U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

REPORT

ON

WHITNEY RESERVOIR

BOSQUE AND HILL COUNTIES

TEXAS

EPA REGION VI

WORKING PAPER No. 668

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

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REPORT
ON
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WITH THE COOPERATION OF THE
TEXAS WATER QUALITY BOARD
AND THE
TEXAS NATIONAL GUARD
MARCH, 1977

CONTENTS

FOREWORD

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

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

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

Hugh C. Yantis, Jr., Executive Director of the Texas Water Quality Board, and John B. Latchford, Jr., Director, and the staff of the Field Operations Division 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 Thomas Bishop, the Adjutant General of Texas, and Project Officer Colonel William L. Seals, who directed the volunteer efforts of the Texas National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

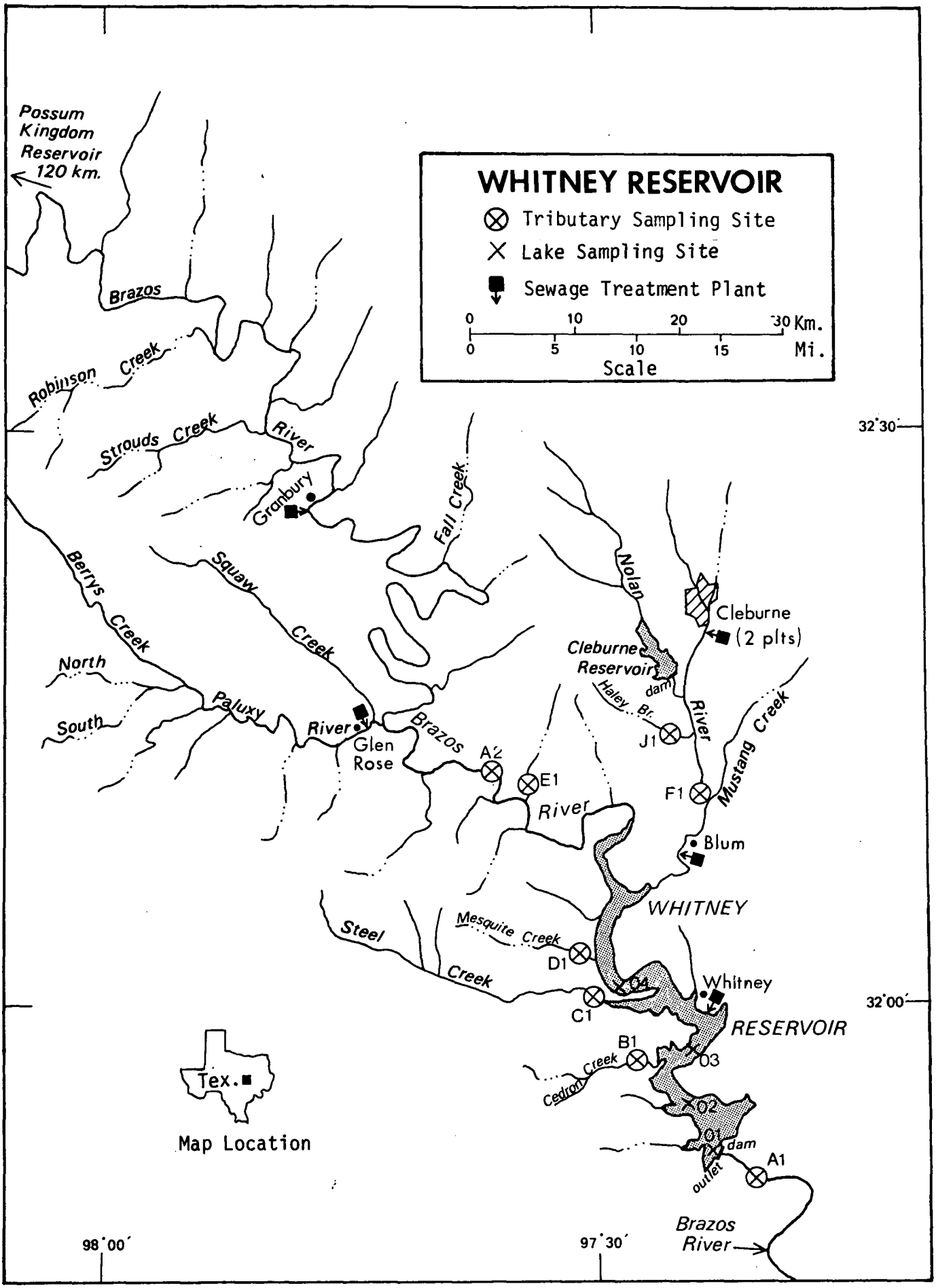
NATIONAL EUTROPHICATION SURVEY

STUDY RESERVOIRS

State of Texas

NAME	COUNTY
Amistad	Val Verde
Bastrop	Bastrop
Belton	Bell, Coryell
Braunig	Bexar
Brownwood	Brown
Buchanan	Burnet, Llano
Caddo	Harrison, Marion, TX; Caddo Parish, LA
Calaveras	Bexar
Canyon	Comal
Colorado City	Mitchell
Corpus Christi	Jim Wells, Live Oak, San Patricio
Diversion	Archer, Baylor
Eagle Mountain	Tarrant, Wise
Fort Phantom Hill	Jones
Houston	Harris
Kemp	Baylor
Lake O'The Pines	Camp, Marion, Morris, Upshur
Lavon	Collin
Lewisville (Garza-Little Elm)	Denton
Livingston	Polk, San Jacinto, Trinity, Walker

Lyndon B. Johnson	Burnet, Llano
Medina	Bandera, Medina
Meredith	Hutchinson, Moore, Potter
O. C. Fisher (San Angelo)	Tom Green
Palestine	Anderson, Cherokee, Henderson, Smith
Possum Kingdom	Palo Pinto, Stephens, Young
Sam Rayburn	Angelina, Jasper Nacogdoches, Sabine, San Augustine
Somerville	Burleson, Lee, Washington
E. V. Spence	Coke
Stamford	Haskell
Stillhouse Hollow	Bell
Tawakoni	Hunt, Rains, Van Zandt
Texoma	Cooke, Grayson TX; Bryan, Johnston, Love, Marshall, OK
Travis	Burnet, Travis
Trinidad	Henderson
Twin Buttes	Tom Green
White River	Crosby
Whitney	Bosque, Hill
Wright Patman (Texarkana)	Bowie, Cass


WHITNEY RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Plant
0 10 20 30 Km.
0 5 10 15 Mi.
Scale
Possum Kingdom Reservoir 120 km.
Brazos
Robinson Creek
Strouds Creek
River
Granbury
Fall Creek
Nolan
Cleburne
(2 plts)
Cleburne Reservoir
dam
Haley Br.
River
Mustang Creek
Berrys Creek
Squaw Creek
North
South
Paluxy
River
Glen Rose
Brazos
A2
E1
River
J1
F1
Blum
WHITNEY
Steel
Creek
Mesquite Creek
D1
C1
Whitney
RESERVOIR
B1
Cedron Creek
03
02
01
dam
outlet
A1
Brazos River
Tex.
Map Location
32°30'
32°00'
98°00'
97°30'

WHITNEY RESERVOIR

STORET NO. 4839

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Whitney Reservoir is eutrophic; i.e., well supplied with nutrients and quite productive. Whether nutrient enrichment is beneficial or deleterious depends on the actual or potential effect on the uses of the reservoir. In this regard, no nuisance conditions are known to personnel of the Texas Water Quality Board and there is little or no impairment of the designated beneficial uses of this water body.

Whitney Reservoir ranked fifteenth in overall trophic quality when the 39 Texas reservoirs sampled in 1974 were compared using a combination of six water quality parameters*. Fourteen of the reservoirs had less median total phosphorus, eight had less and two had the same median dissolved orthophosphorus, 18 had less and one had the same median inorganic nitrogen, 11 had less mean chlorophyll a, and eight had greater mean Secchi disc transparency. Marked depression or depletion of hypolimnetic dissolved oxygen occurred at all sampling stations in May and August.

Survey limnologists noted submerged vegetation in the shallows near stations 1 and 2 in August. Reportedly, aquatic vegetation is not a problem in this reservoir, however (Anonymous, 1973).

* See Appendix A.

B. Rate-Limiting Nutrient:

The algal assay results are not considered representative of conditions in the reservoir at the time of sampling due to significant nutrient changes in the sample during shipment from the field to the laboratory. The reservoir data indicate phosphorus limitation at all stations in March and May but nitrogen limitation at all but station 1 in November.

C. Nutrient Controllability:

1. Point sources--During the sampling year, point sources contributed 9.7% of the total phosphorus load to Whitney Reservoir. The wastewater treatment plants at Cleburne contributed an estimated 5.6%, the facility at Granbury contributed an estimated 2.2%, and three other facilities, along with septic tanks serving shoreline dwellings, collectively contributed an estimated 1.9%.

The present phosphorus loading of 1.24 g/m^2/year is 1.9 times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 16), but even complete removal of phosphorus at the listed point sources would leave a loading of 1.12 g/m^2/yr. However, regardless of the applicability of Vollenweider's eutrophic level to Texas water bodies, Whitney Reservoir is phosphorus-limited much of the time, and point source phosphorus control could help slow the rate of eutrophication, particularly if a significant portion of the phosphorus export of the Nolan River proves to be controllable (see below).

2. Non-point sources--It is estimated that the phosphorus contribution of non-point sources accounted for 90.3% of the total load impacting Whitney Reservoir. The Brazos River contributed 56.2%, Nolan River contributed 31.2%, and two other gaged tributaries collectively contributed 0.5%. Ungaged minor tributaries and immediate drainage were estimated to have contributed 1.0%.

The phosphorus export rate of Nolan River was from 20 to 40 times greater than the rates of the other reservoir tributaries (see page 15). This is indicative of an underestimation of the contribution of the wastewater treatment plants at Cleburne.

II. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 95.35 kilometers^2.
2. Mean depth: 8.1 meters.
3. Maximum depth: >30.2 meters.
4. Volume: 773.519 x 10^6 m^3.
5. Mean hydraulic retention time: 0.8 years (based on 1972-1976 mean outflow).

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

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Brazos River	65,824.8	42.170
Cedron Creek	108.8	0.466
Steel Creek	233.1	0.920
Nolan River	909.1	2.870
Minor tributaries & immediate drainage -	609.0	2.350
Totals	67,684.8	48.776

2. Outlet -

Brazos River	67,780.2**	45.890

C. Precipitation***:

1. Year of sampling: 91.4 centimeters.
2. Mean annual: 87.6 centimeters.

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† Table of metric conversions--Appendix B.
†† At conservation pool; Barrows, 1977.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of reservoir.
*** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Whitney Reservoir was sampled four times in 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at four stations on the reservoir (see map, page vi). 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 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 depths sampled were 30.2 meters at station 1, 22.3 meters at station 2, 21.9 meters at station 3, and 12.8 meters at station 4.

The sampling results are presented in full in Appendix D and are summarized in the following table (the August nutrient samples were not preserved properly and were not analyzed).

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR WHITNEY LAKE
STORET CODE 4839

PARAMETER	1ST SAMPLING (3/ 8/74) 4 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (5/16/74) 4 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (8/13/74) 4 SITES RANGE	MEAN	MEDIAN
TEMP (C)	10.5 - 17.4	14.0	13.6	16.9 - 26.0	22.7	23.5	19.2 - 28.3	26.6	27.1
DISS OXY (MG/L)	6.0 - 12.9	9.1	9.3	1.0 - 7.8	4.5	5.0	0.0 - 7.5	4.2	5.6
CNDCTVY (MCROMO)	1470. - 1670.	1567.	1575.	1660. - 2006.	1848.	1843.	1870. - 2619.	2255.	2226.
PH (STAND UNITS)	7.8 - 8.3	8.1	8.2	7.4 - 8.3	7.8	7.7	7.5 - 8.6	8.0	8.0
TOT ALK (MG/L)	124. - 144.	131.	128.	122. - 155.	132.	125.	******	-**********	
TOT P (MG/L)	0.018 - 0.039	0.025	0.021	0.010 - 0.132	0.028	0.017	******	-**********	
ORTHO P (MG/L)	0.004 - 0.008	0.005	0.005	0.004 - 0.016	0.008	0.008	******	-**********	
NO2+NO3 (MG/L)	0.060 - 0.090	0.074	0.080	0.020 - 0.290	0.099	0.060	******	-**********	
AMMONIA (MG/L)	0.020 - 0.220	0.055	0.040	0.020 - 0.290	0.089	0.070	******	-**********	
KJEL N (MG/L)	0.400 - 0.700	0.480	0.400	0.300 - 1.000	0.526	0.500	******	-**********	
INORG N (MG/L)	0.080 - 0.300	0.130	0.115	0.040 - 0.360	0.187	0.170	******	-**********	
TOTAL N (MG/L)	0.460 - 0.780	0.554	0.480	0.380 - 1.060	0.625	0.610	******	-**********	
CHLRPYL A (UG/L)	1.7 - 4.3	2.5	1.9	1.6 - 5.8	3.2	2.7	11.9 - 18.8	14.9	14.5
SECCHI (METERS)	1.0 - 2.7	2.1	2.4	0.7 - 2.7	1.7	1.8	1.1 - 1.8	1.6	1.7

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR WHITNEY LAKE
STORET CODE 4839

4TH SAMPLING (11/ 1/74)

PARAMETER	4 SITES RANGE	MEAN	MEDIAN
TEMP (C)	20.9 - 22.3	21.9	22.0
DISS OXY (MG/L)	2.6 - 7.6	6.6	7.2
CNDCTVY (MCROMO)	1862. - 2496.	1984.	1953.
PH (STAND UNITS)	7.3 - 8.1	7.8	7.9
TOT ALK (MG/L)	88. - 111.	102.	104.
TOT P (MG/L)	0.028 - 0.063	0.041	0.040
ORTHO P (MG/L)	0.008 - 0.032	0.017	0.016
NO2+NO3 (MG/L)	0.020 - 0.080	0.036	0.030
AMMONIA (MG/L)	0.040 - 0.330	0.134	0.075
KJEL N (MG/L)	0.500 - 0.800	0.650	0.600
INORG N (MG/L)	0.060 - 0.390	0.170	0.105
TOTAL N (MG/L)	0.520 - 0.880	0.686	0.635
CHLRPYL A (UG/L)	4.8 - 10.8	7.0	6.3
SECCHI (METERS)	0.6 - 2.2	1.6	1.9

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
03/08/74	1. Scenedesmus sp.	804
	2. Oocystis sp.	686
	3. Chroomonas sp.	356
	4. Crucigenia sp.	237
	5. Ankistrodesmus sp.	185
	Other genera	383
	Total	2,651
05/16/74	1. Scenedesmus sp.	382
	2. Tetraedron sp.	127
	3. Coelastrum sp.	32
	4. Oscillatoria sp.	32
	5. Euglena sp.	32
	Other genera	80
	Total	685
08/13/74	1. Oscillatoria sp.	2,265
	2. Lyngbya sp.	1,762
	3. Anabaenopsis sp.	1,611
	4. Diploneis sp.	1,007
	5. Pennate diatoms	705
	Other genera	2,266
	Total	9,616
11/01-04/74	1. Dactylococcopsis sp.	1,261
	2. Oocystis sp.	850
	3. Oscillatoria sp.	521
	4. Merismopedia sp.	274
	5. Tetraedron sp.	274
	Other genera	576
	Total	3,756

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
03/08/74	1	1.7
	2	2.0
	3	1.9
	4	4.3
05/16/74	1	1.6
	2	2.4
	3	3.0
	4	5.8
08/13/74	1	11.9
	2	14.4
	3	14.6
	4	18.8
11/01-04/74	1	4.8
	2	7.2
	3	5.4
	4	10.8

C. Limiting Nutrient Study:

Due to significant nutrient changes in the samples during shipment from the field to the laboratory, the algal assays are not considered representative of conditions in the reservoir at sampling time. The reservoir data indicate that phosphorus was the limiting nutrient in March and May; i.e., the mean inorganic nitrogen/orthophosphorus ratios were 18/1 or greater at all stations. However, nitrogen limitation is indicated in November at stations 2, 3, and 4 (nearest the point sources), and phosphorus limitation is indicated at station 1; i.e., the mean

inorganic nitrogen/orthophosphorus ratios were 12/1 or less at stations 2, 3, and 4 and 15/1 at station 1.

Nitrogen limitation, as indicated by in-lake nitrogen to phosphorus ratios, does not necessarily mean that the trophic condition of the lake can be improved by controlling nitrogen inputs. In many cases, the apparent condition of nitrogen-limitation results from excessive phosphorus input from point sources and is often accompanied by a corresponding increase in primary production. In such cases, the reversal of the enriched condition depends upon phosphorus control, not nitrogen control.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Texas National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vi), except for the months of April and May when two samples were collected. Sampling was begun in September, 1974, and was completed in August, 1975.

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

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 shown are those measured minus point-source loads, if any.

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

The operators of the Cleburne, Granbury, Glen Rose, Blum, and Whitney wastewater treatment plants did not participate in the Survey; nutrient loads from these sources were estimated at 1.134 kg P and 3.401 kg N/capita/year, and flows were estimated at 0.3785 m^3/capita/day.

* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal* -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Cleburne (2 plants)	5,800	tr. filter	2,195.3	Buffalo Creek/ Nolan River
Granbury	2,300	tr. filter	870.6	Brazos River
Glen Rose	400	stab. pond	151.4	Paluxy River
Blum	450	act. sludge	170.3	Nolan River
Whitney	900	stab. pond	340.6	Whitney Reservoir

2. Known industrial - None

* Anonymous, 1971.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Brazos River	66,235	56.2
Cedron Creek	215	0.2
Steel Creek	380	0.3
Nolan River	36,740	31.2
b. Minor tributaries & immediate drainage (non-point load) -	1,220	1.0
c. Known municipal STP's -		
Cleburne	6,575	5.6
Granbury	2,610	2.2
Glen Rose	455	0.4
Blum	510	0.4
Whitney	1,020	0.9
d. Septic tanks* -	250	0.2
e. Known industrial - None	-	-
f. Direct precipitation** -	1,670	1.4
Total	117,880	100.0

2. Outputs -

Lake outlet - Brazos River 28,815

3. Net annual P accumulation - 89,065 kg.

* Estimate based on 8 campgrounds, 8 parks, and 805 lakeshore dwellings; 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) -		
Brazos River	1,260,695	75.6
Cedron Creek	10,360	0.6
Steel Creek	23,380	1.4
Nolan River	167,785	10.1
b. Minor tributaries & immediate drainage (non-point load) -	59,380	3.6
c. Known municipal STP's -		
Cleburne	19,725	1.2
Granbury	7,820	0.5
Glen Rose	1,360	<0.1
Blum	1,530	0.1
Whitney	3,060	0.2
d. Septic tanks* -	9,425	0.5
e. Known industrial - None	-	-
f. Direct precipitation** -	102,940	6.2
Total	1,667,460	100.0

2. Outputs -

Lake outlet - Brazos River 1,395,635

3. Net annual N accumulation - 271,825 kg.

* Estimate based on 8 campgrounds, 8 parks, and 805 lakeshore dwellings: see Working Paper No. 175.
** See Working Paper No. 175.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Brazos Creek	1	19
Cedron Creek	2	95
Steel Creek	2	100
Nolan River	40	185

E. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P Conc. (mg/l)	Mean Total N Conc. (mg/l)
Mesquite Creek	0.020	0.715
Camp Creek	0.022	0.767
Haley Branch	0.169	1.213

F. 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	1.24	0.93	17.5	2.9

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

"Dangerous" (eutrophic loading)	0.64
"Permissible" (oligotrophic loading)	0.32

V. LITERATURE REVIEWED

Anonymous, 1971. Inventory of municipal waste facilities. EPA Publ. OWP-1, vol. 6, Wash., DC.

Anonymous, 1973. Fisheries management recommendations. Fed. Aid Proj., TX Parks & Wildlife Dept., Austin.

Barrows, David, 1977. Personal communication (reservoir morphometry and hydraulic retention time). Canyon Proj. Off., Fort Worth Distr., Corps of Engrs., New Braunfels, TX.

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 CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
4801	AMISTAD LAKE	0.013	0.500	371.474	2.042	14.900	0.009
4802	BASTROP LAKE	0.022	0.090	419.917	12.392	15.000	0.007
4803	BELTON RESERVOIR	0.016	0.185	378.312	8.025	15.000	0.007
4804	BRAUNIG LAKE	0.134	0.150	461.625	22.762	14.800	0.062
4805	BROWNWOOD LAKE	0.027	0.100	470.375	4.887	14.400	0.007
4806	LAKE BUCHANAN	0.036	0.250	437.625	8.606	15.000	0.012
4807	CADDO LAKE	0.055	0.070	463.333	14.808	11.400	0.013
4808	CALAVERAS LAKE	0.038	0.060	461.667	22.500	13.000	0.007
4809	CANYON RESERVOIR	0.010	0.450	384.812	2.500	14.800	0.006
4810	LAKE COLORADO CITY	0.042	0.090	473.625	12.675	10.200	0.012
4811	CORPUS CRISTI LAKE	0.113	0.130	475.187	19.756	14.000	0.050
4812	DIVERSION LAKE	0.025	0.080	470.111	15.867	9.000	0.009
4813	EAGLE MOUNTAIN LAKE	0.024	0.070	469.625	5.662	11.000	0.008
4814	FT PHANTOM HILL LAKE	0.060	0.105	474.909	6.317	9.800	0.022
4815	GARZA LITTLE ELM RESERVO	0.045	0.380	475.782	14.156	14.600	0.018
4816	KEMP LAKE	0.023	0.110	455.000	10.217	10.400	0.007
4817	HOUSTON LAKE	0.097	0.260	486.187	16.650	12.400	0.036
4818	LAKE OF THE PINES	0.031	0.090	440.000	12.919	15.000	0.011
4819	LAVON RESERVOIR	0.063	0.180	485.333	5.400	8.800	0.018
4820	LIVINGSTON LAKE	0.196	0.555	465.469	16.112	15.000	0.128
4821	LYNDON B JOHNSON LAKE	0.042	0.420	456.500	8.100	14.900	0.013
4822	MEDINA LAKE	0.010	0.600	403.562	12.944	15.000	0.004
4823	LAKE MEREDITH	0.021	0.070	439.312	3.037	14.900	0.009
4824	PALESTINE LAKE	0.031	0.180	442.625	10.619	14.800	0.010
4825	POSSUM KINGDOM RESERVOIR	0.023	0.070	419.045	9.495	15.000	0.009
4826	SAN ANGELO RESERVOIR	0.098	0.140	481.000	24.675	10.200	0.011
4827	SAM RAYBURN RESERVOIR	0.029	0.150	439.458	6.267	15.000	0.009
4828	E V SPENCE RESERVOIR	0.036	0.080	462.583	11.775	15.000	0.008

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
4829	SOMERVILLE LAKE	0.053	0.115	473.833	24.491	13.000	0.013
4830	STAMFORD LAKE	0.073	0.060	482.714	18.457	10.600	0.012
4831	STILLHOUSE HOLLOW RESERV	0.018	0.160	406.250	3.917	15.000	0.010
4832	TAWAKONI LAKE	0.046	0.100	466.417	18.246	13.200	0.013
4833	TEXARKANA LAKE	0.106	0.120	478.500	19.119	12.400	0.030
4834	TEXOMA LAKE	0.042	0.160	451.321	12.493	15.000	0.018
4835	TRAVIS LAKE	0.018	0.250	389.913	5.595	15.000	0.007
4836	TRINIDAD	0.389	0.110	479.500	24.300	10.000	0.240
4837	TWIN BUTTES RESERVOIR	0.029	0.250	454.917	8.708	14.800	0.009
4838	WHITE RIVER RESERVOIR	0.020	0.110	434.500	4.333	15.000	0.009
4839	WHITNEY LAKE	0.028	0.120	430.500	6.912	15.000	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	INDEX NO
4801	AMISTAD LAKE	95 (36)	5 (2)	100 (38)	100 (38)	39 (14)	63 (21)	402
4802	BASTROP LAKE	79 (30)	76 (28)	82 (31)	47 (18)	17 (0)	92 (34)	393
4803	BELTON RESERVOIR	92 (35)	26 (10)	97 (37)	68 (26)	17 (0)	84 (31)	384
4804	BRAUNIG LAKE	5 (2)	42 (16)	50 (19)	8 (3)	49 (17)	5 (2)	159
4805	BROWNWOOD LAKE	66 (25)	70 (26)	29 (11)	87 (33)	58 (22)	84 (31)	394
4806	LAKE BUCHANAN	47 (18)	21 (7)	74 (28)	63 (24)	17 (0)	39 (14)	261
4807	CADDO LAKE	26 (10)	91 (33)	42 (16)	32 (12)	76 (29)	30 (10)	297
4808	CALAVERAS LAKE	45 (17)	100 (38)	47 (18)	11 (4)	67 (25)	92 (34)	362
4809	CANYON RESERVOIR	99 (37)	8 (3)	95 (36)	97 (37)	49 (17)	97 (37)	445
4810	LAKE COLORADO CITY	39 (14)	76 (28)	26 (10)	42 (16)	88 (33)	39 (14)	310
4811	CORPUS CRISTI LAKE	8 (3)	47 (18)	18 (7)	13 (5)	61 (23)	8 (3)	155
4812	DIVERSION LAKE	68 (26)	83 (31)	32 (12)	29 (11)	97 (37)	63 (21)	372
4813	EAGLE MOUNTAIN LAKE	71 (27)	91 (33)	34 (13)	79 (30)	79 (30)	76 (28)	430
4814	FT PHANTOM HILL LAKE	24 (9)	66 (25)	21 (8)	74 (28)	95 (36)	16 (6)	296
4815	GARZA LITTLE ELM RESERVO	34 (13)	13 (5)	16 (6)	34 (13)	55 (21)	21 (7)	173
4816	KEMP LAKE	76 (29)	61 (22)	55 (21)	55 (21)	84 (32)	92 (34)	423
4817	HOUSTON LAKE	16 (6)	16 (6)	0 (0)	24 (9)	72 (27)	11 (4)	139
4818	LAKE OF THE PINES	54 (20)	76 (28)	66 (25)	39 (15)	17 (0)	46 (17)	298
4819	LAVON RESERVOIR	21 (8)	29 (11)	3 (1)	84 (32)	100 (38)	21 (7)	258
4820	LIVINGSTON LAKE	3 (1)	3 (1)	39 (15)	26 (10)	17 (0)	3 (1)	91
4821	LYNDON B JOHNSON LAKE	39 (14)	11 (4)	53 (20)	66 (25)	39 (14)	30 (10)	238
4822	MEDINA LAKE	99 (37)	0 (0)	89 (34)	37 (14)	17 (0)	100 (38)	342
4823	LAKE MEREDITH	82 (31)	91 (33)	71 (27)	95 (36)	39 (14)	63 (21)	441
4824	PALESTINE LAKE	54 (20)	32 (12)	63 (24)	53 (20)	49 (17)	51 (19)	302
4825	POSSUM KINGDOM RESERVOIR	74 (28)	91 (33)	84 (32)	58 (22)	17 (0)	63 (21)	387
4826	SAN ANGELO RESERVOIR	13 (5)	45 (17)	8 (3)	0 (0)	88 (33)	46 (17)	200
4827	SAM RAYBURN RESERVOIR	59 (22)	39 (15)	68 (26)	76 (29)	17 (0)	63 (21)	322
4828	E V SPENCE RESERVOIR	50 (19)	83 (31)	45 (17)	50 (19)	17 (0)	76 (28)	321

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
4829	SOMERVILLE LAKE	29 (11)	55 (21)	24 (9)	3 (1)	67 (25)	30 (10)	208
4830	STAMFORD LAKE	18 (7)	97 (37)	5 (2)	18 (7)	82 (31)	39 (14)	259
4831	STILLHOUSE HOLLOW RESERV	88 (33)	37 (14)	87 (33)	92 (35)	17 (0)	51 (19)	372
4832	TAWAKONI LAKE	32 (12)	70 (26)	37 (14)	21 (8)	63 (24)	30 (10)	253
4833	TEXARKANA LAKE	11 (4)	51 (19)	13 (5)	16 (6)	72 (27)	13 (5)	176
4834	TEXOMA LAKE	39 (14)	34 (13)	61 (23)	45 (17)	17 (0)	21 (7)	217
4835	TRAVIS LAKE	88 (33)	21 (7)	92 (35)	82 (31)	17 (0)	84 (31)	384
4836	TRINIDAD	0 (0)	61 (22)	11 (4)	5 (2)	92 (35)	0 (0)	169
4837	TWIN BUTTES RESERVOIR	59 (22)	21 (7)	58 (22)	61 (23)	49 (17)	63 (21)	311
4838	WHITE RIVER RESERVOIR	84 (32)	61 (22)	76 (29)	89 (34)	17 (0)	63 (21)	390
4839	WHITNEY LAKE	63 (24)	51 (19)	79 (30)	71 (27)	17 (0)	76 (28)	357

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4809	CANYON RESERVOIR	445
2	4823	LAKE MEREDITH	441
3	4813	EAGLE MOUNTAIN LAKE	430
4	4816	KEMP LAKE	423
5	4801	AMISTAD LAKE	402
6	4805	BROWNWOOD LAKE	394
7	4802	BASTROP LAKE	393
8	4838	WHITE RIVER RESERVOIR	390
9	4825	POSSUM KINGDOM RESERVOIR	387
10	4835	TRAVIS LAKE	384
11	4803	BELTON RESERVOIR	384
12	4831	STILLHOUSE HOLLOW RESERV	372
13	4812	DIVERSION LAKE	372
14	4808	CALAVERAS LAKE	362
15	4839	WHITNEY LAKE	357
16	4822	MEDINA LAKE	342
17	4827	SAM RAYBURN RESERVOIR	322
18	4828	E V SPENCE RESERVOIR	321
19	4837	TWIN BUTTES RESERVOIR	311
20	4810	LAKE COLORADO CITY	310
21	4824	PALESTINE LAKE	302
22	4818	LAKE OF THE PINES	298
23	4807	CADDO LAKE	297
24	4814	FT PHANTOM HILL LAKE	296
25	4806	LAKE BUCHANAN	261
26	4830	STAMFORD LAKE	259
27	4819	LAVON RESERVOIR	258
28	4832	TAWAKONI LAKE	253

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
29	4821	LYNDON B JOHNSON LAKE	238
30	4834	TEXOMA LAKE	217
31	4829	SOMERVILLE LAKE	208
32	4826	SAN ANGELO RESERVOIR	200
33	4833	TEXARKANA LAKE	176
34	4815	GARZA LITTLE ELM RESERVO	173
35	4836	TRINIDAD	169
36	4804	BRAUNIG LAKE	159
37	4811	CORPUS CRISTI LAKE	155
38	4817	HOUSTON LAKE	139
39	4820	LIVINGSTON LAKE	91

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 TEXAS 03/16/76

LAKE CODE 4839 WHITNEY RES.

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 67780.2

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4839A1	67780.2	24.92	29.17	29.73	42.76	117.23	94.01	42.19	30.58	36.81	53.52	26.90	21.80	45.89
4839A2	65824.8	16.42	18.69	24.64	34.26	111.29	65.13	40.21	26.62	55.22	54.37	22.37	34.83	42.17
4839B1	108.8	0.651	0.623	0.453	0.765	1.472	0.311	0.156	0.051	0.144	0.453	0.244	0.272	0.466
4839C1	233.1	1.25	1.22	0.85	1.50	2.89	0.71	0.34	0.11	0.28	0.88	0.48	0.57	0.92
4839F1	909.1	1.98	2.94	2.18	5.95	9.06	4.81	0.71	0.23	0.65	2.80	1.19	1.95	2.87
4839ZZ	704.5	2.63	2.78	2.07	3.94	7.28	2.41	0.88	0.34	0.85	2.35	1.16	1.50	2.35

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 67780.2
SUM OF SUB-DRAINAGE AREAS = 67780.1
TOTAL FLOW IN = 583.33
TOTAL FLOW OUT = 549.63

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4839A1	9	74	10.930	8	0.028				
	10	74	10.081	12	18.802	20	3.087		
	11	74	198.218	9	376.614				
	12	74	25.542	7	26.363				
	1	75	28.600	11	19.001				
	2	75	121.762	8	173.865				
	3	75	39.644	5	57.483				
	4	75	64.562	4	39.927	18	113.551		
	5	75	22.172	6	24.324	19	0.0		
	6	75	131.107	11	237.012				
	7	75	19.284	12	4.276				
	8	75	24.466	19	29.166				
4839A2	9	74	12.006	7	0.878				
	10	74	97.976	12	21.124				
	11	74	181.794	16	51.537				
	12	74	13.705	7	19.482				
	1	75	24.069	27	3.256				
	2	75	103.073	2	385.109				
	3	75	35.113	25	29.733				
	4	75	43.325	12	31.149	27	13.564		
	5	75	25.089						
	6	75	112.418	10	413.426				
	7	75	13.026	12	1.671				
	8	75	29.166						

TRIBUTARY FLOW INFORMATION FOR TEXAS 03/16/76

LAKE CODE 4839 WHITNEY RES.

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
483981	9	74	0.963	8	0.0				
	10	74	0.765	12	0.006	20	0.023		
	11	74	0.368	10	3.908				
	12	74	0.119	7	0.119				
	1	75	0.096	11	0.096				
	2	75	0.850	2	2.407				
	3	75	0.156	5	0.142				
	4	75	2.265	3	0.108	18	0.249		
	5	75	0.156	6	0.130	19	0.065		
	6	75	0.156	11	0.396				
	7	75	0.051	12	0.031				
	8	75	0.023	19	0.023				
4839C1	9	74	2.039	8	0.0				
	10	74	1.642	12	0.011	20	0.048		
	11	74	0.821	10	8.353				
	12	74	0.255	7	0.255				
	1	75	0.204	11	0.204				
	2	75	1.841	8	1.076				
	3	75	0.340	5	0.311				
	4	75	4.842	3	0.232	18	0.538		
	5	75	0.340	6	0.280	19	0.139		
	6	75	0.340	11	0.878				
	7	75	0.113	12	0.068				
	8	75	0.045						
4839F1	9	74	4.729	7	0.368				
	10	74	4.899	12	0.538				
	11	74	4.955	16	2.209				
	12	74	1.359	3	1.246				
	1	75	1.189	27	0.736				
	2	75	12.063	26	1.359				
	3	75	1.472	25	0.680				
	4	75	7.051	12	4.332	29	1.756		
	5	75	3.143						
	6	75	4.446	10	71.075				
	7	75	0.538	12	0.425				
	8	75	0.074	19	0.0				
4839ZZ	9	74	10.024						
	10	74	7.504						
	11	74	6.003						
	12	74	1.756						
	1	75	1.501						
	2	75	13.762						
	3	75	2.265						
	4	75	14.980						
	5	75	3.370						
	6	75	4.134						
	7	75	0.680						
	8	75	0.161						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/03/29

483901
31 51 58.0 097 22 18.0 3
WHITNEY LAKE
48035 TEXAS

120491

11EPALES 2111202
0096 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
74/03/08	13 30	0000	12.8		108	1560	8.20	135	0.030	0.600	0.080	0.006
	13 30	0006	12.7	10.0		1525	8.20	124	0.030	0.400	0.080	0.005
	13 30	0020	12.5	9.8		1480	8.20	125	0.030	0.400	0.080	0.004
	13 30	0050	11.6	12.9		1480	8.20	126	0.040	0.400	0.080	0.005
	13 30	0070	11.0	9.5		1500	8.15	126	0.040	0.400	0.080	0.006
	13 30	0092	10.5	8.8		1470	8.05	126	0.070	0.400	0.080	0.007
74/05/16	15 00	0000	22.3		105	1916	8.00	125	0.050	0.600	0.070	0.006
	15 00	0005	22.2	7.2		1908	8.00	125	0.030	0.400	0.040	0.006
	15 00	0022	21.6	6.2		1885	7.90	125	0.050	0.400	0.060	0.007
	15 00	0030	21.3	5.0		1765	7.65	125	0.070	0.500	0.110	0.008
	15 00	0060	18.5	2.0		1703	7.40	125	0.070	0.500	0.290	0.012
	15 00	0087	16.9	1.4		1679	7.40	125	0.060	0.500	0.280	0.011
74/08/13	15 00	0000	27.5	6.6	72	2209	8.30					
	15 00	0015	27.0	6.4		2195	8.15					
	15 00	0030	26.9	5.6		2189	8.00					
	15 00	0045	26.4	0.4		2163	7.70					
	15 00	0060	24.2	0.0		2052	7.70					
	15 00	0084	19.2	0.0		1870	7.60					
74/11/01	11 00	0000	22.0	7.4	85	1956	7.85	104	0.080	0.700	0.030	0.008
	11 00	0005	21.9	7.2		1955	7.94	106	0.060	0.600	0.030	0.008
	11 00	0015	21.9	7.4		1966	7.91	107	0.070	0.600	0.040	0.010
	11 00	0040	21.9	7.6		1976	7.90	107	0.060	0.700	0.030	0.009
	11 00	0065	21.9	5.4		1960	7.85	110	0.250	0.800	0.040	0.014
	11 00	0099	21.6	2.6		2496	7.28	111	0.260	0.500	0.030	0.015

STORET RETRIEVAL DATE 76/03/29

483901
31 51 58.0 097 22 18.0 3
WHITNEY LAKE
48035 TEXAS

120491

11EPALES 2111202
0096 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
74/03/08	13	30 0000	0.021	1.7	
	13	30 0006	0.020		
	13	30 0020	0.019		
	13	30 0050	0.018		
	13	30 0070	0.021		
	13	30 0092	0.024		
74/05/16	15	00 0000	0.010	1.6	
	15	00 0005	0.012		
	15	00 0022	0.012		
	15	00 0030	0.014		
	15	00 0060	0.026		
	15	00 0087	0.037		
74/08/13	15	00 0000		11.9	
74/11/01	11	00 0000	0.028	4.8	
	11	00 0005	0.029		
	11	00 0015	0.030		
	11	00 0040	0.030		
	11	00 0065	0.033		
	11	00 0099	0.043		

STORET RETRIEVAL DATE 76/03/29

483902
31 54 33.0 097 24 14.0 3
WHITNEY LAKE
48035 TEXAS

120491

11EPALES 2111202
0070 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
74/03/08	14 30	0000	15.0		96	1640	8.30	128	0.020	0.400	0.060	0.006
	14 30	0005	14.9	10.0		1600	8.30	127	0.020	0.400	0.060	0.005
	14 30	0020	14.8	9.9		1600	8.30	128	0.020	0.400	0.060	0.005
	14 30	0040	13.1	9.4		1540	8.20	128	0.040	0.400	0.070	0.005
	14 30	0066	12.0	8.8		1535	8.10	128	0.080	0.500	0.080	0.008
74/05/16	15 25	0000	24.3		80	1990	8.20	124	0.040	0.600	0.050	0.005
	15 25	0005	24.3	7.8		1988	8.20	124	0.030	0.400	0.040	0.005
	15 25	0015	24.2	6.8		1982	8.00	125	0.050	0.400	0.060	0.007
	15 25	0030	23.5	5.2		1947	7.70	125	0.070	0.400	0.130	0.008
	15 25	0040	21.2	4.5		1843	7.50	128	0.070	0.400	0.140	0.011
	15 25	0060	18.5	2.8		1767	7.50	126	0.090	0.400	0.200	0.009
74/08/13	14 25	0000	28.3	7.4	72	2285	8.60					
	14 25	0007	27.7	7.0		2238	8.50					
	14 25	0020	27.2	6.2		2226	8.20					
	14 25	0040	27.0	2.0		2226	7.80					
	14 25	0050	26.4	0.0		2193	7.70					
	14 25	0060	24.4	0.0		2081	7.70					
74/11/04	10 30	0000	22.1	7.2	83	1872	7.95	105	0.060	0.600	0.020K	0.016
	10 30	0005	22.2	7.2		1875	8.03	105	0.050	0.600	0.020K	0.011
	10 30	0015	22.2	7.2		1874	7.99	103	0.050	0.500	0.020K	0.019
	10 30	0035	22.2	7.4		1878	7.98	101	0.040	0.600	0.020K	0.015
	10 30	0055	22.1	5.8		1877	7.95	103	0.170	0.600	0.020	0.012
	10 30	0073	21.6	3.8		2313	7.36	104	0.200	0.600	0.030	0.016

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/29

483902
31 54 33.0 097 24 14.0 3
WHITNEY LAKE
48035 TEXAS

120491

11EPALES 2111202
0070 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
74/03/08	14 30	0000	0.020	2.0	
	14 30	0005	0.020		
	14 30	0020	0.021		
	14 30	0040	0.020		
	14 30	0066	0.025		
74/05/16	15 25	0000	0.013	2.4	
	15 25	0005	0.013		
	15 25	0015	0.013		
	15 25	0030	0.013		
	15 25	0040	0.016		
	15 25	0060	0.021		
74/08/13	14 25	0000		14.4	
74/11/04	10 30	0000	0.034	7.2	
	10 30	0005	0.033		
	10 30	0015	0.032		
	10 30	0035	0.033		
	10 30	0055	0.045		
	10 30	0073	0.045		

STORET RETRIEVAL DATE 76/03/29

483903
31 57 27.0 097 23 57.0 3
WHITNEY LAKE
48035 TEXAS

120491

11EPALES 2111202
0071 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
74/03/08	15 10	0000	15.8		96	1670	8.30	128	0.030	0.600	0.060	0.005
	15 10	0005	15.6	10.0		1630	8.30	128	0.030	0.500	0.060	0.006
	15 10	0020	15.3	9.2		1620	8.25	127	0.030	0.400	0.070	0.005
	15 10	0045	13.8	8.8		1600	8.10	131	0.060	0.400	0.080	0.004
	15 10	0072	13.3	7.7		1580	8.00	132	0.090	0.600	0.080	0.006
74/05/16	15 45	0000	24.8		60	2006	8.25	124	0.040	0.500	0.020	0.004
	15 45	0005	24.8	7.6		2003	8.25	125	0.020	0.400	0.020	0.005
	15 45	0015	24.7	7.6		1996	8.15	122	0.030	0.400	0.040	0.005
	15 45	0035	24.1	5.8		1956	7.55	129	0.090	0.300	0.080	0.007
	15 45	0055	20.8	2.0		1826	7.50	132	0.120	0.500	0.160	0.007
	15 45	0066	19.4	1.6		1797	7.50	128	0.110	0.500	0.210	0.008
74/08/13	11 55	0000	28.3	7.2	60	2284	8.50					
	11 55	0010	27.6	6.4		2259	8.20					
	11 55	0025	27.2	5.2		2267	8.10					
	11 55	0040	27.1	6.6		2070	8.40					
	11 55	0050	27.0	2.0		2274	7.50					
	11 55	0065	23.9	0.6		2043	7.80					
74/11/04	10 05	0000	22.3	7.6	64	1952	8.13	107	0.080	0.800	0.020	0.026
	10 05	0005	22.2	7.4		1952	7.73	107	0.060	0.600	0.020	0.017
	10 05	0015	22.2	7.4		1954	7.95	105	0.050	0.600	0.020	0.019
	10 05	0030	22.1	7.4		1961	7.97	104	0.050	0.600	0.040	0.014
	10 05	0045	22.2	7.4		1960	7.66	104	0.060	0.500	0.020	0.020
	10 05	0066	22.1	5.6		2350	7.51	95	0.330	0.700	0.060	0.024

STORET RETRIEVAL DATE 76/03/29

483903
31 57 27.0 097 23 57.0 3
WHITNEY LAKE
48035 TEXAS

120491

11EPALES 2111202
0071 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
74/03/08	15	10 0000	0.022	1.9	
	15	10 0005	0.022		
	15	10 0020	0.021		
	15	10 0045	0.022		
	15	10 0072	0.033		
74/05/16	15	45 0000	0.017	3.0	
	15	45 0005	0.017		
	15	45 0015	0.016		
	15	45 0035	0.021		
	15	45 0055	0.025		
	15	45 0066	0.026		
74/08/13	11	55 0000		14.6	
	11	55 0016			5.0
	11	55 0020			1.0
74/11/04	10	05 0000	0.041	5.4	
	10	05 0005	0.041		
	10	05 0015	0.040		
	10	05 0030	0.038		
	10	05 0045	0.041		
	10	05 0066	0.055		

STORET RETRIEVAL DATE 76/03/29

483904
32 20 40.0 097 28 43.0 3
WHITNEY LAKE
48035 TEXAS

120491

11EPALES 2111202
0046 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
74/03/08	15 50	0000	17.4		38	1620	8.00	144	0.080	0.600	0.090	0.007
	15 50	0006	17.4	7.8		1605	8.00	144	0.070	0.500	0.080	0.004
	15 50	0020	16.9	7.6		1570	7.95	144	0.080	0.600	0.080	0.006
	15 50	0042	13.4	6.0		1520	7.75	144	0.220	0.700	0.080	0.005
74/05/16	16 15	0000	26.0		27	1760	8.00	151	0.100	0.800	0.060	0.008
	16 15	0005	25.9	6.6		1762	8.00	151	0.080	0.600	0.030	0.008
	16 15	0015	25.3	2.8		1684	7.70	155	0.190	0.700	0.050	0.012
	16 15	0025	24.6	1.0		1670	7.50	155	0.290	0.900	0.070	0.016
	16 15	0041	23.0	1.0		1660	7.50	154	0.290	1.000	0.060	0.015
74/08/13	11 15	0000	28.0	5.6	42	2479	8.50					
	11 15	0007	27.7	7.5		2512	8.40					
	11 15	0015	27.3	4.4		2557	7.95					
	11 15	0025	27.2	2.9		2583	7.70					
	11 15	0035	27.1	5.8		2619	7.70					
74/11/04	09 40	0000	20.9	6.6	24	1862	7.74	89	0.240	0.800	0.080	0.020
	09 40	0005	21.2	6.6		1866	7.74	89	0.240	0.800	0.070	0.028
	09 40	0015	21.2	6.6		1869	7.74	88	0.250	0.800	0.070	0.026
	09 40	0036	21.2	6.8		1924	7.72	91	0.240	0.700	0.060	0.032

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/08	15 50	0000	0.034	4.3	
	15 50	0006	0.038		
	15 50	0020	0.038		
	15 50	0042	0.039		
74/05/16	16 15	0000	0.036	5.8	
	16 15	0005	0.046		
	16 15	0015	0.058		
	16 15	0025	0.059		
	16 15	0041	0.132		
74/08/13	11 15	0000		18.8	
	11 15	0008			5.0
	11 15	0013			1.0
74/11/04	09 40	0000	0.052	10.8	
	09 40	0005	0.058		
	09 40	0015	0.058		
	09 40	0036	0.063		

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/03/10

4839A1
31 50 43.0 097 20 00.0 4
BRAZOS RIVER
48107 7.5 SMITHS BEND
T/WHITNEY RESERVOIR
AT END OF UNIMPROVED RD 2.8 MI SE OF DAM
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
74/09/08	09	43	0.240	0.400	0.020	0.005K	0.015
74/10/12	14	22	0.240	0.500	0.040	0.015	0.015
74/10/20	14	00	0.192	0.700	0.050	0.010	0.020
74/11/09	10	15	1.240	0.200	0.020	0.010	0.010
74/12/07	11	00	0.248	0.400	0.056	0.008	0.020
75/01/11	14	55	0.304	0.900	0.048	0.005	0.030
75/02/08	07	00	2.200	0.400	0.008	0.008K	0.010K
75/03/05	16	20	0.095	0.550	0.030	0.010	0.010
75/04/04	10	40	0.055	0.750	0.080	0.040	0.045
75/04/18	13	45	0.075	0.650	0.055	0.005K	0.020
75/05/06	16	05	0.055	0.250	0.055	0.005	0.020
75/05/19	16	48	0.050	0.600	0.020	0.010	0.020
75/06/11	15	47	0.060	0.550	0.055	0.010	0.010
75/07/12	11	02	0.030	0.800	0.030	0.010	0.020
75/08/19	17	35	0.015	1.000	0.055	0.015	0.050

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10

4839A2
32 11 45.0 097 36 20.0 4
BRAZOS RIVER
48 7.5 BRAZOS POINT
T/WHITNEY RESERVOIR
2NDRY RD BRDG 1.1 MI S OF JCT W HWY 200
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
74/09/07	11	45	0.012	0.700	0.015	0.010	0.057
74/10/12	11	05	0.040	0.400	0.020	0.005	0.020
74/12/07	11	45	0.136	0.400	0.024	0.008	0.030
75/01/27	15	15	0.136	0.600	0.040	0.008	0.010
75/02/02	10	20	0.375	0.600	0.024	0.008	0.040
75/03/25	09	30	0.020	0.500	0.030	0.010	0.020
75/04/12	13	30	0.030	1.050	0.065	0.012	0.020
75/04/27	12	13	0.025	0.550	0.035	0.005	0.010K
75/06/10	15	47	0.315	2.400	0.090	0.090	0.690
75/07/12	13	45	0.540	0.550	0.025	0.015	0.050

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10

483981
31 57 04.0 097 28 48.0 4
CEDRON CREEK
48 7.5 ALLEN BEND
T/WHITNEY RESERVOIR
TX HWY 56 BRDG 5.5 MI S OF LAKESIDE VILL
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
74/10/12	09	48	0.576	0.400	0.015	0.005K	0.010K
74/10/20	13	45	0.448	0.400	0.020	0.030	
74/11/10	10	30	0.552	0.650	0.020	0.010	0.010K
74/12/07	10	40	0.464	0.200	0.032	0.008K	0.010K
75/01/11	17	30	0.296	0.300	0.008	0.005	0.020
75/02/02	07	25	0.090	0.200	0.040	0.008K	0.010K
75/03/05	15	45	0.380	0.200	0.005	0.010	0.010
75/04/03	16	45	0.190	0.300	0.012	0.005	0.010K
75/04/18	12	05	0.240	0.250	0.012	0.005K	0.010K
75/05/06	18	00	0.270	0.575	0.050	0.010	0.080
75/05/19	16	06	0.260	0.250	0.010	0.005	0.010K
75/06/11	11	07	0.145	0.350	0.015	0.005	0.020
75/07/12	14	00	0.270	0.200	0.010	0.005K	0.010K

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10

4839C1
32 00 20.0 097 29 00.0 4
STEELE CREEK
48 BOSQUE CO MAP
T/WHITNEY RESERVOIR
TX HWY 56 BRDG 1.5 MI S OF LAKESIDE VLG
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
74/10/17	08 45		0.160	0.100	0.015	0.005K	0.010K
74/10/20	13 55		0.128	0.600	0.015	0.005	0.005
74/11/10	10 45		0.464	0.600	0.035	0.005	0.010K
74/12/07	10 55		0.464	0.900	0.008	0.008K	0.020
75/01/11	17 00		0.432	0.300	0.016	0.005K	0.030
75/02/08	07 35		0.576	0.300	0.008	0.008K	0.010K
75/03/05	15 25		0.470	0.250	0.005K	0.010	0.010
75/04/03	15 32		0.330	0.400	0.045	0.020	0.020
75/04/18	12 15		0.250	0.550	0.015	0.005K	0.010
75/05/06	18 15		0.310	0.100	0.025	0.005K	0.010
75/05/19	14 52		0.260	0.650	0.025	0.005K	0.010K
75/06/11	13 49		0.200	0.200	0.010	0.005K	0.030
75/07/12	13 00		0.180	0.400	0.015	0.005K	0.010K
75/08/19	15 55		0.055	0.350	0.030	0.020	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10

483901
32 02 50.0 097 31 12.0 4
MESQUITE CREEK
48 7.5 MORGAN
T/WHITNEY RESERVOIR
HWY 56 BRDG 214 MI NW OF JCT W HWY 927
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
74/09/08	13	45	0.012	0.600	0.010	0.020	0.030
74/10/12	09	15	0.112	0.300	0.015	0.015	0.020
74/10/20	14	16	0.088	0.600	0.015	0.010	0.020
74/11/10	11	00	0.336	0.700	0.015	0.025	0.025
74/12/07	11	05	0.480	0.600	0.072	0.016	
75/01/11	16	35	0.500	0.600	0.032	0.010	0.010
75/02/08	07	45	0.780	0.100K	0.008K	0.016	0.016
75/03/05	15	15	0.470	0.850	0.010	0.010	0.010
75/04/03	15	15	0.230	0.600	0.025	0.010	0.010
75/04/18	11	45	0.185	0.250	0.010	0.015	0.030
75/05/06	18	25	0.190	0.300	0.050	0.017	0.030
75/05/19	15	30	0.130	0.250	0.020	0.005K	0.010K
75/06/11	13	30	0.110	0.630	0.015	0.010	0.030
75/07/12	13	30	0.110	0.200	0.010	0.005	0.010K
75/08/19	15	42	0.010	0.400	0.015	0.005	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10

4839E1
32 12 12.0 097 33 49.0 4
CAMP CREEK
48 7.5 BRAZOS POINT
T/WHITNEY RESERVOIR
2NDRY RD BRDG 0.1 MI E OF FREELAND
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
74/09/07	12	25	0.080	0.400	0.020	0.005K	0.005K
74/10/12	11	20	0.352	0.400	0.020	0.005K	0.010K
74/11/16	10	00	0.384	0.300	0.015	0.005K	0.010K
75/01/27			0.200	0.300	0.032	0.008K	0.010K
75/02/16	14	20	0.200	1.200	0.048	0.008K	0.010K
75/03/25	09	20	0.300	0.250	0.060	0.005	0.010K
75/04/12	13	00	0.200	0.600	0.015	0.005K	0.040
75/04/29	12	00	0.270	0.250	0.040	0.005K	0.010K
75/06/10	00	03	0.290	1.100	0.050	0.030	0.110
75/07/12	14	00	0.390	0.200	0.095	0.005K	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10

4839F1
32 10 29.0 097 23 22.0 4
NOLAN RIVER
48 7.5 BLUM
T/WHITNEY RESERVOIR
HWY 174 BRDG 1.5 MI NE OF JCT W HWY 933
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
74/09/07	13	45	1.000	1.100	0.085	0.510	0.570
74/10/12	12	50	2.240	0.500	0.035	0.760	0.780
74/11/16	10	45	1.200	0.900	0.105	0.410	0.470
74/12/03	12	45	1.100L	0.200	0.112	0.432	0.500
75/01/27	13	30	1.540	0.900	0.048	0.720	0.750
75/02/26	10	48	0.256	0.700	0.032	0.016	0.040
75/03/25	10	10	1.200	0.850	0.050	0.430	0.460
75/04/12	14	30	0.850	0.900	0.090	0.125	0.170
75/04/29	13	00	1.100	0.400	0.050	0.460	0.480
75/06/10	00	01	0.340	2.750	0.045	0.090	0.760
75/07/12	13	20	0.260	1.250	0.070	0.005	0.020

STORET RETRIEVAL DATE 76/03/10

4839J1
32 14 03.0 097 24 10.0 4
HALEY BRANCH
48 7.5 BLUM
T/WHITNEY RESERVOIR
2NDRY RD XING 0.25 MI N OF JCT W HWY 916
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
74/09/07	13	17	0.264	0.800	0.025	0.012	0.030
74/10/12	13	05	0.480	0.600	0.045	0.005	0.010
74/11/09	11	00	0.576	0.300	0.010	0.005K	0.010K
74/12/03	13	00	0.600	0.350	0.032	0.008K	0.010K
75/01/27	13	45	0.374	0.500	0.016	0.016	0.020
75/02/26	11	05	0.136	1.400	0.096	0.464	0.540
75/03/25	10	20	0.185	0.350	0.035	0.005K	0.010
75/04/12	14	00	0.250	0.450	0.055	0.005	0.010K
75/04/18	13	15	0.180	0.650	0.045	0.005K	0.010
75/06/10	00	01	0.300	1.200	0.070	0.050	0.160
75/07/12	13	00	2.100	1.300	0.050	1.000	1.050

K VALUE KNOWN TO BE
LESS THAN INDICATED