1 in July.

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* See Appendix A.

C. Nutrient Controllability:

1. Point sources--No known municipal point sources impacted Nelson Reservoir during the sampling year. Septic tanks serving shoreline dwellings were estimated to have contributed 0.2% of the total phosphorus load, but a shoreline survey would have to be conducted to determine the significance of those sources.

The present phosphorus loading of 0.41 g/m^2/year is greater than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 11).

2. Non-point sources--Non-point sources accounted for 99.8% of the total phosphorus load during the sampling year. The Nelson Canal inlet contributed 95.5% of the total.

Major agricultural land uses in the area include pasturing and crop land as reported by Survey limnologists. Further study is needed to determine the controllability of the nutrient contributions of such sources.

II. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 18.45 kilometers^2.
2. Mean depth: 5.7 meters.
3. Maximum depth: 8.5 meters.
4. Volume: 105.165 x 10^6 m^3.
5. Mean hydraulic retention time: 1.8 years (based on 1975 outflow).

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

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Nelson Canal	-	2.290
Minor tributaries & immediate drainage -	-	-
Totals	-	2.290

2. Outlet -

Nelson Canal	-	0.028**
Nelson South Canal	-	1.869
Totals	-	1.897

C. Precipitation***:

1. Year of sampling: 46.9 centimeters.
2. Mean annual: 30.0 centimeters.

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† Table of metric conversions--Appendix B.
†† Surface area - Horpestad, 1974; volume - Martin and Hanson, 1966.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976"; no drainage areas or normalized flows - canal flow is completely regulated (Pike, 1975).
** Leakage through canal gates.
*** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Nelson Reservoir was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two or more depths at three stations on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first and last visits, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 1.5 meters at station 1, 11.6 meters at station 2, and 5.5 meters at station 3.

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 NELSON RESERVOIR
STORET CODE 3009

PARAMETER	1ST SAMPLING (5/30/75) 3 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/24/75) 3 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/ 8/75) 3 SITES RANGE	MEAN	MEDIAN
TEMP (C)	10.0 - 14.0	12.2	12.1	16.4 - 23.0	21.0	21.2	15.8 - 17.9	16.7	16.7
DISS OXY (MG/L)	8.2 - 10.0	9.3	9.4	3.6 - 9.2	7.2	7.4	8.8 - 10.0	9.2	9.2
CNDCTVY (MCROMO)	420. - 553.	460.	449.	509. - 574.	560.	567.	562. - 582.	570.	569.
PH (STAND UNITS)	8.4 - 8.6	8.5	8.5	8.2 - 8.8	8.5	8.5	8.5 - 8.9	8.7	8.8
TOT ALK (MG/L)	165. - 173.	169.	168.	171. - 181.	175.	175.	181. - 194.	186.	186.
TOT P (MG/L)	0.023 - 0.052	0.034	0.031	0.016 - 0.035	0.025	0.025	0.024 - 0.061	0.037	0.033
ORTHO P (MG/L)	0.011 - 0.022	0.018	0.019	0.002 - 0.022	0.007	0.006	0.003 - 0.013	0.006	0.003
NO2+NO3 (MG/L)	0.080 - 0.150	0.113	0.100	0.020 - 0.120	0.048	0.040	0.020 - 0.020	0.020	0.020
AMMONIA (MG/L)	0.040 - 0.060	0.056	0.060	0.020 - 0.060	0.034	0.030	0.020 - 0.040	0.025	0.020
KJEL N (MG/L)	0.400 - 0.700	0.489	0.500	0.400 - 0.500	0.422	0.400	0.600 - 1.200	0.812	0.800
INORG N (MG/L)	0.120 - 0.210	0.169	0.160	0.040 - 0.180	0.082	0.070	0.040 - 0.060	0.045	0.040
TOTAL N (MG/L)	0.500 - 0.820	0.602	0.580	0.440 - 0.530	0.470	0.450	0.620 - 1.220	0.832	0.820
CHLRPYL A (UG/L)	1.3 - 5.4	2.7	1.5	1.5 - 1.8	1.6	1.6	1.3 - 41.8	17.3	8.9
SECCHI (METERS)	0.5 - 2.1	1.3	1.3	1.2 - 1.7	1.5	1.5	0.6 - 0.6	0.6	0.6

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
05/30/75	1. Chroomonas sp.	347
	2. Centric diatoms	261
	3. Cryptomonas sp.	87
	4. Ankistrodesmus sp.	43
	5. Nitzschia sp.	43
	Total	781
07/24/75	1. Chroomonas sp.	523
	2. Aphanizomenon sp.	486
	3. Ankistrodesmus sp.	75
	Total	1,084
09/08/75	1. Aphanizomenon sp.	3,800
	2. Flagellates	192
	3. Chroomonas sp.	171
	4. Oscillatoria sp.	128
	5. Schroederia sp.	107
	Other genera	43
	Total	4,441

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
05/30/75	1	1.3
	2	1.5
	3	5.4
07/24/75	1	1.5
	2	1.6
	3	1.8
09/08/75	1	1.3
	2	8.9
	3	41.8

C. Limiting Nutrient Study:

Due to significant changes in nutrient levels during shipment of the samples from the field to the laboratory, the algal assay results are not considered representative of conditions in the reservoir at the time the samples were taken (05/30/75 and 09/08/75). The reservoir data indicate nitrogen limitation at all sampling stations and times, with the exception of station 1 in July. Except for station 1 in July, all of the mean inorganic nitrogen/orthophosphorus ratios were 13/1 or less, and nitrogen limitation would be expected. The ratio of 21/1 at station 1 in July indicates phosphorus limitation.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Montana 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 month of June when two samples were collected. Sampling was begun in October, 1974, and was completed in September, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling were provided by the Montana District Office of the U.S. Geological Survey which received the daily and monthly regulated flows for Nelson Canal from the U.S. Bureau of Reclamation.

In this report, nutrient loads for the sampled tributary were calculated using mean concentrations and mean flow.

No known wastewater treatment plants impacted the reservoir during the sampling year.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Nelson Canal	7,295	95.5
b. Minor tributaries & immediate drainage (non-point load) -	-	-
c. Known municipal STP's - None	-	-
d. Septic tanks * -	15	0.2
e. Known industrial - None	-	-
f. Direct precipitation** -	325	4.3
Total	7,635	100.0

2. Outputs -

Reservoir outlet -	Nelson Canal	45
	Nelson South Canal	1,295
	Total	1,340

3. Net annual P accumulation - 6,295 kg.

* Estimate based on 50 shoreline dwellings (field limnologists observations); 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) -		
Nelson Canal	134,975	86.8
b. Minor tributaries & immediate drainage (non-point load) -	-	-
c. Known municipal STP's - None	-	-
d. Septic tanks* -	535	0.4
e. Known industrial - None	-	-
f. Direct precipitation** -	19,920	12.8
Total	155,430	100.0

2. Outputs -

Reservoir outlet -	Nelson Canal	1,650
	Nelson South Canal	79,745
	Total	81,395

3. Net annual N accumulation - 74,035 kg.

* Estimate based on 50 shoreline dwellings (field limnologists observations); see Working Paper No. 175.
** See Working Paper No. 175.

D. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading 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	0.41	0.34	8.4	4.0

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Nelson Reservoir:

"Dangerous" (eutrophic loading)	0.36
"Permissible" (oligotrophic loading)	0.18

V. LITERATURE REVIEWED

Horpestad, Abe, 1974. Personal communication (reservoir morphometry). MT Dept. of Health & Env. Sci., Helena.

Martin, R. O. R., and Ronald L. Hanson, 1966. Reservoirs in the United States. Water Supply Paper No. 1838, U.S. Geol. Surv., Wash., DC.

Pike, George M., 1975. Personal communication (regulated flow in Nelson Canal). U.S. Geol. Surv., Helena.

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.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

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 ORTHO P
3001	CANYON FERRY RESERVOIR	0.047	0.170	442.800	5.816	14.400	0.029
3002	CLARK CANYON RESERVOIR	0.044	0.160	398.750	2.375	12.000	0.027
3003	FLATHEAD LAKE	0.008	0.050	267.833	1.273	9.000	0.004
3004	GEORGETOWN RESERVOIR	0.022	0.040	367.333	6.983	10.200	0.011
3005	HEBGEN RESERVOIR	0.022	0.040	367.700	4.083	13.800	0.020
3006	KOOCANUSA RESERVOIR	0.045	0.100	337.643	2.669	10.400	0.044
3007	MARY RONAN LAKE	0.020	0.040	371.091	4.673	14.200	0.006
3008	MC DONALD LAKE	0.006	0.180	190.667	0.467	6.400	0.002
3009	NELSON RESERVOIR	0.029	0.075	456.750	7.233	11.400	0.007
3010	SEELEY LAKE	0.015	0.040	362.857	2.171	13.200	0.010
3011	SWAN LAKE	0.010	0.050	282.750	3.289	9.600	0.004
3012	TALLY LAKE	0.011	0.050	339.167	2.083	9.200	0.004
3013	TIBER RESERVOIR	0.018	0.180	448.555	2.806	9.600	0.004
3014	TONGUE RIVER RESERVOIR	0.051	0.050	474.111	16.878	13.600	0.008
3016	WHITEFISH LAKE (LOWER)	0.008	0.040	290.000	1.400	7.000	0.003

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 ORTHO P	INDEX NO
3001	CANYON FERRY RESERVOIR	14 (2)	14 (2)	21 (3)	21 (3)	0 (0)	7 (1)	77
3002	CLARK CANYON RESERVOIR	7 (1)	21 (3)	29 (4)	64 (9)	36 (5)	14 (2)	171
3003	FLATHEAD LAKE	89 (12)	61 (8)	93 (13)	93 (13)	86 (12)	75 (9)	497
3004	GEORGETOWN RESERVOIR	39 (5)	79 (10)	50 (7)	14 (2)	57 (8)	29 (4)	268
3005	HEBGEN RESERVOIR	39 (5)	79 (10)	43 (6)	36 (5)	14 (2)	21 (3)	232
3006	KOOCANUSA RESERVOIR	21 (3)	29 (4)	71 (10)	57 (8)	50 (7)	0 (0)	228
3007	MARY RONAN LAKE	50 (7)	96 (13)	36 (5)	29 (4)	7 (1)	57 (8)	275
3008	MC DONALD LAKE	100 (14)	4 (0)	100 (14)	100 (14)	100 (14)	100 (14)	504
3009	NELSON RESERVOIR	29 (4)	36 (5)	7 (1)	7 (1)	43 (6)	50 (7)	172
3010	SEELEY LAKE	64 (9)	96 (13)	57 (8)	71 (10)	29 (4)	36 (5)	353
3011	SWAN LAKE	79 (11)	46 (6)	86 (12)	43 (6)	68 (9)	75 (9)	397
3012	TALLY LAKE	71 (10)	61 (8)	64 (9)	79 (11)	79 (11)	75 (9)	429
3013	TIBER RESERVOIR	57 (8)	4 (0)	14 (2)	50 (7)	68 (9)	75 (9)	268
3014	TONGUE RIVER RESERVOIR	0 (0)	46 (6)	0 (0)	0 (0)	21 (3)	43 (6)	110
3016	WHITEFISH LAKE (LOWER)	89 (12)	79 (10)	79 (11)	86 (12)	93 (13)	93 (13)	519

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	3016	WHITEFISH LAKE (LOWER)	519
2	3008	MC DONALD LAKE	504
3	3003	FLATHEAD LAKE	497
4	3012	TALLY LAKE	429
5	3011	SWAN LAKE	397
6	3010	SEELEY LAKE	353
7	3007	MARY RONAN LAKE	275
8	3013	TIBER RESERVOIR	268
9	3004	GEORGETOWN RESERVOIR	268
10	3005	HEBGEN RESERVOIR	232
11	3006	KOOCANUSA RESERVOIR	228
12	3009	NELSON RESERVOIR	172
13	3002	CLARK CANYON RESERVOIR	171
14	3014	TONGUE RIVER RESERVOIR	110
15	3001	CANYON FERRY RESERVOIR	77

APPENDIX B

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 C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR MONTANA 08/05/76

LAKE CODE 3009 NELSON RESERVOIR

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 0.0

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3009ZZ	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 = 0.0
SUM OF SUB-DRAINAGE AREAS = 0.0
TOTAL FLOW IN = 0.0
TOTAL FLOW OUT = 0.0

NOTE *** CANAL-NO DRAINAGE AREAS OR NORMALIZED FLOWS.

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3009A1	10	74	0.0	5	0.028				
	11	74	0.0	3	0.028				
	12	74	0.0	8	0.028				
	1	75	0.0	4	0.028				
	2	75	0.0	2	0.028	22	0.028		
	3	75	0.0						
	4	75	0.0	5	0.028				
	5	75	0.0	3	0.028				
	6	75	0.0	6	0.028	20	0.142		
	7	75	0.0	26	0.028				
	8	75	0.0	23	0.028				
	9	75	0.0	27	0.028				
3009A2	10	74	0.283	5	1.416				
	11	74	0.0	3	0.028				
	12	74	0.0	8	0.0				
	1	75	0.0	4	0.0				
	2	75	0.0	2	0.0	22	0.0		
	3	75	0.0						
	4	75	0.878	5	0.0				
	5	75	4.136	3	4.955				
	6	75	2.577	6	4.248	20	8.495		
	7	75	1.671	26	2.124				
	8	75	5.239	23	2.832				
	9	75	1.274	27	0.708				
3009B1	10	74	0.0	5	0.028				
	11	74	0.566	3	0.028				
	12	74	0.0	8	0.028				
	1	75	0.0	4	0.028				
	2	75	0.0	2	0.0	22	0.0		
	3	75	0.0						
	4	75	0.0	5	0.0				
	5	75	0.283	3	0.142				
	6	75	2.747	6	2.690	20	1.982		
	7	75	4.644	26	5.239				
	8	75	2.265	23	1.416				
	9	75	0.708	27	0.566				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/08/05

300901
48 31 48.0 107 31 58.0 3
NELSON RESERVOIR
30071 MONTANA

090191

11EPALES 2111202
0008 FEET DEPTH CLASS 00

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
75/05/30	09 50	0000	14.0	9.8		442	8.55	173	0.060	0.700	0.120	0.020
	09 50	0005	13.9	10.0		442	8.55	173	0.040	0.500	0.080	0.011
75/07/24	15 20	0000	23.0	7.4	60	570	8.30	172	0.030	0.400	0.050	0.002
	15 20	0005	21.2	7.4		561	8.40	171	0.040	0.400	0.050	0.006
75/09/08	14 00	0000	15.9	8.8	22	567	8.50	181	0.020K	0.800	0.020K	0.003
	14 00	0005	15.8			562	8.70	181	0.020K	0.600	0.020K	0.003

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/30	09 50	0000	0.033	1.3	
	09 50	0005	0.025		
75/07/24	15 20	0000	0.016	1.5	
	15 20	0005	0.019		
75/09/08	14 00	0000	0.031	1.3	
	14 00	0005	0.026		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

300902
48 29 35.0 107 33 00.0 3
NELSON RESERVOIR
30071 MONTANA

11EPALES 760109 2111202
0042 FEET DEPTH CLASS 00

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
75/05/30	10 20	0000	12.1	9.4	83	497	8.50	173	0.060	0.400	0.100	0.018
	10 20	0005	12.0	9.1		553	8.50	172	0.050	0.400	0.100	0.017
	10 20	0015	11.3	9.4		449	8.50	167	0.060	0.400	0.120	0.016
	10 20	0025	10.0	8.8		457	8.50	167	0.050	0.400	0.100	0.019
	10 20	0038	10.8	8.2		457	8.40	168	0.060	0.500	0.100	0.021
75/07/24	15 45	0000	22.7	7.8	66	574	8.50	174	0.020	0.400	0.040	0.006
	15 45	0005	20.9	7.4		567	8.50	175	0.030	0.400	0.040	0.005
	15 45	0015	20.4	6.8		555	8.40	175	0.040	0.400	0.040	0.007
	15 45	0034	16.4	3.6		509	8.20	177	0.060	0.400	0.120	0.022
75/09/08	14 25	0000	17.9	10.0	24	582	8.70	184	0.020K	0.800	0.020K	0.005
	14 25	0005	16.9	9.2		570	8.75	184	0.020K	0.800	0.020K	0.004
	14 25	0015	16.5	9.2		568	8.75	187	0.020K	0.600	0.020K	0.003
	14 25	0032	16.2	8.8		562	8.75	188	0.020K	0.600	0.020K	0.003

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/30	10 20	0000	0.025	1.5	
	10 20	0005	0.023		
	10 20	0015	0.026		
	10 20	0025	0.031		
	10 20	0038	0.037		
75/07/24	15 45	0000	0.025	1.6	
	15 45	0005	0.022		
	15 45	0015	0.027		
	15 45	0034	0.033		
75/09/08	14 25	0000	0.042	8.9	
	14 25	0005	0.035		
	14 25	0015	0.024		
	14 25	0032	0.028		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

300903
48 29 04.0 107 36 40.0 3
NELSON RESERVOIR
30071 MONTANA

11EPALES 760109 2111202
0007 FEET DEPTH CLASS 00

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
75/05/30	10 50	0000	13.0	10.0	19	422	8.60	166	0.060	0.600	0.150	0.021
	10 50	0005	13.0	9.4		420	8.60	165	0.060	0.500	0.150	0.022
75/07/24	16 05	0000	22.4	8.0	48	572	8.85	175	0.030	0.400	0.040	0.004
	16 05	0005	22.0	9.2		565	8.65	175	0.020	0.500	0.020K	0.006
	16 05	0018	20.4	7.0		568	8.50	181	0.040	0.500	0.030	0.007
75/09/08	14 45	0000	17.2	9.4	24	577	8.90	190	0.040	1.100	0.020K	0.013
	14 45	0004	17.0	8.8		575	8.90	194	0.040	1.200	0.020K	0.013

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/05/30	10 50	0000	0.052	5.4	
	10 50	0005	0.052		
75/07/24	16 05	0000	0.021	1.8	
	16 05	0005	0.031		
	16 05	0018	0.035		
75/09/08	14 45	0000	0.049	41.8	
	14 45	0004	0.061		

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/08/05

3009A1
48 32 02.0 107 31 21.0 4
NELSON CANAL
30 7.5 HEWITT LAKE
0/NELSON RESERVOIR 090191
BNK OFF SEC RD XING AT N TIP OF POOL
11EPALES 2111204
0000 FEET DEPTH CLASS 00

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
74/10/05	11	35	0.072	1.850	0.063	0.169	0.178
74/11/03	09	55	0.104	1.200	0.110	0.020	0.030
74/12/08	09	10	0.112	1.500	0.100	0.020	0.030
75/01/04	14	50	0.104	1.000	0.075	0.010	0.020
75/02/02	08	55	0.096	1.300	0.088	0.016	0.020
75/02/22	15	30	0.104	0.575	0.072	0.016	0.040
75/04/05	14	50	0.090	1.400	0.080	0.010	0.030
75/05/03	15	00	0.115	3.750	0.082	0.020	0.090
75/06/06	20	00	0.070	1.650	0.050	0.010	0.050
75/06/20	10	30	0.085	1.300	0.080	0.015	0.030
75/07/26	08	00	0.045	3.450	0.150	0.005	0.030
75/08/23	14	40	0.005	1.700	0.030	0.065	0.070
75/09/27	14	20	0.025	2.600	0.052	0.005	0.040

STORET RETRIEVAL DATE 76/08/05

3009A2
48 27 35.0 107 37 50.0 4
NELSON CANAL
30 15 BOWDOIN
T/NELSON RESERVOIR 090191
US HWY 2 BRDG 13 MI W OF SACO
11EPALES 2111204
0000 FEET DEPTH CLASS 00

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
74/10/05	12	10	0.012	0.600	0.010	0.037	0.047
74/11/03	10	30	0.008	0.800	0.015	0.005	0.030
75/05/03	15	20	0.230	1.700	0.055	0.030	0.160
75/06/06	08	30	0.005	1.150	0.010	0.010	0.095
75/06/20	10	30	0.015	4.400	0.050	0.020	0.160
75/07/26	08	25	0.020	2.000	0.065	0.020	0.110
75/08/23	15	30	0.005	2.000	0.025	0.045	0.140
75/09/27	15	00	0.005	2.000	0.025	0.005	0.070

STORET RETRIEVAL DATE 76/08/05

300981
48 31 42.0 107 31 09.0 4
NELSON SOUTH CANAL
30 7.5 HEWITT LAKE
O/NELSON RESERVOIR 090191
BNK OFF SEC RD XING AT NE TIP OF POOL
11EPALES 2111204
0000 FEET DEPTH CLASS 00

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
74/10/05	11	45	0.072	1.100	0.060	0.010	0.025
74/11/03	10	15	0.104	1.100	0.085	0.015	0.020
74/12/08	09	15	0.032	1.600	0.200	0.010	0.010
75/01/04	14	55	0.024	0.700	0.195	0.005	0.010K
75/02/02	09	00	0.024	0.300	0.136	0.008K	0.010K
75/02/22	15	45	0.032	0.500	0.128	0.008K	0.010
75/04/05	15	00	0.030	1.450	0.133	0.005	0.010K
75/05/03	15	10	0.050	1.650	0.180	0.005	0.008
75/06/06	20	15	0.055	1.850	0.025	0.010	0.020
75/06/20	10	30	0.065	0.800	0.030	0.040	0.040
75/07/26	08	10	0.030	0.600	0.035	0.005K	0.020
75/08/23	14	50	0.005	3.000	0.040	0.020	0.060
75/09/27	14	30	0.020	2.400	0.055	0.005K	0.040

K VALUE KNOWN TO BE
LESS THAN INDICATED