

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY**

WORKING PAPER SERIES



REPORT
ON
BLACK BAYOU RESERVOIR
CADDO PARISH
LOUISIANA
EPA REGION VI
WORKING PAPER No. 530

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

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ON
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WITH THE COOPERATION OF THE
LOUISIANA WILD LIFE AND FISHERIES COMMISSION
AND THE
LOUISIANA NATIONAL GUARD
MARCH, 1977

REPORT ON BLACK BAYOU RESERVOIR

CADDO PARISH, LOUISIANA

EPA REGION VI

by

National Eutrophication Survey

Water and Land Monitoring Branch
Monitoring Applications Laboratory
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Eutrophication Survey Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

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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 nonpoint 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 freshwater 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 the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Louisiana Wild Life and Fisheries Commission, Division of Water Pollution Control for professional involvement, to the Louisiana National Guard for conducting the tributary sampling phase of the Survey, and to those Louisiana wastewater treatment plant operators who provided effluent samples and flow data.

Robert A. Lafleur, Chief; J. Dale Givens, Assistant Chief; Lewis R. Still, Biologist; Louis Johnson, Biologist; Lee Caubarraux, Biologist; Darrell Reed, Engineer; Dempsey Alford, Biologist; and Elwood Goodwin, Water Quality Control Technician, all of the Louisiana Wild Life and Fisheries Commission, Division of Water Pollution Control reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper Series.

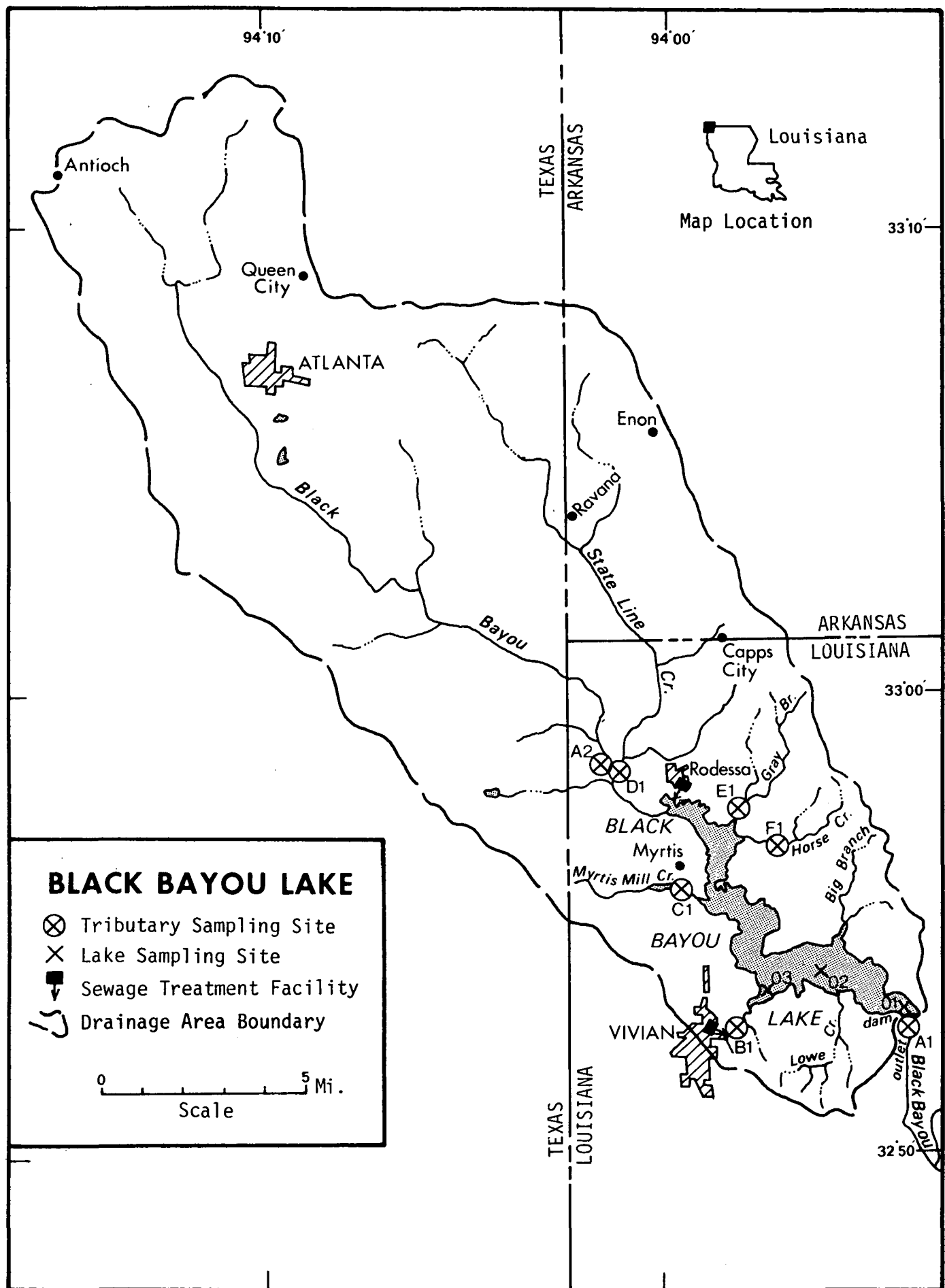
Major General O'Neil Daigle, Jr., the Adjutant General of Louisiana, and Project Officer Colonel Lawrence P. Dupre, who directed the volunteer efforts of the Louisiana National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF LOUISIANA

<u>LAKE NAME</u>	<u>PARISH</u>
Anacoco Lake	Vernon
Lake Bistineau	Bienville, Webster
Black Bayou	Caddo
Black Lake	Natchitoches and Red River
Bruin Lake	Tensas
Bundicks Lake	Beauregard
Caddo Lake	Caddo (Menon and Harrison in Texas)
Cocodrie Lake	Concordia
Cocodrie Lake (Lower)	Rapides
Concordia Lake	Concordia
Cotile Lake	Rapides
Cross Lake	Caddo
D'Arbonne Lake	Union
False River Lake	Pointe Coupee
Indian Creek Reservoir	Rapides
Saline Lake	LaSalle
Turkey Creek Lake	Franklin
Lake Vernon	Vernon
Lake Verret	Assumption



REPORT ON BLACK BAYOU RESERVOIR, LOUISIANA

STORET NO. 2204

I. CONCLUSIONS

A. Trophic Condition:*

On the basis of Survey data and field observations, Black Bayou Reservoir is considered eutrophic, i.e., nutrient rich and highly productive. Whether such nutrient enrichment is to be considered beneficial or deleterious is determined by its actual or potential impact upon designated beneficial water uses of each lake.

Chlorophyll a levels ranged from 2.8 $\mu\text{g/l}$ in the fall to 47.0 $\mu\text{g/l}$ in August with a mean of 17.8 $\mu\text{g/l}$. Potential for primary production as measured by algal assay control yield was high, and Secchi disc transparency was low. Of the 19 Louisiana lakes sampled in 1974, 13 had greater median total phosphorus, 13 had greater median inorganic nitrogen, and 15 had greater median orthophosphorus levels than Black Bayou Reservoir.

Field limnologists reported abundant aquatic macrophytes along the lake bottom and shoreline area. Other studies (Shampine, 1971) indicate that past pollution to Black Bayou Reservoir from oil field wastes appears to have presently been curtailed. The general water quality

*See Appendix E.

in Black Bayou Reservoir appears to range widely, both with respect to areas within the lake and the time of year.

B. Rate-Limiting Nutrient:

Mean inorganic nitrogen to orthophosphorus ratios (N/P) for the reservoir were 9/1 or less on all four sampling occasions suggesting primary limitation by nitrogen.

C. Nutrient Controllability:

1. Point sources -

The mean annual phosphorus load from point sources was estimated to be approximately 18.4% of the total load reaching Black Bayou Reservoir. The city of Vivian contributed this entire point source load.

The phosphorus loading of $1.07 \text{ g P/m}^2/\text{yr}$ for Black Bayou Reservoir is approximately 1.6 times the "eutrophic" load proposed by Vollenweider (1975) for lakes with such volume and detention time. Although elimination of the Vivian point source contributions would substantially reduce loading to the lake, concurrent control of nonpoint sources in the Black Bayou watershed is probably necessary to effect significant water quality improvement.

2. Nonpoint sources -

The mean annual phosphorus load from nonpoint sources was estimated to be 81.6% of the total load. Measured tributaries accounted for 62.5% of the total, and ungaged tributaries were estimated to account for 17.3%.

In general, few lakes are nitrogen limited as a result of low nitrogen. Rather, excessive phosphorus levels shift limitations to nitrogen or other factors. Regardless of the primary nutrient limitation suggested by either algal assay or nutrient ratios, the most feasible approach to nutrient control, if desirable, is through available phosphorus control technology and subsequent establishment of phosphorus limitation within the water body.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake surface area and mean depth were provided by the State of Louisiana; maximum depth was obtained from contour maps provided by the Louisiana Stream Control Commission; tributary flow data were provided by the Louisiana District Office of the U.S. Geological Survey (USGS)(outlet drainage area includes the lake surface area). Mean hydraulic retention time was obtained by dividing the lake volume by mean flow of the outlet. Precipitation values are estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 16.06 km^2 .
2. Mean depth: 1.4 meters.
3. Maximum depth: 2.4 meters.
4. Volume: $21.956 \times 10^6 \text{ m}^3$.
5. Mean hydraulic retention time: 37 days.

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

1. Tributaries -

<u>Name</u>	<u>Drainage area(km²)</u>	<u>Mean flow (m³/sec)</u>
A-2 Black Bayou	295.3	3.37
D-1 State Line Creek	139.6	1.59
E-1 Gray Branch	16.2	0.18
Minor tributaries and immediate drainage -	<u>141.9</u>	<u>1.80</u>
Totals	593.0	6.94

2. Outlet - A-1 Black Bayou

608.6

6.94

C. Precipitation:

1. Year of sampling: 154.3 cm.

2. Mean annual: 117.8 cm.

III. LAKE WATER QUALITY SUMMARY

Black Bayou Reservoir was sampled four times during the open-water season of 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from one or more depths at each station (see map, page v). During each visit, depth-integrated samples were collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During the first and last visits, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 1.8 meters at Station 01, 2.4 meters at Station 02, and 1.5 meters at Station 03. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll a determinations are included in III-B. Results of the limiting nutrient study are presented in III-C.

BLACK BAYOU
STORET CODE 2204

PHYSICAL AND CHEMICAL CHARACTERISTICS

(3/23/74)					(6/ 3/74)					(8/26/74)				
PARAMETER	N°	S*** = 3		MAX DEPTH RANGE (METERS)	N°	S*** = 3		MAX DEPTH RANGE (METERS)	N°	S*** = 3		MAX DEPTH RANGE (METERS)		
		RANGE	MEDIAN			RANGE	MEDIAN			RANGE	MEDIAN			
TEMPERATURE (DEG CENT)														
0.-1.5 M DEPTH	3	16.2- 16.7	16.4	0.0- 0.0	4	25.6- 27.4	26.7	0.0- 1.5	4	29.1- 29.6	29.1	0.0- 1.5		
MAX DEPTH**	3	16.2- 16.7	16.3	0.0- 2.4	3	25.6- 27.4	26.4	0.0- 1.5	3	29.1- 29.6	29.1	0.0- 1.5		
DISSOLVED OXYGEN (MG/L)														
0.-1.5 M DEPTH	2	3.2- 8.0	5.6	0.0- 0.0	3	3.4- 7.0	4.4	0.0- 1.5	3	3.0- 5.6	3.8	0.0- 0.0		
MAX DEPTH**	3	3.2- 8.6	8.0	0.0- 2.4	3	3.4- 7.0	4.4	0.0- 1.5	2	3.8- 5.6	4.7	0.0- 0.0		
CONDUCTIVITY (UMHOS)														
0.-1.5 M DEPTH	3	167.- 232.	169.	0.0- 0.0	4	152.- 292.	222.	0.0- 1.5	4	130.- 266.	139.	0.0- 1.5		
MAX DEPTH**	3	168.- 232.	169.	0.0- 2.4	3	152.- 292.	239.	0.0- 1.5	3	136.- 266.	141.	0.0- 1.5		
PH (STANDARD UNITS)														
0.-1.5 M DEPTH	3	6.0- 6.7	6.4	0.0- 0.0	4	6.7- 8.7	7.3	0.0- 1.5	3	7.0- 7.0	7.0	0.0- 0.0		
MAX DEPTH**	3	6.0- 6.7	6.3	0.0- 2.4	3	6.7- 7.5	7.0	0.0- 1.5	2	7.0- 7.0	7.0	0.0- 0.0		
TOTAL ALKALINITY (MG/L)														
0.-1.5 M DEPTH	3	10.- 11.	10.	0.0- 0.0	4	10.- 13.	10.	0.0- 1.5	0	*****-*****	*****	****-*****		
MAX DEPTH**	3	10.- 11.	10.	0.0- 2.4	3	10.- 13.	10.	0.0- 1.5	0	*****-*****	*****	****-*****		
TOTAL P (MG/L)														
0.-1.5 M DEPTH	3	0.024-0.225	0.030	0.0- 0.0	4	0.042-0.134	0.048	0.0- 1.5	0	*****-*****	*****	****-*****		
MAX DEPTH**	3	0.026-0.225	0.030	0.0- 2.4	3	0.046-0.134	0.050	0.0- 1.5	0	*****-*****	*****	****-*****		
DISSOLVED ORTHO P (MG/L)														
0.-1.5 M DEPTH	3	0.008-0.070	0.009	0.0- 0.0	4	0.003-0.015	0.008	0.0- 1.5	0	*****-*****	*****	****-*****		
MAX DEPTH**	3	0.008-0.070	0.009	0.0- 2.4	3	0.003-0.015	0.013	0.0- 1.5	0	*****-*****	*****	****-*****		
NO2+NO3 (MG/L)														
0.-1.5 M DEPTH	3	0.020-0.090	0.030	0.0- 0.0	4	0.020-0.030	0.025	0.0- 1.5	0	*****-*****	*****	****-*****		
MAX DEPTH**	3	0.020-0.090	0.030	0.0- 2.4	3	0.020-0.030	0.030	0.0- 1.5	0	*****-*****	*****	****-*****		
AMMONIA (MG/L)														
0.-1.5 M DEPTH	3	0.030-0.210	0.030	0.0- 0.0	4	0.040-0.130	0.040	0.0- 1.5	0	*****-*****	*****	****-*****		
MAX DEPTH**	3	0.030-0.210	0.030	0.0- 2.4	3	0.040-0.130	0.040	0.0- 1.5	0	*****-*****	*****	****-*****		
KJELDAHL N (MG/L)														
0.-1.5 M DEPTH	3	0.500-0.800	0.700	0.0- 0.0	4	0.600-0.800	0.600	0.0- 1.5	0	*****-*****	*****	****-*****		
MAX DEPTH**	3	0.500-0.800	0.700	0.0- 2.4	3	0.600-0.800	0.600	0.0- 1.5	0	*****-*****	*****	****-*****		
SECCHI DISC (METERS)														
	3	1.4- 2.1	1.5		3	0.8- 0.9	0.8		3	0.7- 1.1	0.8			

* N = NO. OF SAMPLES

** MAXIMUM DEPTH SAMPLED AT EACH SITE

*** S = NO. OF SITES SAMPLED ON THIS DATE

(11/11/74)

**** = 3 MAX
DEPTH
RANGE
(METERS)

PARAMETER	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CELSI)				
0.-1.5 M DEPTH	5	15.3- 15.8	15.7	0.0- 1.5
MAX DEPTH**	3	15.3- 15.8	15.7	0.0- 1.5
DISSOLVED OXYGEN (MG/L)				
0.-1.5 M DEPTH	5	2.8- 6.0	4.6	0.0- 1.5
MAX DEPTH**	3	2.8- 6.0	4.6	0.0- 1.5
CONDUCTIVITY (UMHDS)				
0.-1.5 M DEPTH	5	99.- 170.	145.	0.0- 1.5
MAX DEPTH**	3	99.- 170.	145.	0.0- 1.5
PH (STANDARD UNITS)				
0.-1.5 M DEPTH	5	5.6- 6.1	5.8	0.0- 1.5
MAX DEPTH**	3	5.6- 6.1	5.8	0.0- 1.5
TOTAL ALKALINITY (MG/L)				
0.-1.5 M DEPTH	5	10.- 15.	10.	0.0- 1.5
MAX DEPTH**	3	10.- 10.	10.	0.0- 1.5
TOTAL P (MG/L)				
0.-1.5 M DEPTH	5	0.034-0.266	0.053	0.0- 1.5
MAX DEPTH**	3	0.034-0.266	0.051	0.0- 1.5
DISSOLVED ORTHO P (MG/L)				
0.-1.5 M DEPTH	5	0.005-0.092	0.016	0.0- 1.5
MAX DEPTH**	3	0.008-0.092	0.016	0.0- 1.5
NO2+NO3 (MG/L)				
0.-1.5 M DEPTH	5	0.020-0.040	0.030	0.0- 1.5
MAX DEPTH**	3	0.020-0.030	0.030	0.0- 1.5
AMMONIA (MG/L)				
0.-1.5 M DEPTH	5	0.060-0.630	0.070	0.0- 1.5
MAX DEPTH**	3	0.060-0.630	0.070	0.0- 1.5
KJELDAHL N (MG/L)				
0.-1.5 M DEPTH	5	0.500-1.200	0.700	0.0- 1.5
MAX DEPTH**	3	0.500-1.200	0.600	0.0- 1.5
SECCHI DISC (METERS)	3	1.1- 1.9	1.1	

* N = NO. OF SAMPLES

** MAXIMUM DEPTH SAMPLED AT EACH SITE

*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

<u>Sampling Date</u>	<u>Dominant Genera</u>	<u>Algal Units per ml</u>
03/22/74	1. <u>Dactylococcopsis</u>	611
	2. <u>Cryptomonas</u>	500
	3. <u>Dinobryon</u>	445
	4. <u>Flagellates</u>	445
	5. <u>Oscillatoria</u>	222
	Other genera	<u>223</u>
	Total	2,446
06/03/74	1. <u>Asterionella</u>	4,802
	2. <u>Aphanothece</u>	2,036
	3. <u>Flagellates</u>	1,200
	4. <u>Ankistrodesmus</u>	626
	5. <u>Melosira</u>	418
	Other genera	<u>1,982</u>
	Total	11,064
08/26/74	1. <u>Centric diatom</u>	2,007
	2. <u>Ankistrodesmus</u>	618
	3. <u>Lyngbya</u>	618
	4. <u>Anabaena</u>	463
	5. <u>Cryptomonas</u>	386
	Other genera	<u>2,973</u>
	Total	7,065
11/11/74	1. <u>Cryptomonas</u>	220
	2. <u>Dactylococcopsis</u>	147
	3. <u>Euglena</u>	110
	4. <u>Oscillatoria</u>	37
	5. <u>Phacus</u>	37
	Other genera	<u>---</u>
	Total	551

2. Chlorophyll a -

<u>Sampling Date</u>	<u>Station Number</u>	<u>Chlorophyll a (µg/l)</u>
03/23/74	01	6.0
	02	5.3
	03	13.0
06/03/74	01	24.1
	02	32.1
	03	23.3
08/26/74	01	23.3
	02	14.5
	03	47.0
11/11/74	01	4.6
	02	2.8
	03	---

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked - (03/23/74)

<u>Spike(mg/l)</u>	<u>Ortho P Conc.(mg/l)</u>	<u>Inorganic N Conc.(mg/l)</u>	<u>Maximum Yield (mg/l-dry wt.)</u>
Control	0.065	0.174	4.1
0.05 P	0.115	0.174	4.1
0.05 P + 1.0 N	0.115	1.174	27.0
1.00 N	0.065	1.174	16.6

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential for primary production in Black Bayou Reservoir was high at the time of spring assay sample collection. Growth response with the addition of nitrogen as well as the lack of response to the addition of phosphorus indicates nitrogen limitation. Maximum growth yield was achieved with the simultaneous addition of both phosphorus and nitrogen.

It should be noted that significant chemical changes took place in Louisiana lake samples between collection and algal assay. The assay data should be considered in this context and until such differences are resolved, used with caution for any prediction of actual lake conditions. Such chemical changes are likely to alter the control yield as well as modifying the N/P ratio.

The autumn algal assay results have not been included as the substantial changes in nutrient levels have removed their information value.

The mean N/P ratios for Black Bayou Reservoir of 9/1 or less on all four sampling occasions suggest primary limitation by nitrogen (an N/P ratio of 14/1 or greater generally reflects phosphorus limitation).

IV. NUTRIENT LOADINGS (See Appendix D for data)

For the determination of nutrient loadings, the Louisiana 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, March, and April when two samples were collected. Sampling was begun in June 1974 and was completed in April 1975.

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

In this report, nutrients loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual nutrient loads, in $\text{kg}/\text{km}^2/\text{yr}$, for Black Bayou, State Line Creek, and Gray Branch, at Stations A-2, D-1, and E-1, respectively, and multiplying the means by the ZZ area in km^2 .

The operator of the Vivian wastewater treatment plant provided monthly effluent samples and corresponding flow data.

A. Waste Sources:

1. Known municipal -

<u>Name</u>	<u>Population Served*</u>	<u>Treatment</u>	<u>Mean Flow (m³/d x 10³)</u>	<u>Receiving Water</u>
Vivian	6,000	Trickling Filter	1.751	Unnamed Stream

2. Known industrial - None

*U.S. EPA, 1971.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

<u>Source</u>	<u>kg P/yr</u>	<u>% of total</u>
a. Tributaries (nonpoint load)		
A-2 Black Bayou	6,865	39.9
D-1 State Line Creek	3,665	21.3
E-1 Gray Branch	220	1.3
b. Minor tributaries and immediate drainage (nonpoint load) -	2,980	17.3
c. Known municipal STP's -		
Vivian	3,175	18.4
d. Septic tanks* -	30	0.2
e. Known industrial - none		
f. Direct precipitation** -	<u>280</u>	<u>1.6</u>
Totals	17,215	100.0
2. Outputs - A-1 Black Bayou	7,985	
3. Net annual P accumulation	9,230	

*Estimate based on 105 lakeshore residences.

**Estimated (see NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

<u>Source</u>	<u>kg N/yr</u>	<u>% of total</u>
a. Tributaries (nonpoint load) -		
A-2 Black Bayou	90,490	41.9
D-1 State Line Creek	47,685	22.1
E-1 Gray Branch	5,030	2.3
b. Minor tributaries and immediate drainage (nonpoint load) -	45,265	21.0
c. Known municipal STP's -		
Vivian	9,175	4.2
d. Septic tanks* -	1,120	0.5
e. Known industrial - none		
f. Direct precipitation** -	<u>17,340</u>	<u>8.0</u>
Totals	216,105	100.0

2. Outputs - A-1 Black Bayou 170,090

3. Net annual N accumulation - 46,015

*Estimate based on 105 lakeshore residences.

**Estimated (see NES Working Paper No. 175).

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

<u>Tributary</u>	<u>kg P/km²/yr</u>	<u>kg N/km²/yr</u>
Black Bayou	23	306
State Line Creek	26	342
Gray Branch	14	310

E. Mean Nutrient Concentrations in Ungaged Streams:

<u>Tributary</u>	<u>Mean Total P (mg/l)</u>	<u>Mean Total N (mg/l)</u>
B-1 Unnamed Stream	3.702	12.467
C-1 Myrtis Mill Creek	0.074	1.035
F-1 Horse Creek	0.037	0.692

The nutrient levels in tributaries C-1 and F-1 were in line with the measurements in the gaged streams entering Black Bayou Reservoir. However, nutrient levels for Unnamed Stream, B-1, were excessively high. This is probably attributable to the proximity of the tributary sampling station to the Vivian municipal sewage treatment plant outfall.

F. Yearly Loadings:

In the following table, the existing phosphorus annual loading is compared to the relationship proposed by Vollenweider (1975). Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his "oligotrophic" 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 "eutrophic" and "oligotrophic".

Note that Vollenweider's model may not apply to lakes with short hydraulic retention times or in which light penetration is severely restricted by high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading <u>(g/m²/yr)</u>
Estimated loading for Black Bayou Reservoir	1.07
Vollenweider's "eutrophic" loading	0.33
Vollenweider's "oligotrophic" loading	0.67

V. LITERATURE REVIEWED

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V. APPENDICES

APPENDIX A
CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

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
TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR LOUISIANA

04/11/77

LAKE CODE 2204 BLACK BAYOU LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 608.6

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS)												
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
2204A1	608.6	10.39	13.25	11.86	14.24	14.98	5.30	1.53	0.62	1.02	1.16	4.87	4.62	6.94
2204A2	295.3	5.04	6.43	5.78	6.91	7.25	2.58	0.74	0.31	0.48	0.57	2.38	2.24	3.37
2204D1	139.6	2.38	3.03	2.72	3.26	3.43	1.22	0.34	0.14	0.24	0.27	1.19	1.05	1.59
2204E1	16.2	0.278	0.340	0.311	0.368	0.396	0.142	0.040	0.017	0.028	0.031	0.130	0.122	0.182
2204ZZ	158.0	2.69	3.43	3.09	3.71	3.88	1.39	0.40	0.16	0.26	0.31	1.27	1.19	1.80

SUMMARY

TOTAL DRAINAGE AREA OF LAKE =	608.6	TOTAL FLOW IN =	83.92
SUM OF SUB-DRAINAGE AREAS =	609.1	TOTAL FLOW OUT =	83.85

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2204A1	6	74	21.804	8	84.951				
	7	74	0.821	6	0.074				
	8	74	0.048	10	0.076				
	9	74	1.557	7	0.227				
	10	74	0.708	5	0.170	18	0.119		
	11	74	11.468	9	0.227				
	12	74	10.194	6	0.283				
	1	75	11.412	11	16.509				
	2	75	37.095	8	20.388	22	10.675		
	3	75	19.963	7	11.921	22	12.884		
	4	75	8.891	5	5.947	19	6.796		
	6	74	10.194	8	41.059				
2204A2	7	74	0.396	6	0.170				
	8	74	0.028	10	0.034				
	9	74	0.736	7	0.127				
	10	74	0.340	5	0.127	18	0.113		
	11	74	5.578	9	0.425				
	12	74	5.012	7	0.340				
	1	75	5.522	11	8.014				
	2	75	18.010	8	9.883	22	5.182		
	3	75	9.684	7	5.777	22	6.258		
	4	75	4.304	5	2.888	19	3.285		
	6	74	0.510	8	19.539				
	7	74	0.190	6	0.017				
2204D1	8	74	0.011	10	0.017				
	9	74	0.368	7	0.051				
	10	74	0.164	5	0.023	18	0.028		
	11	74	2.633	9	0.340				
	12	74	2.379	7	0.283				
	1	75	2.605	11	3.794				
	2	75	8.523	8	4.672	22	2.435		
	3	75	4.587	7	2.747	22	2.945		
	4	75	2.039	5	1.359	19	1.557		

TRIBUTARY FLOW INFORMATION FOR LOUISIANA

04/11/77

LAKE CODE 2204 BLACK BAYOU LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS (CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2204E1	6	74	0.595	8	3.398				
	7	74	0.023	6	0.0				
	8	74	0.003	10	0.0				
	9	74	0.042	7	0.003				
	10	74	0.020	5	0.003	18	0.003		
	11	74	0.311	9	0.040				
	12	74	0.283	7	0.028				
	1	75	0.311	11	0.453				
	2	75	0.991	8	0.538	22	0.283		
	3	75	0.538	7	0.311	22	0.340		
	4	75	0.227	5	0.170	19	0.170		

APPENDIX C
PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 75/12/11
 NATL EUTROPHICATION SURVEY
 EPA-LAS VEGAS

220402
 32 54 00.0 093 55 57.0
 BLACK BAYOU
 22 LOUISIANA

118PALES

2111202
 0007 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CONDUCTVY FIELD MICROMHO	00400 PH SU	00410 TALK CAC03 MG/L	00610 NH3-N TOTAL MG/L	00425 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTH0 MG/L P
74/03/23	09 40	0000	16.4		84	167	6.40	10K	0.030	0.500	0.020	0.004
	09 40	0005	16.3	8.6		168	6.25	10K	0.030	0.500	0.020	0.008
74/06/03	12 10	0000	27.0		35	204	8.70	10K	0.040	0.500	0.020	0.003
	12 10	0005	25.6	3.4		239	6.70	10K	0.130	0.500	0.030	0.013
74/08/26	11 15	0000	29.1	5.6	43	141	7.00					
74/11/11	08 50	0000	15.8	4.0	45	99	5.72	10K	0.070	0.500	0.020K	0.014
	08 50	0005	15.8	4.6		99	5.62	10K	0.070	0.500	0.020K	0.016

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LI PEMNING PERCENT
74/03/23	09 40	0000	0.024	5.3	
	09 40	0008	0.026		
74/06/03	12 10	0000	0.042	32.1	
	12 10	0005	0.046		
74/08/26	11 15	0000		14.5	
74/11/11	08 50	0000	0.053	2.8	
	08 50	0005	0.061		

— K VALUE KNOWN TO BE LESS THAN
 INDICATED —

STORET RETRIEVAL DATE 75/12/11
 NATL EUTROPHICATION SURVEY
 EPA-LAS VEGAS

220403
 32 53 10.0 093 57 26.0
 BLACK BAYOU
 22 LOUISIANA

				00010	00300	00077	00094	00400	00410	00610	00625	00630	00671
DATE	TIME	DEPTH	WATER	DO	TRANSP	CNDUCTVY		PH	T ALK	NH3-N	TOT KjEL	NO2&NO3	PHOS-DIS
FROM	OF		TEMP		SECCHI	FIELD			CACO3	TOTAL	N	N-TOTAL	ORTHO
TO	DAY	FEET	CENT	MG/L	INCHES	MICROMHU		SI	MG/L	MG/L	MG/L	MG/L	MG/L P
74/03/23	09 50	0000	16.2	3.2	54	232		6.05	11	0.210	0.400	0.090	0.070
74/06/03	12 25	0000	26.4	4.4	32	292		7.00	13	0.040	0.800	0.020	0.015
74/08/26	11 30	0000	29.6	3.8	26	266		7.00					
74/11/11	09 10	0000	15.3	2.8	45	170		5.75	10K	0.630	1.200	0.030	0.042

				00665	32217	00031
DATE	TIME	DEPTH	PHOS-TOT	CHLRPHYL	INCDT LT	
FROM	OF			A	REMNING	
TO	DAY	FEET	MG/L P	UG/L	PERCENT	
74/03/23	09 50	0000	0.225	13.0		
74/06/03	12 25	0000	0.134	23.3		
	12 25	0001			50.0	
	12 25	0005			1.0	
74/08/26	11 30	0000		47.0		
74/11/11	09 10	0000	0.266			

___ K VALUE KNOWN TO BE LESS THAN
 INDICATED

APPENDIX D
TRIBUTARY AND WASTEWATER
TREATMENT PLANT DATA

STORET RETRIEVAL DATE 77/04/11

2204A1
32 52 55.0 093 53 50.0 4
BLACK BAYOU
22 7.5 VIVIAN N
0/BLACK BAYOU LAKE 101691
LA HWY 2 XING DAM
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/T/PA/AMBNT/STREAM

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&N03 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
74/06/08	09 25		0.004	0.700	0.010	0.010	0.040
74/07/06	10 05		0.064	1.300	0.100	0.020	0.110
74/08/10	13 00		0.208	1.200	0.280	0.015	0.070
74/09/07			0.032	0.700	0.050	0.005	0.025
74/10/05	11 15		0.032	0.400	0.045	0.010	0.025
74/10/18	20 00		0.032	0.500	0.035	0.010	0.025
74/11/09	09 00		0.024	0.700	0.140	0.020	0.030
74/12/06	11 30		0.040	0.500	0.070	0.015	0.050
75/01/11	07 00		0.008	0.600	0.040	0.015	0.030
75/02/08	07 30		0.032	0.600	0.072	0.005K	0.050
75/02/22	07 35		0.008	0.500	0.032	0.008	0.040
75/03/07	09 25		0.016	1.050	0.024	0.008	0.040
75/03/22	08 30		0.009	0.400	0.015	0.005	0.030
75/04/05	10 00		0.005	0.300	0.025	0.005	0.010K
75/04/19	08 30		0.005	0.650	0.020	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

2204A2
32 58 30.0 094 01 40.0 4
BLACK BAYOU
22 7.5 MCLEOD
T/BLACK BAYOU LAKE 101691
LA HWY 168 BRDG 2 MI W OF RODESSA
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TPA/AMBN/STREAM

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
74/06/08	11 55		0.092	0.720	0.030	0.025	0.025
74/07/06	09 30		0.084	0.600	0.065	0.035	0.110
74/08/10	11 45		0.080	0.650	0.045	0.020	0.072
74/09/07	09 20		0.068	0.700	0.045	0.050	0.075
74/10/05	14 20		0.136	0.600	0.290	0.045	0.080
74/10/18	16 50		0.032	0.550	0.020	0.055	0.100
74/11/09	09 45		0.008	0.600	0.025	0.045	0.070
74/12/07	09 10		0.032	2.900	0.032	0.030	0.050K
75/01/11	09 40		0.056	0.800	0.044	0.030	0.080
75/02/08	10 45		0.016	0.400	0.024	0.032	0.050
75/02/22	09 30		0.024	0.700	0.032	0.032	0.090
75/03/07	10 10		0.048	1.000	0.016	0.032	0.070
75/03/22	09 45		0.009	0.600	0.010	0.022	0.060
75/04/05	09 05		0.065	1.000	0.040	0.040	0.060
75/04/19	08 35		0.105	1.300	0.090	0.045	0.100

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

220481
32 52 40.0 093 58 15.0 4
UNNAMED STREAM
22 7.5 VIVIAN N
T/BLACK BAYOU LAKE 101691
BNK DOWNSTREAM FROM VIVIAN STP OUTFALL
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TYPA/AM8NT/STREAM

DATE	TIME	DEPTH	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
FROM	OF						
TO	DAY	FEET					
74/06/08	08	55	0.600	5.500	1.300	0.695	1.600
74/07/06	08	40	1.512	25.000	4.100	8.600	10.500
74/08/10	12	25	1.840	22.000	8.600	10.500	11.500
74/09/07	08	35	1.700	13.500	6.200	5.500	
74/10/05	09	05	1.360	26.000	3.300	5.600	6.000
74/10/18	19	00	1.240	14.000	3.800	0.650	0.800
74/11/09	08	45	1.040	9.600	1.000	2.000	3.200
74/12/07	09	30	1.240	3.100	0.780	0.525	0.740
75/01/11	10	00	0.800	6.200		0.550	1.900
75/02/08	11	15	0.950	6.000	0.552	0.464	1.650
75/02/22	09	45	0.690	8.300	0.760	0.800	2.800
75/03/07	11	45	0.528		0.650	0.040	
75/03/22	10	10	0.635	5.500	0.588	0.588	1.330
75/04/05	09	45	0.510	9.900	1.720	0.950	1.800
75/04/19	09	05	0.720	5.100	2.000	0.775	4.300

STORET RETRIEVAL DATE 77/04/11

2204C1
32 55 50.0 093 59 35.0 4
MYRTIS MILL CREEK
22 7.5 VIVIAN N
T/BLACK BAYOU LAKE 101691
LA HWY 1 BRDG 0.4 MI S LA HWY 769 JCT
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TYPA/AMBT/STREAM

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
74/06/08	10 25		0.076	1.100	0.070	0.025	0.025K
74/07/06	09 15		0.018	1.500	0.185	0.030	0.210
74/08/10	12 15		0.092	0.200	0.100	0.030	0.090
74/09/07	09 05		0.056	1.000	0.085	0.025	0.085
74/10/05	10 40		0.040	2.600	0.150	0.055	0.080
74/10/18	18 31		0.024	0.200	0.190	0.030	0.205
74/11/04	09 00		0.008	0.500	0.030	0.025	0.040
74/12/07	08 40		0.032	0.500	0.025	0.010	0.030
75/02/04	11 10		0.030	0.400	0.065		0.030
75/02/22	09 00		0.016	1.400	0.048	0.008	0.040
75/03/07	10 07		0.024	0.750	0.032	0.015	0.030
75/03/22	09 15		0.012	0.450	0.024	0.015	0.040
75/04/05	09 25		0.025	1.400	0.050	0.010	0.040
75/04/19	08 25		0.030	0.800	0.090	0.025	0.040

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

220401
32 58 25.0 094 01 20.0 4
STATE LINE CREEK
22 7.5 MCLEOD
T/BLACK BAYOU LAKE 101591
LA HWY 168 BPDG 1.5 MI W OF RODESSA
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TYPA/AMBT/STREAM

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
74/06/08	11 40		0.080	0.600	0.050	0.030	0.070
74/07/06	09 34		0.092	0.600	0.050	0.085	0.175
74/08/10	11 47		0.028	1.800	0.045	0.010	0.055
74/09/07	09 25		0.052	0.900	0.030	0.050	
74/10/05	13 18		0.080	0.800	0.035	0.045	0.085
74/10/18	15 30		0.024	0.650	0.030	0.055	0.100
74/11/09	09 35		0.003	2.000	0.075	0.050	0.090
74/12/07	09 05		0.032	0.400	0.020	0.020	0.040
75/01/11	09 35		0.045	0.400	0.048	0.032	0.060
75/02/08	10 40		0.016	0.400	0.028	0.005K	0.050
75/03/07	10 05		0.040	0.700	0.035	0.032	0.090
75/03/22	09 40		0.022	0.800	0.035	0.024	0.070
75/04/05	09 00		0.070	0.600	0.050	0.040	0.060
75/04/19	08 30		0.100	0.900	0.105	0.035	0.070

K VALUE KNOWN TO BE
LESS THAN INDICATED

STOPET RETRIEVAL DATE 77/04/11

2204E1
 32 57 30.0 093 58 07.0 4
 GRAY BRANCH
 22 7.5 VIVIAN N
 T/BLACK BAYOU LAKE 101691
 2NDRY RD BRDG 2 MI SE OF RODESSA
 11EPALES 04001004
 0000 FEET DEPTH CLASS 00

/TYPA/AMBNT/STREAM

DATE	TIME	DEPTH	00630 NO2AN03 N-TOTAL	00625 TOT KJEL N	00610 NH3-N TOTAL	00671 PHOS-DIS ORTHO	00665 PHOS-TOT
FROM	OF		MG/L	MG/L	MG/L	MG/L P	MG/L P
TO	DAY	FEET					
74/06/08	10	50	0.080	0.700	0.035	0.040	0.095
74/07/06	09	45	0.020	0.800	0.350	0.010	0.030
74/08/10	12	00	0.032	2.200	0.910	0.050	0.120
74/09/07	09	30	0.040	0.700	0.115	0.005	0.015
74/10/05	12	05	0.040	0.600	0.143	0.015	0.020
74/10/18	19	30	0.024	0.400	0.055	0.010	0.015
74/11/09	09	20	0.016	0.600	0.230	0.020	0.020
74/12/07	08	55	0.016	0.800	0.065	0.010	0.030
75/01/11	09	25	0.024	1.000	0.120	0.030	0.040
75/02/08	11	00	0.032	1.100	0.064	0.032	0.032
75/02/22	09	10	0.032	0.600	0.088	0.016	0.030
75/03/07	09	55	0.032	0.900	0.060	0.008	0.030
75/03/22	09	30	0.018	1.250	0.062	0.009	0.080
75/04/05	09	15	0.020	0.600	0.105	0.005	0.020
75/04/19	08	50	0.030	0.850	0.160	0.010	0.020

STORET RETRIEVAL DATE 77/04/11

2204F1
32 57 30.0 093 57 10.0 4
HORSE CREEK
22 7.5 VIVIAN N
T/BLACK BAYOU LAKE 101691
2NDRY RD BRDG 3 MI SE OF RODESSA
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TYPE/AMNT/STREAM

DATE	TIME	DEPTH	00630	00625	00610	00671	00665
FROM	OF		NOR&N03	TOT KJEL	NH3-N	PHOS-DIS	PHOS-TOT
TO	DAY	FEET	N-TOTAL	N	TOTAL	ORTHO	
			MG/L	MG/L	MG/L	MG/L P	MG/L P
74/06/08	10	40	0.028	0.690	0.030	0.025	0.025
74/07/06	09	50	0.080	0.800	0.060	0.025	0.070
74/08/10	12	10	0.020	0.700	0.055	0.025	0.085
74/09/07	09	35	0.048	0.500	0.027	0.015	0.030
74/10/05	11	10	0.048	0.500	0.035	0.010	0.020
74/10/18	19	15	0.048	0.400	0.037	0.010	0.025
74/11/09	09	15	0.008	0.850	0.060	0.020	0.030
74/12/07	08	50	0.016	0.600	0.045	0.010	0.020
75/01/11	09	20	0.016	0.500	0.024	0.015	0.020
75/02/08	11	05	0.024	0.800	0.032	0.008	0.020
75/02/22	09	05	0.040	0.900	0.088	0.032	0.080
75/03/07	09	30	0.016	0.500	0.016	0.008	0.040
75/03/22	09	25	0.015	0.650	0.022	0.009	0.030
75/04/05	09	20	0.010	0.900	0.035	0.010	0.020
75/04/19	09	55	0.010		0.090	0.030	

APPENDIX E
PARAMETRIC RANKINGS OF LAKES
SAMPLED BY NES IN 1973
STATE OF
LOUISIANA

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
2201	ANACOCO LAKE	0.031	0.080	455.833	8.700	10.400	0.007
2202	BRUIN LAKE	0.057	0.250	450.333	16.350	15.000	0.012
2203	LAKE BISTINEAU	0.061	0.100	458.000	12.933	13.200	0.018
2204	BLACK BAYOU	0.046	0.090	453.417	17.818	12.200	0.009
2205	BUNDICK LAKE	0.157	0.135	469.667	20.467	10.600	0.073
2207	COCODRIE LAKE	0.090	0.400	479.000	35.300	7.700	0.026
2208	COTILE LAKE	0.037	0.100	442.333	12.650	14.000	0.011
2209	CONCORDIA LAKE	0.076	0.080	468.333	32.950	14.800	0.009
2210	CROSS LAKE	0.057	0.080	475.250	38.385	11.400	0.010
2211	D'ARBONNE LAKE	0.038	0.100	458.250	6.800	13.200	0.011
2212	FALSE RIVER LAKE	0.082	0.130	442.500	24.550	14.900	0.023
2213	INDIAN CREEK	0.031	0.150	458.333	21.467	14.800	0.010
2214	SALINE LAKE	0.111	0.350	493.000	15.333	9.600	0.025
2215	TURKEY CREEK LAKE	0.176	0.170	477.833	21.967	14.600	0.033
2216	LAKE VERRET	0.163	0.100	481.428	62.028	12.000	0.056
2217	LAKE VERNON	0.018	0.120	436.667	4.900	14.400	0.007
2219	BLACK LAKE	0.077	0.150	454.000	12.733	11.600	0.015
2220	COCODRIE	0.106	0.050	478.333	33.433	11.800	0.014
4807	CADDO LAKE	0.049	0.070	463.562	20.125	10.000	0.008

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

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INOPG N	500- MEAN SEC	MEAN CHLORA	15- MIN DO	MEDIAN DISS ORTHO P
2201	ANACOCO LAKE	92 (16)	83 (14)	67 (12)	89 (16)	83 (15)	94 (17)
2202	BRUIN LAKE	61 (11)	11 (2)	83 (15)	61 (11)	0 (0)	50 (9)
2203	LAKE BISTINEAU	50 (9)	58 (9)	61 (11)	72 (13)	42 (7)	33 (6)
2204	BLACK BAYOU	72 (13)	72 (13)	78 (14)	56 (10)	50 (9)	81 (14)
2205	BUNDICK LAKE	11 (2)	33 (6)	33 (6)	44 (8)	78 (14)	0 (0)
2207	COCODRIE LAKE	28 (5)	0 (0)	11 (2)	11 (2)	100 (18)	17 (3)
2208	COTILE LAKE	83 (15)	58 (9)	94 (17)	83 (15)	33 (6)	61 (11)
2209	CONCORDIA LAKE	44 (8)	83 (14)	39 (7)	22 (4)	14 (2)	81 (14)
2210	CROSS LAKE	56 (10)	83 (14)	28 (5)	6 (1)	72 (13)	69 (12)
2211	D'ARBONNE LAKE	78 (14)	58 (9)	56 (10)	94 (17)	42 (7)	56 (10)
2212	FALSE RIVER LAKE	33 (6)	39 (7)	89 (16)	28 (5)	6 (1)	28 (5)
2213	INDIAN CREEK	92 (16)	28 (5)	50 (9)	39 (7)	14 (2)	69 (12)
2214	SALINE LAKE	17 (3)	6 (1)	0 (0)	67 (12)	94 (17)	22 (4)
2215	TURKEY CREEK LAKE	0 (0)	17 (3)	22 (4)	33 (6)	22 (4)	11 (2)
2216	LAKE VERRET	6 (1)	58 (9)	6 (1)	0 (0)	56 (10)	6 (1)
2217	LAKE VERNON	100 (18)	44 (8)	100 (18)	100 (18)	28 (5)	100 (18)
2219	BLACK LAKE	39 (7)	22 (4)	72 (13)	78 (14)	67 (12)	39 (7)
2220	COCODRIE	22 (4)	100 (18)	17 (3)	17 (3)	61 (11)	44 (8)
4807	CADDO LAKE	67 (12)	94 (17)	44 (8)	50 (9)	89 (16)	89 (16)