NORTHEAST LAKE

A STUDY IN URBAN ECOLOGY
PHASE I DIAGNOSTIC/FEASIBILITY STUDY

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PHASE I DIAGNOSTIC/FEASIBILITY STUDY

by

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April 1983 Herbert J. Grimshaw

SECTION I

INTRODUCTION

This report was prepared in response to Section 314-a of the Clean Water Act (P.L. 92-500) of 1977 which, upon election to participate, requires each state to trophically classify, diagnose, and restore their publicly owned freshwater lakes. The initial step in this process, the classification study, culminated in the publication in December 1980, of the "Classification of Oklahoma Reservoirs Using LANDSAT Multispectial Scanner Data." This document, the diagnostic-feasibility study of Northeast Lake, constitutes one result of compliance with the second step of this process.

An application for the participation of Northeast Lake in the third or restoration phase of the process has been submitted.

SECTION II

GENERAL SUMMARY

This study was designed to identify the cause or causes of the persistent pollution problem occurring in Northeast Lake. Results from the analysis of field and laboratory data indicated that there were three main sources of pollution enter the lake. They are as follows:

(1) stormwater runoff from city streets;

(2) raw sewage entering the lake due to overflow from clogged sewer lines in the watershed; and

(3) stormwater runoff from the Oklahoma City Zoo.

SECTION III

CONCLUSIONS

Watershed:

(1) The watershed is large in area relative to the reservoir's surface area (53:1; Figure 12, Task 10).

(2) It is an urban watershed which is 46 percent developed (Figure 12, Task 10).

(3) It is logical to infer that urbanization will continue in this watershed, and if no actions are taken, the impact of stormwater runoff on Northeast Lake will increase.

Reservoir:

(1) Blue-green algal blooms of *Microcystis spp.* occur in the summer (Table 1, Task 10).

(2) The reservoir does not thermally stratify (Figure 19, Task 10).

(3) Urban runoff caused the reservoir to become anoxic (Figures 29 and 30, Task 10).

(4) Sites 2, 8, 11, and 12 are significantly greater in total phosphorus concentrations than site 4 (at the 0.05 significance level) (Figure 37, Task 10).

(5) Site 11 had a significantly higher total nitrogen concentration than sites 4, 9, and 12 (at the 0.01 significance level) (Figure 38, Task 10).

(6) Data on water samples collected at sites 8 and 11 were determined by visual inspection to have extremely high fecal coliform levels compared to all other sample sites (Figure 40, Task 10).

(7) By comparing sites high in fecal coliform to sites high in nutrients, and using location data, we can conclude:

   (a) high total phosphorus and fecal coliform levels at site 8 were due to zoo runoff and animal waste;

   (b) high level total nitrogen, total phosphorus and fecal coliform levels at site 11 were due to sewage from a sewer line break;

   (c) the high total phosphorus level at site 12 was due to either landfill or golf course runoff; and

   (d) the high total phosphorus level at site 2 was due to its receiving road wash from Grand Boulevard and the Oklahoma City Zoo parking lot.

(8) As indicated by visual, mechanical, and Cesium analysis, there has been and continues to be a great amount of erosional material deposited in the reservoir. Most of this material originates from the stream bank which becomes scoured by rapidly flowing waters during and after storm events (Appendix 10-B).

(9) Because no agency has been designated to manage the lake, Northeast Reservoir has deteriorated to its present condition.

SECTION IV

RECOMMENDATIONS

(1) A stormwater detention pond needs to be constructed to contain Oklahoma City Zoo's runoff.

(2) A diversion canal needs to be constructed around Northeast Lake to eliminate the adverse impact of stormwater runoff on the lake.

(3) The control structure for the diversion canal needs to be designed such that complete bypass of low flow can be effected.

SECTION V

BACKGROUND INFORMATION (TASKS 1-9)

Basin Description (Task 1):

Northeast Lake, located on an unnamed tributary of the Deep Fork River, Latitude 35°, 31.4 minutes, longitude 97°, 28 minutes, Section 12, Township 12N, Range 3WIM, Oklahoma County, receives water from two major and several minor intermittent streams. Flow from springs, located on the lakes southeastern side, tends to maintain the lake at near constant volume throughout the typically dry summer and fall months.

The larger of the two major tributaries is approximately 4.14 kilometers (2.58 miles) long, flows in a northeasternly direction, and passes through Springlake Amusement Park prior to its influx into the lake, the smaller stream, approximately 520 meters (≅ 1,700 feet) in length; flows in a northernly direction and passes through the Lincoln Park Golf Course prior to entering the lake from the south. The approved state water quality standards for the lake are contained in Table 1, Task 1.

Geology and Soils (Task 2):

Northeast Lake is located within the Central Redbed Plains geomorphic province which is characterized by Red Permian shales and sandstones forming gently rolling hills and broad flat plains. Deltaic, alluvial and shallow-marine components contribute to the formation which is from 300 meters (≅ 1,000 feet) to 1400 meters (≅ 4,500 feet) thick and is underlain by a salt unit.

The Northeast Lake drainage is characterized by moderate to high permeability and low to moderate slopes. The average coefficient of permeability for near surface alluvium is 43 gpd/ft^2. The major soil type is the Darnell-Stephenville soils complex.

Public Access and Transportation to the Lake (Task 3):

Northeast Lake is accessible via both public and private transportation. United States Highway 66 and Interstate Highway 35 pass within a mile of it and Mastrans has a daily routing schedule which includes a stop at the Oklahoma City Zoo. The lake is within easy walking distance of the Zoo. Additional accessibility is provided by Lincoln Park.

Population (Task 4):

Northeast Lake lies within U.S. census tract 1061. When it is combined with census tracts 1052 and 1004, they form a rectangular area stretching from 78th and 23rd Streets in a north-south direction and from Bryant to Kelley Avenue in an east-west direction.

Table 1, Task 1. State Water Quality Standards applied to Northeast Lake.

PARAMETER	LIMIT
Physical:	
Color	75 color units
Odor	None detectable by human senses
Temperature	Can be raised no more than 3° above original
Turbidity	25 NTU
Microbiological:	
Coliform organisms	200/100 ml (monthly geometric mean)
Inorganic Elements (mg/liter):	
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Copper	1.0
Fluoride (at 95°F)	1.6
Lead	0.05
Mercury	0.002
Nitrates (as N)	10
Oxygen	Greater than 5.0
pH	6.5 to 8.5
Selenium	0.01
Silver	0.05
Zinc	5.0
Radioactive Elements (picocuries/liter):	
Radium - 226 and 228	5
Strontium - 90	8
Gross alpha particles (excluding radom and uranium)	15
Gross beta particles	50
Organic Chemicals:	
Cyanide	0.2
Detergents (total)	0.2
Methylene blue active substances	0.5
Oil and Grease	None visible
Phthalate esters	0.003
Polychlorinated biphenyls	0.0003
Pesticides (mg/liter):	
Aldrin/dieldrin	1.0
Endrin	1.0
Benzidine	1.0
Toxaphene	1.0
DDT	0.2
2,4-D	100
2,4,5-T	50

Table 1, Task 4 contains a detailed breakdown of this population with record to size and economic structure. Table 2, Task 4 provided data regarding occupation distribution.

Historical Land Uses (Tasks 5 and 6):

Construction of Northeast Lake was completed in 1908. Until the late 30's, swimming and fishing constituted the primary recreational uses of the lake. Swimming there apparently was quite popular and stimulated the subsequent construction of a sand covered swimming beach and bathhouse. Degraded water quality, presumably fecal coliform pollution resulted in closure of the swimming beach around 1945 and to date, it has never been reopened.

Presently fishing and boating constitute recreational uses of the lake. The Oklahoma City Zoo operates a stern wheeler which provides an opportunity for Zoo visiters to tour the lake. Extensive sediment accumulation within the the lake, has greatly reduced the area within which this boat can navigate.

Recreational fishing, primarily by the black population residing near the lake, now constitutes the lake's primary recreational use. This form of recreation is presently threatened by the potential for herbicidal and heavy metal contamination of the lake's fish.

Although the data for quantitative documentation is not available, observation of the lake user population indicates that Northeast Lake is heavily fished by the black population residing in th neighborhood near the lake. Based upon historical data presented in Task 5, it is apparent that the swimmer and boater components of the lake user population have already been significantly impacted by the degradation of the lake's water quality. The fishery resource is presently impacted and, it will only be a matter of time before it is completely destroyed if timely corrective action is not taken. The destruction of Northeast Lake's fishery would adversely impact individuals who utilize the fishery as a dietary protein supplement.

Lake Uses Compared to Other Lakes (Task 7):

Lake Overholser and Lake Thunderbird constitute the two most heavily visited reservoirs in the area. Lake Thunderbird is the most popular with over 3,000,000 visitors in 1980. Lake attendance data presented in this task were compiled by a variety of methods. Lake operators used different methods for each lake. Lake Thunderbird data is compiled by the Oklahoma Department of Tourism and Recreation. They derive their estimate by expanding upon a car count at access points. The other lake operators make use of permit data to derive annual attendance figures. The operator of both Shawnee Lakes is the City of Shawnee. It appears they do not separate attendance by lake. They reported the same figure for each lake. Data is presented is Table 1, Task 7.

Table 1, Task 4. Size and economic structure of the population residing near Northeast Lake.

U.S. CENSUS TRACT	POPULATION	
	SIZE*	ECONOMIC STRUCTURE**
1061	4144	17,216
1052.01	1907	16,518
1052.02	1820	15,767
1004	4949	12,797

* Oklahoma City Census Tract Population and Housing File, Office of Research and Economic Development, City of Oklahoma City, 1970-1980.

** Urban Statistical Division, R. L. Polk and Co., 1977-1978.

Table 2, Task 4. Occupational distribution of persons 18 and over by U.S. Census Tract.

Professional and Managerial	237* 18.29%	88 10.33%	54 8.64%	125 7.23%
Clerical and Sales	73 5.63%	44 5.16%	24 3.84%	78 4.51%
Skilled, Semi-Skilled and Foreman	143 11.03%	117 13.73%	98 15.68%	163 9.43%
Service, Operatives and Unskilled	251 19.37%	252 29.58%	192 30.72%	831 22.04%
No Occupation Indicated	269 20.76%	125 14.67%	140 22.40%	573 33.14%
Retired	167 12.89%	114 13.38%	55 8.80%	237 13.71%
Military and Students	76 5.86%	78 9.15%	39 6.24%	112 6.48%
Title not Classified	80 6.17%	34 3.99%	23 3.68%	60 3.47%

* Urban Statistical Division, R. L. Polk and Co., 1977-1978.

Table 1, Task 7. Reservoirs within an eighty kilometer radius of Northeast Lake.

LAKE	1980 ATTENDANCE
Springlake	N/A
Hefner	91,900
Overholser	100,200
Stanley Draper	98,800
Thunderbird	3,251,798
Fort Cobb	160,891
Chickasha	40,378
Shawnee North	21,727 combined
Shawnee South	21,727 combined
Carl Blackwell	27,835*
McMurtry	12,000
Liberty	2,937
Buthrie	3,505
Aluma	N/A*

* 1979 Data

RESERVOIRS WITHIN THE OKLAHOMA CITY CORPORATE LIMITS

Hefner
Overholser
Springlake
Stanley Draper
Aluma

RESERVOIRS WITHIN A FIVE MILE RADIUS OF NORTHEAST LAKE

Springlake
Aluma

Point Source Pollution (Task 8):

There are no industries with NPDES permits within the drainage basin of Northeast Lake. However, much of the urban drainage of Northeast Lake is commercialized. An inventory of the basin has identified 23 potential pollution sources (Table 1, Task 8).

A review of these potential pollution sources in this one lake basin of three square miles, illustrates the magnitude of unknown potential pollution sources statewide. More funding is needed to determine the actual pollution control workload in the state of Oklahoma.

Land Use (Task 9):

The areas for each land use in the watershed were calculated planimetrically from aerial photography. The total area for the watershed was calculated by using a planimeter over entire area and not by addition of land use areas. This method eliminated carry over of planimeter error. The percentages were calculated based on the addition of land use acreages totaling 1,500 acres. These data are presented in Tables 1 and 2 (Task 9).

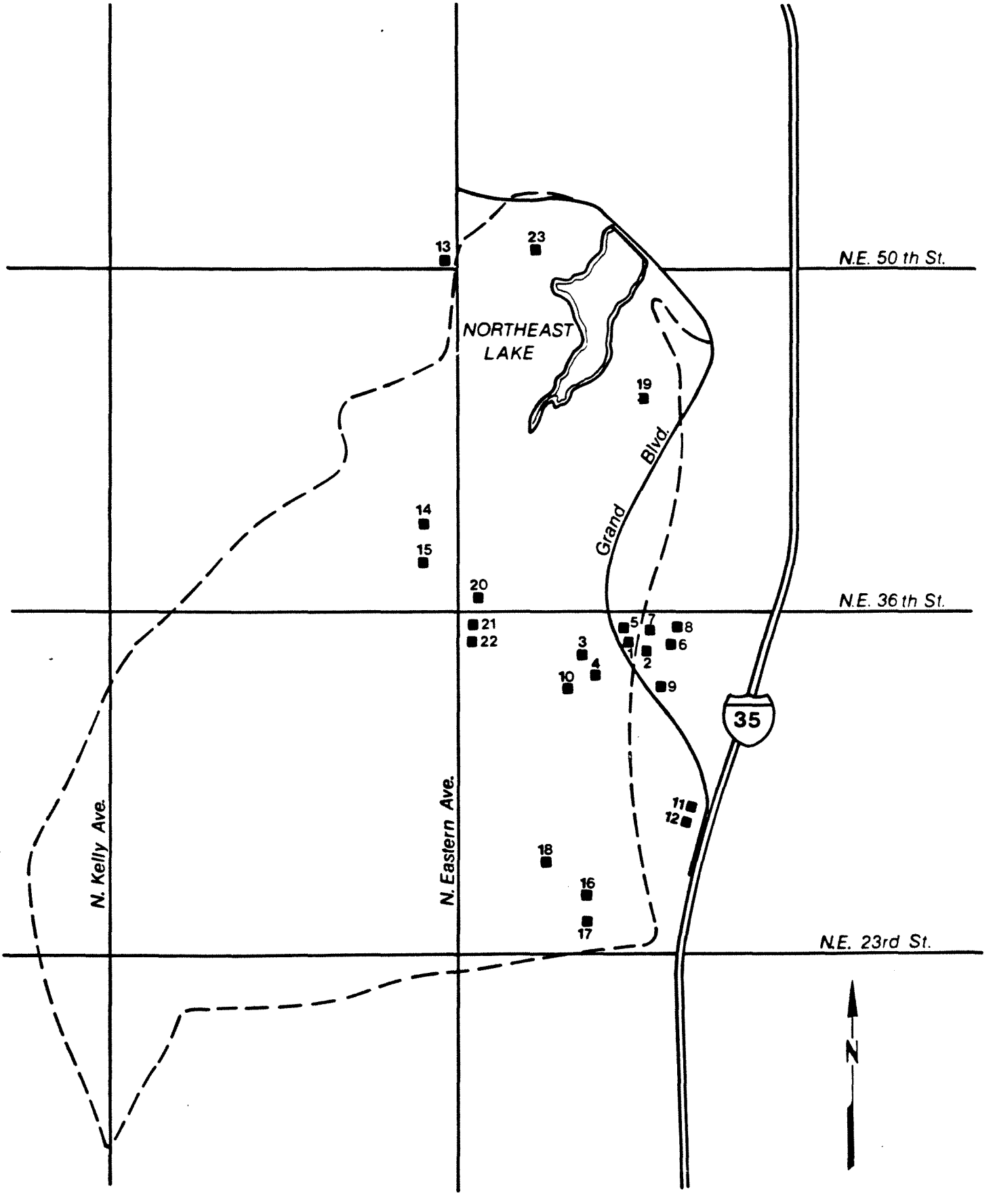
Three documents were found which relate to Oklahoma's land use-loading rate relationships. These include a masters and doctoral dissertation by W. K. Roach, and a 1968 Storm Sewer Discharge Study conducted in Tulsa, Oklahoma (Tables 3-7, Task 9). These data are unsuitable for inclusion in the Northeast Lake study. They give rough estimates of loading rates, and are not specific enough for use in restoration planning.

In addition to nutrients, runoff can contain pathogenic bacteria and viruses. Many pathogens can be found at the Oklahoma City Zoo with only one human pathogen identified (Salmonella). A list of pathogens found in association with the Zoo have been identified and are attached (Table 8, Task 9) along with the chemical equivalence of common name pesticides used by the Zoo (Table 9, Task 9). The pollution inventory indicates the pachyderm house has the greatest amount of fecal contamination with high E. coli production (Figure 1, Task 9). Some pollution originates in the Galapagos area. Periodic parasite problems are experienced from the deer, giraffe, and antelope areas. Other animal exhibits such as the cats, bears, and sea lion enclosures drain into the city sewers.

Table 1, Task 8: Potential Pollution* Sources Found in Northeast Lake Drainage Basin in Preliminary Survey.

(1) Bell Telephone Company maintenance yard
(2) Public Storage Rent A Garage
(3) Headquarters, Oklahoma Military Department, Army and Air National Guard
(4) U.S. Post Office Warehouse 3506 (possible underground gasoline storage tanks)
(5) Private Rodeo Ground and Stables, Hobby Horse Stables, Horse Motel, 3500 Grand Blvd.
(6) Pipe Yard, oilfield (near horse motel)
(7) Phillips Petroleum Company Exploration and Production, Oklahoma City, Oklahoma (high pressure pipeline) (near horse motel)
(8) Railroad Tracks (near horse motel)
(9) Southwest Paving Company, Northeast 30th and Grand, Oklahoma City, Oklahoma
(10) Oklahoma Publishing Company, Newsprint Transport, 3101 North Blvd. Place, P. O. Box 25125, Telephone 232-3311 ext-595 (underground gas tanks in vicinity)
(11) The Farm Store, Route 4 Box 370F, 2921 North Interstate 35
(12) Thermal Dynamics, Inc. (Lennox), 2917 North Interstate 35, Oklahoma City, Oklahoma, 73111, Telephone 495-0003, home office 6926 Melrose Lane
(13) Car Wash, 50th and Eastern, (across from Zoo)
(14) Parkview Jr. Academy (across from Zoo near Springlake Park)
(15) Springlake Park, Owner Dale T. Thomas (only has stormwater runoff after rain)
(16) Oklahoma City Public Schools Service Center, 2700 Mirmar (public school bus maintenance)
(17) Campus Police Training Headquarters Public Schools
(18) Oklahoma State Agency for Surplus Property (inspected twice, results of its inspection submitted in last report)
(19) Lincoln Park Golf Course
(20) Krouse Army Reserve Center, Northeast 36th and Eastern
(21) Oklahoma Department of Public Safety
(22) Mabel Bassett Correctional Institute
(23) The Oklahoma City Zoo, 2101 Northeast 50th, Oklahoma City, Oklahoma, 73111

*In 1981 it was estimated to inspect, draft, and certify a state and federal waste discharge permit for one industry costs approximately $2,180.23, to do inspections on all these sources is estimated to be $50,140.


N.E. 50 th St.
N.E. 36 th St.
N.E. 23rd St.
NORTHEAST LAKE
Grand Blvd.
N. Kelly Ave.
N. Eastern Ave.
35
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13
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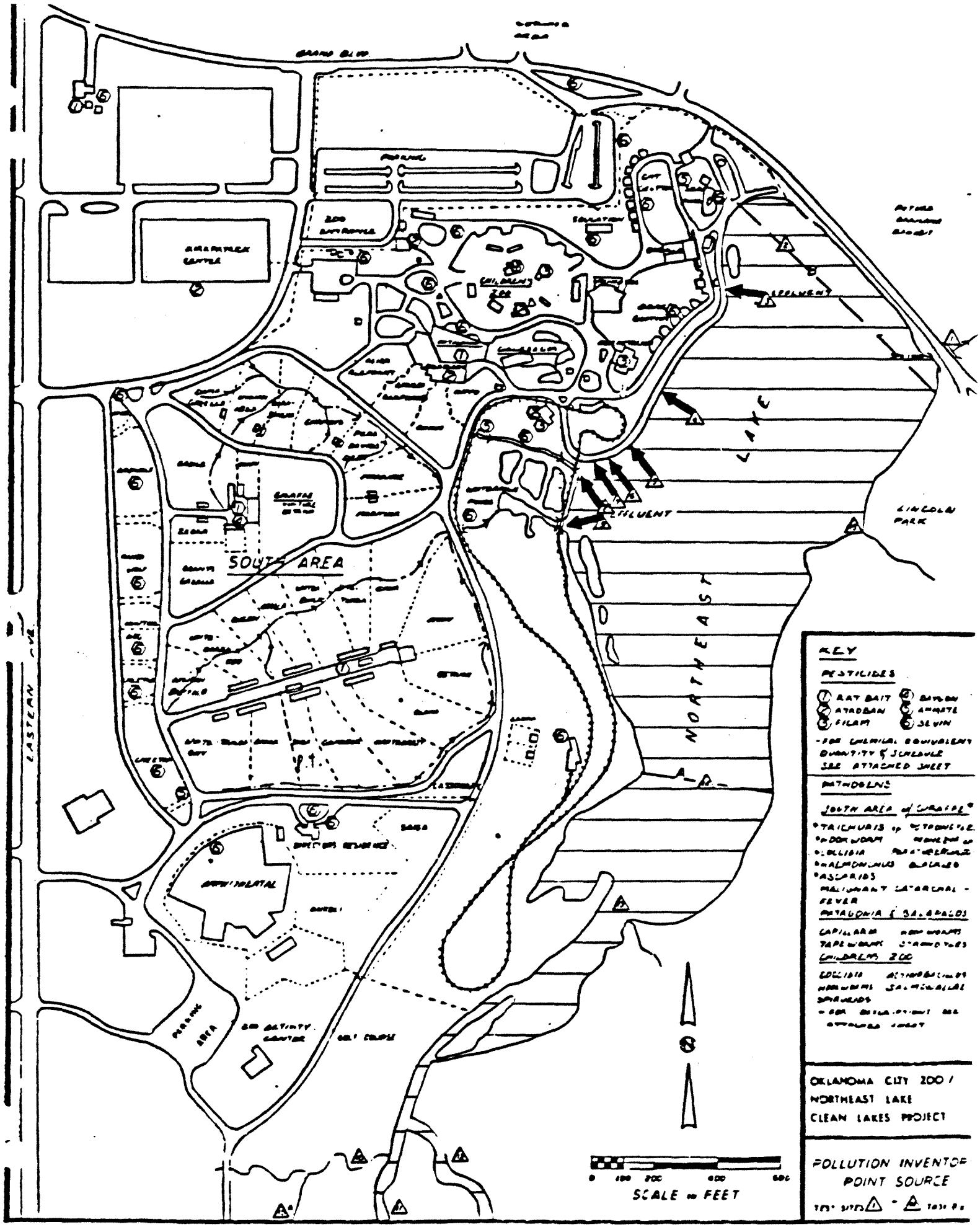

Figure 1, Task 9 Pollution Inventory Point Source

Table 1, Task 9. ~~Wasteload~~ land uses by percent

Land use	Percentage Calculations*:	Northeast Lake
Housing	40	percent
Semi-Natural	26.7	
Golf Course	14.8	
Zoo	8.9	
Dump	2.7	
Reservoir	2.3	
Landfill	2.0	
Lincoln Park	1.5	
Parking lot	0.9	
Total	99.8	percent

*Based on 1500 acres Additional Total

Table 2, Task 9 - Watershed Land Uses. Northeast Lake, Oklahoma City, Oklahoma

NORTHEAST LAKE WATERSHED LAND USE DATA*			
LAND USE CATEGORY	AREA		
	ACRES	HECTARES	SQUARE METERS
Total Area	1796	727	7.27×10^6
Housing	603	244	2.44×10^6
Semi Natural (Grass and/or Trees)	401	162	1.62×10^6
Golf Course	222	90	9×10^5
Zoo	133	54	5.4×10^5
Dump	41	17	1.7×10^5
Reservoir	34	14	1.4×10^5
Landfill	30	12	1.2×10^5
Lincoln Park	22	9	9×10^4
Asphalt Parking Lot (Spring Lake)	14	6	6×10^4

*Compiled based on March 30, 1981 data.

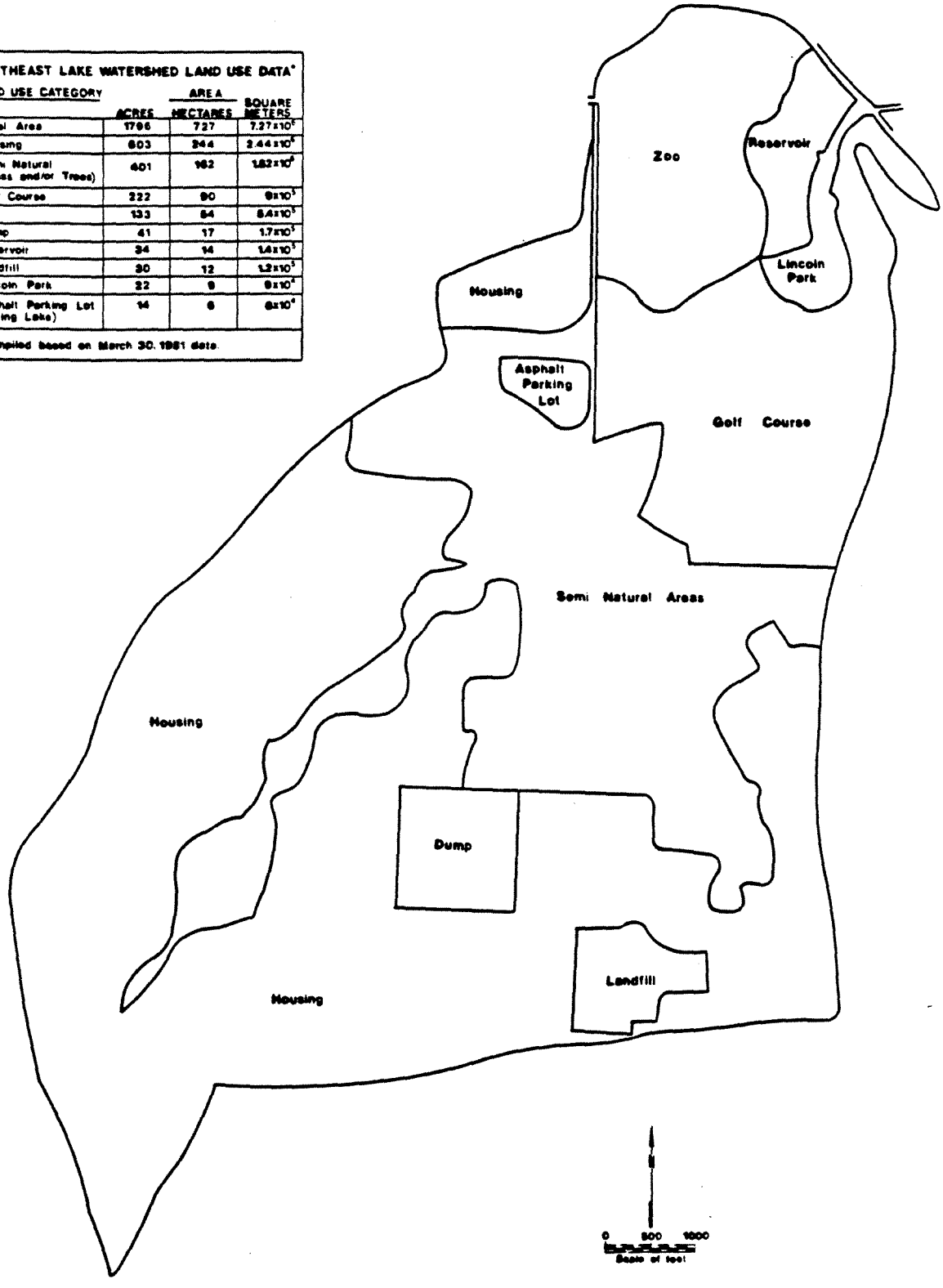

TABLE 3, TASK 9

MINIMUM, MAXIMUM, MEAN,
AND STANDARD DEVIATION FOR EACH
PARAMETER IN mg/L FOR EACH MONTH IN MOORE, OKLAHOMA*

STATION #	T-ALK	Cl	NH_4	ORG-N	COD	PO_4	NO_3	NO_2	SO_4
1U MIN	.61	2.00	0.00	0.00	16.00	.11	.03	.01	3.00
MAX	242.00	128.00	1.80	17.80	2170.00	7.56	5.58	.63	500.00
MEAN	86.41	20.63	.76	4.00	316.27	.79	1.40	.90	78.50
s	65.34	27.92	.85	4.18	456.24	1.14	.97	.11	116.39
2U MIN	6.00	2.00	0.00	1.00	20.00	.04	.01	0.00	2.00
MAX	567.00	209.00	.40	11.00	2240.00	11.90	4.93	.35	350.00
MEAN	89.00	21.84	.01	3.41	322.68	.95	.54	.01	41.58
s	142.35	36.79	.12	2.92	514.65	1.43	.73	.33	50.74
3U MIN	11.00	2.00	0.00	.80	16.00	.05	.05	0.00	3.00
MAX	534.00	230.00	2.00	9.70	1180.00	.56	17.40	.30	173.00
MEAN	81.96	35.21	1.95	3.27	142.86	.14	1.30	.05	39.61
s	114.23	55.23	2.01	4.41	235.00	.37	4.60	.21	46.25
4U MIN	13.00	2.00	0.00	1.50	13.87	.07	.05	.01	2.00
MAX	1382.00	195.00	2.60	12.88	5890.00	42.00	4.15	.40	450.00
MEAN	112.78	28.72	.24	3.69	484.88	2.70	1.51	.24	53.47
s	233.62	39.67	.31	3.41	1099.39	4.30	2.32	.72	79.73
5U MIN	22.00	2.00	0.00	1.30	19.00	.04	.01	0.00	3.00
MAX	745.00	829.00	1.10	12.90	950.00	1.11	3.57	1.18	250.00
MEAN	116.19	86.74	.54	2.84	108.90	.42	1.16	.17	54.44
s	136.93	164.11	.85	2.14	143.46	.24	.73	.29	63.93
6U MIN	107.00	13.00	0.00	0.00	12.00	.01	.05	0.00	45.00
MAX	517.00	420.00	0.00	0.00	232.00	.93	183.00	.05	320.00
MEAN	289.46	151.54	0.00	0.00	97.70	.30	25.71	.03	90.92
s	152.85	155.74	0.00	0.00	72.18	.28	60.91	.01=2	53.07

* Data from a masters thesis by W. K. Roach, 1975. Note: information with regard to sample size is not provided.

Table 4, Task 9. Legal Decription, Location, and Station Number of sample sites utilized in the 1975 study by W. K. Roach.

STATION No. -- LOCATION	LEGAL DESCRIPTION
1U -- N.E. 12th and Broadway	SE¼, SW¼, SW¼, Section 11, Township 10N, Range 3WIM
2U -- Pizza Hut	SW¼, SW¼, SE¼, Section 10, Township 10N, Range 3WIM
3U -- N.W. 5th City Park	SE¼, SW¼, NE¼, Section 15, Township 10N, Range 3WIM
4U -- Telephone Road City Park	SE¼, SE¼, NE¼, Section 15, Township 10N, Range 3WIM
5U -- Highway 37 at Church	SW¼, SE¼, SE¼, Section 15, Township 10N, Range 3WIM
6U -- S.W. 19th and Telephone Rd.	NE¼, NE¼, NE¼, Section 27, Township 10N, Range 3WIM

Table 5, Task 9. Land use and drainage above each sampling station in the 1975 study by W. K. Roach.

	BASIC LAND USE (Percent of total area) SAMPLING STATION											
	1U	2U	3U	4U	5U	6U	1R	2R	3R	4R	5R	6R
Agriculture	0	0	0	0	0	5	45	40	44	50	20	25.3
Pasture	0	0	0	0	0	10	30	40	25	25	55	30
Timer	0	0	0	0	0	0	5	10	5	20	5	20
Residential	70	80	55	80	65	50	10	5	4	1	2	0.5
Commercial	10	0	10	2	5	5	0	0	2	0.1	3	0.2
Paved	20	10	15	10	20	15	10	0	4	3	5	7
Park Areas	0	10	20	3	5	10	0	0	5	0.7	10	15
Institutional	0	0	0	5	5	5	0	0	1	0.2	0	3

SAMPLING STATION	AREA (SQ. MILES)	DRAINAGE (STAS. ABOVE)
1U	1	
2U	0.5	
3U	1	2U
4U	2.75	1U
5U	3.0	1U, 2U, 3U, 4U
6U	4.0	5U
1R	1.75	
2R	8.0	
3R	16.5	1U, 2U, 3U, 4U, 5U, 6U
4R	14.25	3R
5R	58.0	(Minus Lake Draper)
6R	21.0	1U, 2U, 3U, 4U, 5U, 6U 1R, 2R, 3R, 4R, 5R, 6R

TABLE 6, TASK 9

LOADING RATES* OF POLLUTANTS BY LAND USE IN OKLAHOMA

LOCATION	LAND USE	LOADING RATES OF VARIOUS POLLUTANTS BY LAND USE (LB/AC/YR)[1]								
		BOD	COD	SS	SO_4	$NO_2 + NO_3$	NH_3	ORG-N	TOT-N	TOT-N
Idabel	Rangeland	14.25	34.52	74.89	20.55	.33	.51	1.74	2.45	.22
	Pasture	16.52	56.23	34.31	8.68	.71	.82	1.93	1.80	.68
	Cropland	20.19	57.14	269.00	13.49	5.04	1.39	2.72	11.64	.26
	Woodland(cc)	16.68	52.22	81.9	9.97	.31	.62	1.18	1.91	.14
	Woodland	14.16	56.38	60.95	18.36	1.06	.58	1.71	.23	.12
Mangum	Cropland	6.49	25.03	392.00	7.40	.07	.07	1.56	.96	.67
	Rangeland	7.25	21.71	74.85	6.22	.24	.05	.59	1.05	.24
	Pasture	.61	4.13	34.91	2.92	.02	.01	.05	.04	.10
	Heavy Agri.	.57	14.84	282.00	7.39	.08	.01	.18	.27	.20
Freedom	Cropland	6.23	40.75	666.00	24.08	.30	.11	1.88	1.67	.23
	Rangeland	4.63	16.07	140.00	3.99	.23	.09	.89	1.23	.53
	Ungrazed Range	4.51	14.90	59.34	21.02	.14	.09	.72	.97	.12
	Pasture	1.81	12.43	65.16	1.81	.10	.04	.68	.55	.14
Tahlequah	Urban	1.74	5.39	40.54	1.10	.06	.05	.11	.09	.05
	Cropland	.01	.04	.03	.02	.0004	.0005	.001	.002	.001
	Pasture	.21	2.18	3.58	.80	.03	.06	.09	.90	.01
	Rangeland	1.69	5.44	29.10	.95	.02	.08	.06	.06	.02
Muskogee	Active Mine	14.96	42.16	236.00	1446.00	54.15	2.03	1.58	32.98	.33
	Inactive Mine	10.37	32.00	44.09	642.00	16.26	1.20	1.46	2.03	.34
	Reclaimed Mine	4.18	21.12	109.60	1566.00	46.55	2.87	1.06	41.48	.15

[1] Average Values

* Data from 1978 doctoral disseration by W. K. Roach. Note: information with regard to sample size and range is not provided.

Table 7, Task 9. Concentration data obtained from a 1968 sewer discharge study conducted in Tulsa, Oklahoma.*

MEAN BOD (mg/L)	MEAN COD (mg/L)	MEAN TOTAL NITROGEN (mg/L)	MEAN TOTAL PHOSPHORUS AS P (mg/L)	MEAN SUSPENDED SOLIDS (mg/L)
11	85	0.3 - 1.5	0.2 - 1.2	247

* We have been unable to obtain a copy of this document which is referenced in W. K. Roach 1978.

Note: Information concerning sample size and range is not provided. Also, note that mean values are presented as having ranges.

Table 8, Task 9. Description of pathogens found at the Oklahoma City Zoo.

Trichuris
Hookworms
Haemonchus - Roundworms
Ascarids
Strongyles
Monezia
Capillaria
Tape worm - Flatworm
Coccidia - Protozoan parasite
Paratuberculosis
Blackleg - Bacteria pathogens
Salomella (only human pathogen)
malignant catarrhal fever - virus
Pathogenic to cattle, kudu, buffalo, gaur.
Unknown whether pathogenic in other animals.

Table 9, Task 9. Chemical equivalence of common name pesticides used by the Zoo.

Atroban:	Bendiocarb: 2,2-dimethyl-1, 3 benzodioxol-4-01 methylcarbamate
Bagon:	Isopropoxphenyl methyl carbamate
Sevin:	Carbaryl (1-naphthyl methylcarbamate)
Ficam:	Permethrin (3-phenoryphenyl), Methyl (±)-cis, trans-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropane-carboxylate
Rat Bait:	2-Diphenylacetyl-1, 3-indandione
Ammate X-NI:	Ammonium Sulfamate

Schedule of applications and quantity:

Ammate:	Average - 7 applications per year. Less than 10 lbs. of concentrate.
Bagon:	Four cases of aerosol per year or 384 oz./year.
Atroban:	Thirty applications/year. Average 15 lbs. of concentrate per year.
Sevin:	Six applications/year. Average 30 lbs. of concentrate per year.
Rat Bait:	Twenty-six applications/year. Average 75 lbs per year.
Ficam:	Twenty-six applications per week. Average 4½ lbs. of concentrate per year.

SECTION VI

LIMNOLOGICAL ANALYSIS (TASK 10)

Trophic Condition:

Northeast Lake is a small, hypereutrophic urban reservoir located near the municipal zoo in northeastern Oklahoma City. The mean annual chlorophyll a level, between 1981 and 1982, was 64.2 µg/L. During the sampling period, the chlorophyll a values ranged between 20 and 200 µg/L (Figure 1, Task 10). Carlson's Trophic State Index or TSI (1977), a measure of the trophic condition of a lake, was computed from the following formula:

$$TSI = 9.81 \times \ln(chla) + 30.6 \qquad (1)$$

When maximum mean summer chlorophyll a data were utilized, a TSI value of 82 was obtained, indicating that the reservoir was hypereutrophic.

Analysis of gross community photosynthesis over a 24-hour period during the summer (Figure 2, Task 10), indicates that photosynthesis was confined to the upper two meters of the water column. This observation is in consensus with Wetzel (1975) who states that photosynthetic activity occurs primarily in the first several meters of the water column. Total community respiration for that same population (transect b; same date) was maximal at two meters (Figure 3, Task 10). When the ratio of photosynthesis to respiration (P/R) was plotted as a function of depth (Figure 4, Task 10), a significant linear relationship emerged. P/R decreased linearly with depth according to the equation:

$$P/R = -1.17D(meters) + 3.32 \qquad (2)$$

Dissolved oxygen, percent saturation, and other data related to photosynthetic activity will be discussed in detail in the section concerning physical, chemical, and biological quality of the lake and tributaries.

Morphometric Characteristics:

At its former spillway elevation (1,098 ft. MSL), Northeast Lake has a surface area of 14 hectares (1.4×10^5 m^2). Frustrum method calculations (Lind, 1974) based upon bathymetric data (refer to section concerning bathymetric mapping) indicate the reservoir has a total volume of 2.47×10^5 m^3. The maximum depth of Northeast Lake is 3.35 meters, while its mean depth was 1.8 meters.

Hydrologic Budget:

An areal land use weighted runoff coefficient, groundwater discharge, evaporation coefficient, and empirical data from rain events were used to calculate Northeast Lake's hydrologic budget (Figure 5, Task 10). The reservoir's annual hydrologic residence time was calculated to be 0.0878 years (or 32 days). Figure 6, Task 10, relates the percentage of the Northeast Lake volume displaced as a function of rainfall within the

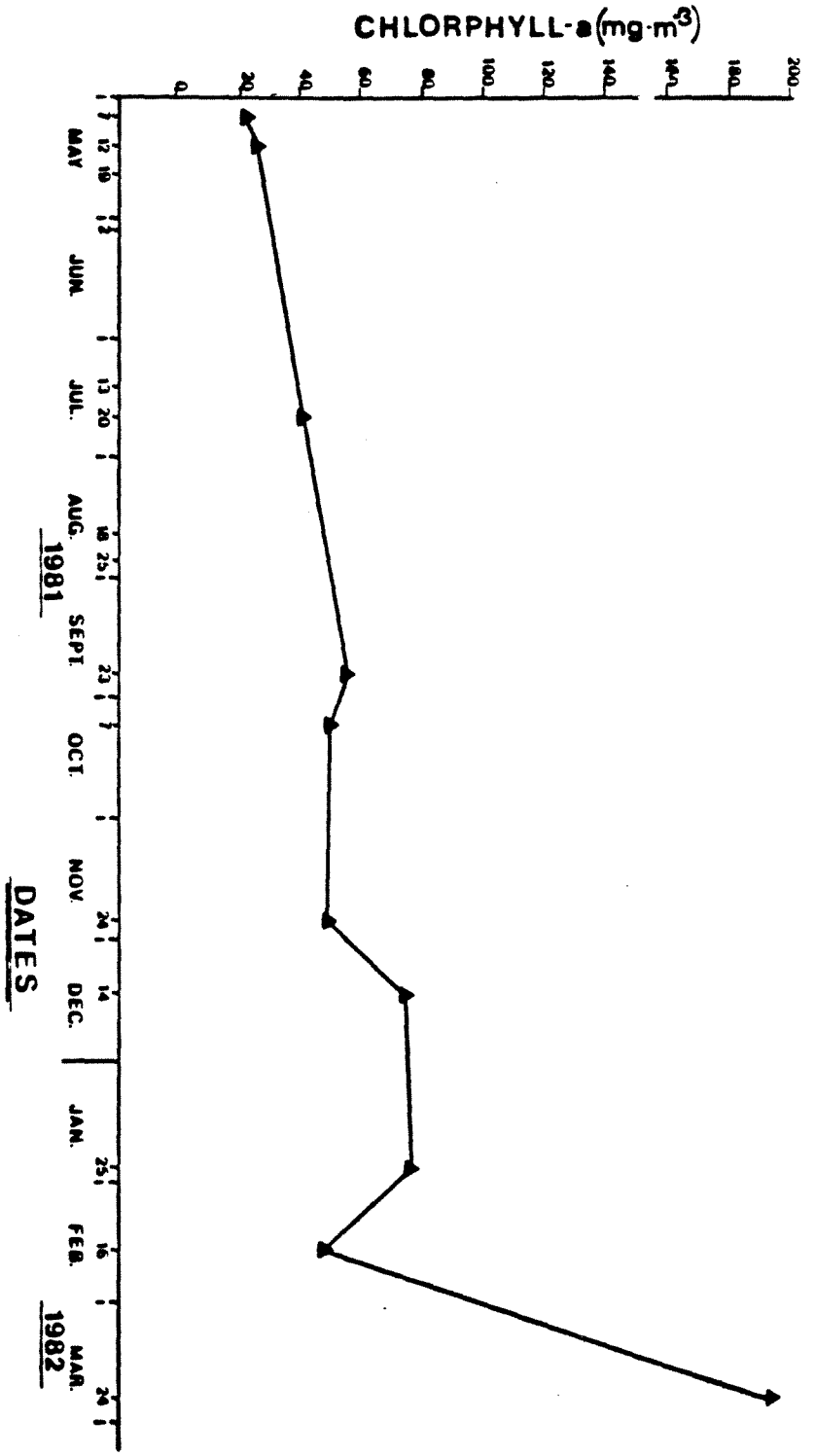

Figure 1, Task 10. Temporal variability of chlorophyll a at transect B in Northeast Reservoir.

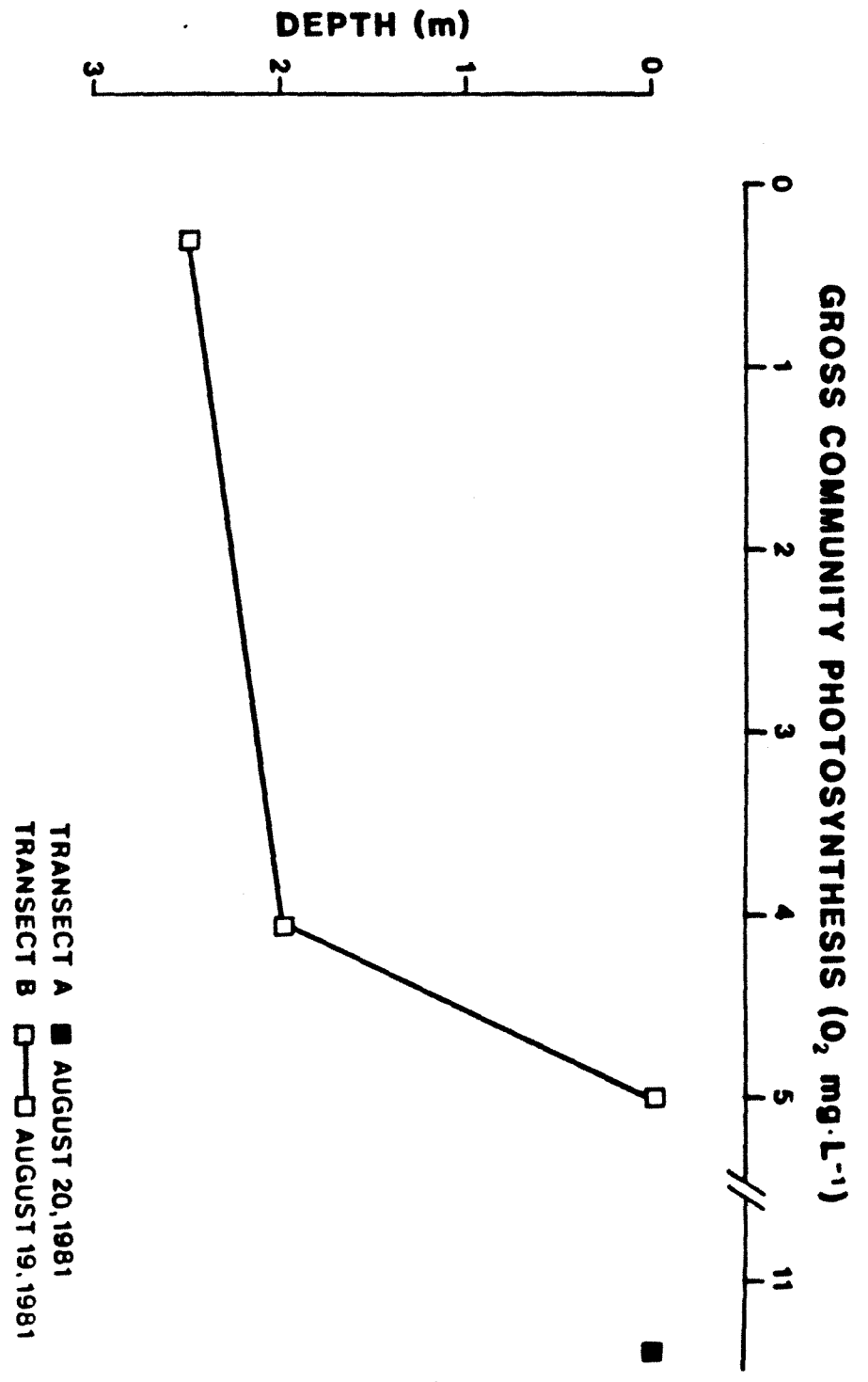

Figure 2, Task 10. Vertical gross community photosynthesis profile taken in Northeast Reservoir.

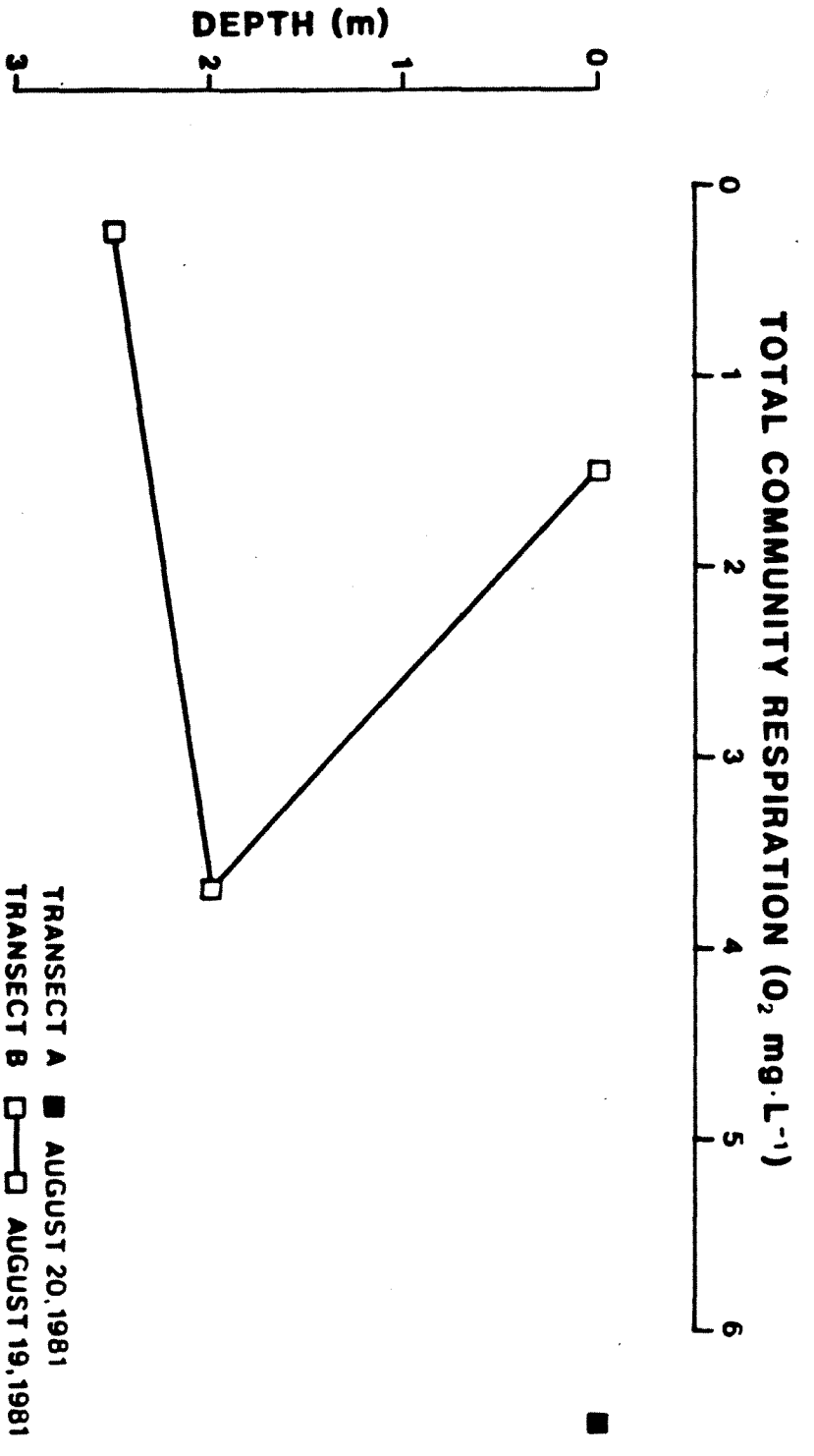

Figure 3, Task 10. Vertical community respiration profile taken in Northeast Reservoir.

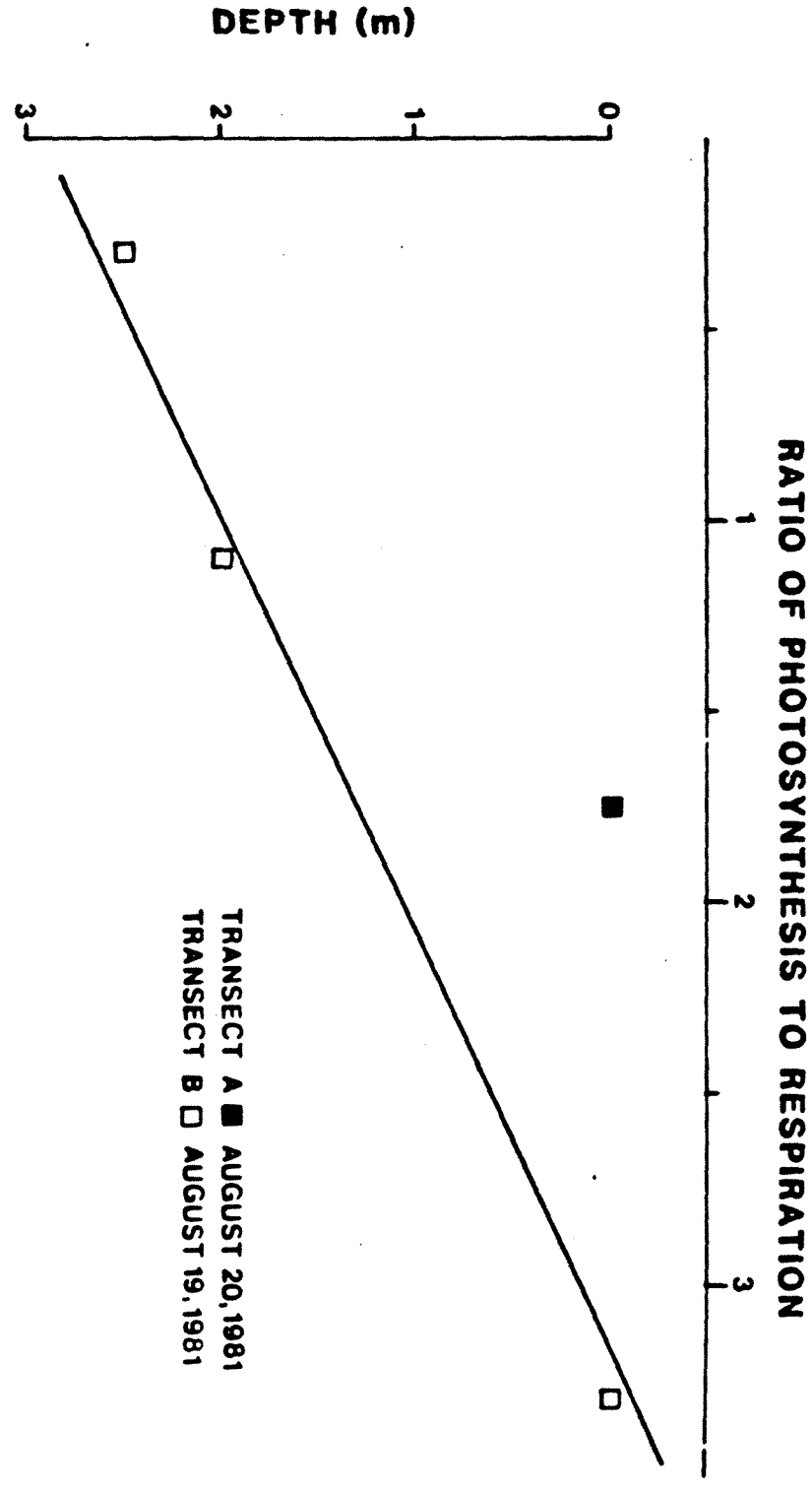

Figure 4, Task 10. Vertical profile of the ratio of photosynthesis to respiration taken in Northeast Reservoir.

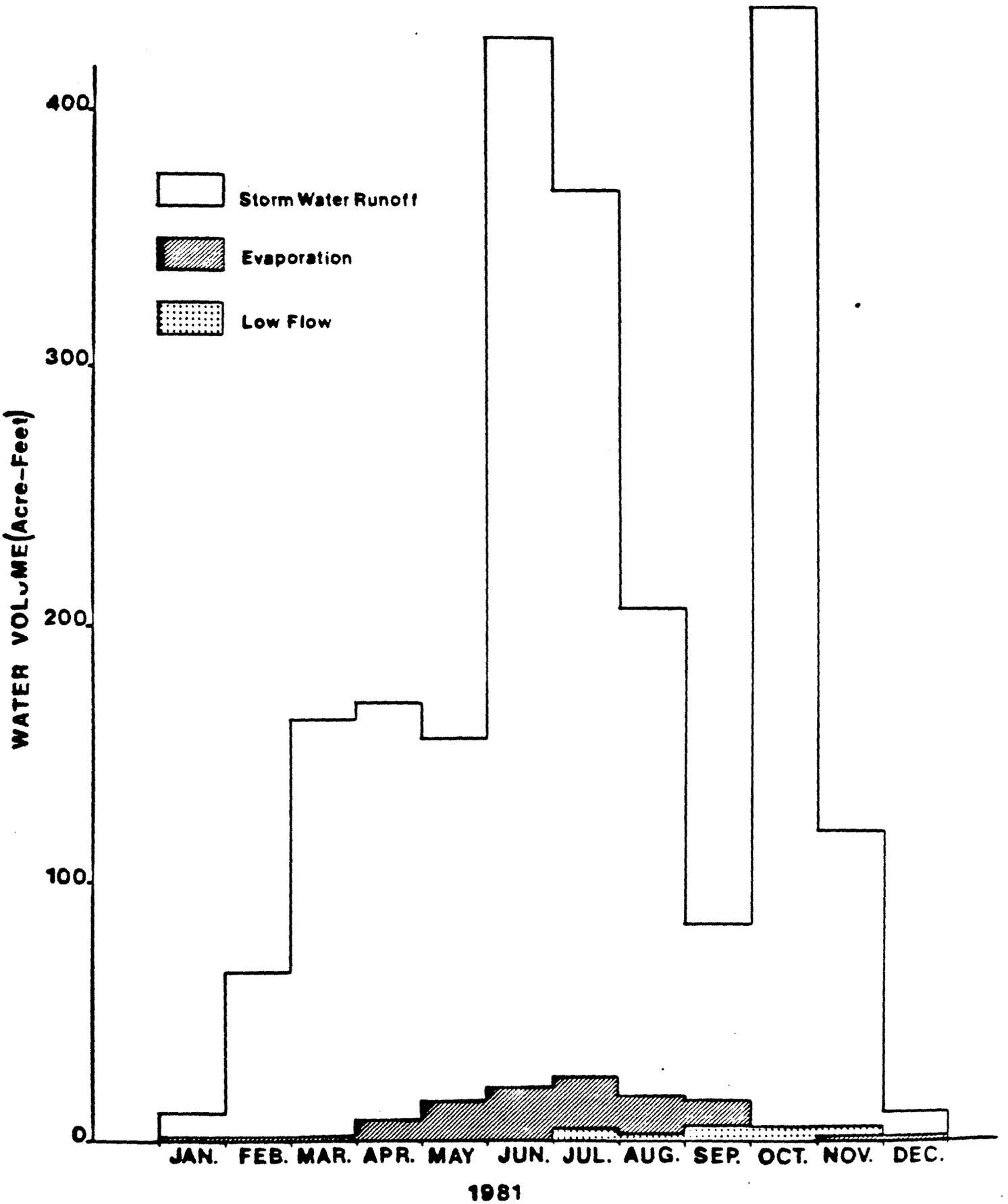

Figure 5, Task 10. Hydrologic budget for Northeast Reservoir for 1981.

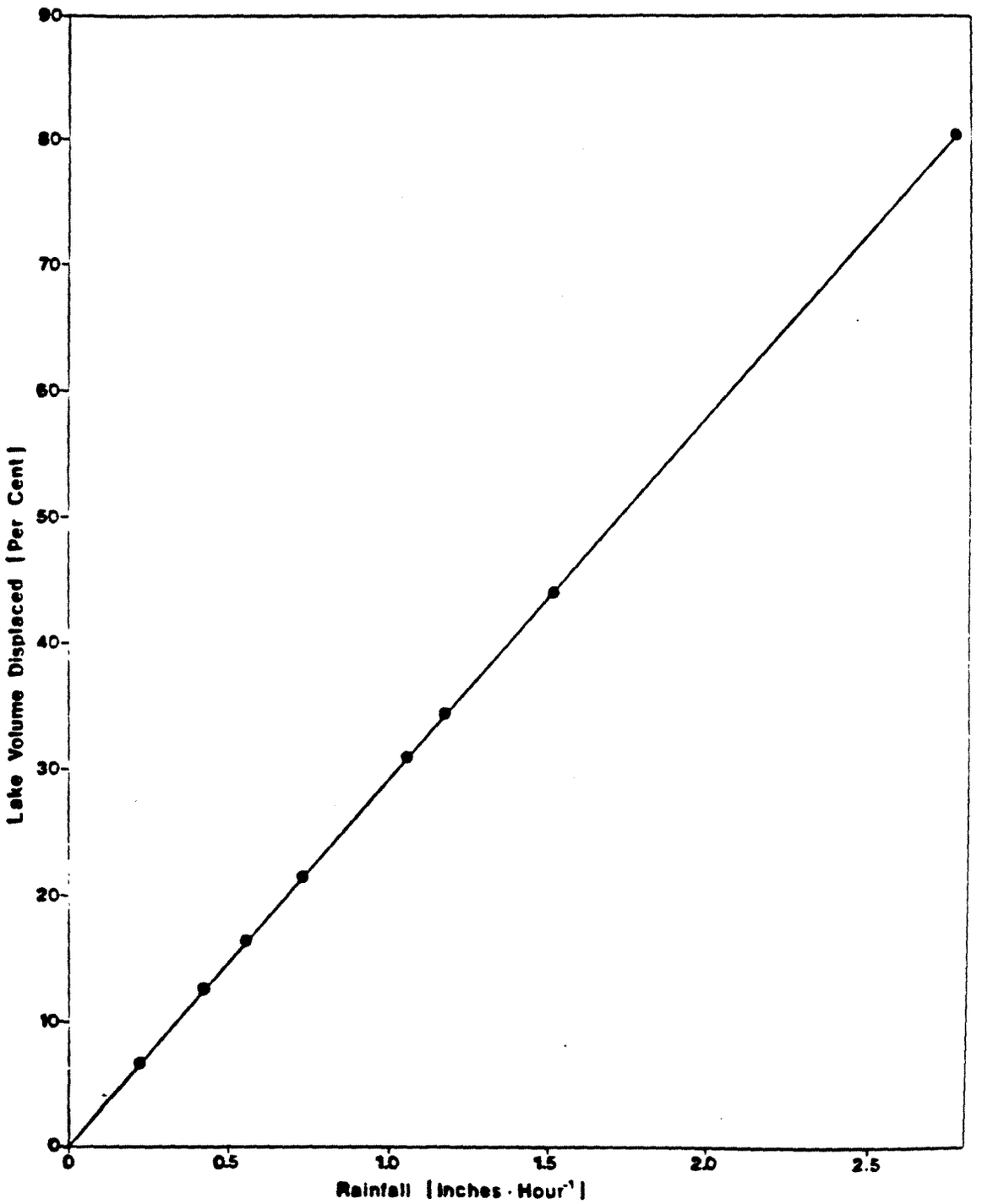

Figure 6, Task 10. Calculated relationship between rainfall and Northeast Reservoir volume displaced.

reservoir's watershed. Theoretically a 3.0 inch per hour rain event could displace 90 percent of the reservoir volume.

Five and 15 minute unit hydrographs of the Northeast Lake tributaries are displayed in Figures 7 through 10, Task 10. These figures illustrate the time course of runoff events and indicate that discharge increases rapidly to a maximum, approximately 30 minutes after the onset of the rain event and then decreases slowly.

Two years of precipitation data (1981-1982) are presented in Figure 11, Task 10. Although rainfall within the Northeast lake watershed showed a certain amount of variability (June 1982-December 1982), the data are not significantly different from the long-term data collected independently by USGS at a Site near the Northeast Lake watershed (see inset, Figure 11, Task 10). Consequently, although peak rainfall periods varied from year to year, an estimated 37 and 38.5 inches of precipitation per annum has fallen on the Northeast Lake watershed during 1981 and 1982.

Northeast Lake Watershed Land Use Data:

Planimetrically derived data on land use within the Northeast Lake watershed (based upon aerial photographs) are presented in Figure 12, Task 10. According to Uttormark (1974), lakes with a watershed area to reservoir area ratio greater or equal to 20:1 are considered eutrophic. The fact that Northeast Lake has a watershed surface area 52.8 times larger than the surface area of the reservoir itself is in agreement with this estimate of the lake's hypereutrophic condition (refer to section on trophic condition; and on physicaly, chemical, and biological quality of the alk and tributaries).

Watershed land usage constitutes a source of pollutants to Northeast Lake. Housing (residential and small business streets) comprises over 1/3 of the entire Northeast Lake watershed area. Accumulated pollutants and their subsequent impact on the reservoir, following rain events, constitutes a major aspect of the nonpoint source pollution to the lake. The golf course occupies only 12 percent of the total watershed area; however, because of the application of chemical fertilizers, insecticides, and fungicides for green maintenance and the golf course's close proximity to the lake, the potential exists for a significant nonpoint source of nutrient and heavy metal pollution to the lake. The Oklahoma City Zoo, which is adjacent to the reservoir, has a system that conducts waste effluent from the animal enclosures directly into Northeast Lake through a number of outfalls. This study indicates several of these outfalls are significant sources of pollution to the reservoir (refer to section concerning the assessment of P and N inflows and outflows and the section concerning bacteriological data). An illegal landfill and dump exists within the confines of the Northeast Lake watershed. Sewer lines under the dump were determined to be the source of high levels of fecal coliform at Site 11, while the landfill and/or golf course may have contributed to the significantly higher levels of phosphorus at Site 12.

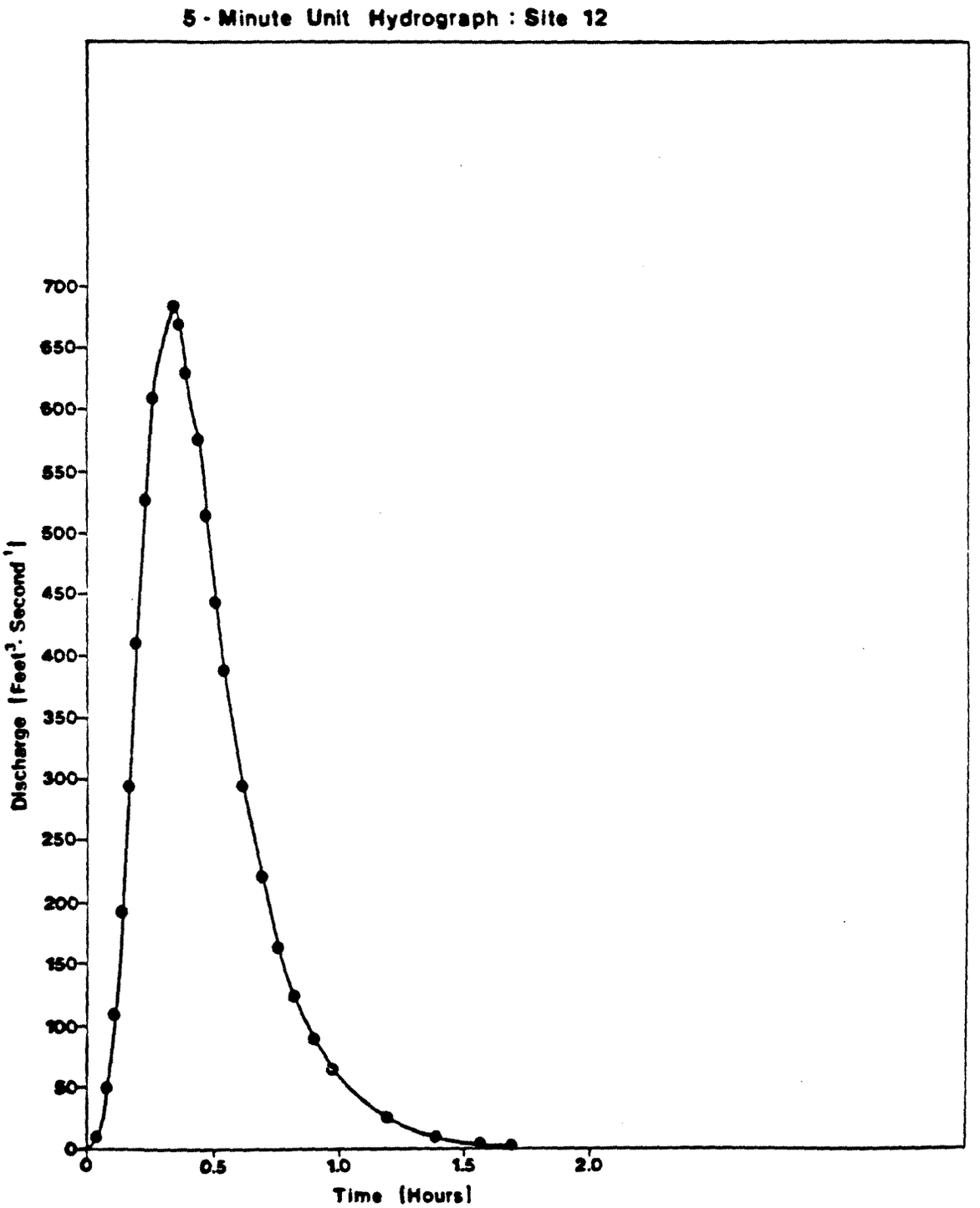

Figure 7, Task 10. 5-minute unit hydrograph for Site 12.

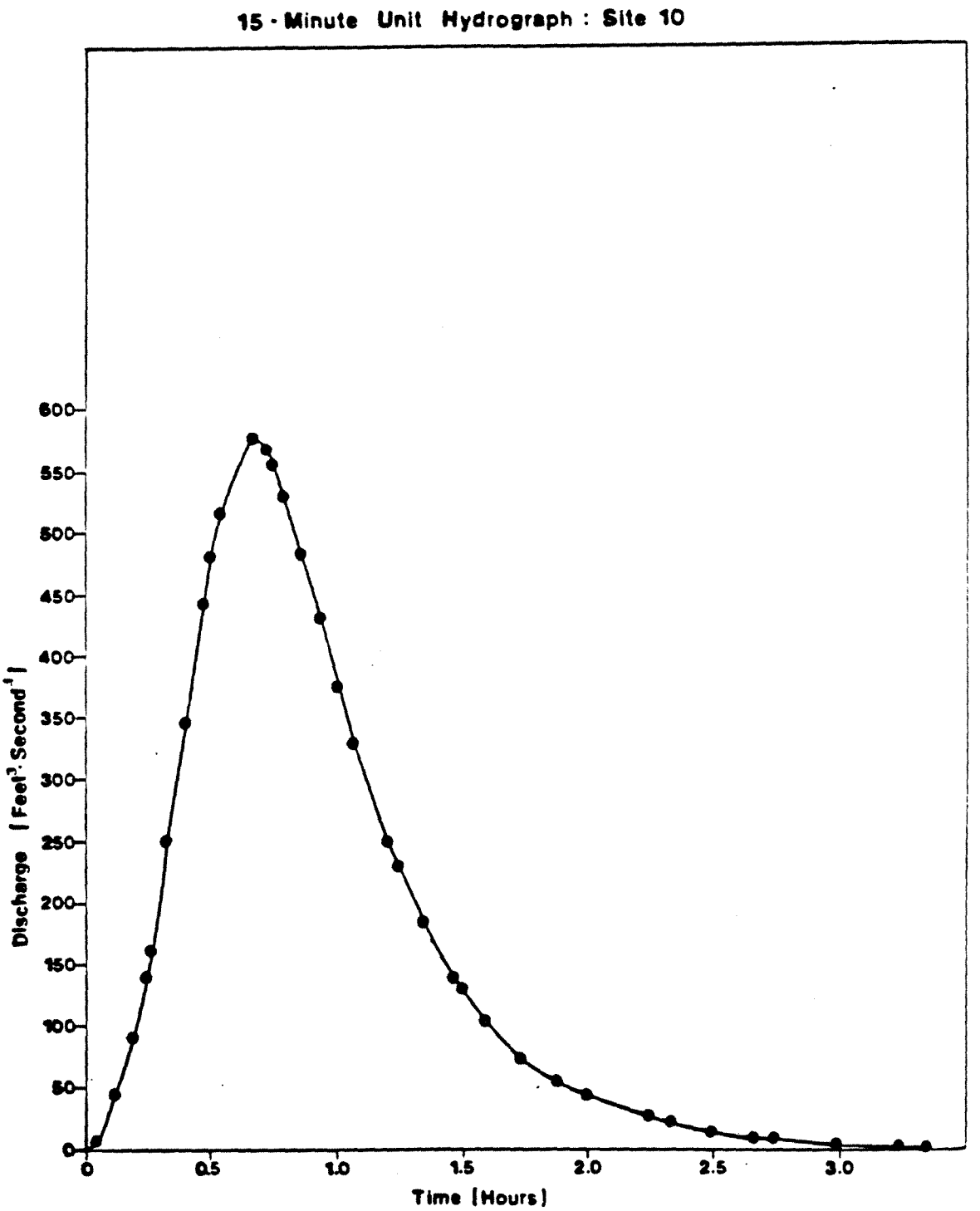

Figure 8, Task 10. 15-minute hydrograph for Site 10.

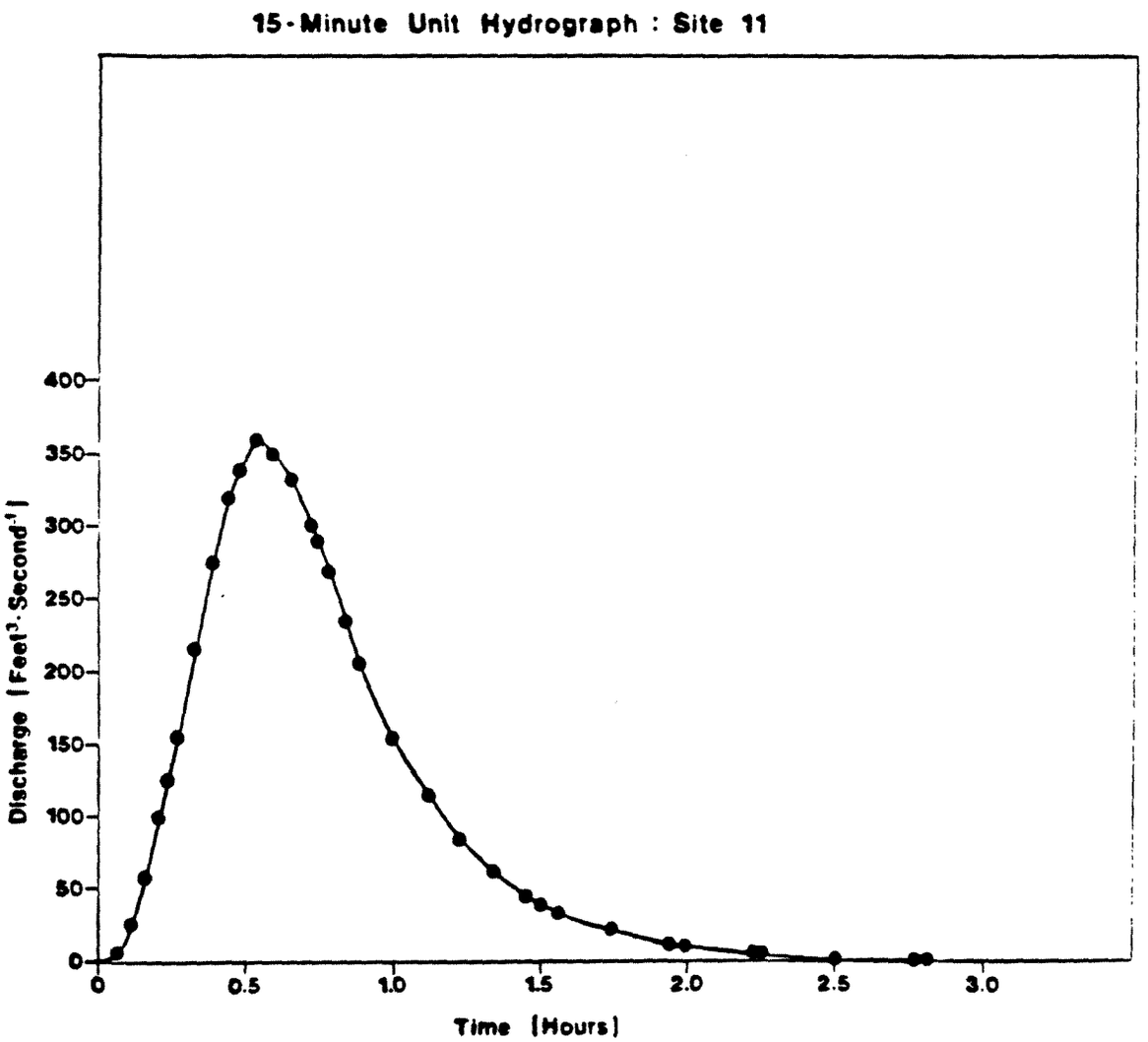

Figure 9, Task 10. 15-minute unit hydrograph for Site 11.

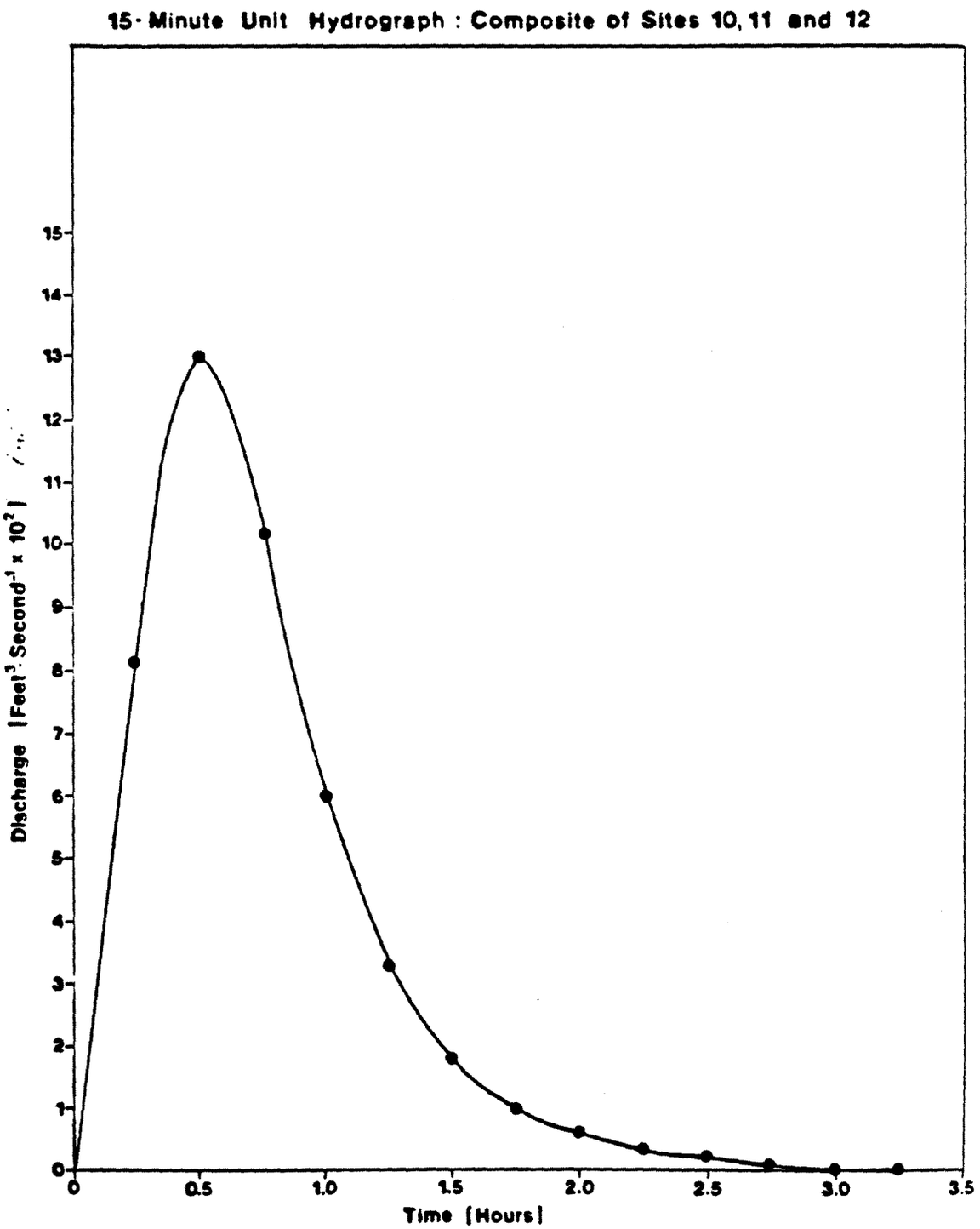

Figure 10, Task 10. Composite 15-minute hydrograph for Sites 10, 11, and 12.

Figure 11, Task 10. Monthly total precipitation in and near the Northeast Reservoir watershed.

NORTHEAST LAKE WATERSHED LAND USE DATA*			
LAND USE CATEGORY	AREA		
	ACRES	HECTARES	SQUARE METERS
.al Area	1796	727	7.27×10^6
Housing	603	244	2.44×10^6
Semi Natural (Grass and/or Trees)	401	162	1.62×10^6
Golf Course	222	90	9×10^5
Zoo	133	54	5.4×10^5
Dump	41	17	1.7×10^5
Reservoir	34	14	1.4×10^5
Landfill	30	12	1.2×10^5
Lincoln Park	22	9	9×10^4
Asphalt Parking Lot (Spring Lake)	14	6	6×10^4

*Compiled based on March 30, 1981 data

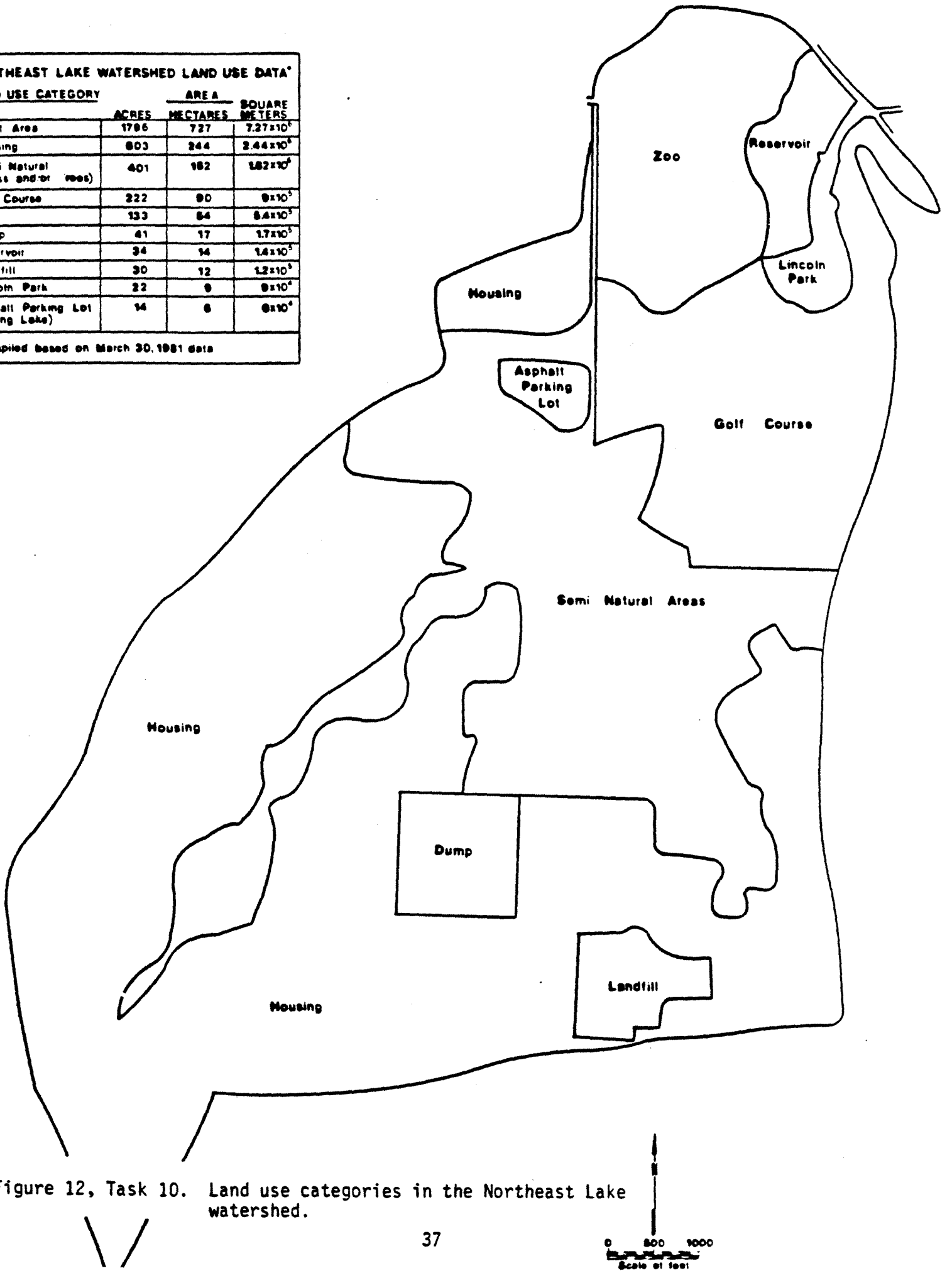

Figure 12, Task 10. Land use categories in the Northeast Lake watershed.

Physical, Chemical and Biological Quality of the Lake and Important Lake Tributaries:

Physical

Northeast Lake lies on Pleistocene deposits of the Garber Wellington formation (Figure 13, Task 10). Gamma-ray analyses of three of the four wells located in the Northeast Lake region indicate that the subsurface geology consists of interdigitating, lenticular strata of sandstone and shale (Figures 14 and 15, Task 10). These data attest to a relatively high degree of regional subsurface porosity.

Chemical

Water samples and in situ measurements were collected from 12 station Sites and two in-lake transect Sites during the course of this study (Figure 16, Task 10). Sites 2 through 9 were zoo outfalls located along a concrete wall that served as an interface between the zoo grounds and the reservoir. In-lake water collection and measurements occurred at transects A and B. Sites 10, 11, and 12 were located in the three tributaries entering the lake while the outlet from the lake was designated as Site 1. Owing to flow conditions (e.g., absence of water in a tributary or outfall), not all Sites were sampled on a consistent basis. Enough information was collected, however, to permit characterization of the reservoirs water chemistry. Water samples were analyzed for a number of parameters including: Total Nitrogen, Total Phosphates, and chlorophyll a. Field measurements were collected for water temperature, pH, dissolved oxygen, and conductivity utilizing the hydrolab model 4000.

Temperature

Figure 17, Task 10, indicates that temperature in the reservoir (surface) reached a peak in July and August 1981, fell to a low level in December 1981, and then increased towards a second peak. Surface temperatures among the various sampling Sites in and around the lake (Figure 18, Task 10) did not vary appreciably, and as expected, water temperature decreased slightly with depth (Figure 19, Task 10), although the shallow nature of the reservoir and wind mixing precluded thermal stratification.

Water pH

Figure 20, Task 10, indicates that during the 1981 sampling period, the in-lake pH fluctuated from weakly to relatively highly alkaline. The elevated pH readings during late July and August, 1981, were due to unusually high photosynthetic activity (Grimshaw, et al., 1980) as CO_2 uptake by large populations of algae caused a shift in the carbonic acid equalibria and thus elevated the pH. Spatially, the pH of the water remained relatively constant lake wide (Figure 21, Task 10), although the pH at Site 3 was unusually high. Figure 22, Task 10, illustrates that a shift in pH decreased with increasing depth. This was probably due to bacterial respiration. The concommitant disappearance of dissolved oxygen with increasing depth supports the supposition that

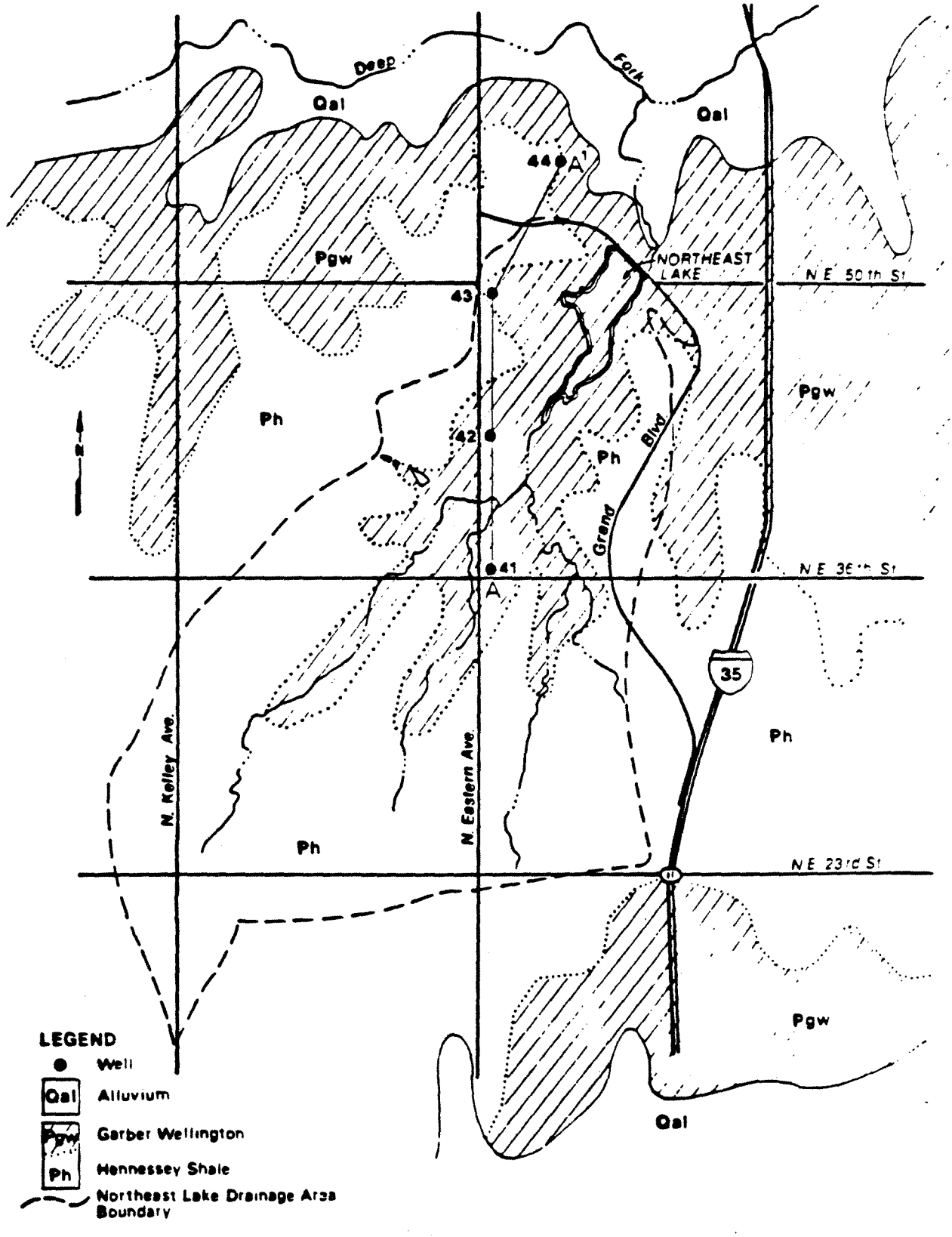

Figure 13, Task 10. Geological formations and well locations in the Northeast Lake watershed.

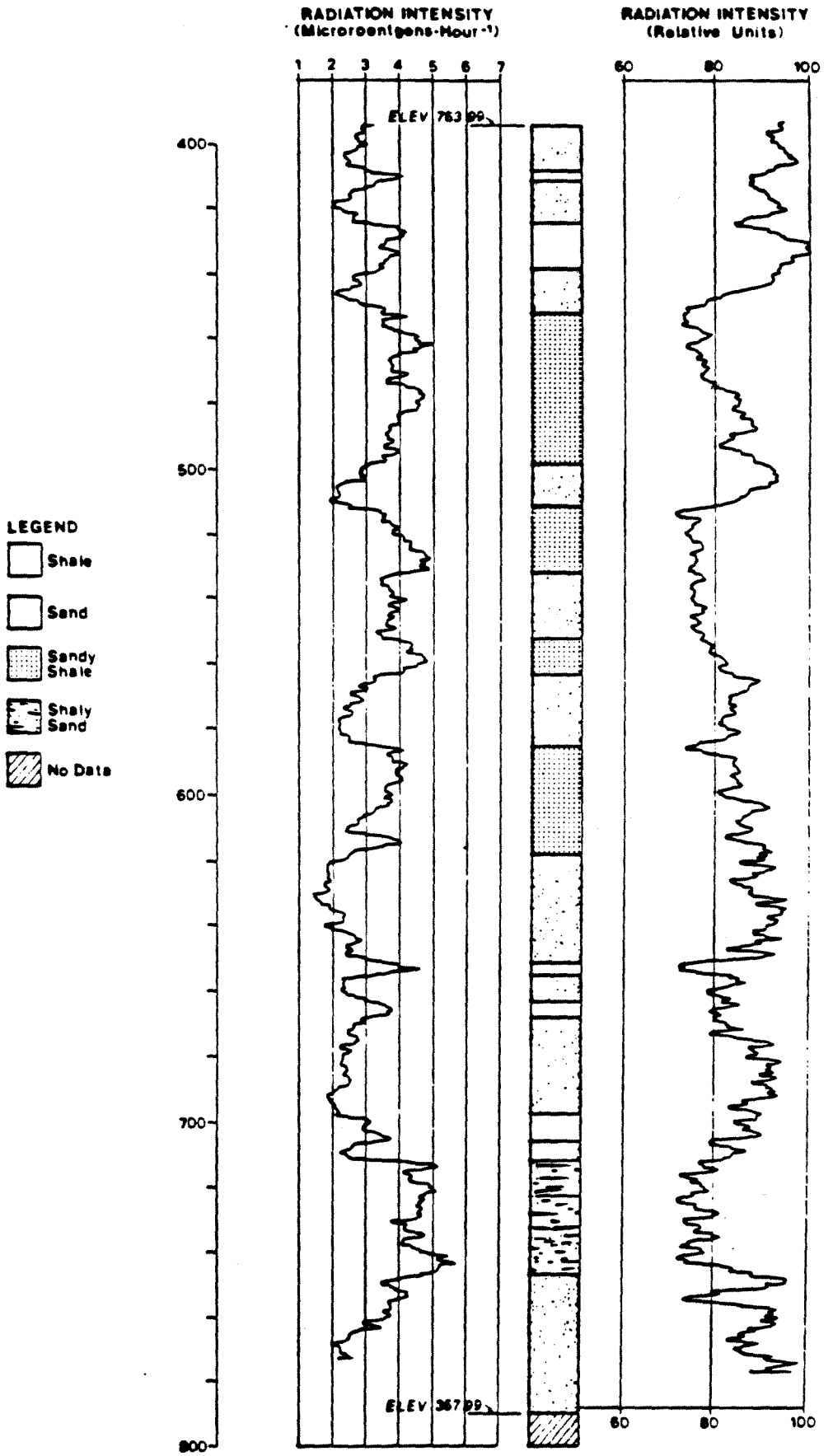

Figure 14, Task 10. Gamma-ray log analysis of well 43 in Northeast Lake watershed.

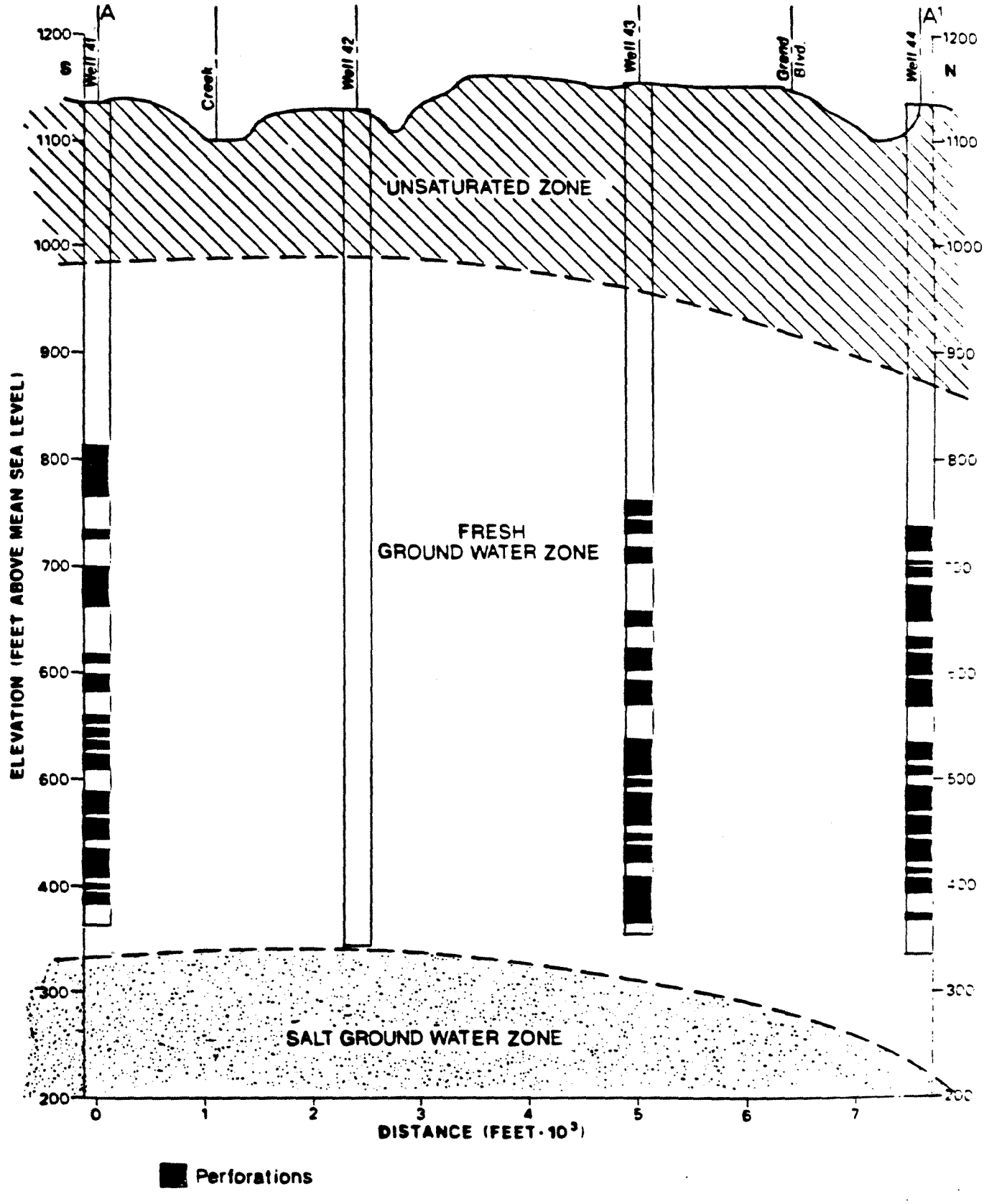

Figure 15, Task 10. Vertical stratigraph profile of wells in Northeast Reservoir.

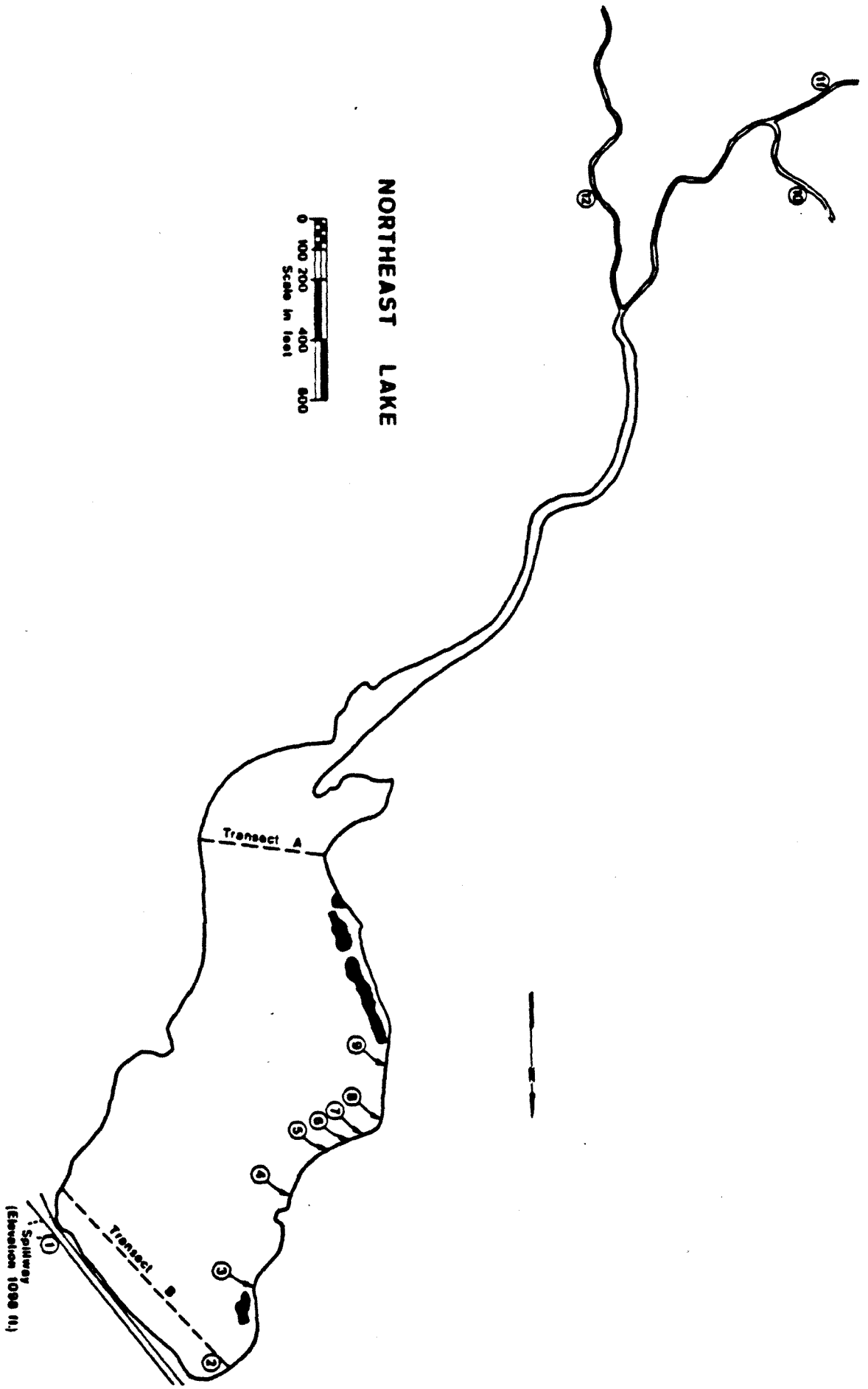

Figure 16, Task 10. Sample sites utilized in this study.

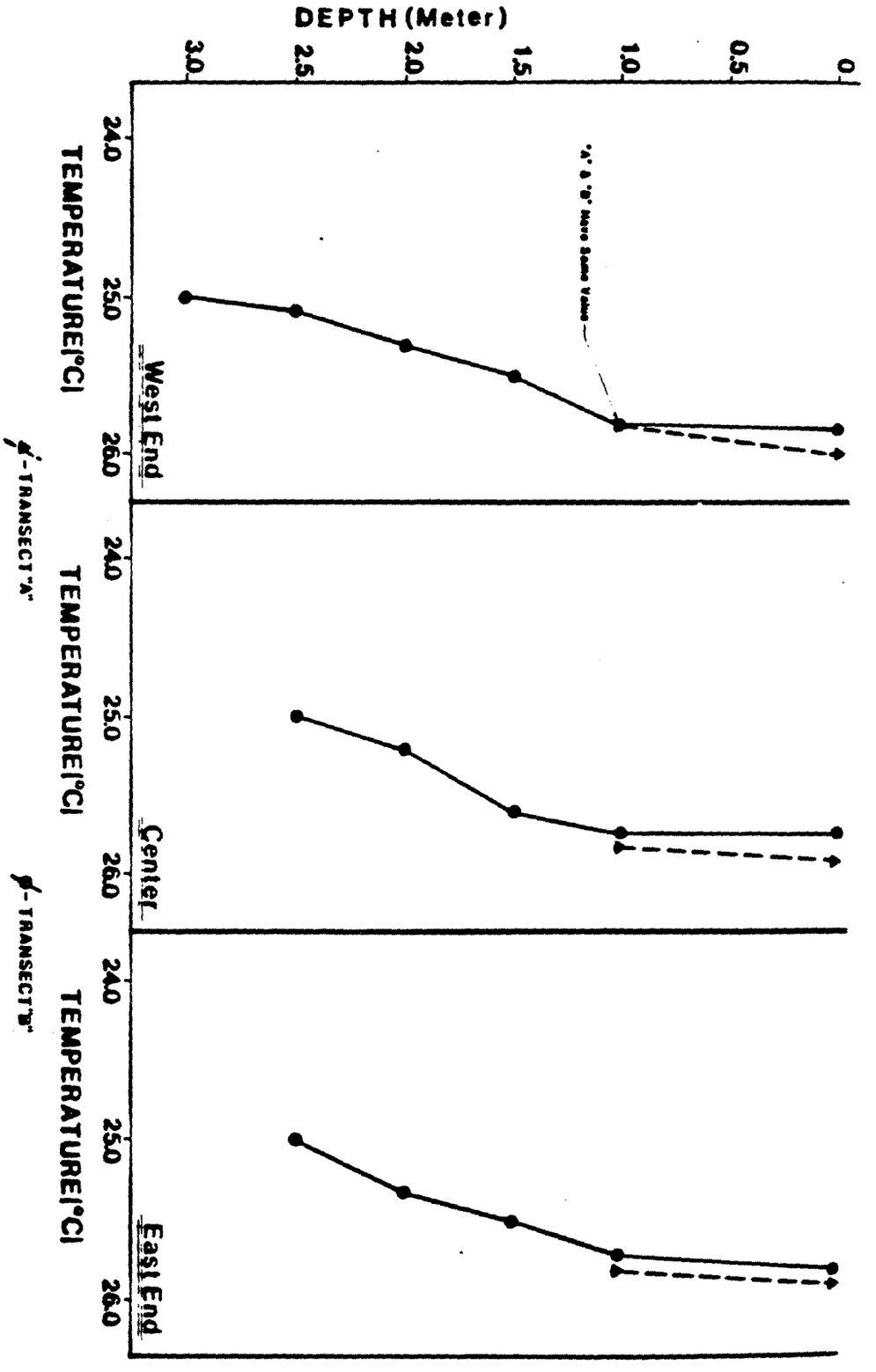

Figure 19, Task 10. Vertical and horizontal variability of temperature in Northeast Reservoir on July 29, 1981.

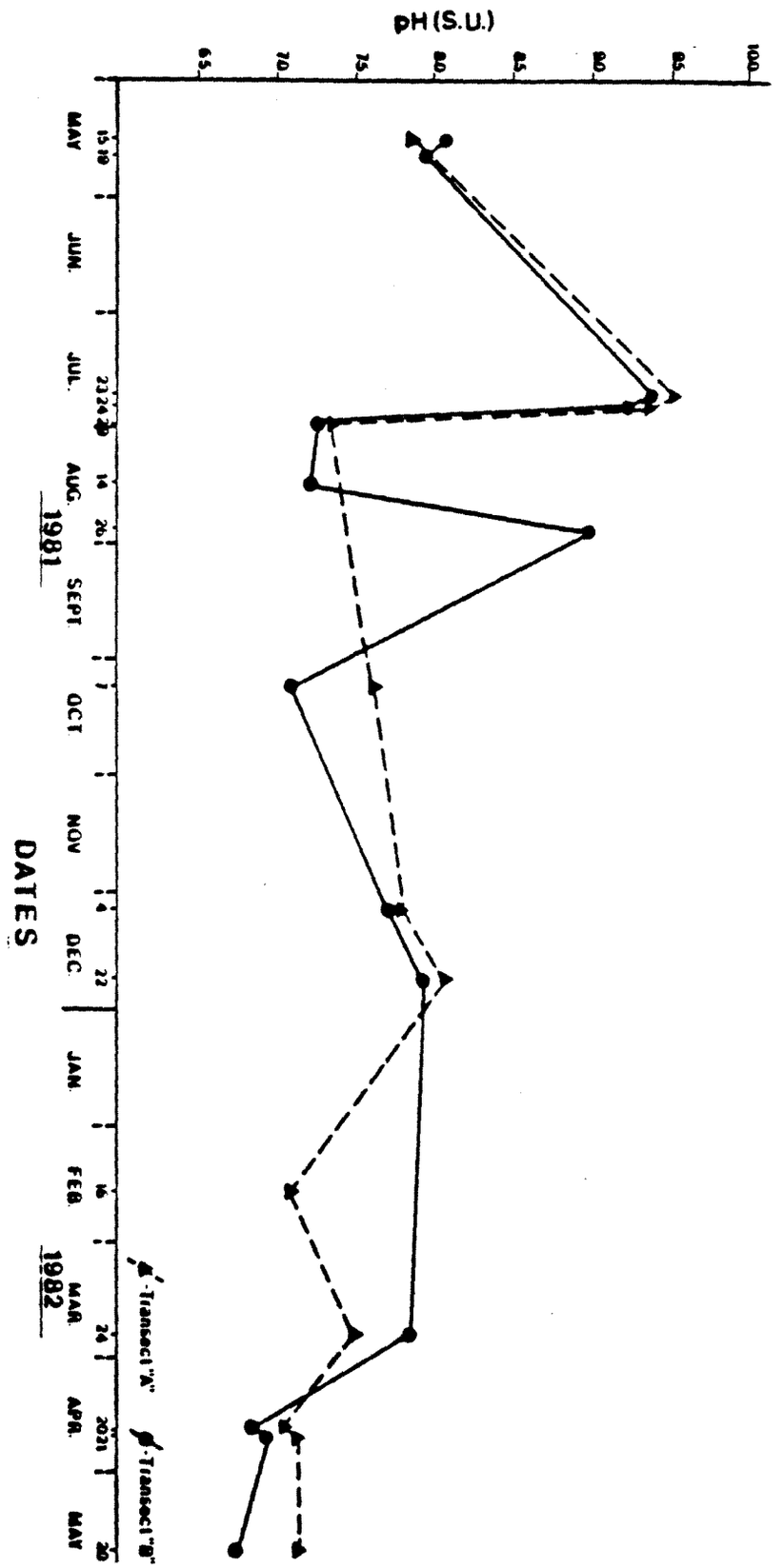

Figure 20, Task 10. Temperal variability of surface pH in Northeast Reservoir.

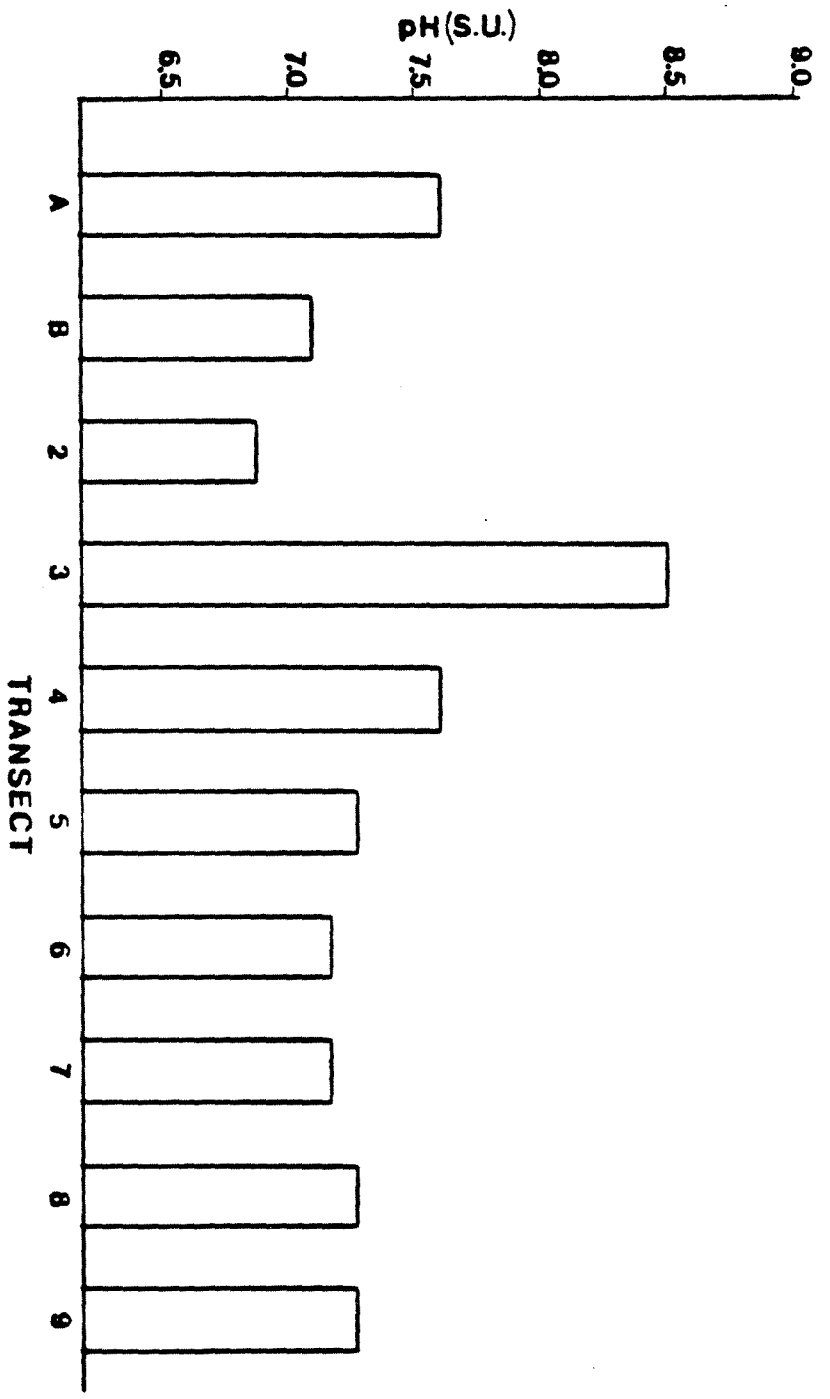

Figure 21, Task 10. Spatial variability of surface pH in Northeast Reservoir on October 7, 1981.

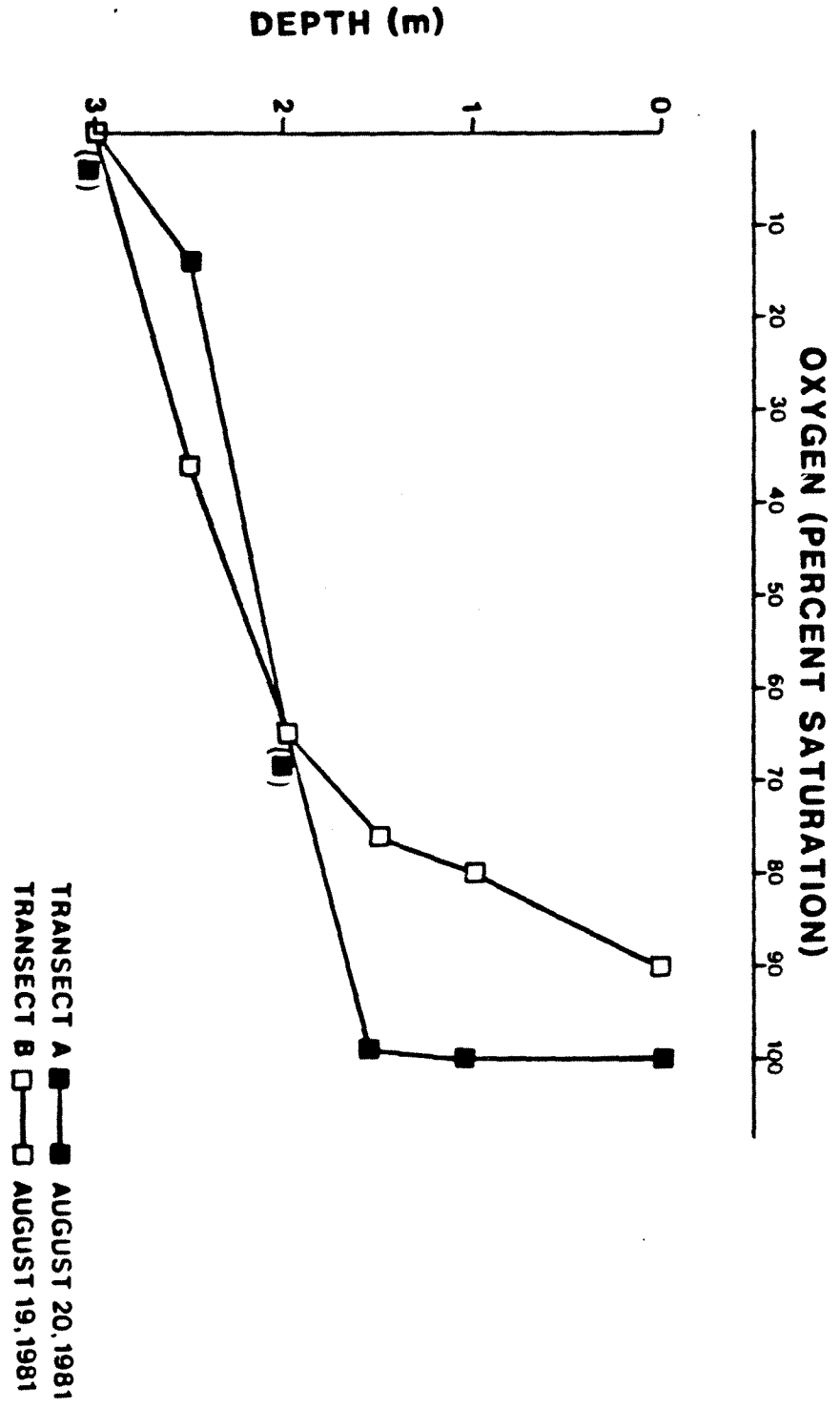

Figure 23, Task 10. Vertical profile of oxygen saturation for Northeast Reservoir.

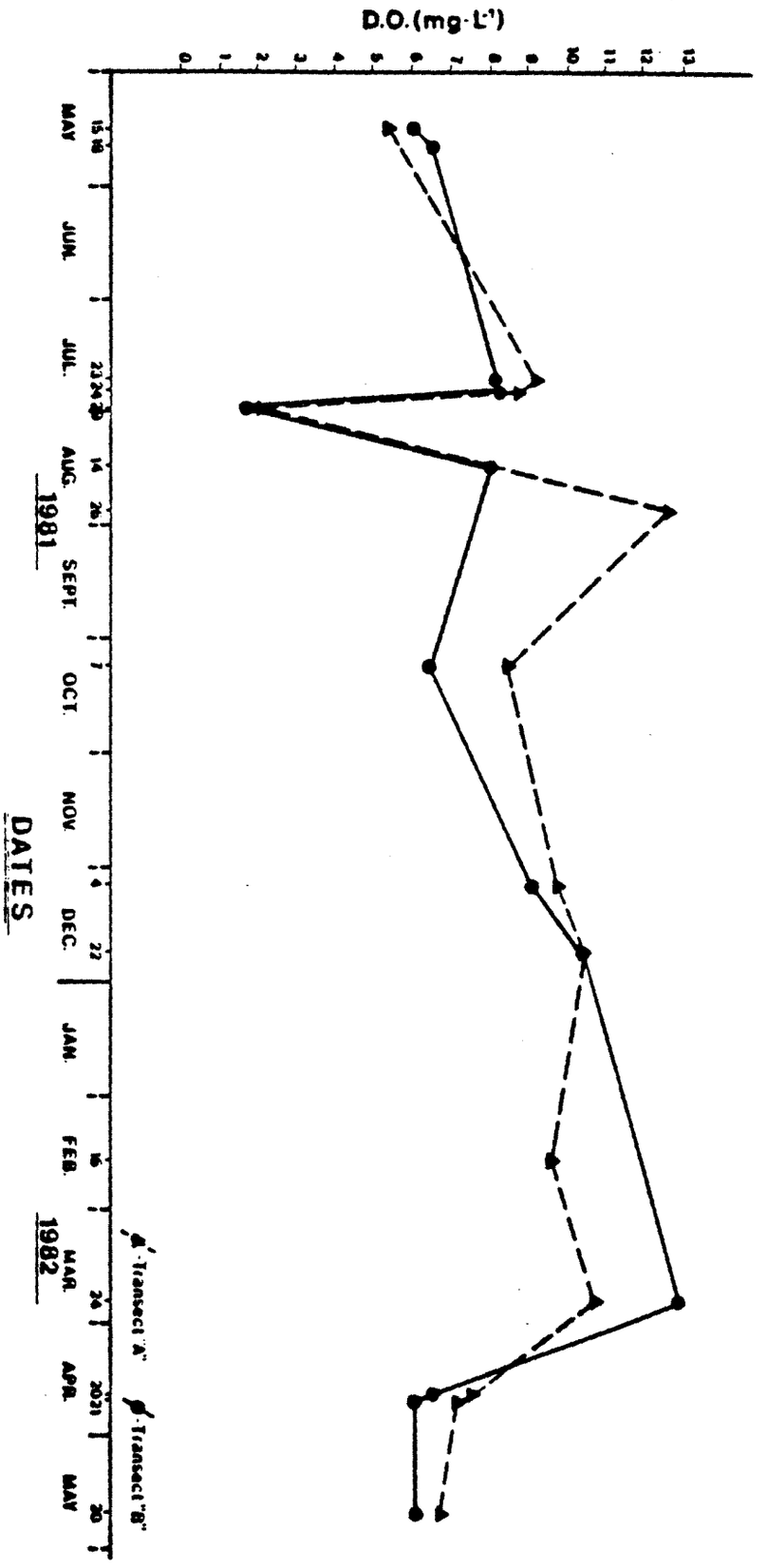

Figure 24, Task 10. Temporal variability of surface dissolved oxygen concentration in Northeast Reservoir.

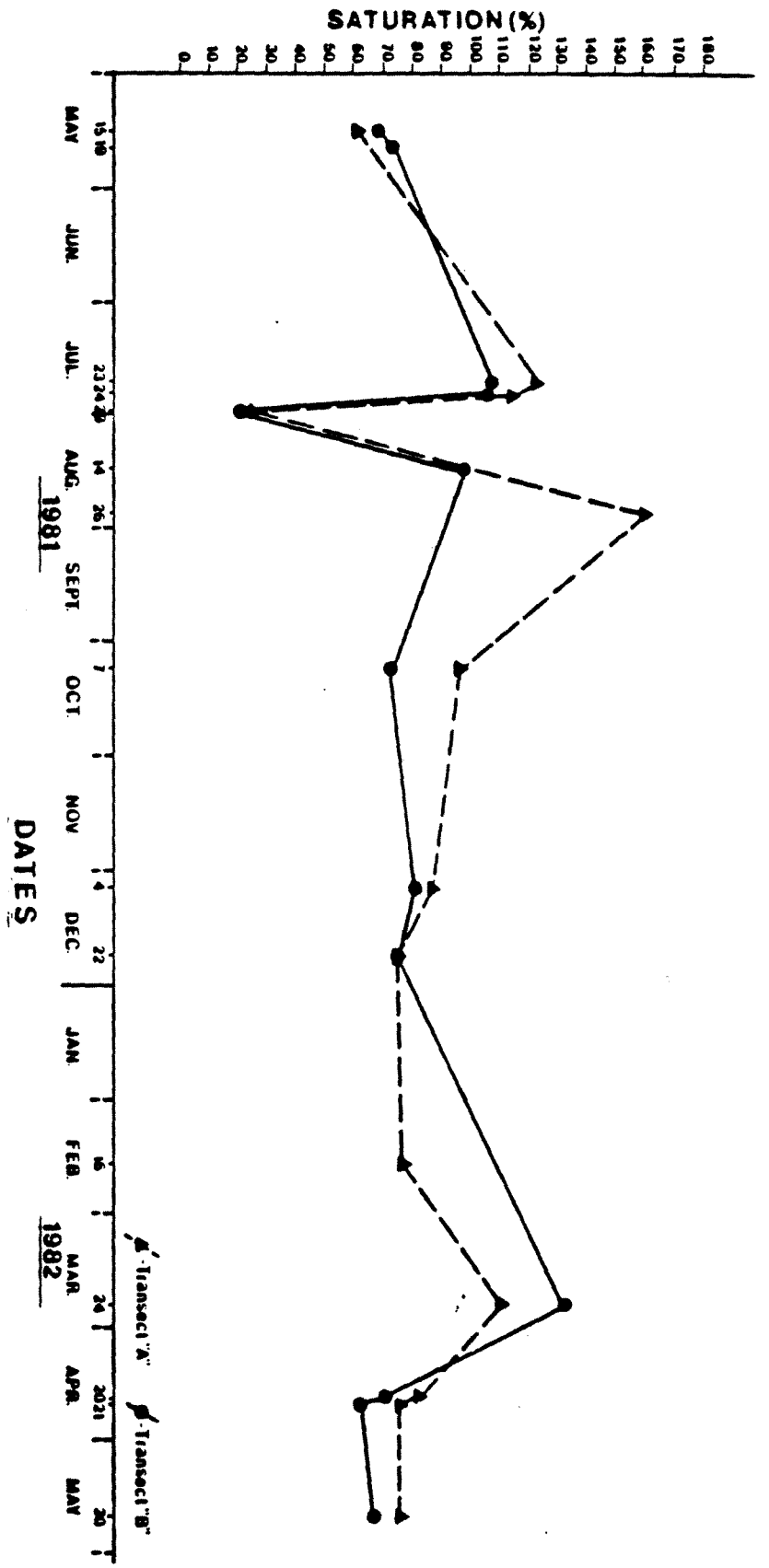

Figure 25, Task 10. Temporal variability of surface oxygen saturation in Northeast Reservoir.

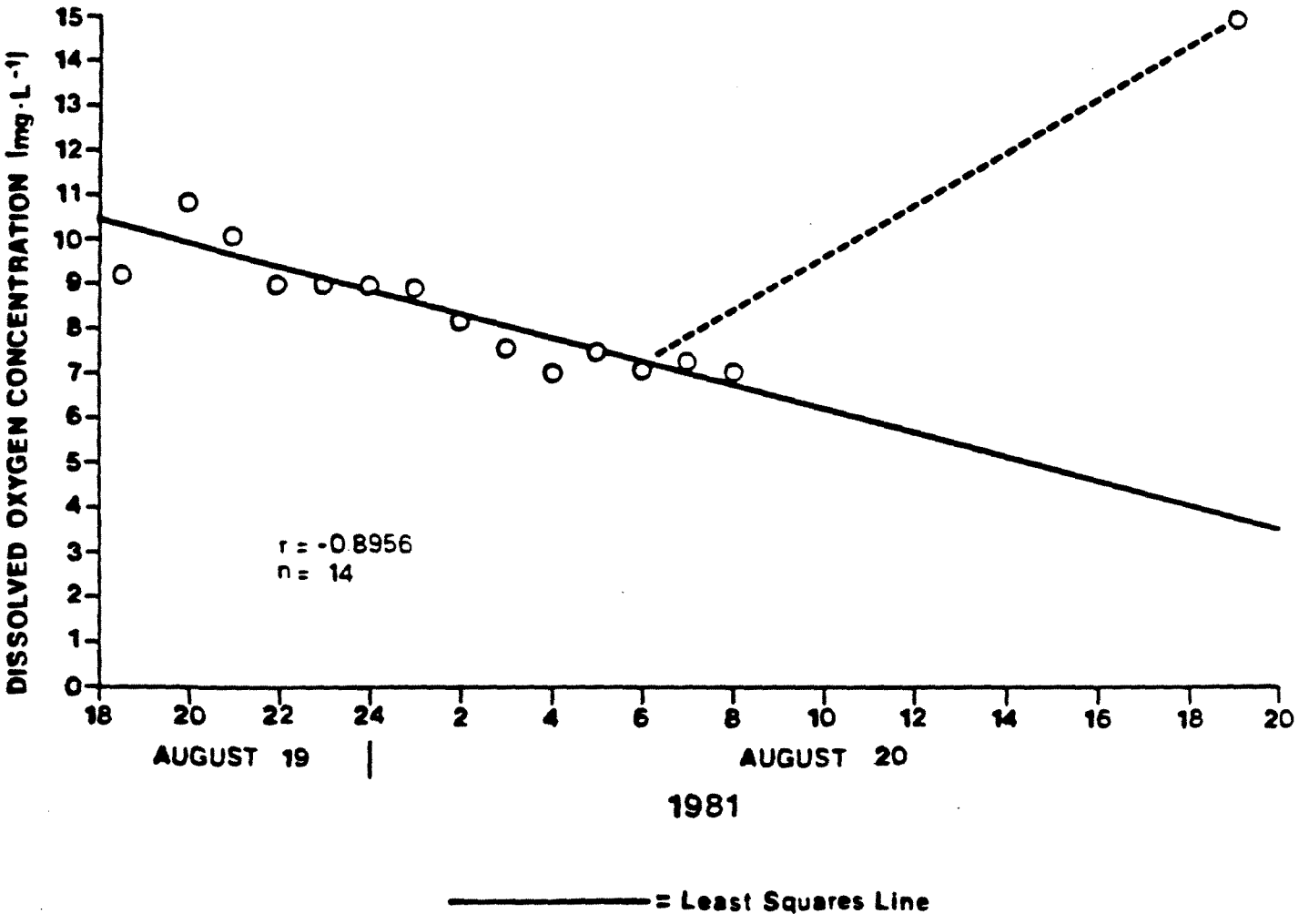

Figure 26, Task 10. Temporal variation of dissolved oxygen concentration (surface) at transect A in Northeast Reservoir.

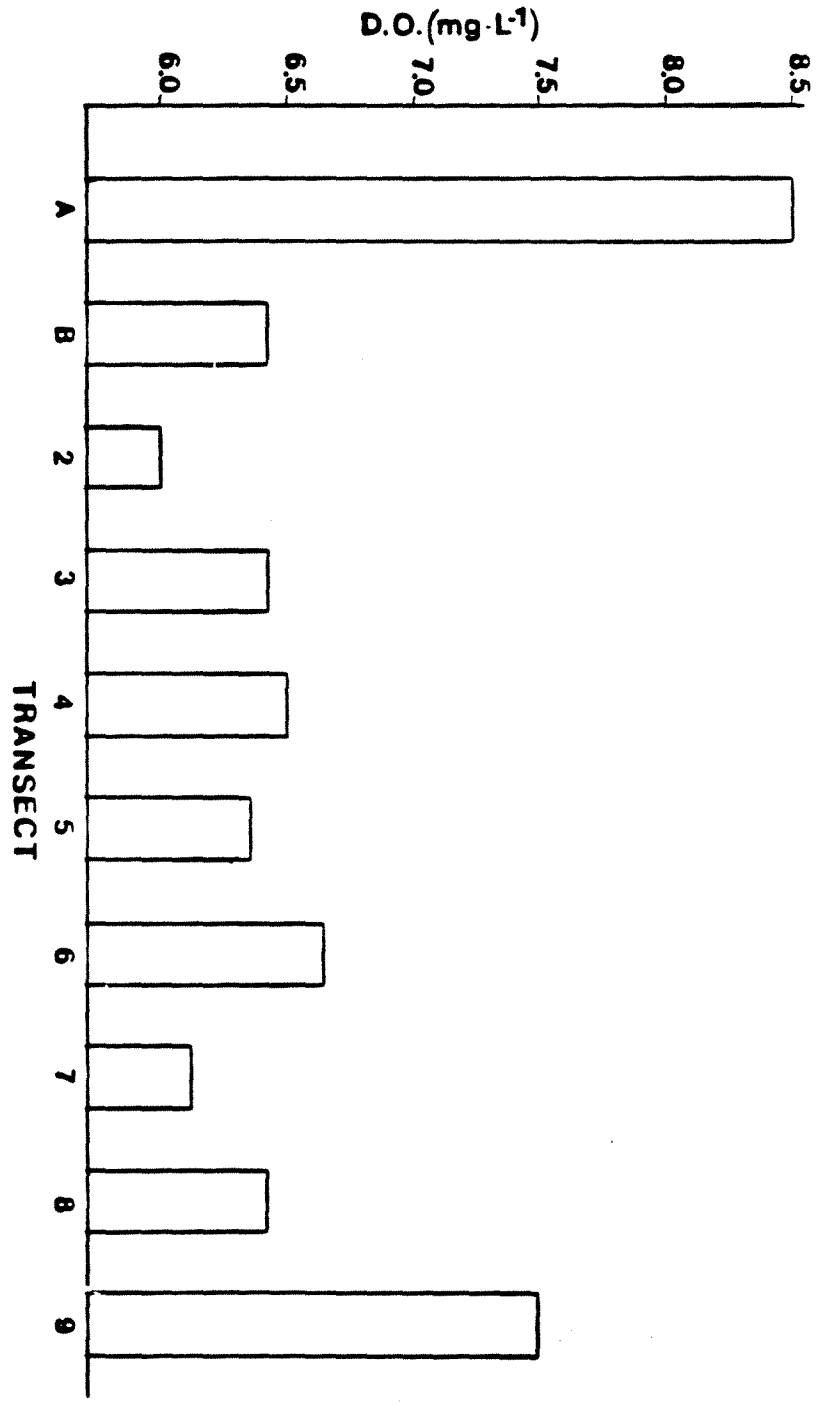

Figure 27, Task 10. Spatial variability of surface dissolved oxygen concentration in Northeast Reservoir on October 7, 1981.

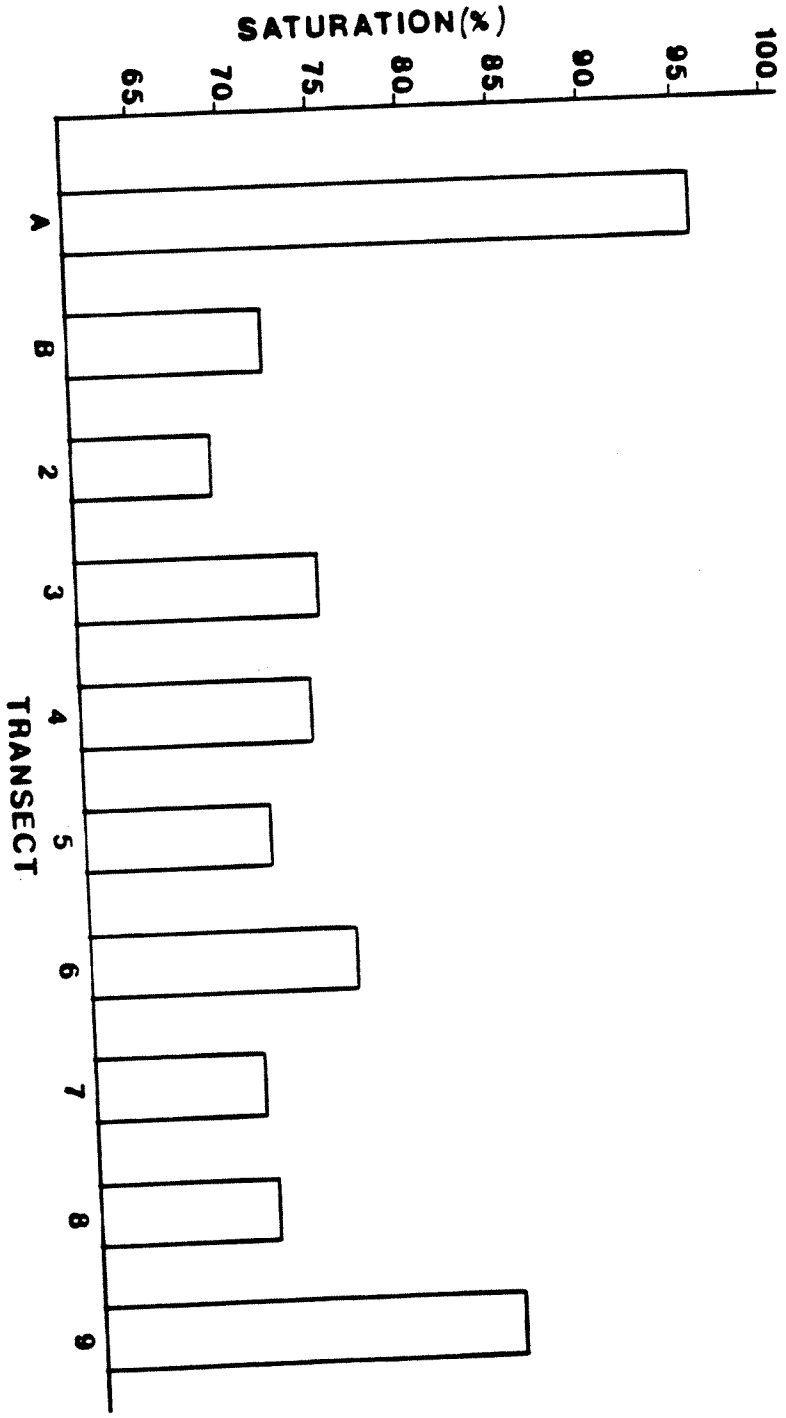

Figure 28, Task 10. Spatial variability of oxygen saturation in Northeast Reservoir on October 7, 1981.

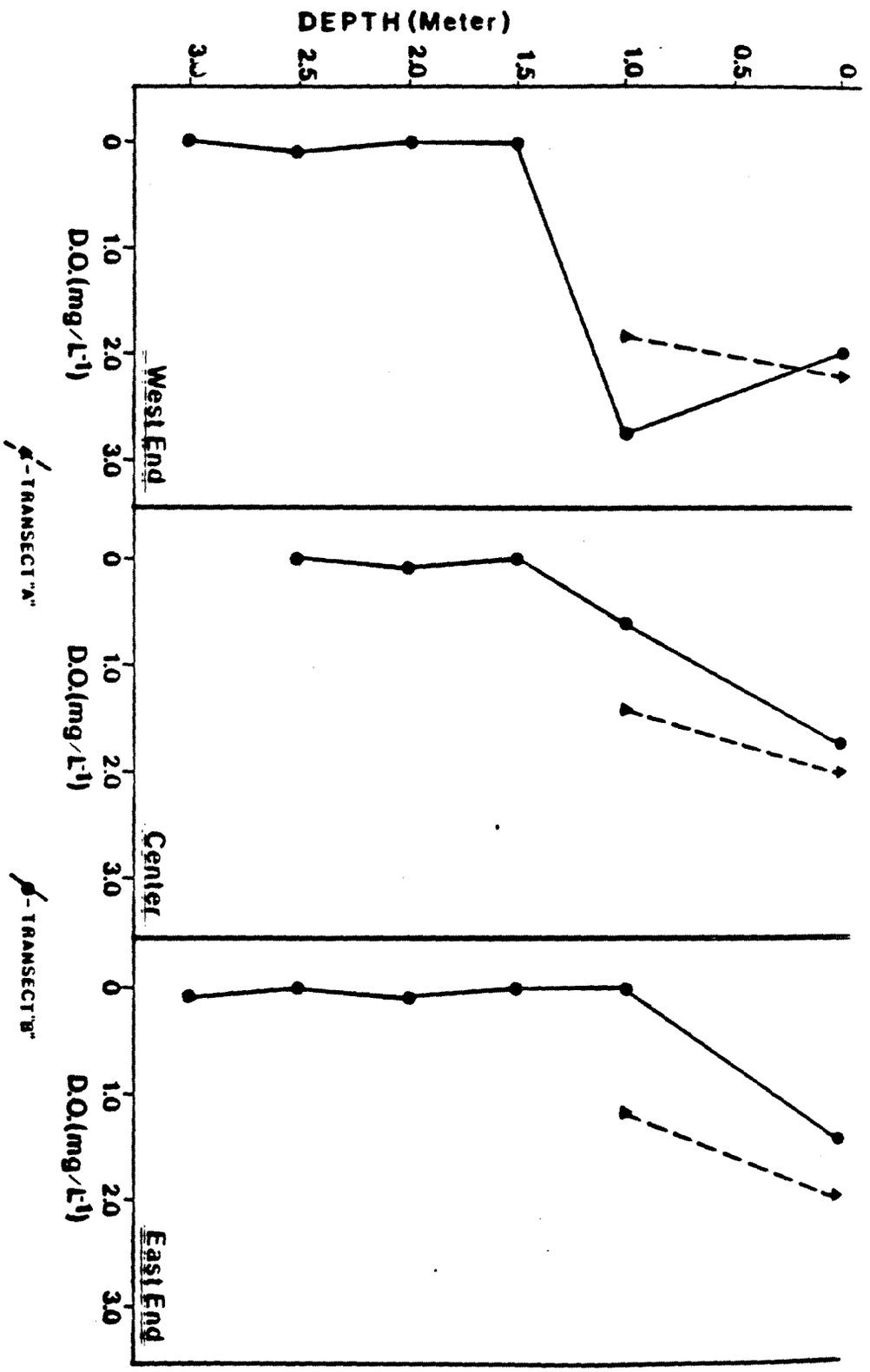

Figure 29, Task 10. Vertical and horizontal variability of dissolved oxygen concentration in Northeast Reservoir on July 29, 1981.

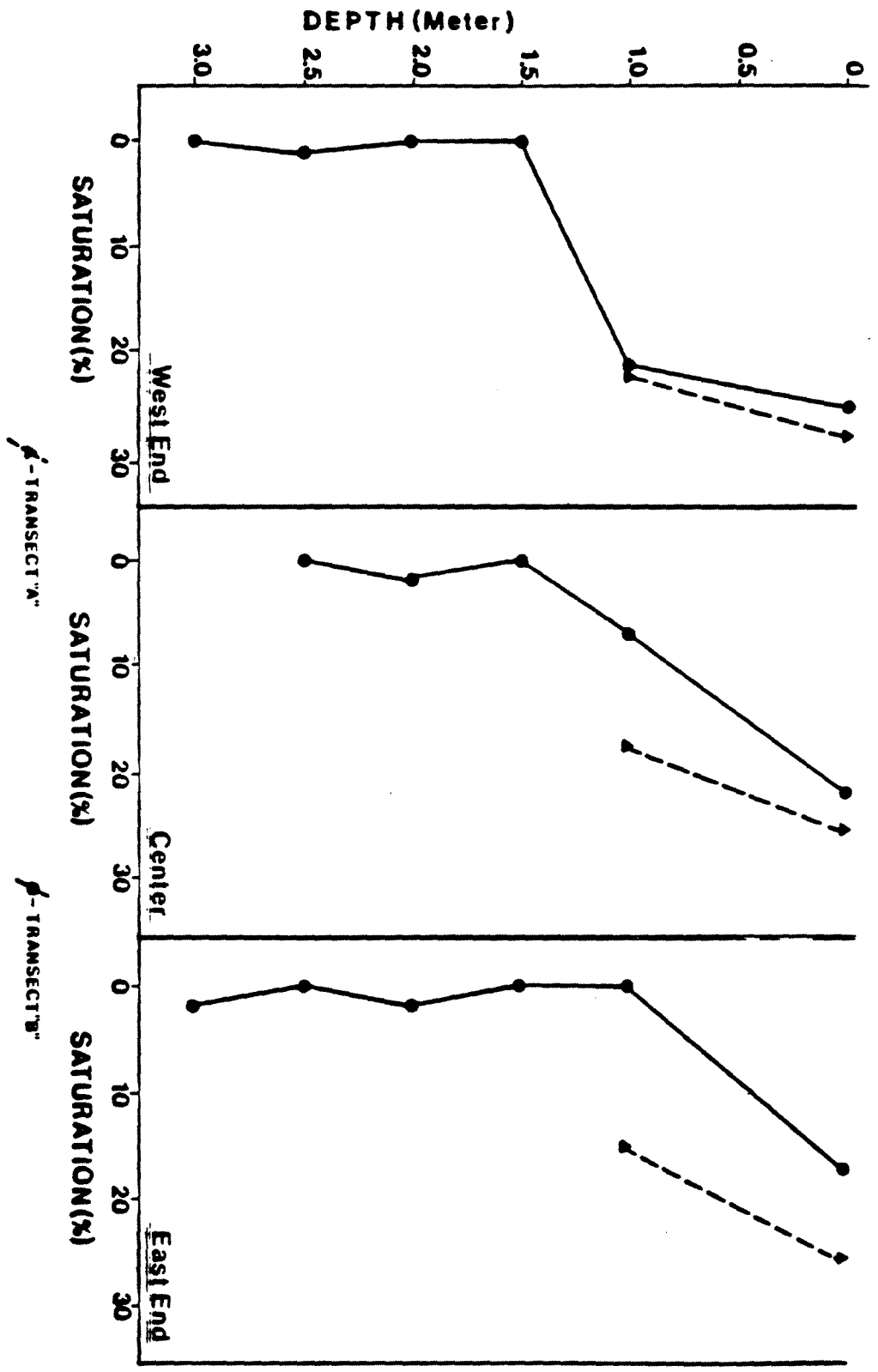

Figure 30, Task 10. Vertical and horizontal variability of oxygen saturation in Northeast Reservoir on July 29, 1981.

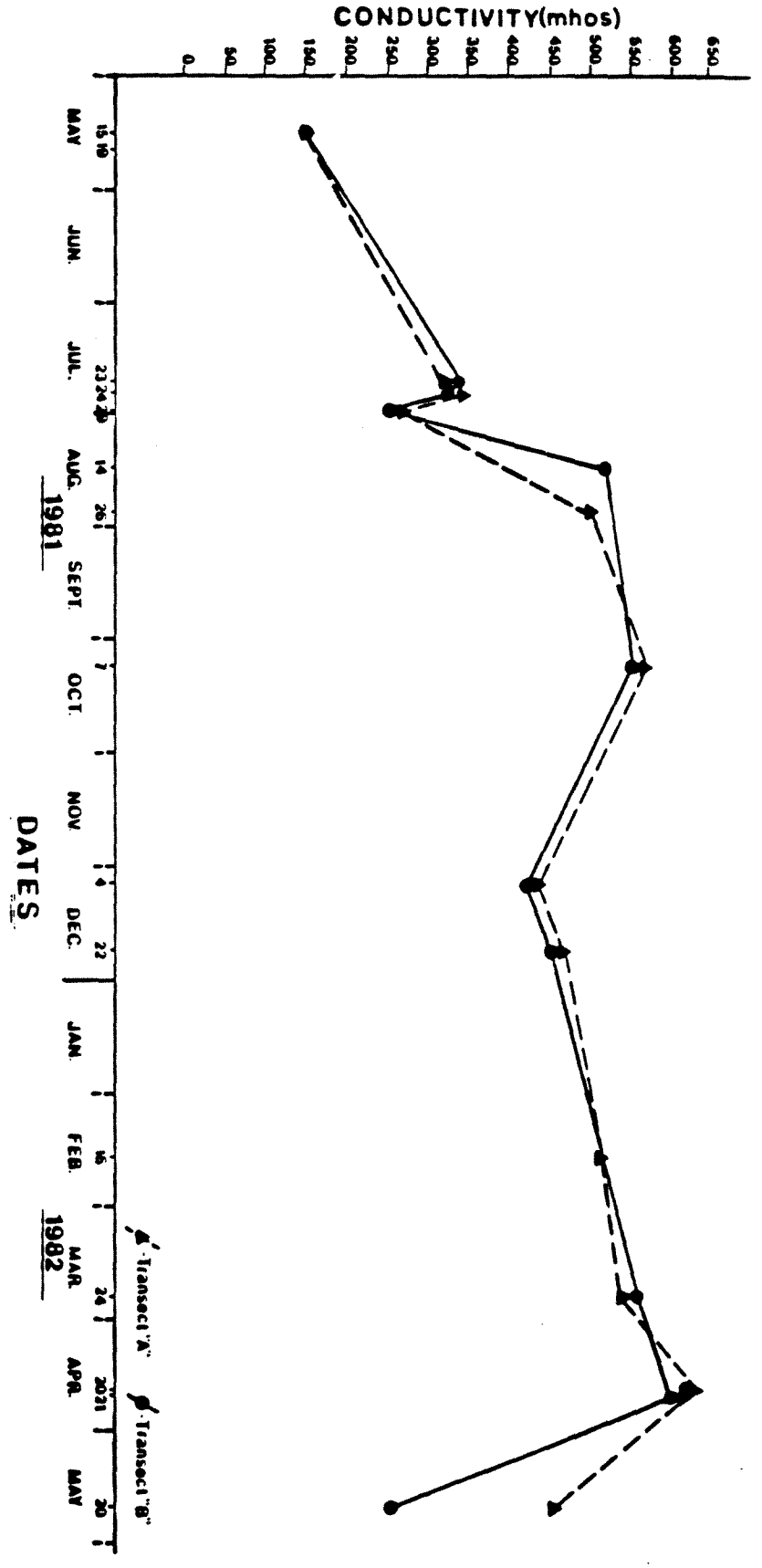

Figure 31, Task 10. Temporal variability of surface conductivity in Northeast Reservoir.

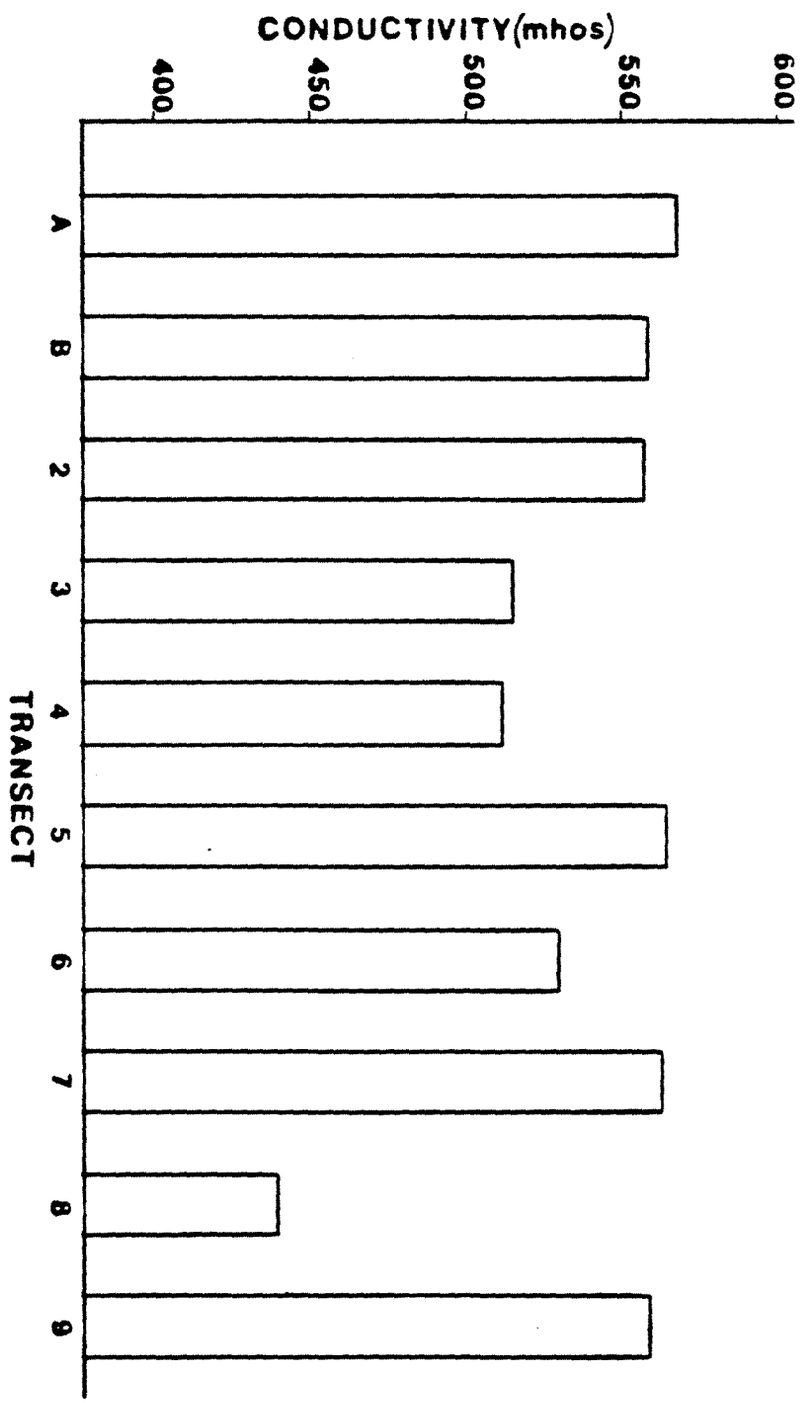

Figure 32, Task 10. Spatial variability of surface conductivity in Northeast Reservoir on October 7, 1981.

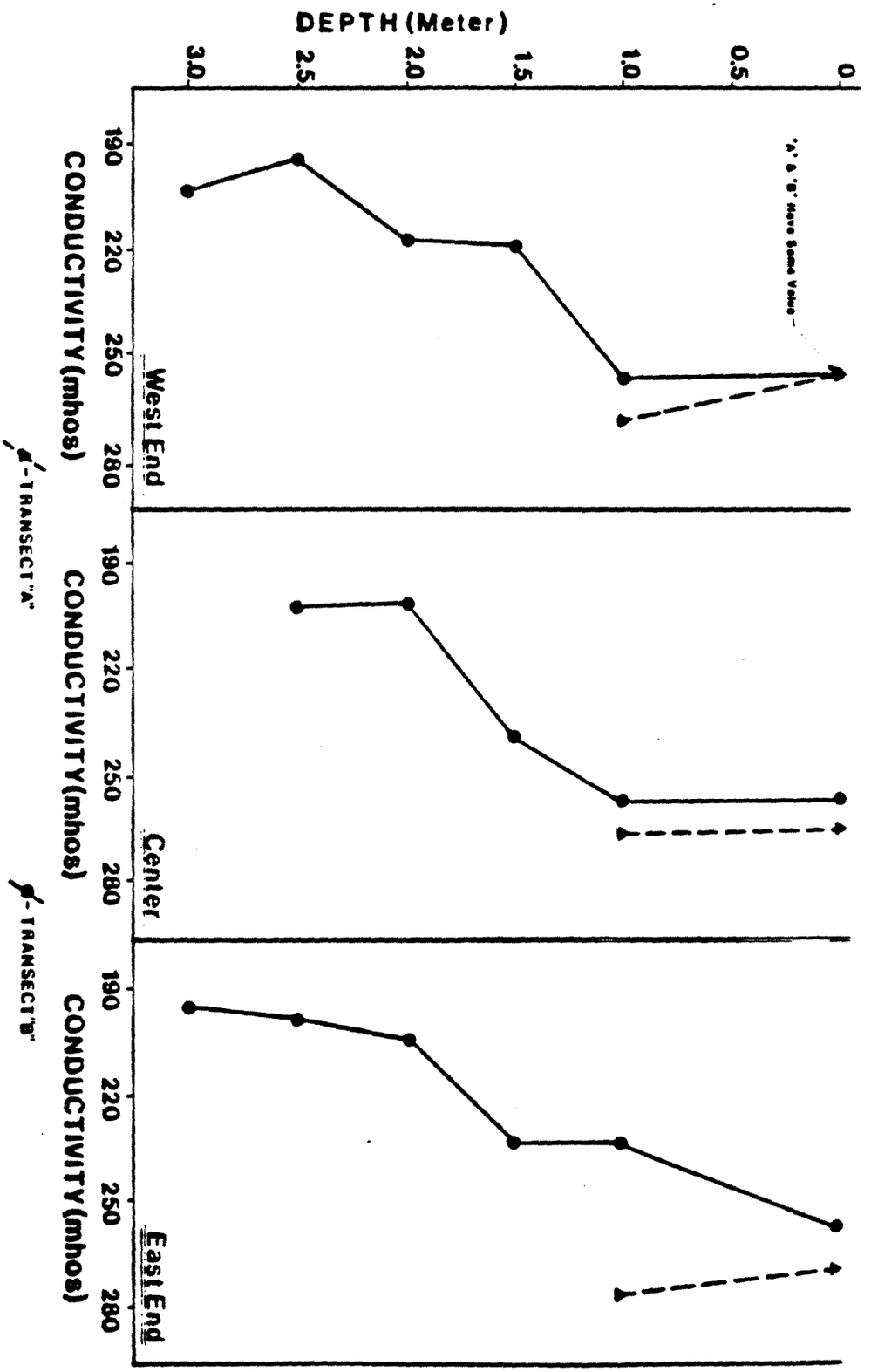

Figure 33, Task 10. Vertical and horizontal of conductivity in Northeast Reservoir on July 29, 1981.

Biological

The problem of algal blooms and algal bloom die-off has significantly influenced the water quality of Northeast Lake. The trophic condition of Northeast Lake was discussed earlier with regard to gross photosynthetic and respiratory activity of the lake community. Microcystis aeruginosa (a blue-green alga) was identified as the primary constituent of the reservoir's summer algal blooms. During blooms, algal populations were often concentrated on the surface of a lake in such numbers that the passage of the boat left a temporary path visible in the water formed by differential concentrations of the blue-green alga. The natural buoyancy of M. aeruginosa and wind induced concentration were responsible for their high densities in the surface water. Table 1, Task 10, contains both unit (algal cell numbers) and volume algal concentrations for five algal species found in Northeast Lake during a summer bloom in 1982. Three of the five species are in the phylum Cyanophyta which includes the blue-green algae. Both single cell and colonial forms of aeruginosa were in such high concentrations that they comprised over 83 percent of a given volume of a lake water. When blue-green algae occur in high concentrations they can constitute a health hazard since they excrete an exotoxin which induces vasoconstriction in vertebrates (Schwimmer and Schwimmer, 1968). Chlorophyll a analysis of this same sample of lake water (Table 1, Task 10) indicated a pigment content two orders of magnitude greater than that previously obtained (Appendix 10-A). The longitudinal chlorophyll a data displayed in Figure 1, Task 10, illustrates one of these hypereutrophic oscillations. As mentioned in Section 1, if the maximum value observed on March 24, 1982 (of approximately 200 mg per m^3) represents a typical, high level of chlorophyll a, the TSI would be greater than 82 which by definition is indicative of a hypereutrophic lake.

Bathymetric Mapping and Sediment Core Analysis:

Northeast Lake's bathymetric map was drawn based upon direct sounding data and indicated a present lake volume of 2.47×10^5 m^3 or 201.7 acre-feet. As seen in Figure 34, Task 10, the topographical relief of the lake bed indicates a general trend of shallow to deep from south to north with the old stream channel still meandering through the lake bed. Since no bathymetric maps were made prior to this date, volumetric changes could not be determined from comparative bathymetric data; however, sediment core samples taken along the length of the lake bed were analyzed using visual, mechanical, and Cesium 137 methods to determine sediment composition and sedimentation rates (Appendix 10- B). Visual inspection of the dry lake bed and core samples taken from the lake confirmed that a considerable amount of sand (approximately 25 acre-feet) has been deposited throughout the upper reaches of the lake and the amount of deposition decreased towards the north (dam) end of the lake.

Assessment of Phosphorus and Nitrogen Inflows and Outflows to the Lake:

Figures 35 and 36, Task 10, illustrate how Total Phosphorus and Total Nitrogen concentration in Northeast lake water (Transect B) fluctuated throughout the sampling period.

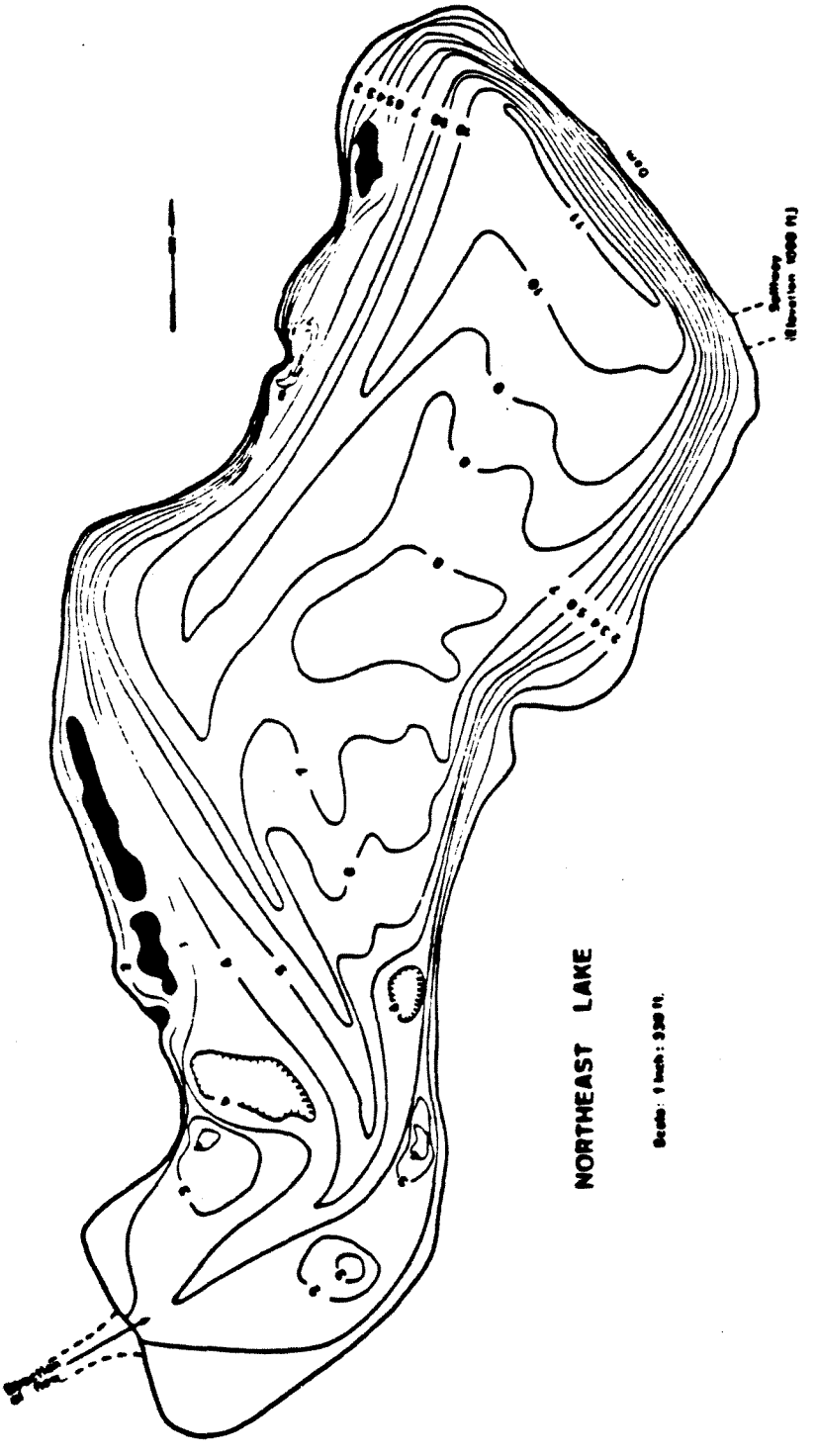

Figure 34, Task 10. Bathymetric map of Northeast Reservoir.

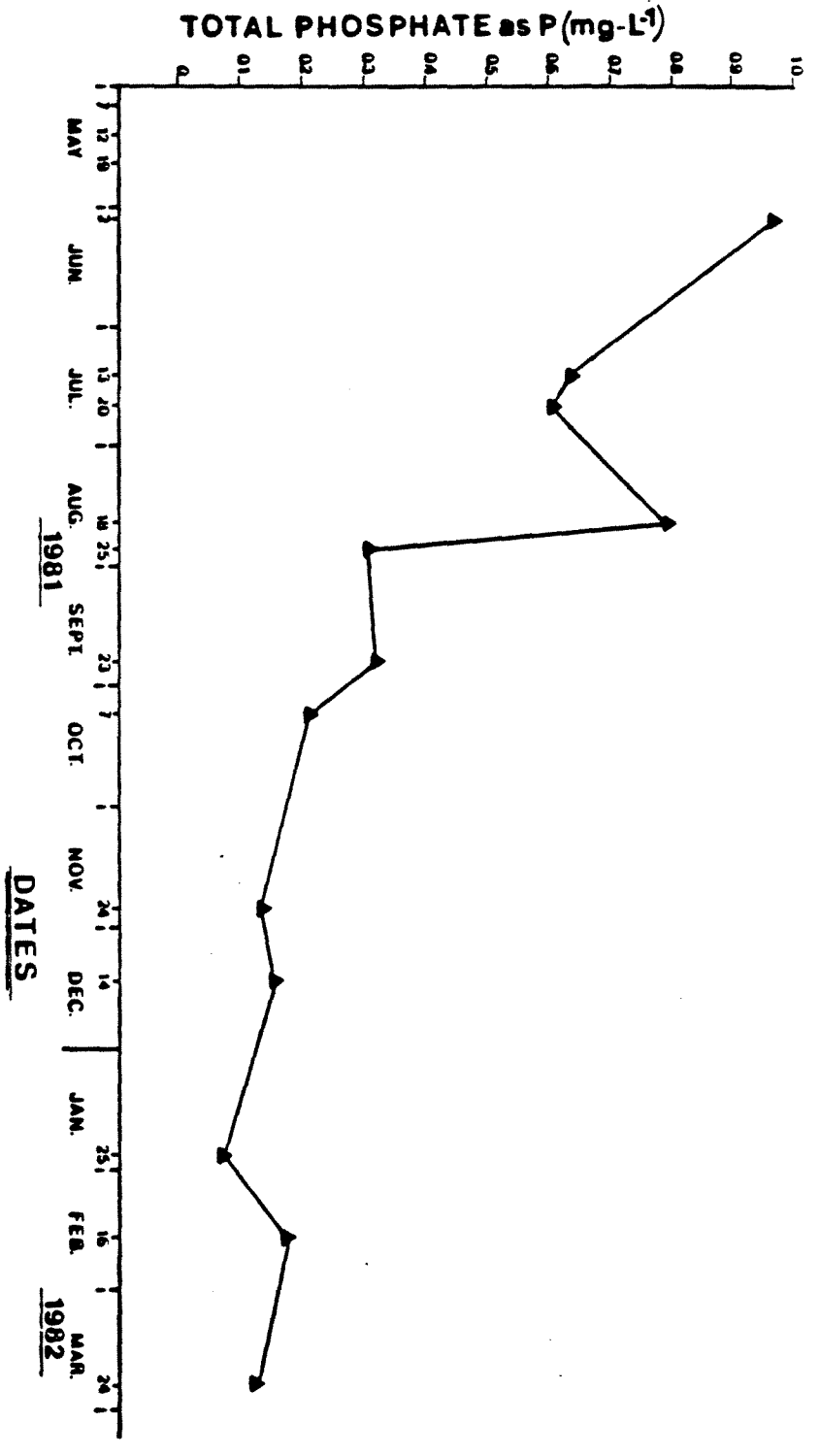

Figure 35, Task 10. Temporal variability in total phosphorus in Northeast Reservoir.

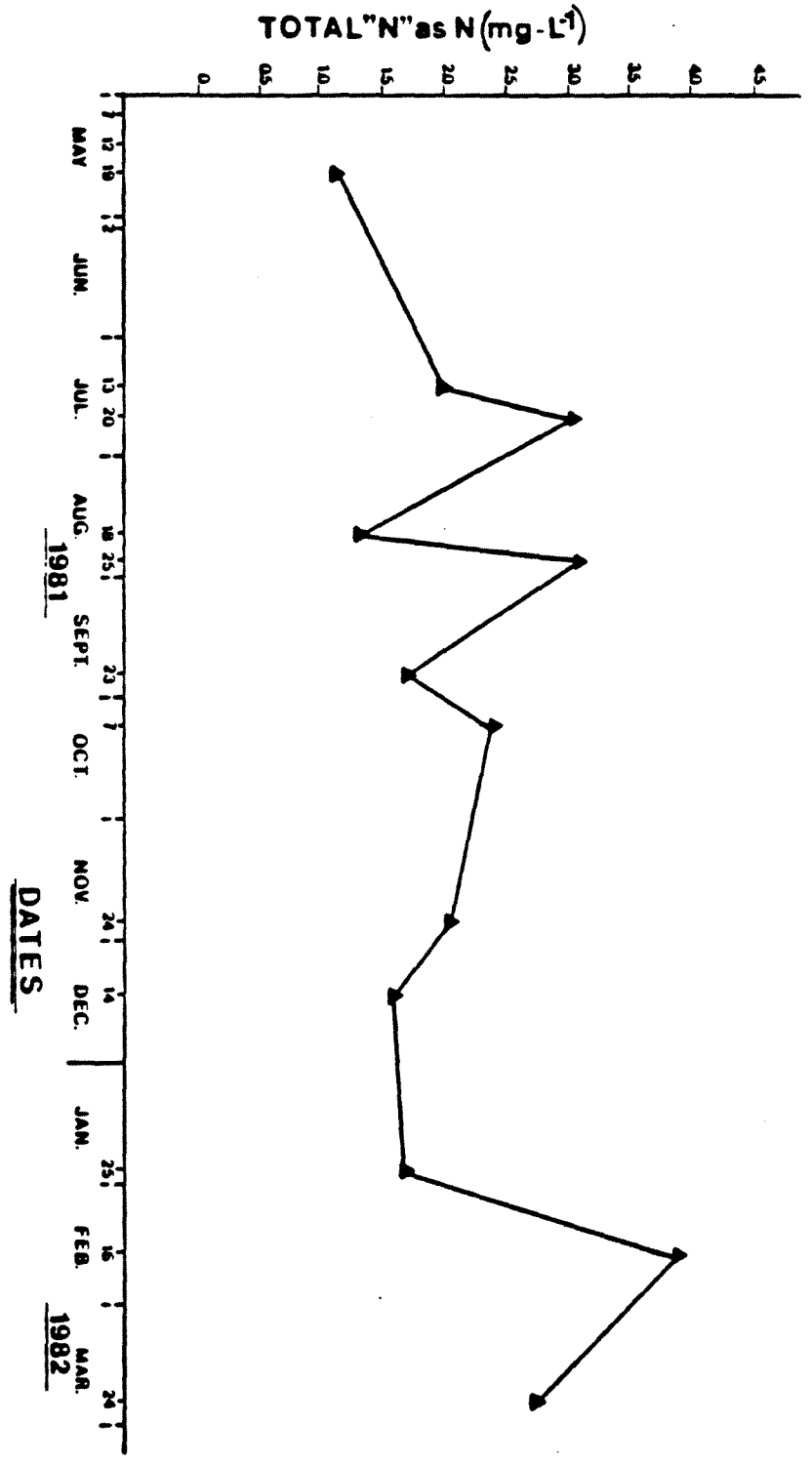

Figure 36, Task 10. Temporal variability in total nitrogen in Northeast Reservoir.

Table 1, Task 10. Phytoplankton and chlorophyll analysis.

CLASSIFICATION	UNITS	VOLUME IN um^3/mL
Chlorophyta		
Volvocales		
Chlamydomonas sp.	18,000	$2.9X10^7$
Euglenophyta		
Euglenales		
Lepocinclis	6,900	
Cyanophyta		
Chroococcales		
Chroococcus Dispersus	34,000	$8.4X10^7$
Microsystis aeruginosa (colonies)	$2.5X10^5$	$3.8X10^{10}$
**M. aeruginosa* (single cells)	$1.4X10^6$	$1.2X10^8$
Parameter µg/L		
Chlorophyll *a*	16,000	
Pheophytin *a*	200	

* Due to the method of preservation used or the conditions in the lake at the time of collection many colonies separated into single cells.

Phosphorus

Phosphate concentrations were significantly higher in the summer months. Annual loadings for phosphorus based upon these summer values indicate the annual total phosphorus loading for Northeast lake was 1,150 kgs, while the annual areal total phosphorus loading was 8.2 grams per square meter (Table 2, Task 10).

Nonparametric analysis of the Total Phosphorus concentrations for the 12 station Sites and transect B (Figure 37, Task 10) indicated the values of phosphorus found in two of the tributaries (Sites 11 and 12) and two of the zoo outfalls (Sites 2 and 8) were significantly higher than the average concentration of Total Phosphorus from Site 4. Table 3, Task 10, illustrates the spatial variation in mean annual Total Phosphorus.

Nitrogen

Unlike phosphorus (and possibly because it is the limiting nutrient), Total Nitrogen concentration for in-lake water showed a high degree of variation within seasons but no significant increase or decrease between seasons (Figure 36, Task 10). Annual loadings for nitrogen were calculated based on annual Total Nitrogen loadings estimated from groundwater contribution and nitrogen loadings estimated from the concentration of nitrates found to be present in local precipitation (Gopal, 1977). The rainfall volume necessary to calculate nitrogen loading was based on the USGS data collected near the Northeast Lake watershed (Figure 11, Task 10). The groundwater component of the Total Nitrogen loading was 1,213 kg per year while precipitation contributed 770 kg (NO_3-N) per year. Thus, nearly 2,000 kgs. of Total Nitrogen was estimated to impact Northeast Lake annually, resulting in an annual areal Total Nitrogen loading of 14.1 grams per square meter of lake surface. Spatial variation in mean annual Total Nitrogen is illustrated in Table 3, Task 10.

Nonparametric analysis of Total Nitrogen data (Figure 38, Task 10) indicated that one tributary (Site 11) had Total Nitrogen concentrations that were significantly higher ($p < .01$) than Total Nitrogen concentrations from two zoo outfalls (Sites 4 and 9) and one adjacent tributary (Site 12). This elevated level of Total Nitrogen was due to sewage which overflowed and ran into tributary 11 within the confines of the illegal dump (refer to section concerning hydrologic budget and section concerning bacterilogical data).

Total Nitrogen to Total Phosphorus Rations (N/P)

Total N/P ratios were determined for in-lake water (Site B) on 11 sampling occasions when such parameters were analyzed (Table 4, Task 10). The average N/P ratio for the entire sampling period was 11.68:1; however, N/P ratios ranged from 1.7:1 to 24.4:1. It appears, therefore, that nitrogen is a limiting nutrient for the blue-green algae during the summer and fall months (when the N/P ratio is less that 7:1) while phosphorus is a limiting nutrient during the winter and spring. Since blue-green algal blooms are almost exclusively a summer phenomenon, it can be inferred that nitrogen is the limiting nutrient to these bloom

Absolute Differences Between Sample Sites for Total Phosphorus Rank Sums

1	2	3	4	5	6	7	8	9	10	11	12	8	
	20	12	24.5	0	6	6	25.5	10.5	8	23.5	23.5	7	1
		32	44.5	20	14	14	5.5	30.5	12	3.5	3.5	27	2
			12.5	12	18	18	37.5	1.5	20	35.5	35.5	5	3
				24.5	30.5	30.5	50	14	32.5	48	48	17.5	4
					6	6	25.5	10.5	8	23.5	23.5	7	5
						0	19.5	16.5	2	17.5	17.5	13	6
							19.5	16.5	2	17.5	17.5	13	7
								36	17.5	2	2	32.5	8
									18.5	34	34	3.5	9
										15.5	15.5	15	10
											0	30.5	11
												30.5	12
													8

Critical Value
-at .05 is 45
-at .01 is 49

Figure 37. Task 10. Nonparametric spatial analysis of total phosphorus rank sums.

Absolute Differences Between Sample Sites for Total Nitrogen Rank Sums

1	2	3	4	5	6	7	8	9	10	11	12	8	
	16	8	16	1	6	4	21	19	9	36	20	0	1
		8	32	15	22	20	5	35	7	20	36	16	2
			24	7	14	12	13	27	1	28	28	8	3
				17	10	12	37	3	25	52	4	16	4
					7	5	20	20	8	35	21	1	5
						2	27	13	15	42	14	6	6
							25	15	13	40	16	4	7
								40	12	15	41	21	8
									28	55	1	19	9
										27	29	9	10
											56	36	11
												20	12
													8

Critical Value
-at .05 is 45
-at .01 is 49

Figure 38, Task 10. Nonparametric spatial analysis of total nitrogen rank sums.

Table 2, Task 10. Physico-chemical characteristics of Northeast Lake with regard to phosphorus loading.

PHYSICO-CHEMICAL CHARACTERISTICS	PREDIVERSION	POSTDIVERSION
Reservoir Volume (m)	2.47×10^5	
Mean Depth (m)	1.77	
Annual Discharge (m^3)	2.82×10^6	4.34×10^5
Hydraulic Residence		
Time (years)	8.78×10^{-2}	1.76
$Z \cdot t_w$ (m. $year^{-3}$)	20	1.01
Annual Total phosphorus loading (kg)	879	132
Annual Areal Total phosphorus loading	6.28	0.94

Table 3, Task 10. Sample Site variation in mean annual total phosphorus and nitrogen concentration.

SAMPLE SITES	MEAN ANNUAL TOTAL PHOSPHORUS CONCENTRATION (mg/L)	MEAN ANNUAL TOTAL NITROGEN CONCENTRATION (mg/L)
1	0.319	2.318
2	0.524	14.68
3	0.371	2.355
4	0.277	2.108
5	0.381	2.856
6	0.393	2.422
7	0.953	2.825
8	0.579	6.083
9	0.313	2.219
10	0.551	4.776
11	1.146	10.236
12	0.428	1.467
A	0.329	3.01
B	0.362	2.285

Table 4, Task 10. N to P ratios for Northeast Lake (Transect 8).

SAMPLE DATE	N/P	
7/13/81	3.13	
7/20/81	5.01	
8/18/81	1.69	$\bar{X}$ = 5.082
8/25/81	10.19	
9/23/81	5.39	
10/7/81	11.40	
11/24/81	14.78	
12/14/81	9.94	$\bar{X}$ = 17.178
1/25/82	24.37	
2/16/82	20.41	
3/24/82	22.17	

$\bar{X}$ = 11.695

events in Northeast Lake. This supposition is strengthened by the fact that Microcystis spp. cannot synthesize nitrogen from the atmosphere and therefore must obtain it in dissolved form from the water. Nitrogen uptake during summer blooms would explain the decrease observed in the N/P ratio during this season.

Soluble Reactive Phosphorus and Nitrogen Species:

The biologically active and immediately available component of phosphorus (dissolved orthophosphate) in Northeast Lake water ranged in value between 5 and 548 µg/L during the sampling period (May 1981-March 1982). The mean value of dissolved orthophosphate was 239 µg/L (n=13) which constituted 61.1 percent of the Total Phosphorus detected.

The mean value of Total Nitrogen in Northeast Lake water was found to be 2,748 µg/L (n=12) during the sampling period. The nitrogen species of nitrate, nitrite, ammonia, and kjeldahl nitrogen comprised 9.53, 1.35, 21.43, and 68.89 percent of the average total nitrogen, respectively.

Turbidity and Alkalinity Data:

Figure 39, Task 10, is a turbidity map of Northeast Lake taken between late-August and early-September 1979 and based on LANDSAT satellite data (Grimshaw, et al., 1980). During this period, turbidity in the lake was high (as it was often during the 1981-1982 sampling period) as NTU values were greater than 70 for most of the lake.

Analysis of the suspended and dissolved solids data for in-lake water over the sampling period indicate that peak levels occurred on July 13, 1,981 (40 µg/L) for suspended solids and November 24, 1981 (3,212 µg/L) for dissolved solids; however, average values for each component at the near dam transect over the entire sampling period was 15.26 µg/L for suspended solids and 268 µg/L for dissolved solids.

Turbidity in Northeast Lake was high throughout most of the year. Lake water color ranged from brick-red (inorganic turbidity) to lime-green (algal turbidity) while lake water odor ranged form mildly offensive (due to hydrogen sulfide production) to strongly offensive (following several fish die offs and algal blooms).

Alkalinity data for the near dam region ranged from 60 to 108 µg/L for total Alkalinity (average of 84.2) while phenolphthalein alkalinity ranged from 0 to 22 µg/L. These data indicate that Northeast reservoir is a moderately well buffered lake. However, the pH vertical profile data (Figure 22, Task 10) does indicate that acidity increased with increasing depth as would be expected.

Predominant Vascular Plants:

The predominant species of aquatic macrophyte, Typha spp., a cattail, was distributed primarily on the west side of the southern reaches of the lake in a shallow area frequented by several species of water fowl (Task 11). The other aquatic macrophyte observed in the lake was Lemna spp., or duck weed, which, like the algae, predominately populated the

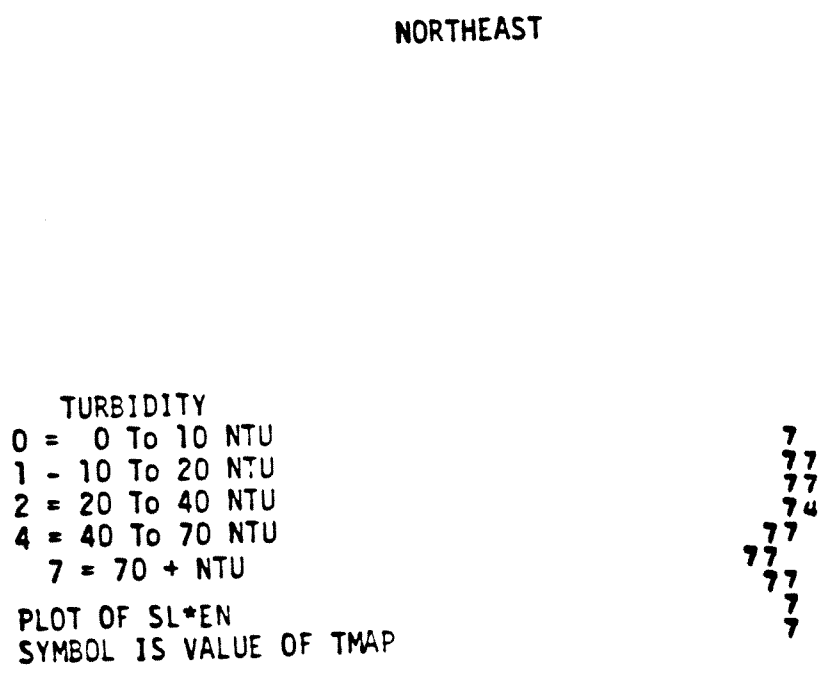

Figure 39, Task 10. Turbidity map of Northeast lake based on LANDSAT satellite data (August and September, 1975).

lake during the summer months. The areal extent of these macrophytes was less than one percent of the reservoir's surface area.

Bacteriological Data:

Fecal coliform bacterial contamination of Northeast lake proved to be a major problem in this small, urban reservoir. Figure 40, Task 10, indicates the location and the severity of this problem. According to the 1979 Oklahoma Water Quality Standards, all of the sampling locations exceeded the Primary Body Contact (i.e., swimming) standard while all but two locations (Site 3 and transect B) had mean annual coliform levels that exceeded the Secondary Body Contact (i.e., fishing and boating) standard.

Two locations were found to contribute the majority of the bacterial contamination and efforts have been made to eliminate these sources of pollution. Site 11 (a tributary in the watershed which received sewage overflow from an illegal dump) had a mean annual fecal coliform level that was three orders of magnitude higher than the 1979 standard for Secondary Body Contact while Site 8 (zoo outfall from the hippo and hoof stock enclosures) had a mean annual coliform level that was two orders of magnitude greater than the standard. Site 11 tributary received raw sewage because of clogging and overflow at a sewer line as the result of sewer riser damage during dumping operation on the grounds of an illegal dump. Since the sewer lines in this area paralleled the tributaries, raw sewage flowed into the tributary when these sewer lines were occluded. Damage to the sewer risers has subsequently been repaired and the problem at this location has been eliminated.

Site 8 effluent from the zoo had mean annual coliform levels two orders of magnitude higher than the Oklahoma 1979 Secondary Body Contact standard. As a result of the bacteriological and nutrient analysis for this Site (and the high levels of coliform at other outfalls), it has been recommended that all zoo outfalls be connected to ~~the city sewer~~ STORMWATER RETENTION BASIN ~~line~~. This would eliminate the majority of the zoo-related impact to the lake.

Fish Flesh Analysis for Chlorinated Hydrocarbons and Heavy Metals:

Table 5, Task 10, indicates the results of a fish flesh analysis performed on Bullhead Catfish from Northeast Lake. Fish composites were analyzed by the Oklahoma State University's Water Quality Research Laboratory. Although a problem had been reported to exist regarding excessive chlordane content in the fish of Northeast Lake, the Board was unable to confirm the existance of a fish flesh residue problem.

Sediment Analysis:

Most Oklahoma reservoirs are characterized by high levels of inorganic turbidity and by high rates of inorganic sedimentation. Figure 41, Task 10, illustrates the relative amount of sediment accumulation in eight Oklahoma reservoirs. As mentioned in the earlier section concerning bathyemetric mapping and sediment care analysis, sand has been

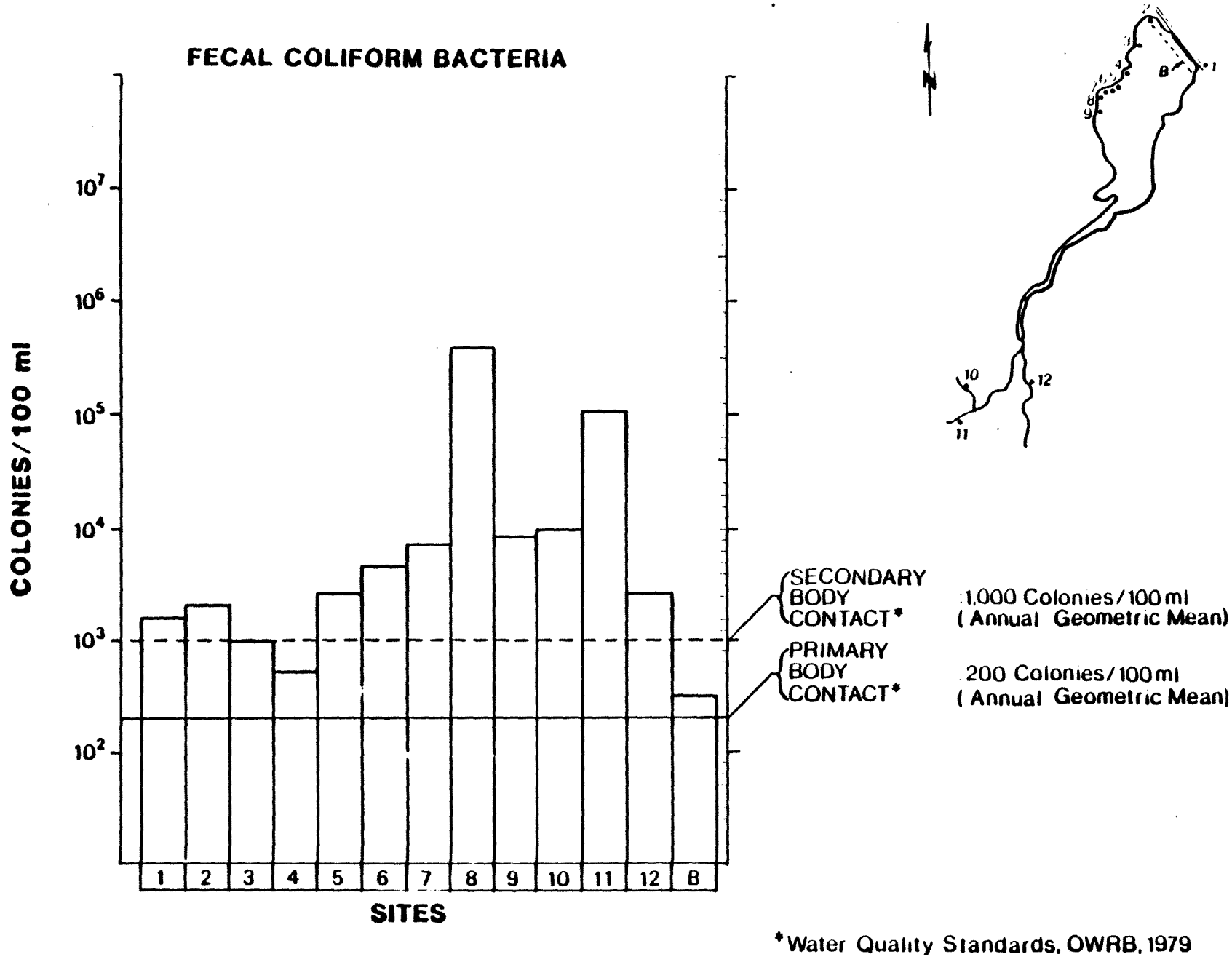

Figure 40, Task 10. Horizontal fecal coliform profile in Northeast Reservoir.

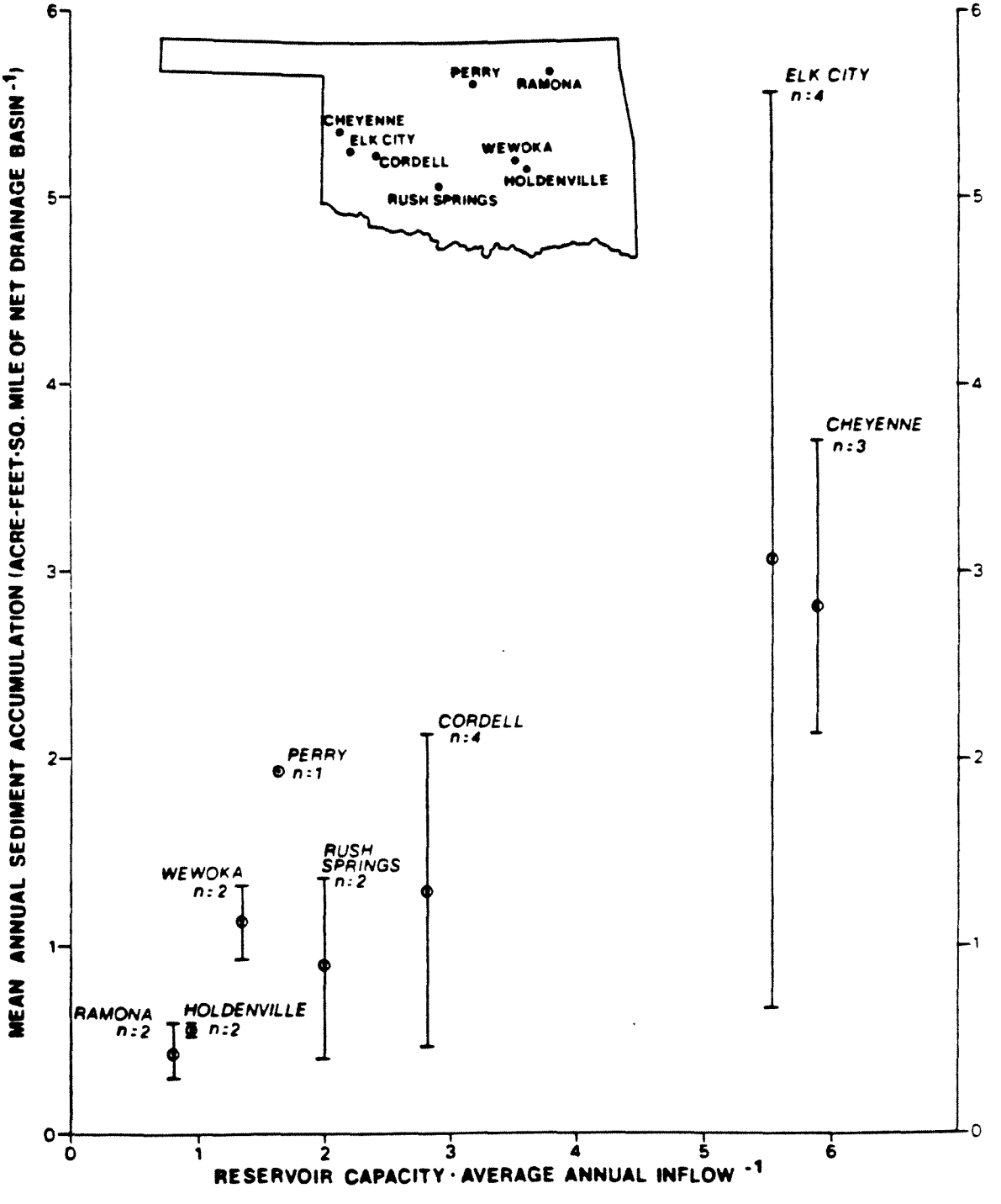

Figure 41, Task 10. Sediment accumulation in eight Oklahoma Reservoirs.

Table 5, Task 10. Concentration of chlorinated hydrocarbon pesticides, heavy metals, and PCB's in fish filets (µg/kg).

PARAMETER	CONCENTRATION (µg/L)
A & B BHC	1.06
Lindane	0.09
Heptachlor	<0.10
Aldrin	<0.20
p,pDDE	9.17
Dieldrin	<0.20
p,pDDT	<0.70
Endrin	<0.70
Methoxychlor	<2.00
Chlordane	41.20
Arochlor 1242	<6.00
Arochlor 1254	12.70
p,pDDD	<0.70
Cadmium	<100
Chromium	800
Copper	500
Lead	<1000
Zinc	7800
Mercury	240

differentially deposited along the reservoir's old stream channel with increasing amounts deposited towards the upper reaches (southern end) of the reservoir.

An analysis of the Total Extractable material from the sediment of Northeast Lake (Table 6, Task 10) indicated a potential problem with chlordane, methoxychlor, 2,4-D, and Silvex; however, upon further analysis of the sediment by the EP-Toxicity, no significant problems were found (Table 7, Task 10). More specifically, the four compounds mentioned above did exceed USGS sediment alert levels (1977) when the Total Extractable Test was performed on the sediment. The compounds 2,4-D and Silvex were found possibly to be in concentrations higher than the alert level; however, since the measured sediment values were reported to be less than 25 micrograms per kilogram of sediment, they may have actually been less than the alert level of 20 micrograms per kilogram. Methoxychlor and chlordane were, however, significantly higher than the USGS alert levels under the Total Extractable Test conditions. Consequently, Northeast Lake sediment was subjected to the EP-Toxicity test. The levels detected for both Methoxychlor and Chlordane under these more realistic desorbtion conditions were less than Federal Register alert levels (1980) (for methoxychlor) or Region VI Alert Levels for sediments (for chlordane). Appendix 10-C contains the various toxicity and alert levels used in these analyses.

Table 6, Task 10. Total extractable test for Northeast Reservoir sediment.

PARAMETER	NORTHEAST RESERVOIR (µg/L)	USGS ALERT LEVELS (µg/L)
Lindane	1.7	20
Heptachlor	1.4	20
Aldrin	3.0	20
p,pDDE	10.85	--
Dieldrin	5.0	20
p,pDDT	12.0	20
Endrin	14.0	20
Methoxychlor	<50	20
Chlordane	158	20
Arochlor 1254	135	--
p,pDDD	11.8	--
a + b BHC	9.4	--
2,4-D	<25	20
2,4,5-T	7	--
Silvex	<25	20

* Analyzed by Oklahoma City-County Health Department Laboratory.
** USGS Alert Levels (1977)

Table 7, Task 10. EP-Toxicity test for Northeast Reservoir sediment.

PARAMETER	NORTHEAST RESERVOIR (µg/L)	ALERT LEVEL
Methoxychlor	<0.36	10 mg/liter*
Chlordane	<1.00	2.4 micrograms/liter**

* Federal Register Alert Levels (1980)
** Region 6 Alert Levels (1980)

SECTION VII

BIOLOGICAL RESOURCES (TASK 11)

Northeast Reservoir is located upon recent alluvial deposits over the Garber sandstone formations. Soils in this region are classified primarily as bottomland and forested uplands, while the associated, generalized vegetation area is classified as Post Oak/Blackjack. This type of vegetation area is characterized by a mixture of forest (predominantly deciduous trees) and grasslands. Post Oak (Quercus stellata) and Blackjack Oak (Q. marilandica) are the principal trees in this vegetation area with Black Hickory (Carya buckleyi) less heavily distributed. Little bluestem (Andropogon scoparius) and big bluestem (A. furcatus) comprise the dominant grasses in this vegetation area.

Principal terrestrial vertebrates associated with the Post Oak/Blackjack vegetation area include the opposum (Didelphis virginiana), fox squirrel (Scurius niger rufiventer), cottontail rabbit (Sylvilagus floridanus), striped skunk (Mephitis mesomelas), white-tail deer (Odocoileus virginianus louisianae), racoon (Procyon lotor), and bobcat (Lynx rufus).

The bobwhite (Colinus virginianus) is the principal avian species associated with the Post Oak/Blackjack vegetation area; however, a number of species not associated with this vegetation type utilize Northeast Lake and the periphery of the reservoir. A survey of waterfowl in and around Northeast Lake was made during the Fall of 1981. Five species were identified: common egret (Casmerodius albus), American coot (Fulica americana), mallard duck (Anas platyrhynchos), red-breasted merganser (Mergus serrator), and green heron (Butorides viresiens).

Northeast Lake has also provided a habitat for a population of red-ear turtles (Chrysemys scripta) and the water snakes Natrix; however, the most significant populations of aquatic vertebrates are the fishes (Black bullhead catfish (Ictalurus melas); bluegill (Lepomis macrochiris); Black crappie (Pomoxis nigromaculatus), and Largemouth bass (Salmoides micropterus). Fish were collected in August 1981 utilizing four, 25 cm. bar mesh gill nets. Nets were set perpendicular to the dam extending toward the south end of the lake. Sampling indicated that Black bullhead and Bluegill were the predominant species. Black crappie and Largemouth bass comprised only a fraction of the total catch.

The large numbers of Black bullhead relative to other species are indicative of a reservoir of poor water quality. This species exists in poorly oxygenated habitats that more sensitive game fish cannot tolerate. As mentioned in Task 10, Northeast Reservoir is subjected to to algal blooms and stormwater runoff that can totally deplete the oxygen dissolved in the water. The anoxic and near anoxic conditions that occur in the reservoir during the spring and summer limit Northeast Reservoir's species diversity and are the cause of the dominant population of Black bullheads in Northeast Reservoir.

A comprehensive list of the flora and fauna of the central Oklahoma region is presented in Appendix 11-A.

SECTION VIII

RESTORATION ALTERNATIVES AND RECOMMENDATIONS (TASK 12)

Northeast lake has three different causes of its present polluted state: 1) stormwater runoff from Oklahoma City streets; 2) stormwater runoff from the Oklahoma City Zoo; and 3) clogged sewer lines in the watershed which cause raw sewage to enter the lake. The third problem, i.e., the clogged sewer lines have already been corrected. Consequently, the selection of restoration alternatives needs to address items one and two above, i.e., the problems of stormwater runoff from Oklahoma streets and from the Oklahoma City Zoo.

Restoration alternatives were evaluated and discussed with the Northeast Lake Committee throughout the course of the public participation program. These alternatives were grouped into symptomatic and causative approaches and were evaluated with regard to their cost and applicability to Northeast Lake.

Symptomatic Approaches:

Dilution

The addition of dilution water to Northeast Lake would reduce the concentration of nutrients in the lake but obviously would not reduce the lake's nutrient loading. Consequently, this restoration method is viewed as a symptomatic treatment and not as one which would solve the lake's problem. The mean summer Total Phosphorus concentration in Northeast Lake is 500 mg/L. A level that would probably be acceptable would be around 50 mg/L. Consequently, if the assumption was made that the dilution water was completely free of phosphorus, Northeast Lake would require dilution by an order of magnitude. Such a reduction would require 10 lake volume changes. Consequently, this procedure would cost:

> 10 lake volumes X 65,180,000 gallons per lake volume X 0.0025 dollars per gallon* or $1,629,500 dollars per year.

Nutrient Inactivation

Nutrient inactivation by application of aluminum sulfate is also viewed as a symptomatic lake restoration technique. In addition to its symptomatic nature, the method also has the disadvantage that it can only be applied after an environmental impact has occurred.

Application rates taken from the literature range from 0.4 to 22.6 mg per liter. Utilizing the upper treatment level, a single application to Northeast Lake would cost $2,455 for aluminum sulfate and an additional $2,400 in personnel and application hardware, resulting in a total cost of approximately $5,000 per application.

* Water cost provided by the City of Oklahoma City Water Resources Department.

246,706,300 liter/lake volume X 22.6 mg/liter = 5,575,562,380 mg or 5,576 kilograms X 0.4405286 dollars/kilogram = $2,455.94.

Then 2,455.94 + 2,400 = $5,000.

Macrophyte Harvesting

Macrophyte harvesting was not a feasible restoration option for Northeast Lake since the areal extent of lake bottom covered by macrophytes is less than 1% of the lake's surface area (Task 10).

Aeration/Mixing

Hypolimnetic aeration was not considered as a feasible restoration for Northeast Lake since the data from Task 10 shows that this shallow reservoir is already naturally mixed year round due to wind action.

Dredging

Dredging of Northeast Lake is not proposed by this phase one Clean Lake study as a restoration method since it would only serve to increase the hydraulic residence. However, the Oklahoma City Zoo is planning to dredge based on verbal dialogs with them at our public meetings. Dredging may improve the water quality in the reservoir if done in concert with other restoration methods. The volume of material to be dredged will be determined utilizing the results from this study. The dredge material will be made available for public bid. If bids are received, dredging will then be accomplished at no cost.

Causative Treatment:

Biomanipulation

Biomanipulation was considered to be too poorly documented to be proposed as a restoration method. Additionally, the dramatic oxygen depletion which occurs in this reservoir following storm events (Task 10) precludes biomanipulation as a viable restoration technique.

Watershed Management

Dump and Landfill

Management of Northeast Lake's watershed has already been initiated. During the analysis of land uses in the watershed, an illegal landfill and dump were discovered. Vehicular traffic to and within the dump, which is located over sewer lines, had resulted in risers to these sewer lines being broken and occluded by construction debris. This resulted in their backing up and overflowing from the risers into tributaries to Northeast Lake.

Legal action has been initiated by the Oklahoma City-County Health Department which should result in the dump being closed and cleaned up. Oklahoma City's sewer line maintenance personnel have already repaired

the clogged sewer lines and consequently they no longer backup and overflow into the tributaries. Oklahoma City-County Health Department is also presently addressing the problem of the landfill.

Oklahoma City Zoo Stormwater Detention Basin

Runoff from the Oklahoma City Zoo (Figures 37 and 40 in Task 10, Site 8) has been identified as a statistically significant pollution source entering Northeast Lake. The Oklahoma City Zoo has agreed to provide $100,000 in matching funds to finance the construction of a stormwater detention basin. The total operation is estimated to cost $200,000. This stormwater detention basin will prevent any runoff nutrient loading from entering Northeast Lake from the Oklahoma City Zoo.

Diversion

Urban Runoff Diversion Canal

Inspection of Northeast Lake's hydrologic budget (Figure 6, Task 10) illustrates the fact that surface runoff is largely responsible, on an annual basis, for the present water quality characteristics exhibited by this urban reservoir. Consequently, an analysis of nutrient loadings due to surface runoff should quantitatively illustrate the problem. The many inputs to this reservoir and the variable and intermittent nature of their discharges makes it difficult to fractionate the loadings to the reservoir into those components which were contributed by the zoo, by the broken sewer lines in the watershed, and by stormwater runoff. An upper limit to the stormwater loadings can be determined, however, if certain assumptions are made. If we assume: (a) that there is no assimilation of Total Phosphorus by the reservoir (this is reasonable due to the short annual hydraulic residence time (Table 2, Task 10), but even if there is some Total Phosphorus loss to the sediments, they constitute a finite quantity, and any sediment loading after stormwater diversion will asymptotically approach zero over time); (b) that the zoo and the watershed sewer lines contributed no Total Phosphorus to the lake (this assumption is clearly incorrect but allows us to calculate an upper limit due to stormwater loadings); and (c) that there is a "first flush" effect which contributes 85 percent of the Total Phosphorus loading during the first two thirds of the hydrograph (ACOG, 1977; Table 1, Task 12).

The reservoir then can be conceptualized as functioning as a manifold which integrates all the nutrient input concentrations in a discharge weighted manner and expresses them as an outfall nutrient concentration. Consequently, the upper limits of Total Phosphorus loading due to stormwater runoff can be calculated using a mean annual site 1 Total Phosphorus concentration of 312 micrograms per liter or 312 milligrams per cubic meter. Multiplying this mean annual Total Phosphorus concentration (using May 12, 1981, through March 21, 1982, data) by the annual outfall discharge of 2.82×10^6 cubic meters results in an upper limit to the annual stormwater runoff Total Phorsphorus load being 879 kilograms or expressed on an areal basis is 6.28 grams per square meter of reservoir surface area.

Table 1, Task 12. Temporal variation of Total Phosphorus loading in Oklahoma City stormwater runoff.

TIME SINCE ONSET OF RAINFALL (hr)	TOTAL P (mg/L)	DISCHARGE (m^3/sec)	ACCUMULATED % REDUCTION IN DISCHARGE	TOTAL P LOADING (kg/hr)	ACCUMULATED % REDUCTION IN P LOADING
0-1	1.1	.54	49.5	2.14	27.2
1-2	3.7	.34	80.7	4.53	84.6
2-3	1.6	.21	100.0	1.21	100.0

(based on data collected at Byers, Spring of 1976 - ACOG 1977)

The effect of diversion of the first two-thirds of the stormwater runoff discharge throughout the year can be determined by reducing the prediversion loadings by 85 percent and recalculating hydrologic residence time. This results in a mean annual post-diversion upper limit due to stormwater runoff Total Phosphorus loading of 132 kilograms or expressed on an areal basis of 0.94 mg per square meter of reservoir surface area. Figure 1, Task 12 illustrates this reduction in the upper limit of stormwater loading superimposed on Vollenweider's Total Phosphorus loading plot reinterpreted for shallow lakes and reservoirs (Clasen, 1980).

Selective diversion of stormwater runoff should reduce the stormwater loading to Northeast Lake by at least 85 percent, and transform a hypereutrophic reservoir into an oligo-mesotrophic reservoir.

The location of the diversion canal was chosen to permit complete bypass of golf course runoff which is at the present time entering Northeast Lake. Similarly, the provision for a control structure, which will permit complete bypass, will protect the lake should future oil pipeline breaks occur. To permit almost complete first flush bypass of urban runoff, a concrete lined diversion canal 6,000 feet long, 26 feet wide, and 7 feet deep would be required. Utilizing peak discharge of 2,400 cfs determined from a HEC 1 simulation based upon 100 year return period and 24-hour duration design criteria, this diversion canal will bypass approximately 93 percent of the peak discharge from the watershed.

The diversion canal would cost approximately $858,000 dollars (Table 2, Task 12). Oklahoma City is able to match $400,000 via in-kind construction cost services.

Lake Restoration Accomplishments

There has been good coordination among the various agencies and organizations concerned with the restoration of the Northeast Lake and the watershed.

Damaged and clogged sewer lines located below an illegal dump within the watershed were identified as the cause of sewage infiltration into one of the lakes tributaries. On June 29, 1982, the Oklahoma City-County Health Department (OCCHD) held a meeting with landowners of the dump, and City and State agency officials discussed the problems. A plan of action was formulated to improve the condition. The landowners stated they were attempting to control the dumping problem by fencing and renovating the property. The damaged sewer lines below the dump site have been repaired by Oklahoma City.

On November 3, 1982, another meeting was held with OCCHD and OWRB officials regarding the dump site problem. Despite the assurance by landowners that dumping of construction and other refuse could be controlled, continued dumping had occurred. As a consequence of the meeting, legal actions by OCCHD and the municipal attorney have been taken. Letters of noncompliance have been sent to the landowners instructing them that failure to comply with health standards will result in criminal prosecution. Further actions are being taken by local agencies to have the refuse on the dump site removed.

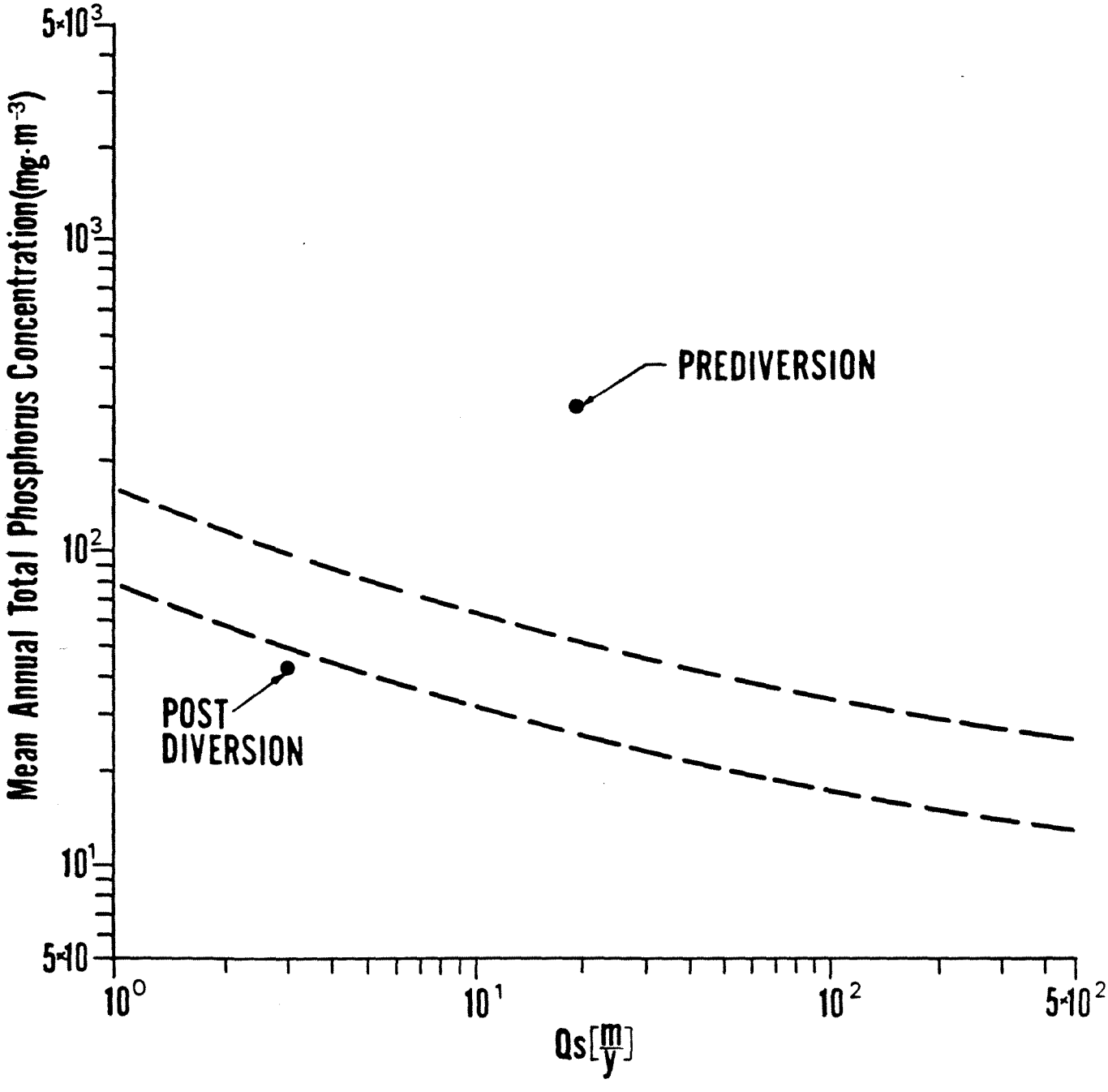

Figure 1, Task 12. Total phosphorus loading versus predicted trophic state.

Table 2, Task 12. Diversion canal cost estimates.

DIVERSION CANAL DEPTH (feet)	CANAL DISCHARGE CAPABILITIES (cfs)	AMOUNT OF PROBABLE MAXIMUM FLOOD PEAK BYPASSED (percent)	MEAN WATER VELOCITY IN CANAL (ft. sec^{-1})	COST OF 6000 FOOT CANAL @ \$4.50 ft^{-2} (U.S. dollars X 10^5)
1	77	3	5.9	4.00
2	247	10	9	4.76
3	493	21	11	5.53
4	813	34	13	6.29
5	1208	50	14	7.05
6	1683	70	16	7.82
7	2238	93	17	8.58
8	2877	120	18	9.34

Other accomplishments concerning the lake include the activities of the Zoo in organizing clean up programs with local youth organizations. On February 26, 1982, Oklahoma City Boy Scouts policed debris on the Northeast Lake bed. With local media coverage, the event was important in making the problems and potential of the lake known to people of the Oklahoma City area.

Finally, the Zoo is planning the disposal of the accumulated lake bottom sediment through bids from local contractors for use as top soil.

Proposed Northeast Lake Restoration Plan

The proposed restoration plan includes three separate actions/items:

Action 1:

> Initiation of legal action to close the illegal dump site in the watershed and to repair and unclog the sewer lines located beneath.

These actions have already begun.

Action 2:

> The construction of a stormwater detention basin to collect Oklahoma City Zoo runoff.
>
> The Oklahoma City Zoo agreed that diverting their runoff to a detention basin (Figure 2, Task 12) is a viable option. Fourteen thousand five hundred dollars from Task 12 in the Northeast Lake Work Plan has been directed towards a study to determine how to accomplish this.

Action 3:

> Construct a diversion canal to divert stormwater runoff and its pollutant load around the lake (Figure 3, Task 12). The diversion canal would be designed with the provision for complete bypass. An additional advantage of the diversion canal would be its collection of nutrient, pesticide, and herbicide runoff from Lincoln Park Golf Course.

Justification for Additional Funding:

Northeast Lake is located in an urban area, surrounded by Lincoln Park Golf Course, the Oklahoma City Zoo, and Lincoln Park, consequently it is heavily used. Local funding has already resulted in the completion of Action 1 of the Northeast Lake Restoration Plan.

The Oklahoma City Zoo has agreed to and is actively pursuing a plan to divert their runoff to a detention basin west of the reservoir. Additionally, they have conducted a trash pick up day at Northeast Lake and have plans to use the accumulated sediment in the lake for landscaping top soil.

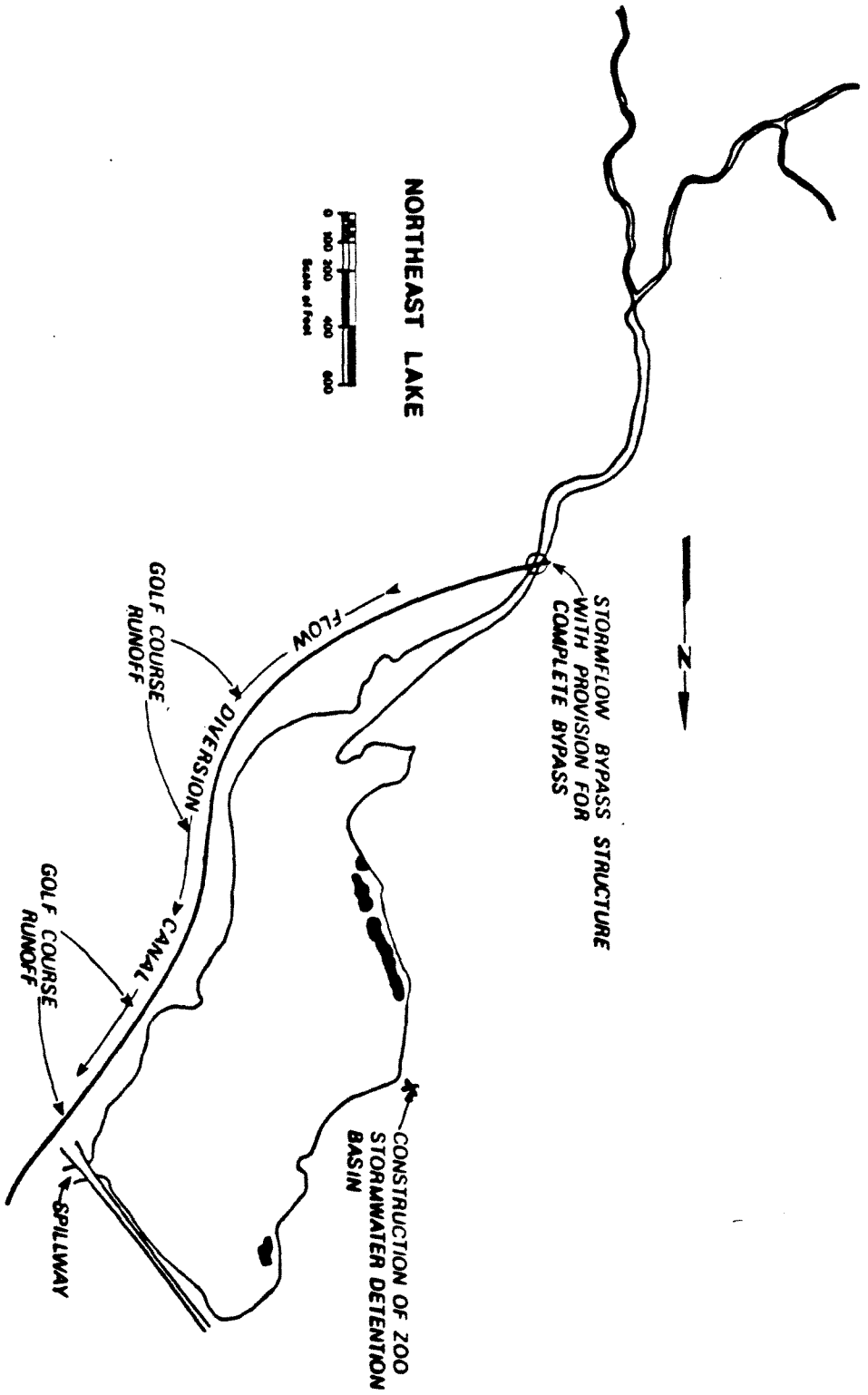

Figure 2, Task 12. Northeast Lake restoration plan.

The completion of proposed restoration Actions 2 and 3, a detention basin and the construction of a diversion canal, remain to be completed due to a lack of funds.

In an effort to identify local funding sources, the Oklahoma City Zoological Trust and Oklahoma City Community Development Department have been contacted. The Oklahoma City Zoological Trust, Oklahoma Zoological Society, and the Lincoln Park County Association have jointly agreed to commit $100,000 in matching funds to support the Northeast Lake Restoration Plan activities, provided federal funds are available. In a similar spirit the Oklahoma City Community Development Department has committed $400,000 of in-kind matching funds for construction of Northeast Lake dam, spillway, and diversion canal. The provision of $500,000 in federal funds would provide the necessary stimulus to completely restore Northeast Lake and would provide a major high quality recreation resource in a densely populated urban area.

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SECTION IX

RESTORATION BENEFITS (TASK 13)

A discussion of the particular benefits expected to result from implementing the project, including new public water uses that may result from the enchanced water quality follows.

Implementation of the proposed restoration plan should result in the following ecological benefits:

(1) The elimination (or reduction) of algal blooms, algal die offs, fish kills, and material desorbtion.

(2) The elimination of the health hazard due to bacterial infection. Reduction of bacterial levels in Northeast Lake will reduce the possibility of infection through paddle boat aerisol innoculation

(3) Diversion of the low quality portion of the stormwater has been calculated to result in a shift in the trophic state of the lake from hypereutrophic to oligo-mesotrophic (Appendix A). Another benefit would be the development of a diverse community indicative of a high quality reservoir includes: populations of sports fish; green algae; and diatoms.

Benefits that could be enjoyed by the public, following activities could take place within an esthetically pleasing setting once the lake level is restored to its original level (after dam/diversion canal construction):

(1) paddle boat operation by the zoo;

(2) lakeside fishing and picnicking by local residents; and

(3) aesthetic appreciation of the lake (including the lack of offensive odors formerly associated with the lake).

Additionally, the public would benefit from the improved condition of the lake, due to a reduction in their exposure to the very high levels of fecal coliform and associated pathogenic bacteria and viruses.

SECTION X

PHASE II PROJECT MANAGEMENT AND SAMPLING SCHEDULE (TASKS 14 AND 15)

A program was developed in order to monitor Northeast Lake water quality during implementation of the project. This will allow for the determination of the effects of the project on water quality, and will provide data which will indicate if a redirection of the project is needed to meet its goals. Those parameters which were indicated to be significant in the Phase I diagnostic Monitoring program will be of major concern (Table 1, Tasks 14 and 15).

A proposed milestone work schedule for project completion under Phase II is presented. Included is a proposed budget and payment schedule that is related to the milestone (Table 2, Tasks 14 and 15).

Table 1, Tasks 14 and 15. Phase II Monitoring Program.

DATE	PARAMETERS	MONITORING FREQUENCY
Grant Award Date (GAD) plus one month	Fecal coliform Total phosphorus	As specified in Federal Register Vol. 24, No. 25
GAD plus two months	Fecal coliform Total phosphorus	As specified in Federal Register Vol. 24, No. 25
GAD plus three months (Phase II work begins)	Fecal coliform Total phosphorus	As specified in Federal Register Vol. 24, No. 25
GAD plus 4....15 months	Fecal coliform Total phosphorus	As specified in Federal Register Vol. 24, No. 25

Sampling will be conducted above and below project area (i.e. two sites).

Table 2, Tasks 14 and 15. Northeast Lake Phase II Milestone Schedule.

DATE	ACTIVITY
Grant Award Date (GAD) plus one month or adjusted to two months before onset of work	Phase II Monitoring Program
GAD plus two months	Pre-project monitoring continues
GAD plus three months	Project work begins
GAD plus 4....15 months	Concurrent and past project monitoring

SECTION XI

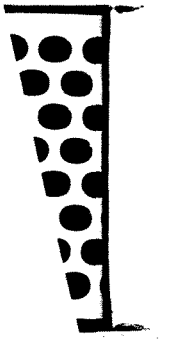
SOURCES OF NON-FEDERAL PHASE II FUNDING (TASK 16)

llowing agencies have been identified as sources of non-federal
ation funding:

Oklahoma City has agreed to $400,000 of in-kind match.

•Oklahoma City Zoological Trust has agreed to $100,000 of in-kind match.

•Copies of letters from both authorities regarding the above mentioned agreements are included.



SECTION XII

SUMMARY OF POLLUTION CONTROL ACTIVITIES IN THE WATERSHED (TASK 17)

As specified in the Clean Lakes Federal Regulations for this task, the following agencies were contacted concerning pollution control programs, grants, or other construction activity occuring or to occur within the Northeast Lake watershed: Oklahoma Department of Pollutin Control (DPC), Department of Agriculture Soil Conservation Service (ASCS), Agriculture Stabilization and Conservation Services Program (ASCSP), Department of Housing and Urban Development block grant program (HUD), Oklahoma City Housing Authority (OKCHA), Department of Grants Management for Oklahoma City (DGMOKC), and Association of Central Oklahoma Governments (ACOG).

Representatives from most agencies did not know of any pollution control projects, grants, or activities occurring or scheduled to occur in the Northeast lake watershed. The DGMOKC representative indicated that there was one community development block grant on the edge of the watershed involving sewerline improvement; however, construction had been completed and only paper work remains to be filed.

ACOG repsentative indicated that there was no present or proposed discharges anticipated in the region. Representatives of the other agencies mentioned above, likewise were not aware of any pollution control programs in the Northeast Lake watershed.

SECTION XIII

OPERATION AND MAINTENANCE PLAN (TASK 18)

This Phase II project involves diverting the runoff from the Oklahoma City Zoo into a detention basin. Consequently the Oklahoma City Zoo will be responsible in the operation and active maintenance of the facility. Similarly, they will be responsible for developing the time period in which this operation will take place.

SECTION XIV

PERMIT REQUIREMENTS (TASK 19)

According to a representative for the Army Corp of Engineers' (COE), no 404 permit will be required for restoration as Northeast Lake is located above the COE's defined headwaters of the Deep Fork tributary.

SECTION XV

PUBLIC PARTICIPATION (TASK 20)

The projected public participation program for the Northeast Lake Phase II project is included in Table 1, Task 20. Appendix 20-A contains a complete record of the Phase I public participation activities to date for Northeast Lake. Meeting announcements, attendance records, responsiveness summaries, and press releases are also included.

Table 1, Task 20. Northeast Lake Phase II Public Participation Milestone Schedule.

DATE	ACTIVITY
Grant Award Date (GAD)	Revise mailing list
GAD plus two months	Press release for public meeting
GAD plus three months	Public meeting to begin project
GAD plus five months and every two months thereafter until restoration projects end.	Committee meeting for update

A public meeting will be held at the beginning of the two year monitoring program which is required for any Phase II project. Also, press releases will be sent out before each major restoration technique is implemented.

SECTION XVI

REFERENCES

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APPENDIX 10-A

WATER CHEMISTRY ANALYSIS

OKLAHOMA CITY COUNTY HEALTH DEPARTMENT
ENVIRONMENTAL HEALTH SERVICES
PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division

Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE Sampling Dates: 5/7/81

	Station No.			
PARAMETERS	1	2	3	4
Nitrate as N(ppm)	6.08	8.57	7.83	4.13
Fecal Coliform(#/100ml)	R	R	R	R

PARAMETERS	5	6	7	8
Nitrate as N(ppm)	7.30	1.18	7.41	7.30
Fecal Coliform(#/100ml)	R	R	R	R

PARAMETERS	9	10	11	B
Nitrate as N(ppm)	7.62	0.10*	10.27	
Turbidity(NTU)				170
Chloraphyll-a(ppb)				20.4/21.1
Pheophytin-a				3.4/1.8
Fecal Coliform(#/100ml)	R	R	R	

R=Rejected: See analyst comments.

*=Less than indicated value.

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ENVIRONMENTAL HEALTH SERVICES
PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division
Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE. Sampling Dates: 5/12/81

	Station No.				
	1	2	3	4	5
PARAMETERS					
(ppm)					
Total Alkalinity	80	90	100	66	90
"P" Alkalinity	1*	1*	1*	1*	1*
Dissolved Solids	230	200	200	170	220
Settleable Solids(ml/L)	0.1*	0.1*	0.1*	0.1*	0.1
Dis. Ortho Phosphate as P	0.330	0.294	0.382	0.254	0.290
Total Ortho Phosphate as P	0.460	0.536	0.460	0.304	0.484
Total Phosphate as P	0.535	0.943	0.637	0.332	0.485
Nitrite as N	0.05	0.04	0.04	0.03	0.04
BOD	34.5	23.8	9.8	8.3	13.2
as(NTU): Turbidity	80	360	80	55	80

R=Rejected: See analyst comments.
*=Less than indicated value.

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	Station No.				
	6	7	8	9	10
PARAMETERS (ppm)					
Total Alkalinity	20	88	132	58	206
"P" Alkalinity	1*	1*	1*	1*	1*
Dissolved Solids	90	190	210	150	500
Settleable Solids(ml/L)	0.1*	0.1*	0.1*	0.2	0.1
Dis. Ortho Phosphate as P	0.100	0.304	0.588	0.254	0.100
Total Ortho Phosphate as P	0.100	0.408	0.640	0.356	0.228
Total Phosphate as P	0.127	0.586	0.841	0.383	0.230
Nitrite as N	0.01*	0.05	0.06	0.02	0.05
BOD	11.4	15.9	30.7	18.9	31.8
as(NTU): Turbidity	24	75	45	55	45

R = Rejected: See analyst comments.

* = Less than indicated value.

	Station No.		
	11	12	B
PARAMETERS			
(ppm)			
Total Alkalinity	244	224	
"P"Alkalinity	1*	1*	
Dissolved Solids	900	470	
Settleable Solids(ml/L)	0.1*	0.1*	
Dis. Ortho Phosphate as P	0.768	0.290	
Total Ortho Phosphate as P	4.208	0.434	
Total Phosphate as P	4.640	0.485	
Nitrite as N	0.01*	0.01*	
BOD	77	28.6	
as(NTU): Turbidity	75	15	
(as ppb) Chlorophyll-a			21.6/22.4
Pheophyton-a			7.4/4.0

R = Rejected: See analyst comments.

* = Less than indicated value.

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PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division

Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE Sampling Dates: 5/12/81

Parameter	Station No. 1	2	3
Fecal Coliforms (#/100ml)	1.4×10^3	8.2×10^3	2.4×10^3
	4	5	6
	4.8×10^3	3.8×10^4	9.0×10^2
	7	8	9
	1.5×10^5	3.5×10^5	1.6×10^4
	10	11	12
	2.7×10^3	$4.0 \times 10^{5*}$	1.9×10^3
		B	
		1.8×10^3	

* = Greater than indicated Value

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ENVIRONMENTAL HEALTH SERVICES
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Environmental Monitoring and Analysis Division

Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE Sampling Dates: 5/19/81

	Station No.			
PARAMETERS(ppm)	1	2	3	4
Nitrate as N	1.14	0.32	0.73	1.86
Ammonia as N	0.85	0.72	0.36	0.61
Kjeldahl N as N	0.90	4.26	0.78	3.14

PARAMETERS(ppm)	5	6	7	8
Nitrate as N	0.47	0.15	0.56	0.56
Ammonia as N	0.63	0.10*	0.61	1.11
Kjeldahl N as N	2.91	0.11*	0.45	3.58

PARAMETERS(ppm)	9	10	~~10A~~	11
Nitrate as N	0.49	0.10*	0.10*	0.10*
Ammonia as N	0.61	0.37	0.10*	9.83
Kjeldahl N as N	0.11*	2.58	23.18	20.83

PARAMETERS(ppm)		12	B
Nitrate as N		0.10*	0.48
Ammonia as N		0.10*	0.58
Kjeldahl N as N		0.90	0.11*

R=Rejected: See analyst comments.
*=Less than indicated value.

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ENVIRONMENTAL HEALTH SERVICES
PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division

Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE Sampling Dates: 5/27/81

	Sample #	Fecal Coliforms (#/100ml)
Station 11	5378	4.4×10^6
	5377	4.0×10^6
	5376	3.2×10^6
	5375	4.0×10^6
	5374	4.9×10^6
	5373	5.2×10^6
	5372	4.3×10^6
		MEAN = 4.3×10^6
Station B	5371	2.2×10^2
	5370	1.4×10^2
	5369	2.4×10^2
	5368	5.2×10^2
	5367	2.2×10^2
	5366	4.8×10^2
	5365	2.0×10^2
		MEAN = 2.9×10^2
Station 8	5364	8.7×10^4
	5363	6.0×10^4
	5362	8.5×10^4
	5361	5.1×10^4
	5360	6.7×10^4
	5359	7.9×10^4
	5358	6.2×10^4
		MEAN = 7.0×10^4

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PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division
Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE — **Sampling Dates:** 06/01/81

	Station No.			
Parameter	2a	2b	3a	3b
Fecal Coliforms (#/100ml)	1.4×10^3	4.0×10^3	1.2×10^3	1.0×10^3
Fecal Strep.	3.6×10^3	2.0×10^3	4.6×10^3	4.4×10^3
Ratio	0.39	2.00	0.26	0.23
	4a	4b	5a	5b
Fecal Coliforms	1.0×10^3	1.0×10^3	4.6×10^3	3.6×10^3
Fecal Strep.	2.2×10^3	1.8×10^3	1.9×10^4	1.5×10^4
Ratio	0.45	0.56	0.24	0.24
	6a	6b	7a	7b
Fecal Coliforms	2.8×10^3	3.7×10^3	5.0×10^3	2.0×10^3
Fecal Strep.	1.2×10^4	1.7×10^4	1.6×10^4	4.2×10^4
Ratio	0.23	0.22	0.31	0.48
	8a	8b	9a	9b
Fecal Coliforms	3.0×10^4	9.9×10^4	2.6×10^3	2.8×10^3
Fecal Strep.	4.2×10^4	3.2×10^4	8.4×10^3	7.4×10^3
Ratio	0.71	0.31	0.31	0.38
	B	B'		
Fecal Coliforms	2.2×10^2	2.2×10^2		
Fecal Strep.	9.0×10^1	1.2×10^2		
Ratio	2.22	1.83		

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PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division
Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE

Sampling Dates: 06/01/81

Parameter	Station No. 1a	1b	10a	10b
Fecal Coliforms (#/100ml)	3.4×10^4	2.8×10^4	7.7×10^4	9.1×10^4
Fecal Strep.	1.5×10^4	2.4×10^4	1.3×10^5	1.1×10^5
Ratio	2.27	1.17	0.59	0.83

	11a	11b	12a	12b
Fecal Coliforms	3.9×10^5	2.5×10^5	4.0×10^4	5.9×10^4
Fecal Strep.	3.5×10^5	3.0×10^5	6.9×10^4	7.1×10^4
Ratio	1.11	0.83	0.58	0.83

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ENVIRONMENTAL HEALTH SERVICES
PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division
Analytical Report Summary

6/02/81

Project O.W.R.B. NORTHEAST LAKE. Sampling Dates: 6/~~4~~&2/81

	Station No.				
	1	2	3	4	5
PARAMETERS					
(ppm)					
Total Alkalinity	94	100	74	88	100
"P" Alkalinity	1*	1*	1*	12	12
as(NTU): Turbidity	61	R	38	36	56
BOD	2.4	300	30	3	3
Dissolved Solids	210	240	230	190	230
Settleable Solids(ml/L)	0.1*	R	0.1*	0.1*	0.1
Dis. Ortho Phosphate as P	0.454	0.172	0.506	0.450	0.550
Total Phosphate as P	0.465	2.001	0.783	0.544	0.723
Nitrite as N	0.01	0.01*	0.01*	0.01*	0.01*

R=Rejected: See analyst comments.
*=Less than indicated value.

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	Station No.				
	6	7	8	9	10
PARAMETERS (ppm)					
Total Alkalinity	48	92	74	94	114
"P" Alkalinity	4	14	14	14	1*
as(NTU): Turbidity	R	R	150	130	290
BOD	45	39	10	7	4.5
Dissolved Solids	140	230	210	220	250
Settleable Solids(ml/L)	0.1	0.1	0.1*	0.1*	0.1*
Dis. Ortho Phosphate as P	0.450	0.520	0.520	0.645	1.143
Total Phosphate as P	1.751	1.619	0.687	0.544	1.147
Nitrite as N	0.01*	0.01*	0.01*	0.01*	0.09

R = Rejected: See analyst comments.

* = Less than indicated value.

6/02/81

Northeast Lake

PARAMETERS (#100ml)	Station No. 1	2	3
Total Coliform	2.3×10^2	1.4×10^3	7.0×10^2
Fecal Coliform	8.0×10^1	5.0×10^1	8.0×10^1
Fecal Strep	2.6×10^2	1.3×10^3	3.3×10^2
	4	**5**	**6**
Total Coliform	4.9×10^2	7.0×10^2	2.0×10^2
Fecal Coliform	2.2×10^2	2.0×10^2	2.0×10^2
Fecal Strep	1.7×10^3	1.1×10^3	9.0×10^2
	7	**8**	**9**
Total Coliform	8.0×10^2	2.0×10^5*	5.0×10^2
Fecal Coliform	5.0×10^2	2.0×10^5*	5.0×10^2
Fecal Strep	1.7×10^3	1.7×10^5	2.0×10^2
	10	**11**	**12**
Total Coliform	7.0×10^3	1.7×10^4	1.6×10^4
Fecal Coliform	2.3×10^3	2.0×10^3	4.6×10^2
Fecal Strep	1.3×10^3	6.0×10^3	3.3×10^2
	B		
Total Coliform	4.6×10^2		
Fecal Coliform	1.1×10^2		
Fecal Strep	1.4×10^2		

*=Less than detection limit.

	Station No.		
	11	12	B
PARAMETERS (ppm)			
Total Alkalinity	78	140	98
"P"Alkalinity	1*	1*	10
as(NTU): Turbidity	60	66	35
BOD	4.7	2.5	2.7
Dissolved Solids	170	290	240
Settleable Solids(ml/L)	0.1*	0.1*	0.1
Dis. Ortho Phosphate as P	0.488	0.583	0.548
Total Phosphate as P	0.547	0.679	0.962
Nitrite as N	0.06	0.10	0.01*

R = Rejected: See analyst comments.

* = Less than indicated value.

OKLAHOMA CITY COUNTY HEALTH DEPARTMENT
ENVIRONMENTAL HEALTH SERVICES
PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division
Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE *Sampling Dates: 06/15/81*

	Station No.	
Parameter	*8*	*10*
Fecal Coliforms (#/100ml)	5.9×10^5	1.0×10^5
	11	*12*
	3.6×10^6	1.4×10^4

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Project O.W.R.B. NORTHEAST LAKE. *Sampling Dates: 6/15/81*

	Station No.				
PARAMETERS	*2*	*3*	*4*	*5*	*6*
(ppm)					
Total Alkalinity	*86*	*46*	*80*	*84*	*22*
"P" Alkalinity	*0*	*2**	*0*	*0*	*4*
Dis. Ortho Phosphate as P	*0.348*	*0.104*	*0.340*	*0.352*	*0.092*
Total Phosphate as P	*0.224*	*0.136*	*0.464*	*0.500*	*0.240*
Nitrite as N	*0.08*	*0.01*	*0.04*	*0.04*	*0.02*
Nitrate as N	*0.13*	*0.64*	*0.06*	*0.82*	*0.28*
Ammonia as N	*0.11**	*0.11**	*0.11**	*0.22*	*0.11**
Kjedahl N as N	*4.37*	*0.11**	*1.57*	*1.90*	*3.25*
Total N as N	*4.69**	*0.87**	*1.78**	*2.98*	*3.66**
Chlorophyll-a (ppb)	*39.5*	*15.5*	*45.2*	*46.9*	*0.9*
Pheophytin-a (ppb)	*2.4*	*0.0*	*0.0*	*0.0*	*1.9*

R=Rejected: See analyst comments.
**=Less than indicated value.*

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6/15

PARAMETERS (ppm)	Station No. 7	8	9	10	11
Total Alkalinity	86	136	50	138	196
"P" Alkalinity	0	0	0	0	0
Dis. Ortho Phosphate as P	0.344	0.652	0.372	0.092	2.992
Total Phosphate as P	0.656	1.064	0.500	0.220	3.744
Nitrite as N	0.05	0.15	0.01	0.04	0.02
Nitrate as N	0.51	1.03	0.11	0.53	1.19
Ammonia as N	0.34	2.02	0.11*	0.11*	9.86
Kjedahl N as N	3.36	13.10	1.01	2.24	12.43
Total N as N	4.26	16.30	1.24*	2.92*	23.50
Chlorophyll-a (ppb)	56.5	24.1	39.7	4.1	18.6
Pheophytin-a (ppb)	0.0	63.4	5.9	0.9	0.0

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*=Less than indicated value.

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Project O.W.R.B. NORTHEAST LAKE. *Sampling Dates: 7/13/81*

	Station No.				
	B	2	3	4	5
PARAMETERS					
(ppm)					
Total Alkalinity	88	90	92	78	88
"P" Alkalinity	22	28	30	26	24
Suspended Solids	22	32	16	26	38
Dis. Ortho Phosphate as P	0.496	0.496	0.556	0.440	0.584
Total Phosphate as P	0.638	0.518	0.518	0.492	0.628
Nitrite as N	0.01*	0.01*	0.01*	0.01*	0.01*
Nitrate as N	0.10*	0.10*	0.10*	0.10*	0.10*
Ammonia as N	0.10*	0.10	0.10*	0.10*	0.10*
Kjeldahl N as N	1.79	R	2.13	2.58	5.49
Total N as N	2.00*	0.21*	2.34*	2.79*	5.70*

R=Rejected: See analyst comments.
**=Less than indicated value.*

	Station No.			
	6	7	8	9
PARAMETERS				
(ppm)				
Total Alkalinity	*90*	*80*	*122*	*66*
"P" Alkalinity	*26*	*22*	*18*	*8*
Suspended Solids	*96*	*22*	*24*	*238*
Dis. Ortho Phosphate as P	*0.556*	*0.584*	*0.384*	*0.268*
Total Phosphate as P	*0.680*	*0.638*	*0.518*	*0.736*
Nitrite as N	*0.01**	*0.01**	*0.01**	*0.01**
Nitrate as N	*0.10**	*0.10**	*0.10**	*0.10**
Ammonia as N	*0.10**	*0.10**	*0.11*	*0.32*
Kjeldahl N as N	*4.59*	*2.13*	*1.12*	*2.35*
Total N as N	*4.80**	*2.34**	*1.34**	*2.78**

R = Rejected: See analyst comments.

** = Less than indicated value.*

	Station No. 10	11
PARAMETERS		
(ppm)		
Total Alkalinity	*232*	*68*
"P"Alkalinity	*6*	*0*
Suspended Solids	*48*	*4*
Dis. Ortho Phosphate as P	*0.184*	*0.508*
Total Phosphate as P	*0.220*	*0.578*
Nitrite as N	*0.86*	*0.01*
Nitrate as N	*1.27*	*0.10**
Ammonia as N	*0.25*	*1.61*
Kjeldahl as N	*1.34*	*2.46*
Total N as N	*3.71*	*4.18**

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OKLAHOMA CITY COUNTY HEALTH DEPARTMENT
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Project O.W.R.B. NORTHEAST LAKE *Sampling Dates: 7/13/81*

	Station No.		
Parameter	*B*	*2*	*3*
Fecal Coliforms (#/100ml)	7.0×10^2	5.6×10^3	4.9×10^3
Fecal Strep.	3.1×10^2	4.0×10^2	9.0×10^2
	4	*5*	*6*
Fecal Coliforms	5.0×10^2	1.0×10^2	5.2×10^3
Fecal Strep.	2.0×10^2	5.0×10^1*	6.9×10^3
	7	*8*	*9*
Fecal Coliforms	4.0×10^3	3.7×10^5	7.0×10^4
Fecal Strep.	2.0×10^2*	5.0×10^2	1.1×10^4
	10	*11*	
Fecal Coliforms	6.0×10^4	3.0×10^4	
Fecal Strep.	4.0×10^2	1.0×10^4*	

* = *Less than indicated Value*

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Project O.W.R.B. NORTHEAST LAKE. Sampling Dates: 7/20/81

	Station No.				
	B	2	3	4	5
PARAMETERS					
(ppm)					
Total Alkalinity	R	78	60	82	88
"P" Alkalinity	0	0	12	16	20
Suspended Solids	40	1980	44	36	48
Dis. Ortho Phosphate as P	0.528	0.424	0.218	0.420	0.450
Total Phosphate as P	0.613	0.838	1.810	0.588	0.613
Nitrite as N	0.01*	0.01*	0.01*	0.01*	0.01*
Nitrate as N	0.10*	0.10*	0.27	0.10*	0.10*
Ammonia as N	0.10*	0.21	0.10*	0.10*	0.10*
Kjeldahl N as N	2.86	102.42	3.53	5.43	4.87
Total N as N	3.07*	102.74*	3.91*	5.64*	5.08*
Chlorphyll-a (ppb)	41.1	1196.5	67.6	111.1	96.0
Pheophytin-a (ppb)	65.4	0	0	0	8.9

R=Rejected: See analyst comments.
*=Less than indicated value.

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	Station No.				
	6	7	8	9	10
PARAMETERS(ppm)					
Total Alkalinity	70	70	50	36	234
"P" Alkalinity	4	6	0	0	0
Suspended Solids	50	42	54	76	38
Dis. Ortho Phosphate as P	0.346	0.372	0.088	0.088	0.140
Total Phosphate as P	0.562	0.512	0.236	0.212	0.537
Nitrite as N	0.01	0.01*	0.02	0.03	0.03
Nitrate as N	0.10*	0.10*	0.10*	0.12	0.10*
Ammonia as N	0.22	0.15	0.66	0.27	0.22
Kjeldahl N as N	2.41	2.63	5.32	1.06	0.84
Total N as N	2.74*	2.89*	6.10*	1.49	1.19*
Chlorophyll-a (ppb)	58.9	68.8	51.7	8.9	52.4
Pheophyll-a (ppb)	1.6	0.0	6.2	5.3	5.8

* = Less than indicated value.

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Project O.W.R.B. NORTHEAST LAKE Sampling Dates: 7/20/81

	Station No.			
Parameter(#/100ml)	B	2	3	4
Fecal Coliforms	1.5×10^2	2.1×10^3	7.3×10^3	4.8×10^2
Fecal Strep.	2.7×10^2	#	6.8×10^3	4.6×10^2
	5	6	7	8
Fecal Coliforms	5.0×10^3*	1.6×10^4*	1.6×10^4*	2.3×10^5
Fecal Strep.	5.0×10^3*	2.0×10^4*	2.0×10^4*	1.0×10^6*
		9	10	
Fecal Coliforms		1.0×10^5	7.0×10^3	
Fecal Strep.		4.3×10^4	3.0×10^2	

= No Sample

* = More than Indicated Value

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Project O.W.R.B. NORTHEAST LAKE. Sampling Dates: 8/18/81

	Station No.				
	1	2	3	4	5
PARAMETERS (ppm)					
Total Alkalinity	48	78	60	64	80
"P" Alkalinity	0	0	6	0	0
Suspended Solids	14	18	4	8	18
Dis. Ortho Phosphate as P	0.292	0.352	0.099	0.205	0.312
Total Phosphate as P	0.800	0.575	0.125	0.425	0.575
Nitrite as N	0.16	0.02	0.02	0.02	0.03
Nitrate as N	0.29	0.10*	0.47	0.25	0.25
Ammonia as N	0.59	1.28	0.39	0.53	1.11
Kjeldahl N as N	0.31	3.33	0.11*	0.14	0.70
Total N as N	1.35	4.73*	0.99*	0.94	2.09

*=Less than indicated value.

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Project O.W.R.B. NORTHEAST LAKE — Sampling Dates: 8/18/81

Parameter(#/100ml)	Station No. 1¹	1²	2¹	2²
Fecal Coliforms	R	R	3.6×10^3	3.8×10^3
Fecal Strep.	8.6×10^2	3.7×10^2	1.6×10^2	1.4×10^2
	3¹	3²	4¹	4²
Fecal Coliforms	5.0×10^2	5.0×10^2	2.7×10^3	1.9×10^3
Fecal Strep.	1.3×10^3	6.0×10^2	3.0×10^3	2.5×10^3
	5¹	5²	6¹	6²
Fecal Coliforms	1.5×10^4	1.1×10^4	1.6×10^4	1.4×10^4
Fecal Strep.	4.6×10^4	3.2×10^4	2.2×10^4	2.2×10^4
	7¹	7²	8¹	8²
Fecal Coliforms	R	R	R	R
Fecal Strep.	3.0×10^4	1.8×10^4	1.7×10^4	4.8×10^4
	9¹	9²	10¹	10²
Fecal Coliforms	6.0×10^3	1.2×10^4	1.2×10^4*	1.2×10^4
Fecal Strep.	5.0×10^3	3.0×10^3	5.8×10^3	5.6×10^3
	11¹	11²		
Fecal Coliforms	R	R		
Fecal Strep.	7.0×10^3	2.9×10^4		

R = Rejected. See Analyst's Comments

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	Station No.			
	6	7	8	9
PARAMETERS(ppm)				
Total Alkalinity	68	74	74	76
"P" Alkalinity	0	0	0	0
Suspended Solids	12	14	6	20
Dis. Ortho Phosphate as P	0.259	0.325	0.272	0.299
Total Phosphate as P	0.500	0.525	0.425	0.500
Nitrite as N	0.03	0.04	0.04	0.03
Nitrate as N	0.25	0.25	0.25	0.25
Ammonia as N	0.92	1.09	1.08	1.18
Kjeldahl N as N	1.76	0.70	1.88	1.26
Total N as N	2.96	2.08	3.25	2.72

	Station No. 10	11
PARAMETERS(ppm)		
Total Alkalinity	72	142
"P" Alkalinity	0	0
Suspended Solids	24	8
Dis. Ortho Phosphate as P	0.338	0.205
Total Phosphate as P	0.850	0.375
Nitrite as N	0.01	0.09
Nitrate as N	0.25	0.25
Ammonia as N	3.76	2.45
Kjeldahl N as N	1.71	0.92
Total N as N	5.73	3.71

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Project O.W.R.B. NORTHEAST LAKE. Sampling Dates: 8/25/81

	Station No.				
	1	2	3	4	5
PARAMETERS (ppm)					
Total Alkalinity	80	68	74	46	84
"P" Alkalinity	20	0	24	10	10
Suspended Solids	23	1396	27	9	21
Dis. Ortho Phosphate as P	0.180	0.190	0.102	0.108	0.172
Total Phosphate as P	0.312	0.590	0.222	0.210	0.368
Nitrite as N	0.01	0.01*	0.01	0.01	0.02
Nitrate as N	0.10	0.10*	0.21	0.10*	0.10*
Ammonia as N	0.10*	0.44	0.10*	0.10*	0.10*
Kjeldahl N as N	2.97	52.70	4.42	3.75	1.29
Total N as N	3.18*	53.25*	4.74*	3.96*	1.51*

*=Less than indicated value.

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	Station No.			
	6	7	8	9
PARAMETERS(ppm)				
Total Alkalinity	68	88	100	82
"P" Alkalinity	8	12	2	12
Suspended Solids	53	22	30	17
Dis. Ortho Phosphate as P	0.186	0.254	0.408	0.216
Total Phosphate as P	0.278	0.398	0.534	0.292
Nitrite as N	0.03	0.02	0.02	0.02
Nitrate as N	0.10*	0.10*	0.10*	0.10*
Ammonia as N	0.10*	0.10*	2.58	0.10*
Kjeldahl N as N	3.30	6.10	5.54	6.22
Total N as N	3.53*	6.32*	8.24*	6.44*

	Station No. 10	11
PARAMETERS(ppm)		
Total Alkalinity	199	72
"P" Alkalinity	0	0
Suspended Solids	16	50
Dis. Ortho Phosphate as P	1.006	0.840
Total Phosphate as P	1.463	1.101
Nitrite as N	0.36	0.01*
Nitrate as N	0.13	0.10*
Ammonia as N	10.40	4.17
Kjeldahl N as N	6.66	4.54
Total N as N	17.55	8.82*

	Station No.			
	1A	2A	1B	2B
PARAMETERS(micrograms/liter)				
Trichromatic				
Chlorophyll a	128.3	147.9	86.2	91.2
Chlorophyll b	0.0	0.6	0.0	1.8
Chlorophyll c	6.1	10.0	6.7	4.7
Monochromatic				
Chlorophyll a	136.1	147.7	83.0	89.7
Pheophytin a	0.0	0.0	0.0	0.0

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Project O.W.R.B. NORTHEAST LAKE — Sampling Dates: 8/25/81

	Station No.			
Parameter(#/100ml)	2	3	4	5
Total Coliforms	2.4×10^4*	2.4×10^3	3.3×10^2	7.9×10^2
Fecal Coliforms	1.6×10^4	4.9×10^2	7.0×10^1	4.9×10^2
Fecal Strep.	9.2×10^3	4.9×10^2	1.1×10^2	2.3×10^2
	6	7	8	9
Total Coliforms	2.3×10^3	4.9×10^3	2.4×10^6+	3.3×10^3
Fecal Coliforms	2.3×10^3	1.7×10^3	9.2×10^5	2.3×10^3
Fecal Strep.	4.0×10^2	3.3×10^3	3.5×10^5	8.0×10^2
	10	11	12	
Total Coliforms	5.4×10^4	2.2×10^5	2.0×10^2	
Fecal Coliforms	7.9×10^3	4.9×10^4	2.0×10^2*	
Fecal Strep.	2.3×10^3	1.1×10^4	2.0×10^2*	

* = Less than Indicated Value

+ = Greater than Indicated Value

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Project O.W.R.B. NORTHEAST LAKE. Sampling Dates: 9/23/81

	Station No.				
	1	2	3	4	5
PARAMETERS (ppm)					
Total Alkalinity	66	70	52	60	66
"P" Alkalinity	4	0	16	8	0
Suspended Solids	4	20	6	2	16
Dissolved Ortho Phosphate as P	0.210	0.210	0.119	0.171	0.197
Total Phosphate as P	0.321	0.346	0.171	0.246	0.346
Nitrite as N	0.01*	0.01*	0.01*	0.01*	0.01*
Nitrate as N	0.10*	0.10*	0.43	0.10*	0.10*
Ammonia as N	0.10*	0.10*	0.10*	0.10*	0.10*
Kjeldahl N as N	1.52	1.49	1.12	0.84	1.31
Total N as N	1.73*	1.70*	1.66*	1.05*	1.52*
Chlorophyll a (ppb)	57.4	62.8	23.5	37.2	57.4
Pheophytin a (ppb)	#	2.5	#	#	#

*=Less than indicated value.

= Less than Detection Limits.

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	Station No.				
	6	7	8	9	10
PARAMETERS(ppm)					
Total Alkalinity	56	64	88	40	190
"P" Alkalinity	6	6	0	0	0
Suspended Solids	2	4	82	6	10
Dissolved Ortho Phosphate as P	0.171	0.184	0.482	0.119	0.444
Total Phosphate as P	0.371	0.271	0.720	0.221	0.720
Nitrite as N	0.01*	0.01*	0.03	0.02	0.52
Nitrate as N	0.10*	0.10*	0.13	0.21	0.76
Ammonia as N	0.10*	0.10*	2.03	0.10*	0.91
Kjeldahl N as N	0.65	1.87	6.44	2.24	2.05
Total N as N	0.86*	2.08*	8.63	2.57*	4.34
Chlorophyll a (ppb)	33.7	48.2	16.8	10.9	0.9
Pheophytin a (ppb)	1.5	#	45.9	3.5	0.7

* = Less than Indicated Value

= Less than Detection Limit

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Project O.W.R.B. NORTHEAST LAKE Sampling Dates: 9/23/81

	Station No.			
Parameter(#/100ml)	1	2	3	4
Fecal Coliforms	4.9×10^2	8.0×10^2	2.2×10^2	3.5×10^3
Fecal Strep.	5.0×10^1	5.0×10^2	7.9×10^2	4.9×10^2
	5	6	7	8a
Fecal Coliforms	2.4×10^4*	9.2×10^4	9.2×10^4	2.4×10^7
Fecal Strep.	5.4×10^3	3.5×10^4	3.5×10^4	3.1×10^4
	8b	9	10	
Fecal Coliforms	2.4×10^7*	3.5×10^4	2.2×10^3	
Fecal Strep.	3.5×10^5	1.1×10^4	5.0×10^2	

* = More than Indicated Value

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Project O.W.R.B. NORTHEAST LAKE. Sampling Dates: 10/7/81

	Station No.			
	1	2	3	4
PARAMETERS (ppm)				
Total Alkalinity	70	62	58	20
"P" Alkalinity	0	0	0	4
Dissolved Solids	363	350	340	340
Suspended Solids	12	30	18	2
Dissolved Ortho Phosphate as P	0.184	0.242	0.167	0.050*
Total Phosphate as P	0.215	0.242	0.174	0.050*
Nitrite as N	0.01	0.01*	0.01*	0.01*
Nitrate as N	0.10*	0.10*	0.29	0.10*
Ammonia as N	0.10*	0.10	0.17	0.10*
Kjeldahl N as N	2.24	3.27	1.21	0.10*
Total N as N	2.45*	3.48*	1.68*	0.31*
Chlorophyll a (ppb)	49.9	61.9	57.4	5.4
Pheophytin a (ppb)	3.0	5.8	1.7	0.0

*=Less than indicated value.

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	Station No. 5	6	7	8
PARAMETERS(ppm)				
Total Alkalinity	60	38	58	64
"P" Alkalinity	0	0	0	0
Dissolved Solids	207	357	197	167
Suspended Solids	36	52	42	104
Dissolved Ortho Phosphate as P	0.242	0.128	0.256	0.653
Total Phosphate as P	0.242	0.132	0.256	0.904
Nitrite as N	0.01*	0.01*	0.01*	0.02
Nitrate as N	0.10*	0.10*	0.10*	0.20
Ammonia as N	0.17	0.17	0.11	0.73
Kjeldahl N as N	1.59	0.75	3.36	2.99
Total N as N	1.87*	1.03*	3.58*	3.94
Chlorophyll a (ppb)	68.2	44.9	71.1	123.5
Pheophytin a (ppb)	2.1	0.2	2.5	15.2

* = Less than Indicated Value

	Station No. 9	10	11
PARAMETERS(ppm)			
Total Alkalinity	62	82	102
"P" Alkalinity	0	0	0
Dissolved Solids	220	250	150
Suspended Solids	26	12	24
Dissolved Ortho Phosphate as P	0.269	0.435	0.666
Total Phosphate as P	0.270	0.684	0.739
Nitrite as N	0.01*	0.07	0.11
Nitrate as N	0.10*	0.23	0.13
Ammonia as N	0.11	0.34	0.73
Kjeldahl N as N	3.17	2.05	2.10
Total N as N	3.39*		3.07
Chlorophyll a (ppb)	111.6	3.1	1.4
Pheophytin a (ppb)	3.4	1.8	0.3

* = Less than Indicated Value

= Less than Detection Limit

OKLAHOMA CITY COUNTY HEALTH DEPARTMENT
ENVIRONMENTAL HEALTH SERVICES
PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division

Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE — Sampling Dates: 10/07/81

	Station No.			
Parameter(#/100ml)	1	2	3	4
Total Coliforms	5.4×10^3	1.1×10^3	5.4×10^3	5.0×10^1
Fecal Coliforms	5.4×10^3	7.0×10^2	2.2×10^3	2.0×10^1*
Fecal Strep.	3.3×10^2	1.7×10^2	1.3×10^3	4.6×10^2
	5	6	7	8a
Total Coliforms	3.5×10^3	7.0×10^3	4.6×10^3	2.0×10^5
Fecal Coliforms	3.5×10^3	4.9×10^3	3.1×10^3	2.0×10^5
Fecal Strep.	1.7×10^3	3.3×10^3	3.3×10^3	4.9×10^6
	8b	9	10	
Total Coliforms	7.0×10^5	4.9×10^3	9.4×10^3	
Fecal Coliforms	4.0×10^5	3.3×10^3	3.1×10^3	
Fecal Strep.	7.9×10^6	1.1×10^4	1.3×10^4	
	11a	11b		
Total Coliforms	2.3×10^4	1.3×10^4		
Fecal Coliforms	8.0×10^3	2.0×10^3		
Fecal Strep.	5.0×10^3	1.3×10^4		

* = More than Indicated Value

OKLAHOMA CITY-COUNTY HEALTH DEPARTMENT

ENVIRONMENTAL HEALTH SERVICES

PUBLIC HEALTH LABORATORY

Environmental Monitoring and Analysis Division

Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE Sampling Dates: 11-24-81

	Station No.				
	1	2	3	4	5
PARAMETERS (ppm)					
Total Alkalinity	76	80	80	24	78
Dissolved Solids	248	236	212	520	220
Suspended Solids	12	12	12	0	16
Dis. Ortho-Phosphate as P	0.092	0.092	0.050*	0.050*	0.073
Total Phosphate as P	0.198	0.271	0.050*	0.050*	0.126
Nitrite as N	0.03	0.03	0.02	0.01*	0.08
Nitrate as N	0.28	1.62	0.24	0.10*	0.26
Ammonia as N	0.53	0.60	0.39	0.10*	0.60
Kjeldahl N as N	1.03	1.63	0.75	0.11*	1.40
Total Nitrogen	1.87	3.88	1.40	0.32*	3.06
Chlorophyll a (ppb)	53.3	84.8	3.3	0.3	44.2
Pheophytin a (ppb)	*	*	0.6	*	*

*=Less than detection limit.

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Northeast Lake 11-24-81

	Station No.				
	6	7	8	9	10
PARAMETERS (ppm)					
Total Alkalinity	82	78	44	48	320
Dissolved Solids	244	260	124	528	1036
Suspended Solids	22	26	38	122	14
Dis. Ortho-Phosphate as P	0.086	0.090	0.080	0.080	0.050*
Total Phosphate as P	0.150	0.150	0.183	0.150	0.138
Nitrite as N	0.03	0.03	0.01*	0.01	0.03
Nitrate as N	0.24	0.29	0.13	0.17	0.53
Ammonia as N	0.62	0.62	0.23	0.12	0.22
Kjeldahl N as N	1.31	1.40	0.23	0.33	0.37
Total Nitrogen	2.20	2.34	0.60*	0.63	1.15
Chlorophyll a (ppb)	47.3	43.9	7.6	18.9	7.1
Pheophytin a (ppb)	*	*	9.9	*	*

*=Less than indicated value.

Northeast Lake 11-24-81

	Station No.		
	11	12	B
PARAMETERS (ppm)			
Total Alkalinity	372	432	80
Dissolved Solids	840	612	3212
Suspended Solids	2	14	20
Dis. Ortho-Phosphate as P	0.050*	0.259	0.073
Total Phosphate as P	0.174	0.320	0.138
Nitrite as N	0.09	0.01*	0.03
Nitrate as N	0.10*	0.10*	0.21
Ammonia as N	4.02	0.10*	0.68
Kjeldahl N as N	4.20	0.28	1.12
Total Nitrogen	8.39*	0.49*	2.04
Chlorophyll a (ppb)	0.7	1.1	48.8
Pheophytin a (ppb)	*	*	*

*=Less than detection limits.

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Environmental Monitoring and Analysis Division

Analytical Report Summary

Project O.W.R.B. NORTHEAST LAKE Sampling Dates: 12-14-81

	Station No.				
	1	2	3	4	5
PARAMTERS (ppm)					
Total Alkalinity	96	92	90	84	84
"P" Alkalinity	0	0	0	0	0
Dissolved Solids	204	268	256	204	240
Suspended Solids	12	14	22	22	20
Dis. Ortho-Phosphate as P	0.050*	0.050*	0.050*	0.050*	0.050*
Total Phosphate as P	0.150	0.138	0.126	0.102	0.102
Nitrite as N	0.02	0.02	0.02	0.02	0.02
Nitrate as N	0.21	0.17	0.54	0.18	0.17
Ammonia as N	0.17	R	0.10*	0.13	0.10
Kjeldahl N as N	1.03	1.03	0.75	0.84	0.65
Total Nitrogen	1.43	1.22	1.41*	1.17	0.94
Chlorophyll a (ppb)	108.3	152.3	132.2	120.9	105.0
Pheophytin a (ppb)	3.5	*	*	*	*

*=Less than detection limit.

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Northeast Lake 12-14-81

	Station No.				
	6	7	8	9	10
PARAMETERS (ppm)					
Total Alkalinity	84	86	126	68	258
"P" Alkalinity	0	0	0	0	0
Dissolved Solids	252	608	224	200	748
Suspended Solids	8	12	58	20	34
Dis. Ortho-Phosphate as P	0.050*	0.050*	0.163	0.055	0.074
Total Phosphate as P	0.126	0.102	0.257	0.126	0.304
Nitrite as N	0.02	0.02	0.04	0.01	0.08
Nitrate as N	0.19	0.22	0.37	0.30	0.67
Ammonia as N	0.12	0.13	1.22	0.14	1.98
Kjeldahl N as N	0.75	0.65	4.67	0.37	2.89
Total Nitrogen	1.08	1.02	6.30	0.82	5.62
Chlorophyll a (ppb)	82.8	83.5	11.3	58.6	*
Pheophytin a (ppb)	0.6	1.0	25.4	*	6.7

*=Less than detection limit.

Northeast Lake 12-14-81

PARAMETERS (ppm)	11	12	B
Total Alkalinity	250	406	86
"P" Alkalinity	0	0	0
Dissolved Solids	572	696	52
Suspended Solids	26	22	20
Dis. Ortho-Phosphate as P	0.061	0.572	0.055
Total Phosphate as P	0.364	0.721	0.161
Nitrite as N	0.16	0.09	0.02
Nitrate as N	0.37	0.39	0.20
Ammonia as N	3.28	1.16	0.17
Kjeldahl N as N	3.31	1.17	1.21
Total Nitrogen	7.12	2.81	1.60
Chlorophyll a (ppb)	3.1	13.5	76.7
Pheophytin a (ppb)	0.4	0.2	49.7

*=Less than detection limit.

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ENVIRONMENTAL HEALTH SERVICES
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Analytical Report Summary

Project: **O.W.R.B. N.E. LAKE** Sampling Date: 1-25-82

	Station No.			
PARAMETERS	1	2	3	4
Total Alkalinity	94	104	100	40
Dissolved Solids	272	256	300	192
Suspended Solids	20	18	20	214
Dissolved Ortho-Phosphate as P	0.050*	0.050*	0.050*	0.050
Total Phosphate	0.096	0.101	0.076	0.053
Nitrite (as N)	0.03	0.02	0.02	0.01
Nitrate (as N)	0.10*	0.10*	0.76	0.14
Ammonia (as N)	0.17	0.16	0.18	0.10*
Kjeldahl N (as N)	1.21	1.40	1.21	0.10*
Total N (as N)	1.51*	1.68*	2.17	0.35*
Chlorophyll a	89.1	81.9	70.7	4.4
Pheophytin a	1.4	1.3	2.6	0.7

* = less than indicated value

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ENVIRONMENTAL HEALTH SERVICES

Environmental Monitoring and Analysis Division

Analytical Report Summary

Project: O. W. R. B. N. E. LAKE Sampling Date: 1-25-82

	Station No.
PARAMETERS	B
Total Alkalinity	102
Dissolved Solids	296
Suspended Solids	12
Dissolved Ortho-Phosphate as P	0.050*
Total Phosphate	0.071
Nitrite (as N)	0.01
Nitrate (as N)	0.10
Ammonia (as N)	0.22
Kjeldahl N (as N)	1.40
Total N (as N)	1.73
Chlorophyll a	77.9
Pheophytin a	2.2

*less than indicated value

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Environmental Monitoring and Analysis Division

Analytical Report Summary

Project **O.W.R.B. Northeast (Zoo) Lake** Dates Received:2-16-82

PARAMETERS	1	2	3	4
Total Alkalinity	98	100	108	62
Dissolved Solids	328	348	340	208
Suspended Solids	14	28	14	6
Dissolved Ortho PO_4 (as P)	0.094	0.107	0.082	0.050*
Total Phosphate	0.250	0.256	0.200	0.125
Nitrite (as N)	0.05	0.05	0.04	0.01
Nitrate (as N)	1.07	0.96	1.48	0.39
Ammonia (as N)	0.75	0.80	0.82	0.27
Kjeldahl N (as N)	2.24	2.80	2.15	0.75
Total N (as N)	4.11	4.61	4.49	1.42
Chlorophyll a	48.8	32.4	20.0	5.3
Pheophytin a	0.6	2.2	1.7	0.7

* less than indicated value

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PARAMETERS	5	6	7	8
Total Alkalinity	100	112	106	154
Dissolved Solids	344	336	328	216
Suspended Solids	14	12	10	58
Dissolved Ortho PO_4 (as P)	0.094	0.082	0.082	0.348
Total Phosphate(as P)	0.308	0.221	0.183	0.496
Nitrite (as N)	0.04	0.05	0.05	0.04
Nitrate (as N)	1.01	1.05	0.96	0.60
Ammonia (as N)	0.88	0.87	0.86	1.06
Kjeldahl N (as N)	2.24	2.05	1.96	5.41
Total N (as N)	4.17	4.02	3.83	7.11
Chlorophyll a	27.9	31.2	34.9	4.5
Pheophytin a	1.2	1.7	0.9	27.1

* less than indicated value

PARAMETER	9	10	11	12
Total Alkalinity	74	202	218	188
Dissolved Solids	168	692	700	436
Suspended Solids	36	2	6	28
Dissolved Ortho PO_4 (as P)	0.050*	0.050*	0.082	0.050*
Total Phosphate	0.152	0.183	0.492	0.292
Nitrite (as N)	0.02	0.10	0.13	0.02
Nitrate (as N)	0.73	1.23	1.01	0.77
Ammonia (as N)	0.38	1.51	3.67	0.71
Kjeldahl N (as N)	0.84	1.68	3.68	0.84
Total N (as N)	1.97	4.52	8.49	2.34
Chlorophyll a	9.8	1.0	0.3	0.5
Pheophytin a	2.3	0.2	1.0	0.0

PARAMETER	A	B
Total Alkalinity	100	118
Dissolved Solids	292	296
Suspended Solids	4	4
Dissolved Ortho PO4 (as P)	0.120	0.107
Total Phosphate (as P)	0.219	0.192
Nitrite (as N)	0.05	0.05
Nitrate (as N)	0.97	0.83
Ammonia (as N)	0.85	0.89
Kjeldahl N (as N)	1.68	2.15
Total N (as N)	3.55	3.92
Chlorophyll a	56.5	47.5
Pheophytin a	0.0	0.0

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Analytical Report Summary

Project: O.W.R.B. NORTHEAST LAKE Dates Received: 3-24-82

	Station No.			
	1	2	3	4
PARAMETERS				
Total Alkalinity	108	112	108	96
Dissolved Solids	340	350	330	310
Suspended Solids	18	40	26	22
Dis. Ortho-Phosphate as P	0.079	0.050*	0.050*	0.050*
Total Phosphate	0.165	0.286	0.163	0.194
Nitrite (as N)	0.04	0.04	0.03	0.04
Nitrate (as N)	0.79	0.65	1.42	0.68
Ammonia (as N)	0.10*	0.10*	0.10*	0.10*
Kjeldahl N (as N)	1.68	2.52	1.49	1.21
Total N (as N)	2.61*	3.31*	3.04*	2.03*
Chlorophyll a	160.0	229.0		117.0
Pheophytin a	5.6	4.9		3.1

* = less than indicated value

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Northeast Lake 3-24-82

	5	6	7	8
Total Alkalinity	110	110	110	136
Dissolved Solids	360	350	350	210
Suspended Solids	10	48	26	100
Dis. Ortho-Phosphate as P	0.114	0.061	0.065	0.286
Total Phosphate (as P)	0.219	0.272	0.325	0.487
Nitrite (as N)	0.04	0.40	0.04	0.01
Nitrate (as N)	0.81	0.78	0.75	1.46
Ammonia (as N)	0.10*	0.10*	0.20	0.38
Kjeldahl N (as N)	1.58	1.12	1.49	1.87
Total N (as N)	2.53*	2.40*	2.48	3.72
Chlorophyll a	173.0	240.0	187.0	3.4
Pheophylin a	5.9	0	3.2	4.9

*less than indicated value

Northeast Lake 3-24-82

	9	10	11	12
Total Alkalinity	66	266	128	128
Dissolved Solids	200	1200	450	340
Suspended Solids	32	4	4	0
Dis. Ortho-Phosphate as P	0.073	0.050	0.479	0.208
Total Phosphate	0.198	0.165	0.681	0.309
Nitrite (as N)	0.02	0.02	0.16	0.02
Nitrate (as N)	0.55	0.53	0.82	0.37
Ammonia (as N)	0.10*	0.14	2.81	0.10*
Kjeldahl N (as N)	1.12	0.28	3.17	0.28
Total N(as N)	1.79*	0.97	6.96	0.77*
Chlorophyll a	139.0	18.3	14.7	7.5
Pheophytin a	10.0	2.2	0.7	0.0

* less than indicated value

	A	B
Total Alkalinity	108	108
Dissolved Solids	370	360
Suspended Solids	60	12
Dis. Ortho-Phosphate as P	0.050*	0.050*
Total Phosphate	0.438	0.124
Nitrite (as N)	0.04	0.04
Nitrate (as N)	0.84	0.65
Ammonia (as N)	0.10*	0.10*
Kjeldahl N (as N)	1.49	1.96
Total N (as N)	2.47*	2.75*
Chlorophyll a	100.0	196.0
Pheophytin a	7.4	3.0

*less than indicated value

OKLAHOMA CITY-COUNTY HEALTH DEPARTMENT

ENVIRONMENTAL HEALTH SERVICES

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Analytical Report Summary

Project: Northeast Lake Sampling Date: 4-21-82

	Site No.				
	1	2	3	4	5
PARAMETERS					
Total Alkalinity	128	130	104	80	130
Dissolved Solids	332	328	240	864	324
Suspended Solids	72	20	16	14	24
Dissolved Ortho PO_4	0.115	0.193	0.190	0.085	0.104
Total Phosphate (as P)	0.237	0.301	0.216	0.192	0.301
Nitrite (as N)	0.07	0.05	0.02	0.03	0.06
Nitrate (as N)	0.34	0.32	0.45	0.18	0.33
Ammonia (as N)	0.70	0.93	0.24	0.38	0.73
Kjeldahl N (as N)	1.49	1.96	0.56	0.75	1.31
Total N (as N)	2.60	3.26	1.27	1.34	2.43
Chlorophyll a	18.1	21.3	5.9	7.3	18.1
Pheophytin a	7.8	6.7	3.0	2.5	5.6

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Site No.

PARAMETERS	6	7	8	9	10
Total Alkalinity	132	132	114	88	172
Dissolved Solids	324	332	216	252	544
Suspended Solids	18	24	208	32	10
Dissolved Ortho PO_4	0.125	0.129	0.416	0.067	0.091
Total Phosphate (as P)	0.218	0.140	0.642	0.103	0.103
Nitrite (as N)	0.06	0.06	0.04	0.04	0.03
Nitrate (as N)	0.21	0.21	0.38	0.15	0.16
Ammonia (as N)	0.72	0.74	0.88	0.18	0.12
Kjeldahl N (as N)	1.40	1.21	6.53	0.84	0.47
Total N (as N)	2.39	2.22	7.83	1.21	0.78
Chlorophyll a	18.5	18.6	14.6	19.8	13.3
Pheophytin a	5.6	5.2	45.5	4.8	3.0

	Site No. 11	12	13	14
PARAMETERS				
Total Alkalinity	372	116	130	128
Dissolved Solids	800	244	328	352
Suspended Solids	68	50	18	22
Dissolved Ortho PO_4	0.209	0.334	0.138	0.125
Total Phosphate (as P)	0.774	0.371	0.443	0.244
Nitrite (as N)	0.25	0.02	0.05	0.05
Nitrate (as N)	0.39	0.12	0.31	0.24
Ammonia (as N)	2.97	0.10*	0.77	0.75
Kjeldahl N (as N)	3.27	0.28	1.40	1.21
Total N (as N)	6.88	0.52*	2.53	2.25
Chlorophyll a		39.6	20.2	11.6
Pheophytin a		1.8	3.7	5.2

*=less than indicated value

OKLAHOMA CITY-COUNTY HEALTH DEPARTMENT

ENVIRONMENTAL HEALTH SERVICES

Environmental Monitoring and Analysis Division

Analytical Report Summary

Project: Northeast Lake Sampling Date: 5-20-82

	Site No. 1	2	3	4	5
PARAMETERS					
Total Alkalinity	66	140	86	62	64
Dissolved Solids	244	316	252	252	232
Suspended Solids	310	358	134	158	286
Dissolved Ortho PO_4	0.232	0.179	0.184	0.244	0.249
Total Phosphate (as P)	0.510	0.214	0.187	0.248	0.522
Nitrite (as N)	0.05	0.04	0.03	0.04	0.04
Nitrate (as N)	0.64	0.53	1.30	0.73	0.74
Ammonia (as N)	0.69	0.43	0.57	0.60	0.59
Kjeldahl N (as N)	2.89	7.19	2.52	4.20	4.57
Total N (as N)	4.27	8.19	4.42	5.57	5.94
Chlorophyll a	2.4	8.5	2.0	10.0	3.6
Pheophytin a	4.3	0.5*	2.2	6.8	7.8

*=less than indicated value

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	Site No.				
	6	7	8	9	10
PARAMETERS					
Total Alkalinity	82	84	144	72	142
Dissolved Solids	240	236	328	276	420
Suspended Solids	184	240	124	286	560
Dissolved Ortho PO_4	0.289	0.278	0.444	0.473	0.311
Total Phosphate (as P)	0.292	0.470	0.644	0.854	0.450
Nitrite (as N)	0.03	0.05	0.13	0.05	0.09
Nitrate (as N)	0.64	0.73	1.73	1.77	2.73
Ammonia (as N)	0.49	0.57	1.06	0.35	0.65
Kjeldahl N (as N)	2.89	3.83	6.53	3.36	3.17
Total N (as N)	4.05	5.18	9.26	5.37	6.64
Chlorophyll a	3.5	6.9	4.0	3.1	3.5
Pheophytin a	3.3	1.4	13.9	4.4	6.4

	Site No.			
	11	12	A	B
PARAMETERS				
Total Alkalinity	204	214	108	66
Dissolved Solids	908	536	344	216
Suspended Solids	420	154	242	282
Dissolved Ortho PO_4	0.389	0.240	0.271	0.254
Total Phosphate (as P)	0.502	0.241	0.394	0.616
Nitrite (as N)	0.11	0.04	0.05	0.05
Nitrate (as N)	5.65	1.80	1.72	0.70
Ammonia (as N)	0.58	0.14	0.42	0.71
Kjeldahl N (as N)	3.92	1.59	2.71	3.08
Total N (as N)	10.26	3.57	4.90	4.54
Chlorophyll a	2.2	0.5*	2.0	5.3
Pheophytin a	0.5*	0.5*	9.3	3.4

*=less than indicated value

APPENDIX 10-B

SEDIMENT CORE DATA

Appendix 10-B, Table 1. 1983 Northeast (Zoo) Lake samples.

PROFILE #	DEPTH	^{137}Cs
	(inches)	pCi/g
1	0-2	0.085
	2-4	0.149
	4-6	0.043
	6-8	0.106
	8-10	0.153
	10-12	0.135
	12-14	0.289
	14-16	0.291*
	16-18	0.137
	18-20	0.210
	20-22	0.004
	22-24	0.024
	24-26	0.056
2	0-2	0.021
	2-4	0.039
	4-6	0.030
	6-8	0.034
	8-10	0.029
	10-12	0.125*
	12-14	0.100
	14-16	0.049
	16-18	0.095
	18-20	0.078
	20-22	0.014
	22-24	0.039
	24-26	--

Appendix 10-B, Table 2. Samples taken at site A near Monk on October 20, 1981.

DEPTH (inches)	CLAY <2μ	2-20μ	SILT 2-50μ	>20μ	SAND >50μ
0-2	71.8	21.2	26.2	7.0	2.0
2-4	53.5	26.5	39.0	20.0	7.5
4-6	44.5	28.5	44.7	27.0	10.8
6-8	42.8	28.2	46.7	29.0	10.5
8-10	40.8	28.7	27.2	31.5	32.0
10-12	52.0	26.0	40.3	22.0	7.7
12-14	70.5	21.7	26.7	7.8	2.8
14-16	79.0	18.0	20.5	3.0	.5
16-18	81.0	16.5	18.5	2.5	.5
18-20	80.0	18.0	19.5	2.0	.5

Appendix 10-B, Table 3. Calculated cesium-137 content in sediment profile (81-OK-601) from Zoo (Northeast) Lake per gram of <2μ clay.

Depth	81-OK-601	% clay	^{137}Cs per gram <2μ clay
inches	pCi/g		pCi/g clay
0-2	0.873	71.8	1.216
0-4	0.737	53.5	1.378
0-6	0.631	44.5	1.418
0-8	0.699	42.8	1.633
0-10	0.808	40.8	1.980
0-12	1.239	52.0	2.383
0-14	2.219	70.5	3.148
0-16	2.921	79.0	3.697
0-18	1.375	81.0	1.698
0-20	2.140	80.0	2.675
0-22			
0-24			
0-26			

Appendix 10-B, Table 4. Measured concentration of cesium-137 in sediment samples from Northeast (Zoo) Lake, 1982-83.

Depth	81-OK-601	1982	Zoo Lake Profiles 1	2	3	4	5	6
inches			pCi/g					
0-2 (0-1)	0.873	0.672	0.085	0.021	0.025	0.091	0.498	0.694
(1-2)		0.541						
2-4	0.737	0.771	0.149*	0.039	0.079	0.188	0.490	0.617
		0.782*						
4-6	0.631	0.728	0.043	0.030	0.186	0.257	0.467	0.794
		0.774						
6-8	0.699	0.782	0.106	0.034	0.232	0.445	0.973	0.655
		0.786						
8-10	0.808	0.959	0.153	0.029	0.365	0.434	1.696	0.789
		0.910						
10-12	1.239	1.270	0.135	0.125	0.419	0.816	1.808	0.500
		1.668						
12-14	2.219	1.498	0.289	0.100	0.504	0.922	0.593	0.105
		1.405						
14-16	2.921	0.872	0.291	0.049	0.436	0.463	0.069	0.153
		1.011						
16-18	1.375	0.618	0.136	0.095	0.432	0.500	0.107	0.033
		0.450						
18-20	2.140	0.221	0.210	0.078	0.705	0.502	0.032	0.008
20-22	---	---	0.004	0.013	0.301	0.320	0.063	0.023
22-24	---	---	0.024	0.040	0.125	0.133	0.093	0.041
24-26	---	---	0.056	0.023	0.109	0.217	0.022	0.120

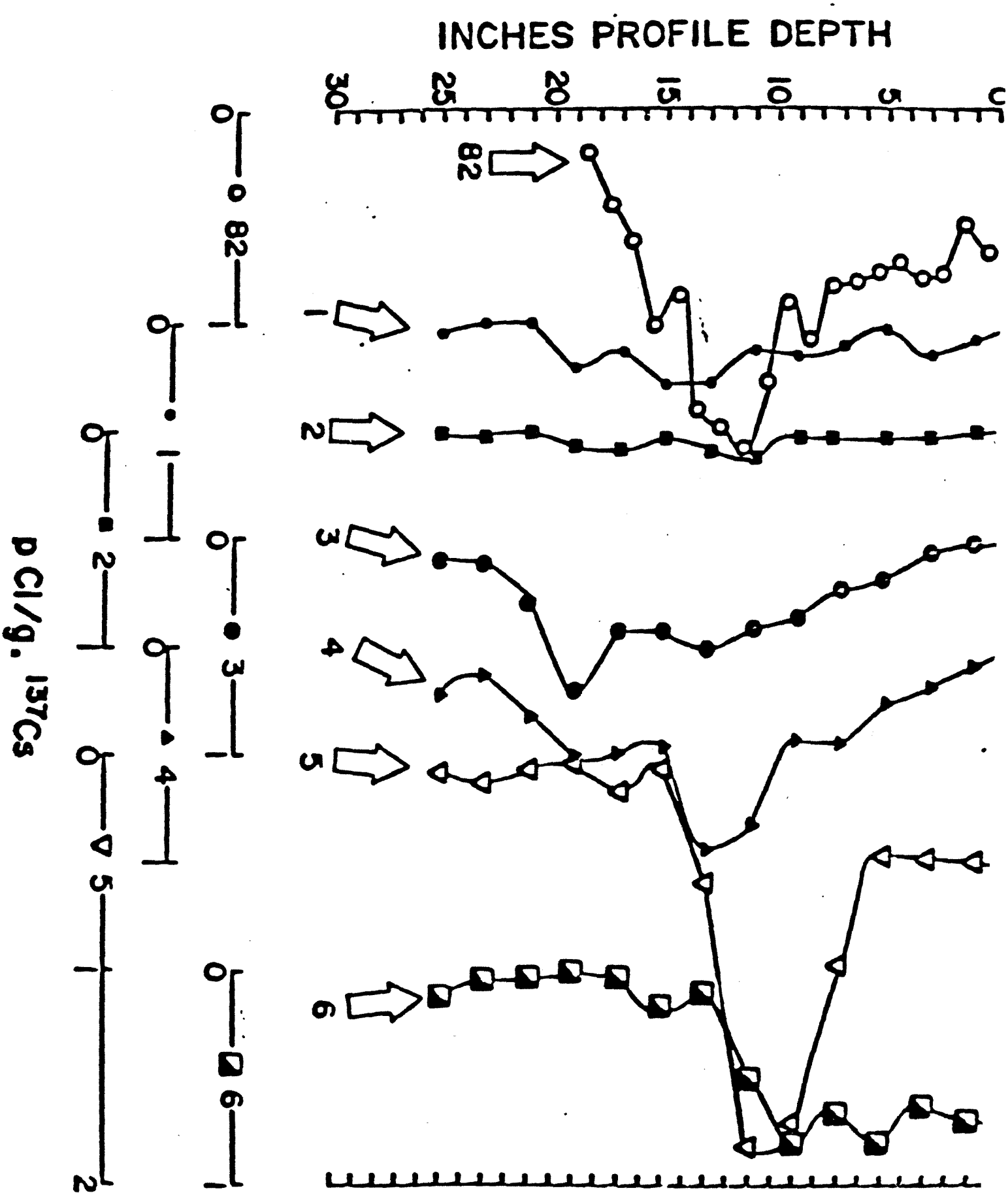
Underlined ═══, 1964 peak

Underlined ———, 1958 peak

*, 1971 peak

Appendix 10-B, Table 5. Average sedimentation rates calculated for Northeast (Zoo) Lake profiles for given depths.

Time	81-OK-601	1982	Profile 1	2	3	4	5	6
			inches/year					
1954-58	---	0.8+	1.6+	2.0+	1.6+	1.6+	2.0+	2.4+
1954-64	0.5+	0.7+	1.09	1.45	1.27	1.27	1.45	1.73
1959-1964	---	0.67	0.67	1.0	1.2	1.2	1.2	1.2
1965-1971	---	1.14	1.71	1.14	---	---	---	---
1965-1981	0.82	---	---	---	---	---	---	---
1965-1982	---	0.67	0.78	0.56	0.67	0.67	0.56	0.44
1972-1981	---	---	---	---	---	---	---	---
1972-1982	---	0.27	0.2	0.2	---	---	---	---
1954-1981	0.7+	---	---	---	---	---	---	---
1954-1982	---	0.65+	0.9+	0.9+	0.9+	0.9+	0.9+	0.9+



Appendix 10-B, Figure 1. Concentration of fallout, cesium-137 in sediment profiles from Northeast (Zoo) Lake in Oklahoma City, Oklahoma, 1982-1983.

APPENDIX 10-C

TOXICITY CRITERIA FOR SEDIMENT

Appendix 10-C, Table 1. Toxic criteria for metals in freshwater and sediments

PARAMETER	USGS ALERT LEVELS IN SEDIMENT (µg/L)	REGION 6 ALERT LEVELS FOR SEDIMENT (µg/L) INTERSTITIAL ELUTRIATE	
Antimony	500,000	-	-
Arsenic	200,00	440 (As^{+3})	440 (As^{+3})
Barium	2,000,000	1,000	1,000
Berryllium	200,00	11; 1,100*	11; 1,100*
Roron	--	750	750
Cadmium	20,000	24 hr. avg.	Max. level
Chromium	200,000(t)	0.29	21
Copper	2,000,000	5.6	Max. level
Cyanide***	100,000	3.5	52
Iron	--	1,000	1,000
Lead	500,000	24 hr. avg.	Max. level
Manganese	--	50	50
Mercury	20,000	.00057	.0017
Nickel	2,000,000	24 hr. avg.	Max. level
Selenium	20,000	35**	260**
Silver	1,000,000	(.01 x 96 hr. LC50)	Max. level
Zinc	5,000,000	47	Max. level

* According to hardness of water
** As inorganic selenite
*** expressed as free cyanide (CN) HCN + CN
(t) = total chromium

Appendix 10-C, Table 2. Toxic criteria for pesticides in freshwater and sediments.

PARAMETER	FDA ACTION LEVELS (µg/kg) F/S TISSUE	USGS ALERT LEVELS IN (µg/kg)	REGION 6 ALERT LEVELS FOR SEDIMENT (µg/L) INTERSTITIAL ELUTRIATE	
Aldrin	300	20	3.0	3.0
Chlordane	-	20	.0043	2.4
Chlorophenoxy Herbicides	-	20	100	100
2, 4-D				
2, 4, 5-TP (Silvex)	-	20	10	10
DDT	5000	20	.0010	1.1
Dementon	-	-	.1	.1
Dieldrin	300	20	.0019	2.5
Endolsulfan	-	-	.056	.22
Endrin	300	20	.0023	.18
Guthion	-	-	.01	.01
Heptachlor	300	20	.0053	.52
Heptachlor Epoxide	300	20	.0053	.52
Kepone	300	-	300	300
Lindane	-	20	.01	.01
Malathion	-	20	.1	.1
Methoxychlor	-	20	.03	.03
Mirex	100	20	.001	.001
Parathion	-	20	.04	.04
Toxaphene	5000	20	.013	1.6

Appendix 10-C, Table 3. Maximum concentration of contaminants for characteristics of EP-Toxicity.

EPA HAZARDOUS WASTE NUMBER	CONTAMINANT	MAXIMUM CONCENTRATION (milligrams per liter)
D004	Arsenic	5.0
D005	Barium	100.0
D006	Cadmium	1.0
D007	Chromium	5.0
D008	Lead	5.0
D009	Mercury	0.2
D010	Selenium	1.0
D011	Silver	5.0
D012	Endrin (1,2,3,4,10,10-hexachloro-1,7-epoxy 1,4,4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8-dimethano naphthalene	0.02
D013	Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer	0.4
D014	Methoxychlor (1,1,1-Trichloro-2,2-bis (p-methoxypheny)(ethane)	10.0
D015	Toxaphene ($C_{16}H_{16}Cl_8$ Technical chlorinated camphene, 67-69 percent chlorine)	0.5
D016	2,4-D, (2,4-Dichlorophenoxyacetic acid)	10.0
D017	2,4,5-TP Silves (2,4,5-Trichlorophenoxypropionic acid)	1.0

X

APPENDIX 11-A CENTRAL

LIST OF FLORA AND FAUNA IN OKLAHOMA ~~COUNTY~~

LIST OF TREES

FAMILY ACERACAE

#box elder	*Acer negundo*
silver maple	*Acer saccharinum*
sugar maple	*Acer saccharum*

FAMILY CORNACEAE

#roughleaf dogwood	*Cornus drummondii*

FAMILY EBENACEAE

#persimmon	*Diospyros virginiana*

FAMILY FAGACEAE

#bur oak	*Quercus macrocarpa*
blackjack oak	*Quercus marilandica*
#chinquapin oak, chestnut oak	*Quercus muhlenbergii*
scrub oak	*Quercus prinoides*
Schneck's oak	*Quercus shumardii, var. schneckii*
#post oak	*Quercus stellata*
black oak	*Quercus velutina*

FAMILY JUGLANDACEAE

bitternut hickory	*Carya cordiformis*
#pecan	*Carya illinoensis*
shagbark hickory	*Carya ovata*
black hickory	*Carya texana*
white mockernut hickory	*Carya tomentosa*
#black walnut	*Juglans nigra*

FAMILY LEGUMINOSAE

honey locust	*Gleditsia triacanthos*
#Kentucky coffee tree	*Gymnocladus dioica*

FAMILY MORACEAE

#osage orange, Bois d'arc	*Maclura pomifera*
white mulberry	*Morus alba*
black mulberry	*Morus nigra*
red mulberry	*Morus rubra*

FAMILY OLEACEAE

swamp privet	*Forestiera pubescens*
white ash	*Fraxinus americana*
#green ash	*Fraxinus pennsylvanica*

FAMILY PINACEAE

ashe juniper	*Juniperus ashei*
#red cedar	*Juniperus virginia*

FAMILY PLATANACEAE

sycamore	*Platanus occidentalis*

LIST OF SHRUBS AND WOODY VINES, CONT.

FAMILY LILIACEAE

bristly greenbriar, cat brier	*Smilax bona-nox*
greenbriar	*Smilax rotundifolia*
China root	*Smilax tamnoides*
hispid greenbriar	*Smilax tamnoides, var. hispida*

FAMILY LORANTHACEAE

Christmas mistletoe	*Phoradendron serotinum*

FAMILY MALVACEAE

bladder ketmia	*Hibiscus trionum*

FAMILY MENISPERMACEAE

#redberried moonseed, coral vine	*Cocculus carolinus*
common moonseed	*Menispermum canadense*

FAMILY RANUNCULACEAE

yamleaf clematis	*Clematis dioscoreifolia*
Pitcher's clematis	*Clematis pitcheri*

FAMILY RHAMNACEAE

jerseytea	*Ceanothus americanus*
smaller red-root	*Ceanothus herbaceus*

FAMILY ROSACEAE

green hawthorne	*Crataegus biridis*
Engelmann's hawthorne	*Crataegus engelamannii*
downy hawthorne	*Crataegus mollis*
Reverchon's hawthorne	*Crataegus reverchonii*
leafy rose, white prairie rose	*Rosa foliolosa*
Arkansas rose	*Rosa arkansana*
Enslen's dewberry	*Rubus enslenii*
highbush blackberry, Oklahoma blackberry	*Rubus ostryifolius*
southern dewberry	*Rubus trivialis*
	Rubus villosus

FAMILY RUBIACEAE

common buttonbush	*Cephalanthus occidentalis, var. pubescens*

FAMILY SAPINDACEAE

balloon vine	*Cardiospermum halicacabum*

FAMILY SAXIFRAGACEAE

golden currant	*Ribes odoratum*

FAMILY SOLANACEAE

matrimony vine	*Lycium halmifolium*

FAMILY VERBENACEAE

American beautyberry	*Callicarpa americana*

LIST OF SHRUBS AND WOODY VINES, CONT.

FAMILY VITACEAE

peppervine	*Ampelopsis arborea*
simple-leaved ampelopsis	*Ampelopsis cordata*
ivy treebine, marine vine	*Cissus incisa*
Virginia creeper	*Parthenocissos quinquefolia*
bush grape	*Vitis acerfolia*
summer grape	*Vitis aestivalis*
sweet grape	*Vitis cinerea*
cat grape	*Vitis palmata*
#riverbank grape, wild grape	*Vitis riparia*
sand grape	*Vitis rupestris*
frost grape	*Vitis vulpina*

LIST OF GRASSES AND SEDGES

FAMILY GRAMINEAE

#western wheat grass	*Agropyron smithii*
#spring bentgrass, rough hairgrass, winter bentgrass	*Agrostis hyemalis*
hairgrass	*Aira elegans*
#big bluestem	*Andropogon gerardi*
#sand bluestem	*Andropogon hallii*
silvery beardgrass	*Andropogon ternerius*
Virginia beardgrass	*Andropogon virginicus*
few-flowered aristida	*Aristida oligantha*
silver bluestem	*Bothriochloa saccharoides*
#side oats grama	*Bouteloua curtipendula*
#bluegrama	*Bouteloua gracilis*
hairy grama	*Bouteloua hirsuta*
hairy grama	*Bouteloua pectinata*
#grama grass	*Bouteloua rigidiseta*
#rescuegrass	*Bromus willdenowii*
#Japanese chess	*Bromus japonicus*
#smooth brome	*Bromus pubescens*
#cheat, chess grass	*Bromus secalinus*
#downy chess	*Bromus tectorum*
#buffalo grass	*Buchloe dactyloides*
mat sandbur, grassbur	*Cenchrus pauciflorus (incertus)*
broadleaf spanglegrass	*Chasmanthium latifolium*
stout woodreed	*Cinna grundinacea*
#Bermuda grass	*Cynodon dactylon*
#(hairy) crabgrass	*Digitaria sanguinalis*
	Echinochloa colonum
barnyardgrass	*Echinochloa crusgalli*
goosegrass	*Eleusine indica*
nodding wild rye	*Elymus canadensis*
#smooth southern (wild rye)	*Elymus virginicus*
lacegrass	*Eragrostis capillaris*
short-stalked love-grass	*Eragrostis curtipedicellata*
stinkgrass	*Eragrostis cilianensis*
	Eragrostis diffusa
Frank's love-grass	*Eragrostis frankii*
love-grass	*Eragrostis intermedia*
love-grass	*Eragrostis oxylepis*
creeping love-grass	*Eragrostis reptans*
purple love-grass	*Eragrostis spectabilis*
#nodding fescue	*Festuca obtusa*
#southern fescue, annual fescue	*Festuca sciurea*
beard grass	*Gymnopogon ambiguus*
#little barley	*Hordeum pusillum*
prairie junegrass	*Koeleria macrantha*
whitegrass	*Leersia virginica*
green sprangletop	*Leptochloa dubia*
bearded sprangletop	*Leptochloa fascicularis*
	Leptochloa uninervia
diffuse crab-grass, fall witchgrass	*Leptoloma cognatum*
ray-grass	*Lolium perenne*

LIST OF GRASSES AND SEDGES, CONT.

FAMILY GRAMINEAE, CONT.

Carolina jointtail	*Manisurus cylindrica*
*nimble will (grass)	*Muhlenbergia schreberi*
beaked panicum	*Panicum anceps*
common switch grass	*Panicum capillare*
fall panicum	*Panicum dichotomiflorum*
gaping panicum	*Panicum hians*
	Panicum lanuginosum, var. lindheimeri
*softleaf panicum (panic-grass)	*Panicum malacophyllum*
blunt panic-grass	*Panicum obtusum*
*panicum (panic-grass)	*Panicum oligosanthes*
redtop panicum	*Panicum rigidulum*
Scribner panicum	*Panicum scribnerianum*
roundseed panicum	*Panicum sphaerocarpon*
*switch grass	*Panicum virgatum*
joint-grass	*Paspalum distichum*
Florida paspalum	*Paspalum floridanum*
hurrahgrass	*Paspalum setaceum, var. muehlenbergii*
*vasey grass	*Paspalum urvailii*
*canary grass	*Phalaris caroliniana*
*annual bluegrass	*Poa annua*
*Texas bluegrass, prairie bluegrass	*Poa arachnifera*
*prairie spear-grass, plains bluegrass	*Poa arida*
annual Beard-grass	*Polymnia uvedalia*
schedonnardus	*Schedonnardus paniculatus*
*little bluestem	*Schizachyrium scoparium*
knotroot bristlegrass	*Setaria geniculatas*
green bristlegrass	*Setaria viridis*
*indiangrass	*Sorghastrum nutans*
*johnsongrass	*Sorghum halepense*
hair-grass dropseed	*Sporobolus giroides*
tall dropseed, long-leaved rush-grass	*Sporobolus asper*
sand dropseed	*Sporobolus cryptandrus*
*white tridens	*Tridens albescens*
tall red-top	*Tridens flavus*
narrow-three-toothed grass	*Tridens strictus*
*(eastern) gamagrass	*Tripsacum dactyloides*
*wheat (escaped)	*Triticum aestivum*
*six weeks fescue	*Vulpia octoflora*

FAMILY CYPERACEAE

	Carex annectens
southern sedge	*Carex austrina*
Frank's sedge	*Carex frankii*
*sedge	*Carex gravida*
hop sedge	*Carex lupulina*
redroot flat sedge	*Cyperus erythrorhizos*
	Cyperus aristatus
chufa	*Cyperus esculentus*
slender flat sedge	*Cyperus filiculmis*
Hall's cyperus	*Cyperus hallii*

LIST OF GRASSES AND SEDGES, CONT.

FAMILY CYPERACEAE, CONT.

globe flat sedge	*Cyperus ovularis*
false nutgrass	*Cyperus strigosus*
	Eleocharis acicularis
#flatstem spikesedge, spikerush	*Eleocharis compressea*
blunt spikesedge	*Eleocharis obtusa*
slender fimbry	*Fimbristylis autumnalis*
fimbry	*Fimbristylis caroliniana*
#bullrush	*Fimbristylis drummondii*
hairy fimbristylis	*Fimbristylis puberula*
umbrellagrass	*Fuirena simplex*
American bulrush	*Scirpus americanus*
rusty bulrush	*Scirpus lineatus*
softstem bulrush	*Scirpus validus*
fringed bulrush	*Scleria ciliata*

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES

FAMILY ACANTHACEAE

water willow	*Justicia americana*
wild petunia	*Ruellia humilus*

FAMILY AIZOACEAE

carpet weed	*Mollugo verticillata*

FAMILY ALISMACEAE

Kansas sagittaria	*Sagittaria ambigua*

FAMILY AMARANTHACEAE

	Amaranthus albus
redroot pigweed	*Amaranthus retroflexus*
common waterhamp	*Amaranthus tamarascinus*

FAMILY AMARYLLIDACEAE

cebolleta	*Cooperia drummondii*
yellow stargrass	*Hypoxis hirsuta*

FAMILY AMMIACEAE

#bristly-fruited spermolepis	*Spermolepis echinata*

FAMILY APOCYNACEAE

#hemp dogbane	*Apocynum cannabinum*

FAMILY ARACEAE

drug sweetflag	*Acorus calamus*
#dragonroot Jack-in-the-pulpit, green dragon Jack-in-the-pulpit	*Arisaema dracontium*

FAMILY ASCLEPIADACEAE

bluntleaf milkweed	*Asclepias amplexicaulis*
swamp milkweed	*Asclepias incarnata*
butterfly weed	*Asclepias tuberosa*
#(green) milkweed	*Asclepias viridis*

FAMILY BIGNONIACEAE

#trumpet flower, trumpet vine	*Campsis radicans*

FAMILY BORAGINACEAE

India heliotrope	*Heliotropium indicum*
pasture heliotrope	*Heliotropium tenellum*
corn gromwell	*Lithospermum arvense*
hairy puccoon	*Lithospermum carolinense*
narrowleaf gromwell	*Lithospermum incisum*

FAMILY CAMPANULACEAE

small Venus looking glass	*Triodanis biflora*
slimpod Venus looking glass	*Triodanis leptocarpa*
#(clasping) Venus looking glass	*Triodanis perfoliata*

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES, CONT.

FAMILY CARYOPHYLLACEAE

Pitcher's sandwort	*Arenaria patula*
thymeleaf sandwort	*Arenaria serpyllifolia*
shortstalk chickweed	*Cerastium brachypodum*
big chickweed	*Cerastium vulgatuom*
jagged chickweed	*Holosteum umbellatum*
#chickweed (starwort)	*Stellaria media*

FAMILY CHENOPODIACEAE

#lambs quarters	*Chenopodium album*
slimleaf goosefoot	*Chenopodium leptophyllum*
monolepsis	*Monolepis nuttalliana*
#tumbleweed, Russian thistle	*Salsola kali*

FAMILY COMMELINACEAE

slender day-flower	*Commelina erecta*
#(western) spiderwort	*Tradescantia occidentalis*
reflexed spiderwort	*Tradescantia ohioensis*

FAMILY COMPOSITAE

#(western) yarrow	*Achillea millifolium*
prairie false dandelion	*Agoseris cruspidata*
short common ragweed	*Ambrosia artemisiifolia, var. elatior*
#western ragweed	*Ambrosia psilostachya*
#giant ragweed	*Ambrosia trifida*
#pussytoes	*Antennaria plantaginifolia*
Arkansas dozedaisy	*Aphanostephus skirrhobasis*
sagewort	*Artemisia carruthii*
#(Louisiana) sage	*Artemisia ludoviciana*
many-flowered aster	*Aster ericoides*
aromatic aster	*Aster oblongifolius*
skydrop aster	*Aster patens*
western daisy	*Astranthium integrifolium*
	Bidens discoideis
beggar ticks	*Bidens frondosa*
basket flower	*Centaurea americana*
#least daisy, prairie daisy	*Chaetopappa asteroides*
hairy goldaster	*Chrysopsis villosa var. stenophylla*
#wavy-leaved thistle	*Cirsium undulatum*
horse weed	*Conyza canadensis*
#big flower coreopsis, large flowered tickseed	*Coreopsis grandiflora*
tickseed coreopsis	*Coreopsis lanceolata*
#plains coreopsis, brown-eyed susan	*Coreopsis tinctoria*
clasping coneflower	*Dracopsis amplexicaulis*
narrow-leaved purple cone-flower	*Echiniacea angustifolia*
yerba de tayo	*Eclipta alba*
leafy elephantfoot	*Elephantopus carolinianus*
#annual fleabane, daisy fleabane	*Erigeron annuus*

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES, CONT.

FAMILY COMPOSITAE, CONT.

#Philadelphia (fleabane)	*Erigeron philadelphicus*
daisy fleabane	*Erigeron ramonsus*
#(prairie) fleabane	*Erigeron strigosus*
late eupatorium	*Eupatorium serotinum*
#bighead cvax, rabbit tobacco	*Evax prolifera*
blanket flower	*Gaillardia lanceolata*
#snowy gaillardia, indian blanket	*Gaillardia pulchella*
#rayless gaillardi	*Gaillardia sauvis*
sweet everlasting	*Gnaphalium obtusifolium*
purple cudweed	*Gnaphalium purpureum*
spinytooth gumweed	*Grindelia lanceolata*
#curlycup gumweed, gumplant	*Grindelia squarrosa*
common broomweed	*Gutierrezia (Xanthocephalum) dracunculoides*
bitter sneezeweed	*Helenium amarum, var. amarum*
#common sunflower	*Helianthus annuus*
Maximilian's sunflower	*Helianthus maximiliani*
ashy sunflower	*Helianthus mollis*
#prairie sunflower	*Helianthus petiolaris*
wolly white hymenoppus	*Hymenopappus tenuifolius*
#(narrow leaf) hymenoxys	*Hymenoxys linearifolia*
rough marsh elder	*Iva angustifolia*
western dwarf dandelion	*Krigia occidentalis*
	Krigia oppositifolia
plains kuhnia	*Kuhnia eupatorioides, var. ozarkana*
Canada lettuce	*Lactuca canadensis*
lettuce	*Lactuca scariola, var. integrata*
#aster	*Leucelene ericoides*
dotted gay feather	*Liatris punctata*
scaley gay feather	*Liatris squarrosa*
#ragweed parthenium, false ragweed	*Parthenium hysterophorus*
#purple pluchea, marsh fleabane	*Pluchea purpurascens*
	Prenanthes altissima
#Carolina false dandelion, leafy false dandelion	*Pyrrhopappus carolinianus*
false dandelion	*Pyrrhopappus geiseri*
#false dandelion	*Pyrrhopappus grandiflorus*
pinewoods coneflower	*Rudbeckia pulcherrima*
#black-eyed susan	*Rudbeckia hirta*
rosin-weed	*Silphium gatesii*
compass plant	*Silphium laciniatum*
Missouri goldenrod	*Solidago missouriensis, var. fasciculat*
variety golden-rod	*Solidago mollis*
stiff golden-rod	*Solidago rigida*
(spiny) sow-thistle	*Sonchus asper*
#red-seeded dandelion	*Taraxacum erythrosperum*
#red-seeded dandelion, common dandelion	*Taraxacum officinale*
#thread leaf thelesperma	*Thelesperma ambiguum*

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES, CONT.

FAMILY COMPOSITAE, CONT.

goat's beard	*Tragopogon major*
oyster plant	*Tragopogon porrifolius*
goat's beard	*Tragopogon pratensis*
#winged verbesina	*Verbesina helianthoides*
#(Baldwin) ironweed	*Vernonia baldwinii*
cocklebur	*Xanthium commune*
abrojo	*Xanthium strumarium*

FAMILY CRUCIFERAE

sicklepod	*Arabis canadensis*
Virginia rockcress	*Arabis virginica*
indian mustard	*Brassica juncea*
charlock	*Brassica kaber*
rutabaga	*Brassica napus*
	Brassica oleracea
turnip, field mustard, bird's rape	*Brassica rapa*
#(common) shepherdpurse	*Capsella bursa-pastoris*
#tansy-mustard	*Descurainia pinnata*
#shortpod draba	*Draba brachycarpa*
wedge leaved whitlow grass	*Draba cuneifolia*
draba	*Draba reptans*
western wallflower	*Erysimum asperum*
spreading erysimum	*Erysimum repandum*
wild pepper-grass	*Lepidium densiflorum*
#Virginia pepper-grass	*Lepidium virginianum*
	Lesquerella engelmannii
stalkless yellow cress	*Rorippa nastortium-aquaticum*
	Sibara virginica
Sisymbrium altissimum	*Sisymbrium altissimum*
hedge mustard	*Sisymbrium officinale*
	Streptanthus hyacinthoides

FAMILY CUCURBITACEAE

#stinking gourd, Missouri gourd	*Cucurbita foetidissima*

FAMILY DROSERACEAE

annual sundew	*Drosera annua*

FAMILY ELATINACEAE

Texas bergia	*Bergia texana*
	Elatine triandra

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES, CONT.

FAMILY EUPHORBIACEAE

copperleaf	*Acalypha gracilens*
hophornbeam copperleaf	*Acalypha ostryaefolia*
copperleaf	*Acalypha rhomboidea*
#Virginia copperleaf, copperweed	*Acalypha virginica*
#bull nettle	*Cnidoscolus texanus*
wooly croton	*Croton capitatus*
tropic croton	*Croton glandulosus*
#(one seed) croton	*Croton monanthogynus*
Texas croton	*Croton texensis*
rushfoil	*Crotonopsis linearis*
flowering spurge	*Euphorbia corollata*
	Euphorbia corollata, var. mollis
ridgeseed euphorbia	*Euphorbia glyptosperma*
hairy spreading euphorbia	*Euphorbia humistrata*
#snow-on-the-mountain	*Euphorbia marginata*
	Euphorbia missurica, var. intermedia
milk purslave, spotted euphorbia	*Euphorbia nutans*
warty euphorbia	*Euphorbia spathulata*
mat euphorbia	*Euphorbia serpens*
slimseed euphorbia	*Euphorbia strictospora*
prairie surge	*Euphorbia zygophylloides*
euphorbia	*Euphorbia supina*

FAMILY FUMARIACEAE

golden corydalis	*Corydalis aurea*

FAMILY GENTIANACEAE

lira de San Pedro, bluebells	*Eustoma russellianum*
squarestem rose gentian	*Sabatia angularis*
	Sabatia campestris

FAMILY GERANIACEAE

pink needle, pin clover, alfilerillo	*Erodium cicutarium*
#(Carolina) crane's-bill	*Geranium carolinianum*

FAMILY IRIDACEAE

#(prairie) blue-eye grass	*Sisyrinchium campestre*

FAMILY JUNCACEAE

flatleaf rush	*Juncus crassifolius*
slimpod rush	*Juncus diffusissimus*
#(Dudley) rush	*Juncus dudleyi*
inland rush	*Juncus interior*
grassleaf rush	*Juncus marginatus*
poverty rush	*Juncus tenuis*
Torrey rush	*Juncus torreyi*

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES, CONT.

FAMILY LABIATAE

false pennyroyal	*Hedeoma drummondii*
rough false pennyroyal	*Hedeoma hispidum*
#(henbit) deadnettle	*Lamium amplexicaule*
lemon beebalm	*Monarda citriodora*
basil beebalm	*Monarda clinopodioides*
#wild bergamot, horse mint	*Monarda fistulosa*
spotted beebalm	*Monarda punctata*
self-heal	*Prunella vulgaris, var. lanceolata*
azure sage	*Salvia azurea, var. grandiflora*
#(small) skullcap	*Scutellaria parvula*
bugleweed	*Lycopus americanus*
Virginia germander	*Teucrium canadense*

FAMILY LEGUMINOSAE

milkvetch, ground plum	*Astragalus crassicarpus, var. crassicarpus*
#(Nuttall) milkvetch	*Astragalus nuttallianus*
Atlantic wild indigo	*Baptisia leucantha*
#(plains wild) indigo, cream colored false indigo	*Baptisia leucophaea*
#blue (false) wild indigo	*Baptisia (australis, var.) minor*
wild senna, partridge poa	*Cassia fasciculata*
#(prairie) mimosa, Illinois bundleflower	*Desmanthus illinoensis*
#sessil tickclover, beggars tick	*Desmodium glutinosum*
sessil tickclover	*Desdodium sessilifolium*
downy milkpea	*Galactia volubilis*
wild licorice	*Glycyrrhiza lepidota*
coast indigo	*Indigofera miniata*
roundhead lespedeza	*Lespedeza capitata*
wand lespedeza	*Lespedeza frutescens*
lespedeza	*Lespedeza intermedia*
Korean lespedeza	*Lespedeza stipulacea*
Stuev's lespedeza	*Lespedeza stuevei*
#white sweet clover	*Melilotus alba*
yellow sweet clover	*Melilotus officinalis*
yellow neptunia	*Neptunia lutea*
stemless loco-weed	*Oxytropis lambertii*
white prairie clover	*Petalostemum candidum, var. candidum*
purple prairie clover	*Petalostemum purpureum*
digitate psoralea	*Psoralea digitata*
#wild alfalfa, scurvy pea	*Psoralea tenuiflora*
#(catclaw) sensitive briar	*Schrankia uncinata*
bequilla	*Sesbania exaltata*
trailing wildbean	*Strophostyles helvola*
	Strophostyles pauciflora
wild sweetpea	*Tephrosia virginiana*
#(least) hop-clover	*Trifolium dubium*
#white clover	*Trifolium repens*
#vetch	*Vicia dasycarpa*

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES, CONT.

FAMILY LILIACEAE

#wild garlic	*Allium canadensis*
wild drummond onion	*Allium drummondii*
blue funnellily	*Androstephium coeruleum*
asparagus, garden asparagus	*Asparagus officinalis*
white fawnlily	*Erythronium albidum*
#false garlic	*Northoscordum bivalve*
shrubby yucca, small soapweed	*Yucca arkansana*
bear-grass, spanish dagger	*Yucca glauca*

FAMILY LINACEAE

Lewis flax	*Linum lewisii*
#(large-flowered) yellow flax	*Linum rigidum*
grooved-yellow flax	*Linum sulcatum*

FAMILY LOGANIACEAE

juniperleaf	*Polypremum procumbens*

FAMILY LYTHRACEAE

Wright's ammannia	*Ammannia auriculata*
purple ammannia	*Ammannia coccinea*
winged lytrum	*Lythrum lanceolatum var. alatum*
toothcup	*Rotala ramosior*

FAMILY MALVACEAE

indian mallow	*Abutilon theophrasti*
plains poppymallow	*Callirhoe alcaeoides*
#purple poppymallow	*Callirhoe involucrata*
common mallow	*Malva neglecta*
common mallow	*Malva rotundifolia*
scarlet globe mallow	*Sphaeralcea coccinea*

FAMILY NYCTAGINACEAE

#(wild) four o'clock	*Mirabilis nyctaginea*

FAMILY ONAGRACEAE

small flower gaura	*Gaura parviflora*
	Gaura triangulata
seedbox	*Ludwigia alternifolia*
false loosestrife	*Ludwigia glandulosa*
false loosestrife	*Ludwigia palustris*
verdolaga de agua	*Ludwigia peploides*
#cutleaf evening primrose	*Oenothera laciniata*
Missouri primrose, glade-lily	*Oenothera missouriensis*
four point evening primrose	*Oenothera rhombipetala*
#(narrow-leaf) evening primrose	*Oenothera serrulata*
amapola del campo, showy primrose	*Oenothera speciosa*

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES, CONT.

FAMILY OXALIDACEAE

yellow wood sorrel	*Oxalis dillenii*
upright yellow wood-sorrel	*Oxalis stricta*
#violet wood-sorrel	*Oxalis violacea*

FAMILY PAPAVERACEAE

leafy white prickly poppy	*Argemone polyanthemos*

FAMILY PHYTOLACCACEAE

#poke weed, pokeberry	*Phytolacca americana*

FAMILY PLANTAGINACEAE

#bottle brush plantain, large-breasted plantain	*Plantago aristata*
plantain	*Plantago elongata*
#wooly plantain, silver plantain	*Plantago purshii (patagonica)*
#redseed plantain	*Plantago rhodosperma*
#paleseed plantain, dwarf plantain	*Plantago virginica*

FAMILY POLEMONIACEAE

standing cypress	*Ipomopsis rubra*

FAMILY POLYGALACEAE

white milkwort	*Polygala alba*
whorled milkwort	*Polygala verticillata*

FAMILY POLYGONACEAE

annual fleabane	*Eriogonum annuum*
longleaf wild-buckwheat	*Eriogonum longifolium, var. plantagineum*
#knotweed	*Polygonum aviculari*
prostrate knotweed	*Polygonum paviculare, var. littorale*
#Pennsylvania smartweed, pink smartweed	*Polygonum pensylvanicum*
dotted smartweed	*Polygonum (Persicaria) punctatum*
bushy knotweed	*Polygonum ramossissimum*
#(wood) pale dock	*Rumex altissimus*
#curly dock	*Rumex crispus*
#heartwing sorrel, wild sorrel	*Rumex hastatulus*
#wild begonia	*Rumex vemosus*
swamp dock	*Rumex verticillatus*

FAMILY PORTULACACEAE

spring beauty	*Claytonia virginica*

FAMILY PRIMULACEAE

western rockjasmine	*Androsace occidentalis*

FAMILY RANUNCULACEAE

Carolina anemone	*Anemone caroliniana*
#prairie larkspur	*Delphinium virescens*
blister buttercup	*Ranunculus sceleratus*

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES, CONT.

FAMILY ROSACEAE

#prickly poppy	*Agrimonia intermedia*
manyflower groovebur	*Agrimonia parviflora*
#white avens, geum	*Geum canadense*

FAMILY RUBIACEAE

#poorjo	*Diodia teres*
#(catchweed) bedstraw	*Galium aparine*
#(woods) bedstraw	*Galium circalcans*
	Hedyotis nigricans
	Hedyotis uniflora

FAMILY SAXIFRAGACEAE

ditch stonecrop	*Penthorum sedoides*

FAMILY SCROPHULARIACEAE

	Gratiola brevifolia
Virginia-hedge hyssop	*Gratiola virginica*
	Leucospora multifada
#(oldfield) toadflax	*Linaria canadensis*
monkey flower	*Mimulus alatus*
cobaea beard-tongue	*Penstemon cobaea*
beard-tongue	*Penstemon laxiflorus*
Oklahoma beard-tongue	*Penstemon oklahomensis*
	Scrophularia lanceolata
#flannel mullein, common mullein	*Verbascum thapsus*
water speedwell, brook-pimpernel	*Veronica anagallis-aquatica*
#(purselane) speedwell	*Veronica peregrina*
wayside speedwell	*Veronica polita*

FAMILY SOLANACEAE

#jimsonweed	*Datura stramonium*
#(clammy) ground cherry	*Physalis heterophylla*
#(Carolina) horsenettle	*Solanum carolinense*
#silverleaf nightshade, silverleaf nettle	*Solanum elaeagnifolium*
black nightshade	*Solanum nigrum*
#buffalobur	*Solanum rostratum*

FAMILY UMBELLIFERAE

#(Texas) chervil	*Chaerophyllum texanum*
water hemlock	*Cicuta maculata*
#wild carrot	*Daucus pusillus*
levenworth eryngo	*Eryngium levenworthii*
buttonshakerroot eryngo	*Eryngium yuccifolium*
whorled pennywort	*Hydrocotyle verticillata*
Arkansas dogshade	*Limnosciadium pinnatom*
	Ptilimnium nuttallii
hedge parsley	*Torilis japonica*
	Trepocarpus aethusae

LIST OF HERBACEOUS PLANTS OTHER THAN GRASSES AND SEDGES, CONT.

FAMILY URTIECEAE

smallspike false nettle	*Boehmeria cylindrica*
James nailwort	*Paronychia jamesii*

FAMILY VALERIANACEAE

#(beaked) cornsalad	*Valerianella radiata*

FAMILY VERBANACEAE

#wedge leaf frogfruit, spoon leaf frogfruit	*Phyla cuneifolia*
Texas frog-fruit	*Phyla incisa*
frogfruit, northern frog-fruit	*Phyla lanceolata*
common frogfruit, capeweed	*Phyla nodiflora*
small-flowered verbena	*Verbena bipinnatifida*
bigbract verbena	*Verbena bracteata*
rose verbena, rose vervain	*Verbena canadensis*
Texas verbain	*Verbena halei*
blue verbena, blue vervain	*Verbena hastata*
rose verbena, verbena	*Verbena simplex*
#(hoary) vervain	*Verbena stricta*
white verbena, white vervain	*Verbena urticifolia*

FAMILY VIOLACEAE

lanceleaf violet	*Viola lanceolata, var. uittata*
#Missouri violet	*Viola missouriensis*
#field pansy, wild pansy	*Viola rafinesquii*

FAMILY ZYGOPHYLLACEAE

puncture vine	*Tribulus terrestris*

APPENDIX 602-D

TERRESTRIAL WILDLIFE SPECIES LIST

LIST OF AMPHIBIANS

The following list contains 16 species and subspecies of amphibians known to exist in the ACOG region. Nomenclature and taxonomic order are based on Conant (1975).

ORDER URODELA

small-mouthed salamander	*Ambystoma texanum*
spotted salamander	*Ambystoma maculatum*
barred tiger salamander	*Ambystoma tigrinium mavortium*

ORDER ANURA

Hurter's spadefoot (Rare-2)	*Scaphiopus holbrooki hurteri*
plains spadefoot	*Scaphiopus bombifrons*
dwarf American toad	*Bufo americanus*
Rocky Mountain toad	*Bufo woodhousei woodhousei*
Great Plains toad	*Bufo cognatus*
Blanchard's cricket frog	*Acris crepitans blanchardi*
eastern gray treefrog	*Hyla versicolor*
spotted chorus frog	*Pseudacris clarki*
western chorus frog	*Pseudacris triseriata*
Strecker's chorus frog	*Pseudacris streckeri streckeri*
western narrow-mouthed toad	*Gastrophryne olivacea*
bullfrog	*Rana catesbeiana*
plains leopard frog	*Rana blairi*

LIST OF REPTILES

The following list contains 53 species and subspecies of reptiles known to exist in the ACOG region. Nomenclature and taxonomic order are based on Conant (1975).

TURTLES	ORDER TESTUDINES
midland smooth softshell turtle	*Trionyx muticus muticus*
western spiny softshell turtle	*Trionyx spiniferus hartwegi*
common snapping turtle	*Chelydra serpentina*
yellow mud turtle	*Kinosternon flavescens flavescens*
western chicken turtle	*Deirochelys reticularia miaria*
red-eared turtle	*Chrysemys scripta elegans*
three-toed box turtle	*Terrapene carolina triunguis*
ornate box turtle	*Terrapene ornata ornata*
LIZARDS AND SNAKES	**ORDER SQUAMATA**
eastern collared lizard	*Crotaphytus collaris*
northern earless lizard	*Holbrookia maculata maculata*
Texas horned lizard	*Phrynosoma cornutum*
southern prairie lizard	*Sceloporus undulatus consobrinus*
five-lined skink	*Eumeces fasciatus*
Great Plains skink	*Eumeces obsoletus*
southern prairie skink	*Eumeces serpentrionalis obtusirostris*
ground skink	*Leiolopisma laterale*
prairie racerunner	*Cnemidophorus sexlineatus viridis*
western slender glass lizard	*Ophisaurus attenuatus attenuatus*
New Mexico blind snake	*Leptotyphlops dulcis dissectus*
plains blind snake	*Leptotyphlops dulcis dulcis*
Kansas glossy snake	*Arizona elegans elegans*
western worm snake	*Carphophis amoenus vermis*
*scarlet snake (Rare-1)	*Cemophora coccinea copei*
eastern yellow-bellied racer	*Coluber constrictor flaviventris*
prairie ringneck snake	*Diadophis punctatus arnyi*
Great Plains rat snake	*Elaphe guttata emoryi*
black rat snake	*Elaphe obsoleta obsoleta*
dusty hognose snake	*Heterodon nasicus gloydi*
plains hognose snake	*Heterodon nasicus nasicus*
eastern hognose snake	*Heterodon platyrhinos*
*Texas night snake (Rare-2)	*Hypsiglena torquata texana*
prairie kingsnake	*Lampropeltis calligaster calligaster*
speckled kingsnake	*Lampropeltis getulus holbrooki*
western milk snake	*Lampropeltis triangulum gentilis*
eastern coachwhip	*Masticophis flagellum flagellum*
western coachwhip	*Masticophis flagellum testaceus*
blotched water snake	*Natrix erythrogaster transversa*
diamond-backed water snake	*Natrix rhombifera rhombifera*
rough green snake	*Opheodrys aestivus*
bullsnake	*Pituophis melanoleucus sayi*
Graham's water snake	*Natrix grahami*
Great Plains ground snake	*Sonora episcopa episcopa*

LIZARDS AND SNAKES, CONT.	ORDER SQUAMATA
Texas brown snake	*Storeria dekayi texana*
flat-headed snake	*Tantilla gracilis*
checkered garter snake	*Thamnophis marcianus marcianus*
western ribbon snake	*Thamnophis proximus proximus*
red-sided garter snake	*Thamnophis sirtalis parietalis*
central lined snake	*Tropidoclonion lineatum annectens*
rough earth snake	*Virginia striatula*
broad-banded copperhead	*Agkistrodon contortrix laticinctus*
timber rattlesnake	*Crotalus horridus horridus*
western massasauga	*Sistrurus catenatus tergeminus*
western pigmy rattlesnake	*Sistrurus miliarius streckeri*

LIST OF BIRDS

The following list contains 335 species of birds known to exist in the ACOG region. Of these 335 species, 65 are found very infrequently (less than ten reported observations) in the four county ACOG area and probably reflect accidental sightings, extreme range extensions, or even possible zoo escapes. These 65 species should not be considered typical avifauna of the region, and are denoted by "(Infrequent)" after their common names (this information was furnished by David O. Dillon Jr., and Richard Gunn of the Oklahoma Department of Pollution Control, based on their review of Dr. G. M. Sutton's birding records). It should also be noted that no distinctions are made between winter and summer residents, breeding species, and migrant species. Nomenclature and taxonomic order are based on Sutton (1974).

LOONS	ORDER GAVIIFORMES Family Gaviidae
common loon	*Gavia immer*
GREBES	ORDER PODICIPEDIFORMES Family Podicipedidae
horned grebe	*Podiceps auritus*
eared grebe	*Podiceps nigricollis*
western grebe	*Aechmophorus accidentalis*
pied-billed grebe	*Podilymbus podiceps*
PELICANS AND ALLIES	ORDER PELECANIFORMES Family Pelecanidae
white pelican	*Pelecanus erythrorhynchos*
	Family Phalacrocoracidae
double-crested cormorant	*Phalacrocorax auritus*
olivaceous cormorant (Infrequent)	*Phalacrocorax olivaceous*
	Family Anhingidae
*anhinga (Endangered)(Infrequent)	*Anhinga anhinga*
DEEP WATER WADERS	ORDER CICONIIFORMES Family Ardeidae
great blue heron	*Ardea herodias*
green heron	*Butorides virescens*
little blue heron	*Florida caerulea*
cattle egret	*Bubulcus ibis*
great egret	*Casmerodius albus*
snowy egret	*Egretta thula*
Louisiana heron (Infrequent)	*Hydranassa tricolor*
black-crowned night heron	*Nycticorax nycticorax*
yellow-crowned night heron	*Nyctanassa violacea*
least bittern	*Ixobrychus exilis*
American bittern	*Botaurus lentiginosus*
	Family Ciconiidae
wood stork (Infrequent)	*Mycteria americana*

	Family Threskiornithidae
white-faced ibis	*Plegadis chihi*
roseate spoonbill (Infrequent)	*Ajaia ajaja*
SWANS, GEESE AND DUCKS	ORDER ANSERIFORMES
	Family Anatidae
whistling swan	*Olor columbianus*
Canada goose	*Branta canadensis*
white-fronted goose	*Anser albifrons*
snow goose	*Chen caerulescens*
mallard	*Anas platyrhynchos*
black duck (Infrequent)	*Anas rubripes*
gadwall	*Anas strepera*
pintail	*Anas acuta*
green-winged teal	*Anas crecca*
blue-winged teal	*Anas discors*
cinnamon teal	*Anas cyanoptera*
northern shoveler	*Anas cylpeata*
American wigeon or baldpate	*Anas americana*
wood duck	*Aix sponsa*
redhead	*Aythya americana*
ring-necked duck	*Aythya collaris*
canvasback	*Aythya valisineria*
greater scaup (Infrequent)	*Aythya marila*
lesser scaup	*Aythya affinis*
common goldeneye	*Bucephala clangula*
bufflehead	*Bucephala albeola*
oldsquaw (Infrequent)	*Clangula hyemalis*
surf scoter (Infrequent)	*Melanitta perspicallata*
black scoter (Infrequent)	*Melanitta nigra*
ruddy duck	*Oxyura jamaicensis*
hooded merganser	*Lophodytes cucullatus*
common merganser	*Mergus merganser*
red-breasted merganser	*Mergus serrator*
DIURNAL BIRDS OF PREY	ORDER FALCONIFORMES
	Family Catharidae
turkey vulture	*Cathartes aura*
black vulture (Infrequent)	*Coragyps atratus*
	Family Accipitridae
Mississippi kite	*Ictinia mississippiensis*
*swallow-tailed kite (Endangered) (Infreq.)	*Elanoides forficatus*
goshawk	*Accipiter gentilis*
sharp-skinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperii*
red-tailed hawk	*Buteo jamaicensis*
red-shouldered hawk	*Buteo lineatus*
broad-winged hawk	*Buteo platypterus*
Swainson's hawk	*Buteo swainsoni*
rough-legged hawk	*Buteo lagopus*
ferruginous hawk	*Buteo regalis*
Harris's hawk (Infrequent)	*Parabuteo unicinctus*
*golden eagle (Rare-1)	*Aquila chrysaetos*
+*bald eagle (Endangered)	*Haliaeetus leucocephalus*
marsh hawk	*Circus cyaneus*

DIURNAL BIRDS OF PREY, CONT.	ORDER FALCONIFORMES
	Family Pandioidae
osprey	*Pandion haliaetus*
	Family Falconidae
*prairie falcon (Endangered)(Infrequent)	*Falco mexicanus*
+*peregrine falcon (Endangered)(Infrequent)	*Falco peregrinus*
merlin	*Falco columbarius*
American kestrel or sparrow hawk	*Falco sparverius*
CHICKENLIKE BIRDS	ORDER GALLIFORMES
	Family Phasianidae
bobwhite	*Colinus virginianus*
	Family Meleagrididae
turkey	*Meleagris gallopavo*
CRANES AND ALLIES	ORDER GRUIFORMES
	Family Gruidae
+whooping crane (Endangered)	*Grus americana*
*sandhill crane (Rare-2)	*Grus canadensis*
RAILS AND ALLIES	ORDER RALLIFORMES
	Family Rallidae
king rail	*Rallus elegans*
Virginia Rail (Infrequent)	*Rallus limicola*
sora rail	*Porzana carolina*
black rail (Infrequent)	*Laterallus jamaicensis*
*purple gallinule (Rare-2)(Infrequent)	*Porphyrula martinica*
common gallinule	*Gallinula chloropus*
American coot	*Fulica americana*
SHOREBIRDS, GULLS, AUKS AND ALLIES	ORDER CHARADRIIFORMES
	Family Charadriidae
semipalmated plover	*Charadrius semipalmatus*
piping plover	*Charadrius melodus*
snowy plover	*Charadrius alexandrinus*
killdeer	*Charadrius vociferus*
*mountain plover (Rare-2) (Infrequent)	*Charadrius montanus*
American golden plover	*Pluvialis dominica*
black-bellied plover	*Pluvialis squatarola*
ruddy turnstone	*Arenaria interpres*
	Family Scolopacidae
American woodcock	*Philohela minor*
common snipe	*Capella gallinago*
*long-billed curlew (Rare-2)	*Numenius americanus*
whimbrel	*Numenius phaeopus*
upland sandpiper	*Bartramia longicauda*
spotted sandpiper	*Actitis macularia*
solitary sandpiper	*Tringa solitaris*
greater yellow legs	*Tringa melanoleuca*
lesser yellow legs	*Tringa flavipes*
willet	*Catoptrophorus semipalmatus*
red knot	*Calidris canutus*

RAILS AND ALLIES, CONT.	ORDER RALLIFORMES
	Family Scolopacidae
pectoral sandpiper	*Calidris melanotos*
white-rumped sandpiper	*Calidris fuscicollis*
Baird's sandpiper	*Calidris bairdii*
least sandpiper	*Calidris minutilla*
dunlin	*Calidris alpina*
semipalmated sandpiper	*Calidris pusilla*
western sandpiper	*Calidris mauri*
sanderling	*Calidris alba*
long-billed dowitcher	*Limnodromus scolopaceus*
stilt sandpiper	*Micropalama himantopus*
buff-breasted sandpiper	*Tryngites subruficollis*
marbled godwit	*Limosa fedao*
Hudsonian godwit	*Limosa haemastica*
	Family Recurvirostridae
American avocet	*Recurvirostra americana*
black-necked stilt	*Himantopus mexicanus*
	Family Phalaropodidae
red phalarope (Infrequent)	*Phalaropus fulicarius*
Wilson's phalarope	*Steganopus tricolor*
northern phalarope	*Lobipes lobatus*
	Family Stercorariidae
parasitic jaeger (Infrequent)	*Stercorarius parasiticus*
	Family Laridae
glaucous gull	*Larus hyperboreus*
herring gull	*Larus argentatus*
ring-billed gull	*Larus delawarensis*
laughing gull	*Larus artricilla*
Franklin's gull	*Larus pipixcan*
Bonaparte's gull	*Larus philadelphia*
black-legged kittwake (Infrequent)	*Rissa tridactyla*
Forster's tern	*Sterna forsteri*
common tern	*Sterna hirundo*
least tern	*Sterna albifrons*
Caspian tern	*Hydroprogne caspia*
black tern	*Chlidonian niger*
black skimmer (Infrequent)	*Rynchops nigra*
PIGEONS AND ALLIES	ORDER COLUMBIFORMES
	Family Columbidae
band-tailed pigeon (Infrequent)	*Columba fasciata*
rock dove	*Columba livia*
mourning dove	*Zenaida macroura*
Inca dove (Infrequent)	*Scardafella inca*
PARROTS	ORDER PSITTACIFORMES
	Family Psittacidae
monk parakeet	*Myiopsitta monachus*

CUCKOOS AND ALLIES	ORDER CUCLIFORMES Family Cuclidae
yellow-billed cuckoo	*Coccyzus americanus*
black-billed cuckoo	*Cocyzus erythropthalmus*
roadrunner	*Geococcyx californianus*
groove-billed ani (Infrequent)	*Crotophaga sulcirostris*
OWLS	ORDER STRIGIFORMES Family Tytonidae
barn owl	*Tyto alba*
	Family Stridigae
screech owl	*Otus asio*
great horned owl	*Bubo virginianus*
snowy owl	*Nyctea scandiaca*
burrowing owl	*Speotyto cunicularia*
barred owl	*Strix varia*
long-eared owl	*Asio otus*
short-eared owl	*Asio flammeus*
GOATSUCKERS AND ALLIES	ORDER CAPRIMULGIFORMES Family Caprimulgidae
chuck-will's-widow	*Caprimulgus carolinensis*
whip-poor-will (Infrequent)	*Caprimulgus vociferus*
poor-will (Infrequent)	*Phalaenoptilus nuttallii*
common nighthawk	*Chordeiles minor*
SWIFTS AND HUMMINGBIRDS	ORDER APODIFORMES Family Apodidae
chimney swift	*Chaetura pelagica*
	Family Trochilidae
ruby-throated hummingbird	*Archilochus colubris*
black-chinned hummingbird	*Archilochus alexandri*
rufous hummingbird (Infrequent)	*Selasphorus rufus*
KINGFISHERS AND ALLIES	ORDER CORACIIFORMES Family Alcedinidae
belted kingfisher	*Megaceryle alcyon*
WOODPECKERS AND ALLIES	ORDER PICIFORMES Family Picidae
common flicker	*Colaptes auratus*
pileated woodpecker	*Dryocopus pileatus*
red-bellied woodpecker	*Centurus carolinus*
red-headed woodpecker	*Melanerpes erythrocephalus*
*Lewis's woodpecker (Rare-2)(Infrequent)	*Asyndesmus lewis*
yellow-bellied sapsucker	*Sphyrapicus varius*
hairy woodpecker	*Dendrocopos villosus*
downy woodpecker	*Dendrocopos pubescens*
ladder-backed woodpecker	*Dendrocopos scalaris*

SPARROWLIKE BIRDS	ORDER PASSERIFORMES
	Family Tyrannidae
eastern kingbird	*Tryannus tryannus*
western kingbird	*Tryannus verticalis*
scissor-tailed flycatcher	*Muscivora forficata*
great crested flycatcher	*Myiarchus crinitus*
eastern phoebe	*Sayornis phoebe*
*Say's pheobe (Rare-2)(Infrequent)	*Sayornis saya*
yellow-bellied flycatcher	*Empidonax flaviventris*
Acadian flycatcher	*Empidonax virescens*
Alder flycatcher	*Empidonax alnorum*
least flycatcher	*Empidonax minimus*
eastern wood pewee	*Contropus virens*
olive-sided flycatcher	*Nuttallornis borealis*
vermilion flycatcher (Infrequent)	*Pyrocephalus rubinus*
	Family Alaudidae
horned lark	*Eremophila alpestris*
	Family Hirundinidae
tree swallow	*Iridoprocne bicolor*
bank swallow	*Riparia riparia*
rough-winged swallow	*Stelgidopteryx ruficollis*
barn swallow	*Hirundo rustica*
cliff swallow	*Petrochelidon pyrrhonota*
purple martin	*Progne subis*
	Family Corvidae
blue jay	*Cyanocitta cristata*
*black-billed magpie (Rare-2)(Infrequent)	*Pica pica*
common crow	*Corvus brachyrhyrchos*
Clark's nutcracker (Infrequent)	*Nucifraga columbiana*
	Family Paridae
Carolina chickadee	*Parus carolinensis*
tufted titmouse	*Parus bicolor*
	Family Sittadae
white-breasted nuthatch	*Sitta carolinensis*
red-breasted nuthatch	*Sitta canadensis*
	Family Certhiidae
brown creeper	*Certhia familaris*
	Family Troglodytidae
house wren	*Troglodytes aedon*
winter wren	*Troglodytes troglodytes*
Bewick's wren	*Thryomanes bewickii*
Carolina wren	*Thryothorus ludovicianus*
long-billed marsh wren	*Telmatodytes palustris*
short-billed marsh wren	*Cistothrous platensis*
rock wren (Infrequent)	*Salpinctes obsoletus*

SPARROWLIKE BIRDS, CONT.	ORDER PASSERIFORMES
	Family Mimidae
mockingbird	*Mimus polyglottis*
gray catbird	*Dumetella carolinensis*
brown thrasher	*Toxostoma rufum*
*curve-billed thrasher (Rare-2)(Infreq.)	*Toxostoma curvirostre*
*sage thrasher (Rare-2) (Infrequent)	*Oreoscoptes montanus*
	Family Turdidae
robin	*Turdus migratorius*
wood thrush	*Hylocichla mustelina*
hermit thrush	*Catharus guttatus*
Swainson's thrush	*Catharus ustulatus*
gray-cheeked thrush	*Catharus minimus*
veery	*Catharus fuscescens*
eastern bluebird	*Sialia sialis*
mountain bluebird	*Sialia currucoides*
Townsend's solitaire	*Myadestes townsendi*
	Family Sylviidae
blue-gray gnatcatcher	*Polioptila caerulea*
golden-crowned kinglet	*Regulus satrapa*
ruby-crowned kinglet	*Regulus calendula*
	Family Motacillidae
water pipit	*Anthus spinoletta*
Sprague's pipit	*Anthus spragueii*
	Family Bombycillidae
Bohemian waxwing (Infrequent)	*Bombycilla garrulus*
cedar waxwing	*Bombycilla cedroroum*
	Family Laniidae
northern shrike (Infrequent)	*Lanius excubitor*
loggerhead shrike	*Lanius ludovicianus*
	Family Sturnidae
starling	*Sturnus vulgaris*
	Family Vireonidae
black-capped vireo	*Vireo atricapilla*
white-eyed vireo	*Vireo griseus*
Bell's vireo	*Vireo bellii*
yellow-throated vireo	*Vireo flavifrons*
solitary vireo	*Vireo solitarius*
red-eyed vireo	*Vireo olivaceus*
Philadelphia vireo	*Vireo philadelphicus*
warbling vireo	*Vireo gilvus*
	Family Parulidae
black-and-white warbler	*Mniotilta varia*
prothonotary warbler	*Protonotaria citrea*

...WLIKE BIRDS, CONT.	ORDER PASSERIFORMES Family Parulidae, cont.
...lden-winged warbler (Infrequent)	*Vermivora chrysoptera*
Blue-winged warbler (Infrequent)	*Vermivora pinus*
Tennessee Warbler	*Vermivora peregrina*
orange-crowned warbler	*Vermivora celata*
Nashville warbler	*Vermivora ruficapilla*
northern parula warbler	*Parula americana*
yellow warbler	*Dendroica petechia*
magnolia warbler	*Dendroica magnolia*
black-throated blue warbler (Infrequent)	*Dendroica caerulescens*
yellow-rumped warbler	*Dendroica coronata*
black-throated gray warbler (Infrequent)	*Dendroica nigrescens*
black-throated green warbler	*Dendroica virens*
Blackburnian warbler	*Dendroica fusca*
yellow-throated warbler	*Dendroica dominica*
chestnut-sided warbler (Infrequent)	*Dendroica pensylvanica*
bay-breasted warbler (Infrequent)	*Dendroica castanea*
blackpoll warbler (Infrequent)	*Dendroica striata*
prairie warbler	*Dendroica discolor*
oven bird	*Seiurus aurocapillus*
northern waterthrush	*Seiurus noveboracensis*
Louisiana waterthrush	*Seiurus motacilla*
Kentucky warbler	*Oporornis formosus*
Connecticut warbler (Infrequent)	*Oporornis agilis*
mourning warbler	*Oporornis philadelphia*
MacGillivray's warbler	*Oporornis tolmiei*
common yellowthroat	*Geothylpis trichas*
yellow-breasted chat	*Icteria virens*
hooded warbler (Infrequent)	*Wilsonia citrina*
Wilson's warbler	*Wilsonia pusilla*
Canada warbler (Infrequent)	*Wilsonia canadensis*
American redstart	*Setophaga ruticilla*
	Family Ploceidae
English sparrow	*Passer domesticus*
	Family Icteridae
bobolink	*Dolichonyx oryzivorus*
eastern meadow lark	*Sturnella magna*
western meadow lark	*Sturnella neglecta*
yellow-headed blackbird	*Xanthocephalus xanthocephalus*
red-winged blackbird	*Agelaius phoeniceus*
orchard oriole	*Icterus spurius*
northern oriole	*Icterus galbula*
rusty blackbird	*Euphagus carolinus*
Brewer's blackbird	*Euphagus cyanocephalus*
great-tailed grackle	*Cassidix mexicanus*
common grackle	*Quiscalus quiscula*
brown-headed cowbird	*Molathrusater*

SPARROWLIKE BIRDS, CONT.	ORDER PASSERIFORMES
	Family Thraupidae
scarlet tanager (Infrequent)	*Piranga olivacea*
summer tanager	*Piranga rubra*
	Family Fringillidae
cardinal	*Cardinal s cardinalis*
rose-breasted grosbeak	*Pheucticus ludovicianus*
black-headed grosbeak (Infrequent)	*Pheucticus melanocephalus*
blue grosbeak	*Guiraca caerulea*
indigo bunting	*Passerina cyanea*
lazuli bunting (Infrequent)	*Passerina amoena*
painted bunting	*Passerina ciris*
dickcissel	*Spiza americana*
evening grosbeak	*Hesperiphona vespertina*
purple finch	*Carpodacus purpureus*
house finch (Infrequent)	*Carpodacus mexicanus*
pine grosbeak (Infrequent)	*Pinicola enucleator*
pine siskin	*Spinus pinus*
American goldfinch	*Spinus tristis*
lesser goldfinch (Infrequent)	*Spinus psaltria*
red crossbill	*Loxia curvirostra*
white-winged crossbill (Infrequent)	*Loxia leucoptera*
green-tailed towhee (Infrequent)	*Chlorura chlorura*
rufous-sided towhee	*Pipilo erythrophthalmus*
lark bunting (Infrequent)	*Calamospiza melanocorys*
Savannah sparrow	*Passerculus sandwichensis*
grasshopper sparrow	*Ammodramus savannarum*
Baird's sparrow (Infrequent)	*Ammodramus bairdii*
Henslow's sparrow (Infrequent)	*Ammodramus henslowii*
sharp-tailed sparrow (Infrequent)	*Ammospiza caudacuta*
LeConte's sparrow	*Ammospiza leconteii*
vesper sparrow	*Pooecetes gramineus*
lark sparrow	*Chondestes grammacus*
Cassin's sparrow	*Aimophila cassinii*
*black-throated sparrow (Rare-2) (Infreq.)	*Amphispiza bilineata*
dark-eyed junco	*Junco hyemalis*
*gray-headed junco (Rare-2) (Infrequent)	*Junco caniceps*
tree sparrow	*Spizella arborea*
chipping sparrow	*Spizella passerina*
clay-colored sparrow	*Spizella pallida*
Brewer's sparrow (Infrequent)	*Spizella breweri*
field sparrow	*Spizella pusilla*
Harris's sparrow	*Zonotrichia querula*
white-crowned sparrow	*Zonotrichia leucophrys*
white-throated sparrow	*Zonotrichia albicollis*
fox sparrow	*Passerella iliaca*
Lincoln's sparrow	*Melospiza lincolnii*
swamp sparrow	*Melospiza georgiana*
song sparrow	*Melospiza melodia*
McCown's longspur	*Calcarius mccownii*
Lapland longspur	*Calcarius lapponicus*
Smith's longspur	*Calcarius pictus*
chestnut-collared longspur	*Calcarius ornatus*
snow bunting (Infrequent)	*Plectrophenax nivalis*

LIST OF MAMMALS

The following list contains 51 species of mammals known to exist in the ACOG region. Nomenclature and taxonomoc order are based on Blair (1968) and Greer (1977).

ORDER MARSUPIALIA	
Virginia oppossum	*Didelphis virginiana*
ORDER INSECTIVORA	
short-tailed shrew	*Blarina brevicauda*
least shrew	*Cryptotis parva*
eastern mole	*Scalopus aquaticus*
ORDER CHIROPTERA	
silver-haired bat	*Lasionycteris noctivagans*
eastern pipistrelle	*Pipistrellus subflavus*
red bat	*Lasiurus borealis*
hoary bat	*Lasiurus cinereus*
big brown bat	*Eptesicus fuscus*
cave myotis	*Myotis velifer*
Townsend's big-eared bat	*Plecotus townsendii*
Brasilian free-tailed bat (guano bat)	*Tadarida brasiliensis*
ORDER EDENTATA	
nine-banded armadillo	*Dasypus novemcinctus*
ORDER LAGOMORPHA	
black-tailed jackrabbit	*Lepus californicus*
eastern cottontail	*Sylvilagus floridaans*
*swamp rabbit (Endangered)	*Sylvilagus aquaticus*
ORDER RODENTIA	
eastern fox squirrel	*Sciurus niger*
*black-tailed prairie dog (Rare-2)	*Cynomys ludovicianus*
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
southern flying squirrel	*Glaucomys volans*
plains pocket gopher	*Geomys bursarius*
hispid pocket mouse	*Perognathus hispidus*
Ord's kangaroo rat	*Dipodomys ordii*
beaver	*Castor canadensis*
plains harvest mouse	*Reithrodontomys montanus*
fulvous harvest mouse	*Reithrodontomys fulvescens*
deer mouse	*Peromyscus maniculatus*
white-footed mouse	*Peromyscus leucopus*
cotton mouse	*Peromyscus gossypinus*
northern grasshopper mouse	*Onychomys leucogaster*
hispid cotton rat	*Sigmodon hispidus*
eastern woodrat	*Neotoma floridana*
*prairie vole (Rare-1)	*Microtus ochrogaster*
woodland vole	*Microtus pinetorum*

LIST OF MAMMALS, CONT.

ORDER RODENTIA, CONT.

muskrat	*Ondatra zibethicus*
*meadow jumping mouse (Rare-2)	*Zapus hudsonius*
nutria	*Myocastor coypus*
gray squirrel	*Sciurus carolinensis*
Texas mouse	*Peromyscus atiwateri*

ORDER CARNIVORA

coyote	*Canis latrans*
red fox	*Vulpes*
gray fox	*Urocyon cinereoargenteus*
raccoon	*Procyon lotor*
long-tailed weasel	*Mustela frenata*
mink	*Mustela vison*
badger	*Taxidea taxus*
striped skink	*Mephitis mephitis*
eastern spotted skunk	*Spilogale putorius*
+*mountain lion (cougar)(Endangered)	*Felis concolor*
bobcat	*Lynx rufus*

ORDER ARTIODACTYLA

whitetail deer	*Odocoileus virginianus*
bison	*Bison bison*

*Denotes species listed as rare or endangered by the Rare and Endangered Species of Oklahoma Committee (1975). The pertinent definitions used by this committee are as follows:

Endangered - Any species or subspecies occurring in Oklahoma threatened with extinction through the destruction, drastic modification, or severe curtailment, or the threatened destruction, drastic modification or severe curtailment of its habitat, or its over-utilization for commercial or sporting purposes, or the effect on it of disease or predation, or other natural or man-made factors affecting its continued existence. Continued survival of this species is unlikely without implementation of special protective measures.

Rare-1 - A rare species or subspecies is one that, although not presently threatened with extinction, is in such small numbers that it may be endangered if its environment worsens.

Rare-2 - A species or subspecies that may be quite abundant where it does occur but is known in only a few localities or in a restricted habitat within Oklahoma.

+Denotes species listed as endangered by the U.S. Fish and Wildlife Service. The Endangered Species Act of 1973 (PL 93-205; 87 Stat. 884) defines as "endangered", those species in danger of "extinction throughout all or a significant part of their range".

APPENDIX 20-A

PUBLIC PARTICIPATION MEETING SUMMARIES

This appendix is available upon request from the Oklahoma Water Resources Board, 1000 N. E. 10th, 12th Floor, Oklahoma City, OK 73105, or by calling (405)-271-2555.

APPENDIX 20-A

PUBLIC PARTICIPATION MEETING SUMMARIES

This appendix is available upon request from the Oklahoma Water Resources Board, 1000 N. E. 10th, 12th Floor, Oklahoma City, OK 73105, or by calling (405)-271-2555.

TASK - PUBLIC PARTICIPATION FOR PHASE I STUDY

FOR NORTHEAST LAKE

INTRODUCTION

The Oklahoma Water Resources Board, in cooperation with the Oklahoma Department of Pollution Control, will provide for, encourage, and assist public participation in developing proposed Phase I projects for the restoration and, or protection of four publicly owned lakes. The Oklahoma Water Resources Board (OWRB) has designated Lynda Sinclair to serve as the agency Public Participation Coordinator (PPC) for the four Phase I studies. In accordance with the Public Participation Federal Regulations, Title 40, Section 25.11, the following activities are planned: Public comment will be solicited in developing, evalutating and selecting alternatives for lake restoration or protection; in assessing environmental impacts; and identifying measures to mitigate any adverse impacts that are identified. Relevant project information will be completed and available for review in a depository 30 days prior to any meeting.

A formal public hearing will be held before the final selection of an alternative for lake restoration if the alternative involves major construction, dredging or significant modifications to the environment, or if deemed appropriate by the Regional Administrator or the Project Officer.

A summary of the public comments and grantee's response to said comments shall be prepared and submitted to EPA either as a report or as responsiveness summaries.

Public consultation will be coordinated with related or existing programs or activities to encourage the greatest participation by the public.

The Public Participation Program must remain flexible to enable incorporation of the needed modifications in accordance with the public input. Maintaining this philosophy throughout the program will be accomplished by following the "Citizen Participation by Objective Method" as outlined in the "Citizen Participation Handbook", Third Edition 1978, Institute for Participatory Planning, Laramie, Wyoming.

As delineated in the project proposal submitted July 30, 1979, we will utilize valid and legitimate mechanisms to establish SEACA (Substantial Effective Agreement on a Course of Action) in accordance with the Citizen Participation Handbook.

In overview, the SEACA process will ensure that the interested and or affected public will have the opportunity to be involved, informed, and heard in the decision making process regarding major project results. The mechanisms for this public involvement should include the utilization of several activities such as public meetings, fact sheets for press releases and news letters, presentations to various civic functions and organizations and public awareness bulletins (posters) which with planning can be integrated to form SEACA.

Each public meeting held will include the important two-way communication feature as public input will assist in project direction. Fact sheets in newsletters and for press releases should inform and solicit public involvement when needed for project direction. The public awareness education bulletins should ensure that the "lake-user public" has the opportunity to review the project. These notices can provide an alternative means of informing the public that would not attend or do not have the opportunity to attend public meetings.

FEDERAL REQUIREMENTS

FOR PUBLIC PARTICIPATION

The OWRB has included the five basic functions required in the proposed policy on public participation from the Code of Federal Register, 40 CFR-Part 25 reference. The public participation task will be addressed according to these basic functions: Identification, Outreach, Dialogue, Assimilation and Feedback.

1. IDENTIFICATION:

   A mailing list of potential interest groups has been assimilated for Northeast Lake. These groups were chosen as those who may be affected or interested in any phase of the Clean Lakes program. Attached are mailing lists of these groups, which may be expanded at any time. A Gopher committee will be chosen to represent each lake.

2. OUTREACH:

   Accurate information that is pertinent and understandable will be sent out in a timely manner through media ads, mailings, depositories and public service announcements as well as other means of cummunication.

   a. Content:

      Information concerning the project such as background, time tables of proposed actions and technical summaries will be provided. Public meetings will be held to discuss the issues and to inform the public of the social, economical and environmental consequences of proposed decisions.

      Newsletters and news releases will inform the public of available materials or documents.

   b. Notification:

      All appropriate parties will be notified of any opportunities to participate and give input. This will usually be done through mailouts and the media.

c. Timing:

A formal public meeting will have 30 days notice where as a public hearing will have 45 days notice. Notification will be handled through mailing lists and material posted in Northeast Lake area.

d. Fees For Copying:

Copies of pertinent documents will be provided free of charge. Any charges incurred will be charged to the Northeast Lake grant.

e. Depositories:

Copies of the workplan, reports, studies and important documents will be placed in local public and university library depositories. A list of these depositories is attached.

3. DIALOGUE:

This will provide the public an avenue to exchange views and explore issues, answers and consequences. The method chosen will be the most effective one at the time. This could be meetings, workshops, hearings and the establishment of a Gopher committee.

The public will be notified of meetings well in advance and the meeting times and places will be scheduled at the most convenient times and locations possible for the public.

a. Requirements For A Public Hearing:

Public hearings will be held with the approved guidelines that follow:

1. Timing of Notice - Notices will be well publicized and mailed out 45 days in advance. (Exceptions are lsited in the Federal Register.)

2. Content of Notice - The notice will identify the issues to be discussed at the hearing and will include a discussion of the agency's tentative plans on these issues.

3. Provision of Information - All reports, documents and data relevant to the public hearings will be made available to the public as soon as the OWRB is able to release them. This should be no later then 30 days prior to the hearing.

4. Conduct of Hearing - The public attending a hearing will be informed of the issues at hand, the considerations of the OWRB and DPC regarding the laws and regulations, the Boards tentative conclusions along with obtaining input from the public. This can be done through questions and answer period to allow for full expression of views.

5. Record of Hearings - The hearing record will be left open 10 days following the hearing to receive additional comment. A transcript will be prepared and made available to the public.

b. Requirements For Advisory Groups:

The use of an Advisory Committee has not yet been established for Northeast Lake. The legitimacy of such a committee for this area is still being questioned.

4. Assimilation:

There will be an assimilation of public view points and preferences into the final conclusions. This will be done by putting together the results of "Outreach and Dialogue". The OWRB and DPC will then incorporate the views and concerns of the public into subsequent project actions. Assimilation will include three elements:

a. Documentation:

Documentation will outline considerations of the public's views in the form of Responsiveness Summaries or other appropriate forms.

b. Content:

Each Responsiveness Summary will include:

1. An explanation of the Public Participation activity conducted.

2. Identify those people or groups who attended.

3. Describe the matters on which the public was consulted.

4. Summarize the public's views, comments, and suggestions.

5. Depict the Water Board's responses. If modification will be considered or if not, why the proposal is rejected.

c. USE:

Responsiveness Summaries will be used in any decisions made on the project.

5. FEEDBACK:

The OWRB in coordination with the DPC will inform interested parties and other groups of the outcome of the publics involvement. This may be done through personal letters or phone calls. The following elements must be present:

a. Content:

A statement of the action taken on Northeast Lake will indicate the effect the public's comments had on that action.

b. Availability:

The OWRB and DPC will supply the public with appropriate feedback and will insure that all public participants in the Northeast Lake area have access to that feedback. Also, when Responsiveness Reports or similar documents have been prepared they will be made available to the public.

NORTHEAST LAKE
PUBLIC PARTICIPATION
ESTABLISHED OBJECTIVES AND TECHNIQUES

The Public Participation Program was planned around the Hans Bleiker Citizens Participation by Objectives Handbook. The following techniques were chosen by the handbooks systematic determination of selecting techniques to fulfill stated objectives.

Objectives obtained from the handbook will be listed for Northeast Lake and following these a list of alternative techniques will be displayed. In order to meet the federal regulations concerning Public Participation, at the end of each technique a reference will be made as to which regulation the technique addresses. Objectives were selected by a working team from OWRB and DPC which included personnel familiar with the current status at each lake in the program. The four lakes were considered jointly so that economy of scale could be identified if possible.

Each of the lakes shared some objectives that may be considered very important to these projects: establishing and maintaining the legitimacy of the OWRB and DPC, and establishing and maintaining the legitimacy of our decision making processes were needed for every lake in the program, these, along with specific objectives for each lake will be the main concern of the Public Participation Program.

NORTHEAST LAKE OBJECTIVES

1. Establishing the legitimacy of the agencies involved. (OWRB, DPC, EPA and the Oklahoma City Zoo)
2. Establishing the legitimacy of the agencies' decision-making process.
3. Maintaining the legitimacy of the agencies' decision-making process.
4. Getting to know all of the potentially affected interests.
5. Having all interests receive and understand the information that is being communicated.

Several techniques as identified by the CP Process will be used as aids in achieving the defined objectives listed above. Following the description of these techniques will be a calendar with specific dates listed for public meetings and hearings. There are also listings of all other types of public contacts along with a milestone schedule.

A. Using a Committee of "Gofers":

A committee of "Gofers" will be chosen from representatives of interested organizations and individuals in and around the Northeast Lake area. These people will be responsible for keeping their group as well as the general public informed, of pertinent information throughout the project. By this method our agency will be making the most of existing organizations by getting to know the potentially affected interests. The "Gofer" committee will be established in place of the Citizens Advisory Committee and a list of representatives will be completed and sent to EPA in Januray 1981. This method has shown to be an effective way to involve the public (Dialogue, Assimilation and Feedback).

B. Develope a List of Potential Interests/Mailing List:

A group of potential interests such as the Northeast Neighborhood Association and the Zoological Society, will be established into a list along with a mailing list of other organizations. Information will be sent out in quarterly reports or when significant findings develope. A completed list will be sent to EPA (Dialogue, Assimilation and Feedback).

C. Communication to the Public:

A slide presentation will be designed for use during public service announcement television spots. It will briefly describe the project and who to call if there are any comments concerning the project design or implementations (Outreach and Dialogue).

Radio public service announcements will be utilized to verbally present the project and to provide a contact number for interested individuals to utilize (Outreach and Dialogue).

The existing OWRB Newsletter will be used to provide information concerning the projects in the Oklahoma City area as well as the other projects outside the Oklahoma City area (Outreach and Assimilation).

There will be quarterly press releases to keep the public informed on the progress of the project (Outreach and Assimilation).

The Oklahoma City Zoo personnel have undertaken the following forms of public communication:

Grant identification and description with lakeside graphics accompained by leaflet handouts announcing the public participation workshop (Outreach, Assimilation and Feedback).

There will be a final publication of data collected, feasibility of alternative solutions and public needs (Outreach and Assimilation).

D. Public Meetings:

There will be two public meetings. The first meeting will be held in December, 1980 to review the Northeast work plan and get input from the public on the work plan's function. The second meeting will be held in April, 1982 to discuss and review the data collected during the sampling period. The Zoo will be involved in this public presentation. A forum will follow to gain public feedback and to discuss alternative directions for the lake project (Assimilation and Feedback).

E. Public Hearings:

A public hearing will be held in Januray, 1983, near the end of the project to obtain formal comments. The draft will be left open to the public 10 days after the public hearing for this purpose. All comments will be considered prior to submittal to EPA of the final plan (Outreach, Dialogue, Assimilation and Feedback).

F. Brochure/Handbill:

A brochure descirbing the projects along with a contact phone number will be distributed in the Oklahoma City area. This brochure will include all six grants that are included in the Clean Lakes 314 Project. A handbill describing the Northeast Lake Project will be distributed in the Northeast, Oklahoma City area, in December, 1980.

G. Public Workshop:

The Oklahoma City Zook will provide a public workshop that will be closely coordinated with the OWRB and DPC to determine public use and projected use of the lake. This workshop will be held in conjunction with the first meeting of the OWRB in December, 1980 (Outreach, Dialogue, Assimilation and Feedback).

NORTHEAST	1980	1981	1982	1983
JANUARY		"Gofer" Committee organization and list sent to EPA Quarterly press release	Quarterly press release	1/13/83 Public hearing 1/24/83 Comment period ends Responsiveness Summary
FEBRUARY		*PSA development for duration of project		2/1/83 Final report to to DPC 2/14/83 Final report to PCCB
MARCH		**Lakeside graphics	3/19/82 Public meeting notice	3/1/83 Final report to EPA
APRIL		"Gofer" meeting Quarterly press release	4/22/82 Public meeting with forum Quarterly press release	
MAY			Channel 13 T.V. Spot	
JUNE				
JULY		Quarterly press release	Quarterly press release	
AUGUST				
SEPTEMBER		* 9/1/81 Public forum	*Final summation of data - Booklet	
OCTOBER		Quarterly press release	Quarterly press release	
NOVEMBER	*Workshop with OWRB public meeting moved to December 11/10/80 Public meeting notice	End of sampling	11/29/82 Public hearing notice	
DECEMBER	Sampling starts Workplan review 12/11/80 Public meeting			

SAMPLING

GOFER---COMMITTEE---CONTACTS

GOFER---COMMITTEE---CONTACTS

Quarterly press release to include: articles in newsletters, environmental education releases to media referring to the Clean Lakes Program and decision-making process and Public Service Announcements (a slide presentation for T.V. and radio spots).

Participate in publication of Oklahoma Clean Lakes brochure.

Project identification sign at lake site.

* PSA - Public Service Announcements

** These tasks to be completed by Zoo personnel.

NORTHEAST LAKE

NORTHEAST LAKE

PUBLIC PARTICIPATION BUDGET

	Total Public Participation Funds	OWRB	DPC
"Gofer Committee Formation, Meetings and Staff Support	$2400	$1200	$1200
One Public Meeting	600	300	300
One Public Meeting with Forum	1034	517	517
Public Hearing	600	300	300
Public Service Announcements (PSA)	free	---	---
Newsletters	325	325	---
Brochures	650	125	125
Workshop	922	461	461
Printing Costs	1700	1700	---
Informational Mailing	1351	---	1351
Responsiveness Summaries	846	336	510
Meeting Facilities	500	---	500
Speaker Availability	400	400	---
Sign	100	50	50
	$11,428	$5714	$5714

File

NORTHEAST LAKE PUBLIC MEETING

PROGRAM

December 11, 1980

7:00 - 9:00 p.m.

— Introduction and Historical Perspective...Ken Morris

— Oklahoma Water Resources Board (OWRB) Work Plan Overview...Jim Grimshaw

— Oklahoma City Zoo Work Plan Overview...Steve Haus

— OWRB and Zoo Public Participation Program...Lynda Sinclair and Steve Haus

— Discussion and Questions from the Audience

— Evaluation of Public Meeting

PUBLIC MEETING

CLEAN LAKES PROJECT

NORTHEAST LAKE

December 11, 1980

ATTENDANCE RECORD

* If you would like to be added to our mailing list, please indicate "YES" under the heading.

Name	Address	Mailing List	Representing
1. Stephen C. Hans	412 N.W. 25th		OKC. Zoo
2. Ken Morris	510 Elmwood Norman		OWRB
Don Schreeber	410 S. Macy #3 Norman		[illegible]
Lee Ann Baldwin	2908 NW 28 OKC		OWRB
Helda Brown	404 NW 94th Apt. 247-S OKC		OWRB
Mark Brown	" "		[illegible]
Kay Stephenson	1836 Churchill Way		OCCHD
Donita Moore	1240 NW 101 St OKC		OCCHD
Bob Lynch	804 A Cardinal CR. Norman		OCCHD
Lynda Sinclair	Water Board 1000 N.E. 10th, 12th floor OKC.		OWRB
Robert M. Kennedy	N.E. 10th & Eastern		ODPC
Herbert J. Grimshaw	2833 S.W. 86th St OK. City		OWRB

DRAFT

Oklahoma City Zoo
Lake Study Workplan
Presentation (with slides)
December 11, 1980 7:00 p.m.
Stephen C. Haus

The zoo is essentially a sub-contractor to the Water Resources Board for the E.P.A. grant. We are planning future lake-side exhibits, all of which hinge on upgrading the water quality of Northeast Lake. Our work plan includes 4 tasks.

1. Identification and proposed solutions to zoo based pollution.

2. Description and impact of Africana on Northeast Lake.

3. Lake side landscape plans.

4. Aquarium and Aquatic Park feasibility and architectural studies, with their impact on the lake.

I will briefly summarize these four tasks (slides).

1. Northeast Lake pollution from the zoo is coming from soil erosion, fecal runoff, pesticides and herbicides, and storm drain overflow.

   - Hippo pool is flushed into the lake daily.

   - South ungulate area is being washed away.

   - Animal density is too high.

   - Pesticide use with 'Roseall,' in summer powder shoved into rat holes.

   - Herbicide use with 'Roundup' applied in summer for weed control every two months. 'Selen' to combat Dutch Elm disease - each tree saturated.

   - All chemicals are biodegradable in a relatively short period of time.

   - Main problem - siltation and fecal runoff leading to algae bloom in lake.

Possible Solutions:

Reroute hippo pool drainage to sewerline. Add retaining wall in eroded areas, fill with topsoil, reseed, and practice animal rotation.

2. Africana - A 230 acre reserve for breeding and exhibition of African animals located north of Northeast Lake will reduce the animal density of the South Area. Northeast Lake is the only year round water source for Africana. It remains critical that water quality improves.

3. The Lake Side Landscaping will emphasize native plant species. The Tall Grass Prairie will be reinstated. Islands that would double as siltation containments will be planned as waterfowl habitats. The lake side in the core park area will be planted with shade trees, as windbreaks and to reduce summer temperatures. Lake side landscaping will be coordinated with Aquaticus.

4. Aquaticus, the proposed aquarium and aquatic park, will begin with a feasibility study. $350,000 has been received from a 1974 bond issue and additional funding sources will be explored. The phased development of Aquaticus will include;

   (1) Aquatic Cycle - introduction to the world of water through diorama of the ocean-evaporation-cloud formation-rain, cycle.

   (2) Sea Lion Exhibit (naturalistic).

   (3) Limnarium (lake profile).

   (4) Coral Reef Exhibit.

   (5) Tidal Pool.

   (6) Aquatic adaptions.

   (7) Delphinarium (dolphin exhibit).

   (8) Paddle Fish Exhibit.

   (9) Ocean Depth Exhibit.

   (10) Aquatic Giants.

   (11) Fish/water and man (how man has adapted aquatic organisms to his particular needs).

   (12) Support facilities will include:

      a. Aquatic Classroom and Laboratory.

      b. Visitor Facilities.

      c. Curatorial Office.

None of this can take place unless the lake is cleaned up. Finding solutions to this will be our primary objective.

JAMES R. BARNETT, Acting Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

1000 N.E. 10TH STREET • P.O. BOX 53585 • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

DATE: February 9, 1981

TO: Bob Kinniburgh
Department of Pollution Control

FROM: Ron Jarman, Chief
Water Quality Division

SUBJECT: Responsiveness Summary for
Northeast Lake Public Meeting

Enclosed is a copy of the Responsiveness Summary of the Northeast Lake Public Meeting held on December 11, 1980.

If you have any questions or comments regarding this summary, please contact Ken Morris of this office.

RESPONSIVENESS SUMMARY

NORTHEAST LAKE CLEAN LAKES REPORT

PUBLIC MEETING ON DRAFT WORK PLAN

December 11, 1980

The following is a summation of issues discussed and action taken in response to citizen comments.

NOTIFICATION PROCEDURES:

A notification period of thirty days was observed for this public meeting with additional advertisement as the meeting date approached. The press release notice identified the work plan as the major issue to be discussed along with instructions on how and where to obtain a copy of the work plan before the meeting.

Notices for the Northeast Lake public meeting were sent to all major newspapers and radio stations in the Oklahoma City area. The notice identified the work plan as the major issue to be discussed at the meeting with information on where to obtain copies. The Oklahoma Gazette, an Oklahoma Department of Libraries newsletter, gave notification of the meeting on November 3, 1980. Another article appeared in the Daily Oklahoman, December 5, 1980. The Department of Pollution Control requested the Oklahoma City Metropolitan Library System to make copies of the work plan available for public review in the Oklahoma City area. Copies of the work plan were made available along with thirty day advanced notice through the Oklahoma Water Resources Board.

AGENDA:

The agenda for the work plan review public meeting consisted of:

- Introduction and historical perspective of the Clean Lakes Program and the Northeast Lake Clean Lakes Project.
- Oklahoma Water Resources Board (OWRB) work plan overview.
- Oklahoma City Zoo work plan overview (handout attached).
- OWRB and Zoo Public Participation Program.
- Discussion and questions from the audience.

A copy of the agenda handed out at the meeting is attached.

PARTICIPANTS:

Speakers: Ken Morris, Project Coordinator (OWRB); Jim Grimshaw, Principal Investigator (OWRB); Lynda Sinclair, Public Participation Coordinator (OWRB); Bob Kinniburgh, Environmental Planner (DPC).

Attendees: A list of persons who attended the meeting is attached. No individuals representing the public were present, despite extensive coverage of the meeting thirty days prior to its convening.

ISSUES:

It was agreed among participants that the Clean Lakes Project planned for Northeast Lake was important, due mainly to the high public use of the lake and the potential health hazards that exist. Specific issues raised included the suitability of using Section 314 funds for the planning of zoo exhibits, and the adequacy of sampling only male sunfish for flesh analyses, as opposed to sampling both sexes.

QUESTIONS AND STATEMENTS:

All of the questions and issues raised during the meeting were addressed and were answered during the meeting or taken into consideration as part of the work plan review. General agreement was reached as to work plan design, and indications were that no changes are needed. A ten day comment period was designated and announced at the meeting. No replies were received.

Questions and respective responses made during the meeting are given below. The questions and comments as written are not verbatim quotes, but are summaries of questions and comments received, and the responses of the Okahoma Water Resources Board (OWRB) and the Department of Pollution Control (DPC):

Question: Steve Haus asked if Section 314 Clean Lakes funds could be used for projects such as planning the construction of a zoo exhibit for recreational purposes around the lake, if the proposed project included specific measures designed to prevent the pollution of a lake? Mr. Haus was also sorry to see the bath house restoration plan removed from the work plan.

Response: Ken Morris explained that he thought Section 314 funds were to be used for the restoration and/or preservation of a lake, primarily to make it available for recreational uses. He further thought that it would not be appropriate to use the funds for the construction of new structures, such as zoo exhibits, and for the planning of such, but that would primarily depend upon EPA's review of the work plan. The reason for this thought, Mr. Morris explained, was due to a discussion held at an EPA sponsored Clean Lakes Workshop in Atlanta, Georgia. Mr. Morris again pointed out that this may not be so and it really depends on EPA's ruling regarding the work plan review.

In regards to the bath house, a suggestion was made by Dr. Grimshaw to contact the Historical Society to determine if the house could receive landmark status and then qualify for funds under the Historical Society. Mr. Haus indicated he had contacted the Society and now he was waiting for a response. It was mentioned other avenues for funding such a project may exist.

Question: Why are just male sunfish populations being collected for the fish flesh analyses?

Response: The explanation given by Jim Grimshaw is that male sunfish exhibit territorial behavoir, and tend to limit their movement to a restricted area. Toxic substances introduced to the lake through inflows will tend to localize in the areas adjacent to the inflows. Male sunfish occupying these areas should exhibit higher levels of the toxins in their bodies in comparison to those residing in areas of the lake further from the inflow. Significant differences in body concentrations of the toxins among the subpopulations of male sunfish in the lake should be detectable statistically. Female sunfish tend to range over larger areas of their habitat, exposing themselves to the ambient environment of a broad area of the water body they inhabit. Therefore, body toxin levels of the female fish would not be expected to vary significantly.

WHAT'S NEXT:

All issues and questions raised at the meeting are summarized in the question and answer section. If further information is required or there is dissatisfaction with action taken, contact Ken Morris at the Oklahoma Water Resources Board.

With respect to public participation, alternative methods are being sought to inform the public as to where meetings will be held and alternative methods made to arouse more interest in the Northeast Lake Project. The attendance at the December 11, 1980, meeting indicates a degree of apathy regarding public meetings. In view of the response obtained at the public meetings held regarding the Phase I projects it seems apparent alternative forms of public participation need to be utilized. Furthermore, the problem with attendance at public meetings is not with the announcement procedures. However, attempts will be made to obtain greater multi-media exposure including public service announcements over the radio, on television, and continuing to place notices in local newspapers. Leaders of community service groups will be contacted well in advance of future activities so they can inform members of their civic organizations.

The Environmental Protection Agency has recently given final conditional approval of the Northeast Lake Work Plan. As there was no indication of a needed change in the work plan design at the public meeting, the final draft will be available with requested EPA modifications for distribution in the near future. A notice will be sent out concerning this matter. Quarterly press releases will be distributed to keep the public informed on the progress of this project.

NORTHEAST ZOO LAKE

PUBLIC FORUM

Omniplex Library
Sept. 1, 1981
7:00 p.m.

AGENDA

This is your meeting. It has been designed to inform you of the ongoing Northeast Lake Clean Lakes Project. We encourage comments and questions and want to know how we can help the project best suit your needs.

I. Introduction

Ken Morris - The Clean Lakes Project, Northeast Lake

Jim Ringo - Environmental Planner, Dept. of Pollution Control

Lynda Sinclair - Clean Lakes Public Participation Coordinator

II. OWRB Staff

Dr. Jim Grimshaw - Lake analysis progress (limnological data), slides/transparencies

- Restoration options and funding availability

Questions

III. Zoo Staff

Dr. Lawrence Curtis - Africana project

- Aquaticus project model/brochures

Questions

IV. Public Participation

- Critique forms and Sign-in sheets

PUBLIC FORUM

CLEAN LAKES PROJECT

NORTHEAST LAKE

September 1, 1981

ATTENDANCE RECORD

NAME	ADDRESS	MAILING LIST*	REPRESENTING
Lynda Sinclair	10th & Stonewall		OWRB
Tommy B. White	N.E. 23d Kelly		OCCHD
Robert Lynch	N.E. 23rd Kelly		OCCHD
George E Froent			John Robson Assoc.
JOHN ROBSON	2927 PASEO		ARCHITECT
Jim Ringe	1304 Abbey Norman		ODFC
Neil Garrison	5000 W. Memorial Rd		citizen
Carla B. Paul	11167 N.E. 55		League of Women Voters & area resident
[illegible]	OKC ZOO		OKC ZOO
John K. Post	OKC Z		

*If you would like to be added to our mailing list, please indicate "YES" under the heading.

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

March 31, 1982

Mr. Neal Balkan
2509 Dittmer
Oklahoma City, Oklahoma 73127

Dear Mr. Balkan:

The ~~second~~ meeting for the Northeast Lake Clean Lakes Project will be held Tuesday, April 6, 1982, at 7:30 p.m., in the Belle Isle Library, Room C, 5501 North Villa, Oklahoma City, Oklahoma.

This organizational meeting will involve selection of a chairperson and possibly voting for members. Information on residence in the surrounding watershed will also be examined. Those people on the Northeast Lake Clean Lakes mailing list will be notified of the meeting. If you know of anyone not represented on the mailing list that you would like to see listed, please contact Lynda Sinclair at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LS:sdh

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

NORTHEAST CLEAN LAKE COMMITTEE MEETING, APRIL 6, 1982
BELLE ISLE BRANCH LIBRARY

PRESENT: Lynda Sinclair, Public Participation Coordinator,
Oklahoma Water Resources Board
Jimmie Pigg, Concerned Citizen
Kyle McKinley, Oklahoma Department of Transportation
Dr. Jim Grimshaw, Environmental Specialist/Supervisor
Project Principal Investigator
Oklahoma Water Resources Board
Mrs. Cynthia Grimshaw
Ralph Campbell, Programs Director,
Oklahoma Department of Pollution Control
Nathaniel Batchelder, Public Information Curator,
Oklahoma City Zoo
Dr. George Hulsey, Region 8 Director,
National Wildlife Federation
Mrs. Patricia Hulsey
George Kroenert, Concerned Citizen
Ken Morris, Project Leader, Clean Lakes Program
Oklahoma Water Resources Board

MINUTES: (1) Ms. Sinclair called the meeting to order and explained its purpose was to form a committee which would assist in planning and decision-making regarding the Northeast Lake clean-up project.

(2) Mr. Morris indicated the project is near a major decision point in that the diagnostic portion of the study is almost near completion and the feasibility study is about to begin. Additional discussion followed about the EPA interim report requirement.

(3) Mr. Ralph Campbell, State Lake Coordinator, explained the need for the interim report requirement. Additional comments were made about the funding need for a Phase II project.

(4) Dr. Grimshaw reported that eight months of the requisite twelve months of monitoring of pollution problems in the lake are now complete in the first part of Phase I, the diagnostic phase of the project. (To follow, Dr. Grimshaw explained, would be the second part of Phase I, a development of a solution plan, and Phase II, implementation of the solution plan.)

(5) Dr. Hulsey requested Dr. Grimshaw give a subjective pre-analysis report on his findings to date. Dr. Grimshaw indicated that final analysis of his data was likely to reveal problems such as outlined in the Workplan Introduction, i.e., nutrient pollution; sedimentation with possible heavy metals pollution; pesticides and herbicides; and fecal coliform bacteria.

(6) Mr. Pigg and Dr. Hulsey suggested that a more appropriate meeting place be found. They thought the Belle Isle Library was not close enough to the area being affected by the project and that more people might attend if a different meeting place was arranged.

(7) Mr. Pigg expressed concern that signs alerting the local population to the possible dangers of eating certain species of fish from the lake had not been erected. He said a report indicating the probability of such problems had been sent from the State Department of Health to the City-County Health Department which had erected signs at lake Hefner on the basis of similar studies. Dr. Grimshaw reported that the OWRB had not yet confirmed the findings of the study Mr. Pigg cited.

(8) There was consensus that signs should be erected alerting the public that studies on possible health hazards relating to eating fish from the lake while the study is in progress. Mr. Pigg and Mr. Campbell agreed to pursue having such signs erected through the Department of Pollution Control.

(9) Mr. Morris noted that the environmental impact statement on the Zoo's proposed Aquaticus project was insufficiently specific and detailed to comply with EPA guidelines for the project workplan. Mr. Batchelder agreed to relay this information on to the Zoo.

(10) Mr. Batchelder agreed to serve as temporary chairperson for future meetings while the group develops.

(11) May 4 at 7:30 p.m. was selected as the next meeting time.

(12) Mr. Batchelder agreed to investigate a meeting site and report to Ms. Sinclair.

(13) Ms. Sinclair restated the importance of Board representation at meetings and urged those present to encourage others to attend.

(14) The meeting was adjourned.

ATTENDANCE RECORD

1st COMMITTEE MEETING
APRIL 6, 1982

NORTHEAST (ZOO) LAKE
CLEAN LAKES PROJECT

Agency in Charge: Oklahoma Water Resources Board
Project Leader-Ken Morris
Principal Investigator-Dr.Jim Grimshaw
Public Participation Coordinator- Lynda Sinclair

PRIVATE CITIZEN GROUP

1 Immel Ryt	7
2 Jim Grimshaw	8
3 George E Kissent	9
4	10
5	11
6	12

PUBLIC INTEREST GROUP	ORGANIZATION
1 George Hulsey	Nat'l Wildlife Federation
2	
3	
4	
5	
6	
7	

CONTINUED
ATTENDANCE RECORD

APRIL 6, 1982

ECONOMIC INTEREST GROUP	ORGANIZATION
1 Nathaniel Batchelder	OKC Zoo
2	
3	
4	
5	
6	
7	

PUBLIC OFFICIAL GROUP	AFFILIATION
1 Kyle P. McKinley	OK Dept of Transportation
2 Jim Grimshaw	OK Water Resources Board
3 Rizk D. Campbell	OK Dept. of Pollution Control
~~5 Nathaniel Batchelder~~	~~OKC Zoo~~
4 Patricia Chelsey	City of Norman
6	
7	
8	
9	

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

DATE: April 16, 1982

TO: Ralph Campbell, Programs Director
Department of Pollution Control

FROM: Ron Jarman, Chief
Water Quality Division

Enclosed is a list of committee members for the Northeast (Zoo) Lake Clean Lakes Project by groups as listed in the Federal guidelines for the Clean Lakes Public Participation program.

These names were obtained through the mailing list and letters asking for committee members. The first committee meeting has been held as of April 6, 1982, and a tentative group of committee members were selected. Mr. Nathaniel Batchelder was selected as the temporary chairperson for the Northeast (Zoo) Lake Committee. All four groups are represented, but this list will remain "open" to obtain new additions or to drop those not wishing to be on the committee.

Thank you for your patience in this matter. If you have any questions, please contact Lynda Sinclair or Ken Morris of this office.

Enclosures as stated

cc: Lawrence Curtis
OKC Zoo Director
John Preston
Assistant Director of Educational Services
Nathaniel Batchelder
OKC Zoo

PROJECT OFFICIALS FOR NORTHEAST LAKE

1
Ms. Shirley Harvey, Project Officer
U.S. Environmental Protection Agency
Clean Lakes Coordinator
Region VI
1201 Elm Street
Dallas, Texas 75250
Ms. Harvey

2
Mr. Ralph Campbell, Programs Director
Department of Pollution Control
State Clean Lakes Coordinator
P.O. Box 53504
Oklahoma City, Oklahoma 73152
Mr. Campbell

3
Mr. Ken Morris, Project Leader
Oklahoma Water Resources Board
Project Coordinator
P.O. Box 53585
Oklahoma City, Oklahoma 73152
Mr. Morris

4
Jim Grimshaw, Ph.D.
Principal Investigator
Oklahoma Water Resources Board
P.O. Box 53585
Oklahoma City, Oklahoma 73152
Dr. Grimshaw

5
Mr. Don Schreiber and Ms. Lynda Sinclair
Project Limnologists
Oklahoma Water Resources Board
P.O. Box 53585
Oklahoma City, Oklahoma 73152
Mr. Schreiber and Ms. Sinclair

13
Ms. Lynda Sinclair
Public Participation Coordinator
Oklahoma Water Resources Board
P.O. Box 53585
Oklahoma City, Oklahoma 73152
Ms. Sinclair

NORTHEAST LAKE COMMITTEE - PRIVATE CITIZENS - JOB Q

1
Mr. Amos Verne Bollinger
P.O. Box 888
Choctaw, Oklahoma 73020
Mr. Bollinger

2
Mr. Jimmie Pigg
401 Rock Place
Moore, Oklahoma 73060
Mr. Pigg

42
Mr. Hamp Baker, Chairman
Oklahoma Corporation Commission
Jim Thorpe Building
Third Floor
Oklahoma City, Oklahoma 73105
Mr. Baker

48
Mr. Paul Clowers
Oklahoma County Engineer
Oklahoma County Court House
Room 119
Oklahoma City, Oklahoma 73102
Mr. Clowers

29
Mr. Blaney Qualls
Oklahoma Department of Mines
4040 North Lincoln Boulevard
Room 109
Oklahoma City, Oklahoma 73105
Mr. Qualls

35
Mr. Lawrence Edmison, Director
Oklahoma Department of Pollution Control
1000 Northeast Tenth Street
Oklahoma City, Oklahoma 73105
Mr. Edmison

33
Mr. Miles Logsdon
Division of Planning & Development
Oklahoma Department of Tourism & Recreation
500 Will Rogers Building
Oklahoma City, Oklahoma 73105
Mr. Logsdon

37
Mr. Monty Murphy
Oklahoma Department of Transportation
200 Northeast 21st Street
Oklahoma City, Oklahoma 73105
Mr. Murphy

41
Mr. Richard A. Ward
Oklahoma Department of Transportation
200 Northeast 21st Street
Oklahoma City, Oklahoma 73105
Mr. Ward

Northeast Lake - Public Officials - Job H

44
Mr. J. Carl Miller
Oklahoma Department of Transportation
200 Northeast 21st
Oklahoma City, Oklahoma 73105
Mr. Miller

90
Mr. Kyle McKinley
Oklahoma Department of Transportation
200 Northeast 21st
Oklahoma City, Oklahoma 73105
Mr. McKinley

11
Mr. Ric Gomez
Chief, Environmental Services
Oklahoma Department of Wildlife Conservation
P.O. Box 53465
Oklahoma City, Oklahoma 73159
Mr. Gomez

28
Mr. Steve Lewis, Director
Oklahoma Department of Wildlife Conservation
1801 North Lincoln Boulevard
Oklahoma City, Oklahoma 73105
Mr. Lewis

43
Mr. Ron Suttles
Environmental Biologist
Oklahoma Department of Wildlife Conservation
1801 North Lincoln Boulevard
Oklahoma City, Oklahoma 73105
Mr. Suttles

25
Mr. W. J. Bowman, Chief
Oklahoma Employment Security Commission
Will Rogers Building
Oklahoma City, Oklahoma 73152
Mr. Bowman

40
Mr. Bryce A. Baggett
Executive Director
Oklahoma Employment Security Commission
200 Will Rogers Building
Oklahoma City, Oklahoma 73105
Mr. Baggett

Northeast Lake - Public Officials - Job H

32
Dr. Charles J. Mankin
Oklahoma Geological Survey
830 Van Vleet Oval
Room 163
Norman, Oklahoma 73019
Dr. Mankin

34
Dr. Kenneth V. Luza
Oklahoma Geological Survey
830 Van Vleet Oval
Room 163
Norman, Oklahoma 73019
Dr. Luza

31
Thomas Donica, M.D., Member
Oklahoma State Board of Health
4900 North Portland
Oklahoma City, Oklahoma 73112
Dr. Donica

12
Mr. Jack Craig, Commissioner
Oklahoma State Department of Agriculture
122 State Capitol
Oklahoma City, Oklahoma 73105
Mr. Craig

15
Mr. Jim Leach
Forestry Division
Oklahoma State Department of Agriculture
State Capitol Building
Oklahoma City, Oklahoma 73105
Mr. Leach

16
Mr. Bob Birchell
Forestry Division
Oklahoma State Department of Agriculture
State Capitol Building
Oklahoma City, Oklahoma 73105
Mr. Birchell

21
Mr. Joseph P. Marak
Oklahoma State Department of Agriculture
122 State Capitol Building
Oklahoma City, Oklahoma 73105
Mr. Marak

26
Mr. Clyde Bower
Environmental Coordinator
Oklahoma State Department of Agriculture
122 State Capitol Building
Oklahoma City, Oklahoma 73105
Mr. Bower

30
Dr. Joan Leavitt, Commissioner
Oklahoma State Department of Health
P.O. Box 53551
Oklahoma City, Oklahoma 73104
Dr. Leavitt

39
Mr. Mark Coleman
Oklahoma State Department of Health
1000 Northeast Tenth Street
Oklahoma City, Oklahoma 73105
Mr. Coleman

22
Mr. Brent VanMeter, Acting Director
Water Facilities Engineering Service
Oklahoma State Depatment of Health
Standards Division
P.O. Box 53551
Oklahoma City, Oklahoma 73152
Mr. VanMeter

82
Councilman Roy Carmack
The Village
3004 Kerry Lane
The Village, Oklahoma 73120
Councilman Carmack

5
Mr. David Burris
Tinker Air Force Base
2854 CES/DEEX
Tinker AFB, Oklahoma 73145
Mr. Burris

60
Mr. Eddie Jackson
Chairman of the Board
Town of Forest Park
P.O. Box 11397
Forest Park, Oklahoma 73121
Mr. Jackson

Northeast Lake - Public Officials - Job H

62
Town of Hallpark
Box 1205
Norman, Oklahoma 73070
Sir or Madam

63
Mr. Matthew Watkins
Town of Harrah
P.O. Box 636
Harrah, Oklahoma 73045
Mr. Watkins

64
Mr. Joseph D. Burkhart
Board Member
Town of Jones
P.O. Box 512
Jones, Oklahoma 73049
Mr. Burkhart

6
Mr. Beryl G. Baggett
Area Conservationist
U.S. Department of Agriculture
Soil Conservation Service - Area V
1016 Northwest 67th - Suite A
Oklahoma City, Oklahoma 73116
Mr. Baggett

91
Ms. Shirley Harvey
Project Officer
U.S. Environmental Protection Agency
Region VI
1201 Elm Street
Dallas, Texas 75270
Ms. Harvey

4
Mr. Jerry Stoner
U.S. Geological Survey, WRD
201 Northwest Third Street
Room 621
Oklahoma City, Oklahoma 73102
Mr. Stoner

9
Mr. Ray Crooks
Meterologist in Charge
Weather Service Forecast Office
Will Rogers World Airport
P.O. Box 59997
Oklahoma City, Oklahoma 73159
Mr. Crooks

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

NORTHEAST (ZOO) LAKE CLEAN LAKES
COMMITTEE MEETING, MAY 4, 1982
OKLAHOMA ZOOLOGICAL LIBRARY

Private Citizens

Letitia Reason
Dan O'Brien

Public Interest Group

Leroy A. Tease, Carverdale Neighborhood Association
Lynn A. Leverett, Levco-Dredging Co.
R. Fenton Rood, Sierra Club
John Robison, Neighborhood Development & Conservation Center, OKC
Bob Reed, ARBCO Dredging, Inc., Arlington, Texas
Theople Roberts, Northeast Park Estates
Nathaniel Batchelder, Chairperson, Public Information Curator, Oklahoma City Zoo
John Preston, Assistant Director of Educational Services, Oklahoma City Zoo

Public Officials

Angela Brown, elected Secretary, Tourism Dept.-Planning & Development
Kyle P. McKinley, Oklahoma Dept. of Transportation
Charlie Marshall, Oklahoma City/County Health Dept.
Al Metts, Oklahoma City Water Resources Dept.

Project Officials

Lynda Sinclair, Public Participation Coordinator, Oklahoma Water Resources Board
Dr. Jim Grimshaw, Principal Investigator, Northeast Lake, Oklahoma Water Resources Board

MINUTES:

(1) Ms. Sinclair called the meeting to order and described the purpose of the committee would be to examine the information/data on Northeast Lake and obtain input from their represented groups, and the public, on what type of restoration project they would like to see performed. Explanation was made as to the status of the project. The Phase I diagnostic study is at completion. The feasibility study is beginning. Its purpose will be to determine the most feasible restoration plan for the lake to be presented to EPA.

(2) Mr. Batchelder, Chairperson, called for introduction of those attending. He asked J. Preston to read minutes of the April 6th meeting.

(3) Dr. Grimshaw gave a report on his studies of the lake. He described how the work plan was designed to follow EPA guidelines by performing delineated work tasks.

Information from the work plan was reviewed with the use of overlays:

(a) Monitoring sites were identified. Statistical techniques will be used to identify which of the specified sites is contributing significant pollution to the lake.

(b) A Bathymetric Map-It's purpose is to calculate lake volume. Volume can be calculated from existing maps or be used to supply baseline information to determine sediment accumulation.

(c) Cross-Sectional Profile - This technique shows lake shape. Lakes with different shapes behave differently.

(d) Retention Time is required to be calculated. Rainfall to discharge was plotted in acre feet. This determines how long it takes the lake water to be completely changed by water flowing into the lake. Example: a 2½" rainfall displaces 75% of the lake water. This lake water changes very rapidly in response to rainfall.

(e) Sedimentation Rate - No existing information. Data was obtained from the Soil Conservation Service on other cities in Oklahoma that have the same size watershed as the Northeast Lake watershed.

Cesium 137 Dating Technique will be used to determine how much sediment has accumulated.

(f) Geology of Watershed Basin. This will be useful in determining restoration techniques:

(1) Surface Water/Groundwater Relationship - The lake is sitting on top of fresh groundwater that is underlined by salty groundwater.

(2) Radiation Logs - Provides information pertaining to geological substrate; material underlying the lake. This information will be used to determine the hydrologic budget.

(3) Hydrologic Budget - This will tell how much water comes into and goes out of the lake through outlets, evaporation and the ground.

(g) Human activity in the Watershed - Specifically the location of sewerlines with respect to major tributaries in lake proper. These sewer lines were constructed parallel to the tributaries. When the lines become old and porous they leak or infiltrate. Excess rain and ground water cause percolation back up into tributaries that flow into the lake.

(h) Gross Primary Production - Shows where in the lake most biological activity is occuring, the ratio of how much material is produced in the lake to how much material is consumed. When the ratio goes to one (1), production and consumption are equal. Ratio is one (1) at Northeast lake at two meters. This shows most of the activity is occuring in the top part of the lake. This is not unusual for Oklahoma lakes because of turbidity (non-clarity) but usually a healthy lake shows biological activity continuing down toward the bottom.

(i) Oxygen Expressed in Percent (%) Saturation - Shows how much oxygen that could be in the water is actually in the water. Only 20% oxygen was in the lake after the 2½" rainfall in July. A very healthy lake would have 100% oxygen. This indicates that there is significant contribution from street runoff into the lake which also has an oxygen demand.

The highest oxygen reading was found to be at the surface and contained only 2 mg/L oxygen. This is enough oxygen for carp to survive but not game fish, such as bass. Major storm events cause runoff from roads and fields in the watershed creating a tremendous oxygen demand and displaces most of the old water in the lake. This flushing process should actually improve this condition but instead it deteriates the lake even further.

(j) Nature of the Watershed - Shows percent land use in watershed. Watershed was dertermined by connecting contour peaks on a contour map and superimposing these on aerial photos of the region. These areas were planimetered (measured) for real estimates.

Work on this task discovered that a landfill and dump exist in the watershed. There is some positive aspect of the existing light industry and housing in the area in that it forms a seminatural buffer that reduces impact around the lake.

Water sampling will be completed in June. Final data can be obtained after this time.

QUESTIONS:

(1) Ms. Roberts: Is there an overflow or reserve area for the lake water?

Dr. Grimshaw: There is a spillway, but a sewerline problem exists causing contribution of nutrients and bacteria to go directly into streams and indirectly into the lake.

(2) Mr. Tease: How good are the springs?

Dr. Grimshaw: One exists at Spring Lake on the west side (across the street) of Northeast Lake and there is one located on the Zoo side. It would take a lot of spring water to make up for the incoming poor quality water.

(3) Mr. Robison: What are the agents responsible for ~~production~~ reduction of oxygen in the lake from the streets?

Dr. Grimshaw: Studies from other cities show runoff to contain organic compounds that consume oxygen. These organic compounds could be plant material and nutrient influx from the leaking sewerlines.

Sewerline breaks and runoff cause oxygen in the lake to be used up. Fish are killed and organisms the fish feed on are killed. The complexity of organisms in the lake are also decreased along with the aesthetic value of the lake. This process leaves less desirable units in the water. No game fish, such as bass, exist in the lake. Only fish such as bullhead catfish.

(4) Mr. Batchelder: What about the contribution of the roadways?

Dr. Grimshaw: There are two square miles of runoff that go directly into the lake. There are no storm drains in this area. This causes accelerated sedimentation by runoff from tributaries. An earthen bypass canal along the eastern side of the lake would be the most cost effective way to eliminate the impact of stormwater runoff. Holding ponds are not feasible.

What about traffic on the lake?

The Zoo steamboat runs but no public boats are allowed.

(5) Charlie Marshall discussed the idea raised at the last meeting of putting up "no fishing" signs. There have been two sources of data

collected. One shows elevated levels of chlordane taken two years ago. The second more recent study does not show a problem exists. City-County Health Department will resample for further analysis, hopefully with the help of OWRB and the State Health Department. At present, not enough information exists as to whether or not there is a chlordane problem in Northeast lake. The lake situation could have changed in the last two years.

(6) The possible selection of technical committee was expressed by Dr. Grimshaw to help him evaluate data for report back to the committee.

(7) Dr. Grimshaw presented three feasible restoration techniques:

(a) Zoo could tie into existing sewerline on west side to handle Zoo runoff. This would be cheap and take up minimal area.

Existing oxidation ponds could also be used to reduce the offensive smell and increase aesthetic value.

(b) Funds are said to be available for sewerline repair and renewal, above Northeast Lake.

With the old system there are alot of leaks and breaks in the existing lines. Other lines could be diverted away from the lake.

These two processes in themselves would significantly improve water quality.

(c) A bypass canal on the east side of the lake would divert storm flow from going directly into the lake. This would be inexpensive and take care of the lack of strom drains.

(8) Mr. Robison: Will this be just another document to collect dust? Who will get the finished report?

Dr. Grimshaw: This report goes to the Department of Pollution Control (DPC) then to the Environmental Protection Agency (EPA) in Dallas then to Washington.

(9) Ms. Sinclair reported that the Clean Water Act will be coming under revision in the next two months and that the fate of Section 314, the Clean Lakes Program, may also be decided. A group known as the North American Lake Management Society is committeed to an effective national program of lake management. If the program is reauthorized, there may be additional money available for Phase II projects. It is likely that Phase II's will not be funded by EPA, otherwise.

(10) How can citizens get involved? Are other agencies involved? Is Oklahoma City?

Grimshaw and Sinclair explained the design of the committee in representing the community. The committee will consist of four groups: private citizens, public interest group, economic interest group, and public officials. These people will take back ideas discussed at the meetings to their specific groups for feedback at future meetings.

(11) The committee must:

(a) Arrive at a solution(s) on what needs to be done.

(b) Develop some way to get it implemented. It will resolve what needs to be done and how, by finding the best strategy for funding, technical solutions etc., based on restoration options presented to them. It would make the final decisions on what would be proposed as solution(s) to the lake problems.

(12) Dr. Grimshaw - Possible options at this point:

(a) No action.

(b) Zoo waste clean-up/sewerline tie in.

(c) And by-pass canal.

(d) Dredging.

(e) Combination of all three methods.

(13) Mr. Batchelder asked if chlordane is no longer used.

Dr. Grimshaw stated it is a persistent, carcinogenic compound that is very complex by nature. Mr. Marshall remarked chlordane was banned by the Federal Government in 1980.

CONCLUSIONS:

(1) Mr. Batchelder mentioned that representation by new citizens present at the committee meeing indicated that there is local citizen interest in cleaning up the lake and making it once again a happy resource for the whole community.

Suggestions for committee members:

(a) Make citizens aware. Generate interest in the lake.

(b) Prepare to express concern. Make the community aware of the study by presenting a program to different community groups. One such group is the Lincoln Park County Association that consists of representatives from all recreational and educational institutions on the Northeast side of town.

(c) Work to find local and state support.

(2) Mr. Robison suggested going to City Council to find out what they are going to do about the sewerline problems.

(3) Mr. Tease said the Neighborhood Associations will play an important role. He wanted something to take back to his group. He asked if there were restrictions on lake use he should know about.

Dr. Grimshaw stated that at one time swimming was allowed but due to the continued deterioration the lake does not have its original uses.

(4) Mr. Batchelder: Should we have a consensus on the sewerline problem? Who needs to be notified of sewer problems? Could this issue get on a bond issue?

Mr. Robison suggested going to City Hall and contacting your congressman. Mr. Tease suggested getting signed petitions from home owners. person

(5) Technical Committee was formed:

Volunteers to work with Dr. Grimshaw:

John Robison
Fenton Rood
Charlie Marshall
Theople Roberts

It was suggested that Dr. Hulsey, National Wildlife Federation, be invited to serve on the committee.

(6) Mr. Preston suggested proposal of recommendations be held until a final decision can be made.

Dr. Grimshaw proposed the following:

(a) Committee will be presented with data. Final data can be obtained by the end of this summer, 1982.

(b) Option(s) and costs will be delinated by Dr. Grimshaw.

(c) Committee will decide on reasonably/feasible option(s) for restoration.

(d) Decide on how to go about performing the option(s) decided upon.

(7) Mr. Batchelder asked if the committee should say something about the sewerline problem at this time. Mr. Robison pointed out that if the sewerline is leaking into the lake the city should be approached. This is a neighborhood problem. A problem is believed to exist because of the high fecal coliform colonies, up to 10^6 colonies/100 ml.

(8) Mr. Metts with the Oklahoma City Water Resources Department said he is not sure if the problem has been brought to the attention of the people in this Department. He suggested a clear definition of the problem be stated. This information can then be taken before the City Water Department before going to City Hall. He would report this problem to the city.

(9) Mr. Marshall suggested the committee should organize its information before presenting it. The City Water Department will report back to committee.

(10) Mr. Tease wanted to know if we could contact our council person, Gory James. He should be aware of this type of problem. Mr. Batchelder asked Mr. Tease to call Mr. James and invite him to the next committee meeting.

(11) Mr. Batchelder indicated the next step is for the technical committee to meet and bring information to the general committee for consensus. The general committee should broaden its base of support.

(12) Dr. Grimshaw explained that preliminary data indicates the problems. Once sampling is finished, it will be documented for proof.

(13) Mr. Preston again made very strong suggestions that the committee should formulate a "package" of information before going to the city or coming out with separate problems a little at a time. If the city can be implicated, so can the Zoo.

(14) Mr. Robison: The city's responsibility is to repair broken sewerlines regardless of the Clean Lakes project. The Zoo has funding problems that the city doesn't have.

(15) The next meeting was set for June 8th, 1982, 7:30 p.m. at the Oklahoma Zoological Library.

(16) Nathaniel Batchelder was reinstated as permanent chairperson for the committee.

(17) Meeting was Adjourned.

ATTENDANCE RECORD

COMMITTEE MEETING

N.E. (ZOO) LAKE
CLEAN LAKES PROJECT

May 4, 1982

Agency in Charge: Oklahoma Water Resources Board
Project Leader-Ken Morris
Principal Investigator -Dr. Jim Grimshaw

Public Participation Coordinator-Lynda Sinclair

PRIVATE CITIZEN GROUP

PLEASE PRINT!

1 ✓ Letitia Rison	7 7701 Kentish #125 OKC, OK 73132
2 ✓ DAN O'BRIEN	8
3	9
4	10
5	11
6	12

PUBLIC INTEREST GROUP	ORGANIZATION
1 ✓ Leroy A. Tease	Carriendale N.A.
2 Lynn A. Leweccett	Levco Dredging
3 ~~Charlie Marshall~~	~~Okla City/Co Health~~
4 ✓ R. Fenton Rood	Sierra Club
5 ✓ John Robison	NEIGHBORHOOD DEVELOPMENT & CONSERVATION CENTER OKC
6 ✓ Pre Reed	ARBCO DREDGING INC. ARL. TX.
7 ✓ ~~Al Motts~~	~~OKC Water Resources Dept.~~
8 ✓ ~~DAN O'BRIEN~~ Theodore Roberts	~~Private~~ Northeast Park Estates

CONTINUED
ATTENDANCE RECORD

May 4, 1982

	ECONOMIC INTEREST GROUP	ORGANIZATION
1		
2		
3		
4		
5		
6		
7		

	PUBLIC OFFICIAL GROUP	AFFILIATION
1	Virgila Brown quit the Dept. 3624 N. Donna Bethany, OK 73008 work ph 521-2973	Planning Dept - (Planning & Development)
2	Kyle P. McKinley	OK Dept of Transportation
3	Charlie Marshall	OK City/County
4	Al Mutts	OCC Water Resources Dept.
5	Lynda Sinclair	Public Participation Coordinator, OCURB
6	Dr. Jim Grimshaw - Principal Investigator,	NE Lake OCURB
7		
8		
9		

COMMITTEE MEETING TOPICS
NORTHEAST (ZOO) LAKE
CLEAN LAKES PROJECT

May 4, 1982

Lynda Sinclair

Introduction

Nathaniel Batchelder, Chairperson

Review minutes of last meeting, handout
Propose selection of a secretary/minutes taker.

Dr. Jim Grimshaw, Principal Investigator

Summary of information collected to date.
Booklet - Tasks 1 through 9, Quarterly Progress Reports 1 through 4, and Interim Report #2.
Transparencies

Propose selection of a Technical Committee

Nathaniel Batchelder

Selection of new Chairperson

Lynda Sinclair

New information concerning further funding.

Adjournment

AGENDA
NORTHEAST (ZOO) LAKE
ADVISORY COMMITTEE

June 8, 1982

1. Introduction

2. Minutes

3. Discussion of Problems on Northeast Lake

    a) Zoo Runoff
    b) Sewer line infiltration and overflow into tributaries
    c) Golf course runoff
    d) Stormwater runoff from streets into tributaries
    e) Fish flesh residue

4. Question/Answer

5. Adjournment

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

July 19, 1982

Notices went out too late for Members to make meeting. YS

Ms. Letitia Reason
3201 N.W. 26th
Oklahoma City, Oklahoma 73107

Dear Ms. Reason:

A committee meeting for the Northeast Lake Clean Lakes Project is scheduled for July 20, 1982, at 7:30 p.m. at the Oklahoma Zoological Library, Second Floor, Kirkpatrick Center located on Eastern Avenue and 52nd Street, Oklahoma City, Oklahoma.

Enclosed is a copy of the summary of the meeting held June 8, 1982. All committee members are urged to attend, bringing ideas and questions from their interest group to this meeting. If you have any questions, please contact Lynda Sinclair of this office at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

Enclosure as stated

PROJECT OFFICIALS FOR NORTHEAST LAKE

1
Ms. Ann Hartley, Project Officer
U.S. Environmental Protection Agency
Clean Lakes Coordinator
Region VI
1201 Elm Street
Dallas, Texas 75250
Ms. Hartley

2
Mr. Ralph Campbell, Programs Director
Department of Pollution Control
State Clean Lakes Coordinator
P.O. Box 53504
Oklahoma City, Oklahoma 73152
Mr. Campbell

3
Dr. Main Hutcheson, Project Leader
Oklahoma Water Resources Board
Project Coordinator
P.O. Box 53585
Oklahoma City, Oklahoma 73152
Dr. Hutcheson

4
Jim Grimshaw, Ph.D.
Principal Investigator
Oklahoma Water Resources Board
P.O. Box 53585
Oklahoma City, Oklahoma 73152
Dr. Grimshaw

5
Mr. Don Schreiber and Ms. Lynda Sinclair
Project Limnologists
Oklahoma Water Resources Board
P.O. Box 53585
Oklahoma City, Oklahoma 73152
Mr. Schreiber and Ms. Sinclair

13
Ms. Lynda Sinclair
Public Participation Coordinator
Oklahoma Water Resources Board
P.O. Box 53585
Oklahoma City, Oklahoma 73152
Ms. Sinclair

NORTHEAST LAKE COMMITTEE - PRIVATE CITIZENS

1
Mr. Amos Verne Bollinger
P.O. Box 888
Choctaw, Oklahoma 73020
Mr. Bollinger

2
Mr. Jimmie Pigg
401 Rock Place
Moore, Oklahoma 73060
Mr. Pigg

3
Ms. Letitia Reason
3201 N.W. 26th
Oklahoma City, Oklahoma 73107
Ms. Reason

NORTHEAST LAKE COMMITTEE - PUBLIC INTEREST

11
Mr. Doug Brown
Carverdale Neighborhood Assoc.
1109 Carverdale Drive
Oklahoma City, Oklahoma 73111
Mr. Brown

7
Mr. Kirt Cunningham
Oklahoma Wildlife Federation
4545 Lincoln Blvd.
Suite 171
Oklahoma City, Oklahoma 73105
Mr. Cunningham

10
Dr. George Hulsey
Regional Director
National Wildlife Federation
502 South Crawford
Norman, Oklahoma 73069
Dr. Hulsey

8
Mr. Harold Jones
North Park Neighborhood Assoc.
Urban League of Oklahoma City
1824 Northeast 54th
Oklahoma City, Oklahoma 73111
Mr. Jones

9
Ms. Carla B. Paul
League of Women Voters
1116 Northeast 55th
Oklahoma City, Oklahoma 73111
Ms. Paul

4
George Reid
Regents Professor/Director
University of Oklahoma
Bureau of Water & Environmental
Resources Research
Norman, Oklahoma 73019
Professor Reid

2
Ms. Barbara Rice, President
League of Women Voters
of Oklahoma
307 Northwest 42nd Street
Oklahoma City, Oklahoma 73118
Ms. Rice

3
Bill Roach, Ph.D.
Water Utilities Training Center
Oscar Rose Junior College
6420 Southeast 15th Street
Midwest City, Oklahoma 73110
Dr. Roach

5
Ms. Theople Roberts
Northeast Park Estates
1724 Northeast 56th
Oklahoma City, Oklahoma 73111
Ms. Roberts

1
Mr. John Robison
Neighborhood Development and
Conservation Center
2927 North Paseo
Oklahoma City, Oklahoma 73103
Mr. Robison

6
Mr. Fenton Rood
Sierra Club
728 Northwest 21st
Oklahoma City, Oklahoma 73103
Mr. Rood

NORTHEAST LAKE COMMITTEE - ECONOMIC INTEREST

1
Mr. Todd E. Thompson
Chemical Resources, Inc.
First Life Assurance Building
119 North Robinson, Suite 909
Oklahoma City, Oklahoma 73102
Mr. Thompson

3
Oklahoma City Chamber of Commerce
One Santa Fe Plaza
Oklahoma City, Oklahoma 73102
Sir or Madam

4
Mr. Nathaniel H. Batchelder
Chairperson of Lake Committee
Oklahoma City Zoo
Public Information
2101 N.E. 50th
Oklahoma City, Oklahoma 73111
Mr. Batchelder

5
Mr. John Preston
Assistant Director of Educational Services
Oklahoma City Zoo
2101 N.E. 50th
Oklahoma City, Oklahoma 73111
Mr. Preston

2
Mr. Leo Cravens
Executive Vice-President
Oklahoma State Home Builders Assocation
800 Northeast 63rd Street
Oklahoma City, Oklahoma 73105
Mr. Cravens

NORTHEAST LAKE COMMITTEE - PUBLIC OFFICIALS

6
Mr. Earl Hearn
Oklahoma City Water Department
City of Oklahoma City
200 North Walker
Oklahoma City, Oklahoma 73102
Mr. Hearn

1
Mr. Edwin Kessler, Director
National Severe Storms Laboratory
National Oceanic and Atmospheric Adm.
Environmental Research Laboratories
1313 Halley Circle
Norman, Oklahoma 73069
Mr. Kessler

4
Mr. Charlie Marshall
Environmental Health Services
Oklahoma City-County Health Department
P.O. Box 53445
Oklahoma City, Oklahoma 73105
Mr. Marshall

8
Mr. Kyle McKinley
Oklahoma Department of Transportation
200 Northeast 21st
Oklahoma City, Oklahoma 73105
Mr. McKinley

3
Mr. J. Carl Miller
Oklahoma Department of Transportation
200 Northeast 21st
Oklahoma City, Oklahoma 73105
Mr. Miller

7
Ms. Sylvia Ritzky
Environmental Health Services
Oklahoma City-County Health Department
P.O. Box 53445
Oklahoma City, Oklahoma 73105
Mr. Ritzky

2
Mr. Jerry Stoner
U.S. Geological Survey, WRD
201 Northwest Third Street
Room 621
Oklahoma City, Oklahoma 73102
Mr. Stoner

5
Mr. Matthew Watkins
Town of Harrah
P.O. Box 636
Harrah, Oklahoma 73045
Mr. Watkins

1
Mr. Richard D. Bednar
Engineering Division
City of Oklahoma City
200 North Walker
Oklahoma City, Oklahoma 73102
Mr. Bednar

2
Mr. Paul Brum
Engineering Division
City of Oklahoma City
200 North Walker
Oklahoma City, Oklahoma 73102
Mr. Brum

September 27, 1982

Mr. Charlie Marshall
Environmental Health Services
Oklahoma City-County Health Department
P.O. Box 53445
Oklahoma City, Oklahoma 73105

Dear Mr. Marshall:

A Northeast Lake Technical Subcommittee meeting will be held on Thursday, October 7, 1982, at 7:00 p.m. in Room 1102, Oklahoma Water Resources Board, 1000 N.E. 10th Street, Oklahoma City.

If you have any questions regarding this meeting, please contact Lynda Sinclair of this office at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

September 27, 1982

Mr. John Robison
Neighborhood Development and
Conservation Center
2927 North Paseo
Oklahoma City, Oklahoma 73103

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Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

September 27, 1982

Ms. Theople Roberts
Northeast Park Estates
1724 Northeast 56th
Oklahoma City, Oklahoma 73111

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Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

September 27, 1982

Mr. Fenton Rood
Sierra Club
728 Northwest 21st
Oklahoma City, Oklahoma 73103

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Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

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September 27, 1982

Mr. Amos Verne Bollinger
P.O. Box 888
Choctaw, Oklahoma 73020

Dear Mr. Bollinger:

A committee meeting for the Northeast (Zoo) Lake Clean Lakes project will be held on October 21, 1982, at 7:00 p.m. in the Oklahoma Zoological Library, Kirkpatrick Center, Eastern & 52nd Street, Oklahoma City.

If you have any questions regarding this meeting, please contact Lynda Sinclair of this office at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

NORTHEAST LAKE COMMITTEE - PRIVATE CITIZENS

1
Mr. Amos Verne Bollinger
P.O. Box 888
Choctaw, Oklahoma 73020
Mr. Bollinger

2
Mr. Jimmie Pigg
401 Rock Place
Moore, Oklahoma 73060
Mr. Pigg

3
Ms. Letitia Reason
3201 N.W. 26th
Oklahoma City, Oklahoma 73107
Ms. Reason

NORTHEAST LAKE COMMITTEE - PUBLIC INTEREST

11
Mr. Doug Brown
Carverdale Neighborhood Assoc.
1109 Carverdale Drive
Oklahoma City, Oklahoma 73111
Mr. Brown

7
Mr. Kirt Cunningham
Oklahoma Wildlife Federation
4545 Lincoln Blvd.
Suite 171
Oklahoma City, Oklahoma 73105
Mr. Cunningham

10
Dr. George Hulsey
Regional Director
National Wildlife Federation
502 South Crawford
Norman, Oklahoma 73069
Dr. Hulsey

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Mr. Harold Jones
North Park Neighborhood Assoc.
Urban League of Oklahoma City
1824 Northeast 54th
Oklahoma City, Oklahoma 73111
Mr. Jones

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Ms. Carla B. Paul
League of Women Voters
1116 Northeast 55th
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Ms. Paul

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George Reid
Regents Professor/Director
University of Oklahoma
Bureau of Water & Environmental
Resources Research
Norman, Oklahoma 73019
Professor Reid

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Ms. Barbara Rice, President
League of Women Voters
of Oklahoma
307 Northwest 42nd Street
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Bill Roach, Ph.D.
Water Utilities Training Center
Oscar Rose Junior College
6420 Southeast 15th Street
Midwest City, Oklahoma 73110
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Ms. Theople Roberts
Northeast Park Estates
1724 Northeast 56th
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Mr. John Robison
Neighborhood Development and
Conservation Center
2927 North Paseo
Oklahoma City, Oklahoma 73103
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Mr. Fenton Rood
Sierra Club
728 Northwest 21st
Oklahoma City, Oklahoma 73103
Mr. Rood

NORTHEAST LAKE COMMITTEE - ECONOMIC INTEREST

5
Mr. Bob Reed
ARBCO Dredging, Inc.
P.O. Box 170263
Arlington, Texas 76003
Mr. Reed

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Mr. Lynn A. Leverett
LEVCO
Box 7572
Amarillo, Texas 79109
Mr. Leverett

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Oklahoma City Chamber of Commerce
One Santa Fe Plaza
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Executive Vice-President
Oklahoma State Home Builders Assocation
800 Northeast 63rd Street
Oklahoma City, Oklahoma 73105
Mr. Cravens

NORTHEAST LAKE COMMITTEE - PUBLIC OFFICIALS

6
Mr. Earl Hearn
Oklahoma City Water Department
City of Oklahoma City
200 North Walker
Oklahoma City, Oklahoma 73102
Mr. Hearn

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Mr. Edwin Kessler, Director
National Severe Storms Laboratory
National Oceanic and Atmospheric Adm.
Environmental Research Laboratories
1313 Halley Circle
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200 Northeast 21st
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201 Northwest Third Street
Room 621
Oklahoma City, Oklahoma 73102
Mr. Stoner

5
Mr. Matthew Watkins
Town of Harrah
P.O. Box 636
Harrah, Oklahoma 73045
Mr. Watkins

MINUTES OF NORTHEAST LAKE COMMITTEE MEETING

The Northeast Lake Committee meeting was held October 21, 1982. Those in attendance were as follows:

Jim Grimshaw	OWRB
Gary Shapiro	OWRB
Sylvia Ritzky	OCCHD
Nathaniel Batchelder	Oklahoma City Zoo
Theople Roberts	Park Estate N. Assoc.
Carla B. Paul	League of Women voters of Oklahoma County
Earl E. Hearn	Oklahoma City Water Resources Department

The Committee's recommendations for action to be taken are as follows:

(1) Contact Oklahoma City-County Health Department regarding the status of sewer lines and dumping problems in Northeast Lake watershed.

(2) Contact, by letter, organizations, such as chamber of commerces and museum associations, to pass resolutions as to whether they want the lake restored.

(3) The Zoo is interested in dredging the lake and is going to investigate the mechanisms to do so.

(4) After meeting with Mr. Curtis, a formal letter will be written to the Zoo specifying what needs to be done regarding Zoo effluent.

(5) Mr. Nathanul Batchelder will help contact area high schools and universities regarding their interest in participating in the lake study.

(6) Possibilities were discussed for a "call in" question and answer program on a Northeast side radio station.

(7) Mr. Batchelder will help contact Black Chronicle reporter, Mr. Freddie Williams, to publish a feature article discussing the Northeast Lake study.

The next Lake Advisory Committee meeting was tentatively set for November 23, 1982, at 7:00 p.m. in the Oklahoma Zoological Library of the Kirkpatrick Center.

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

November 18, 1982

Mr. Amos Verne Bollinger
P.O. Box 888
Choctaw, Oklahoma 73020

Dear Mr. Bollinger:

A committee meeting for the Northeast (Zoo) Lake Clean Lakes project will be held at 7:00 p.m. on November 23, 1982, at the Kirkpatrick Center Library, 2100 N.E. 52nd, Oklahoma City, Oklahoma.

If you have any questions regarding this meeting, please contact Lynda Sinclair of this office at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

NORTHEAST LAKE COMMITTEE - PRIVATE CITIZENS

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Mr. Matthew Watkins
Town of Harrah
P.O. Box 636
Harrah, Oklahoma 73045
Mr. Watkins

NORTHEAST LAKE
GENERAL COMMITTEE MEETING
SUMMARY

November 23, 1982

PRESENT:

Earl Hearn, Oklahoma City Water Resources Department
Lynn Weiner, Oklahoma City-County Health Department
Sylvia Ritzky, Oklahoma City-County Health Department
Nathaniel Batchelder, Public Information Curator, Oklahoma City Zoo
H. James Grimshaw, OWRB
Lynda Sinclair, OWRB
Gary Shapiro, OWRB

Discussions were held and comments were made at the meeting on each of the following topics:

LANDFILL/SEWER LINE INVESTIGATION:

Lynn Weiner, OCCHD, in response to the joint OWRB/OCCHD meeting of November 3, 1982, presented information concerning OCCHD's investigation of the illegal dumping activities within the Northeast Lake watershed. Additional dumping of approximately six automobile bodies has occurred since last summer. Non-Compliance letters from the City Attorney should be issued sometime in late November or early December. A thirty day clean up time was mentioned as a reasonable interval before more serious measures are taken.

Other actions may be taken to insure proper closure of the illegal dump site:

(1) the landfill may be listed as a public health hazard;

(2) coordinate zoning regulations to handle rubbish dumping; and

(3) if legal, have city maintenance close off dedicated access road.

The alternatives available to OCCHD, if there is no response to the letter, are to have the City Council declare the dump a nuisance and then take a disposition through District Court to find ordinances or State laws that may be used to help the situation.

LAKE RESTORATION RESOLUTION:

The Oklahoma City Zoo and OWRB are working on resolutions to gain support for the restoration of Northeast Lake. Mr. Nathaniel Batchelder has already written a short resolution for Mr. Curtis to be presented to the Zoological Trust.

MEETING WITH MR. CURTIS CONCERNING ZOO EFFLUENT:

A meeting was held on November 10, 1982, with Mr. L. Curtis, Zoo Director, to discuss the pollution coming from the Zoo into Northeast Lake. OWRB has proposed that funds be utilized to develop a plan and implement a mechanism for collecting Zoo effluent from the Zoo outfalls and transporting it to the old oxidation ponds at the north side sewage treatment plant. The outfall material would gravity flow from pond to pond and be given more time to oxidize before running into the creek below the lake.

OWRB has drafted a letter to EPA asking that funds for unapproved Tasks 9c, d, and e be transferred to the Feasibility portion (Task 12) of the Phase I work plan. This task may allow hook-up to the sewer treatment plant.

OWRB is awaiting response from EPA on this request. The Zoo is in favor of this action but would like formal communication from OWRB.

OTHER BUSINESS - IMPACT OF STORMWATER RUNOFF:

(1) Stormwater runoff is a major item that impacts the lake and should be addressed for proper restoration.

Street runoff goes directly into the tributaries and into Northeast Lake because of non-existent storm sewers in that part of town. This causes the lake to be anoxic, (without oxygen) except at the surface.

In order to achieve a high quality lake, a diversion canal has been proposed for the east (Lincoln Park) side of the lake. Storm flows could then be by-passed around the lake. A second design would allow inflows to be completely closed voluntarily to avoid situations such as oil pipeline breaks in the watershed.

The diversion canal will act as a three fold solution by solving the oxygen problem, acting as a safety valve for preventing adverse conditions in the watershed from entering the lake, and allowing sediment to by-pass from storm flows.

The committee was asked for help in obtaining information from sources knowledgeable about diversion canals, and the entity responsible for stormwater runoff in the city.

Mr. Paul Brum, Community Development, Engineering Section with Oklahoma City, was suggested as a person to contact.

(2) A final point of discussion centered around locating the agencies or groups responsible for the dam and spillway and thus, the future of Northeast Lake.

The committee suggested that letters asking advice on direction and recommendations for reconstruction of the spillway be directed to the following groups:

(a) Chairman, Board of County Commissioners, District 1;

(b) A. Robert Thomson, Administration, City Parks Department;

(c) Jean I. Everest, Oklahoma City Zoological Trust; and

(d) Goree James, Councilman.

The State Department of Transportion (DOT) will also be contacted for help in this matter.

(3) A Lake Clean-Up Day has been scheduled for Saturday morning, December 11, for Oklahoma City Boy Scouts to come and pick up the trash accumulated in the lake bottom. The Zoo is sending out a press release to area media contacts and it was suggested by the committee that representatives from the above mentioned organizations be invited to the clean-up day festivities.

SELECTION OF NEXT GENERAL COMMITTEE MEETING:

A meeting schedule has been set for future committee meetings. General Committee meetings will be held every third Thursday between 11:30 a.m. and 12:00 p.m. unless otherwise notified. The next meeting will be held on December 16, from 11:30 a.m. to 12:30 p.m. at the Kirkpatrick Center, Zoological Library.

Meeting was adjourned.

NORTHEAST LAKE
GENERAL COMMITTEE MEETING

Kirkpatrick Center
Oklahoma Zoological Library
Eastern and Northeast 52nd
2nd Floor, 7:00 p.m.
November 23, 1982

A G E N D A

I. Call Meeting to Order and Introduction

II. Status of Landfill/Sewerline Investigation by Oklahoma City-County Health Department

III. Progress on Contacting Organizations and Individuals Regarding Lake Restoration Resolution

IV. Report on Meeting with Zoo Director L. Curtis Concerning Zoo Effluent

V. Other Business

VI. Selection of Next General Committee Meeting

VII. Adjournment

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

DATE: December 8, 1982

TO: Mr. Goree James, Councilman
302 Municipal Building

FROM: Ron Jarman, Chief RH
Water Quality Division

SUBJECT: Northeast Lake

Since July, 1980, the Oklahoma Water Resources Board has been conducting a Clean Lakes Study on Northeast (Zoo) Lake located south of 50th Street, east of the Oklahoma City Zoo.

The Clean Lakes Program was established through PL 95-217 to identify, restore, and protect the quality of the nations publicly owned fresh water lakes. This study has involved detailed examination of the lake and its watershed, and the analysis of the economic and technical feasibility of restoration. Results of this study will be presented to EPA.

Due to heavy rains this July, the spillway was damaged and part of 50th Street east of the dam, was washed away. The road is closed to traffic and the lake was drained to inspect the damage and minimize potential safety problems. Oklahoma City determined the cost of reconstructing the spillway and needed dam improvements for safety purposes.

The Northeast Lake Clean Lakes Committee is soliciting advice, suggestions, and your recommendations regarding the proper officials to be contacted and protocol to be utilized in resolving the dam repair problem.

A Lake Clean-up Day is scheduled for Saturday morning, December 11, 1982, for policing trash in the lake bottom by Oklahoma City Area Boy Scouts. A lunch is also planned by the Zoo at the 45th Battalion Armory.

The Oklahoma City Zoo will be releasing information of the event to the area news media. The Northeast Lake Committee is extending an invitation to you to attend the clean-up day festivities.

c: Chairman, District 1
A. Robert Thomson, City Parks Director
Jean I. Everest, Oklahoma Zoological Trust

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

DATE: December 8, 1982

TO: Ms. Jean I. Everest
Oklahoma Zoological Trust

FROM: Ron Jarman, Chief
Water Quality Division

SUBJECT: Northeast Lake

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c: Chairman, District 1
A. Robert Thomson, City Parks Director
Goree James, Councilman

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

DATE: December 8, 1982

TO: Mr. A. Robert Thomson, City Parks Director
Administration
City Parks Department

FROM: Ron Jarman, Chief
Water Quality Division

SUBJECT: Northeast Lake

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Jean I. Everest, Oklahoma Zoological Trust
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OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

DATE: December 8, 1982

TO: Chairman, District 1
County Office Building

FROM: Ron Jarman, Chief
Water Quality Division

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c: A. Robert Thomson, City Parks Director
Jean I. Everest, Oklahoma Zoological Trust
Goree James, Councilman

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

December 7, 1982

Mr. Amos Verne Bollinger
P.O. Box 888
Choctaw, Oklahoma 73020

Dear Mr. Bollinger:

A committee meeting for the Northeast (Zoo) Lake Clean Lakes project will be held from 11:30 a.m. to 12:30 p.m. on December 16, 1982, in the Kirkpatrick Center Zoological Library, Oklahoma City, Oklahoma.

Future committee meetings will be held every third Thursday of the month from 11:30 a.m. to 12:30 p.m. If it becomes necessary to change a meeting date or time, committee members will be notified immediately.

If you have any questions regarding this meeting, please contact Lynda Sinclair of this office at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

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NORTHEAST ZOO LAKE
CLEAN LAKES COMMITTEE MEETING

KIRKPATRICK CENTER
OKLAHOMA ZOOLOGICAL LIBRARY
OKLAHOMA CITY ZOO

11:30 a.m. - 12:30 p.m.
December 16, 1982

AGENDA

I. Introduction

II. Present Summary of November 23rd Meeting

III. New Business
   Discussion of Sediment Analysis
   Other

IV. Questions/Comments

V. Affirmation of New Meeting Date
   Third Thursday of Every Month - 11:30 a.m. - 12:30 p.m.

VI. Adjournment

CLEAN LAKES
COMMITTEE MEETING

NE. Lake Dec. 14, 1982

ATTENDANCE RECORD

Agency in Charge: Oklahoma Water Resources Board

Principal Investigator-Dr. Jim Grimshaw
Public Participation Coordinator-Lynda Sinclair Lynda Sinclair

PRIVATE CITIZEN GROUP

1 _____ 7 _____

2 _____ 8 _____

3 _____ 9 _____

4 _____ 10 _____

_____ 11 _____

6 _____ 12 _____

PUBLIC INTEREST GROUP ORGANIZATION

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

_____

ATTENDANCE RECORD

ECONOMIC INTEREST GROUP	ORGANIZATION
1 [illegible signature]	Okla. St. HBA.
2 John Preston	OKC Zoo
3	
4	
5	
6	
7	

'BLIC OFFICIAL GROUP	AFFILIATION
1 Robert Lynch	Okla. City - Co. Health Dept
2 Earl C. Kean	Okla City Water Res Dept.
3 Sylvia [illegible]	OK. City - Co. Health Dept.
4 John R. Preston	OKC
5 Gary [illegible]	OWRB
6	
7	
8	
9	

SUMMARY

NORTHEAST ZOO LAKE
CLEAN LAKES COMMITTEE MEETING
December 16, 1982

Committee Members Present:

Leo Cravens, Oklahoma State Home Builders Association
Robert Lynch, OCCHD
Sylvia Ritzky, OCCHD
John Preston, Oklahoma City Zoo
Earl E. Hearn, Oklahoma City Water Resources Department
Gary Shapiro, OWRB
H. James Grimshaw, OWRB
Lynda Sinclair, OWRB

Introductions were made, and a summary of the last meeting (November 23, 1982) was presented. Topics of this meeting were reviewed by the committee.

Changes to the Previous Summary:

The December 11, 1982, Lake Clean Up Day was postponed because of weather. The Zoo is still planning to have the Boy Scouts clean up the lake bottom. A new date will be set.

There were no other comments on the summary.

New Business:

(1) Preliminary Sediment Analysis - OWRB has received sediment analysis which shows Chlordane to be elevated, however, additional testing is to be accomplished to confirm this.

(2) Additional Lake Restoration Funds

(a) The committee was informed that three million dollars is available from EPA for existing Clean Lakes programs throughout the Nation.

OWRB has submitted a grant proposal requesting $100,000 in Federal funds to be matched by the Oklahoma City Zoo and other associations involved in the project. Thus, a total of $200,000 is anticipated for the Phase II grant.

A large portion of the funds, including $14,500 from Task 9, will be directed toward study of the Zoo waste load into the lake and connecting the Zoo outfalls to an existing sewer line. The remainder of the funds will be directed toward the construction of a diversion canal.

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City of Oklahoma City
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Oklahoma City, Oklahoma 73102
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National Oceanic and Atmospheric Adm.
Environmental Research Laboratories
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NORTHEAST LAKE COMMITTEE - PUBLIC INTEREST - JOB R

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Mr. Robison

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Mr. Fenton Rood
Sierra Club
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Oklahoma City, Oklahoma 73103
Mr. Rood

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

April 28, 1982

Mr. Neal Balkan
2509 Dittmer
Oklahoma City, Oklahoma 73127

Dear Mr. Balkan:

The OWRB will be holding its second committee meeting to discuss the Clean Lakes Project for Northeast (Zoo) Lake. The meeting will be held Tuesday, May 4, 1982, at 7:30 p.m., in the Oklahoma Zoological Library, Second Floor, Kirkpatrick Center on Eastern and N.E. 52nd, Oklahoma City, Oklahoma.

The meeting will focus on the conditions of the Zoo Lake and what possible restoration methods are being considered. Dr. Jim Grimshaw, principal investigator for the project, will present his data to date and be on hand to answer questions.

The Clean Lakes Program is a partially federally funded program designed to perform a diagnostic study and recommend feasible restoration methods for publicly owned recreational lakes. A committee has been formed but all meetings are open and the public is encouraged to attend.

For more information contact Ken Morris at 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LS:sdh

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Mr. Balkan

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Bethany, Oklahoma 73008
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Okarche, Oklahoma 73762
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Ms. Deatherage

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Mr. Alan David Martinez
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Ms. Million

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Northeast Lake - Public Officials - Job H

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Mr. Albert A. Alberts, Chairman
Canadian County Commissioners
Canadian County Courthouse
El Reno, Oklahoma 73036
Mr. Alberts

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The Honorable Leon L. Liebscher
Canadian County Courthouse
El Reno, Oklahoma 73036
Sir

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The Honorable Eldon Lyon
Mayor
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Mayor Lyon

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Mayor Nolen

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Mr. Watts

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Mr. Paul Buntz
City Manager
City of Guthrie
Guthrie, Oklahoma 73044
Mr. Buntz

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The Honorable Marvin Almon
Mayor
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Mayor Almon

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Mr. Dave Farrington
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Mr. Farrington

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Mr. Vaughan

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Northeast Lake - Public Officials - Job H

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Nicoma Park, Oklahoma 73066
Mayor Fox

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The Honorable William S. Morgan
Mayor
City of Norman
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Mayor Morgan

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Ms. Tagge

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Councilman McCoy

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Ms. Binstock

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Ms. Jane Webster
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Mr. Jim Martin
President of the Board
City of Piedmont
P.O. Box 151
Piedmont, Oklahoma 73078
Mr. Martin

79
Mr. Bob Hulsey
Public Works Director
City of Piedmont
P.O. Box 144
Piedmont, Oklahoma 73078
Mr. Hulsey

80
Mr. Kenneth Beal
City Manager
City of Spencer
P.O. Box 266
Spencer, Oklahoma 73084
Mr. Beal

81
The Honorable Harry Moses
Mayor
City of Spencer
8714 Silver Creek
Spencer, Oklahoma 73084
Mayor Moses

83
Councilman John Rost
City of Warr Acres
P.O. Box 32304
Warr Acres, Oklahoma 73123
Councilman Rost

Northeast Lake - Public Officials - Job H

51
Mr. Emil Fox, County Commissioner
Cleveland County District 1
Cleveland County Courthouse
Norman, Oklahoma 73069
Mr. Fox

46
Mr. August Helmbright
Supervising Sanitarian
Cleveland County Health Department
641 East Robinson
Norman, Oklahoma 73069
Mr. Helmbright

14
Mr. Pierre Taron
COEDD
Sub-State Planning District No. 5
16 East Ninth Street
Shawnee, Oklahoma 74801
Mr. Taron

17
Mr. Gary Witt
Department of Economic and
Community Affairs
4545 N. Lincoln Blvd. - Suite 285
Oklahoma City, Oklahoma 73105
Mr. Witt

24
Mr. Bob Funston, Director
Department of Economic and
Community Affairs
4545 N. Lincoln Blvd. - Suite 285
Oklahoma City, Oklahoma 73105
Mr. Funston

87
Mr. Neil Garrison
Department of Parks and Recreation
Martin Park Nature Center
5500 West Memorial Road
Oklahoma City, Oklahoma 73142
Mr. Garrison

88
Mr. Doug Weeks
Department of Parks and Recreation
Martin Park Nature Center
5000 West Memorial Road
Oklahoma City, Oklahoma 73142
Mr. Weeks

8
James L. Tanner, Col., USAF
Deputy Base Commander
Department of the Air Force
Headquarters 2854th
Air Base Group (AFLC)
Tinker Air Force Base, Oklahoma 73145
Col. Tanner

85
Mr. R. Hunter Kemmet, Director
Economic Development Administration
805 Old Post Office Building
Oklahoma City, Oklahoma 73102
Mr. Kemmet

86
Ms. Laura Thomas
Housing and Urban Development
200 Northwest 5th Street
Oklahoma City, Oklahoma 73102
Ms. Thomas

18
Mr. Thomas H. Clapper
Research Associate
Legislative Council
Room 305, State Capitol
Oklahoma City, Oklahoma 73105
Mr. Clapper

71
The Honorable Earl Musgrave
Mayor, Town of Noble
Box 557
Noble, Oklahoma 73068
Mayor Musgrave

7
Mr. Russell E. Smith
Supervisory Mine Inspector
Mine Safety and Health
Administration
110 North Mercedes
Norman, Oklahoma 73069
Mr. Smith

3
Mr. Edwin Kessler, Director
National Severe Storms Laboratory
National Oceanic and Atmospheric Adm.
Environmental Research Laboratories
1313 Halley Circle
Norman, Oklahoma 73069
Mr. Kessler

Northeast Lake - Public Officials - Job H

38
Mr. Ed Pugh
Special Assistant
Office of the Governor
State Capitol Building
Oklahoma City, Oklahoma 73105
Mr. Pugh

49
Tommy B. White, Ph.D., Director
Environmental Health Services
Oklahoma City-County Health Department
P.O. Box 53445
Oklahoma City, Oklahoma 73105
Dr. White

89
Ms. Sylvia Ritzky
Environmental Health Services
Oklahoma City-County Health Department
P.O. Box 53445
Oklahoma City, Oklahoma 73105
Mr. Ritzky

10
Mr. John A. Hassell
Oklahoma Conservation Commission
Room 20, State Capitol Building
Oklahoma City, Oklahoma 73105
Mr. Hassell

23
Mr. Keith Vaughan
Oklahoma Conservation Commission
20 State Capitol Building
Oklahoma City, Oklahoma 73105
Mr. Vaughan

45
Mr. David Blackford
Oklahoma Conservation Commission
1008½ Northwest 45th
Oklahoma City, Oklahoma 73118
Mr. Blackford

13
Mr. Charles Bowlin
Oklahoma Corporation Commission
Jim Thorpe Building
Oklahoma City, Oklahoma 73105
Mr. Bowlin

Two alternatives for sewer line hook up were presented:

1. Connection of the zoo outfalls to existing city sewer lines if it is determined that the load could be handled by the lines.

2. Construction of a sewer line that would connect the zoo outfalls to the oxidation ponds at the northeast side sewage treatment plant.

(b) Dick Bednar, Community Development, Engineering Section with Oklahoma City, notified OWRB that reconstruction for the Northeast Lake dam is listed in their capitol improvement booklet. If the Phase II proposal grant should go through, it would upgrade the dams priority. Funds may then be made available for reconstruction.

(3) Aquaticus Project Location, John Preston - The original location was set to be in the northwest corner, south of 50th Street, of the Zoo. Recently, several architectural firms have been selected by a Zoo committee to study the Aquaticus project and location. Three other locations have been suggested: (a) south of the original location, (b) either on the west side or on the east side of the lake, and (c) the whole north side of the lake running east to west. Preliminary plans should be drawn by April, 1983, with possible ground breaking in the fall.

It is believed that the Zoo Trust may accept some responsibility of incorporating the lake restoration funding into the Aquaticus and lake exhibit plan.

(4) A final sediment analysis must be obtained. If the sediment does not contain any hazardous material, then the following alternatives are possible:

(a) Be offered to the Oklahoma City Parks Department under stipulation that it be hauled away within a specified time.

(b) Be declared by the Zoo Trust and Oklahoma City Council as surplus and allow it to be sold to competitive bidders, if the Parks Department cannot use the sediment for topsoil.

The general committee meetings will continue to be held on the third Thursday of every month. The next meeting will be held January 20, 1983, at 11:30 a.m. to 12:30 p.m. in the conference room. The conference room is located in the back of the Omniplex with the Zoo staff offices.

188
Mr. Amos Verne Bollinger
P.O. Box 888
Choctaw, Oklahoma 73020
Mr. Bollinger

189
Mr. Jimmie Pigg
401 Rock Place
Moore, Oklahoma 73060
Mr. Pigg

190
Ms. Letitia Reason
3201 N.W. 26th
Oklahoma City, Oklahoma 73107
Ms. Reason

NORTHEAST LAKE COMMITTEE - PUBLIC INTEREST

200
Mr. Doug Brown
Carverdale Neighborhood Assoc.
1109 Carverdale Drive
Oklahoma City, Oklahoma 73111
Mr. Brown

192
Ms. Barbara Rice, President
League of Women Voters
of Oklahoma
307 Northwest 42nd Street
Oklahoma City, Oklahoma 73118
Ms. Rice

198
Ms. Carla B. Paul
League of Women Voters
1116 Northeast 55th
Oklahoma City, Oklahoma 73111
Ms. Paul

199
Dr. George Hulsey
Regional Director
National Wildlife Federation
502 South Crawford
Norman, Oklahoma 73069
Dr. Hulsey

191
Mr. John Robison
Neighborhood Development and
Conservation Center
2927 North Paseo
Oklahoma City, Oklahoma 73103
Mr. Robison

195
Ms. Theople Roberts
Northeast Park Estates
1724 Northeast 56th
Oklahoma City, Oklahoma 73111
Ms. Roberts

197
Mr. Kirt Cunningham
Oklahoma Wildlife Federation
4545 Lincoln Blvd.
Suite 171
Oklahoma City, Oklahoma 73105
Mr. Cunningham

193
Bill Roach, Ph.D.
Water Utilities Training Center
Oscar Rose Junior College
6420 Southeast 15th Street
Midwest City, Oklahoma 73110
Dr. Roach

196
Mr. Fenton Rood
Sierra Club
728 Northwest 21st
Oklahoma City, Oklahoma 73103
Mr. Rood

194
George Reid
Regents Professor/Director
University of Oklahoma
Bureau of Water & Environmental
Resources Research
Norman, Oklahoma 73019
Professor Reid

204
Mr. Bob Reed
ARBCO Dredging, Inc.
P.O. Box 170263
Arlington, Texas 76003
Mr. Reed

205
Mr. Lynn A. Leverett
LEVCO
Box 7572
Amarillo, Texas 79109
Mr. Leverett

103
Mr. Dan Hogan
Oklahoma City Chamber of Commerce
One Santa Fe Plaza
Oklahoma City, Oklahoma 73102
Mr. Hogan

202
Mr. Nathaniel H. Batchelder
Chairperson of Lake Committee
Oklahoma City Zoo
Public Information
2101 N.E. 50th
Oklahoma City, Oklahoma 73111
Mr. Batchelder

203
Mr. John Preston
Assistant Director of Educational Services
Oklahoma City Zoo
2101 N.E. 50th
Oklahoma City, Oklahoma 73111
Mr. Preston

201
Mr. Leo Cravens
Executive Vice-President
Oklahoma State Home Builders Assocation
800 Northeast 63rd Street
Oklahoma City, Oklahoma 73105
Mr. Cravens

NORTHEAST LAKE COMMITTEE - PUBLIC OFFICIALS

211
Mr. Earl Hearn
Oklahoma City Water Department
City of Oklahoma City
200 North Walker
Oklahoma City, Oklahoma 73102
Mr. Hearn

206
Mr. Edwin Kessler, Director
National Severe Storms Laboratory
National Oceanic and Atmospheric Adm.
Environmental Research Laboratories
1313 Halley Circle
Norman, Oklahoma 73069
Mr. Kessler

209
Mr. Charlie Marshall
Environmental Health Services
Oklahoma City-County Health Department
P.O. Box 53445
Oklahoma City, Oklahoma 73105
Mr. Marshall

212
Ms. Sylvia Ritzky
Environmental Health Services
Oklahoma City-County Health Department
P.O. Box 53445
Oklahoma City, Oklahoma 73105
Mr. Ritzky

208
Mr. J. Carl Miller
Oklahoma Department of Transportation
200 Northeast 21st
Oklahoma City, Oklahoma 73105
Mr. Miller

213
Mr. Kyle McKinley
Oklahoma Department of Transportation
200 Northeast 21st
Oklahoma City, Oklahoma 73105
Mr. McKinley

210
Mr. Matthew Watkins
Town of Harrah
P.O. Box 636
Harrah, Oklahoma 73045
Mr. Watkins

207
Mr. Jerry Stoner
U.S. Geological Survey, WRD
201 Northwest Third Street
Room 621
Oklahoma City, Oklahoma 73102
Mr. Stoner

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

January 11, 1983

Mr. J. Carl Miller
Oklahoma Department of Transportation
200 Northeast 21st
Oklahoma City, Oklahoma 73105

Dear Mr. Miller:

A committee meeting for the Northeast (Zoo) Lake Clean Lakes project will be held from 11:30 a.m. to 12:30 p.m. on January 20, 1983, in the Kirkpatrick Center Conference Room, Oklahoma City, Oklahoma, which is at the southeast corner of Kirkpatrick Center, basement offices.

If you have any questions regarding this meeting, please contact Lynda Sinclair of this office at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

NORTHEAST LAKE COMMITTEE - PRIVATE CITIZENS

1
Mr. Amos Verne Bollinger
P.O. Box 888
Choctaw, Oklahoma 73020
Mr. Bollinger

2
Mr. Jimmie Pigg
401 Rock Place
Moore, Oklahoma 73060
Mr. Pigg

3
Ms. Letitia Reason
3201 N.W. 26th
Oklahoma City, Oklahoma 73107
Ms. Reason

NORTHEAST LAKE COMMITTEE - PUBLIC INTEREST

10
Mr. Doug Brown
Carverdale Neighborhood Assoc.
1109 Carverdale Drive
Oklahoma City, Oklahoma 73111
Mr. Brown

7
Mr. Kirt Cunningham
Oklahoma Wildlife Federation
4545 Lincoln Blvd.
Suite 171
Oklahoma City, Oklahoma 73105
Mr. Cunningham

9
Dr. George Hulsey
Regional Director
National Wildlife Federation
502 South Crawford
Norman, Oklahoma 73069
Dr. Hulsey

8
Ms. Carla B. Paul
League of Women Voters
1116 Northeast 55th
Oklahoma City, Oklahoma 73111
Ms. Paul

4
George Reid
Regents Professor/Director
University of Oklahoma
Bureau of Water & Environmental
Resources Research
Norman, Oklahoma 73019
Professor Reid

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Ms. Barbara Rice, President
League of Women Voters
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307 Northwest 42nd Street
Oklahoma City, Oklahoma 73118
Ms. Rice

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Bill Roach, Ph.D.
Water Utilities Training Center
Oscar Rose Junior College
6420 Southeast 15th Street
Midwest City, Oklahoma 73110
Dr. Roach

5
Ms. Theople Roberts
Northeast Park Estates
1724 Northeast 56th
Oklahoma City, Oklahoma 73111
Ms. Roberts

1
Mr. John Robison
Neighborhood Development and
Conservation Center
2927 North Paseo
Oklahoma City, Oklahoma 73103
Mr. Robison

6
Mr. Fenton Rood
Sierra Club
728 Northwest 21st
Oklahoma City, Oklahoma 73103
Mr. Rood

NORTHEAST LAKE COMMITTEE - ECONOMIC INTEREST

5
Mr. Bob Reed
ARBCO Dredging, Inc.
P.O. Box 170263
Arlington, Texas 76003
Mr. Reed

6
Mr. Lynn A. Leverett
LEVCO
Box 7572
Amarillo, Texas 79109
Mr. Leverett

2
Oklahoma City Chamber of Commerce
One Santa Fe Plaza
Oklahoma City, Oklahoma 73102
Sir or Madam

3
Mr. Nathaniel H. Batchelder
Chairperson of Lake Committee
Oklahoma City Zoo
Public Information
2101 N.E. 50th
Oklahoma City, Oklahoma 73111
Mr. Batchelder

4
Mr. John Preston
Assistant Director of Educational Services
Oklahoma City Zoo
2101 N.E. 50th
Oklahoma City, Oklahoma 73111
Mr. Preston

1
Mr. Leo Cravens
Executive Vice-President
Oklahoma State Home Builders Assocation
800 Northeast 63rd Street
Oklahoma City, Oklahoma 73105
Mr. Cravens

6
Mr. Earl Hearn
Oklahoma City Water Department
City of Oklahoma City
200 North Walker
Oklahoma City, Oklahoma 73102
Mr. Hearn

1
Mr. Edwin Kessler, Director
National Severe Storms Laboratory
National Oceanic and Atmospheric Adm.
Environmental Research Laboratories
1313 Halley Circle
Norman, Oklahoma 73069
Mr. Kessler

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Mr. Charlie Marshall
Environmental Health Services
Oklahoma City-County Health Department
P.O. Box 53445
Oklahoma City, Oklahoma 73105
Mr. Marshall

8
Mr. Kyle McKinley
Oklahoma Department of Transportation
200 Northeast 21st
Oklahoma City, Oklahoma 73105
Mr. McKinley

3
Mr. J. Carl Miller
Oklahoma Department of Transportation
200 Northeast 21st
Oklahoma City, Oklahoma 73105
Mr. Miller

7
Ms. Sylvia Ritzky
Environmental Health Services
Oklahoma City-County Health Department
P.O. Box 53445
Oklahoma City, Oklahoma 73105
Mr. Ritzky

2
Mr. Jerry Stoner
U.S. Geological Survey, WRD
201 Northwest Third Street
Room 621
Oklahoma City, Oklahoma 73102
Mr. Stoner

5
Mr. Matthew Watkins
Town of Harrah
P.O. Box 636
Harrah, Oklahoma 73045
Mr. Watkins

Clean Lakes Project
Northeast ZOO Lake Committee Meeting

January 20, 1983
11:30 am - 12:30 pm

OKC Zoo Conference Room
N.E. 50th & Eastern

AGENDA

I. Introduction

II. Old Business

III. New Business

Summary of Analysis of Limnological Studies

IV. Additional Discussion

VI. Selection of Next Meeting Date
Adjournment

NORTHEAST (ZOO) LAKE
CLEAN LAKES COMMITTEE MEETING
SUMMARY

January 20, 1983
Oklahoma City Zoo Conference Room

Committee Members Present

Donita Moore, OCCHD
Mohammad Alam, OCCHD
Theople Roberts, Northeast Park Estates Neighborhood Association
John R. Preston, OKC Zoo
Gary Shapiro, OWRB
Lynda Sinclair, OWRB

A summary of limnological studies relaying information on the hydrologic budget, coliform bacteria, sedimentation, and nutrient loading to the lake was given by Gary Shapiro.

(1) Hydrologic Budget:

A graph depicting water volume from stormwater runoff for the entire year of 1981 showed a significant amount of the water volume of the lake (95%) is supplied by stormwater runoff during the summer months of June through August.

(2) Fecal Coliform Bacteria:

According to OWRB 1979 Standards, the geometric mean for colonies/100 mls of fecal coliform exceed primary and secondary body contact recreation standards. Sample sites 8 and 11 showed the highest concentrations as the result of animal pin runoff (site 8) and sewerline failure at the illegal dump (site 11). It is believed that if these problem areas are corrected, the high coliform bacteria levels would no longer be a problem.

(3) Sedimentation of the Lake:

Core samples of the lake bed have been taken and are being analyzed by the USDA-ARS laboratory in Durant. The Cesium 137 dating method will be used to determine sedimentation rates.

(4) Nutrient Loadings:

Rank sums of total nitrogen and phosphate were analyzed to determine significant differences between sites. Tables comparing sites revealed the following for total nitrogen and total phosphate:

(a) Total Nitrogen - Site 11 showed a significantly high total nitrogen level when compared to sites 4 and 9.

(b) Total Phosphate - Sites 8, 11, and 12 (tributary by the golf course) showed significant levels of phosphorus believed to be due to runoff from street and golf course. These levels are high compared to site 4.

Physico-Chemical characteristics of phosphorus for pre and post diversion was determined. Calculations showed that a four fold reduction in the annual total phosphorus loading could be achieved by diverting only half the amount of discharge that now enters the lake. In terms of percent reduction over the summer months of May, June, July, and August, phosphorus loading would be reduced by 76%. An 89% reduction in phosphorus loading was determined by including September and October in the diversion plan.

A stormwater diversion canal will be examined as a possible solution for reducing nutrient loading to the lake. The reduction of nutrient loading may also possibly reduce algae blooms.

Comments

The committee recommended identification of options for creating a stable ecological system in the lake. These options should include decreasing pollution sources of turbidity and algae.

A recommendation has been made that the Clean Lakes Committee meet with the planners of Aquaticus to relay data concerning water chemistry of the lake, so that this purpose can be achieved.

Updates

Landfill:

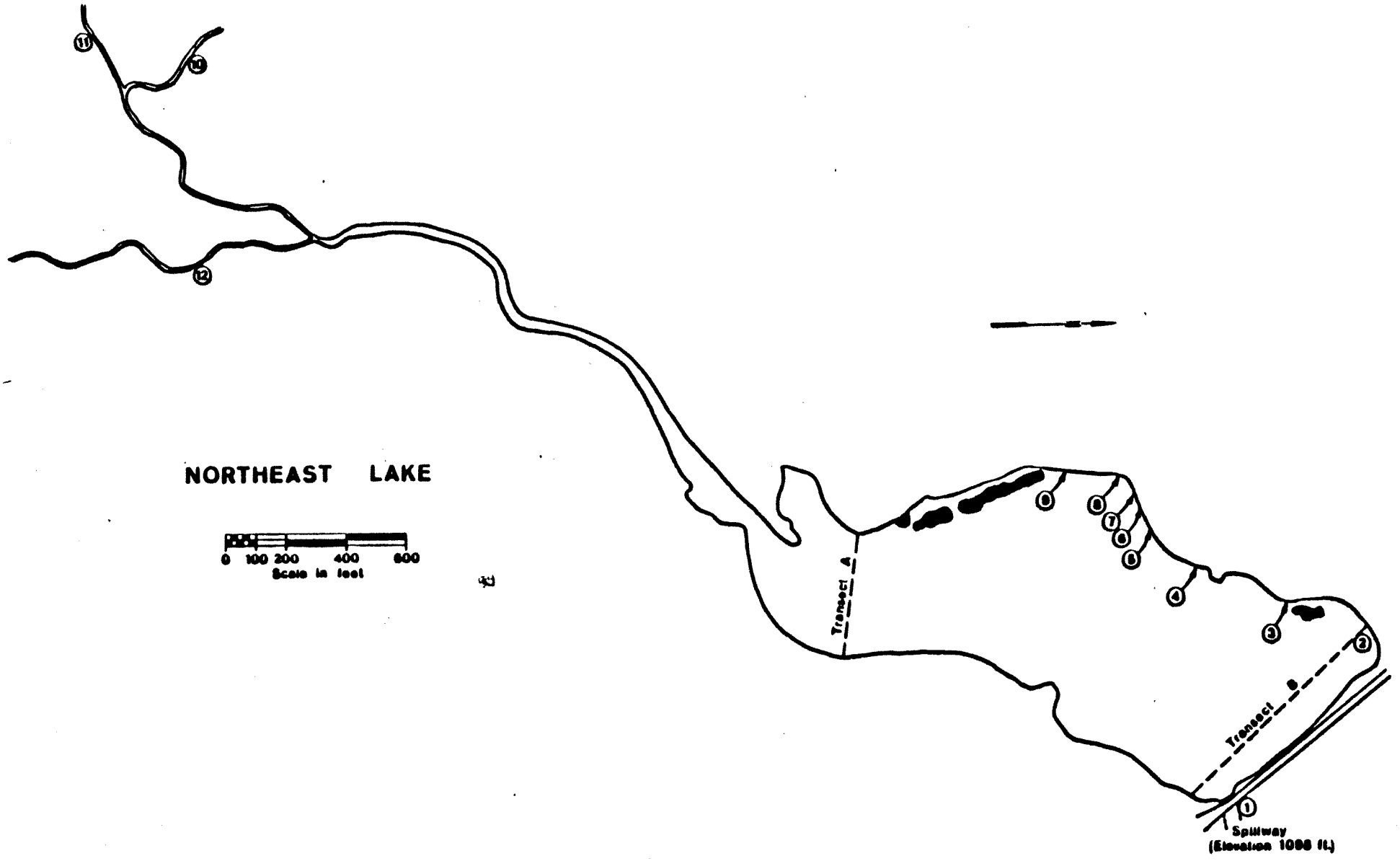
Oklahoma City-County Health Department (OCCHD) received a letter from Mr. Potts, a co-landowner of the landfill, stating that he would start clean-up procedures Monday, January 17, 1983. OCCHD will verify if clean-up of the landfill has been accomplished. A recommendation will be made to the city to reclaim an open street at one end of the landfill, causing public inaccessibility, decreasing incidents of illegal dumping.

Zoo Clean-Up Day

The Explorer Clean-up Day is scheduled for February 26, 1983, beginning Saturday morning. Explorers will clean-up around the dam and lake bottom.

Next Meeting

The next meeting is scheduled for February 17, 1983, from 11:30 a.m. to 12:30 p.m., Oklahoma City Zoo Conference Room, located in the Zoo Offices behind the omniplex.


NORTHEAST LAKE
0 100 200 400 600
Scale in feet
Transect A
Transect B
Spillway
(Elevation 1098 ft.)

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

February 16, 1983

The Honorable Bernest Cain
The State Senate
State Capitol Building
Oklahoma City, Oklahoma 73105

Dear Senator Cain:

A committee meeting for the Northeast (Zoo) Lake Clean Lakes project will be held from 11:30 a.m. to 12:30 p.m. on February 17, 1983, in the Oklahoma City Zoo Conference Room, Oklahoma City, Oklahoma, located behind the Kirkpatrick Center.

If you have any questions regarding this meeting, please contact Lynda Sinclair of this office at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

NORTHEAST (ZOO) LAKE
CLEAN LAKES
COMMITTEE MEETING
February 17, 1983

OKC Zoo Conference Rm.

ATTENDANCE RECORD

Agency in Charge: Oklahoma Water Resources Board

Principal Investigator-Dr. Jim Grimshaw
Public Participation Coordinator-Laura Cook Laura Cook

PRIVATE CITIZEN GROUP

1 _____ 7 _____

2 _____ 8 _____

3 _____ 9 _____

4 _____ 10 _____

_____ 11 _____

6 _____ 12 _____

PUBLIC INTEREST GROUP	ORGANIZATION
1 Jon Tilson, Research Dept.	OKC ZOO
2 Mary Rogge Education Curator	OKC Zoo
3 Carla S Paul	LWV OK. Co.
4	
5	
6	

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

February 3, 1983

Mr. Dan Hogan
Oklahoma City Chamber of Commerce
One Santa Fe Plaza
Oklahoma City, Oklahoma 73102

Dear Mr. Hogan:

A committee meeting for the Northeast (Zoo) Lake Clean Lakes project will be held from 11:30 a.m. to 12:30 p.m. on February 17, 1983, in the Oklahoma City Zoo Conference Room, Oklahoma City, Oklahoma, located behind the Kirkpatrick Center.

If you have any questions regarding this meeting, please contact Lynda Sinclair of this office at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LSS:sdh

Agenda
North East Lake
Committee Meeting
Oklahoma City Zoo Conference Room
February 17, 1983 11:30-12:30pm

1. Introduction
    1. New Public Participation Coordinator - Laura Cook
2. Present Summary of ~~December 16th~~ Jan. 20 meeting
3. Involvement of Phase II Application
    1. Sewerline and Diversion Canal
    2. Possible monies available from Washington EPA
    3. Discussion
4. Adjournment

Next meeting: March 17, 1983 11:30am to 12:30pm

NORTHEAST LAKE
February 17, 1983
MEETING SUMMARY

Committee Members Present:

Sylvia Ritzky, OCCHD
Ron Tilson, Oklahoma City Zoo
Marcy Rogge, Oklahoma City Zoo
Carla Paul, League of Women Voters Oklahoma County
Laura Cook, OWRB
Lynda Sinclair, OWRB
H. James Grimshaw, OWRB
Gary Shapiro, OWRB

Introductions were made of Laura Cook, OWRB new Public Participation Coordinator, and other committee members. A summary of the last meeting (January 20, 1983) was presented and reviewed by the committee.

Dr. Jim Grimshaw, Principle Investigator, presented slides showing progress of the lake study. The following items were then discussed:

(1) Ms. Sylvia Ritzky of OCCHD informed the committee that Mr. Potts, (owner of the land containing the illegal landfill), has taken measures to restrict entry onto his land. He is also in the process of cleaning the area.

(2) Dr. Grimshaw explained that the diversion canal has an estimated cost of $500,000, and the need to find matching funds for a Phase II study (EPA Grant). Dr. Ron Tilson of the Oklahoma City Zoo stated that the Zoo may be interested in matching the funds. He will discuss the matter with Mr. Lawrence Curtis and will report back to Dr. Grimshaw about this and the repair of the dam.

(3) Measures have been taken to connect the Zoo sewer lines to the city system. It was stated that during summer low flow, tying in the Zoo lines will greatly reduce the algal problem.

(4) Dr. Tilson told of the Zoo's preliminary plans to incorporate Northeast Lake and Lincoln Park into Zoo grounds. The Zoo will be working with the State Department of Wildlife and the Department of Parks and Recreation on the idea. The Zoo's thoughts are to turn the public park into a family oriented site and wilderness area. Also, they are thinking of incorporating the lake to be a winter bird sanctuary habitat, so the proposed diversion canal would be very necessary.

(5) Ideas were discussed on measures to increase awareness and the area public in involvement in the alternatives being formulated. Ms. Cook will be contacting the Urban League about sending out information to all the area groups and organizations. Also, the Black Ministers Association will be contacted to aid in this process. Lastly, Ms. Carla Paul will be talking to Mr. Noel at Millwood School to acquire support.

(6) Ms. Cook will talk to Mr. Curtis about ideas to gain political support for lake clean up activities.

The next general committee meeting will be March 17, 1983, at 11:30 a.m. to 12:30 p.m. in the conference room. The conference room is located in the back of the Omniplex with the Zoo staff offices.

March 1983

Announcement to be made during monthly NENA meeting-------

Since one of the goals of NENA is to inform neighborhood representatives on pertinent issues affecting neighborhood residents in the N.E. Quadrant, the following announcement is important. A lake study of Norheast Zoo Lake has been conducted by the Okla. Water Resources Board through a grant provided by EPA. Pollution problems have been identified and restoration methods are being formulated for the lake and surrounding area. Improving the lake would provide a quality place for area residents and their families to visit and enjoy.

The Northeast Lake Committee needs public interest and input to insure that what is accomplished is what the people want. There are two upcoming meetings: one March 17th from 11:30am to 12:30pm at the Okla. City Zoo Conference Room, located behind the Kirkpatrick Center; the other meeting will be March 31st at 7:00pm at the Okla. Dept. of Wildlife Conservation, 1801 Lincoln Blvd.

We encourage all groups to have a representative present and more there if possible.

To be released in NENA newsletter
March 1983

The Northeast Zoo Lake area is currently being considered for restoration under a National Clean Lakes study and recommendations are being formed. Since you live in the vicinity, your families recreational lives will be affected by the decisions that will be made. In order to get public input, your presence and participation at upcoming meetings would be greatly appreciated. The next meeting will be held March 17th from 11:30am to 12:30pm at the Okla. City Zoo Conference Room, located behind the Kirkpatrick Center. If you are unable to attend, there will also be a public meeting March 31st at 7:00pm at the Okla. Dept. of Wildlife Conservation, 1801 Lincoln Blvd.

Although currently drained due to damage of the dam in June, the lake has experienced serious pollution problems for years. Conducting the study under an Environmental Protection Agency grant, Oklahoma Water Resources Board's Principal Investigator Jim Grimshaw identified three major problems with the lake.

A continuing source of contamination comes from sediment and oxygen-demanding materials swept off the surface of surrounding urban areas by rain. Another source of pollutants was traced to sewer line breakage at a dump site three miles away from the lake. Large trucks and other heavy vehicles have damaged sewer lines allowing raw sewage to flow down the tributaries and into the lake.

The Zoo itself has added to the problem through a drainage system that carries animal wastes from enclosures directly into the lake. The Zoo sewer lines have been repaired and action has been taken to close the dump, but for the lake to have the high quality water it had many years ago, all three problems must be corrected.

If you wish to see the area improved in quality, aesthetics, and recreation, help out by voicing your interest at the upcoming lake meetings. For more information on the meetings, contact Laura Cook at 271-2541.

Committee Meeting

Northeast (Zoo) Lake
Fegruary 17, 1983

ATTENDANCE RECORD

ECONOMIC INTEREST GROUP	ORGANIZATION
1	
2	
3	
4	
5	
6	
7	

PUBLIC OFFICIAL GROUP	AFFILIATION
1 Sylvia Ritzky	OCCND
2 Lynda Sinclair	OWRB
3	
4	
5	
6	
7	
8	

Oklahoma Department of Pollution Control
Box 53504 • N.E. 10th & Stonewall • Oklahoma City, Oklahoma 73152 • (405) 271-4677

February 28, 1983

Lawrence R. Edmison, J.D.
Director

Amelia Saul
Executive Assistant

MEMORANDUM

TO: Ron Jarman, Chief
Water Quality Division
OWRB

FROM: David B. Harkness
Programs Director

SUBJECT: Northeast Lake's Clean Lakes Project Public Meeting

At the request of your staff, the Department of Pollution Control has reserved the Wildlife Department's Auditorium for a Public Meeting on the Northeast Lakes' Clean Lakes Project on March 31, 1983, from 7:00 to 9:00 p.m. In addition, I contacted Mr. Ric Gomez of the Wildlife Department and he stated that he would arrange for one of his people to unlock and lock the doors of the building that night.

DBH:wkc

cc: Laura Cook, OWRB

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

March 21, 1983

Ms. Carla B. Paul
League of Women Voters
1116 Northeast 55th
Oklahoma City, Oklahoma 73111

Dear Ms. Paul:

The results of a three year water quality study conducted by the Oklahoma Water Resources Board on Northeast Lake in Oklahoma City, will be the topic of discussion at a Public Meeting on March 31, 1983, starting at 7:00 p.m. It will be held in the first floor auditorium of the Department of Wildlife Conservation's building at 1801 Lincoln Boulevard in Oklahoma City, Oklahoma. The OWRB will present findings of the study and proposed solutions to problems identified during the study. Also, possibilities for an Implementation Grant will be explained.

The public will have an opportunity to make formal statements, either orally or written. More information on the meeting can be obtained by contacting Laura Cook at (405) 271-2541.

Sincerely,

Ron Jarman, Chief
Water Quality Division

RLJ:LC:ft

372
ACOG Representative
112 West Monroe
P.O. Box 561
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Northeast Lake - Complete

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Northeast Lake - Complete

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Ms. Bertha Williams
President
Wright Patrons for Youth
7201 N. Air Depot
Oklahoma City, Oklahoma 73111
Ms. Williams

462
The Honorable Freddye H. Williams
The House of Representatives
State Capitol Building
Oklahoma City, Oklahoma 73105
Mr. Williams

487
Ms. Lucille Williams, President
North Creston Hills
2623 Normandy Drive
Oklahoma City, Oklahoma 73111
Ms. Williams

483
Ms. Maudie Williams
Chairperson
Neighborhood Council #4
714 N.E. 4th
Oklahoma City, Oklahoma 73104
Ms. Williams

Northeast Lake - Complete

350
Mr. Ted A. Williamson
C. H. Guernsey & Company
National Foundation West Building
Northwest 58th and Portland
Oklahoma City, Oklahoma 73112
Mr. Williamson

277
Ms. Britt Wisniewski
Norman Chapter
League of Women Voters
1007 Lincoln Green Street
Norman, Oklahoma 73069
Ms. Wisniewski

370
Mr. Gary Witt
Department of Economic and
Community Affairs
4545 N. Lincoln Blvd. - Suite 285
Oklahoma City, Oklahoma 73105
Mr. Witt

336
Mr. M. A. Witte
Oklahoma Testing Laboratories
P.O. Drawer 60268
Oklahoma City, Oklahoma 73146
Mr. Witte

270
Ms. Cherly Woods
1908 Northwest 41st Street
Oklahoma City, Oklahoma 73118
Ms. Woods

297
Ms. Shirley Wright
Capital Northeast Neighborhood
Association
2608 North Kate
Oklahoma City, Oklahoma 73111
Ms. Wright

344
Mr. R. G. Wynne
Western Electric Company
7725 West Reno Avenue
Oklahoma City, Oklahoma 73125
Mr. Wynne

PUBLIC MEETING

NORTHEAST (ZOO) LAKE
CLEAN LAKES PROJECT

March 31, 1983, 7:00 p.m.
Department of Wildlife Auditorium
1801 Lincoln Boulevard
Oklahoma City, Oklahoma

A G E N D A

I INTRODUCTION AND PROJECT HISTORY - Laura Cook (OWRB)

II PROJECT OVERVIEW - Dr. Jim Grimshaw (OWRB)

III RESTORATION METHODS - Dr. Jim Grimshaw

IV FORMAL STATEMENTS - (five minute limit per statement)

V ADJOURNMENT

Oklahoma Department of Pollution Control

Box 53504 • N.E. 10th & Stonewall • Oklahoma City, Oklahoma 73152 • (405) 271-4677

Lawrence R. Edmison, J.D.
Director

Ralph D. Campbell
Programs Director

November 26, 1980

For further information
contact: Amelia Saul

FOR IMMEDIATE RELEASE

A trip to Oklahoma City's Zoo including a visit to the monkey island in Northeast Lake makes it clear why this lake has been chosen as part of a nationwide Clean Lakes Program to restore water quality to publicly owned, freshwater, recreational lakes.

Northeast Lake, like many other lakes in Oklahoma, has been selected for a Phase I diagnostic-feasibility study to determine the lake's quality, to evaluate solutions to the existing pollution problems, and to recommend the most feasible program to restore or preserve the quality of the lake. This project is being funded by the federal Environmental Protection Agency (EPA) to the Oklahoma Pollution Control Coordinating Board with Dr. Jim Grimshaw, Oklahoma Water Resources Board, and Mr. Steve Haus, Oklahoma City Zoo Clean Lakes Coordinator, acting as project managers.

If the Phase I project reveals that a pollution problem exists and that a feasible solution to the problem is possible, then a Phase II implementation program will be recommended for methods and procedures for controlling pollution entering the lake, and federal assistance from EPA will be requested.

Since the main thrust of the Clean Lakes Program is to restore lake water

quality for public use and appreciation, it is the intention of the EPA and the State of Oklahoma to involve the public as much as possible in the decision-making process. Therefore, a public participation program has been designed to keep the public informed and allow for public input of ideas and views on every aspect of the project. In order to receive these views from the public and to keep them informed of major decision points, public meetings and hearings, as well as brochures, press releases, and radio and TV advertisements, have been scheduled. The first of these scheduled activities is a public meeting to discuss the Northeast Lake project's draft workplan. The meeting is sponsored by the Department of Pollution Control and the Oklahoma Water Resources Board on December 11 at 7:00 p.m. in the Omniplex Library, Kirkpatrick Building, 2101 N. E. 50th, Oklahoma City.

The public is urged to attend and become aware of what each citizen can do to preserve the quality and beauty of this lake. A copy of the draft workplan may be obtained by contacting the Oklahoma Water Resources Board at 271-2538 or the ACOG office. A copy for public review is also available at each of the Oklahoma City Metropolitan branch libraries.

# # #

Daily Oklahoman

December 5, 1980

Lake Pollution Study Slated

The Oklahoma City Zoo's Northeast Lake has been selected for a study to evaluate pollution problems and recommend solutions.

The project is being funded by the federal Environmental Protection Agency and the Oklahoma Pollution Control Coordinating Board.

If the project reveals that a pollution problem exists and a solution is possible, then a program will be recommended for controlling the pollutants entering the lake and federal assistance will be requested.

A public participation program has been designed to keep the public informed. The first meeting is set for 7 p.m. Thursday in the Kirkpatrick Building Omniplex Library, 2101 NE 50.

Oklahoma Gazette

Nov 3, 1980

WATERS AND WATER RIGHTS

Department of Pollution Control

The Oklahoma Department of Pollution Control does hereby give notice that a public meeting will be held to discuss a Clean Lakes Workplan for Northeast Lake (Zoo Lake) in the Omniplex Library, Kirkpatrick Building, 2101 N.E. 50th, Oklahoma City, Oklahoma, at 7:00 p.m. on December 11, 1980. This grant is being funded by the Environmental Protection Agency to the Oklahoma Pollution Control Coordinating Board (PCCB), and the study will be conducted by the Oklahoma Water Resources Board (OWRB), a member agency of the PCCB. The federal Clean Lakes Program is designed to study and restore publicly owned recreational lakes. A copy of the proposed workplan can be obtained by contacting the OWRB at 271-2541.

Any person may present his views either in writing or orally at the above meeting.

[O. G. Register 80-443; filed October 31, 1980 at 11:20 a.m.]

Study Slated On Pollution

The Oklahoma City Zoo's Northeast Lake has been selected for a study to evaluate existing pollution problems and to recommend solutions.

The project is being funded by the federal Environmental Protection Agency and the Oklahoma Pollution Control Coordinating Board.

If the project reveals that a pollution problem exists and a solution is possible, then an implementation program will be recommended for controlling the pollutants entering the lake and federal assistance from EPA will be requested.

A public participation program has been designed to keep the public informed and allow for public airing of ideas and views on every aspect of the project.

Public meetings and hearings, brochures, press releases and radio and television announcements have been planned.

A copy of the draft workplan for the lake is available by calling the Oklahoma Water Resources Board at 271-2538. Copies can also be examined at each of the Oklahoma City metropolitan branch libraries.

Lynda

Oklahoma Department of Pollution Control

Box 53504 • N.E. 10th & Stonewall • Oklahoma City, Oklahoma 73152 • (405) 271-4677

Lawrence R. Edmison, J.D.
Director

Ralph D. Campbell
Programs Director

April 20, 1981
For further information contact:
Amelia Saul

FOR IMMEDIATE RELEASE

The Oklahoma Water Resources Board (OWRB) will begin a sampling program on Northeast Lake pending final approval by the Environmental Protection Agency (EPA). This program is funded in part by the EPA to the Oklahoma Pollution Control Coordinating Board of which the OWRB is a member agency and is designed to determine the nature and sources of pollutants entering the lake. It is anticipated that a significant improvement can be made in the Lake's water quality provided cooperation is received from the drainage area residents.

As public participation is an important part of the Clean Lakes Program, future meetings, such as the one held in December at the Zoo, will be conducted to keep the public informaed and to receive advice from the community.

A copy of the Northeast Lake Phase I workplan is available for review at Oklahoma City area libraries. Copies of the workplan may also be obtained by writing the OWRB, P.O. Box 53585, Oklahoma City, Oklahoma 73152 or calling the OWRB office, (405) 271-2532.

# # #

Oklahoma Department of Pollution Control
Box 53504 • N.E. 10th & Stonewall • Oklahoma City, Oklahoma 73152 • (405) 271-4677

Lawrence R. Edmison, J.D.
Director

July 28, 1981

Ralph D. Campbell
Programs Director

For additional information
contact: Bob Kinniburgh

FOR IMMEDIATE RELEASE

The Oklahoma Water Resources Board (OWRB) and the Oklahoma City Zoo have begun a sampling program on Northeast Lake under the federal Clean Lakes Program. This water quality study is partially funded by the Environmental Protection Agency to the Pollution Control Coordinating Board of which the OWRB is a member agency.

Northeast Lake is an urban lake situated in eastern Oklahoma City near the intersection of N. E. 50th Street and Grand Boulevard. The Oklahoma City Zoo occupies the west and north side of Northeast Lake and is a subcontractor to the OWRB for this Clean Lakes project. The Zoo's responsibilities will be for a non-point source inventory of zoo based pollution, a feasibility study for a lakeside 'Aquaticus' exhibit which was completed in December, 1980, and a lakeside landscaping plan.

The principal investigator, Dr. Jim Grimshaw, along with Water Quality Specialist, Shon Simpson, have made several trips to Northeast Lake to collect water samples. These samples are sent to the Oklahoma City-County Health Department for analysis. Several pollution problems are under examination by the OWRB such as: nutrient pollution with total nitrogen and total phosphorus monitored, sediment pollution, fecal pollution by monitoring fecal coliform concentrations and lead pollution by monitoring selected sites to trace the source of the heavy metal pollution and to demonstrate the distribution of lead in the lake. Sediment, water, and fish flesh will be analyzed for the accumulation of metals. These analyses will gage the impact of heavy metal pollution on people using the lake.

MORE

Letters to individuals soliciting members for the establishment of a Northeast Lake Advisory Committee were mailed in February, 1981. As few responses were received, interested individuals or representatives of public interest groups, economic interests, and public officials are still being sought to participate on the advisory committee. If interested or to obtain a copy of the Northeast Lake workplan contact Lynda Sinclair at 271-2541 or send your name, group affiliation, and address to Box 53585, Oklahoma City, Oklahoma 73152.

# # #

OKLAHOMA PRESS
CLIPPING BUREAU
Oklahoma City, Oklahoma

Daily Oklahoman
Oklahoma City, OK
194,690

State Water Panel, City Zoo Begin Northeast Lake Tests

The Oklahoma Water Resources Board (OWRB) and the Oklahoma City Zoo have begun testing Northeast Lake under the federal Clean Lakes Program.

The water quality study is partially funded by the Environmental Protection Agency through the Pollution Control Coordinating Board, of which the OWRB is a member.

Northeast Lake is an urban lake in eastern Oklahoma City near the intersection of NE 50 and Grand Boulevard.

The Oklahoma City Zoo occupies the west and north sides of the lake and is a subcontractor to the OWRB for the Clean Lakes project. The zoo's responsibilities include compiling an inventory of zoo-based pollution, a feasibility study for a lakeside "Aquaticus" exhibit and a lakeside landscaping plan.

The project's principal investigator, Dr. Jim Grimshaw, along with water quality specialist Shon Simpson, have made several trips to Northeast Lake to collect water samples.

The samples are sent to the Oklahoma City-County Health Department for analysis.

Several pollution problems are under examination by the OWRB. They include: nutrient pollution with total nitrogen and total phosphorous monitored; sediment pollution; fecal pollution by monitoring fecal coliform concentrations and lead pollution by monitoring selected sites to trace the source of the heavy metal pollution and to demonstrate the distribution of lead in the lake.

Sediment, water and fish will be analyzed for the accumulation of metals. These analyses will gauge the impact of heavy metal pollution on people using the lake.

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Because few reposnses were received, interested individuals or representatives of public interest groups, economic interests and pubic officials are still being sought to participate on the committee.

Oklahoma Department of Pollution Control
Box 53504 • N.E. 10th & Stonewall • Oklahoma City, Oklahoma 73152 • (405) 271-4677

Lawrence R. Edmison, J.D.
Director

Ralph D. Campbell
Programs Director

For additional information
contact: Bob Kinniburgh

FOR IMMEDIATE RELEASE

The Oklahoma Water Resources Board (OWRB) and the Oklahoma City Zoo will conduct a Public Forum to discuss the status of the Northeast (Zoo) Lake's Clean Lakes Program on Tuesday, September 1, 7:00 p.m. ~~Omniplex Library~~ Okla Zoo Library, 2nd floor, Kirkpatrick Center, Eastern and N.E. 52nd, Oklahoma City.

Topics of discussion by the OWRB staff will be progress of the program to date, difficulties encountered, and limnological data obtained to date. The staff of the Oklahoma Zoo will discuss the proposed Aquaticus and Africana programs.

The Clean Lakes Program is a partially, federally funded program designed to either protect the integrity of or restore to a useful, enjoyable state the nations publicly-owned lakes. The Northeast ~~Lake grant, awarded~~ to the Pollution Control Coordinating Board of which the OWRB is a member, will study and determine the lake's water quality problems, evaluate possible solutions, and recommend the most feasible program to restore it's quality. The public is encouraged to attend.

For more information or to obtain a copy of the Northeast (Zoo) Lake draft workplan, contact the OWRB at 271-2541.

PUBLIC SERVICE ANNOUNCEMENT FOR MONDAY, AUGUST 31, TUESDAY SEPT. 1 (UNTIL 6 P.M. ONLY)

If you enjoy Oklahoma City's Lincoln Park Zoo and are interested in its future, plan to attend a public forum Tuesday evening at 7 in the Omniplex Library on the second floor of Kirkpatrick Center. Members of the Oklahoma Water Resources Board will update the Board's water quality studies on the zoo's Northeast Lake "Clean Lakes" program. Zoo staff members will discuss the proposed Aquaticus and Africana programs.

The Clean Lakes Program -- partially funded by the EPA -- is aimed at restoring the nation's publicly owned lakes to useful, enjoyable recreational lakes.

Be informed on our zoo's problems and plans. Come to the public forum Tuesday at 7 p.m. in the Omniplex Library -- N.E. 52nd and Eastern.

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OKLAHOMA PRESS
CLIPPING BUREAU
Oklahoma City, Oklahoma

Daily Oklahoman
Oklahoma City, OK
194,690

Clean Lakes Forum Set

The Oklahoma Water Resources Board and the Oklahoma City Zoo will conduct a public forum to discuss the status of the Northeast Lake's clean lakes program at 7 p.m. today.

The forum is scheduled for the Omniplex Library at the Kirkpatrick Center, NE 52 and Eastern.

Topics of discussion by the Water Resources Board staff will include the program's progress to date. Zoo staffers will discuss the proposed acquatics and Africana programs.

The Clean Lakes Program, partially funded by the federal government, is designed to either protect the integrity of or restore to a useful state the nation's publicly-owned lakes.

The Northeast Lake grant, awarded to the Pollution Control Coordinating Board of which the OWRB is a member, will provide for a study to determine the lake's water quality problems, evaluate possible solutions and recommend the most feasible program to restore its quality.

Sept. 1, 1981

Forum Set on Clean Lakes Program

The Oklahoma Water Resources Board and the Oklahoma City Zoo will conduct a public forum to discuss the status of the Northeast Lake's clean lakes program at 7 p.m. today.

The forum is scheduled for the Omniplex Library at the Kirkpatrick Center, NE 52 and Eastern.

Topics of discussion by the Water Resources Board staff will include the program's progress to date. Zoo staffers will discuss the proposed aquaticus and Africana programs.

The Clean Lakes Program, partially funded by the federal government, is designed to either protect the integrity of or restore to a useful state the nation's publicly-owned lakes.

The Northeast Lake grant, awarded to the Pollution Control Coordinating Board of which the OWRB is a member, will provide for a study to determine the lake's water quality problems, evaluate possible solutions and recommend the most feasible program to restore its quality.

Edmond Evening Sun
P.O. Box 271
Edmond, Oklahoma 73034

Daily Tribune
P.O. Box 9
El Reno, OK 73036

Tulsa Tribune
P.O. Box 1770
Tulsa, OK 74102

Karen Dorrell
Transcript
P.O. Drawer 1058
Norman, OK 73070

City Editor
Oklahoman
P.O. Box 25125
OKC, OK 73102

City Editor
Times
P.O. Box 25125
OKC, OK 73102

Tulsa World
P.O. Box 1770
Tulsa, OK 74102

Tribune-Review
P.O. Box 40
Bethany, OK 73008

Oklahoma County News
P.O. Box A
Jones, OK 73049

Black Chronicle
P.O. Box 17498
OKC, OK 73136

Black Dispatch
P.O. Box 1254
OKC, OK 73101

Capitol Hill Beacon
P.O. Box 94760
OKC, OK 73143

Friday
Village P.O. Box 20340
Nichols Village, OK 73156

Putnam City-N.W. News
P.O. Box 32186
OKC, OK 73123

Tinker Take-Off
2854 ABG-PA
Tinker AFB, OK 73145

Key Magazine
P O. Box 1197
[illegible], OK 73101

Eagle
P.O. Box 3267
Tulsa, OK 74101

Jeff Black/Mtn. Boomer
Biology Dept., O.B.U.
Shawnee, OK 74801

Outdoor Oklahoma
1801 N. Lincoln
OKC, OK 73105

Sage Age
P.O. Box 1474
OKC, OK 73101

Scissortail
Zoology Dept., O.U.
Norman, OK 73069

Oklahoma Zoological Soc.
P.O. Box 18424
OKC, OK 73145

KAUT TV News
P.O. Box 14843
OKC, OK 73113

KETA TV News/Features
P.O. Box 14190
OkC, OK 73113

KGMC TV News
P.O. Box 14587
OKC, OK 73113

KOCO TV News
P.O. Box 14555
OKC, OK 73113

KOKH TV News
1228 E. Wilshire
OKC, OK 73111

KTVY TV News
P.O. Box 14068
OKC, OK 73113

KWTV TV News
P.O. Box 14139
OKC, OK 73113

Constitution
P.O. Box 2069
Lawton, OK 73502

Eagle
227 W. Broadway
Enid, OK 73701

Phoenix & Times Democrat
P.O. Box 1968
Muskogee, OK 74401

April 28, 1982

FOR MORE INFORMATION CONTACT:

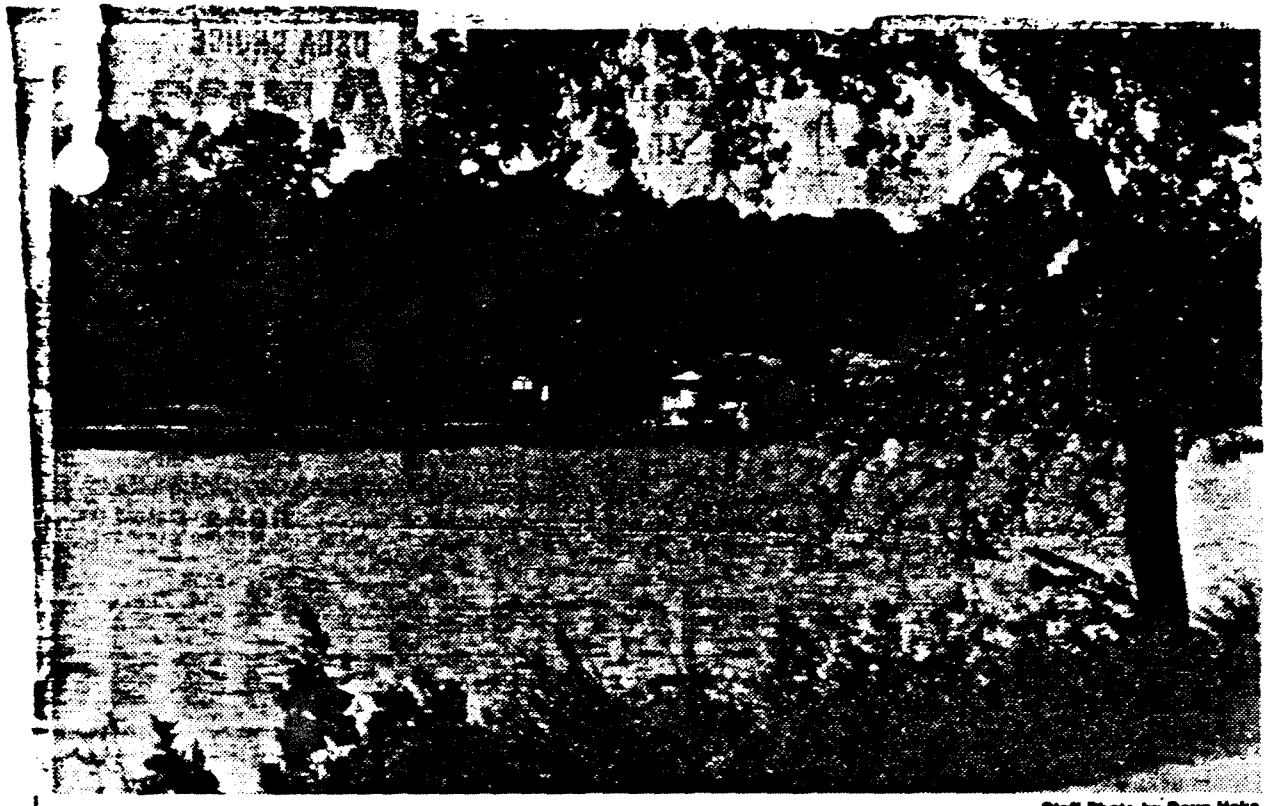
Ken Morris
Water Quality Division
Oklahoma Water Resources Board
271-2541

FOR IMMEDIATE RELEASE:

The OWRB will be holding its second committee meeting to discuss the Clean Lakes Project for Northeast (Zoo) Lake. The meeting will be held on Tuesday, May 4, 1982, at 7:30 p.m. in the Oklahoma Zoological Library, Second Floor, Kirkpatrick Center located at Eastern and N.E. 52nd, Oklahoma City, Oklahoma.

The meeting will focus on the conditions of the Zoo Lake and what possible restoration methods are being considered. Dr. Jim Grimshaw, principal investigator for the project, will present the information gathered to date and be on hand to answer questions.

The Clean Lakes Program is a partially federally funded program designed to perform a diagnostic study and recommend feasible restoration methods for publicly owned recreational lakes. All committee meetings are open and the public is encouraged to attend.



— Staff Photo by Doug Hoke

Bullhead catfish in the city Zoo Lake contain high amounts of chlordane, officials say.

Bullhead Catfish Contaminated By Pesticide in City Zoo Lake

By Covey Bean

The city-county health department Thursday cautioned the public against eating bullhead catfish taken from the 18-acre lake on the grounds of the Oklahoma City Zoo. The pesticide chlordane has been discovered in the flesh of that bottom-feeding species.

The same chemical was responsible for a similar warning to Lake Hefner fishermen several months ago.

Chlordane was found in bullheads taken from Zoo Lake during a pollution study as part of a federally-financed clean lakes program.

Dr. John Ward, director of health agency, said it was not discovered in any other species.

Ward said his department is merely taking the precaution of informing the public, although he emphasized the situation is not a serious problem.

He said the level of chlordane in the laboratory sample was "slightly" above the 300 parts per billion permitted by federal standards.

In large amounts, he said, the pesticide, normally used for lawn care, could cause neurological problems.

Dr. Ward said the source of the pollution has not been located.

Bill Stallings, an aquatic biologist for the state Health Department, who has done water quality work at the lake, said chlordane is not especially toxic, but is very long-lasting.

He said it could have been in the lake for as long as 20 years.

Stallings said the lake also has a problem with algae growth caused by fertilizer drainoff from zoo operations. Zoo Director [illegible] said the

"Out of that study has come a very good analysis of the lake water. So far, all the studies indicate it has good flora and fish life, but the insecticide is coming from somewhere. It isn't coming from the zoo," said Curtis.

Curtis said the lake drains a large watershed south of the zoo, which includes a golf course.

He said about three months ago a sewer line ruptured on the golf course polluting the lake enough to cause him to close a paddleboat concession until the break was repaired. He said the paddleboat operation has since been discontinued because it was not worthwhile economically.

Curtis said the goal of zoo officials is to turn the lake into a "major asset."

However, the clean

June 1, 1992

PRESS RELEASE

A meeting has been scheduled for June 8th to gather community ideas and opinions on possible restoration methods for use on Northeast (Zoo) Lake. The meeting is one in a series of committee meetings held during the past few months to review and discuss the Northeast Lake Clean Lakes Project currently being conducted by the Oklahoma Water Resources Board. These meetings are being held in conjunction with a $100,000 Environmental Protection Agency's Clean Lakes grant awarded to the Oklahoma Pollution Control Coordinating Board of which Oklahoma Water Resources Board is a member. The purpose of the grant program is to determine methods to protect and/or restore publicly owned freshwater lakes through intensive technical studies.

Individuals or groups having an interest in serving on the committee for the Northeast Lake or taking part in the committee meetings should plan to attend the June 8th meeting at 7:30 p.m. in the Oklahoma Zoological Library, located on the second floor of the Kirkpatrick Center, Eastern and 52nd Street, Oklahoma City, Oklahoma.

For additional information contact Lynda Sinclair or Ken Morris with the Oklahoma Water Resources Board at (405) 271-2541.

# # #

Oklahoma Department of Pollution Control
Box 53504 • N.E. 10th & Stonewall • Oklahoma City, Oklahoma 73152 • (405) 271-4677

You're doin' fine, Oklahoma! 1907 Diamond Jubilee 1982

June 16, 1982

Lawrence R. Edmison, J.D.
Director

For More Information Contact:

Ken Morris
Water Quality Division
Oklahoma Water Resources Board
(405) 271-2541

FOR IMMEDIATE RELEASE

A committee has been formed that will help determine what options may be used to eliminate fecal contamination and sewerline infiltration from entering into Northeast (Zoo) Lake, Oklahoma Water Resources Board Limnologist Lynda Sinclair announced today.

Oklahoma City Zoo Public Information Curator, Nathaniel Batchelder, has been elected to chair the committee, which will serve as liaison between community residents and the OWRB in the management of the Northeast Lake Clean Lakes Program. Environmental Protection Agency guidelines call for the committee to have representation from local public interest groups, environmental interest groups, private citizens and public officials.

"We're very interested in having the community involved. We've asked the committee members to talk with the people whose interests they represent and relay to us what their concerns and desires are," Sinclair said. "Plus, any future meetings we have will be open to the public. Whatever decisions are made should reflect the views of the community."

Sinclair said the committee, which has already met twice, evolved during a series of public meetings held in 1981 and 1982 to inform community residents about the project and solicit committee members.

—more—

The National Clean Lakes Program was developed in 1972 as part of the Clean Waters Act with the intention of protecting and/or restoring the quality of the nation's publicly owned freshwater lakes for recreational use. The Northeast (Zoo) Lake project was awarded by grant to the Oklahoma Pollution Control Coordinating Board, and is being administered and coordinated by the OWRB.

The study is currently in Phase I, the determination and diagnosis of the lakes problems and the gathering of information on feasible restoration options. The feasibility study is scheduled for completion in December. Phase II would be the actual implementation of the restoration plan.

Persons seeking information on the status of the project or those wishing to join the committee may contact Sinclair or Ken Morris at the OWRB, P.O. Box 53585, Oklahoma City, OK 73152, (405) 271-2541.

# # #

Oklahoma Department of Pollution Control
Box 53504 • N.E. 10th & Stonewall • Oklahoma City, Oklahoma 73152 • (405) 271-4677

You're doin' fine, Oklahoma! 1907 Diamond Jubilee 1982

March 3, 1983

Lawrence R. Edmison, J.D.
Director

Amelia Saul
Executive Assistant

FOR IMMEDIATE RELEASE

The results of a Phase I three year water quality study conducted by the Oklahoma Water Resources Board (OWRB) at Northeast Lake in Oklahoma City, will be the topic of discussion at a Public Meeting on March 31, starting at 7:00 p.m. in the first floor auditorium of the Department of Wildlife Conservation's building at 1801 Lincoln Boulevard, in Oklahoma City, OK. The OWRB will present the findings of the study and the proposed solutions to pollution problems identified during the study.

Once the study report has been finalized and recommendations made for restoration of the lake, the State of Oklahoma can then apply for Phase II grant money funded under the Clean Lakes Program administered by the U.S. Environmental Protection Agency (EPA). The Phase II money is set aside by the EPA to provide 50 percent matching funds to those projects which EPA determines to be eligible under the Clean Lakes Program.

Although drained during June of 1982 due to structural problems with the dam, Northeast Lake has experienced serious pollution problems for years. The Phase I study conducted under the Clean Lakes Program indentified three major problems with the lake according to the principal investigator Jim Grimshaw.

A continuing source of contamination has been urban stormwater runoff drainage which carries sediment and organic materials to the lake. Another source of contamination was traced to a broken sewer line located at a dump site 3 miles away, which allowed raw sewage to flow down the tributaries to the lake. The third

-more-

identified contamination problem was traced to the Oklahoma City Zoo's drainage system that carries animal wastes from the enclosures directly into the lake. The latter two problems resulted in high fecal coliform and nutrient levels in the lake.

To date, "the sewer lines have been repaired and the dump site closed, so that problem is taken care of. But for the lake to have high quality water that it had many years ago, all three problems must be corrected," Grimshaw says.

One of the most ardent proponents of lake restoration has been the Oklahoma City Zoo. After being made aware of the problems with the lake, the zoo contributed $10,000 to the diagnostic/feasibility study. With the study complete and recommendations made, the City Zoo has offered to contribute matching funds for the Phase II restoration project which will address the remaining problems.

"The 7:00 p.m. Public Meeting will be the last held on the lake's problems," says public participation coordinator Laura Cook. More information on the meeting can be obtained by contacting Laura Cook at (405) 271-2541.

# # #

The Oklahoma Department of Pollution Control does hereby give notice that a public meeting will be held to discuss the results of a 3 year clean lakes diagnostic/feasibility study conducted by the Oklahoma Water Resources Board on Northeast Lake in Oklahoma City. The Public Meeting will be held in the first floor auditorium of the Department of Wildlife Conservation's building at 1801 Lincoln Boulevard, in Oklahoma City, OK, at 7:00 p.m. on March 31, 1983. The Clean Lakes study was conducted under a grant from the U.S. Environmental Protection Agency to the Oklahoma Pollution Control Coordinating Board, who contracted with the Oklahoma Water Resources Board to conduct the study. The study was designed to evaluate existing pollution problems in the lake and make recommendations to correct these problems to restore the lake. A copy of the results may be obtained by contacting Oklahoma Water Resources Board at 271-2541.

Any person may present views either in writing or orally at the above meeting.

# # #

3-year probe complete

Illicit dump taints lake at city's zoo

By Jan Paschal

An illegal dump in northeast Oklahoma City was part of the pollution problem at the city zoo's Northeast Lake, Laura Cook, a state water board employee, said today.

That is one of the findings of a three-year water quality study summarized at a public meeting Thursday night at the Oklahoma Department of Wildlife Conservation building.

"We found contamination from one of the tributaries that ran past an illegal dump three miles north of the lake," said Cook, public participation coordinator for the Oklahoma Water Resources Board.

"There are sewer line risers sticking up out of the ground, but someone drove huge dump trucks in there, backed into the risers and broke them off, which damaged the sewer lines. Raw sewage backed up on the land and eventually ran into the lake," Cook said.

The illegal dump has been taken care of by the city-county Health Department, Jim Grimshaw told those attending the water resources board meeting Thursday night.

Grimshaw was the principal investigator in charge of the three-year water quality study of the zoo lake.

"The lake looks like a big mud puddle. It's not very aesthetic," Grimshaw said.

The city is taking action against the illegal dumpers, Cook said.

Oklahoma City officials also have told the Oklahoma Water Resources Board the city is willing to commit $400,000 in matching funds to repair the zoo lake's spillway and dam, which were damaged last May during a week of torrential rains, Cook said.

Karen Farney, supervisor of the city's Action Center, confirmed that $400,000 commitment.

The Northeast Lake had to be drained last spring after the spillway and dam were damaged.

The state water board's study also found that the zoo lake is being polluted by wastes draining improperly from the animal pens, Cook said.

"The zoo has agreed to put up $100,000 in matching funds to create a holding pen to funnel the animal wastes into the city sewer system," Cook said.

Runoff from the nearby Lincoln Park Golf Course also may be polluting the zoo's lake, but the three-year water quality study was not able to prove that, Cook said.

"We don't have any proof. But we found a lot of nitrates and phosphates in the lake from urban runoff. The Lincoln Golf Course is nearby. We were never able to officially find out from them what type of fertilizer they were applying to the grass.

"They were kind of evasive. But fertilizers do have a lot of nitrates in them, and we suspect this may be a problem," Cook said.

To prevent further pollution from urban runoff, a man-made cement canal will be built along the west side of the lake to catch the chemical fallout before it runs into the lake.

The cement canal will be built in conjunction with the new spillway, Cook said.

The three-year water quality study cost $100,000, with the Environmental Protection Agency paying 70 percent of the cost. The zoo contributed $10,000 and the state paid the rest, Cook said.

Now state and Oklahoma City officials are hoping that the EPA will approve a $500,000 federal matching grant to pay for the construction of the new spillway, dam and cement diversion canal.

"They're reviewing our application now. They're still asking us for more information, so that's a good sign," Cook said.

Wednesday, March 30, 1983

Zoo lake quality results expected

The Oklahoma Water Resources Board will release Thursday the results of a three-year water quality study done on Oklahoma City Zoo's Northeast Lake.

The findings and proposed solutions will be discussed at 7 p.m. in a public meeting at the Department of Wildlife Conservation building, 1801 Lincoln. It is the last public meeting scheduled on the zoo lake.

Although drained in June 1982 because of structural problems with the dam, Northeast Lake has had serious pollution problems for years, according to the Oklahoma Department of Pollution Control.

The Phase I study, conducted through the Clean Lakes Program, identified three major problems with the lake, said principal investigator Jim Grimshaw.

The problems include urban storm water runoff drainage and a broken sewer line located at a dump site three miles from the lake. Raw sewage flows from the dump into the lake tributaries.

The third problem is the zoo's drainage system which carries animal wastes directly into the lake, resulting in a high fecal coliform and nutrient lake levels.

"The sewer lines have been repaired and the dump site closed, so that problem is taken care of," Gresham said. "But for the lake to have high quality water that it had many years ago, all three problems must be corrected."

The zoo, which contributed $10,000 to the study, has offered to contribute matching funds for the Phase II restoration project, he added.

Once the study report has been finalized and recommendations made for restoration of the lake, the state can apply for Phase II grant money from the Clean Lakes Program administered by the federal Environmental Protection Agency.

The Phase II money is set aside by the EPA to provide 50 percent matching funds for eligible projects.

APPENDIX 20-B

NORTHEAST LAKE
ENVIRONMENTAL EVALUATION

NORTHEAST LAKE
ENVIRONMENTAL EVALUATION

(1) Will the proposed project result in the displacement of any people?

No population will be displaced.

(2) Will the proposed project deface existing residences or residential areas? What mitigative actions such as landscaping, screening, or buffer zones have been considered? Are they included?

The proposed project will not deface any residences or residential areas. All work will be within the property boundaries of the Oklahoma City Zoo.

(3) Will the proposed project be likely to lead to a change in established land use patterns, such as an increased development pressure near the lake? To what extent and how will this change be controlled, through land use planning, zoning, or through other methods?

The lake is presently surrounded on the east by Lincoln Park, on the south by Lincoln Park Golf Course, and on the north and west by the Oklahoma City Zoo. Consequently, no increased development pressure is possible near the lake.

(4) How does this project conform to area wide waste treatment management plans, if any, developed under section 208 of the Act?

No conflicts with the Statewide 208 Program have been identified.

(5) Will the proposed project adversely affect a significant amount of prime agricultural land or agricultural operations on such land?

There will be no adverse affects on agricultural operations or land.

(6) Will the proposed project result in significant adverse effect on park land, other public land, or lands of recognized scenic value?

No, on the contrary, park land will be enhanced by the improved nature of the lake.

(7) Has the state historical society or state historical preservation officer been contacted by the grantee? Has he responded, and if so, what was the nature of the response? Will the proposed project result in a significant adverse effect on lands or structures of historical, architectural, archeological or cultural value?

The State Historical Preservation Officer has been contacted and has verbally indicated that there will be no adverse effects.

(8) Will the proposed project lead to a significant long range increase in energy demand?

No, the project itself will utilize gravity flow to direct the runoff. At the present gasoline consumption utilized in travel to other lakes outside of Oklahoma City will be reduced by this improvement to Northeast Lake.

(9) Will the proposed project result in significant and long range adverse changes in ambient air quality or noise level? Short term?

No long range adverse effects in ambient air quality or noise levels are anticipated. In the short term, however, noise levels may be increased slightly.

(10) If the proposed project involves the use of in-lake, chemical treatment, what long and short term adverse effects can be expected from the treatment? How will the grantee mitigate these effects?

It is not anticipated that chemical treatments will be used on this project.

(11) Does the proposal contain all the information that EPA requires in order to determine whether the project complies with Executive Order 11988? Is the proposed project located in a flood plain? If so, will the project involve construction of structures in the flood plain? What steps will be taken to reduce the possible effects of flood damage to the project?

The project of necessity is located in a flood plain, however, the removal of the Oklahoma City Zoo runoff to sanitary sewers will reduce the amount of stormwater runoff entering the lake and help control any future flooding.