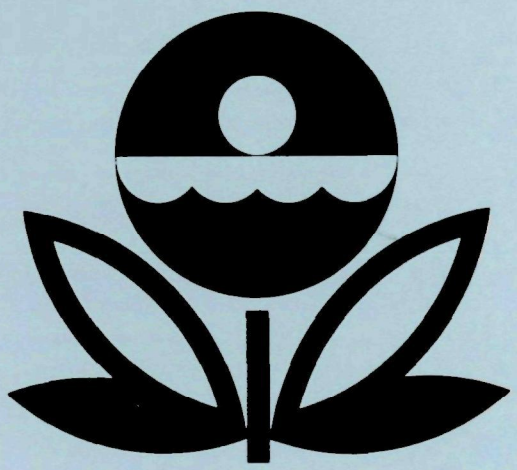
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



REPORT

ON

TALLY LAKE

FLATHEAD COUNTY

MONTANA

EPA REGION VIII

WORKING PAPER No. 801

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPORT
ON
TALLY LAKE
FLATHEAD COUNTY
MONTANA
EPA REGION VIII
WORKING PAPER No. 801

WITH THE COOPERATION OF THE

MONTANA DEPARTMENT OF HEALTH & ENVIRONMENTAL SCIENCES

AND THE

MONTANA NATIONAL GUARD

MAY, 1977

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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.

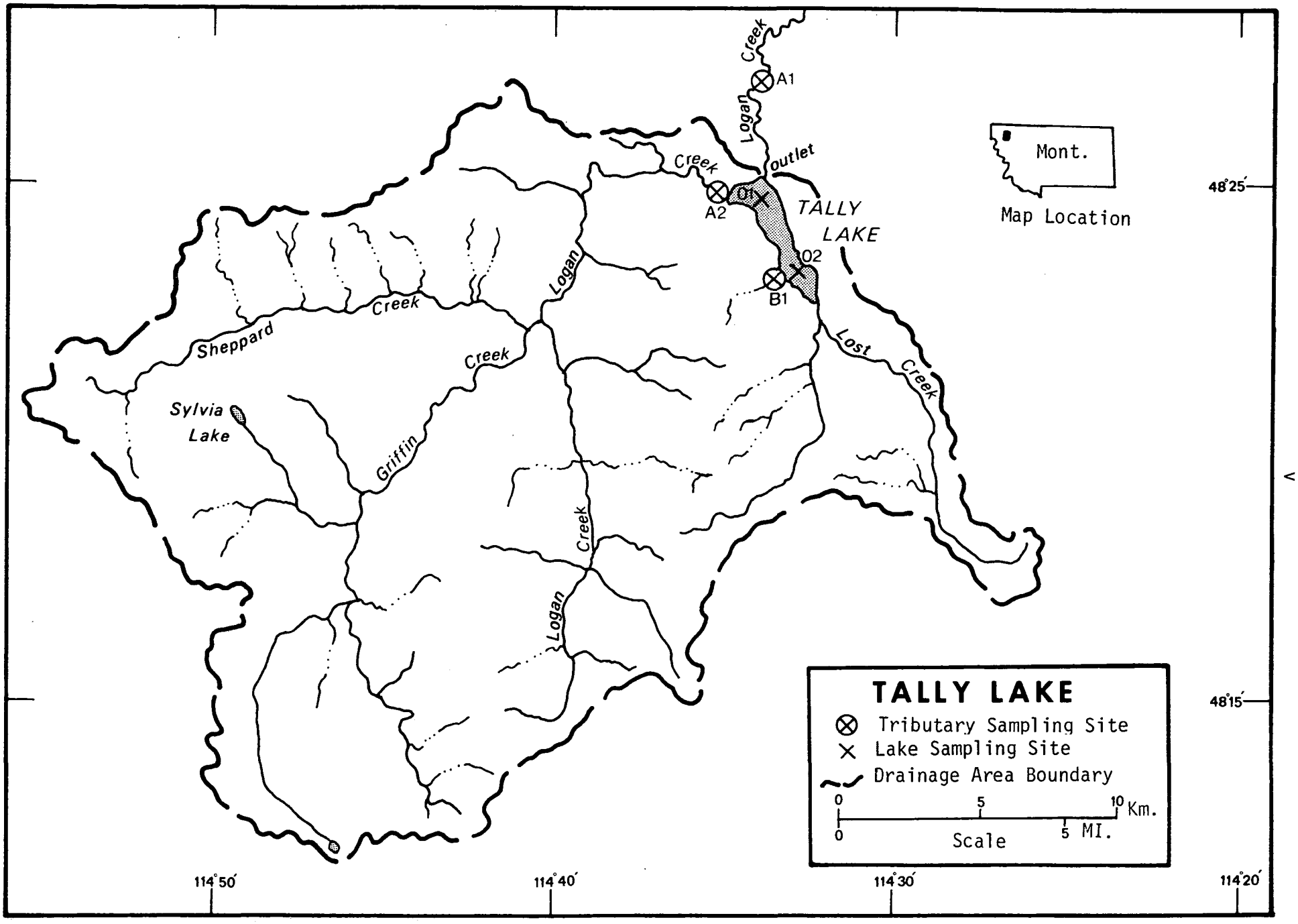
Major General John J. Womack, the Adjutant General of Montana, and Project Officer Major William Yeager, who directed the volunteer efforts of the Montana National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

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


Logan Creek
A1
Logan Creek
Outlet
A2
O1
TALLY LAKE
O2
B1
Mont.
Map Location
48°25'
Sheppard Creek
Logan Creek
Lost Creek
Sylvia Lake
Griffin Creek
Logan Creek
48°15'
TALLY LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
0 5 10 Km.
0 Scale 5 MI.
114°50'
114°40'
114°30'
114°20'

TALLY LAKE

STORET NO. 3012

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Tally Lake is oligo-mesotrophic. It ranked fourth in overall trophic quality when the 15 Montana lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. Four of the water bodies had less median total phosphorus, five had less and three had the same median inorganic nitrogen, two had less and three had the same median orthophosphorus, three had less mean chlorophyll a, and five had greater mean Secchi disc transparency. No significant depression of dissolved oxygen occurred at depths as great as 52 meters.

Survey limnologists did not observe any nuisance conditions and commented on the attractive appearance of the lake.

B. Rate-Limiting Nutrient:

Due to significant nutrient changes in the algal assay samples, the assay results are not considered representative of conditions in the lake at the times of sampling.

The lake data indicate nitrogen limitation in June and phosphorus limitation in July and September.

C. Nutrient Controllability:

1. Point sources--No known municipal or industrial point

* See Appendix A.

sources impacted Tally Lake during the sampling year. Septic tanks serving a lakeshore dwelling and a campground were estimated to have contributed 0.2% of the total phosphorus load, but a shoreline survey would be necessary to determine the actual significance of those sources.

The present phosphorus loading of 0.51 g/m^2/year is slightly more than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as an oligotrophic loading, and every effort should be made to keep phosphorus inputs at the lowest practicable level to protect the existing trophic quality of Tally Lake.

2. Non-point sources--Non-point sources, including precipitation, accounted for 99.8% of the total phosphorus load to Tally Lake during the sampling year. Logan Creek contributed 80.9% of the total load, and the ungaged tributaries added an estimated 15.5% of the total.

The non-point phosphorus export rate of Logan Creek was 5 kg/km^2/yr. This rate is quite low as compared to the rates of two unimpacted tributaries of nearby Whitefish Lake* (9 and 21 kg/km^2/yr).

* Working Paper No. 804.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 5.37 kilometers^2.
2. Mean depth: 68.9 meters.
3. Maximum depth: 150.0 meters.
4. Volume: 369.993 x 10^6 m^3.
5. Mean hydraulic retention time: 2.8 years.

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

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Logan Creek	437.2	3.620
Minor tributaries & immediate drainage -	84.5	0.630
Totals	521.7	4.250**

2. Outlet -

Logan Creek	527.1***	4.250

C. Precipitation****:

1. Year of sampling: 73.6 centimeters.
2. Mean annual: 75.3 centimeters.

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† Table of metric conversions--Appendix B.
†† Domrose, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Sum of inflows adjusted to equal outflow.
*** Includes area of lake.
**** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Tally Lake 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 a number of depths at two stations on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first and last visit, 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 depth sampled at both stations was 51.8 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 TALLY LAKE
STORET CODE 3012

PARAMETER	1ST SAMPLING (6/ 2/75) 2 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/28/75) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/ 5/75) 2 SITES RANGE	MEAN	MEDIAN
TEMP (C)	3.2 - 11.3	6.1	4.9	1.9 - 20.5	9.1	6.4	4.1 - 17.3	10.0	7.0
DISS OXY (MG/L)	7.0 - 11.0	9.1	8.9	6.2 - 8.8	7.7	7.6	5.8 - 8.4	7.6	7.9
CNDCTVY (MCROMO)	97. - 113.	102.	99.	99. - 164.	121.	108.	107. - 155.	128.	116.
PH (STAND UNITS)	7.5 - 8.3	7.8	7.9	7.6 - 8.6	8.0	7.8	7.5 - 8.2	7.8	7.8
TOT ALK (MG/L)	95. - 111.	101.	100.	74. - 93.	88.	90.	87. - 98.	94.	94.
TOT P (MG/L)	0.012 - 0.017	0.013	0.013	0.007 - 0.012	0.008	0.008	0.010 - 0.014	0.012	0.011
ORTHO P (MG/L)	0.005 - 0.025	0.012	0.012	0.002 - 0.005	0.003	0.003	0.002 - 0.006	0.003	0.002
NO2+NO3 (MG/L)	0.020 - 0.060	0.034	0.025	0.020 - 0.050	0.028	0.020	0.020 - 0.060	0.034	0.020
AMMONIA (MG/L)	0.020 - 0.040	0.028	0.030	0.020 - 0.030	0.021	0.020	0.020 - 0.050	0.022	0.020
KJEL N (MG/L)	0.200 - 0.300	0.207	0.200	0.200 - 0.400	0.286	0.300	0.200 - 0.400	0.214	0.200
INORG N (MG/L)	0.040 - 0.090	0.062	0.055	0.040 - 0.070	0.049	0.040	0.040 - 0.110	0.056	0.040
TOTAL N (MG/L)	0.220 - 0.320	0.241	0.235	0.220 - 0.440	0.314	0.320	0.220 - 0.450	0.248	0.220
CHLRPYL A (UG/L)	2.5 - 2.7	2.6	2.6	1.7 - 2.2	1.9	1.9	1.2 - 2.2	1.7	1.7
SECCHI (METERS)	2.4 - 2.4	2.4	2.4	3.4 - 3.7	3.5	3.5	6.1 - 6.6	6.4	6.4

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
06/02/75	1. Dinobryon sp.	322
	2. Synedra sp.	290
	3. Flagellates	258
	4. Asterionella sp.	226
	5. Stephanodiscus sp.	193
	Other genera	129
	Total	1,418
07/28/75	1. Chroomonas sp.	106
	2. Oscillatoria sp.	35
	Total	141
09/05/75	1. Fragilaria sp.	1,107
	2. Dinobryon sp.	420
	3. Chroomonas sp.	191
	4. Centric diatoms	153
	5. Cryptomonas sp.	38
	Other genera	38
	Total	1,947

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
06/02/75	1	2.7
	2	2.5
07/28/75	1	1.7
	2	2.2
09/05/75	1	1.2
	2	2.2

C. Limiting Nutrient Study:

Due to significant nutrient changes in the algal assay samples during shipment from the field to the laboratory, the results are not considered representative of lake conditions at the times of sampling (06/02/75 and 09/05/75).

The lake data indicate Tally Lake was nitrogen limited in June and phosphorus limited in July and September. At those times, the mean inorganic nitrogen to orthophosphorus ratios were 5 to 1, 16 to 1, and 19 to 1, respectively.

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 months of May and 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 and a "normalized" or average year were provided by the Montana District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads, in $kg/km^2/year$, at station A-2 and multiplying by the ZZ area in km^2.

No known wastewater treatment plants impacted Tally Lake during the sampling year.

A. Waste Sources:

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

* See Working Paper No. 175.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Logan Creek	2,210	80.9
b. Minor tributaries & immediate drainage (non-point load) -	425	15.5
c. Known municipal STP's - None	-	-
d. Septic tanks* -	<5	0.2
e. Known industrial - None	-	-
f. Direct precipitation** -	95	3.4
Total	2,730	100.0

2. Outputs -

Lake outlet - Logan Creek 2,035

3. Net annual P accumulation - 695 kg.

* Estimate based on 1 campground and 1 dwelling; 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) -		
Logan Creek	149,750	81.1
b. Minor tributaries & immediate drainage (non-point load) -	28,985	15.7
c. Known municipal STP's - None	-	-
d. Septic tanks* -	80	<0.1
e. Known industrial - None	-	-
f. Direct precipitation** -	5,795	3.2
Total	184,610	100.0

2. Outputs -

Lake outlet - Logan Creek 170,390

3. Net annual N accumulation - 14,220 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Logan Creek	5	343

* Estimate based on 1 campground and 1 dwelling; see Working Paper No. 175.
** See Working Paper No. 175.

E. 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	0.51	0.13	34.4	2.6

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Tally Lake:	
"Dangerous" (eutrophic loading)	0.96
"Permissible" (oligotrophic loading)	0.48

V. LITERATURE REVIEWED

Domrose, Bob, 1975. Personal communication (lake morphometry). MT Dept. of Fish & Game, Kalispell.

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	0.049	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 3012 TALLY LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 527.1

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3012A1	527.1	0.99	1.13	1.50	6.51	22.65	10.76	2.78	0.71	0.85	0.71	1.05	1.08	4.25
3012A2	437.2	0.85	0.85	1.27	5.38	19.82	8.50	2.55	0.85	0.85	0.62	0.85	0.85	3.62
3012ZZ	89.9	0.113	0.113	0.142	0.850	3.398	1.359	0.283	0.085	0.113	0.085	0.113	0.113	0.567

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 527.1
SUM OF SUB-DRAINAGE AREAS = 527.1
TOTAL FLOW IN = 50.01
TOTAL FLOW OUT = 50.72

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3012A1	10	74	0.793	6	0.708				
	11	74	1.019	3	0.991				
	12	74	1.019	8	1.048				
	1	75	0.850	5	0.850				
	2	75	0.991	16	1.048				
	3	75	1.104	10	1.133				
	4	75	3.908	7	1.359				
	5	75	17.302	5	35.396	18	12.743		
	6	75	12.658	3	20.954	8	16.990		
	7	75	3.710	11	5.663				
	8	75	1.133	15	0.991				
	9	75	1.133	7	1.133				
3012A2	10	74	0.651	6	0.708				
	11	74	0.566	3	0.566				
	12	74	0.708	8	0.566				
	1	75	1.331	5	1.331				
	2	75	1.246	16	1.359				
	3	75	0.850	10	0.736				
	4	75	1.501	7	1.133				
	5	75	9.203	5	5.663	18	9.628		
	6	75	8.014	3	8.495	8	7.079		
	7	75	2.180	11	2.832				
	8	75	1.189	15	1.133				
	9	75	0.821	7	0.850				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/08/05

301201
48 24 46.0 114 32 35.0 3
TALLY LAKE
30029 MONTANA

130291

11EPALES 2111202
0999 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
75/06/02	16 35	0000	10.6	10.0	94	110	7.90	96	0.020	0.200	0.020	0.013
	16 35	0005	11.3	10.0		113	7.90	95	0.030	0.200K	0.020K	0.013
	16 35	0021	6.2	9.8		99	7.90	96	0.030	0.200K	0.020K	0.006
	16 35	0045	4.6	8.8		99	7.50	100	0.030	0.200K	0.030	0.006
	16 35	0080	4.0	8.8		97	7.50	102	0.030	0.200	0.040	0.010
	16 35	0120	3.6	8.2		98	7.60	104	0.020	0.200K	0.040	0.011
	16 35	0165	3.2	7.0		102	8.10	107	0.030	0.200K	0.060	0.009
75/07/28	14 10	0000	20.5	7.6	144	164	8.40	91	0.020	0.300	0.020K	0.002
	14 10	0005	20.1	7.4		161	8.40	92	0.030	0.200K	0.020K	0.003
	14 10	0025	8.0	8.0		108	7.80	85	0.020	0.200K	0.020K	0.004
	14 10	0050	9.2	8.0		101	7.70	86	0.020	0.200	0.020	0.003
	14 10	0085	2.6	7.6		101	7.60	90	0.020	0.200K	0.050	0.005
	14 10	0120	2.1	7.6		102	7.60	90	0.020	0.200K	0.050	0.004
	14 10	0170	1.9	7.0		108	8.40	90	0.020	0.200K	0.020K	0.002
75/09/05	15 45	0000	17.3	7.8	260	152	8.15	94	0.020K	0.200	0.020K	0.002
	15 45	0005	16.3	8.4		155	8.20	93	0.020K	0.200	0.020K	0.002K
	15 45	0018	15.8	8.4		143	8.10	94	0.020K	0.200	0.020K	0.002K
	15 45	0050	7.6	8.0		109	7.75	87	0.020K	0.200	0.020K	0.002K
	15 45	0090	5.4	7.8		107	7.60	91	0.020K	0.200	0.040	0.002K
	15 45	0140	4.7	7.2		109	7.50	95	0.020K	0.400	0.050	0.006
	15 45	0170	4.6	5.8		113	7.50	97	0.020K	0.200	0.060	0.005

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/05

301201
48 24 46.0 114 32 35.0 3
TALLY LAKE
30029 MONTANA

130291

11EPALES 2111202
0999 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/06/02	16	35 0000	0.017	2.7	
	16	35 0005	0.013		
	16	35 0021	0.014		
	16	35 0045	0.012		
	16	35 0080	0.012		
	16	35 0120	0.013		
	16	35 0165	0.013		
75/07/28	14	10 0000	0.008	1.7	
	14	10 0005	0.010		
	14	10 0025	0.008		
	14	10 0050	0.007		
	14	10 0085	0.008		
	14	10 0120	0.008		
	14	10 0170	0.007		
75/09/05	15	45 0000	0.013	1.2	
	15	45 0005	0.012		
	15	45 0018	0.011		
	15	45 0050	0.011		
	15	45 0090	0.011		
	15	45 0140	0.012		
	15	45 0170	0.011		

STORET RETRIEVAL DATE 76/08/05

301202
48 23 28.0 114 31 50.0 3
TALLY LAKE
30029 MONTANA

130291

11EPALES 2111202
0999 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
75/06/02	16 55	0000	9.7	11.0	95	110	8.30	98	0.020	0.200	0.020	0.005
	16 55	0005	9.8	10.6		107	8.10	100	0.030	0.300	0.020K	0.013K
	16 55	0020	6.1	10.0		99	7.90	98	0.030	0.200	0.020K	0.014K
	16 55	0045	5.2	9.0		99	7.80	100	0.030	0.200	0.020	0.012J
	16 55	0080	4.0	8.8		97	7.70	106	0.040	0.200	0.050	0.025K
	16 55	0120	3.4	8.2		99	7.55	111	0.030	0.200K	0.060	0.015K
	16 55	0165	3.3	7.0		102	8.10	107	0.020	0.200K	0.060	0.014K
75/07/28	13 40	0000	20.4	8.8	132	158	8.60	74	0.030	0.400	0.020K	0.003
	13 40	0005	20.3	7.6		160	8.30	93	0.020	0.400	0.020K	0.003
	13 40	0020	10.1	8.2		115	7.90	86	0.020	0.300	0.020K	0.002
	13 40	0035	4.9	8.8		102	7.70	86	0.020	0.300	0.020K	0.002
	13 40	0070	3.3			99	7.70	88	0.020	0.400	0.040	0.002
	13 40	0120	2.4	6.8		102	7.60	93	0.020	0.300	0.050	0.004
	13 40	0170	2.1	6.2		109	8.35	91	0.020	0.400	0.020K	0.002
75/09/05	14 10	0000	16.4	8.0	240	149	8.10	94	0.020K	0.200	0.020K	0.002K
	14 10	0005	16.2	8.2		149	8.20	95	0.020K	0.200	0.020K	0.002K
	14 10	0018	15.1	8.2		147	8.10	96	0.020K	0.200	0.020K	0.002K
	14 10	0050	6.4	8.0		111	7.80	90	0.020K	0.200	0.020	0.002K
	14 10	0090	5.2	7.6		111	7.65	92	0.020K	0.200K	0.040	0.002K
	14 10	0140	4.8	6.6		115	7.55	94	0.020K	0.200K	0.060	0.004
	14 10	0170	4.1	6.0		117	7.50	98	0.050K	0.200K	0.060	0.005

K* VALUE KNOWN TO BE LESS
THAN INDICATED

J* VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 76/08/05

301202
48 23 28.0 114 31 50.0 3
TALLY LAKE
30029 MONTANA
130291

11EPALES 2111202
0995 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/06/02	16	55 0000	0.012	2.5	
	16	55 0005	0.012		
	16	55 0020	0.012		
	16	55 0045	0.012		
	16	55 0080	0.014		
	16	55 0120	0.013		
	16	55 0165	0.013		
75/07/28	13	40 0000	0.012	2.2	
	13	40 0005	0.008		
	13	40 0020	0.009		
	13	40 0035	0.009		
	13	40 0070	0.007		
	13	40 0120	0.007		
	13	40 0170	0.008		
75/09/05	14	10 0000	0.014	2.2	
	14	10 0005	0.011		
	14	10 0018	0.011		
	14	10 0050	0.010		
	14	10 0090	0.011		
	14	10 0140	0.012		
	14	10 0170	0.013		

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/08/05

3012A1
48 25 24.0 114 33 50.0 4
LOGAN CREEK
30 7.5 TALLY LAKE
0/TALLY LAKE 130291
FORD ON JEEP RD .6 M NE OF TLY LK RAN ST
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
74/10/06	10	30	0.012	1.350	0.030	0.005K	0.010
74/12/08	13	00	0.008	1.300	0.035	0.005K	0.010
75/01/05	10	13	0.016	1.000	0.010	0.005K	0.010K
75/02/16			0.016	1.400	0.048	0.008K	0.010K
75/03/10	18	35	0.144	1.300	0.024	0.016	0.016
75/04/07	11	00	0.015	1.350	0.020	0.005K	0.010K
75/05/18	10	30	0.025	1.150	0.020	0.005	
75/06/03			0.005	1.200	0.025	0.005K	0.010
75/06/08	11	00	0.005	0.650	0.030	0.005K	0.020
75/07/11	17	30	0.010	9.100	0.075	0.005	0.040
75/08/15	19	00	0.005	1.100	0.145	0.040	0.040
75/09/07	14	30	0.020	0.900	0.025	0.005	0.010K

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/05

3012A2
48 24 53.0 114 35 10.0 4
LOGAN CREEK
30 7.5 TALLY LAKE
T/TALLY LAKE 130291
SEC RD BRDG .8 M SE OF TALLY LK RAN STAT
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
74/10/06	11 00		0.016	1.400	0.025	0.005K	0.065
74/11/03	10 12		0.008	1.200	0.035	0.010	0.010
74/12/08	12 20		0.008	0.600	0.015	0.005K	0.010K
75/01/05	11 30		0.016	0.900	0.005K	0.005	0.010K
75/02/16	15 00		0.035	2.610	0.035		0.010K
75/03/10	17 00		0.152	1.400	0.136	0.016	0.016
75/04/07	11 00		0.065	1.950	0.025	0.005K	0.010K
75/05/05	10 00		0.065	0.850	0.025	0.010	0.020
75/05/18	10 50		0.015	1.750	0.025	0.010	
75/06/03			0.010	1.100	0.360	0.005	0.020
75/06/08	11 00		0.005	0.450	0.025	0.005	0.020
75/07/11	17 00		0.005	1.000	0.065	0.005	0.010
75/08/15	17 30		0.005	0.350	0.140	0.005	0.020
75/09/07	14 00		0.040	1.000	0.025	0.005	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED