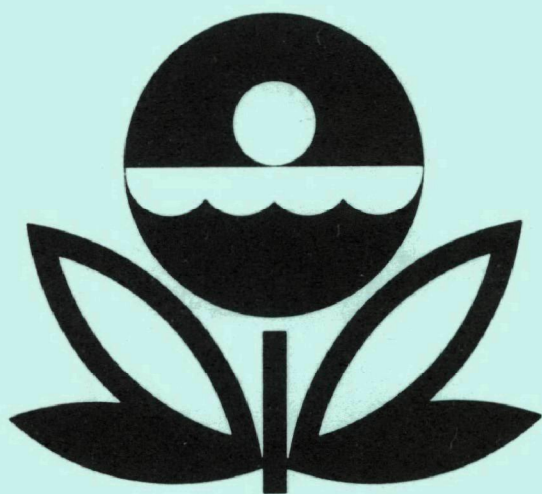


**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY**

WORKING PAPER SERIES



REPORT
ON
BAYOU D'ARBONNE LAKE
UNION AND LINCOLN PARISHES
LOUISIANA
EPA REGION VI
WORKING PAPER No. 539

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

REPORT
ON
BAYOU D'ARBONNE LAKE
UNION AND LINCOLN PARISHES
LOUISIANA
EPA REGION VI
WORKING PAPER No. 539

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

REPORT ON BAYOU D'ARBONNE LAKE
UNION AND LINCOLN PARISHES, 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

Working Paper No. 539

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

March 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 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.

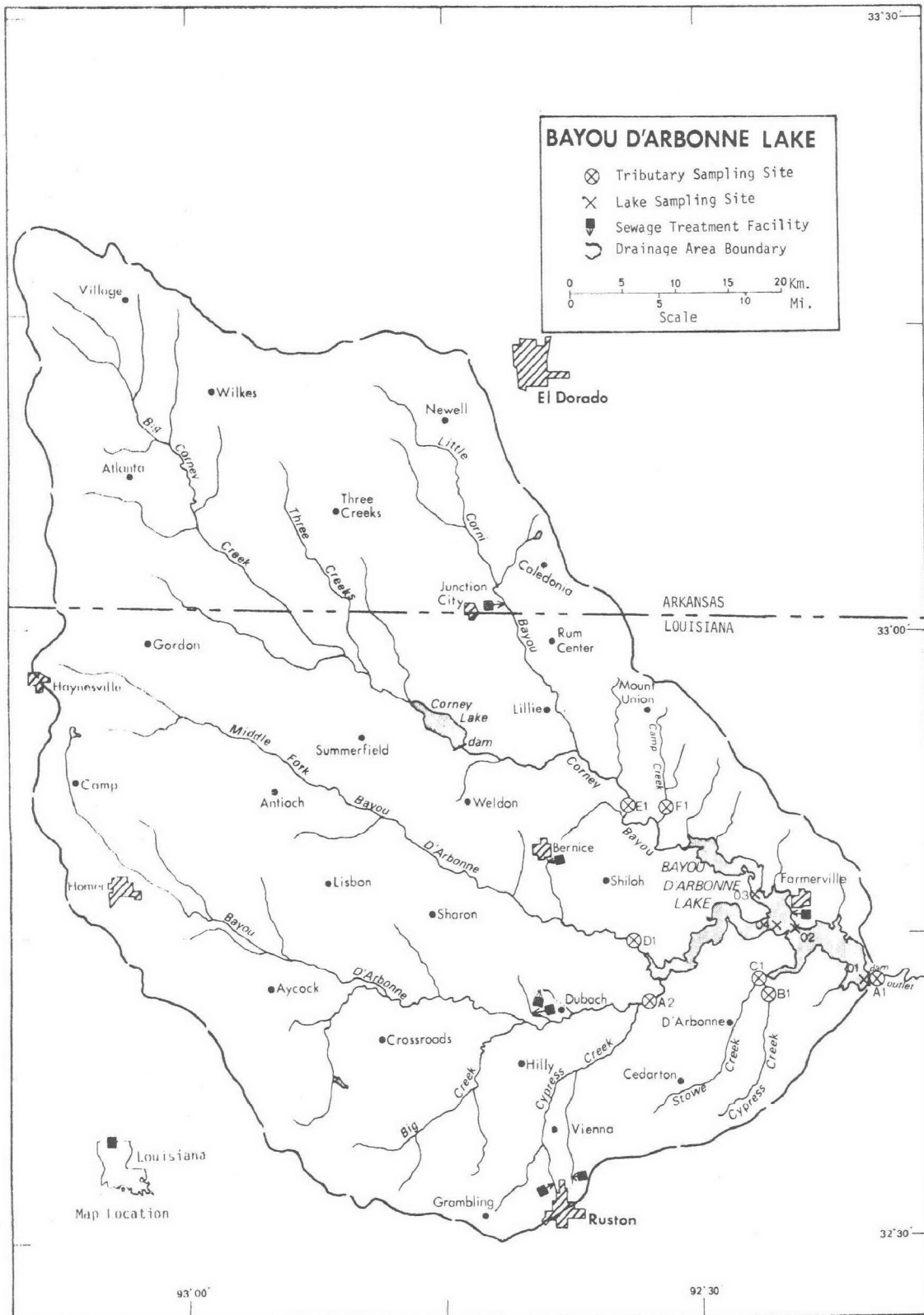
Major General O'Neil Daigle, Jr., the Adjutant General of Louisiana, and Project Officer Colonel Lawrence P. Dupre, who directed the volunteer efforts of the Louisiana National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF LOUISIANALAKE NAMEPARISH

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 BAYOU D'ARBONNE LAKE, LOUISIANA

STORET NO. 2211

I. CONCLUSIONS

A. Trophic Condition:*

Based on Survey data and field observations Lake Bayou D'Arbonne is considered meso-eutrophic. Secchi disc readings had a mean of 106 cm, and potential for primary productivity as measured by algal assay control yield was low. Chlorophyll a values ranged from 2.0 $\mu\text{g/l}$ in the fall to 13.0 $\mu\text{g/l}$ in the summer, with a mean of 6.8 $\mu\text{g/l}$. Of the 19 Louisiana lakes sampled in 1974, 14 had higher median total phosphorus, 9 had higher median inorganic nitrogen, and 10 had higher median orthophosphorus levels than Bayou D'Arbonne Lake.

Shampine (1971) reported that during the summer there are significant quality changes in the lower part of the lake including depletion of dissolved oxygen, production of hydrogen sulfide and increases in the concentrations of iron and dissolved solids.

*See Appendix E.

B. Rate-Limiting Nutrient:

Algal assay results indicate that Bayou D'Arbonne Lake was limited by available phosphorus. Spikes with phosphorus alone or phosphorus and nitrogen simultaneously resulted in increases in assay yield. Addition of nitrogen alone did not stimulate a growth response. The ratio of available nitrogen to orthophosphorus (N/P) in sampled waters indicates nitrogen limitation during the spring and fall and phosphorus limitation during the summer.

C. Nutrient Controllability:

1. Point sources -

Nutrient loading to Lake Bayou D'Arbonne is in excess of the eutrophic level proposed by Vollenweider (1975) and approximately three times greater than the oligotrophic level for a lake of such volume and detention time. The mean annual phosphorus load from point sources was estimated to be 30.8% of the total load reaching the lake. Of the point source load, the city of Ruston contributed a total of 26.8% from two wastewater treatment plants. The remaining four known point sources contributed a total of 4.0% of the total load. Reduction of known point sources would reduce the phosphorus loadings to the lake to slightly below the eutrophic Vollenweider level.

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2. Nonpoint sources -

Nonpoint sources contributed 67.8% of the total load to Lake Bayou D'Arbonne. Corney Creek contributed 26.5% and the Middle Fork Bayou D'Arbonne contributed 14.1%. The loading from ungaged tributaries was estimated to be 14.3% of the total load. Loading calculations for Lake Bayou D'Arbonne yield a net export of nitrogen, indicating sampling was not adequate to accurately depict actual nitrogen loading and export rates.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage 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 the 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: 61.64 km².
2. Mean depth: 2.6 meters.
3. Maximum depth: 12.2 meters.
4. Volume: 160.354 x 10⁶ m³.
5. Mean hydraulic retention time: 36 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/s)</u>
A-2 Bayou D'Arbonne	1,201.8	15.00
B-1 Cypress Creek	74.6	0.91
C-1 Stowe Creek	105.2	1.27
D-1 Middle Fork Bayou D'Arbonne	554.3	7.36
E-1 Corney Bayou	1,748.2	19.51
F-1 Camp Creek	51.8	0.58
Minor tributaries and immediate drainage -	<u>365.7</u>	<u>5.16</u>
Totals	4,101.6	49.79

2. Outlet - A-1 Bayou D'Arbonne	4,162.1	51.82
------------------------------------	---------	-------

C. Precipitation:

1. Year of sampling: 171.1 cm.
2. Mean annual: 125.5 cm.

III. LAKE WATER QUALITY SUMMARY

Bayou D'Arbonne Lake was sampled three 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 four 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 4.6 meters at Station 01, 11.0 meters at Station 02, 7.0 meters at Station 03, and 0.9 meters at Station 04. 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.

D'ARBONNE LAKE
STORET CODE 2211

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	N*	(3/21/74)			N*	(5/31/74)			N*	(11/11/74)		
		S*** = 4	MAX DEPTH RANGE (METERS)	MEDIAN		S*** = 4	MAX DEPTH RANGE (METERS)	MEDIAN		S*** = 4	MAX DEPTH RANGE (METERS)	MEDIAN
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	8	16.5- 17.7	17.6	0.0- 1.5	7	25.1- 27.0	26.6	0.0- 1.5	8	15.0- 16.7	15.2	0.0- 1.5
MAX DEPTH**	4	16.5- 17.7	17.4	0.6- 10.7	4	23.3- 25.7	25.0	0.0- 11.0	4	15.0- 16.7	15.1	0.9- 9.8
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	4	6.4- 8.6	7.9	0.6- 1.5	4	3.6- 35.2	6.0	0.0- 1.5	8	6.6- 8.4	7.9	0.0- 1.5
MAX DEPTH**	4	6.2- 8.6	8.5	0.6- 10.7	4	1.8- 35.2	3.6	0.0- 11.0	4	6.2- 8.4	7.9	0.9- 9.8
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	8	51.- 176.	86.	0.0- 1.5	7	68.- 143.	123.	0.0- 1.5	8	55.- 171.	75.	0.0- 1.5
MAX DEPTH**	4	51.- 176.	79.	0.6- 10.7	4	68.- 136.	100.	0.0- 11.0	4	55.- 166.	83.	0.9- 9.8
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	8	5.9- 6.4	6.2	0.0- 1.5	7	6.2- 6.8	6.5	0.0- 1.5	8	5.4- 5.9	5.8	0.0- 1.5
MAX DEPTH**	4	5.9- 6.3	6.3	0.6- 10.7	4	6.0- 6.7	6.4	0.0- 11.0	4	5.4- 5.8	5.8	0.9- 9.8
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	8	10.- 10.	10.	0.0- 1.5	7	10.- 10.	10.	0.0- 1.5	8	10.- 10.	10.	0.0- 1.5
MAX DEPTH**	4	10.- 10.	10.	0.6- 10.7	4	10.- 15.	10.	0.0- 11.0	4	10.- 10.	10.	0.9- 9.8
TOTAL P (MG/L)												
0.-1.5 M DEPTH	8	0.026-0.038	0.033	0.0- 1.5	7	0.031-0.056	0.039	0.0- 1.5	8	0.035-0.056	0.046	0.0- 1.5
MAX DEPTH**	4	0.029-0.039	0.035	0.6- 10.7	4	0.034-0.166	0.047	0.0- 11.0	4	0.031-0.056	0.044	0.9- 9.8
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	8	0.009-0.019	0.011	0.0- 1.5	7	0.003-0.006	0.004	0.0- 1.5	8	0.006-0.040	0.020	0.0- 1.5
MAX DEPTH**	4	0.013-0.019	0.017	0.6- 10.7	4	0.003-0.005	0.005	0.0- 11.0	4	0.007-0.036	0.011	0.9- 9.8
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	8	0.030-0.070	0.060	0.0- 1.5	7	0.040-0.120	0.060	0.0- 1.5	8	0.020-0.060	0.030	0.0- 1.5
MAX DEPTH**	4	0.030-0.070	0.060	0.6- 10.7	4	0.070-0.120	0.075	0.0- 11.0	4	0.020-0.060	0.030	0.9- 9.8
AMMONIA (MG/L)												
0.-1.5 M DEPTH	8	0.040-0.050	0.040	0.0- 1.5	7	0.060-0.080	0.070	0.0- 1.5	8	0.040-0.080	0.045	0.0- 1.5
MAX DEPTH**	4	0.040-0.050	0.040	0.6- 10.7	4	0.070-0.450	0.145	0.0- 11.0	4	0.040-0.080	0.045	0.9- 9.8
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	8	0.200-0.500	0.350	0.0- 1.5	7	0.400-0.900	0.600	0.0- 1.5	8	0.400-0.600	0.400	0.0- 1.5
MAX DEPTH**	4	0.200-0.400	0.300	0.6- 10.7	4	0.500-1.100	0.600	0.0- 11.0	4	0.400-0.500	0.400	0.9- 9.8
SECCHI DISC (METERS)												
	4	1.0- 1.3	1.2		4	0.6- 1.1	1.0		4	0.8- 1.5	1.0	

* 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>
03/21/74	1. Flagellates	842
	2. <u>Melosira</u>	577
	3. <u>Dactylococcopsis</u>	355
	4. Pennate diatom	310
	5. <u>Cryptomonas</u>	177
	Other genera	<u>223</u>
	Total	2,484
05/31/74	1. Flagellates	625
	2. <u>Cyclotella</u>	208
	3. <u>Cryptomonas</u>	182
	4. <u>Asterionella</u>	156
	5. <u>Synedra</u>	156
	Other genera	<u>678</u>
	Total	2,005
11/11/74	1. Flagellates	682
	2. <u>Cryptomonas</u>	551
	3. <u>Raphidiopsis</u>	175
	4. <u>Ankistrodesmus</u>	97
	5. <u>Dactylococcopsis</u>	83
	Other genera	<u>726</u>
	Total	2,314

2. Chlorophyll a -

<u>Sampling Date</u>	<u>Station Number</u>	<u>Chlorophyll a ($\mu\text{g/l}$)</u>
03/21/74	01	9.3
	02	6.4
	03	3.2
	04	-
05/31/74	01	13.0
	02	12.2
	03	5.7
	04	9.7
11/11/74	01	4.0
	02	5.2
	03	2.0
	04	4.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 03/21/74

<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	0.010	0.117	0.1
0.05 P	0.060	0.117	2.5
0.05 P + 1.0 N	0.060	1.117	12.0
1.00 N	0.010	1.117	0.2

b. 11/11/74

<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	0.011	0.082	0.2
0.05 P	0.061	0.082	2.5
0.05 P + 1.0 N	0.061	1.082	14.0
1.00 N	0.011	1.082	0.2

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential for primary productivity was low on Bayou D'Arbonne Lake during both spring and fall samplings. The substantial increases in yield in each assay with the addition of phosphorus and the lack of response to the addition of nitrogen indicate phosphorus limitation. In both assays the simultaneous addition of nitrogen and phosphorus resulted in maximum yield.

The N/P ratio in the field was 7/1 in the spring and 5/1 in the fall suggesting nitrogen limitation. The N/P ratio was 47/1 in the summer indicating phosphorus limitation (a ratio of

14/1 or greater suggests phosphorus limitation). Algal forms generally "favored" by low N/P ratios, e.g. Dactylococcopsis and Raphidiopsis, appeared during the spring and/or fall sampling.

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.

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 May 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, nutrient 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 $\text{kg}/\text{km}^2/\text{year}$, in Cypress Creek, Stowe Creek, and Camp Creek at Stations B-1, C-1, and F-1, respectively, and multiplying the means by the ZZ area in km^2 .

The operator of the Ruston (North) wastewater treatment plant provided monthly effluent samples and corresponding flow data. The operators of the Bernice, Junction City, Dubach (South), Dubach

(West), and Farmerville wastewater treatment plants provided monthly effluent samples. Nutrient loads for those plants were calculated using an estimated (per capita) flow and the provided sample chemistries. Nutrient loads for the city of Ruston (South) wastewater treatment plant were estimated at 1.134 kg P and 3.401 kg N/capita/year.

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>
Bernice	1,600	Stabilization pond	0.606**	Middle Fork Bayou D'Arbonne
Junction City	716	Stabilization pond	0.271**	Corney Bayou
Ruston (North)	10,230	Activated sludge	4.611	Bayou D'Arbonne
Ruston (South)***	7,900	Trickling filter	2.990**	Bayou D'Arbonne
Dubach (South)	500	Stabilization pond	0.189**	Bayou D'Arbonne
Dubach (West)	513	Stabilization pond	0.194**	Bayou D'Arbonne
Farmerville	3,000	Trickling filter	1.136**	Bayou D'Arbonne

2. Known industrial - None

*Treatment plant questionnaires.

**Estimated at 0.3785 m³/capita/day.

***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 Bayou D'Arbonne	2,640	3.2
B-1 Cypress Creek	2,655	3.2
C-1 Stowe Creek	3,815	4.7
D-1 Middle Fork Bayou D'Arbonne	11,480	14.0
E-1 Corney Bayou	21,645	26.4
F-1 Camp Creek	1,465	1.8
b. Minor tributaries and immediate drainage (nonpoint load) -	12,070	14.7
c. Known municipal STP's -		
Bernice	720	0.9
Junction City	445	0.5
Ruston (North)	12,915	15.7
Ruston (South)	8,960	10.9
Dubach (South)	515	0.6
Dubach (West)	380	0.5
Farmerville	1,205	1.5
d. Septic tanks* -	70	0.1
e. Known industrial - None		
f. Direct precipitation** -	<u>1,080</u>	<u>1.3</u>
Totals	82,060	100.0
2. Output - A-1 Bayou D'Arbonne	48,615	
3. Net annual P accumulation -	33,445	

*Estimate based on 185 lakeside residences, 9 camps, and 1 state park.
 **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 Bayou D'Arbonne	250,765	20.0
B-1 Cypress Creek	32,210	2.6
C-1 Stowe Creek	46,920	3.7
D-1 Middle Fork Bayou D'Arbonne	141,990	11.3
E-1 Corney Bayou	478,985	38.2
F-1 Camp Creek	17,985	1.4
b. Minor tributaries and immediate drainage (nonpoint load) -	149,330	11.9
c. Known municipal STP's -		
Bernice	1,950	0.2
Junction City	1,255	0.1
Ruston (North)	31,950	2.5
Ruston (South)	26,870	2.1
Dubach (South)	780	0.1
Dubach (West)	815	0.1
Farmerville	3,915	0.3
d. Septic tanks* -	2,640	0.2
e. Known industrial - None		
f. Direct precipitation** -	66,545	5.3
Totals	1,254,905	100.0

2. Output - A-1 Bayou D'Arbonne 1,361,750

3. Net annual N export*** - 106,845

*Estimate based on 185 lakeside residences, 9 camps, and 1 state park.

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

***Export probably due to unknown sources and/or sampling error.

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

<u>Tributary</u>	<u>kg P/km²/yr</u>	<u>kg N/km²/yr</u>
Bayou D'Arbonne	2	209
Cypress Creek	36	432
Stowe Creek	36	446
Middle Fork Bayou D'Arbonne	21	256
Corney Bayou	12	274
Camp Creek	28	347

E. 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 (g/m ² /yr)	
Estimated loading for Bayou D'Arbonne Lake	1.33
Vollenweider's "eutrophic" loading	0.98
Vollenweider's "oligotrophic" loading	0.49

V. LITERATURE REVIEWED

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- Vollenweider, R. A. 1975. Input-Output Models With Special Reference to the Phosphorus Loading Concept in Limnology. Schweiz. Z. Hydrol. 37:53-84.

VI. APPENDICES

APPENDIX A CONVERSION FACTORS

CONVERSION FACTORS

Hectares $\times 2.471 =$ acres

Kilometers $\times 0.6214 =$ miles

Meters $\times 3.281 =$ feet

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

Square kilometers $\times 0.3861 =$ square miles

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

Centimeters $\times 0.3937 =$ inches

Kilograms $\times 2.205 =$ pounds

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

APPENDIX B
TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR LOUISIANA

04/11/77

LAKE CODE 2211 BAYOU D'ARBOONNE LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 4162.1

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS)												MEAN
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
2211A1	4162.1	89.48	106.47	97.41	90.61	90.61	36.25	15.01	7.14	13.31	11.75	23.79	43.89	51.82
2211A2	1201.8	25.88	30.87	28.18	26.25	26.22	10.53	4.33	2.07	3.85	3.40	6.88	12.71	15.00
2211B1	74.6	1.67	2.04	1.98	1.73	1.70	0.42	0.20	0.10	0.16	0.16	0.28	0.51	0.91
2211C1	105.2	2.35	2.86	2.80	2.41	2.38	0.59	0.28	0.15	0.23	0.23	0.40	0.71	1.27
2211D1	554.3	14.58	16.54	16.62	13.34	13.28	2.52	1.39	0.79	1.36	1.39	1.90	5.18	7.36
2211E1	1748.2	33.41	45.87	46.16	40.21	39.36	6.34	3.23	2.01	1.76	2.35	3.77	11.41	19.51
2211F1	51.8	0.991	1.359	1.359	1.189	1.161	0.187	0.096	0.059	0.051	0.071	0.110	0.340	0.577
2211ZZ	427.3	9.51	11.61	11.33	9.80	9.71	2.38	1.13	0.59	0.93	0.93	1.59	2.86	5.16

SUMMARY

TOTAL DRAINAGE AREA OF LAKE =	4162.1	TOTAL FLOW IN =	601.63
SUM OF SUB-DRAINAGE AREAS =	4163.2	TOTAL FLOW OUT =	625.72

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2211A1	6	74	305.822	8	141.584				
	7	74	9.288	6	10.251				
	8	74	5.663	10	5.239				
	10	74	22.087	5	12.459				
	11	74	100.525	9	78.154				
	12	74	101.374	7	130.257				
	1	75	115.816	11	174.998				
	2	75	274.673	8	177.830	22	95.711		
	3	75	170.751	22	152.628				
	4	75	86.083	5	60.881	19	94.861		
	5	75	168.768	3	240.693				
	6	74	106.188	8	48.988				
2211A2	7	74	2.662	6	2.945				
	8	74	1.642	10	1.529				
	9	74	29.166	7	19.397				
	10	74	6.371	5	3.596				
	11	74	28.883	9	22.653				
	12	74	29.450	7	37.661				
	1	75	33.414	11	50.404				
	2	75	79.287	8	51.253	22	27.609		
	3	75	49.271	8	39.927	22	44.174		
	4	75	24.834	5	17.556	19	27.411		
	5	75	48.705	3	93.446				

TRIBUTARY FLOW INFORMATION FOR LOUISIANA

04/11/77

LAKE CODE 2211 BAYOU D'ARBONNE LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS (CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2211B1	6	74	5.380	8	2.832				
	7	74	0.164	6	0.184				
	8	74	0.102	10	0.093				
	9	74	1.812	7	1.189				
	10	74	0.396	5	0.340				
	11	74	1.416	9	1.416				
	12	74	2.322	7	2.322				
	1	75	2.067	11	3.030				
	2	75	4.927	8	2.549	22	1.501		
	3	75	3.058	8	1.699	22	2.067		
	4	75	1.529	5	0.085	19	0.368		
	5	75	3.030	3	2.549				
2211C1	6	74	7.787	8	3.540				
	7	74	0.232	6	0.258				
	8	74	0.144	10	0.133				
	9	74	2.549	7	1.756				
	10	74	0.566	5	0.311				
	11	74	2.549	9	0.850				
	12	74	2.549	7	5.947				
	1	75	2.917	11	2.832				
	2	75	6.938	8	3.256	22	0.991		
	3	75	4.304	8	1.274	22	0.991		
	4	75	2.180	5	6.513	19	0.283		
	5	75	4.248	3	1.133				
2211D1	6	74	41.059	8	18.972				
	7	74	1.161	6	1.303				
	8	74	0.708	10	0.651				
	9	74	12.743	7	8.495				
	10	74	2.945	5	1.671				
	11	74	13.394	9	10.421				
	12	74	13.507	7	17.273				
	1	75	15.433	11	23.305				
	2	75	36.529	8	23.673	22	12.743		
	3	75	22.767	8	8.269	22	20.331		
	4	75	11.440	5	8.099	19	12.658		
	5	75	22.455	3	66.828				
2211E1	6	74	128.842	8	59.465				
	7	74	3.879	6	4.304				
	8	74	2.379	10	2.209				
	9	74	42.475	7	28.317				
	10	74	9.260	5	5.239				
	11	74	42.192	9	32.848				
	12	74	42.758	7	54.652				
	1	75	48.705	11	73.624				
	2	75	115.533	8	74.756	22	40.210		
	3	75	71.642	8	26.108	22	64.279		
	4	75	36.246	5	25.542	19	39.927		
	5	75	70.792	3	135.921				

TRIBUTARY FLOW INFORMATION FOR LOUISIANA

04/11/77

LAKE CODE 2211 BAYOU D'ARBONNE LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2211F1	6	74	3.823	8	1.756				
	7	74	0.116	6	0.127				
	8	74	0.071	10	0.065				
	9	74	1.274	7	8.382				
	10	74	0.283	5	0.453				
	11	74	1.246	9	0.991				
	12	74	1.274	7	5.380				
	1	75	1.444	11	15.291				
	2	75	3.426	8	8.353	22	0.991		
	3	75	2.124	8	0.991	22	1.699		
	4	75	1.076	5	0.991	19	0.850		
	5	75	2.095	3	28.600				

APPENDIX C
PHYSICAL AND CHEMICAL DATA

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

221101
 32 42 28.0 092 20 34.0
 D'ARBONNE LAKE
 22 LOUISIANA

11EPALES
 3

2111202
 0020 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 T ALK CAC03 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
74/03/21	11 00	0000	17.7		44	76	6.30	10K	0.050	0.400	0.060	0.011
	11 00	0005	17.7	8.0		78	6.30	10K	0.040	0.400	0.060	0.012
	11 00	0015	17.7	8.6		78	6.30	10K	0.040	0.300	0.060	0.017
74/05/31	09 45	0000	27.0		45	91	6.80	10K	0.070	0.900	0.040	0.003
	09 45	0005	27.0	6.0		84	6.70	10K	0.080	0.400	0.060	0.004
	09 45	0010	27.0	3.8		83	6.50	10K	0.230	0.600	0.050	0.003
	09 45	0015	24.8	1.8		82	6.50	10K	0.220	0.600	0.070	0.003
74/11/11	12 10	0000	16.7	7.8	30	74	5.80	10K	0.080	0.500	0.060	0.013
	12 10	0005	16.7	6.8		77	5.82	10K	0.080	0.400	0.060	0.014
	12 10	0011	16.7	7.8		72	5.82	10K	0.080	0.500	0.060	0.007

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT PEMNING PERCENT
74/03/21	11 00	0000	0.030	9.3	
	11 00	0005	0.033		
	11 00	0015	0.034		
74/05/31	09 45	0000	0.036	13.0	
	09 45	0005	0.031		
	09 45	0010	0.034		
	09 45	0015	0.034		
74/11/11	12 10	0000	0.043	4.0	
	12 10	0003			1.0
	12 10	0005	0.045		
	12 10	0011	0.048		

___ K VALUE KNOWN TO BE LESS THAN
 INDICATED

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

221102
 32 45 20.0 092 24 52.0
 D'ARLONNE LAKE
 22 LOUISIANA

11EPALES 2111202
 3 0040 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 SI	00410 T ALK CAC03 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
74/03/21	11 30	0000	17.5		50	104	6.20	10K	0.040	0.300	0.060	0.015
	11 30	0005	17.5	7.8		93	6.20	10K	0.040	0.300	0.060	0.011
	11 30	0015	17.2	8.0		78	6.20	10K	0.040	0.300	0.060	0.015
	11 30	0035	17.2	8.4		80	6.25	10K	0.040	0.300	0.060	0.017
74/05/31	10 10	0000	26.6		34	141	6.70	10K	0.050	0.700	0.060	0.006
	10 10	0005	26.6	6.0		123	6.50	10K	0.060	0.500	0.060	0.004
	10 10	0015	26.6	5.0		122	6.35	10K	0.050	0.500	0.050	0.002
	10 10	0036	23.3	3.4		117	6.70	15	0.450	1.100	0.070	0.005
74/11/11	11 40	0000	15.5	9.2	36	75	5.89	10K	0.050	0.400	0.030	0.040
	11 40	0005	15.4	8.0		75	5.90	10K	0.040	0.400	0.030	0.032
	11 40	0020	15.2	8.0		84	5.84	10K	0.040	0.400	0.020	0.018
	11 40	0032	15.2	8.0		93	5.82	10K	0.050	0.400	0.030	0.010

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLORPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/21	11 30	0000	0.034	6.4	
	11 30	0005	0.038		
	11 30	0015	0.037		
	11 30	0035	0.039		
74/05/31	10 10	0000	0.043	12.2	
	10 10	0005	0.037		
	10 10	0015	0.039		
	10 10	0036	0.166		
74/11/11	11 40	0000	0.050	5.2	
	11 40	0005	0.048		1.0
	11 40	0020	0.043		
	11 40	0032	0.041		

___ K VALUE KNOWN TO BE LESS THAN
 INDICATED

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

221103
 32 47 01.0 092 27 24.0
 O'ARBONNE LAKE
 22 LOUISIANA

11EPALES
 3

2111202
 0024 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 T ALK CAC03 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
74/03/21	11 55	0000	17.7		52	176	5.90	10K	0.050	0.500	0.030	0.009
	11 55	0005	17.7	6.4		176	5.90	10K	0.050	0.400	0.030	0.011
	11 55	0015	17.6	6.4		176	5.90	10K	0.050	0.400	0.040	0.015
	11 55	0020	17.6	6.2		176	5.90	10K	0.050	0.400	0.030	0.013
74/05/31	10 50	0000	25.8		44	143	6.25	10K	0.070	0.600	0.120	0.004
	10 50	0005	25.8	3.6		141	6.20	10K	0.070	0.500	0.120	0.005
	10 50	0015	25.8	3.8		141	6.10	10K	0.060	0.500	0.100	0.005
	10 50	0023	25.7	3.8		136	6.00	10K	0.070	0.500	0.120	0.005
74/11/11	10 55	0000	15.0	7.0	60	171	5.42	10K	0.050	0.600	0.020K	0.006
	10 55	0005	15.0	6.6		170	5.42	10K	0.040	0.400	0.020K	0.012
	10 55	0011	15.0	6.2		166	5.42	10K	0.040	0.400	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
74/03/21	11 55	0000	0.028	3.2	
	11 55	0005	0.026		
	11 55	0015	0.028		
	11 55	0020	0.029		
74/05/31	10 50	0000	0.040	5.7	
	10 50	0005	0.039		
	10 50	0015	0.039		
	10 50	0023	0.039		
74/11/11	10 55	0000	0.035	2.0	
	10 55	0005	0.040		
	10 55	0006			1.0
	10 55	0011	0.031		

___ K VALUE KNOWN TO BE LESS THAN
 INDICATED

STORET RETRIEVAL DATE 75/02/11
 NATL EUTROPHICATION SURVEY
 EPA-LAS VEGAS

221104
 32 45 15.0 092 26 09.0
 O'ARRONNE LAKE
 22 LOUISIANA

11EPALES 2111202
 3 0005 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 T ALK CACU3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&N03 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/21	12 20	0000	16.5		40	51	6.40	10K	0.040	0.200	0.070	0.015
	12 20	0002	16.5	8.6		51	6.30	10K	0.040	0.200	0.070	0.019
74/05/31	10 30	0000	25.1	5.2	24	68	6.35	10K	0.070	0.600	0.080	0.005
74/11/11	11 20	0000	15.0	8.4	42	58	5.83	10K	0.040	0.500	0.030	0.026
	11 20	0003	15.0	8.4		55	5.83	10K	0.040	0.400	0.030	0.036

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/21	12 20	0000	0.038		
	12 20	0002	0.037		
74/05/31	10 30	0000	0.056	9.7	
74/11/11	11 20	0000	0.048	4.1	
	11 20	0003	0.056		

___ K VALUE KNOWN TO BE LESS THAN
 INDICATED

APPENDIX D
TRIBUTARY AND WASTEWATER
TREATMENT PLANT DATA

STORET RETRIEVAL DATE 77/04/11

2211A1
32 42 40.0 092 20 00.0 4
BAYOU D'ARBONNE
22 15 CALHOUN
0/BAYOU D'ARBONNE LAKE 101791
BANK SMPL 250 YDS BELOW MAIN DAM SPLWAY
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TTPA/AMBNT/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	42	0.024	0.800	0.075	0.005	0.030
74/08/10	09	30	0.008	0.890	0.140	0.005K	0.040
74/09/07	09	52	0.048	0.900	0.100	0.005	0.055
74/10/05	09	40	0.048	0.900	0.070	0.005	0.025
74/11/09	09	45	0.064	0.900	0.125	0.015	0.060
74/12/07	08	45	0.064	1.300	0.055	0.007	0.020
75/01/11	09	55	0.104	0.900	0.040	0.010	0.030
75/03/22	08	45	0.040	0.450	0.025	0.015	0.050
75/04/05	09	55	0.025	0.700	0.050	0.010	0.010
75/04/19	09	50	0.010	0.700	0.025	0.010	0.010
75/05/03	09	55	0.025	0.400	0.055	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

2211A2
 32 41 40.0 092 33 10.0 4
 BAYOU D'ARBONNE
 22 15 RUSTON
 T/BAYOU D'ARBONNE LAKE 101791
 LA HWY 151 BRDG 5.5 MI W LA HWY 33 INTER
 11EPALES 04001004
 0000 FEET DEPTH CLASS 00

/TYPA/AMNT/STPEAM

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	55	0.088	0.600	0.045	0.020	0.095
74/07/06	09	30	0.160	0.600	0.040	0.015	0.065
74/08/10	10	30	0.008	0.700	0.040	0.005	0.065
74/09/07	11	15	0.176	0.400	0.050	0.025	0.075
74/10/05	10	38	0.144	0.200	0.035	0.030	0.035
74/11/09	10	50	0.064	0.300	0.040	0.025	0.050
74/12/07	10	15	0.128	0.600	0.035	0.015	0.015
75/01/11	10	56	0.104	0.500	0.024	0.010	0.040
75/02/08	10	45	0.056	0.850	0.040	0.008	0.035
75/02/22	10	14	0.104	0.400	0.016	0.008	0.040
75/03/08	10	56	0.112	0.600	0.048	0.008	0.060
75/03/22	10	00	0.055	0.450	0.033	0.006	0.040
75/04/05	10	56	0.270	0.700	0.035	0.010	0.010
75/04/19	10	55	0.120	0.450	0.045	0.010	0.050
75/05/03	10	45	0.095	0.750	0.060	0.020	0.110

STORET RETRIEVAL DATE 77/04/11

221131
32 42 00.0 092 26 15.0 4
CYPRESS CREEK
22 15 CALHOUN
T/BAYOU D'ARBONNE LAKE 101791
2NDRY RD BRDG 1.3 MI SE LA HWY 33
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TYP/AMBNT/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	09 18		0.208	1.200	0.065	0.060	0.180
74/07/06	08 45		0.384	0.500	0.045	0.025	0.065
74/08/10	10 00		0.450	0.900	0.040	0.020	0.115
74/09/07	10 35		0.420	0.400	0.045	0.020	0.050
74/10/05	10 05		0.400	0.800	0.045	0.015	0.040
74/11/09	10 10		0.304	0.100K	0.035	0.035	
74/12/07	09 25		0.504	1.300	0.150	0.075	0.310
75/01/11	10 23		0.152	1.000	0.064	0.025	0.230
75/02/08	10 00		0.384	0.400	0.048	0.016	0.040
75/02/22	09 44		0.432	0.400	0.032	0.016	0.050
75/03/08	10 23		0.416	1.000	0.044	0.016	0.060
75/03/22	09 20		0.371	0.400	0.035	0.015	0.050
75/04/05	10 23		0.460	0.550	0.030	0.020	0.020
75/04/19	10 18		0.480	0.450	0.050	0.020	0.070
75/05/03	10 15		0.270	0.650	0.090	0.025	0.100

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE: 77/04/19

2211C1
 32 42 50.0 092 26 35.0 4
 STONE CREEK
 22 15 CALHOUN
 T/BAYOU D'ARBONNE LAKE 101791
 2NDRY RD BRDG 0.6 MI SE LA HWY 33 INTER
 11EPALES 04001004
 0000 FEET DEPTH CLASS 00

/TYPE/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	09 30		0.240	0.800	0.065	0.040	0.135
74/07/06	08 57		0.300	0.450	0.085	0.015	0.070
74/08/10	10 10		0.470	1.500	0.125	0.085	0.280
74/09/07	10 45		0.294	0.300	0.035	0.015	0.030
74/10/05	10 15		0.312	0.200	0.040	0.020	0.035
74/11/09	10 25		0.264	1.200	0.135	0.025	0.050
74/12/07	09 30		0.680	1.600	0.280	0.130	0.440
75/01/11	10 33		0.200	1.100	0.064	0.045	0.310
75/02/08	10 15		0.264	0.300	0.024	0.016	0.040
75/02/22	09 55		0.304	0.600	0.048	0.008	0.040
75/03/08	10 33		0.284	1.400	0.064	0.008	0.050
75/03/22	09 35		0.209	1.050	0.055	0.009	0.030
75/04/05	10 33		0.290	0.500	0.040	0.020	0.020
75/04/19	10 30		0.300	0.400	0.060	0.015	0.040
75/05/03	10 20		0.230	0.800	0.120	0.025	0.090

STORET RETRIEVAL DATE 77/04/11

221101
 32 44 45.0 092 34 00.0 4
 MIDDLE FORK BAYOU D'ARB
 22 15 RUSTON
 T/BAYOU D'ARBONNE LAKE 101791
 2NDRY RD KING 2.7 MI NE LA HAY 151 JCT
 11EPALÉS 04001004
 0000 FEET DEPTH CLASS 00

/TYP/AMBT/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	12	50	0.108	0.500K	0.040	0.025	0.030
74/07/06	14	10	0.216	0.400	0.042	0.030	0.070
74/08/10	10	45	0.096	0.600	0.035	0.025	0.090
74/09/07	13	30	0.032	0.400	0.050	0.015	0.045
74/10/05	12	50	0.064	0.300	0.045	0.025	0.040
74/11/09	13	20	0.016	0.500	0.040	0.030	0.060
74/12/07	13	15	0.032	0.300	0.035	0.015	0.015
75/01/11	13	45	0.032	0.200	0.016	0.015	0.050
75/02/08	13	50	0.016	0.500	0.016	0.016	0.060
75/02/22	13	45	0.008	0.600	0.032	0.014	0.060
75/03/08	13	45	0.048	0.500	0.024	0.008	0.060
75/03/22	13	15	0.015	0.450	0.015	0.010	0.030
75/04/05	13	45	0.060	0.350	0.010	0.005K	0.020
75/04/19	13	50	0.095	0.975	0.100	0.020	0.070
75/05/03	13	45	0.160	1.000	0.135	0.025	0.080

K VALUE KNOWN TO BE
 LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

2211E1
32 51 20.0 092 34 30.0 4
CORVEY BAYOU
22 15 BERNICE
T/BAYOU D'ARBONNE LAKE 101791
LA HWY 550 BRDG 5.5 MI NE LA HWY 2 JCT
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/TYPE/AMNT/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	13 20		0.092	0.660	0.070	0.030	0.030
74/07/06	14 48		0.128	0.600	0.075	0.015	0.050
74/08/10	11 15		0.104	0.600	0.040	0.005	0.040
74/09/07	14 00		0.040	0.700	0.025	0.010	0.025
74/10/05	13 45		0.024	0.900	0.040	0.015	0.027
74/11/09	14 00		0.016	0.700	0.065	0.015	0.035
74/12/07	13 45		0.024	0.300	0.025	0.010	0.010
75/01/11	14 15		0.032	0.800	0.024	0.010	0.040
75/02/08	14 18		0.008	0.400	0.040	0.016	0.030
75/02/22	14 15		0.038	0.700	0.024	0.008	0.060
75/03/08	14 15		0.032	1.000	0.048	0.008	0.040
75/03/22	13 50		0.018	0.500	0.018	0.015	0.030
75/04/05	14 15		0.040	0.700	0.010	0.005K	0.010K
75/04/19	14 20		0.030	1.500	0.080	0.010	0.050
75/05/03	14 15		0.085	0.750	0.135	0.015	0.050

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

2211F1
32 51 30.0 092 32 20.0 4
CAMP CREEK
22 15 PERNICE
T/BAYOU D'ARBORE LANE 101791
2ND KY RD BRDG 2 MI E LA HWY 550 JCT
11EPALES 04001004
0000 FEET DEPTH CLASS 00

/1TP4/AMBN/STREAM

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KUJEL 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	13 35		0.128	1.000	0.080	0.065	0.110
74/07/06	15 03		0.500	0.800	0.050	0.025	0.080
74/08/10	11 30		0.300	0.600	0.025	0.020	0.060
74/09/07	14 15		0.300	0.600	0.020	0.045	0.065
74/10/05	14 14		0.232	0.400	0.020	0.020	0.040
74/11/09	14 30		0.152	0.700	0.045	0.025	0.060
74/12/07	14 10		0.504	0.170	0.170	0.045	0.160
75/01/11	14 35		0.160	1.500	0.056	0.045	0.220
75/02/08			0.304	0.300	0.136	0.016	0.040
75/02/22	14 35		0.336	0.400	0.024	0.016	0.040
75/03/08	14 35		0.336	0.400	0.040	0.016	0.050
75/03/22	14 05		0.218	0.500	0.031	0.022	0.050
75/04/05	19 40		0.070	1.400	0.030	0.019	0.035
75/04/19	14 40		0.290	0.800	0.070	0.025	0.050
75/05/03	14 35		0.460	1.300	0.525	0.055	0.140

STORET RETRIEVAL DATE 77/04/11

221121 PU221121 P000716
 33 00 30.0 092 42 30.0 4
 JUNCTION CITY
 22 15 EL DORADO
 O/LAKE DIARBONNE 101791
 LAKE DIARBONNE
 11EPALES 00001004
 0000 FEET DEPTH CLASS 00

WATER/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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/07/09	10 30		0.040	9.800	0.050K	3.400	4.500		
74/09/10	10 30		0.040	22.000	0.700	3.700	9.775		
74/10/08	10 30		0.040	14.000	1.300	3.300	5.100		
74/11/12	10 00		0.160	15.500	2.200	2.500	4.150		
74/12/10	09 30		4.000	7.350	0.930	2.300	3.300		
75/01/14	12 00		0.080	12.000	2.700	2.700	3.300		
75/02/11	09 45		0.320	8.100	2.160	2.100	2.400		
75/04/08	10 30		1.360	13.000	0.480	0.320	3.450		
75/05/13	11 00		0.050	5.000	1.900	2.200	3.100		
75/06/10	15 20		0.100	18.000	1.200	2.300	7.300		
75/07/08	11 00		0.025	7.600	0.075	2.100	2.600		

K VALUE KNOWN TO BE
 LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

221131 AS221131 P010230
 32 32 30.0 092 38 50.0 4
 RUSTON
 22 15 RUSTON
 D/LAKE D'ARBONNE 101791
 LAKE D'ARBONNE
 11EPALES 00001004
 0000 FEET DEPTH CLASS 00

/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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/07/11	11 00								
CP(T)-			2.160	10.000	0.210	4.800	7.500		1.200
74/07/11	16 00								
74/08/08	11 00								
CP(T)-			4.200	12.000	0.210	6.000	9.000	1.400	1.400
74/08/08	16 00								
74/09/16	11 00								
CP(T)-			5.400	25.000	0.100	4.225	10.000	1.200	1.200
74/09/16	16 00								
74/10/08	11 00								
CP(T)-			4.600	20.000	0.079	5.600	10.000	1.200	1.200
74/10/08	16 00								
74/12/31	11 00								
CP(T)-			4.320	3.700	0.500	1.650	2.700		1.200
74/12/31	16 00								
75/01/17	11 00								
CP(T)-			3.520	21.000	0.790	2.500	7.800	1.200	1.200
75/01/17	16 00								
75/02/14	11 00								
CP(T)-			3.680	17.000	0.120	2.780	6.850	1.200	1.200
75/02/14	16 00								
75/03/27	11 00								
CP(T)-			4.640	7.000	0.420	3.100	4.700	1.200	1.200
75/03/27	16 00								
75/04/17	11 00								
CP(T)-			3.150	23.000	0.230	3.800	9.300	1.200	1.200
75/04/17	16 00								
75/05/23	11 00								
CP(T)-			6.400	1.700	0.050K	5.100	5.300	1.200	1.200
75/05/23	16 00								
75/06/27	11 00								
CP(T)-			4.730	22.000	0.100	4.600	11.000	1.200	1.200
75/06/27	16 00								

K VALUE KNOWN TO BE
 LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

221141 P0221141 P000500
 32 41 30.0 092 40 00.0 4
 DUBACH (S)
 22 15 RUSTON
 D/LAKE D'ARBONNE 101791
 LAKE D'ARBONNE
 11EPALES 00001004
 0000 FEET DEPTH CLASS 00

/AMBT/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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
FROM TO	OF DAY	FEET							
74/07/10	10 30		0.040	15.000	0.050K	7.500	9.050		
74/08/08			0.080	12.000	0.340	8.600	9.700		
74/09/16			0.120	7.500	0.230	7.800	9.370		
74/10/08			0.128	3.800	0.050K	7.750	8.000		
74/12/31	13 30		0.320	6.000	0.250	6.400	6.700		
75/01/17			0.240	7.100	0.050K	5.900	6.200		
75/02/14	10 30		0.160	6.200	0.130	5.500	5.800		
75/03/27	10 15		0.080	10.000	0.170	5.280	6.400		
75/04/17	10 30		0.150	10.500	0.340	5.100	5.600		
75/05/23	10 30		0.150	15.500	4.200	6.500	6.600		
75/06/27	09 30		0.190	29.000	19.500	7.100	8.200		

K VALUE KNOWN TO BE
 LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

221151 P0221151 P000513
 32 42 00.0 092 39 30.0 4
 DUBACH (W)
 22 15 RUSTON
 D/LAKE D'ARBONNE 101791
 LAKE D'ARBONNE
 11EPALES 00001004
 0000 FEET DEPTH CLASS 00

/AM8NT/STREAM

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2SN03 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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/07/10	11 00		0.040	15.000	0.050K	4.900	6.500		
74/08/08			0.040	8.100	0.170	5.730	6.800		
74/09/16			0.080	13.000	0.850	4.850	7.280		
74/10/08			0.080	9.400	0.090	5.300	6.300		
75/01/02			0.720	7.000	0.148	4.500	5.200		
75/01/17			0.480	7.500	0.050K	4.100	4.600	0.100	0.130
75/02/14	10 45		0.316	7.400	0.007	3.900	4.400	0.060	0.074
75/03/27	10 00		0.080	7.000	0.080K	3.600	4.100		
75/04/17	10 15		0.050	4.800	0.075	3.500	3.700		
75/05/23	10 00		0.050	6.600	0.057	3.200	3.800		
75/06/27	09 45		0.125	39.000	0.225	3.800	6.800		

K VALUE KNOWN TO BE
 LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

221161 PD221161 P003000
32 46 30.0 092 24 20.0 4
FARMERVILLE
22 15 FARMERVILLE
D/LAKE D'ARBONNE 101791
LAKE D'ARBONNE
11EPALES 00001004
0000 FEET DEPTH CLASS 00

/AM8NT/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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/07/10	11 00								
CP(T)-			0.440	3.400	0.050K	0.990	1.310		
74/07/10	16 00								
74/09/10	11 00		0.960	10.500	1.100	2.200	4.000		
74/10/14	11 15		1.260	18.000	5.900	5.100	6.800		
74/11/12	11 00		1.440	6.500	0.310	1.000	2.000		
74/12/10	10 00		1.680	5.600	0.076	0.980	1.950		
75/01/14	10 30		1.760	3.500	0.320	0.430	0.840		
75/02/11	11 00		1.360	3.400	0.080K	0.670	1.300		
75/03/12	10 00		1.360	4.400	0.480	0.930	1.100		
75/04/08	11 00		1.680	15.500	0.430	0.320	5.500		
75/05/13	10 00		1.250	2.900	0.320	0.845	1.400		
75/06/20	10 15		0.150	11.500	0.670	3.200	4.400		
75/07/08	11 30		0.275	14.500	2.200	3.300	4.300		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

2211DA P02211DA P001600
 32 49 00.0 092 39 00.0 4
 BERNICE
 22 15 BERNICE
 T/M FORK BAYOU D'ARBONNE 101791
 LAKE D'ARBONNE
 11EPALES 00001004
 0000 FEET DEPTH CLASS 00

/AMBNT/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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/07/09	09 15		0.040	7.400	0.050K	3.450	4.200		
74/09/10	10 00		0.040	17.500	1.100	4.700	6.000		
74/10/08	10 00		0.116	8.600	0.170	3.100	4.200		
74/11/13	16 00		0.240	11.000	0.190	2.900	3.900		
74/12/10	11 00		0.960	7.325	0.310	1.950	3.100		
75/01/14	13 15		0.400	6.500	0.410	1.400	2.400		
75/02/11	10 45		0.412	4.650	0.670	0.755	1.500		
75/03/11	10 30		0.160	5.800	0.470	0.650	1.300		
75/04/08	13 30		0.134	6.700	0.350	1.220	2.400		
75/05/13	14 30		0.050	8.000	0.450	1.850	3.200		
75/06/10	10 00		0.050	4.100	0.250	2.000	2.900		
75/07/08	10 30		0.025	15.500		3.000	3.900		

K VALUE KNOWN TO BE
 LESS THAN INDICATED

APPENDIX E
PARAMETRIC RANKINGS OF LAKES
SAMPLED BY NES IN 1974
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 INORG 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)