

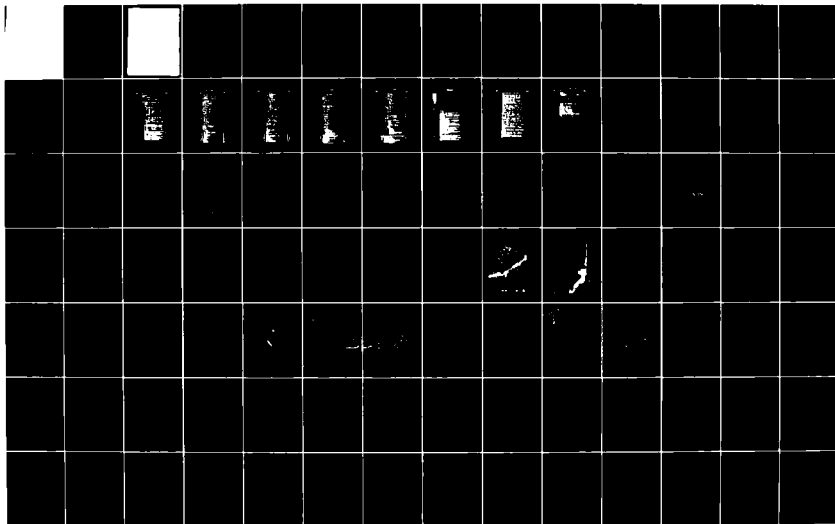
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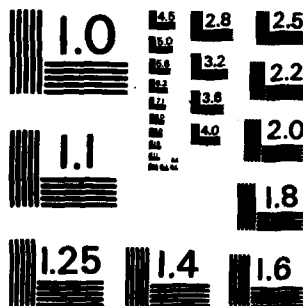
PUBLIC WATER SUPPLY RED RIVER PARISH LOUISIANA(U)
SUNBELT RESEARCH CORP BATON ROUGE LA C W DECKER MAR 81

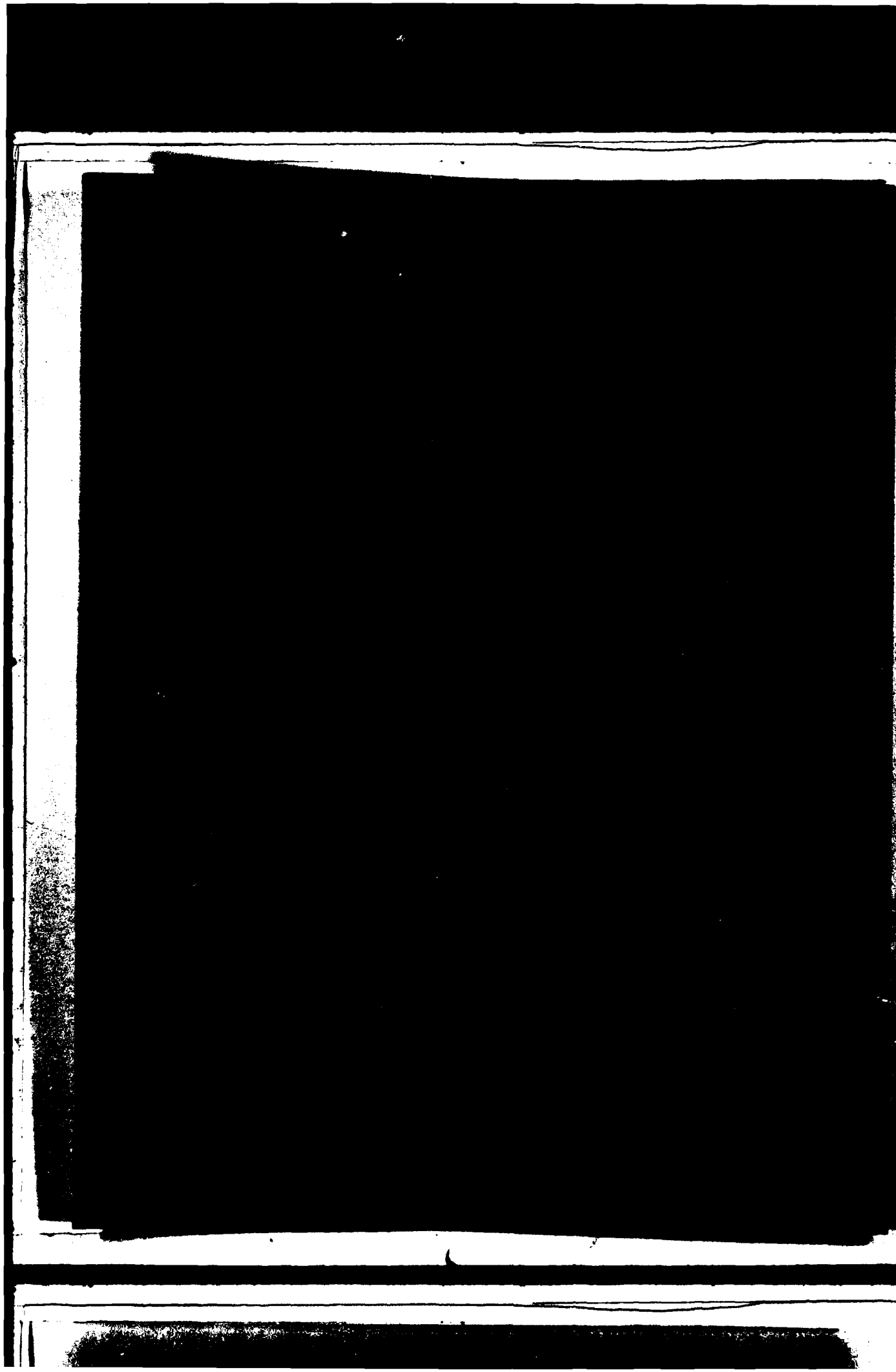
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COVER SHEET

Lead Agency: U.S. Army Corps of Engineers,
New Orleans District Office

Cooperating Agencies:

U.S. Fish and Wildlife Service;
Environmental Protection Agency;
Louisiana Department of Wildlife and Fisheries;
Office of Public Works, Louisiana Department of
Transportation and Development

Title: Public Water Supply
Red River Parish, Louisiana

Contact: Charles W. Decker, P.E.
Chief, Regulatory Functions Branch
U.S. Army Engineer District, New Orleans
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New Orleans, Louisiana 70160

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Draft Environmental Impact Statement, Section 404.

Red River Parish, located in northwest Louisiana, is without an adequate supply of good quality water. This Environmental Impact Statement addresses alternatives which would produce a new source of water and a resulting increase in economy through new industry and residential growth. The alternatives discussed include: (1) withdrawal of water from the Red River and (2) a reservoir built on Grand Bayou near Coushatta, Red River Parish. A third alternative, no action, is also addressed.

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SUMMARY

INTRODUCTION

Permit Application. In December, 1977, the Black Lake Bayou Recreation and Water Conservation District of Red River Parish submitted an application to the Department of the Army, Corps of Engineers, New Orleans District, to install and maintain a dam, spillway, and appurtenances to form a reservoir for municipal and industrial water supply with attendant incidental recreational value. The proposed location of the project is across Grand Bayou at a point 4.1 miles above the mouth of the waterway approximately 7.5 miles east of Coushatta, Red River Parish, Louisiana. The District Engineer determined that an environmental impact statement was required for the proposed project pursuant to Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (86 Stat. 816; 33 USC 1344).

The U.S. Corps of Engineers has required this report to insure a thorough evaluation of both the beneficial and adverse impacts of the proposed project, the impacts of no action, and the impacts of reasonable alternatives. Funds for construction of the proposed Grand Bayou Reservoir will be provided by the State of Louisiana.

Project Purpose and Needs. The primary purpose of this project is to supply municipal, industrial, and agricultural water. Water for domestic users will be furnished to the entire portion of the parish located on the east side of Red River, while the non-domestic users are located in general in the area surrounding the reservoir and in particular in the vicinity of Coushatta. It is upon this premise that alternatives were developed, evaluated, and resultant plan selection made.

If the Grand Bayou Reservoir alternative is selected, in addition to a municipal water supply, a recreation potential will be created. It is the intention of the Black Lake Bayou Recreation and Water Conservation District of Red River Parish to realize this potential in a manner which would benefit the general public's use and enjoyment. Recreation, however, is incidental to the water supply purpose. As such any recreational development as well as any other potential land and/or water uses will be regulated by the Black Lake Bayou Recreation and Water Conservation District so as to insure that the primary purpose of this project, the provision of a water supply source, is not impaired. Because the Red River navigation project will provide recreation facilities for the Coushatta area, the Grand Bayou Reservoir will be constructed for the primary reason of water supply.

The need for water within the project area is expected to increase dramatically in future years. The 1970 water usage for the Grand Bayou

service area was 0.918 million gallons/day(mgd), according to the Feasibility Study for the Grand Bayou Reservoir, Ozarks Regional Commission, Vol. II-A, schedule WM3, 1976. Gulf South Research Institute in a study published in 1979 entitled Present and Projected Water Requirements for Parishes and Major Drainage Basins, 1975-2000, projected the water demand for Red River Parish. Those projections are presented in Table 1.

TABLE 1

PROJECTED WATER USAGE FOR RED RIVER PARISH: 1975-2000

Source	1975	1980	1990	2000
Ground Water (mgd)	7.020	18.990	22.732	26.478
Surface Water (mgd)	0.340	3.375	4.357	5.339
Total Water (mgd)	7.360	22.365	27.089	31.817

The table shows that water usage will increase from 7.36 mgd in 1975 to a projected usage of 31.817 in the year 2000. Of the total water, the ground water usage was estimated to be 7.02 mgd in the year 1975 and 26.48 mgd in the year 2000. This data illustrates the expected high demand for water in the future.

The limited availability of good quality water has inhibited economic development in this economically depressed rural area. The proposed project will provide water in sufficient quantity and quality to allow future municipal and industrial development. The area is presently undergoing rapid change due to the mining and processing of lignite coal in the vicinity. New industrial, commercial and residential growth is expected to occur in the next two decades. To support the growth and attendant demands for water, new water sources such as the Grand Bayou Reservoir project and existing water supplies will be used. Existing water sources will be used to supplement new water supplies.

The estimated water usage from the proposed Grand Bayou Reservoir is summarized in Table 2. The data is taken primarily from the Feasibility Study for the Grand Bayou Reservoir, Ozarks Regional Commission, Vol. II-A, 1976. This study is referred to as the "FDP" in Table 2. The preparers of the FDP used 1979 as a base year and considered the 15th and 30th year for purposes of projection and calculation, hence the years 1998 and 2008 appear in the table.

Project Area.

(1) Location. Red River Parish is located in northwest Louisiana, an area that was defined as a major "energy impact area" in 1979 by the U.S. Department of Energy. Red River Parish is bordered by Caddo,

TABLE 2
ESTIMATED WATER DEMAND OF RED RIVER
PARISH FROM GRAND BAYOU RESERVOIR

NO.	ITEM	YEAR 1993	YEAR 2008	REMARKS
1.	Population	9455 ¹	9990 ²	Yr. 1970 - Pop. 9461 1.2: From FDP, Vol. IIA, Pg. 1 Schedule WI-3 and Pg. SE-1
2.	Domestic/Commercial Usage	963,560 gpd	1,016,440 gpd	Derived from FDP, Vol. IIA, Pg. 1, Schedule No. SM-1, Without Peak Factor
3.	Farm Usage	-0-	479,450 gpd	"
4.	Industrial Usage	1,720,000 gpd	3,424,660 gpd	"
5.	Total	2,683,560 gpd	4,920,550 gpd	"
6.	Add 10(+) percent For Growth	268,356 gpd	649,450 gpd	"
7.	Total say	2,951,916 2.95 mgd	5,570,000 5.57 mgd	
8.	Add 2.4 mgd for downstream req'd *	2.40 mgd	2.40 mgd	*Dept. of Wildlife and Fisheries requirement
GRAND TOTAL OF PROJECT DEMAND		5.35 mgd	7.97 mgd say 8.00 mgd	

Bossier, Bienville, Natchitoches, and DeSoto Parishes, the latter two having also been included in the "energy impact area" in the 1979 designation.

(2) Economic Conditions. Data from the 1970 U.S. Census of Population indicate a relatively depressed economy in Red River Parish. Of the six contiguous parishes, Red River Parish has:

- the lowest family income (\$4,563) compared with the state average of \$7,530;
- the highest percentage of families with incomes below the poverty level (40.0%), compared with the state average of 21.5%;
- the highest percentage of total population receiving public assistance (20.2%), compared with the state average of 11.3%;
- the highest percentage of total population receiving food stamps (31.1%), compared with the state average of 12.0%;
- the highest percentage of households lacking adequate plumbing (37.2%), compared with the state average of 10.6%, and
- the highest percentage of unemployment in 1970 (7.8%), compared with the state average of 5.4%.

The availability of an adequate public water supply for municipal and industrial use is critical to economic development in the parish. A secondary benefit created as a result of the fresh water reservoir will be the addition of recreational opportunities. However, recreation will be an indirect benefit because no extensive plans for new recreational facilities are anticipated due to the fact that recreational opportunities will result from the improvements on the Red River Waterway project.

ALTERNATIVES

Alternative Selection Process. The alternatives for study were identified in several scoping meetings with the U.S. Corps of Engineers. Representatives from the U.S. Corps of Engineers, the cooperating agencies and the applicant attended the scoping meetings.

Reasonable Alternatives. Two reasonable alternatives were selected for detailed study and analysis. Both of these alternatives appear to meet the applicant's needs in terms of water availability. This study will evaluate the quality of the water of both alternatives as it relates to the public's safety. The alternatives are:

1. Withdrawal of water from the Red River upstream of the International Paper Company's discharge point in Red River Parish, Louisiana;
2. Installation of a dam, spillway, and appurtenances to form a reservoir on Grand Bayou, Red River Parish.

Several other alternatives were analyzed in this report, but they were judged to be disqualified for purposes stated below in the report. A No Action alternative was also considered.

Alternatives Deemed Not Feasible. The following alternatives were presented in the scoping process. The research in this report show them not feasible.

-Groundwater. The existing groundwater sources for a public water supply are of doubtful quality or quantity. However, ground water supplies may play an important role in meeting the future requirements of the agricultural sector and isolated commercial and industrial demands. Groundwater from the Red River alluvium is available in substantial quantities, but is primarily limited to non-potable uses such as irrigation. Over the past twenty years, the U.S. Geological Survey and the Office of Public Works, State of Louisiana, Department of Transportation and Development, have conducted an extensive search for new groundwater supplies in Red River Parish. No new adequate supplies of water suited for potable usage were located. Therefore, this alternative was not included as a reasonable alternative even though existing sub-surface water will continue to be used in the future as is shown later in this report under the analysis of alternatives. Future use of sub-surface water will be essentially limited in terms of its systems application.

-Pipeline from Toledo Bend Reservoir. Toledo Bend Reservoir is located approximately 32 miles west of Coushatta on the Louisiana-Texas border. This alternative was not determined to be reasonable due to the long distance and difficult terrain encountered along possible pipeline corridors. The cost of building and operating a long distance pipeline for a relatively limited number of customers with limited water demand would be prohibitive.

-Black Lake. A written request to derive water (if found feasible and cost effective) from Black Lake was refused by the Northwest Louisiana Fish and Game Preserve Commission. Hence, this alternative was dropped from further consideration. A copy of the cited letter appears in Appendix J to this report.

-Lake Bisteneau. As in the case of Black Lake, permission was refused (by the Louisiana Department of Wildlife and Fisheries) for

usage of water from the lake as a public water supply for Coushatta and Red River Parish. Therefore, this possible alternative was dropped from further consideration. A copy of the cited letter appears in Appendix J to this report.

-Grand Bayou Reservoir plus water via a pipeline from Lake Bistineau. This alternative which could have allowed a reduction in the size of the Grand Bayou Reservoir could not be further evaluated when permission to withdraw water from Lake Bistineau was denied by the controlling authority.

-Grand Bayou Reservoir plus water via a pipeline from Black Lake. This alternative was dropped from consideration for the same reason stated above with respect to the potential combination of Grand Bayou Reservoir and Lake Bistineau.

-Grand Bayou plus existing wells. The existing wells have a present capacity which is less than seven percent of the proposed Grand Bayou Reservoir's design capacity of nearly 8 mgd (year 2000). Hence, the effect of combining existing wells with Grand Bayou in meeting the future water requirements for the Town of Coushatta and Red River Parish would result in a relatively small reduction in the designed size of the proposed reservoir. Further, any formal combination would result in the necessity for under-sizing the proposed reservoir by approximately 7 percent of required water volume. Further, the combination would prove to be more expensive than the design, construction, and operation of the proposed reservoir as the primary water supply source. Extensive drilling has resulted in the production of very little increased water supplies, according to reports from the U.S. Geological Survey and the State of Louisiana, Office of Public Works. Department of Transportation and Development. However, as discussed in Section 2 of the Draft Environmental Impact Statement, the existing wells will be retained as a backup service for other users. This report does not suggest the closing of the existing wells.

-Grand Bayou plus the Red River. The combination of both of these sources as a public water supply has been determined economically not feasible. This is true because in order to combine the Red River with the Grand Bayou Reservoir for a public water supply, two separate water systems would have to be designed, constructed, and maintained. Operational expenses would be appreciably more than if one single alternative were chosen. Use of Red River water in combination with water from Grand Bayou would require the development and operation of additional treatment facilities, pipelines and support systems. The case against using Red River water in combination with Grand Bayou water is similar to the case against using Red River water singly with respect to the basic quality of Red River water. If it were deemed feasible in terms of water quality to use Red River water in combination with water from Grand Bayou, it would be obvious that the

quantity of water, coupled with a holding facility, would be adequate for all the system's needs. The quality of Red River water is discussed in detail later in this report. Therefore, the alternative of using these two sources in combination has been determined unfeasible.

-Grand Bayou Reservoir plus Red River plus existing wells. This potential combination was not considered any further because of the expense of simultaneously developing and operating three systems as opposed to one system.

BENEFICIAL/ADVERSE IMPACTS

Red River. The beneficial impacts of the Red River as a source of public water are its location near the Town of Coushatta and its ability to supply water to an expanding population; its abundant quantity of water for most periods of the year; and the relative economy of securing its water. Further, use of water from the Red River would be environmentally less harmful than alternative possibilities. Habitat modification in Red River Parish, if the Red River alternative were selected, would be less than if the Grand Bayou Reservoir alternative were selected. A settling pond would be necessary to remove material in suspension prior to treatment. The location of a pipeline from the Red River to Coushatta would cause the necessity of removing vegetative cover, but the route could be designed to minimize such environmental harm.

The adverse impacts of using Red River water for a public water supply are presented as follows. Water from the Red River is high in dissolved solids and chlorides derived from natural sources plus high counts of fecal coliform. Municipal effluent from Shreveport, Bossier City, and other locations immediately upstream from Coushatta account for the coliform deposits. Additionally, large quantities of putrescibles and attendant leachates are deposited in the Red River upstream from Coushatta by the City of Shreveport and Bossier City, both of which operate river-side garbage dumps. A new International Paper Company containerboard complex will begin discharging effluent treated by an overland flow scheme of land application in the Red River in 1981. The point of discharge is approximately thirteen river miles upstream of Coushatta. It is the opinion of International Paper Company, Southwest Electric Power Company, Pineville Kraft Paper Company, and Sunbeam Industries that water from the Red River can not be used for their operations because of its high content of solids and other pollutants and for that reason those industries have used alternative water supplies.

Grand Bayou Reservoir. The beneficial impacts of Grand Bayou Reservoir as a source of public water are its location near the Town of Coushatta; its abundant quantity and high quality water; and the relative economy of securing its water. The reservoir will be created by the impoundment of Grand Bayou at a point 4.1 miles above

its mouth. Approximately 2,700 acres will be inundated and an additional 200 acres will be cleared. Some 2,035 acres of bottomland will be lost. The project will create 2,700 surface acres of fishery habitat.

The new public water supply from Grand Bayou Reservoir will benefit an expanding population in the region. Because Red River Parish is located in an officially designated "Energy Impact Area" (U.S. Department of Energy, 1979), significant increases in industrial activities are anticipated. This industrial expansion is expected to directly create 5,445 new jobs in the four parish area of Red River, Natchitoches, DeSoto, and Sabine. (See, Designation Report, Public Law 95-620: Powerplant and Industrial Fuel Use Act of 1978, State of Louisiana, Office of the Governor, June 30, 1979, page 18.) Because Red River Parish is in the center of the lignite coal area, many of the new workers will locate in Red River Parish.

Eventual plans for recreation on the proposed lake are not finalized by the Black Lake Recreation and Water Conservation District because the Commission has stated that its plans must be developed so as not to conflict with plans for recreation on the Red River waterway.

The adverse impacts resulting from selection of the Grand Bayou alternative are presented as follows in summary and described throughout this report in detail. The foremost adverse impact will be the loss of 2,700 acres of bottomland hardwoods and the clearance of an additional 200 acres of land which will result in the elimination of wildlife habitat. In Section 2, Subsection "Comparative Impacts Among Alternatives", descriptions of modifications to transportation and transmissions systems and displacements of households, churches, and cemeteries are addressed.

A 17.3 percent survey of the proposed impoundment area was performed to assess the cultural resources subject to potential impact. An additional 25.9 percent of the pool perimeter was surveyed for the same purpose. The search took place during the period between 24 September 1979 and 19 October 1979, a time of dry conditions which allowed for optimal survey results. Eighteen archeological sites were located which will be subject to direct impacts resulting from either complete inundation or erosion along the pool margin. Another five sites, located previously, are also believed to be subject to the same impacts. Detailed results of the cultural resources survey are presented in the report, A Sample-Based Cultural Resources Survey of the Proposed Grand Bayou Reservoir. None of the sites represent unique deposits of cultural resources, however, National Register eligibility has not been assessed on any of the archeological sites reported to date.

MAJOR CONCLUSIONS

Provide Municipal and Industrial Water Supply. The quantity of water from both alternatives is satisfactory for a water supply source although the availability of water from Red River for Bossier City was lacking in the extremely dry season of 1980, particularly in the month of September when Bossier City's system was threatened. Comparing the

two alternatives, the water from Red River has the most variable quality and would require a greater extent of treatment to achieve a water safe for human consumption. Among the two alternatives, there would be a greater adverse impact on the environment if the Grand Bayou Reservoir alternative is chosen. The alternative which has the best quality for a public water supply is the Grand Bayou Reservoir.

Recreation. Although recreation is not the reason for the development, the Grand Bayou Reservoir alternative would create opportunities for recreation and would likely generate some amount of associated business and tourism. Regardless of the water supply alternative selected, the completion of the Red River Waterway project will provide recreational facilities in the area.

Habitat Modification. Selection of the Red River alternative would involve minimum habitat modification. Selection of the Grand Bayou Reservoir alternative would require modification of 2,700 acres of habitat. Please refer to Section 2 for additional details.

AREAS OF CONTROVERSY

The most significant area of controversy is the loss of bottom-land hardwoods associated with the Grand Bayou Reservoir alternative.

ISSUES TO BE RESOLVED

One issue to be resolved involves the operations plan to maintain the habitat below the proposed dam on Grand Bayou. The applicant will work with the lead agency and the cooperating agencies on an appropriate operations plan to minimize habitat modification downstream from the proposed dam site.

Second, procedures necessary to insure compliance with the National Historic Preservation Act will be implemented at the state level. The applicant has stated that all procedures necessary to insure compliance with the National Historic Preservation Act by determining National Register eligibility will be faithfully undertaken. All documentation will be coordinated with the State Historic Preservation Office and the Heritage Conservation and Recreation Service. If appropriate, the applicant will develop and coordinate a mitigation plan with the State Historic Preservation Office and the Advisory Council on Historic Preservation.

Third, new guidelines for Specification of Disposal Sites for Dredged or Fill Material were promulgated by the Environmental Protection Agency on 24 December 1980 in 40 CFR 230. The new guidelines will become effective on 23 March 1981. A written application of these new guidelines will be prepared to insure compliance. Information concerning

the application of these guidelines will be incorporated in the final Environmental Impact Statement when it is printed.

Following, on pages xii and xiii, is Table 3 which shows the relationship of the proposed Grand Bayou Reservoir to environmental and statutory requirements.

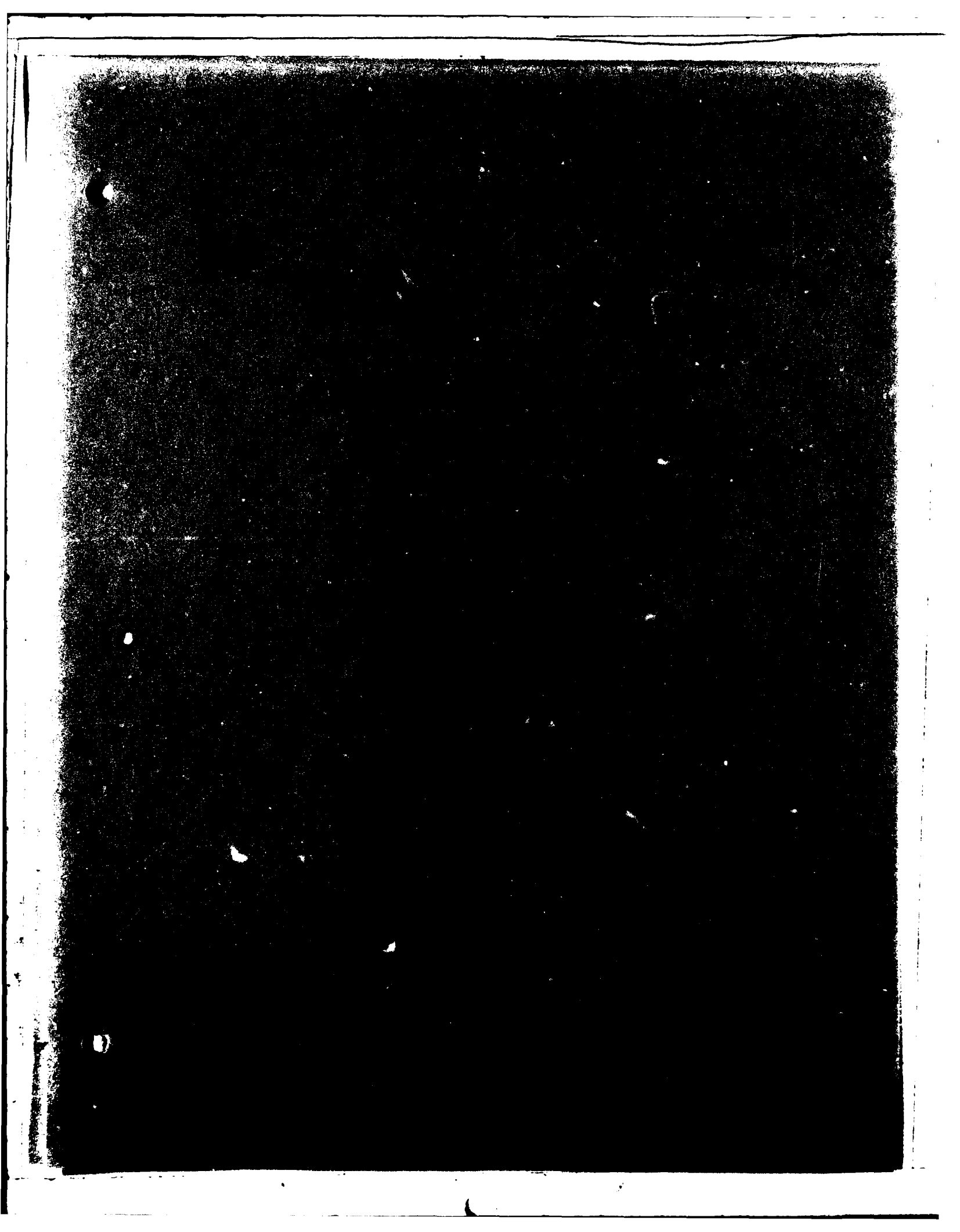
TABLE 3

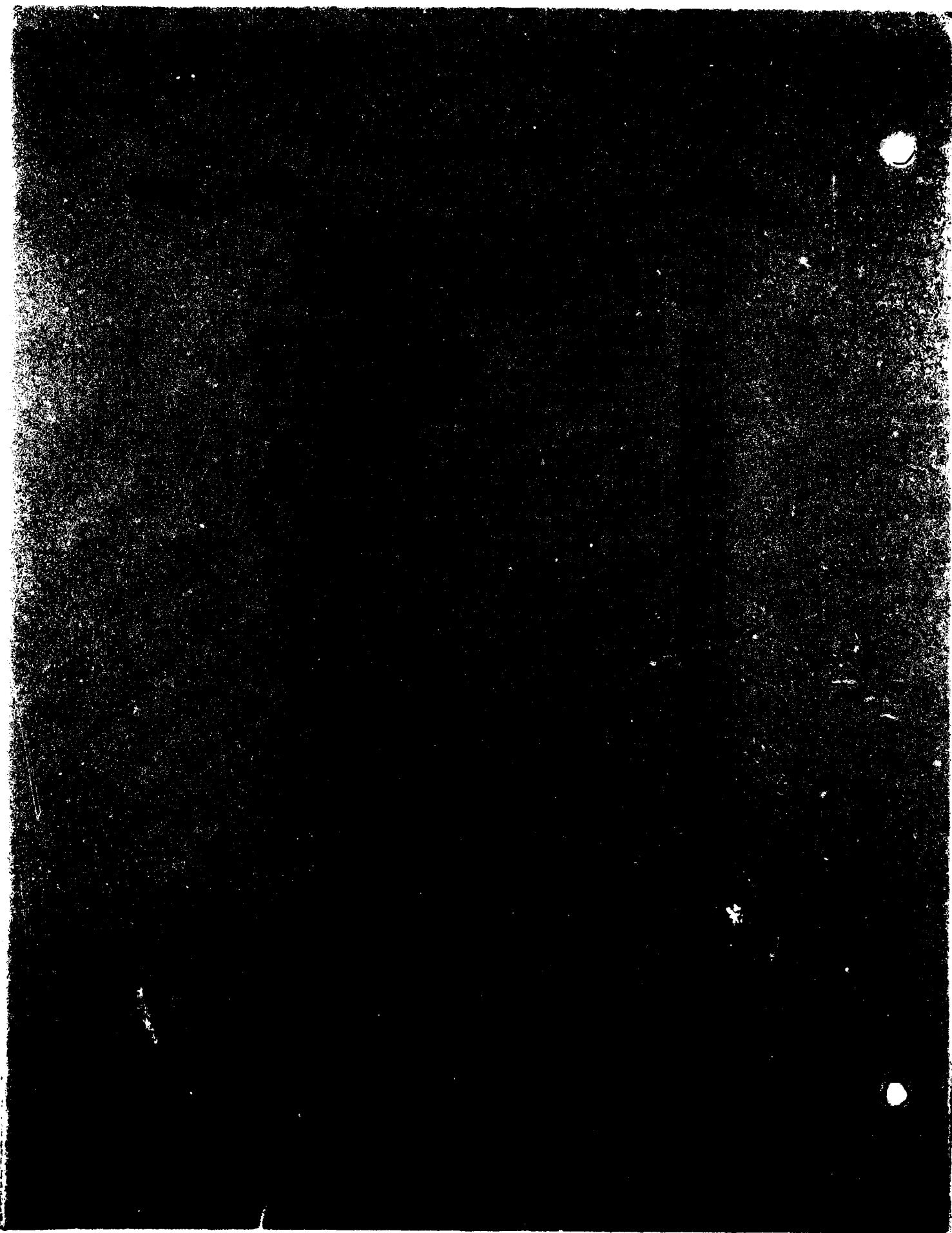
RELATIONSHIP OF THE PROPOSED GRAND BAYOU RESERVOIR TO ENVIRONMENTAL AND STATUTORY REQUIREMENTS

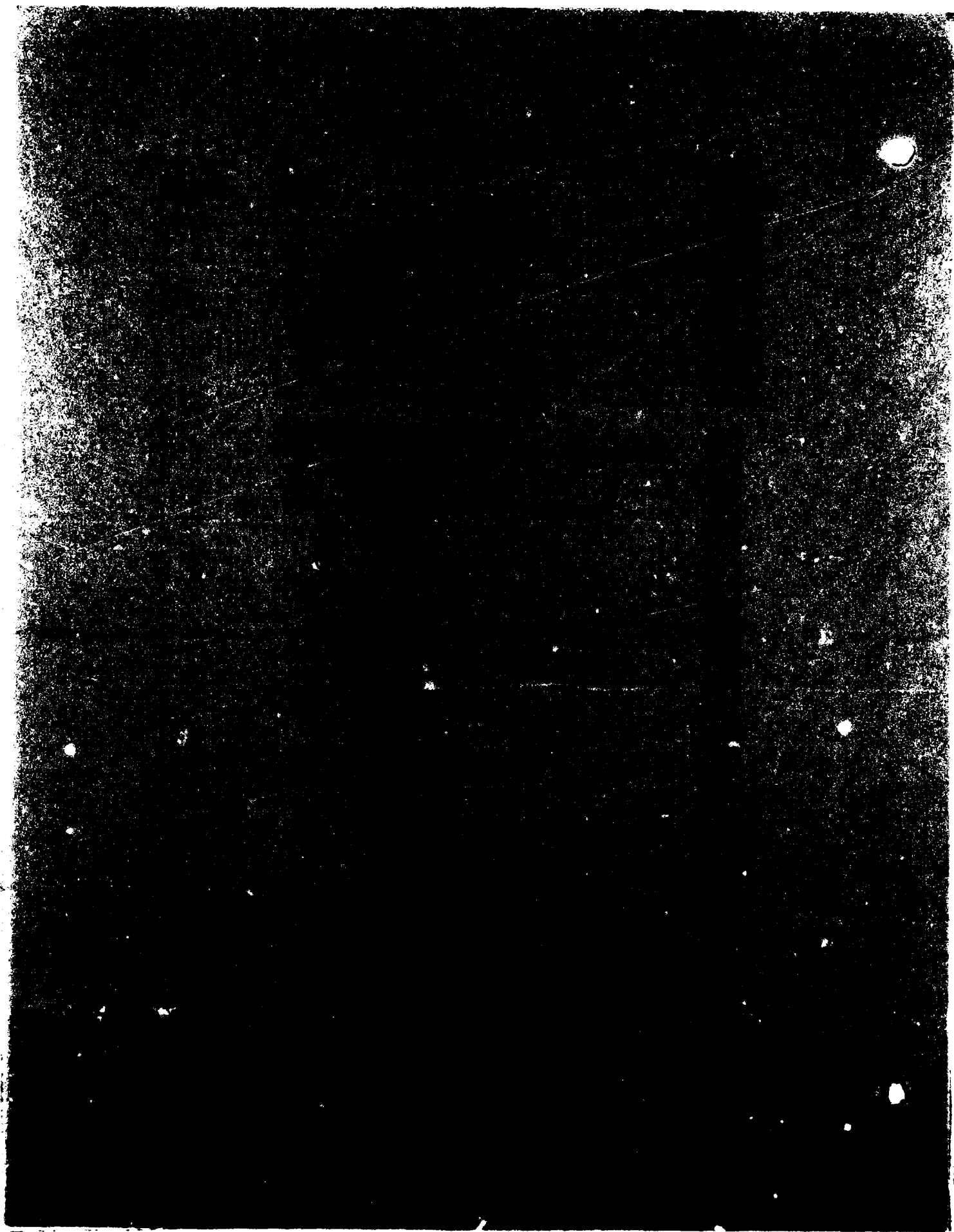
<u>Requirements</u>	<u>Alternatives</u>
Section 9 of River and Harbor Act (R&HA) of 3 March 1899	Not Applicable
Section 10, R&HA	Not Applicable
Section 11, R&HA	Not Applicable
Section 13 of R&HA	Not Applicable
Section 14 of R&HA	Not Applicable
Section 1 of the River and Harbor Act of 1902	Not Applicable
Section 404 of the Clean Water Act (CWA)	Full Compliance
The Marine Protection, Research and Sanctuaries Act	Not Applicable
Section 401 of CWA	Full Compliance
National Environmental Policy Act	Full Compliance
Fish and Wildlife Coordination Act	Full Compliance
Migratory Marine Game Fish Act	Not Applicable
Fish and Wildlife Act of 1956	Partial Compliance
Federal Power Act of 1929	Not Applicable
National Historic Preservation Act of 1966	Full Compliance
Interstate Land Sales Full Disclosure Act	Not Applicable
Endangered Species Act of 1973	Full Compliance
Deepwater Ports Act of 1974	Not Applicable
Marine Mammal Protection Act of 1972	Not Applicable
Wild and Scenic Rivers Act	Not Applicable
Land and Water Conservation Fund Act of 1965	Not Applicable

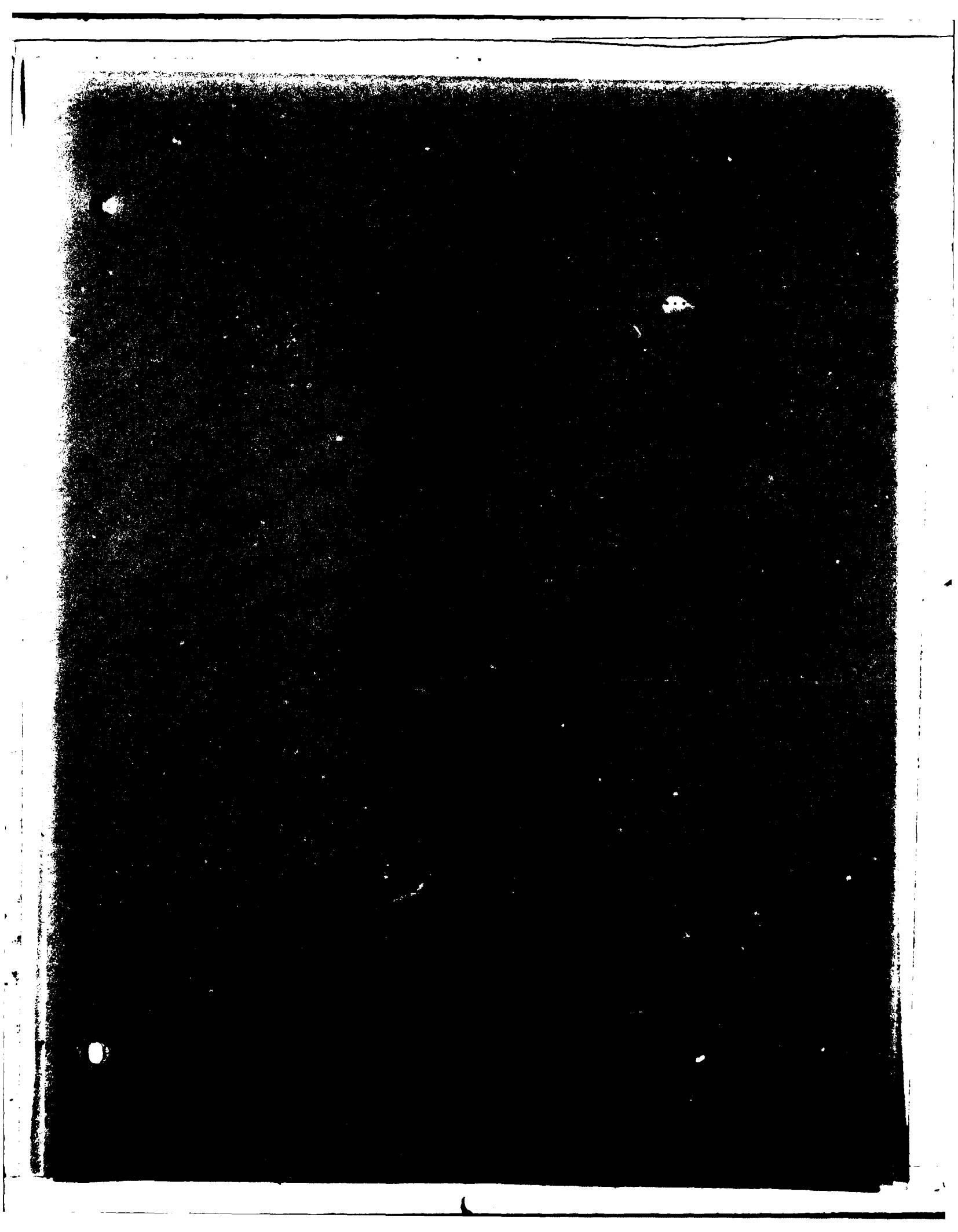
TABLE 3 CONTINUED

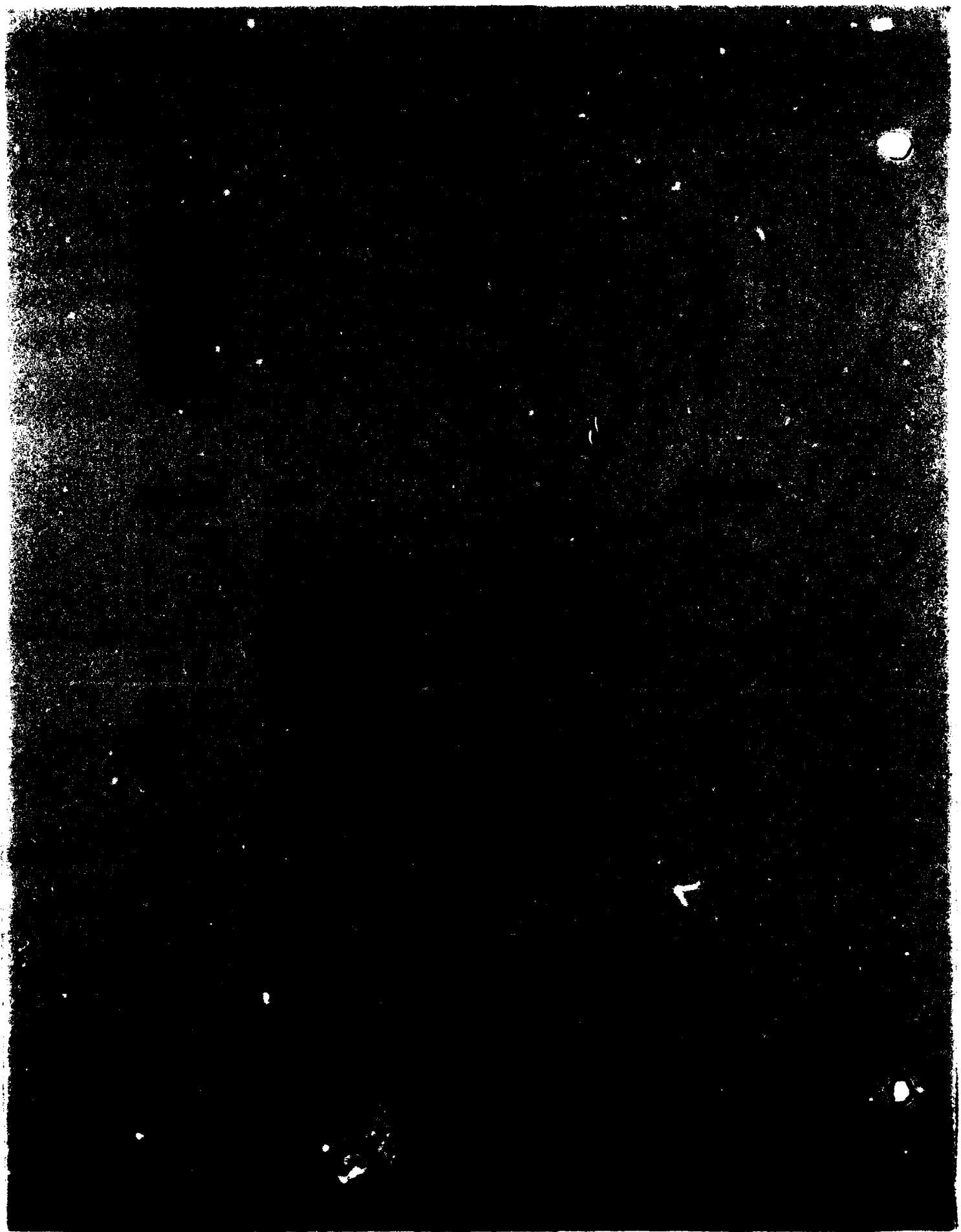
Clean Air Act	Full Compliance
Floodplain Management (E.O. 11988)	Partial Compliance
Louisiana Air Control Act	Full Compliance
Louisiana Archeological Treasure Act	Full Compliance
Louisiana Historic District Preservation Act	Not Applicable
Louisiana Scenic Streams Act	Full Compliance
Louisiana Coastal Zone Management Act	Not Applicable
Louisiana Coastal Zone Management Plan	Not Applicable
Area-wide Comprehensive Plan	Not Applicable

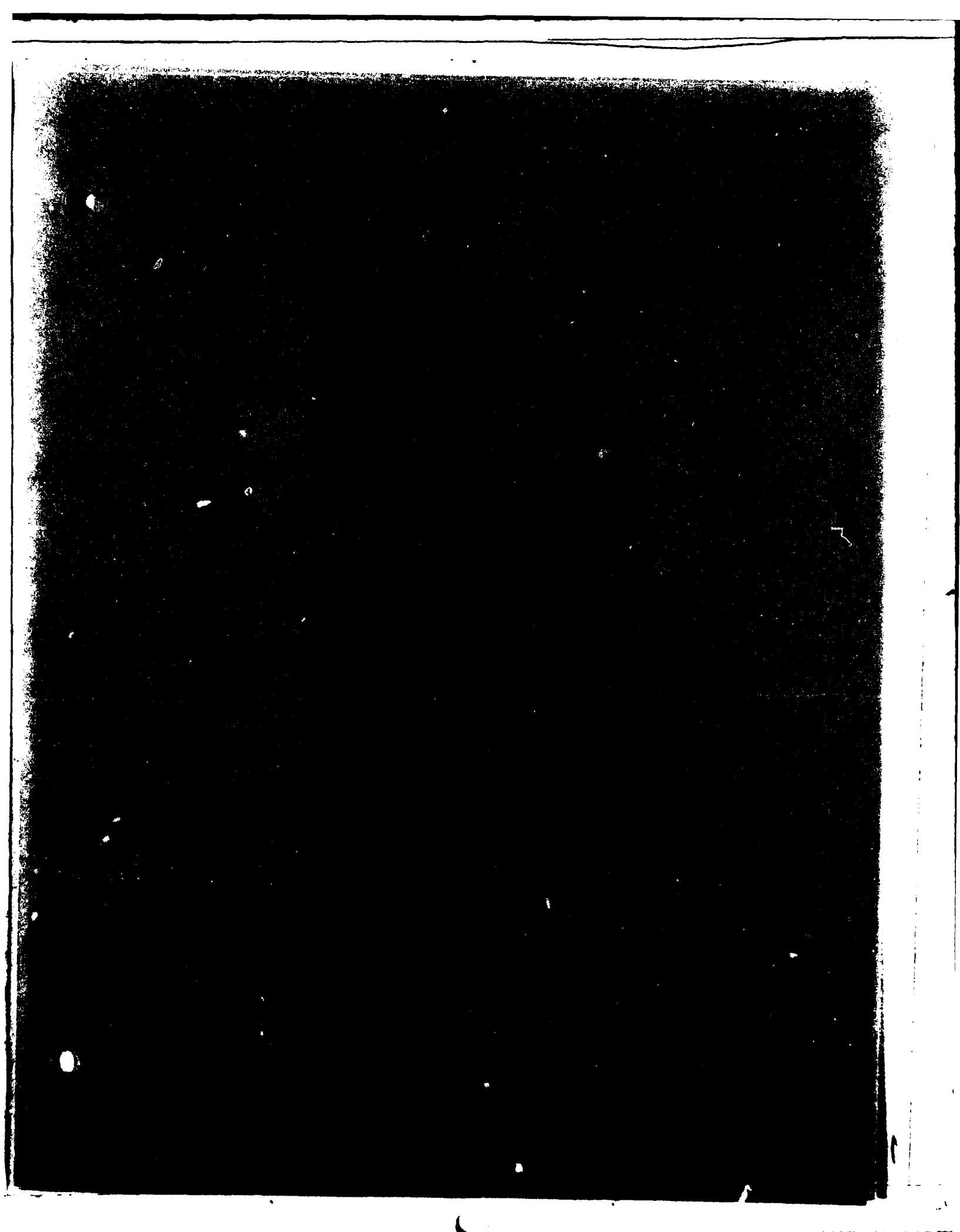


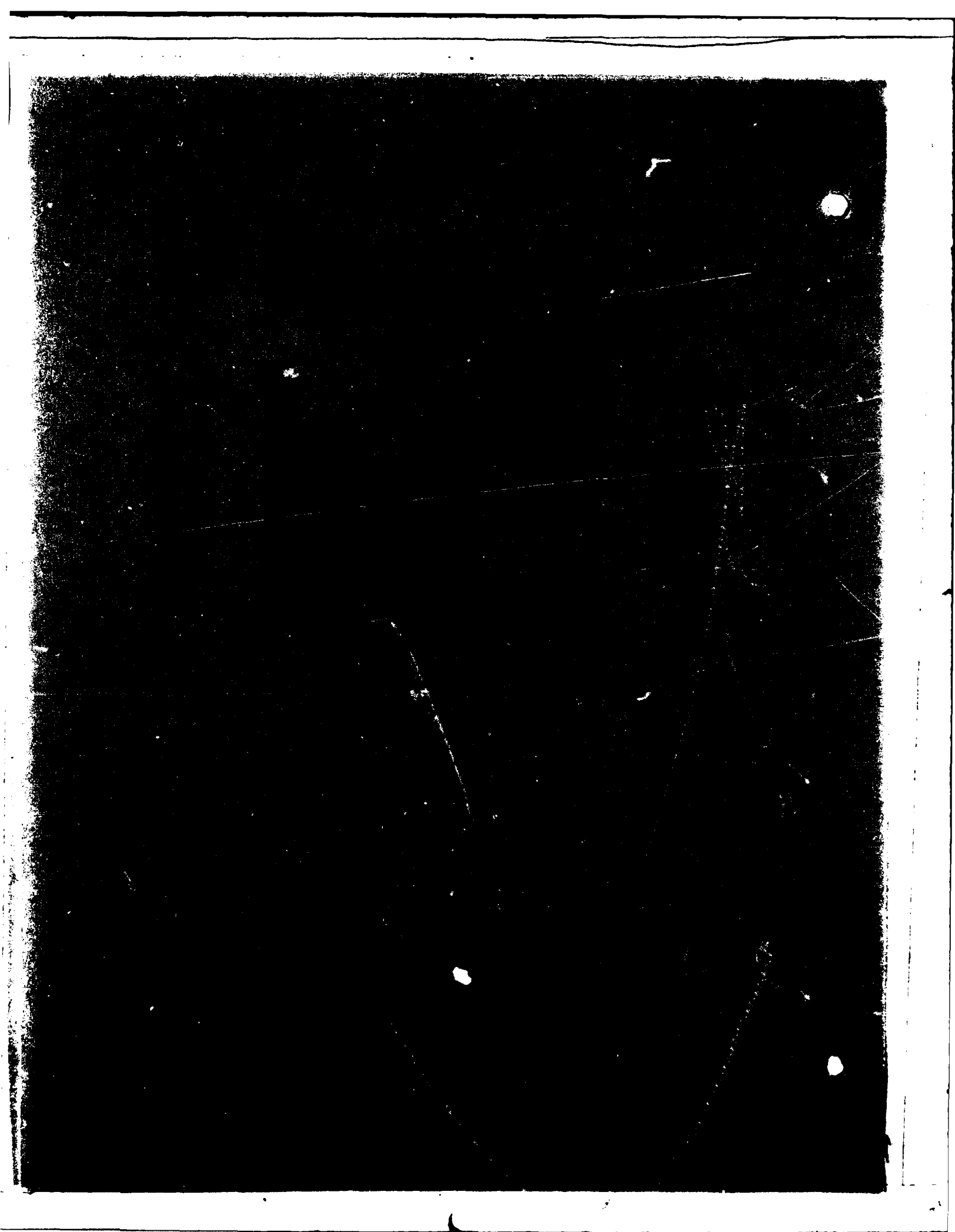












SECTION I

PURPOSE AND NEED FOR THE PROPOSAL

1.01 The applicant is the Black Lake Bayou Recreation and Water Conservation District of Red River Parish. The applicant's primary purpose and need is to provide public multi-purpose water supply in Red River Parish. A secondary benefit will be the creation of a water-related recreation facility.

If the Grand Bayou Reservoir alternative is selected, in addition to a water supply source, a potential for recreation will be created. The applicant recognizes the fact that recreation is incidental to the main purpose of this project, which is water supply. The recreation potential will be realized in a manner which would benefit the general public's use and enjoyment.

The applicant has submitted an application to the Department of the Army, Corps of Engineers, New Orleans District, for a Section 404 permit for the installation and maintenance of a dam, spillway, and appurtenances to form a reservoir on Grand Bayou, Red River Parish, Louisiana, toward the end of fulfilling the purpose and need set forth in the preceding paragraph. (See Appendix H).

On 20 February 1979, the applicant held a public meeting at the parish courthouse in Coushatta. The purpose of this meeting was to give all interested persons a chance to express their opinions of the water situation in the area. Several citizens complained about having to constantly replace plumbing fixtures due to the corrosive elements in the water. The manager of Coushatta's water system described the water situation as "ridiculous" because of the inadequate quantity of good quality water. He also stated that because of the inadequate quantity, especially during the summer, that Coushatta's fire rating was very poor, only one class above the worst rating. Many elected and appointed officials expressed their concern over industries refusing to locate in the area because of the inadequate water supply. It was reported in this meeting that Coushatta had lost 14 industrial prospects because of the limited water supply.

Two of the major industrial corporations, Sunbeam and Pineville Kraft, expressed their concerns over both quantity and quality of the water supply. Sunbeam is on the Coushatta water system but has to treat the water before it enters their plant. Also, in order to be assured of an adequate quantity, Sunbeam had to construct two storage tanks of 250,000 and 100,000 gallons capacity. Sunbeam has to rely on these tanks at least once a week because of pressure reductions in the town's system. Pineville Kraft Corporation is located in Coushatta but was denied permission to utilize the city's water system because of the quantity of water the plant would require. Consequently, Pineville Kraft drilled and maintains three onsite wells.

The annual water usage is not known since the wells are not metered. However, Pineville Kraft must analyze and treat (when necessary) their water an average of six times per day because of the fluctuations in the water quality. The hardness of the water at Pineville Kraft creates a "major expense" since the water must be treated to prevent excessive damage to the plant's boiler. (Please see Pineville Kraft letter in Appendix J.)

Mayor Truman Crawford, Coushatta, said on 20 February 1979, "The Town of Coushatta will experience a major growth impact due to the imminent mining of lignite coal in this region. The state of Louisiana through the Governor's office has predicted that as many as 17,000 new residents will come into this general area by the year 1990. Many of these people will come to Coushatta to live near the mine-mouth power plants. But, we do not have enough water to meet our current needs. There is a major water shortage here that we must solve immediately. Dr. Jackie Huckabay (owner of the hospital in Coushatta) has told me repeatedly that our water is not safe for human consumption."

Truman's concern is supported by the following data provided by the State of Louisiana.

- (1) The American-Canadian Coal Company (AMCA) and the Phillips Coal Company have purchased major coal leases and will begin mining in the area in the early 1980s. Phillips will directly employ 280 people, while AMCA will employ a minimum of 75 workers.
- (2) Cajun Electric Cooperative plans to build five power generators and to employ 1,792 workers for construction and operation by the year 1986.
- (3) Central Louisiana Electric Company and Southwest Electrical Power Company will build two power generators and employ 680 workers.
- (4) Dow Chemical and International Paper Company will employ a total of 675 workers by the year 1986.
- (5) Other major industries are expected to develop plants in the general region.

None of the industries cited above are expected to use water from the proposed Grand Bayou Reservoir. However, the additional population generated by these new industries will benefit from the implementation of this project.

Approximately one billion tons of lignite coal within a 50-mile radius of Coushatta will be mined and processed between 1982 and 2012, thus Coushatta is expected to be the center of rapid population growth. A public water supply is required to support the growth.

SECTION 2

ALTERNATIVES

2.01 ALTERNATIVES CONSIDERED IN THE SCOPING PROCESS

During the early scoping process, three general alternative sources of water to meet the applicant's purpose and need were identified. These include: groundwater, existing surface water, and surface water created by impoundment. The existing surface water category contains two sub-categories: (1) rivers and streams and (2) lakes and reservoirs. From this outline, source specific alternatives were identified (Table II-1).

The primary purpose of the proposed project is to provide a public multi-purpose water supply for the residents of Red River Parish. It is not uncommon, however for per capita water demand to increase somewhat when an adequate supply and distribution system is available. In light of the ever-increasing demand on existing water supplies from such diverse sources as industry, energy production, agriculture, recreation and fish and wildlife purposes it is imperative that regardless of the alternative selected every effort should be made to conserve water, reduce demand and improve efficiency.

These goals can be achieved by a combination of methods including:

- Installation of individual water meters and a periodic testing program to insure accuracy.
- Installation of a leak-free distribution system constructed with a pipe with a high "C" factor. The "C" factor determines to a large extent how easily the water flows through the pipe and consequently how much pump energy is required.
- Proper maintenance program to insure that leaks are detected and repaired quickly.
- Public awareness and education program. Informative brochures describing water conservation methods could be mailed to users in monthly billing statements.

Responsibility for these programs will be shared between the Black Lake Bayou Recreation and Water Conservation District and the individual water districts which purchase the water.

TABLE II-1

DERIVATION OF ALTERNATIVES CONSIDERED
IN THE SCOPING PROCESS

General Alternative Source	Source Specific Alternatives
A. <u>Groundwater</u>	1. Additional Wells
B. <u>Existing Surface Water</u> 1. Rivers/Streams 2. Lakes/Reservoirs	2. Red River 3. Toledo Bend Reservoir 4. Black Lake 5. Lake Bistineau
C. <u>New Surface Water</u>	6. Grand Bayou Reservoir
D. <u>Combinations</u>	7. Grand Bayou Reservoir plus pipeline from Lake Bistineau 8. Grand Bayou Reservoir plus pipeline from Black Lake 9. Grand Bayou Reservoir plus existing wells 10. Grand Bayou Reservoir plus Red River 11. Grand Bayou Reservoir plus existing wells plus Red River
E. No Action	12. No Action

The following alternatives have been eliminated from detailed evaluation for the reasons stated under each alternative.

a. Alternatives Eliminated From Detailed Study

(1) Additional Wells. All existing public water supply sources in Red River Parish come from wells. The largest system in the parish is the Coushatta water system which is owned by the Town of Coushatta and operated by the Central Louisiana Electric Company (CLECO). The Office of Public Works, Louisiana DOTD, in cooperation with the U.S. Geological Survey, Water Resources Division, has drilled twenty-six test wells in eastern Red River Parish near Coushatta since 1967 (Plate II-1). The purpose of this extensive drilling was to locate additional groundwater for municipal and industrial supply. Of the twenty-six test wells, eight (8) or 30% could not produce water. Six (6) or 23% produced less than 12 gallons per minute (gpm). Four (4) of these six (6) produced 4 gpm or less (Table II-2).

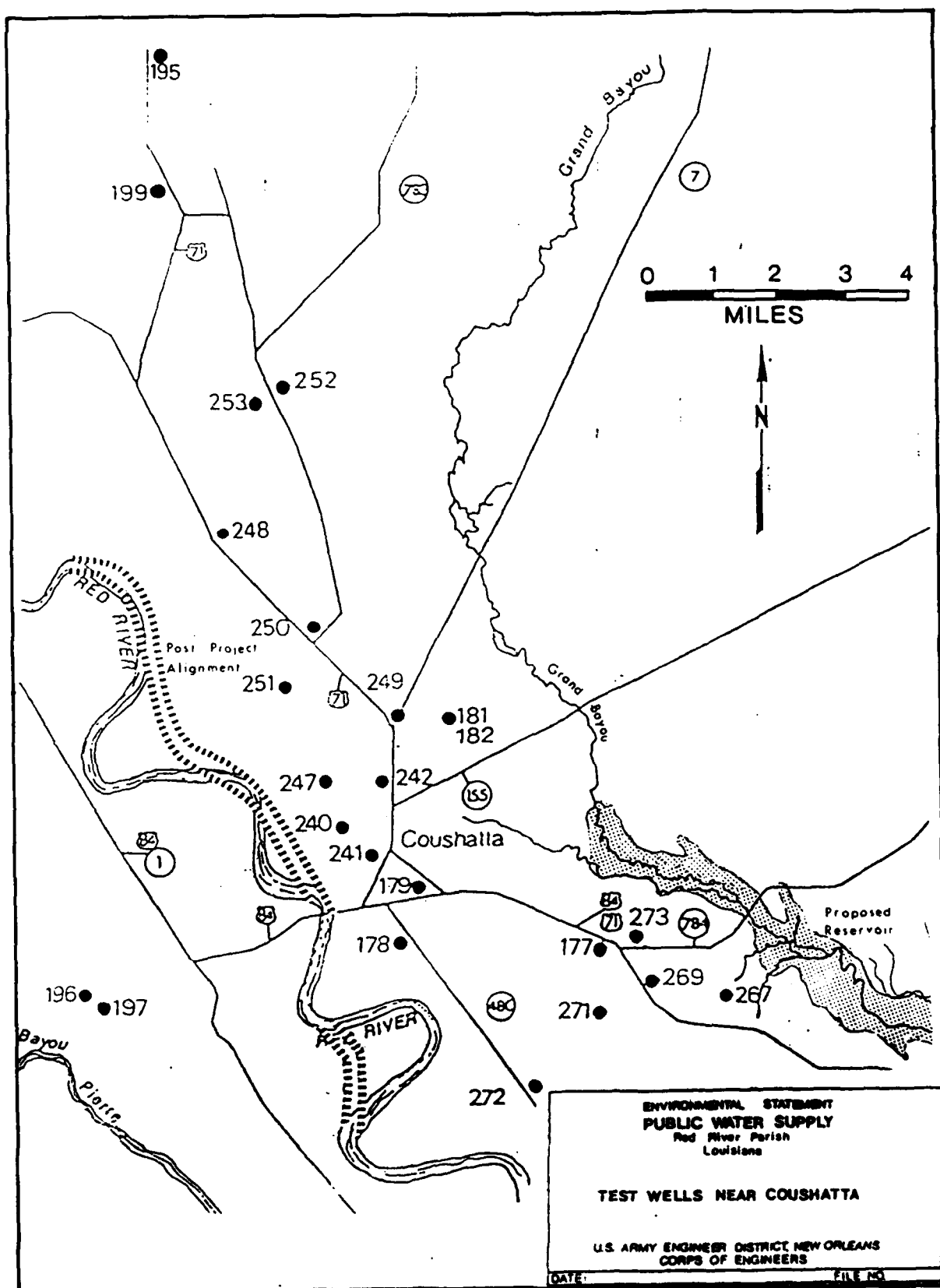
The remaining 12 wells tested produced within a range of 17 to 50 gpm with an average flow of approximately 30 gpm. At this rate of flow, it would require about 130 wells to meet the ultimate demand of 5.57 mgd. The water-bearing sands in this area (Wilcox Formation) are lenticular in nature and are thus sporadically spaced. The strategic difficulties of operating and maintaining up to 130 motors, pumps, and controls in remote locations, plus the extensive collection system which would be required to bring the water to a central treatment plant render this alternative not feasible.

The Louisiana Department of Transportation and Development (DOTD), Office of Public Works, classified only seven of the twelve wells mentioned above as having a "good" reliability.

If the water produced from these wells was unusually pure and clean, the reduced cost of the required treatment would help in reducing the costs of such a system; however, the twelve wells with significant water production exhibited a range of treatment problems such as high chlorides and pH values. Thus, extensive treatment would be required of the water from these wells.

Groundwater from the Red River alluvium is available in substantial quantities, but is primarily limited to non-potable uses such as irrigation. Following is a quotation from the 1962 USGS and Office of Public Works (DOTD) report entitled, "Water Resources in Red River Parish, Louisiana."

"The extremely hard iron-bearing water from the alluvium of the Red River Valley has a distinctive chemical composition. It contains an unusually high percentage of bicarbonate for a water of the calcium-magnesium type. The dissolved-solids content is also high, and the water generally is not considered potable. As indicated by the analysis in Table 11, the hardness averages



Source: Louisiana Department of Transportation and Development, Office of Public Works, 1979.

II-4

PLATE II-1

TEST HOLES AND WELLS - RED RIVER PARISH

II-5

TABLE II-2

TEST HOLES AND WELLS - RED RIVER PARISH
(Continued)

Drilling	199	240	241	242	247	248	249	250	251
Depth	234	300	280	300	306		315		279
Well Depth	90	227	160	285	196		120		180
Strat. Unit	Fleis Terrace	Wilcox	Wilcox	Wilcox	Wilcox		Wilcox		Wilcox
Test Date	11/6/69	4/17/75	4/17/75	4/17/75	6/19/75		6/25/75		7/03/75
Sand Thick- ness (Ft.)	71	47	11	91	40		18		15
Screened									
Interval	80-90	217-227	150-160	275-285	186-196		110-120		170-180
Yield (gpm)	43	39.5	20	24	43		50		37.5
Trans (gpd/ft)	-	3600	730	-	-		10600		2400
Perm (gpd/ft ²)	-	76	66	-	80		600		160
Reliability	-	Good	Good	UNR	Good		Fair		Fair
Water Sample									
Temp (°F)	-	70	70	73.5	67		65		6.8
Color	-0-	-0-	-0-	-0-	-0-		-0-		-0-
Odor	-0-	-0-	-0-	-0-	-0-		-0-		-0-
Taste	-0-	-0-	-0-	OK	-0-		-0-		-0-
pH	7.3	7.9	7.7	8.5	7.9		7.1		7.3
Chloride (ppm)	16	110	8.2	260	88		13		98
Hardness (ppm)	24	55	150	8	130		34		74
Fe (ppm)	±0.68	0.08	0.31	0.06	0.13		1.5		0.1
CO ₃ (ppm)	-0-	-0-	-0-	11	-		-		-
NO ₃ (ppm)	44	285	340	482	-		-		-
SO ₄ (ppm)	9.4	-0-	16	-0-	-		-		-
Fluoride (ppm)	0.1	0.5	0.5	0.9	0.1		0.2		0.2
NO ₂ (ppm)	-0-	0.68	0.1	0.24	-		-		-
Na (ppm)	20	160	120	350	-		-		-
K (ppm)	1.6	4.2	1.3	1.6	-		-		-

NO WATER

NO WATER

TABLE II-2

TEST HOLES AND WELLS - RED RIVER PARISH
(Continued)

Drilling	252	253	267A	267B	269	271	272	273A	273B
Depth	256	279	293	293	305	317	306	292	292
Well Depth	123	165	120	201	210	160		65	248
Strat. Unit	Wilcox	Wilcox	Wilcox	Wilcox	Wilcox	Wilcox		Upland	Wilcox
Test Date	7/17/75	7/25/75	7/26/75	7/11/78	8/7/78	8/18/78		9/22/78	9/18/78
Send Thick-									
ness (Ft.)	20	20	25	55	131	38		41	21 + 15
Screened									
Interval	110-130	155-165	110-120	161-181	155-210	122-160		55-65	200-248
Yield (gpm)	2	4	1	17.3	25	25.5		11	9.6
Trans (gpd/ft)	-	-	-	300	1000	725		-	-
Perm (gpd/ft ²)	-	-	-	5.5	18	20		-	-
Reliability	-	-	UNR	Good	Good	Fair	NO WATER	UNR	Questionable
Water Sample									
Temp (°F)	-	-	-	*69	*70	*69		-	-
Color	-0-	-0-	-0-	-0-	Slightly Cloudy	Cloudy		-0-	-0-
Odor	Slight H ₂ S	-0-	Some	-0-	Sulfur	Slight Sulfur		-0-	-0-
Taste	-0-	Good	Bad	Good	Sulfur	Good		-0-	OK
pH	*7.2	-	8.0	8.3	8.2	8.3		5.5	8.5
Chloride (ppm)	*52	*52	6.2	14	14	12		14	85
Hardness (CaCO ₃)	*28	*6	110	12	5	10		18	20
Fe (ppm)	*0.45	0.1	2.1	0.04	0.08	0.6		0.19	0.05
CO ₃ (ppm)	-	-	-0-	-0-	-0-	-0-		-0-	10
HCO ₃ (ppm)	-	-	174	210	256	254		22	438
SO ₄ (ppm)	-	-	3.4	0.4	0.2	0.2		2	-0-
Fluoride (ppm)	-	-	0.1	0.2	0.3	0.4		0.1	1.2
NO ₃ (ppm)	-	-	0.54	0.6	0.3	0.2		2.3	0.3
Na (ppm)	-	-	21	81	100	100		11	220
K (ppm)	-	-	2.5	2.2	1.2	1.5		1.5	2.4

TABLE II-2

TEST HOLES AND WELLS - RED RIVER PARISH

LEGEND

Source: Louisiana Department of Transportation and Development

UNR* = Unreliable
- = No Test
* = Field Result
No Data = -----

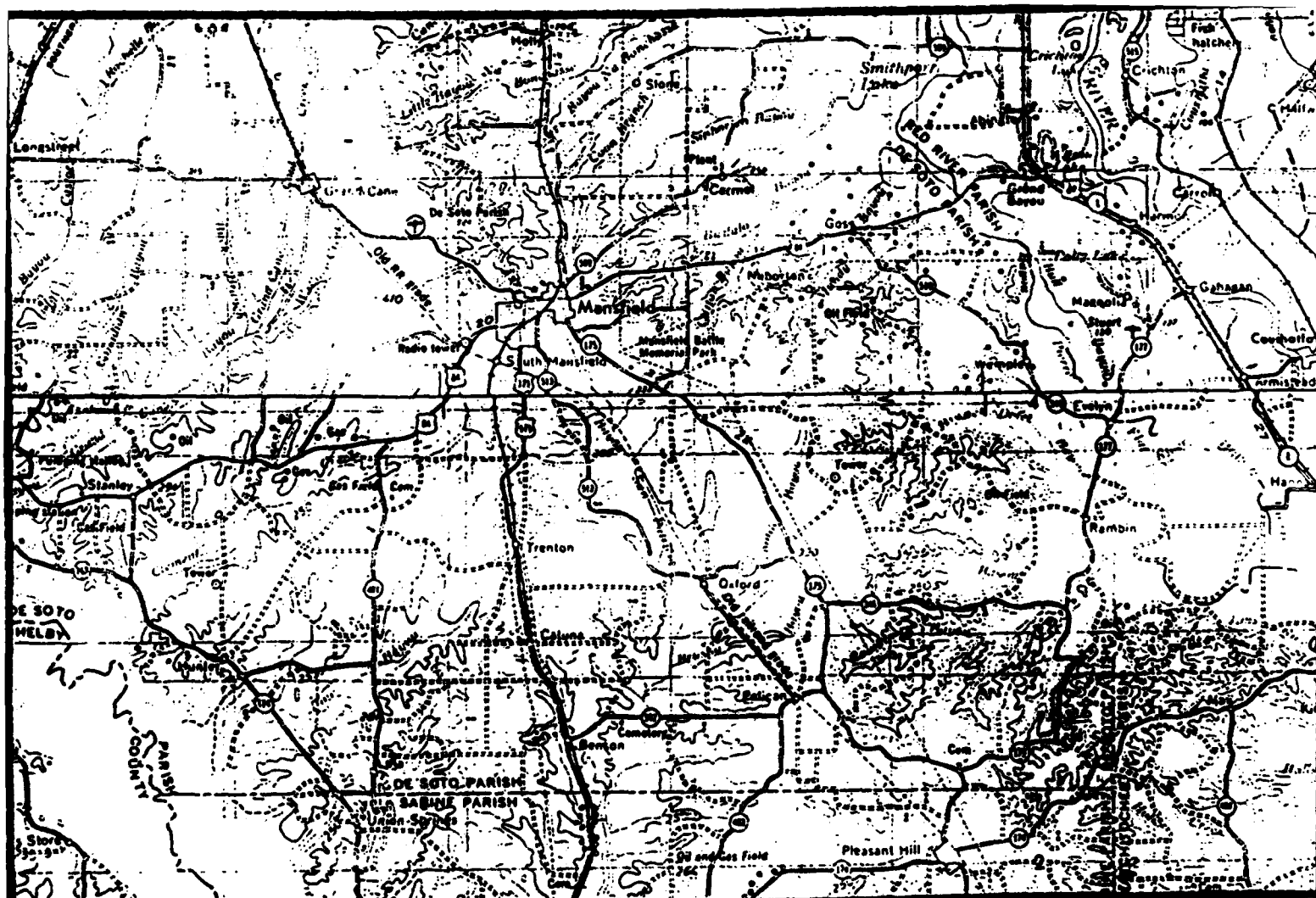
about 500 parts per million (ppm) and the iron content about 6 ppm. The water tends to be alkaline because the pH is above 7.0. The hardness and high iron content may be attributed to passage of the water through the iron-bearing calcareous sediments of red materials overlying the aquifer."

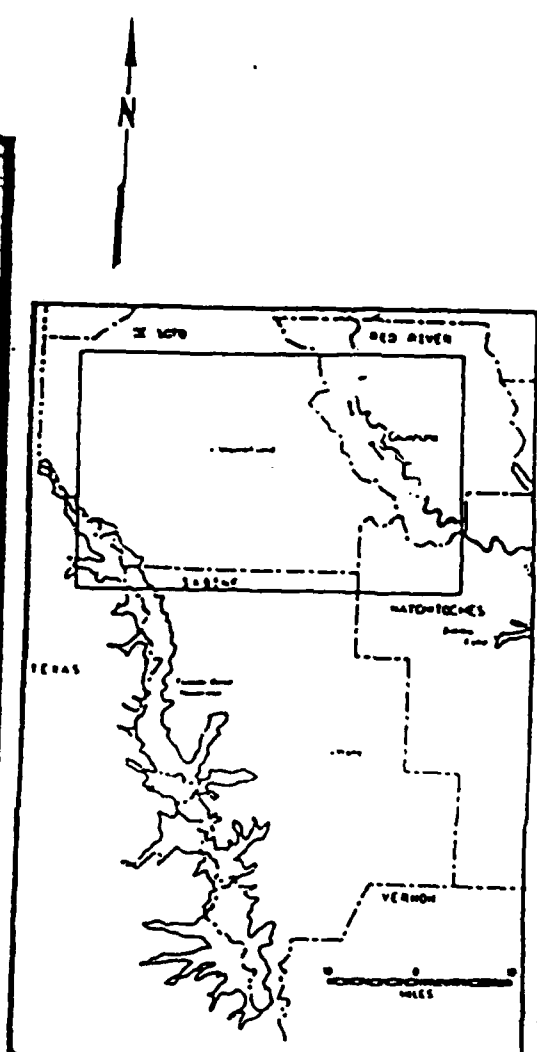
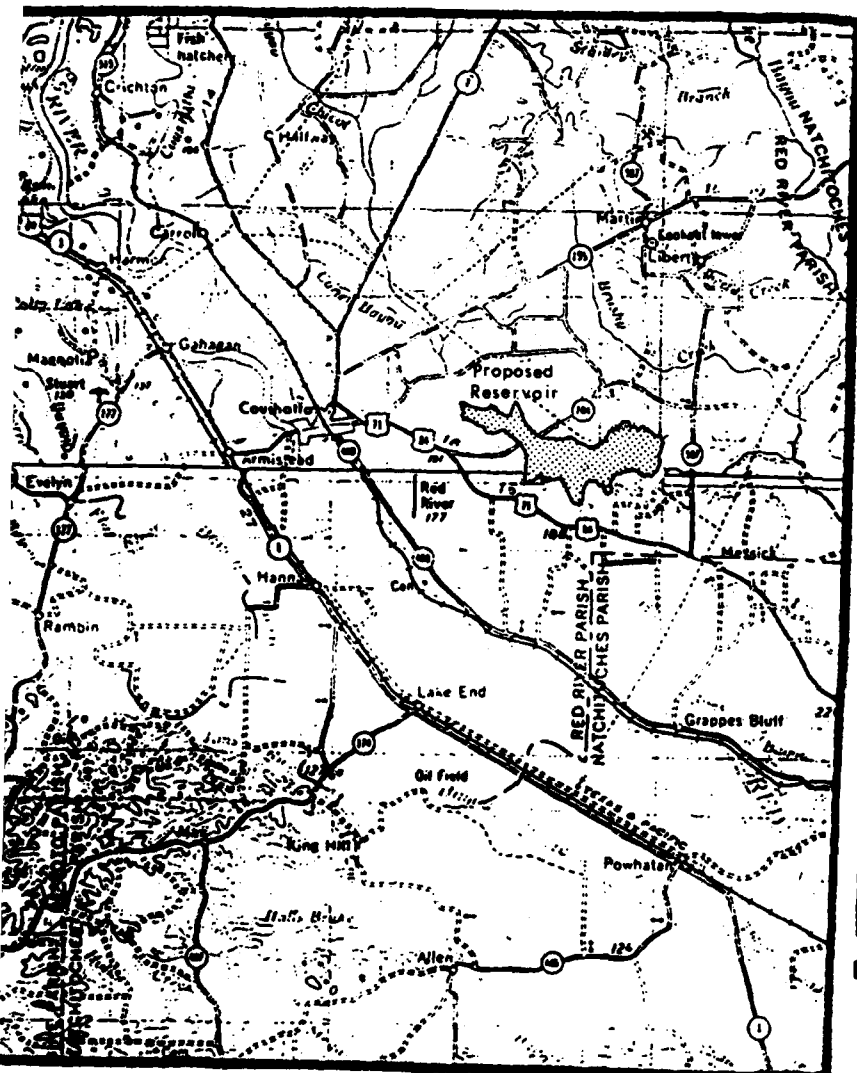
(2) Toledo Bend Reservoir. A pipeline from Toledo Bend Reservoir to Red River Parish east of the Red River was discussed as a possible alternative. This alternative was deleted from detailed study by the U.S. Corps of Engineers in the scoping process due to problems relative to the distance involved (approximately 32 miles) and because of physical obstacles. To support a transmission system from Toledo Bend Reservoir would require placement of pumping stations to carry water from the east to the west side of the Dolet Hills, and then across two navigable streams, Bayou Pierre and the Red River (Plate II-2).

(3) Lake Bistineau. Lake Bistineau is located approximately 22 miles north of Coushatta along the boundaries of Webster, Bossier, and Bienville Parishes. The reservoir was constructed for recreation and conservation purposes. The applicant requested permission from the controlling agency, the Louisiana Department of Wildlife and Fisheries, to withdraw water from Lake Bistineau for a municipal and industrial water supply for Red River Parish. A letter dated 27 March 1980 from Mr. J. Burton Angelle, Secretary of the Louisiana Department of Wildlife and Fisheries, states that Lake Bistineau, "Provides very high quality recreation and the Louisiana Department of Wildlife and Fisheries can not allow the use of the lake in any manner which might jeopardize this activity." A copy of the referenced letter is contained in Appendix J.

(4) Black Lake. Black Lake is located in Natchitoches Parish, approximately 15 miles east-southeast of Coushatta. Black Lake is a 13,500 acre lake constructed for conservation and recreational purposes. The Black Lake Bayou Recreation and Water Conservation District of Red River Parish submitted a written request to the controlling agency, the Northwest Louisiana Fish and Game Preserve Commission, for permission to buy and withdraw water from Black Lake. The Commission members refused to commit any water from Black Lake for the Red River Parish public water supply due to the "current water demands within Natchitoches Parish by users and prospective need for the water in the future." A copy of the letter from the Commission is included in Appendix J.

(5) Grand Bayou Reservoir Plus a Pipeline from Lake Bistineau. This alternative, if it were feasible, would allow reduction in the size of the Grand Bayou Reservoir. Such a system would require the design, construction, and maintenance of two systems with the attendant costs. However, this alternative could not be pursued because





LOCATION MAP

ENVIRONMENTAL STATEMENT
 PUBLIC WATER SUPPLY
 Red River Parish
 Louisiana

LOCATION PLAN
 TOLEDO BEND RESERVOIR
 COUSHATTA

U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
 CORPS OF ENGINEERS

②

permission was refused by the Louisiana Department of Wildlife and Fisheries allowing any water to be drawn from the Lake.

(6) Grand Bayou Reservoir Plus a Pipeline from Black Lake. This alternative was determined not to be feasible because the Northwest Louisiana Fish and Game Preserve Commission will not allow the applicant to draw any water from the Lake. The same problems exist with respect to this alternative as with the alternative discussed in the previous paragraph concerning Lake Bistineau.

(7) Grand Bayou Reservoir Plus Existing Wells. The five existing water supply systems in Red River Parish derive a quantity of water from wells equal to approximately seven percent of the design capacity of the proposed Grand Bayou Reservoir. Hence, consideration of the existing wells as an alternative source along with Grand Bayou Reservoir does not appear feasible. Rather than combining the two sources and reducing the size of the Grand Bayou Reservoir, the applicant prefers to develop as much capacity as is practical within the current design parameters for Grand Bayou Reservoir and the capacities of the existing wells. The duration of water production from the wells is uncertain, but because they are in place, they could remain connected to the system with little or no modification. Existing wells in the parish have often experienced overpumpage with resultant salt infiltration. Health officials in the parish have complained about the poor quality of well water. (See letter from Dr. Jackie Huckabay of Coushatta in Appendix J.) The reliable quantity and quality of water from Grand Bayou Reservoir would reduce the withdrawal required from the wells making it possible to use smaller pumps and motors or to install timers so that the existing system would work only periodically in the future. These wells would have extended life when used periodically and would provide a source of "standby" water for possible emergency conditions such as malfunctions at the Grand Bayou Reservoir, extreme drought periods, pipeline breakages, or other interruptions of the supply from Grand Bayou Reservoir.

The chemical analysis of the well water (Table II-2, typical) and Grand Bayou water (Table III-2) show the chemical properties of both potential water supplies.

(8) Grand Bayou Reservoir Plus Red River. A combination of the Red River and Grand Bayou would cost more than either alternative would cost separately. This is due to the fact that construction of a reservoir includes appreciable costs which are not significantly reduced by size reduction. Further, the construction of a smaller reservoir would not result in the saving of many acres of bottomland hardwoods. Additionally, the development of two systems would necessitate two major pipelines, extra pumping stations, extra rights-of-way, storage facilities, and increased maintenance and operational expenses. The relative percentages of water to be taken from each source, and thus the size of the reservoir required, is difficult to ascertain in the absence of a detailed engineering feasibility study.

In view of the complexities involved and the potentially excessive costs, this alternative is considered to be not reasonable. Subsequently, however, each is analyzed in detail in this report.

(9) Grand Bayou Reservoir Plus Existing Wells Plus Red River. This alternative would pair the two combinations of alternatives listed and discussed previously. It would be more complex and potentially more expensive than other alternatives considered, therefore, it is also deemed unfeasible.

b. Reasonable Alternatives. The U.S. Corps of Engineers identified two reasonable alternatives:

- (1) Withdrawal of water from the Red River (See Appendix I)
- (2) Construction of a reservoir on Grand Bayou

These alternatives were deemed reasonable from the standpoint that each appears to have the potential water supply to meet the applicant's purpose and need, and each is within a reasonable distance of the project area (Red River Parish). Refer to Plate II-3.

c. No Action Alternative. The No Action alternative will leave Red River Parish without an adequate public water supply in the face of rapid economic, industrial, and attendant population growth during the decade of the 1980's and 1990's, resulting from planned extensive lignite coal mining and processing in the area. But, even if the area did not expect substantial growth in the immediate future, without a reliable, sanitary, safe water supply, the area would be adversely impacted.

2.02 RELATION OF THE REASONABLE ALTERNATIVES TO THE APPLICANT'S PURPOSE AND NEED

The applicant's purpose and need is to obtain a source of multipurpose water supply. Both the Grand Bayou Reservoir and Red River alternatives have the potential to meet this purpose and need. Recreational opportunities, although incidental to this project, will also be available from the reservoir. Implementation of the Red River waterway project will provide ample recreational facilities in the area.

a. Potential of Alternatives to Provide for Municipal and Industrial Water Supply. Both of the reasonable alternatives have the potential to supply the quantity of water needed. See Table II-3.

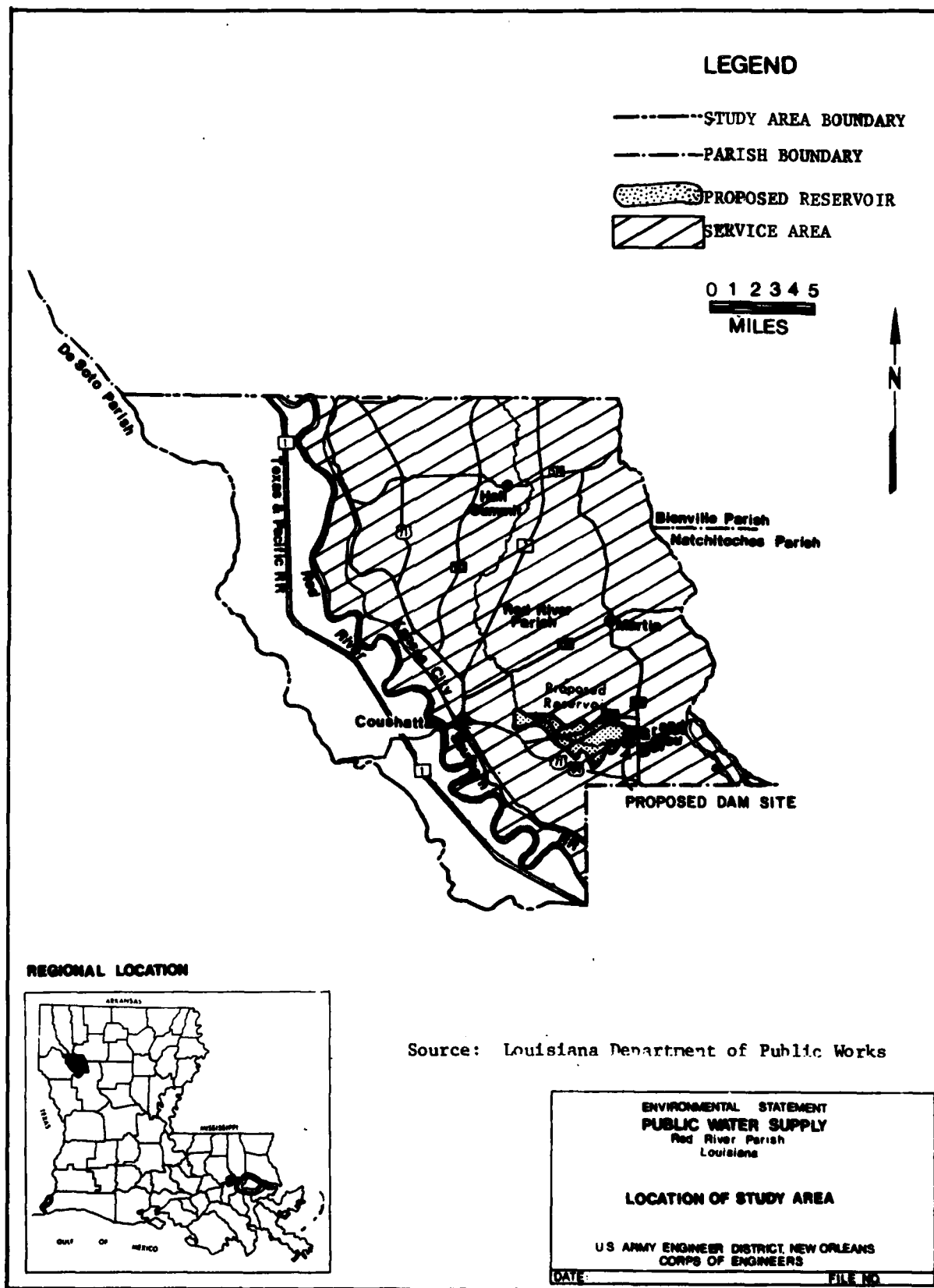


TABLE II-3

**RANKING OF ALTERNATIVES IN RELATION
TO PROJECT REQUIREMENTS**

ALTERNATIVE NAME	SUITABILITY FOR PUBLIC WATER SUPPLY		RECREATIONAL BENEFITS INCIDENTAL TO PROJECT
	QUANTITY	QUALITY	
Red River	Good	Poor	No
Grand Bayou	Good	Good	Yes, Fishing & Hunting
No Action	Poor	Poor	Red River Waterway Project will provide significant recrea- tional facilities on the river near Coushatta

b. Potential of Alternatives to Provide for Recreation. The Grand Bayou Reservoir alternative will provide some recreational value by the fact of its existence, though the purpose of the reservoir is not a recreational one.

The Red River and Grand Bayou alternatives include facilities such as intake structures, pumping stations, and force mains which will convey water into water distribution systems. Neither one of the conveyance facilities will provide recreational opportunities. However, the Red River waterway project, expected to be completed in 1984, will provide recreational facilities near Coushatta.

2.03 COMPARATIVE IMPACTS AMONG ALTERNATIVES

Each of the two reasonable alternatives and the No Action alternative are compared in terms of:

1. Water quality
2. Habitat modification
3. Short-term and long-term pollution
4. Transportation system modifications
5. Displacement of households, churches, and cemeteries
6. Indirect economic benefits.

a. Water Quality Among Alternatives. Water from the Red River is least desirable as a public water supply (Table II-4). The Grand Bayou alternative contains a good water quality. The No Action alternative offers no solution to the need for public water supply.

b. Habitat Modifications Among Alternatives. The Grand Bayou Reservoir would be the most detrimental to bottomland hardwoods (Table II-5). On the other hand, the proposed reservoir would create more habitat for waterfowl and fish than the other alternatives. The pipeline right-of-way could be directed in a route that would be least detrimental to the vegetational communities. A pipeline from Red River would produce forest-edge habitats. With proper restrictions, the Grand Bayou Reservoir could produce a forest-edge habitat also.

TABLE II-4

WATER QUALITY AMONG ALTERNATIVES

ALTERNATIVE	GENERAL QUALITY	PROBLEMATIC PARAMETERS
Red River	Poor	Coliform, iron, dissolved solids, hardness, phosphates, sulfates, turbidity
Grand Bayou	Good	Coliform, dissolved oxygen during low flow periods in late summer
No Action	Fair	Iron, chloride

TABLE II-5
HABITAT MODIFICATIONS AMONG ALTERNATIVES

ALTERNATIVE	DETRIMENTAL	BENEFICIAL
Red River	Requires 85 Acres of land for a settling pond	None
Grand Bayou	Inundation of 2036 acres bottomland hardwoods; 568 acres pine hardwoods; possible deterioration of wetlands below dam site; eutrophication	400-500 acres of waterfowl habitat; 2700 acres fisheries habitat; 62 acres forest edge habitat
No Action	None	None

c. Short-Term and Long-Term Pollution Impacts Among Alternatives. With the exception of the No Action alternative, both of the alternatives will create short-term noise and air pollution during construction (Table II-6). Erosion and sedimentation will also be a short-term impact of construction with all of the alternatives except No Action. Sludge from the water treatment plant will be the major long-term impact that would result from the Red River alternative. An estimated five tons of processed sludge per day must be disposed of in an acceptable lagoon or sanitary landfill. (Based on a treatment plant capable of treating 5.57 mgd an estimated 60,000 gpd at approximately two percent concentration will be produced.) These projections are based on data received from Bossier City, Louisiana, where Red River is treated and used. Pipeline right-of-way maintenance (cutting and spraying) will be required for both the Red River and the Grand Bayou alternatives. Red River alternative involves 10+ miles of force main while Grand Bayou reservoir involves 5+ miles of force main. Noise, air, solid waste, and water pollution, as well as erosion and sedimentation, are long-term effects of the proposed reservoir. The No Action alternative will have no long-term pollution impact upon the environment.

TABLE II-6

SHORT-TERM AND LONG-TERM
POLLUTION IMPACTS AMONG ALTERNATIVES

ALTERNATIVE	SHORT-TERM	LONG-TERM
Red River	Noise, air, sedimentation and erosion from construction	Water treatment process sludge disposal, pipeline right-of maintenance
Grand Bayou	Noise, air, sedimentation and erosion from construction	Noise, air, sedimentation and erosion, solid waste, and water pollution from induced recreation development, pipeline right-of-way maintenance.
No Action	None	None

d. Transportation and Transmission System Modifications Among Alternatives. The Grand Bayou Reservoir alternative will require the most extensive modifications. During construction of the reservoir, two roads and seven bridges would require new structures; one-20" products and one-14" products pipelines would require weighting or realignment; and one electrical transmission powerline would require relocation. The Red River alternative should not require modification to any existing transportation or transmission system; however, because a final site selection for this alternative has not been made, modifications could be necessary. Table II-7 is a summary of the modifications that would be required if any of the alternatives were implemented.

e. Displacements of Households, Churches, and Cemeteries Among Alternatives. The only alternative which will cause a displacement is Grand Bayou. Five households will be displaced as a result of the proposed reservoir, if it is constructed (Table II-8). No cemeteries or churches will be displaced by the reservoir. No displacements are expected for the Red River alternative since a pipeline can be routed to minimize or delete these impacts.

TABLE II-7

TRANSPORTATION AND TRANSMISSION SYSTEM
MODIFICATIONS AMONG ALTERNATIVES

Alternative	Highways	Bridges	Pipelines	Railroads	Powerlines
Red River	None	None	None	None	None
Grand Bayou	1 State Hwy. (#784) raised, 1 parish road raised (Esperanza Road)	Total of seven bridges to be replaced with 3 bridges	1-20" Products, 1-14" Products to be weighted or rerouted	None	1 to be re- located (CLECO)
No Action	None	None	None	None	None

f. Indirect Economic Benefits Among Alternatives. Construction of a new reservoir on Grand Bayou would precipitate an increase in the land value of immediately surrounding areas. Land which is only marginally attractive could become a prime site for homes and campsites after construction of the reservoir.

TABLE II-8

DISPLACEMENT OF HOUSEHOLDS,
CHURCHES AND CEMETERIES AMONG ALTERNATIVES

Alternative	Households	Churches	Cemeteries
Red River	None	None	None
Grand Bayou	Five	None	None
No Action	None	None	None

Documentation showing the increase in surrounding land value caused by reservoir construction in several areas is provided in Section 4.02-a.(5).

g. Archeological/Cultural Impacts Among Alternatives. Direct and indirect impacts among the three alternatives are shown in Table II-9. No direct impacts are listed for the pipeline route because the route has not been specifically located yet. Once the corridor is chosen, a full archeological analysis will be made and appropriate actions taken.

TABLE II-9

NUMBER OF KNOWN ARCHEOLOGICAL SITES AMONG
ALTERNATIVES THAT WILL BE DIRECTLY OR
INDIRECTLY IMPACTED

Alternative	Direct	Indirect
Red River	None	Some possible
Grand Bayou	23	9
No Action	None	None

2.04 COMBINATION OF ALTERNATIVES

The two alternatives under consideration, withdrawal of water from Red River and construction of a reservoir on Grand Bayou, are each capable of supplying the total projected water demand. Thus the combination of these alternatives is not necessary to meet the water supply requirements.

The combination of alternatives is sometimes desirable for other reasons. In this particular situation, however, each of the alternatives is essentially a project in itself. Although a combination of the two projects may reduce the required size of the proposed reservoir, the cost and environmental impact of a combined project would be greatly increased. Refer to Section 2.01-a.(8) for additional discussion of the combination of alternatives.

SECTION III

AFFECTED ENVIRONMENT

3.01 GENERAL DESCRIPTION

a. Geographic Location (Refer to Plate II-3). Red River Parish is located in northwest Louisiana. The parish seat and largest populated municipality is the Town of Coushatta (1970 population, 1,429). The parish's population (1970 population, 9,226) is classified as rural by the U.S. Census. The parish is bound by DeSoto Parish to the west; Caddo, Bossier, and Bienville Parishes to the north and northeast; and Natchitoches Parish to the south and southeast. Two bayous, Bayou Pierre and Black Lake Bayou, form the respective western and eastern boundaries. The Red River crosses the parish from northwest to southeast. If the Grand Bayou alternative is selected the service area, as far as domestic use of water is concerned, represents the portion of Red River Parish located on the east side of Red River.

3.02 GEOLOGICAL ELEMENTS

a. Regional Geology. Red River Parish lies in the northwestern portion of Louisiana and is part of the Gulf Coastal Plain Province. Red River Parish is bordered on the west by Bayou Pierre which runs the entire length of the parish in a north-south direction. Black Lake Bayou forms the eastern border of Red River Parish with Natchitoches Parish. A line approximately 32° 15' N. latitude forms the northern border with Caddo, Bossier and Bienville Parishes. The southern boundary is formed by Bayous Pierre and Lumbro. The Red River flows the entire length of the parish. The alluvial plain of the Red River is a major geological entity of the parish. Grand Bayou drains approximately 111 square miles (about 27 percent) of the total area of Red River Parish. Black Lake Bayou drains approximately 75 square miles in Red River Parish (about 18 percent of the total area of the parish). The Red River is the drainage outlet for the remaining area of the parish. The southeasterly flow of these major streams is effected by the Sabine Uplift, a domed structural feature centered in the southern part of Caddo Parish. The dome is approximately 80 miles long and 65 miles wide (Murray, 1948).

b. Local Geology.

(1) Physiography. Three distinct topographic provinces are found in Red River Parish. The first is the alluvial valley or floodplain areas adjoining the Red River, Grand Bayou, and Black Lake Bayou drainage network. The Prairie Terrace surface is a second topographic province which is primarily situated adjacent to the floodplains of the

major streams. The "hills area" is a third province which consists of terrace uplands and tertiary uplands (Murray, 1948).

(2) Soils. Eleven (11) soil associations exist within the study area. These eleven associations are divided into two major categories based on location and topography: (1) the soils of the Red River alluvial plain and (2) the soils of the upland drainages. Two subdivisions are further derived from the upland soils. These are (1) the nearly level to gently sloping soils and (2) the gently sloping to moderately sloping soils. Table III-1 lists the eleven soil associations and a description of their respective surface and subsurface soils. The surface soils within the study area vary in color from red to yellowish brown and in texture from loams to clays. The thickness of the surface soils vary from three to eleven inches. The subsurface soils of the area are very similar to the surface soils in color and texture; however, the thickness of the subsurface soils vary from eight inches to thirty inches. The soil associations of Red River Parish are shown in Plate III-1. Plate III-2 represents the soil associations of the Grand Bayou area.

3.03 HYDROLOGIC ELEMENTS

a. General Hydrology. The study area encompasses a portion of the Red River drainage basin. Black Lake Bayou and Grand Bayou, both of which flow into Black Lake, are tributaries of the Red River. The drainage areas for Black Lake Bayou and Grand Bayou are 908.34 and 135.84 square miles respectively. The basin area for Black Lake Bayou includes Black Lake, while the area for Grand Bayou is at Black Lake. The drainage area of the Red River at the mouth of Saline Bayou (drainage from Black Lake) is 65,933.86 square miles. This area includes Grand Bayou and Black Lake Bayou (Sloss, 1971).

b. Hydrology of Project Area.

(1) Climatic Characteristics. Climate of Red River Parish is humid subtropical. Maritime tropical air masses from the Gulf of Mexico dominate the lengthy summer season. Arctic or interior air masses are frequent during the winter. The average annual temperature is 65°F, with a low average daily temperature of 47°F in January and a high average daily temperature of 82°F in August. The average length of the freeze-free season is 240 days. Average annual precipitation is 45 inches per year. Most precipitation occurs as rain; however, light snow occurs. Peak precipitation, generally associated with cold front activity, occurs in the winter months and low precipitation occurs in June and August (U.S. Army, 1975).

TABLE III-1

SOILS

ASSOCIATION	PARISH	SURFACE LAYER	SUBSURFACE LAYER
<u>Red River Alluvial Plain</u>			
1) Coughatta	Red River	Reddish Brown Silt Loam	Reddish Brown Silt Loam, Silty Clay Loam, and Very Fine Sandy Loam
2) Moreland-Buxin	Red River	Dark Reddish Brown Clay	Lighter Reddish Brown Clay
3) Severn	Red River	Reddish Brown Very Fine Sand loam	Reddish Brown Very Fine Sandy Loam, Silt Loam, Loam and Loamy Very Fine Sand
4) Campiana-Gallion	Red River	Dark Brown Silt Loam	Reddish Brown Silt Loam
5) Miller-Robuck-Buxin	Bossier	Dark Reddish Brown Clayey	Reddish Brown Clayey
<u>Upland Drainage: Level to Gently Sloping</u>			
1) Guyton	Red River	Dark Grayish Brown Silt Loam	Light Brownish Gray Silt Loam
2) Guyton-Messer	Red River	Dark Grayish Brown Silt Loam	Light Brownish Gray Silt Loam
3) Kolin-Wrightville	Red River, Natchitoches	Brown Silt Loam	Brown Silt Loam
4) Shatta	Red River, Natchitoches	Dark Grayish Brown Silt Loam	Strong Brown or Yellowish Brown Clay Loam
5) Buxin	Bienville	Reddish Brown Clay	Gray Clay
6) Roseblum-Cahaba	Bienville	Gray Silt Loam	Gray Silty Clay Loam
7) Wrightville-Acadia	Webster, Bossier	Gray Silt Loam	Gray Mottled with Brown Silty Loam
8) Perry-Buxin	Bossier	Dark Gray Clay	Dark Gray and Reddish Brown Clay
9) Guyton-Cahaba	Natchitoches	Grayish-Brown Silt Loam	Light Brownish Gray to Gray Silty Clay Loam
<u>Upland Drainage: Gently to Moderately Sloping</u>			
1) Falkner-Boswell	Red River	Brown Silt Loam	Yellowish Brown Silt Loam
2) Ruston	Red River, Natchitoches	Yellowish Brown Fine Sandy Loam	Yellowish Red Loam
3) March-Malbis	Red River	Grayish Brown Fine Sandy Loam	Yellowish Brown Fine Sandy Loam
4) Shubuta-Boswell-Susquehanna	Bienville	Grayish Brown Fine Sandy Loam	Red Sandy Clay
5) Core-Makamie	Bienville, Bossier, Webster	Grayish Brown Fine Sandy Loam	Mottled Red and Gray Plastic Clay
6) Ora-Savannah-Shubuta	Webster	Dark Brown Very Fine Sandy Loam	Yellowish Red Loam

Source: General Soil Map, Red River Parish (1976), Webster Parish (1971), Bossier Parish (1971), Bienville Parish (1971), Soil Conservation Service in Cooperation with Louisiana Agricultural Experiment Station.

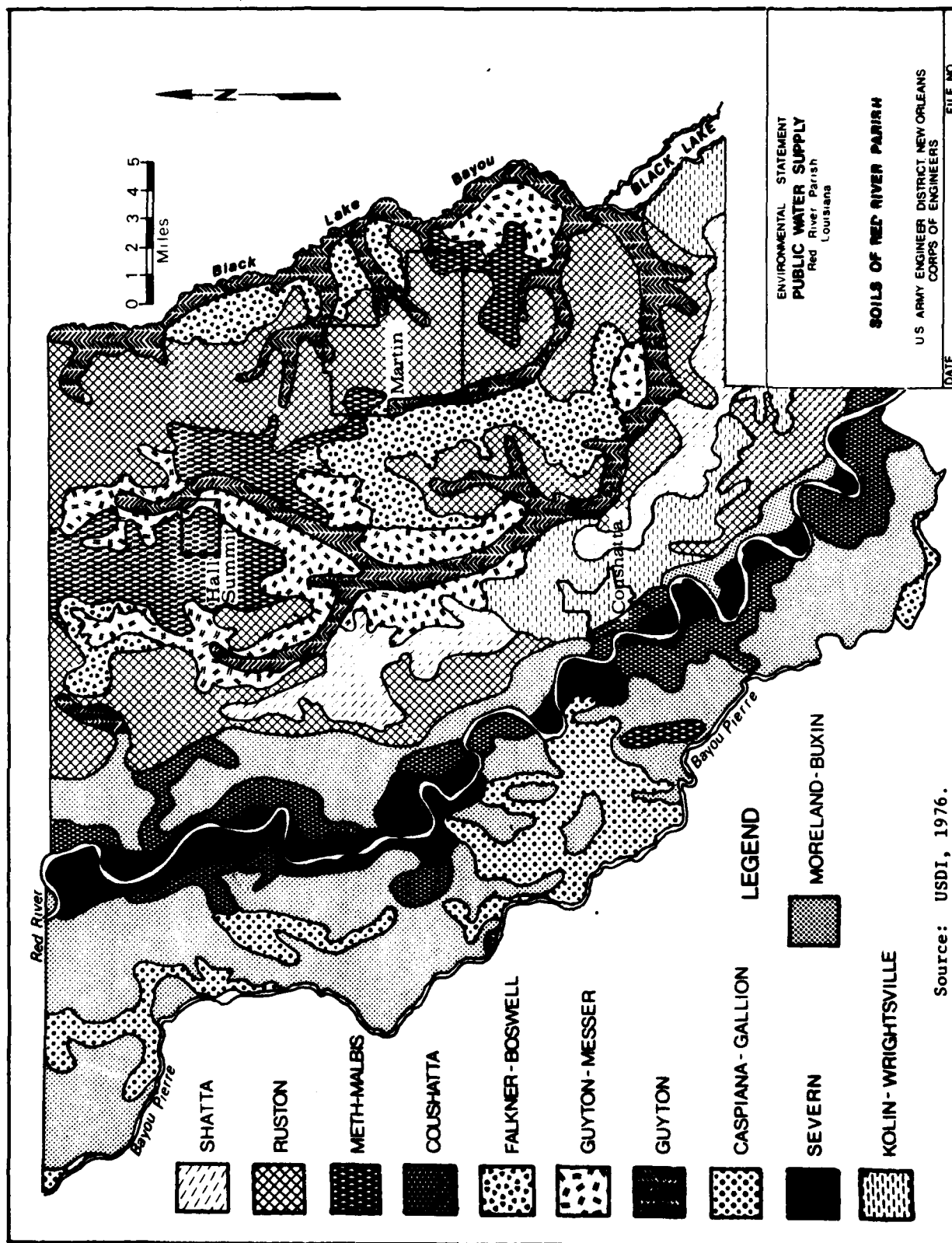
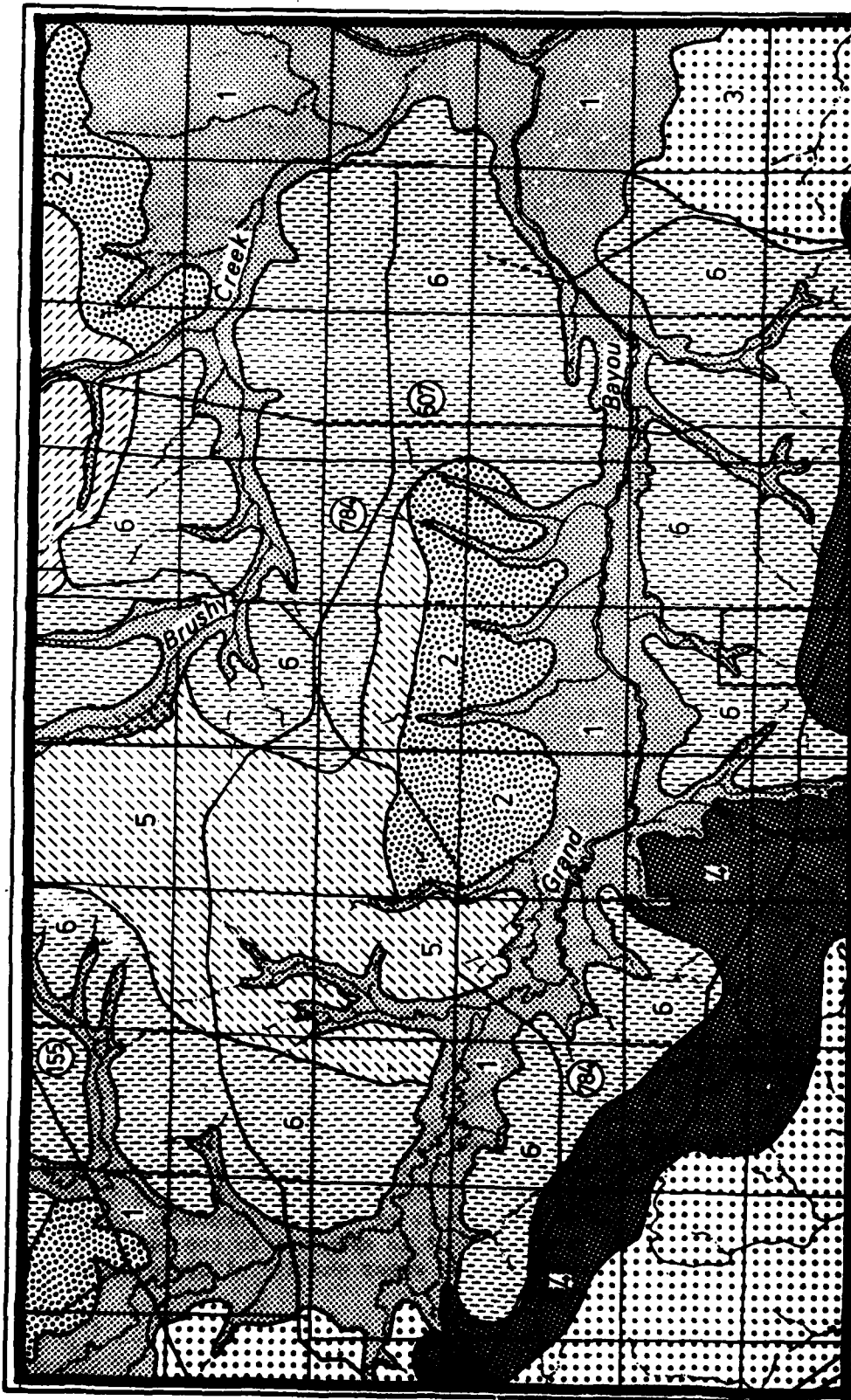


PLATE III-1



ENVIRONMENTAL STATEMENT
PUBLIC WATER SUPPLY
Red River Parish
Louisiana

GRAND BAYOU SOILS

U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

DATE: FILE NO.

SHATTA METH - MALBIS

GUYTON - MESSER FALKNER - BOSWELL

KOLIN - WRIGHTSVILLE RUSTON



Source: USDA, 1976.

PLATE III-2

(2) Drainage Basin.

(a) Red River. The drainage basin of the Red River is approximately 65,933.86 square miles at the mouth of Saline Bayou (Plate III-3). Some of the major tributaries include Black Lake Bayou, Grand Bayou, and Bayou Dorcheat. (Refer to Red River Waterway Louisiana, Texas, Arkansas and Oklahoma, Design Memorandum No. 15, Vol. 3, U.S. Army Corps of Engineers, 1975, for further details of the drainage area of the Red River.)

(b) Grand Bayou. Grand Bayou drains an area of 135.84 square miles of which 111 square miles lie in Red River Parish (Plate III-4). The channel length of Grand Bayou is approximately 40 miles from its mouth, at Black Lake, to its headwaters in Bienville Parish. Bayou Chicot, which drains 27.96 square miles, is the major tributary of Grand Bayou. All other tributaries of Grand Bayou, most of which are intermittent streams, drain an area of less than ten square miles.

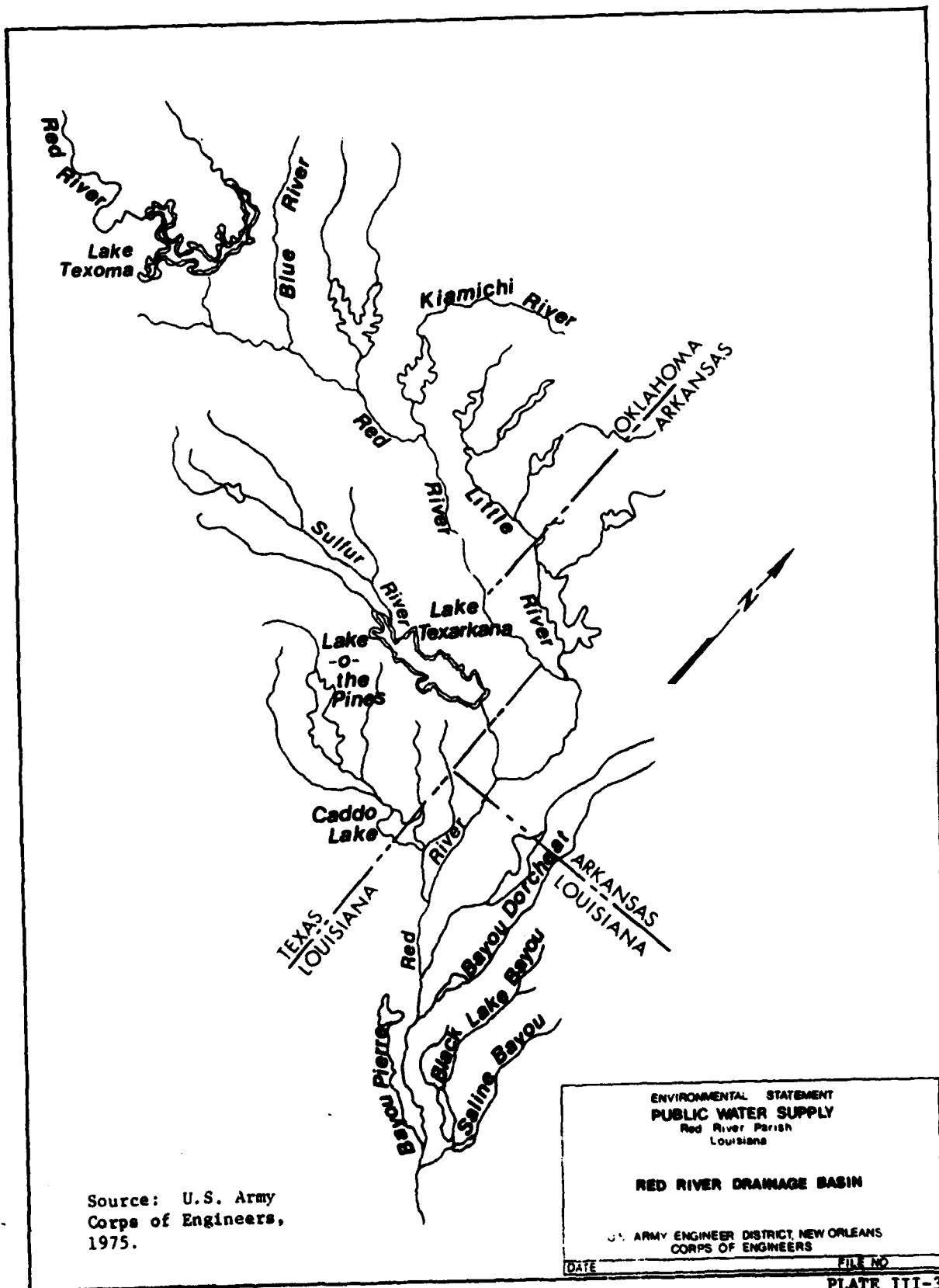
(3) Water Quality.

(a) Red River. Table III-2 is a listing of the important water quality parameters tested by the Environmental Protection Agency.

"The quality of water on the Red River main stem below Denison Dam has been described by various sources as highly variable but generally poor, primarily because of high concentrations of dissolved solids, chloride, total hardness, and fecal coliform....Extensive treatment is required in Louisiana to make the river water acceptable for use by public water supply systems and industrial use. Because of salinity hazards in this reach, the river is also a poor source of irrigation water."

(Refer to Red River Waterway Louisiana, Texas, Arkansas and Oklahoma Design Memorandum No. 15, Vol. III, p. 196, U.S. Army Corps of Engineers, 1975, for further details on water quality of the Red River.)

(b) Grand Bayou. Grand Bayou generally has a good quality water. The amount of pesticides found in the stream are all less than the criteria as set forth by the EPA for safe drinking water. During the low flows in summer months, total coliform counts increase, and dissolved oxygen decreases. The low dissolved oxygen levels in Grand Bayou shown in Table III-2 are due to the low flow at the time of sampling. The total coliform probably is a result of the numerous warm blooded animals that come to drink water from the stream. No municipal effluent is discharged into Grand Bayou. Iron is a problem in Grand Bayou also, as it is in most streams in north Louisiana. The high levels of iron are probably caused by leaching from a poor grade iron ore that is abundant in the area (Germany, 1979). Table III-2 compares the water quality of Grand Bayou with that of the Red River alternative.



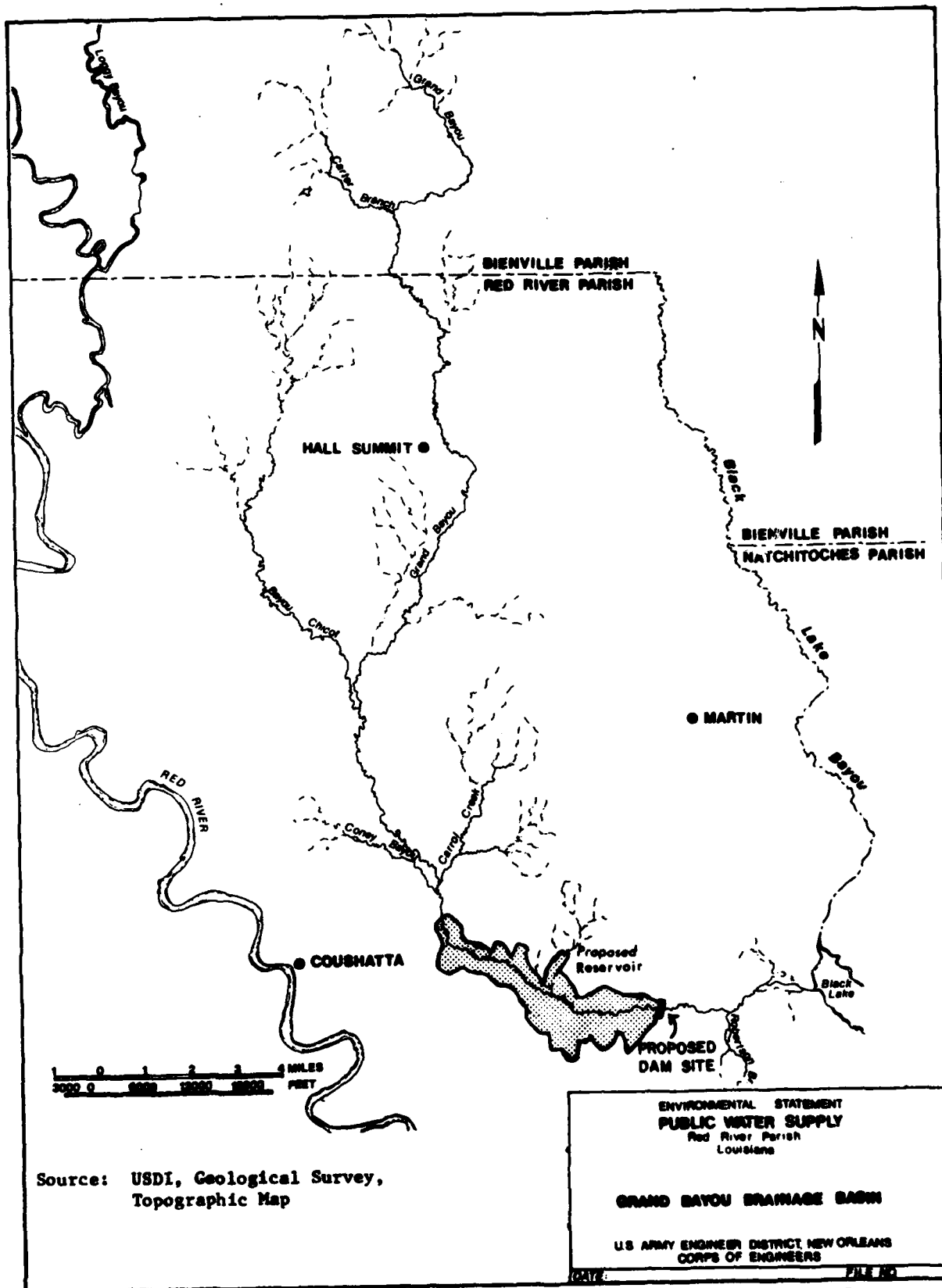


TABLE III-2

WATER QUALITY, RED RIVER AND GRAND BAYOU

PARAMETER	RED RIVER @ COUSHATTA		GRAND BAYOU @ COUSHATTA		STANDARD/ UNITS
	Maximum	Minimum	Maximum	Minimum	
Biological Oxygen Demand	8.8	0.3	6.7	0.0	mg/l
Chemical Oxygen Demand	116.0	0.0	63.0	39.0	mg/l
Dissolved Oxygen	13.0	5.4	8.4	3.3	mg/l
Fecal Coliform	38,000.0	62.0	200.0	80.0	No/100ml
Total Dissolved Solids	696.0	96.0	88.0	61.0	500.0 mg/l
Turbidity	260.0	10.0	20.0	4.0	5 JTU
Color	500.0	5.0	100.0	15.0	15 Units
Temperature	31.0	3.5	27.0	11.1	°C
Conductivity @ 25°C	1260.0	153.0	182.0	84.0	umhos
pH	8.4	6.6	7.1	6.0	units
Total Hardness as CaCO ₃	300.0	60.0	38.0	16.0	mg/l
Total Nitrogen	1.6	0.54	2.3	0.88	mg/l
Total Kjeldahl	1.5	0.44	2.2	0.75	mg/l
Total Phosphates	44.0	0.04	0.13	0.06	mg/l
Total Calcium	68.0	28.0	10.0*	4.4*	mg/l
Total Magnesium	19.0	7.4	4.5*	1.2*	mg/l
Total Sodium	88.0	22.0	25.0*	8.2*	mg/l
Total Potassium	6.0	3.4	6.0*	1.9*	mg/l
Chloride	230.0	11.0	40.0	5.0	250.0 mg/l
Total Sulfate	120.0	9.8	15.0	0.8	250.0 mg/l
Fluoride	0.4	0.0	0.2	0.1	0.7 mg/l

TABLE III-2
WATER QUALITY, RED RIVER AND GRAND BAYOU
 (Continued)

PARAMETER	RED RIVER @ COUSHATTA		GRAND BAYOU @ COUSHATTA		STANDARD/ UNITS
	Maximum	Minimum	Maximum	Minimum	
Total Nitrate	1.8	0.3	0.5	0.2	45.0 mg/l
Total Arsenic	22.0	0.0	+0.0*	+0.0*	50.0 ug/l
Total Cadmium	5.0	0.0	1.0*	1.0*	10.0 ug/l
Total Chromium	30.0	0.0	0*	0*	50.0 ug/l
Diss. Copper	0.0	0.0	5.0	4.0	1000.0 ug/l
Total Iron	30,000.0	370.0	920.0*	870.0*	300.0 ug/l
Total Lead	61.0	0.0	-	-	50.0 ug/l
Total Strontium	190.0	160.0	300.0*	230.0*	ug/l
Total Zinc	150.0	5.0	30.0*	10.0*	5000.0 ug/l
Total Mercury	0.7	0.0	0.1*	0.0*	2.0 ug/l

* Indicates Dissolved not Total, Limits.

Source: EPA STORET information.

(4) Stages and Flows.

(a) Red River. The Red River is one of the major streams in Louisiana. It has a drainage area of 65,933.96 square miles at the mouth of Saline Bayou. Even though the Red River drains a large area, it still becomes quite shallow during the late summer months. (Refer to the Red River Waterway Louisiana, Texas, Arkansas and Oklahoma, Design Memorandum No. 15, U.S. Army Corps of Engineers, 1975, for further details.)

(b) Grand Bayou. The flow of Grand Bayou is highly variable. The basin is normally inundated for extended periods of time during the late winter or early spring months. On the other hand during the mid and late summer months the flow on Grand Bayou drops to near zero. The average discharge for a 21 year period is 65,600 acre feet per year (USDI, 1977). Table III-3 is a listing of the flow on Grand Bayou for the twenty-one year period.

(5) Pool and Flow Level Regulations.

(a) Red River. The Red River Waterway project will require stabilization of the stream. A lock and dam system will be constructed as part of the navigational project. In order to maintain the Red River in a navigable state, the pool elevation will be maintained at an elevation of 115-120' MSL. A final elevation will be determined at a later date. (For further details refer to Final Supplement No. 1 to the Final Environmental Statement, Red River Waterway, Louisiana, Texas, Arkansas, and Oklahoma, and Related Projects; Mississippi River to Shreveport, Louisiana, Reach; U.S. Army Engineer District, New Orleans, Louisiana, February, 1977.) The navigation pool elevations being considered at Coushatta are 115 and 120 feet above mean sea level which will provide a 20-30 foot depth. (For further detail refer to sheet 113 of the 1967-69 hydrographic survey of the Red River.)

(b) Grand Bayou. There are no pool or flow level regulations for Grand Bayou.

(6) Natural and Scenic Streams. Several parameters such as wilderness, recreation, archeological, and botanical qualities are used by the Louisiana Department of Wildlife and Fisheries to evaluate a stream to be included in the natural and scenic streams system. Channelization, clearing and snagging, channel realignment, and reservoir construction are absolutely prohibited on any stream classified as a natural and scenic stream (Louisiana Department of Wildlife and Fisheries, 1973). Grand Bayou and Red River are not listed as natural and scenic streams.

TABLE III-3

FLOW RECORD, GRAND BAYOU, 1956-1977
(Acre-Feet by Month and Year)

Calendar Year	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
56	-	-	-	-	-	-	-	-	-	0.4	5.6	4.6	-
57	1,630	13,590	8,460	20,330	12,400	10,910	419	91	27	1,470	30,510	7,150	107,000
58	13,500	4,630	11,070	4,010	9,910	2,510	4,280	457	28,840	878	1,290	682	81,860
59	1,220	7,220	9,560	11,180	3,720	4,700	250	30	3.4	135	1,950	8,240	48,210
60	10,680	19,960	12,050	525	156	1,190	105	98	6.9	5.6	169	4,300	49,240
61	21,010	12,160	37,280	8,590	685	2,370	337	4,110	8,870	115	3,800	50,390	144,700
62	13,020	5,580	8,930	18,800	11,360	972	729	6.7	30	0	29	135	59,590
63	196	563	559	1,280	24	3.6	11	0.2	65	.6	23	394	3,119
64	1,740	806	5,510	7,430	744	601	.8	1.4	2.4	12	9.9	86	16,940
65	100	2,140	2,790	6,340	399	100	13	24	2,460	101	51	3,610	18,130
66	7,960	27,290	3,450	7,640	10,070	23	0	1.2	1.2	4.8	26	22	56,490
67	73	915	204	302	313	8,870	2,170	3.4	2.8	.7	.6	679	13,540
68	21,790	3,630	13,680	37,760	19,240	1,600	747	551	7,090	157	6,950	19,210	132,400
69	2,310	8,100	17,160	16,940	5,490	124	30	.06	2.5	5.2	354	579	51,090
70	2,420	4,260	8,350	1,870	10,690	1,660	208	3.3	22	931	881	846	32,140
71	1,300	6,130	2,440	414	6,970	14	161	1,850	1,180	56	1,240	12,830	34,590
72	17,860	8,040	4,420	683	456	1.5	3.2	1.0	55	118	2,330	7,790	41,750
73	25,410	7,150	17,910	16,500	3,690	333	301	87	202	396	4,400	14,190	90,570
74	51,290	16,640	9,660	7,270	1,660	7,130	52	64	1,800	2,260	11,050	22,170	131,100
75	23,940	20,820	25,520	3,100	33,960	23,120	26,590	3,860	303	167	303	1,190	162,900
76	5,330	6,310	23,130	2,010	4,880	13,230	5,430	30	11	6.3	7.6	2,320	62,68-
77	6,390	12,470	13,200	6,440	1,390	6.6	45	8.0	53	-	-	-	-
Mean	10,912.8	8,971.6	11,206.3	6,581.3	6,581.3	3,784.2	1,994.4	537.0	2,429.9	324.7	3,113.3	7,467.5	66,901.9

- No Data

Source: "Water Resources Data for Louisiana," 1956-1977. U.S. Department of the Interior, Geological Survey.

3.04 BIOLOGICAL ENVIRONMENT

a. Botanical.

(1) Red River. The terrestrial and aquatic vegetation of the Red River Valley has been described in a report entitled Red River Waterway, Louisiana, Texas, Arkansas and Oklahoma, Design Memorandum No. 15, (U.S. Army Corps of Engineers, 1975, Vol. 6). This is an extensive study which describes the different habitat communities that occur along the Red River and their importance to wildlife.

(2) Grand Bayou. The study area is located in the northwestern portion of the state which Brown (1945) describes as having two major tree regions: (1) the "Bottomland Hardwoods and Cypress Region" and (2) the "Shortleaf Pine-Oak-Hickory Region" (See Plate III-5). These regions are classified as such due to the general distribution of vegetation, which is determined by several environmental factors such as topography, rainfall, and soils. (See Plate III-6 for habitat areas and Appendix C for Vegetational Species of Grand Bayou.)

(a) Bottomland Hardwoods. The hardwood communities are found within the boundaries of the floodplains of the streams that occur in the study area. The soils in these areas are mainly used for woodlands and consist of a dark, grayish brown silt loam. The soils and topography combine to produce two major habitats within the bottomland hardwoods: (1) the wet bottomland hardwoods and (2) the dry bottomland hardwoods.

1. Wet Bottomland Hardwoods. Wetlands in the Grand Bayou area comprise a total of 1393 acres and are found within the study area as swamps, intermittent stream channels and the normal high water flood plain. The soils found within the wet bottomland hardwood regions are nearly level, poorly drained, and frequently flooded. The surface layer is dark grayish brown silt loam about three inches thick (USDA, 1976). Common overstory species are overcup oak (*Quercus lyrata*), Drummond red maple (*Acer rubrum*), and tupelogram (*Nyssa aquatica*). These species produce a medium to sparse canopy. Along the swamps and natural levees bald cypress (*Taxodium distichum*), green ash (*Fraxinus pennsylvanica*), and hornbeam (*Carpinus caroliniana*) are also abundant. The understory consist of a diversity of shrubs, vines, and herbs. The common understory and ground cover species are green hawthorn (*Crataegus viridis*), wild azalea (*Rhododendron canescens*), lizardtail (*Saururus cernuus*), spiderwort (*Tradescantia spp.*), and greenbriar (*Smilax spp.*).

2. Dry Bottomland Hardwoods. These areas are found in the upper regions of the basin on soils which are more readily drained due to the slightly higher elevation and better soil composition. The common species forming the overstory canopy include water oak (*Quercus nigra*), willow oak (*Quercus phellos*), sweet gum (*Liquidambar styraciflua*), and elms (*Ulmus spp.*). Flowering dogwood (*Cornus florida*), silverbell

LEGEND



MARSH REGION



PRAIRIE REGION



BOTTOMLAND HARDWOODS
AND CYPRESS REGION



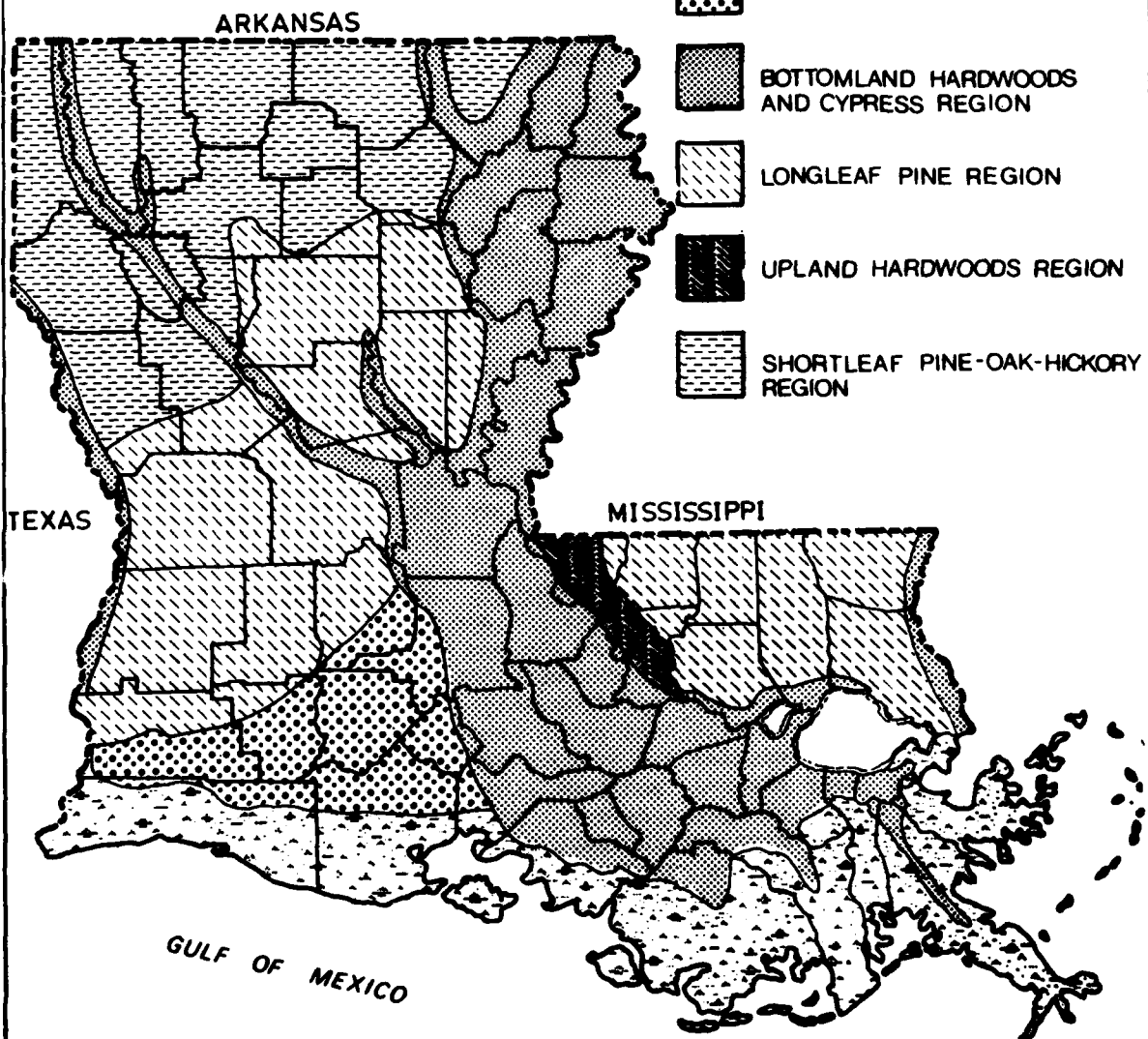
LONGLEAF PINE REGION



UPLAND HARDWOODS REGION



SHORTLEAF PINE-OAK-HICKORY
REGION



0 5 10 20 30 40
MILES

Source: Brown, 1945.
Page 6.

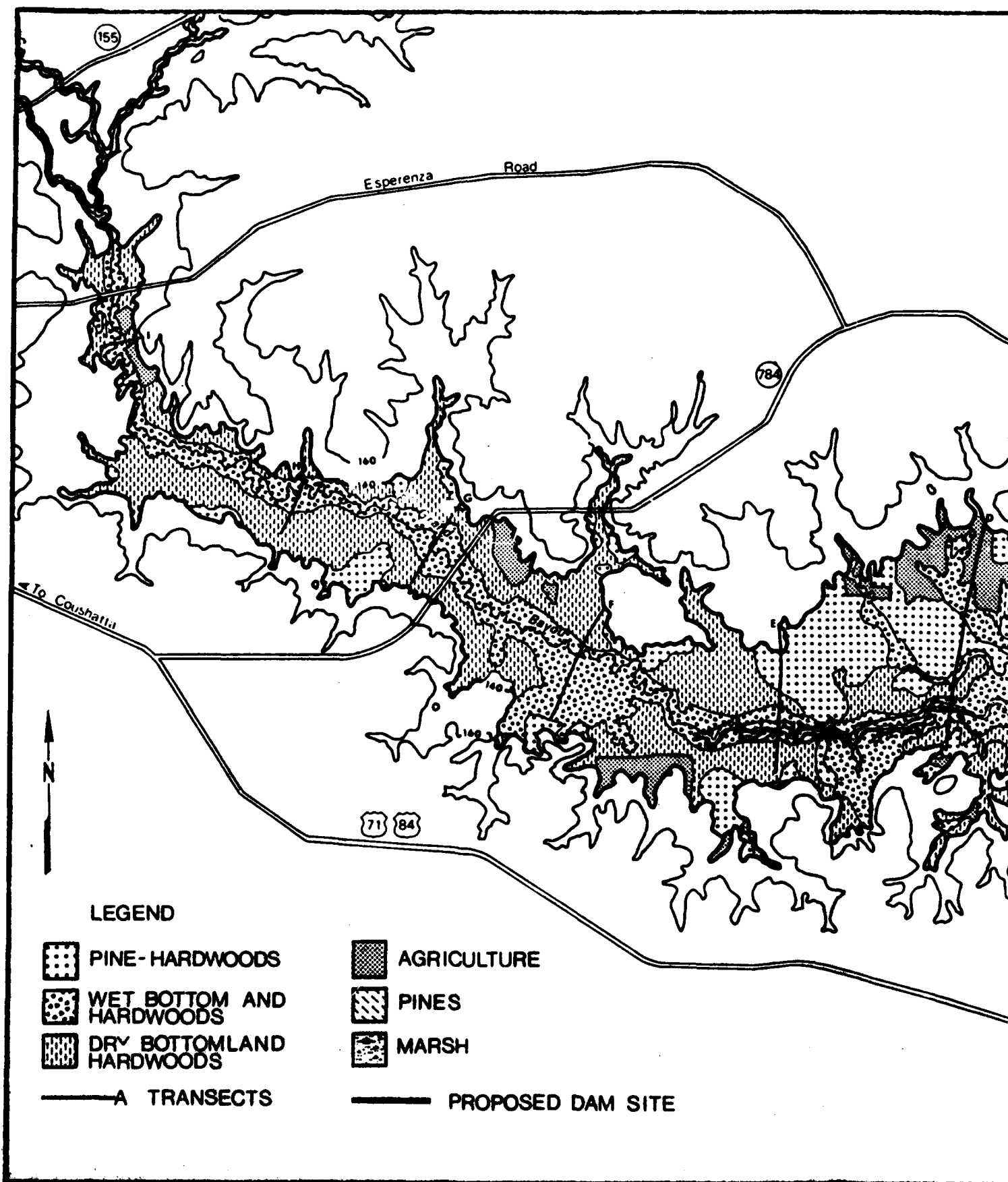
ENVIRONMENTAL STATEMENT
PUBLIC WATER SUPPLY
Red River Parish
Louisiana

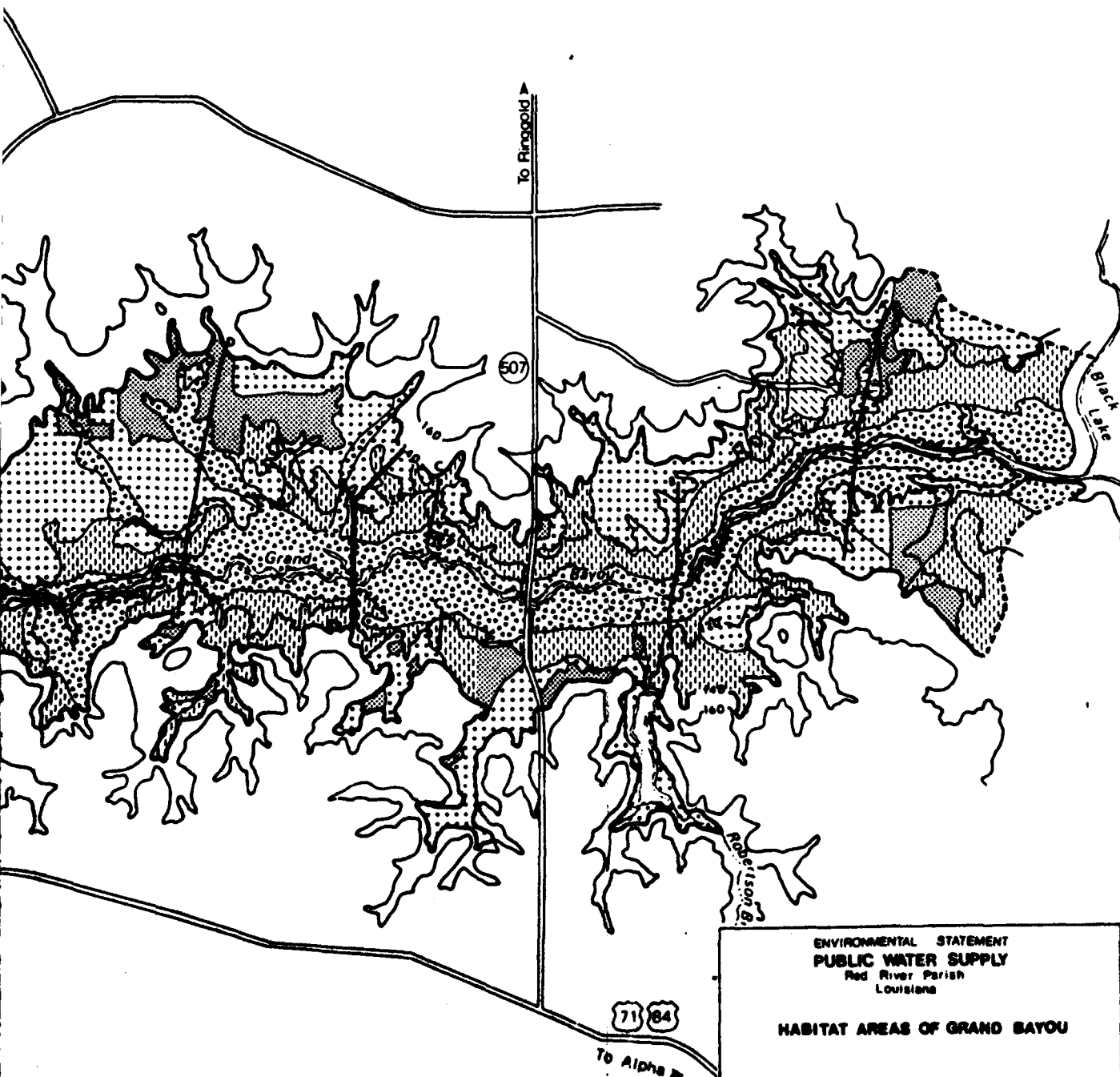
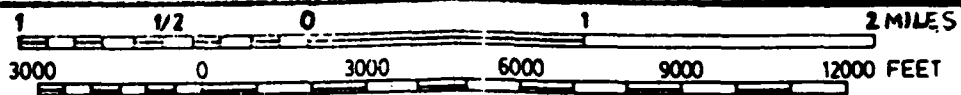
TREE REGIONS OF LOUISIANA

U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

DATE

FILE NO.





ENVIRONMENTAL STATEMENT
PUBLIC WATER SUPPLY
Red River Parish
Louisiana

HABITAT AREAS OF GRAND BAYOU

U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

DATE

FILE NO.

III-15

PLATE III-6

(*Halesia carolina*), parsley hawthorn (*Crataegus marshallii*), and huckleberry (*Vaccinium spp.*) are common species of the woody understory. Herbaceous species and vines common to the community are violets (*Viola rosacea*), partridge berry (*Mitchella repens*), bulb bittercress (*Cardamine bulbosa*), poison ivy (*Rhus radicans*), and muscadine (*Vitis rotundifolia*).

(b) Uplands. The uplands within the study area are in the region described by Brown (1945) as the "shortleaf pine-oak-hickory region". The soils of the uplands within the study area vary from a very fine sandy loam with a clayey subsoil, to a fine yellowish-red sandy loam which is loamy throughout (USDA, 1976). The shortleaf pines within the study area have been cut out and replaced with slash pine (*Pinus ellottii*) and loblolly pine (*Pinus taeda*) or with agricultural lands. The uplands are the best timber producing community that is found within the study area.

1. Pine-Hardwoods. These regions are located mostly above the normal floodplain. The topography of these communities varies from a gentle rolling slope to an abrupt escarpment, especially along the southern or western edge of the study area. The overstory canopy is medium to dense and consists of loblolly pine (*Pinus taeda*), slash pine (*Pinus ellottii*), water oak (*Quercus nigra*), post oak (*Quercus stellata*), mockernut hickory (*Carya tomentosa*), and cow oak (*Quercus michauxii*). Herbaceous plants found in this habitat type include wake robin (*Trillium sessile*), and dewberry (*Rubus spp.*), huckleberry (*Vaccinium spp.*), Mexican plum (*Prunus mexicana*), greenbriar (*Smilax spp.*), arrowwood (*Viburnum spp.*), yellow jessamine (*Gelsemium sempervirens*), and horseshoe (*Symplocos tinctoria*) are common woody shrubs and vines which make up the understory.

2. Agricultural. Few agricultural crops are cultivated within the study area. The majority of croplands are located west of the Red River. Most of the agricultural land in the immediate project area is used for pasture, much of which is unimproved pastureland. Species common to this community type include spiny thistle (*Cirsium horridulum*), broomsedge (*Andropogon virginiana*), dichondra (*Dichondra carolinensis*), rabbit tobacco (*Gnaphalium obtusifolium*), dogfennel (*Eupatorium capillifolium*), Dewberry (*Rubus spp.*), goldenrod (*Solidago spp.*), and St. Augustine grass (*Stenotaphrum secundatum*).

(c) Marshes. One small fresh water marsh (10 acres) is found with the study area. The community is located approximately two miles upstream from the proposed dam site and approximately one mile upstream from Black Lake on Grand Bayou. The marsh is nourished year round with the periodic inundation of Grand Bayou and with the several springs located within the marsh. The plant species common to the community include marsh elder (*Baccharis halimifolia*), spike rush (*Eleocharis spp.*), soft rush (*Juncus effusus*), smartweed (*Polygonum spp.*), and cattails (*Typha latifolia*).

(d) Phytoplankton. Whole water samples were taken at four sample sites to determine the phytoplankton communities (Plate III-7). Temperature, pH, total dissolved solids, and dissolved oxygen were taken at each site before the plankton samples were collected (Table III-4). The group of plankters more commonly represented was the green algae. Six genera of green algae were found in the samples. The most common green algae were *Spirogyra*, *Ulothrix*, and *Microspora*. Common diatoms which were identified included *Melosira*, *Navicula*, and *Synedra*. *Oscillatoria* and *Anabaena* were the two most common blue-green algae. The only two desmids found were *Closterium* and *Penium*, *Closterium* being the more abundant of the two. With the exception of two species of diatoms, all of the plankters were recorded from at least 50 percent of the sample sites (Table III-5). Due to the abundance and diversity of the different taxa, it seems that the primary productivity of Grand Bayou relies heavily on the contribution of the phytoplankters.

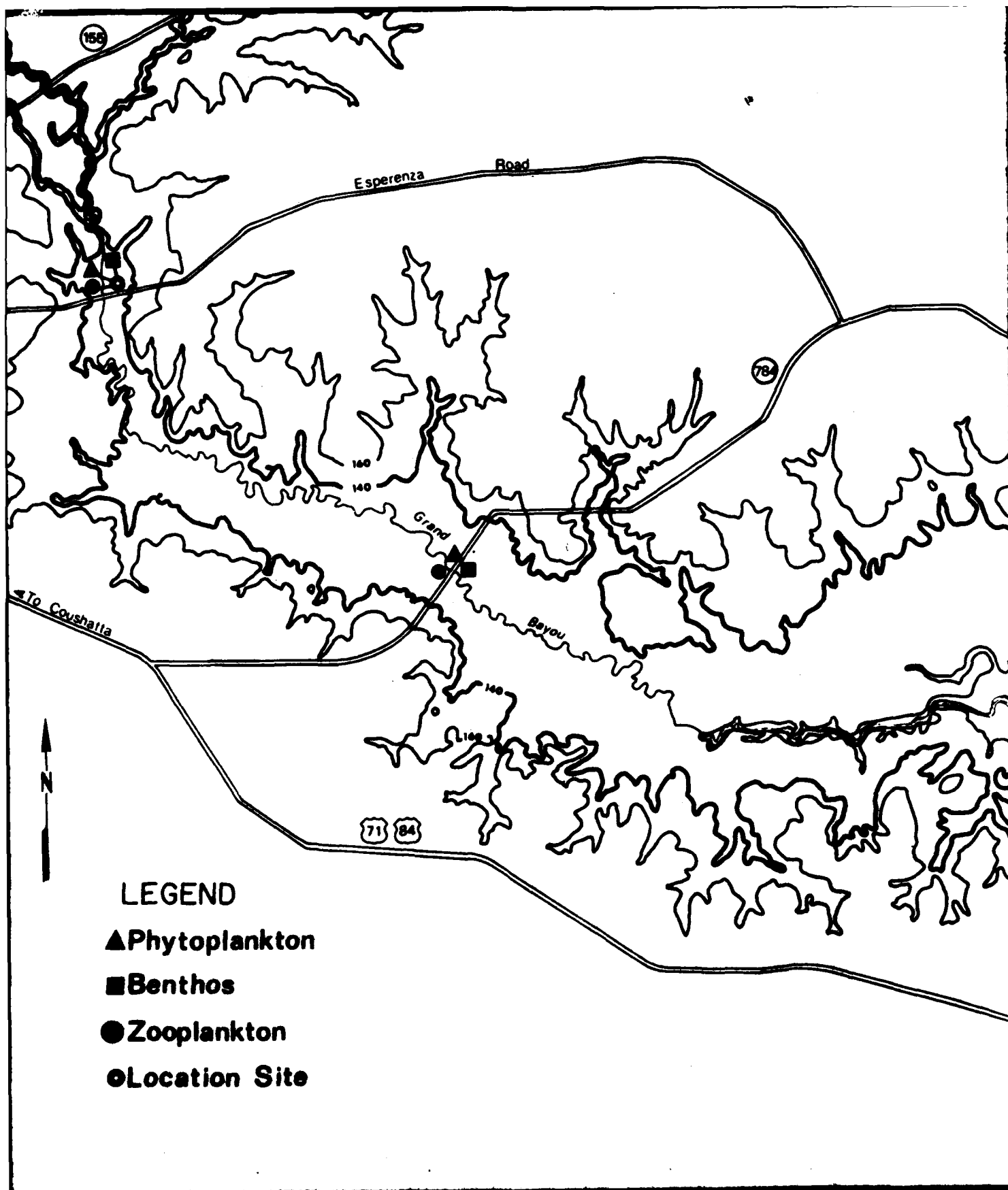
b. Zoological.

(1) Red River. The zoological elements (terrestrial and aquatic) of Red River have been identified in extensive surveys. Narrative descriptions as well as tables of collection data of the zoological elements appear in the Red River Waterway, Louisiana, Texas, Arkansas, and Oklahoma, Design Memorandum No. 15, U.S. Army, 1975.

(2) Grand Bayou. Several environmental factors such as climate, precipitation, topography, and soil composition affect the vegetative cover types so that a numerous amount of ecosystems are formed. These various ecosystems, in turn, affect the wildlife populations. In conjunction with the natural phenomena is man's practice in land use, which also aids in producing variations in the ecosystems. The terrestrial wildlife populations within the study area consist of five groups of invertebrates and vertebrates: insects, mammals, birds, amphibians, and reptiles. On site observations and museum research records 44 mammals (10 furbearers, 5 game species, 29 non-game species), 56 reptiles (15 turtles, 9 lizards, 32 snakes), 23 amphibians (14 frogs and toads, 9 salamanders), 152 birds (4 waterfowl, 5 upland game species, and 143 non-game species).

(a) Terrestrial.

1. Game and Fur Animals. Since the mid 1900's Louisiana has been the nation's leading fur producing state, with most seasons averaging near 40 percent of the total United States wild fur production (O'Neil, 1977). In the six year period of 1971-1977, Louisiana averaged \$12,247,763 for the sale of pelts alone. The sale of trapping, buying, and dealing licenses has also created a steady income in recent years. A total of ten furbearers are known or presumed to be found within the study area. The nutria, the primary fur source since 1961 (Lowery, 1974b), is presumed to live within the basin; however, no



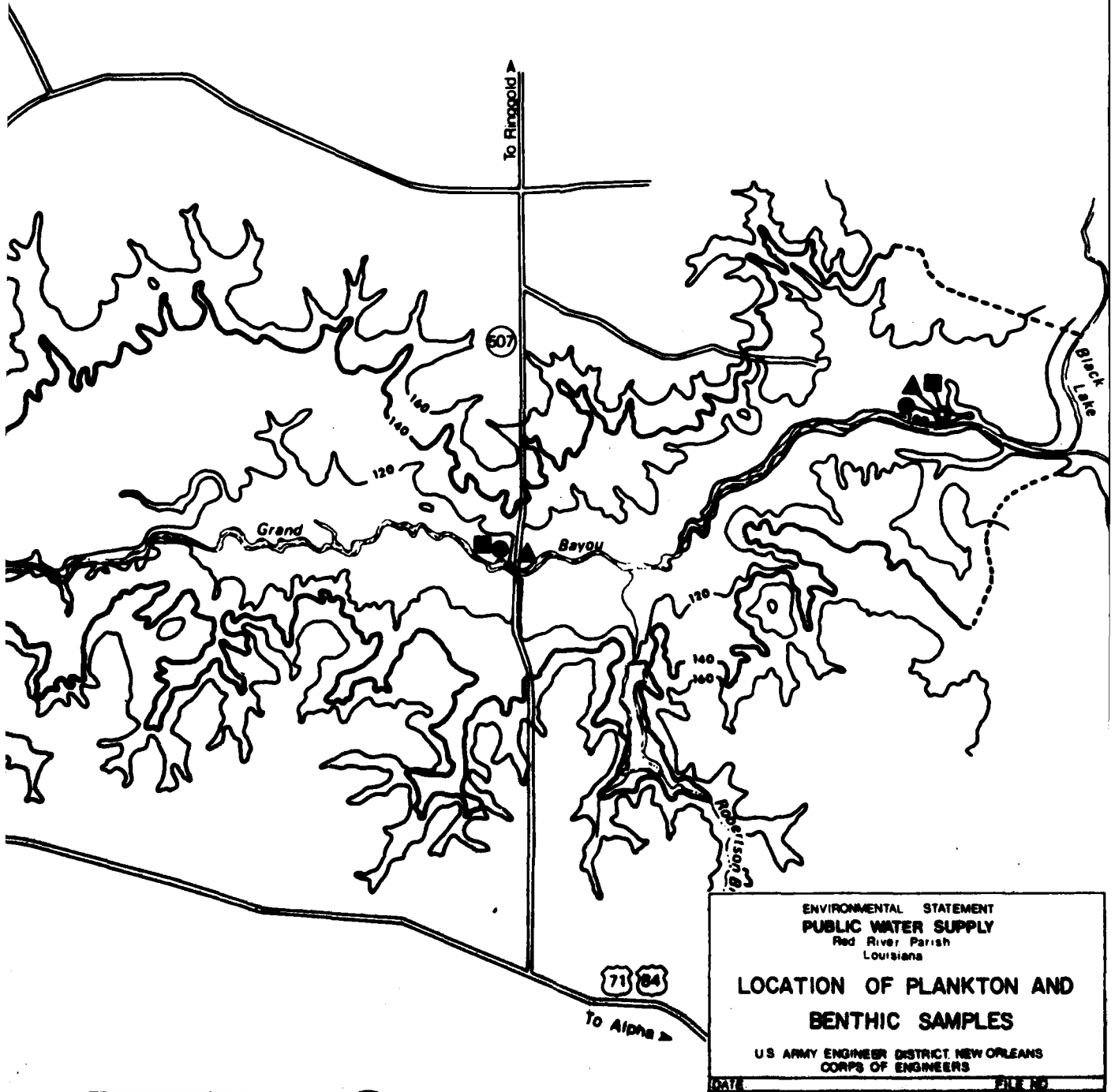
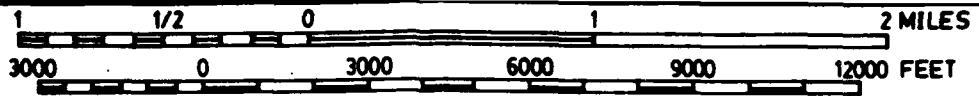


TABLE III-4

WATER ANALYSIS DURING PLANKTON AND BENTHIC SAMPLES
GRAND BAYOU, MAY 1972

TEST	Pt. 1 Esperanza Rd	Pt. 2 LA Hwy 784	Pt. 3 LA Hwy 507	Pt. 4 Black Lake	\bar{x} Results
Temperature, °C	22.00	23.00	24.00	29.00	24.500
pH	6.60	6.70	6.60	7.40	6.825
Total dissolved solids, ppm	115.20	115.20	96.00	1024.00	337.600
Dissolved oxygen, ppm	0.24	0.24	1.28	4.00	1.440

TABLE III-5
PHYTOPLANKTON COUNTS¹
GRAND BAYOU, MAY 1979

	Pt. 1 Esperanza Rd.	Pt. 2 LA Hwy 784	Pt. 3 LA Hwy 507	Pt. 4 Black Lake	Totals
Desmids:					
<i>Closterium</i>	2	1	3	2	8
<i>Penium</i>		2	2		4
Diatoms:					
<i>Melosira</i>	4	1		1	6
<i>Navicula</i>		3	3	1	7
<i>Asterionella</i>		1			1
<i>Synedra</i>				2	2
<i>Stauroneis</i>			1		1
Blue-Green Algae:					
<i>Anabaena</i>	1		2	1	4
<i>Oscillatoria</i>	1	1	3	2	7
<i>Merismopedia</i>				1	1
Green Algae:					
<i>Spirogyra</i>	1	1	4	1	7
<i>Ulothrix</i>	1	3	4	4	12
<i>Ankistrodesmus</i>	1	1			2
<i>Microspora</i>		3	3	1	7
<i>Oedogonium</i>			2	1	3
<i>Euglena</i>		1	1		2

¹These are actual numbers of organisms counted as described in Appendix A. Methodology.

reliable record or sighting has been found of the nutria within the study area. The secondary fur producer, the common muskrat, does not occur within the project area. Other furbearers which have been recorded or sighted within the study area include the Virginia opossum, American beaver, red fox, northern raccoon, striped skunk, and bobcat. The North American mink and Nearctic river otter are both presumed to occur within the project area but were not recorded in the field and museum surveys. Depending upon the vegetative cover types and densities of cover, five game species of mammals are known to occur within the study area in varying population densities. The gray squirrel, swamp rabbit, and white-tailed deer prefer the bottomland hardwoods. The uplands are generally preferred by the fox squirrel and eastern cottontail. The cottontail is especially fond of the dense forest edges along the agricultural pasturelands of the uplands. The fox squirrel requires the pine-hardwood ridges which offer a more open understorey than does the bottomland hardwoods. By far the primary big game animal is the white-tailed deer. The most popular small game mammal is the gray squirrel. Due to the abundance of rabbits, they represent a hunting quotient of similar magnitude as that of the gray squirrel. The sale of sporting goods and hunting licenses represents an enormous monetary input for the state's economy. Aside from the income these animals create from hunting expenditure, they provide certain aesthetic value for nonconsumptive recreation such as nature walks, painting, and nature photography.

2. Non-Game Mammals. Non-game mammals do not represent any direct monetary input into the state's economy. They do provide nonconsumptive recreational activities such as photography, so that aesthetic value is associated with many of the non-game species. More importantly, many of the non-game species are a direct link within the food chain of other species and could affect the economy of the state. The most common group of non-game species found within the area comprise the Order Rodentia. These include the cricetid rats and mice, the Old World rats and mice, and the Plains-pocket Gopher. The house mouse (*Mus musculus*), roof rat (*Rattus rattus*), Eastern wood rat (*Neotoma floridana*), Fulvous harvest mouse (*Reithrodontomys fulvescens*), and Plains-pocket gopher (*Geomys bursarius*) are the only rodents which have been sighted or recorded within the area and adjacent lands within Red River Parish. The red bat (*Lasiurus borealis*), nine-banded armadillo (*Dasypus novemcinctus*), and short-tailed shrew (*Blarina brevicauda*) are the only other non-game mammals which have been recorded as occurring within Red River Parish. Other common non-game mammals presumed to occur within the area include the Eastern mole, Eastern pipistrelle, evening bat, Rafinesque's big-eared bat, Eastern harvest mouse, white-footed mouse, Hispid cotton rat, and coyote (Lowery, 1974b).

3. Game Birds.

a. Resident. The only resident game birds found within the study area are the bobwhite and wild turkey. The project is

located within the region of the state in which turkey hunting is allowed. (Louisiana Department of Wildlife & Fisheries, 1979) However, the bobwhite is considered the primary resident game bird. The bobwhite is very common along undisturbed fence rows, unimproved pastures, and in the pine-hardwood ridges which provide oak mast for food. Some wood ducks and mourning doves set up resident populations but are still considered migratory under the federal classification.

b. Migratory. Two basic groups of migratory game birds occur within the study area. These groups include the upland game birds and the waterfowl. Depending upon the habitat, either group can be found in abundance.

i. Upland Species. American woodcock, common snipe, and mourning doves are the game species associated with the uplands. The bottomland hardwoods are preferred by the woodcock and snipe due to the moist soils found in this region. These two species are not actively hunted, and thus represent only a small portion of consumptive recreation. However, woodcock and snipe are occasionally taken incidental to quail hunting. The mourning dove is the most popular upland migratory game bird. They are quite common in open agricultural fields which are surrounded by trees and provide an adequate water supply.

ii. Waterfowl Species. Woodducks are the most common waterfowl species located within the study area. The woodduck prefers the flooded hardwood bottomland which offers a medium canopy, and plenty of acorns and nesting cavities. Mallards and blue-winged teals were the only other dabbling ducks recorded in the field survey. These two species were found in the beaver ponds that were relatively open. Migrating blue geese were recorded over the study area; however, the basin does not provide the habitat required for geese to land and rest or feed. Some rails and gallinules are presumed to occur along the edges of the beaver ponds (Lowery, 1974a).

4. Non-Game Birds. A total of 143 non-game bird species occur within the study area. None of the non-game species directly affect the state's economy; however, many of these species are direct and important links in the food chain of other species of animals which could provide some monetary input. Also, these non-game species provide an aesthetic and scientific value in the areas of bird watching, nature photography, and research. Common herons found in or near the wetlands include the great blue heron, common egret, snowy egret, little blue heron, green heron, and yellow crowned-night heron. The cattle egret frequents open fields where they feed upon insects stirred up by the cattle. Woodpeckers commonly found are the pileated, red-bellied, red-headed, downy, and hairy woodpeckers. Yellow-bellied sapsucker and common flicker are other woodpeckers found, but are not as common, within the study area. The red-tailed hawk, red-shouldered hawk, and

broad-winged hawk are common raptors which frequent the area. The barred owl is another common bird of prey. Common insectivorous birds include the Eastern kingbird, blue-gray gnatcatcher, ruby-crowned kinglet and great crested flycatcher. Other passerine birds which frequent the study area include the blue jay, common crow, Carolina chickadee, tufted titmouse, Northern mockingbird, brown thrasher, cedar waxwing, white-eyed and red-eyed vireos, yellow-breasted chat, American redstart, Eastern meadowlark, red-winged blackbird, common grackle, summer tanager, indigo and painted buntings, field and white-throated sparrows, cardinal, and the prothonotary, Northern parula, common yellowthroat, yellow-throated, and hooded warblers.

5. Reptiles and Amphibians. A total of 65 reptile and amphibian species are known to occur within the study area. An additional fourteen reptiles and one amphibian are anticipated to occur in the basin. The Western cottonmouth (*Agkistrodon piscivorus*) and the Southern copperhead (*Agkistrodon contortrix contortrix*) were frequently observed during field studies in the basin. The most common water snake observed was the broad-banded water snake (*Natrix fasciata confluens*). Other Colubrids frequently recorded were the Texas rat snake (*Elaphe obsoleta lindheimeri*), the rough green snake (*Opheodrys aestivus*), and the speckled kingsnake (*Lampropeltis getulus holbrooki*). Another reptile which was one of the more common of the herptiles in the area, is the three-toed box turtle (*Terrapene carolina triunguis*). The ground skink (*Eumeces laterale*) was another common reptilian resident of the basin. Frogs and toads which commonly occurred within the project area were the bronze frog (*Rana clamitans*), bullfrog (*Rana catesbeiana*), and Fowler's toad (*Bufo woodhousei fowleri*). The marbled salamander (*Ambystoma opacum*) was the most frequently recorded salamander. (Appendix F.)

6. Insects. By occupying every available niche, the insects have become the most common group of animals to be found in the area. The orders represented in the study ranged from the primitive Collembola to the Lepidoptera and Coleoptera. Most numerous of the insects were the mosquitoes. Butterflies and moths of the order Lepidoptera were also abundant as were the beetles of the order Coleoptera. Along the streams, representatives of the orders Odonata (dragonflies and damselflies) and Ephemeroptera (mayflies) were frequently observed. Some insects are considered pests to agricultural crops and thus represent an enormous potential loss to the state's economy. However, other insects also effect the economy by being predacious upon these pests and thus alleviating some of the agronomic problems. Also these and other insects play a vital role in the food chain of other animals.

(b) Aquatic.

1. Fishes. Fish samples were taken at an accessible point where each transect crossed the Grand Bayou (Refer to Appendix A, Methodology). A total of three, thirty foot drags with a twenty foot

seine were made at each point. The seine had a mesh size of .16 cm. Bluegill (*Lepomis macrochirus*) proved to be the most abundant fish species. Other sunfishes that were very common included the redear (*Lepomis microlophus*), longear (*Lepomis megalotis*), and warmouth (*Lepomis gulosus*). The grass pickerel (*Esox americanus vermiculatus*), and pirate perch (*Aphredoderus sayanus*) and the mosquitofish (*Gambusia affinis*) were other fishes frequently collected. Table III-6 lists the fish that were collected and the locations of the samples taken. Other fish known or presumed to be found within the study area are listed in Appendix G, Fishes.

2. Zooplankton. Zooplankton samples were taken at four (4) sample sites with a standard plankton net (Plate III-7). Three three-minute drags were made at each site. The zooplankters proved to be highly diversified and abundant. The most common taxon was the larvae of the culicid mosquitoes (Table III-7). Other common arthropods include representatives from the order Cladocera and Copepoda. *Daphnia* and *Cyclops* were the most abundant representatives of these two orders, respectively. Nematodes were also well represented with a total of eleven occurring at all four stations. *Keratella* and *Lecane* were rotifers commonly found. *Diffugia* and *Vorticellidae* were frequently identified protozoans representing the Classes Sarcodina and Ciliata, respectively. Coelenterates were also represented with a total of four *Hydra* spp. These were probably scraped from their place of attachment to enter as plankton. Most of the different taxa occurred at fifty percent or more of the stations (Table III-7). Only two taxa, the nematodes and the culicid larvae, were found at all stations. This abundance of mosquito larvae indicates the slow, stagnant flow of the stream which frequently occurs in this season. This rich plankton community should create a great contribution to the primary productivity of the stream. None of the zooplankters provide a direct monetary input for the economy; however, they represent a vital link in the food chain of organisms, and this could affect the economy.

3. Benthic Invertebrates. The benthic macroscopic invertebrates samples were taken at four locations (three samples at each site) along the Grand Bayou (Plate III-7). Each sample area was approximately 1/25 of a square meter in size and each sample was washed using a sieve with a mesh size of .039 inches (one millimeter). Samples identified comprised three phyla: Arthropoda, Annelida, and Mollusca (Table III-8). The class Insecta of the phylum Arthropoda was the most commonly found benthic organism. *Chironomus* sp. (order Diptera) and *Coptotomus* sp. (order Coleoptera) were the two most common representatives of insects which were found during the sampling period. Annelids which were commonly found to occur within the study area include leeches of the class Hirudinea and members of the families Lumbriculidae and Naididae of the class Oligochaeta. Only three genera of mollusks were represented in the samples. These three were *Sphaerium*, *Musculium* and *Anodonta*. The soils of the Grand Bayou are mostly gray silt loam which

TABLE III-6

FISHES COLLECTED FROM GRAND BAYOU
MAY 1979

SCIENTIFIC NAME	COMMON NAME	LOCATIONS-TRANSECTS:									
		A	B*	E	F	G	H	I	Totals		
<i>Aphredoderus sayanus</i>	Pirate Perch	1		3	3				7		
<i>Esox a. vermiculatus</i>	Grass Pickerel	1			1	1			3		
<i>Gambusia affinis</i>	Mosquitofish	31	9	12	10	5			67		
<i>Fundulus chrysotus</i>	Golden Topminnow			1					1		
<i>Fundulus notatus</i>	Blackstripe Topminnow					1		2	3		
<i>Fundulus olivaceus</i>	Blackspotted Topminnow		1						1		
<i>Lepomis gulosus</i>	Warmouth Sunfish				1		1		2		
<i>Lepomis macrochirus</i>	Bluegill Sunfish		11	9	30	48	32	5	135		
<i>Lepomis megalotis</i>	Longear Sunfish	1	2		7		2		12		
<i>Lepomis microlophus</i>	Redear Sunfish			3	9	6		1	19		
<i>Lepomis punctatus</i>	Spotted Sunfish				1				1		
<i>Lepomis symmetricus</i>	Bantam Sunfish				5	7	1		13		
<i>Lepomis spp.</i>	Sunfish (Fry)	2		6	7		2	2	19		
<i>Micropterus salmoides</i>	Largemouth Bass			1					1		
<i>Notropis texanus</i>	Weed Shiner	2							2		
<i>Notropis spp.</i>	Shiners (Fry)				8				8		
<i>Noturus gyrinus</i>	Tadpole Madtom					1			1		

*Points at transects C and D were not accessible due to the sharp slope of the banks and the numerous logs, bushes, and cypress knees.

TABLE III-7

ZOOPLANKTON COUNTS¹
 GRAND BAYOU, MAY 1979

CLASSIFICATION	Pt. 1 Koppers Rd.	Pt. 2 Hwy. 784	Pt. 3 Hwy. 507	Pt. 4 Black Lake	TOTALS:
Protozoa					
Class Ciliata					
Order Holotrichia			1	1	2
Paramecium sp.					
Order Peritrichia			1		6
Family Vorticellidae	5				
Vorticella sp.				1	1
Class Sarcodina					
Order Testacida					
Diffugia sp.	1	3	3		7
Order Centrohelidia				1	1
Acanthocyclops sp.					
Coelenterata					
Class Hydroses					
Order Hydroida					
Hydra sp.		1	1	2	4
Rotifera			1		1
Class Monogonota					
Order Floima					
Keratella sp.				2	2
Lecane sp.	1			3	4

TABLE III-7

ZOOPLANKTON COUNTS¹

GRAND BAYOU, MAY 1979

CONT.

CLASSIFICATION	Pt. 1 Esperanza Rd.	Pt. 2 Hwy. 784	Pt. 3 Hwy. 507	Pt. 4 Black Lake	TOTALS:
Monotoda	3	1	4	3	11
Arthropoda					
Class Crustacea					
Order Cladocera		2	2	2	6
Daphnia sp.			3	1	4
Pleuroxus striatus	1				1
Simoccephalus sp.			2		2
Order Ostracoda	1		1		2
Order Copepoda	1		1		2
Canthocamptus sp.			1		1
Cyclops sp.			6	3	9
Order Anostraca				1	1
Subbranchipus sp.					
Class Insecta	1	2	1		4
Exoskeleton					
Order Diptera					
Family Culicidae					
Larvae	3	5	5	8	21
Order Trichoptera					
Larva		1			1

¹These are actual counts recorded as described in Appendix A. Methodology.

TABLE III-8

BENTHIC COUNTS¹
GRAND BAYOU, MAY 1979

CLASSIFICATION	Pt. 1 Esperanza Rd.	Pt. 2 LA Hwy 784	Pt. 3 LA Hwy 507	Pt. 4 Black Lake	TOTALS:
Arthropoda					
Class Insecta					
Order Coleoptera					
Family Elmidae		2			2
Family Dytiscidae					
<i>Coptotomus</i> sp.		8			8
Order Diptera					
Family Chironomidae					
<i>Chironomus</i> sp.		7		2	9
Order Ephemeroptera					
Family			1		1
<i>Hexagenia</i> sp.					
Order Hemiptera					
Exoskeleton	2		1	1	4
Mollusca					
Class Pelecypoda					
Family Sphaeriidae					
<i>Sphaerium</i> sp.	2	4			6
<i>Musculium</i> sp.	3	2			5
Family Unionidae					
<i>Anodonta grandis</i>	1	1			2
Amelida					
Class Hirudinea					
Class Oligochaeta	2	4		1	7
Family Lumbriculidae					
Family Naididae	5	6			11
		1		4	5

¹These are actual counts recorded as described in Appendix A, Methodology.

should be a good habitat for benthic organisms. However, the Grand Bayou is dry at certain times of the year (Table III-3). Therefore, the habitat is restricted and in turn, populations are limited. Table III-8 lists the benthic organisms that were recorded in the survey.

4. Epibenthic Invertebrates. The epibenthic organisms were recorded during the fish studies incorporating the same methodology that was used for the fish samples. As was mentioned above, the soils of the stream channel are primarily composed of a gray, silty loam. This soil condition and the detritus produced from the dense overstory, provides a fairly adequate habitat for the crustaceans, especially crawfish. The only two groups of crustaceans encountered during the field surveys were the crawfish of the family Astacidae and the freshwater shrimp of the family Palaemonidae. The shrimp were collected only in flooded areas with herbaceous plants or in areas which had stands of aquatic herbaceous plants. The crawfish were abundant in these areas also, but they were collected from the main stream of the channel as well. The crawfish family Astacidae was represented by the genera *Procambarus* and *Orconectes*. Representatives of the genus *Cambarus* were not collected; however, this is a common genus and thus does probably occur within the study area. No gastropods were collected, although members of several families, especially Amnicolidae and Planorbidae, are presumed to exist within the study area (U.S. Army, 1975).

c. Public Hunting Areas. There is only one wildlife management area located near the study area owned or leased by the State of Louisiana. This area is known as the Loggy Bayou Wildlife Management area and is approximately 12 miles north of Coushatta in Bossier Parish. The Loggy Bayou area has a total of 3,699 acres that are open to the public for hunting. Several species that abound in the area include deer, quail, doves, rabbits, squirrels, and ducks (Brunett and Wills, 1978). The Northwest Fish and Game Preserve is located in Natchitoches Parish near Black Lake. This preserve is governed by the Northwest Fish and Game Preserve Commission. The Commission follows the laws and recommendations as set aside by the Louisiana Department of Wildlife and Fisheries. International Paper Company and other private timber companies own approximately 38,549 acres in Red River Parish alone (Burns, 1975), upon which hunting is allowed.

d. Rare and/or Endangered Animal Species. The Bureau of Sport Fisheries and Wildlife in March, 1973, published the Threatened Wildlife of the United States, commonly called the "Red Book". This publication listed those species which the agency considered to be "so few in number or so threatened by present circumstances, as to be in danger of extinction." The status of the species which are considered to be endangered was listed in the Federal Register. This list, compiled by the U.S. Department of the Interior, is titled the "Endangered and Threatened Wildlife and Plants" and appeared in the Federal Register in October, 1977.

(1) Reptiles.

(a) American Alligator. The only reptile that is considered by the federal government to be endangered which could possibly occur within the study area is the American Alligator (*Alligator mississippiensis*). However, populations of the alligator have shown a general increase in recent years, and this has resulted in a delisting from the endangered list in portions of south Louisiana. Only the young alligators prefer heavily vegetated areas, while the adults and sub-adults prefer the remote open bodies of water (O'Neil, 1977). A population of alligators probably does not exist in the area. No alligators were observed in any of the field surveys.

(b) Louisiana Pine Snake. Although it is not considered endangered or threatened, the Louisiana pine snake (*Pituophis melano-leucus ruthveni*) is considered rare because of its limited numbers and range (Ozarks Regional Commission, 1976). The study area is within the limits of the snake's range; therefore, the populations of the Louisiana pine snake could be influenced by any of the projects.

(2) Birds. Three birds are listed in the Federal Register that may possibly occur within the study area. They are the Southern bald eagle (*Haliaeetus leucocephalus leucocephalus*), the red-cockaded woodpecker (*Dendrocopos borealis*), and the ivory-billed woodpecker (*Campephilus principalis*).

(a) Southern Bald Eagle. The primary nesting sites in Louisiana are located in the estuarine areas along the Gulf Coast. Since fish is a favorite food, the bald eagle remains fairly close to, and requires, a relatively large body of water. Some bald eagles migrate north during late spring and summer (Lowery, 1974a). It would be during this migration that an occurrence of the bald eagle within the study area would be most probable; although none were recorded in any of the field surveys.

(b) Red-Cockaded Woodpecker. Long-leaf pine forests are preferred by the red-cockaded woodpecker, although it does occur in other open old age pine forest (Lowery, 1974b). No records were made during field surveys of sightings of the woodpecker. However, the red-cockaded woodpecker is, "Known to inhabit Caddo, Natchitoches, Grant, and Rapides Parishes," (U.S. Army, 1977a). Therefore, it is possible that the red-cockaded woodpecker does occur in the pine-hardwood regions along the edges of the study area.

(c) Ivory-Billed Woodpecker. The ivory-billed woodpecker (*Campephilus principalis*) is another species listed as endangered. However, it is now believed to be extinct. The last authentic report of the ivory-billed woodpecker in Louisiana was in May, 1971. The sighting was south of U.S. Highway 90, at least 113 miles from the study area (Lowery, 1974a).

(3) Mammals. The cougar (*Felis concolor*) is the only endangered mammal that could possibly occur within the study area. The range of the red wolf (*Canis rufus*) originally included the study area; however, it has since been extirpated throughout most of its former range, and now small populations possibly exist only in extreme southwestern Louisiana and southeastern Texas (Lowery, 1974b).

(a) Cougar. The original range of the cougar covered nearly all of the United States and extended down into central America. Due to heavy trapping and hunting, the cougar has now been extirpated throughout most of its former range. The most extensive range in Louisiana is believed to include the Mississippi River Valley and the Upper Atchafalaya River Basin. However, some of the most recent sightings in Louisiana were cited by the Corps of Engineers as follows:

On November 30, 1963, two Caddo Parish law enforcement officers killed an adult cougar at Keithville, Louisiana, 13 miles south of Shreveport. On March 3, 1972, a single sighting was made of a cougar by Joe H. Murphy at Dorcheat Bayou near Sibley, Louisiana, in Webster Parish (U.S. Army, 1975).

The Corps of Engineers cited two other authenticated observations that were in other portions of the state. Considering the information referenced above, the possibility of the cougar occurring in the area does definitely exist.

e. Rare and/or Endangered Plant Species. There is no official record for endangered or threatened plants for Louisiana. The unofficial list, which appears in the Louisiana State Comprehensive Outdoor Recreation Plan (1977), coincides with the species list of the Smithsonian Institute (1975). The only plant listed by both agencies that could possibly be found within the study area is the snapdragon (*Agalinus caddoensis*).

3.05 ARCHEOLOGICAL/HISTORICAL/CULTURAL

a. Red River. There is one known site along this alternative corridor. A systematic survey of this route has not been conducted, however, so it is presently impossible to provide additional information on this site or any possible new sites.

b. Grand Bayou. Twenty-three archeological sites are known within the proposed Grand Bayou pool area and its perimeter. Tables III-9 and III-10 indicate the sites and their associated geological and vegetational zones. It can be seen that the Prairie Terrace and the Pine and Hardwood zones offer the highest probability for site locations.

TABLE III-9

ARCHEOLOGICAL SITES WITHIN AND AROUND
THE PROPOSED GRAND BAYOU POOL
AND THEIR ASSOCIATED GEOLOGICAL ZONES

(Based on a Sample Survey of the Proposed Project Area)

Site Number	Possible Logansport Formation		Possible Montgomery Terrace		Possible Montgomery Terrace		Possible Prairie Terrace		Possible Prairie Terrace		Possible Undiff. Alluvium	
	Logansport Formation	Possible Logansport Formation	Montgomery Terrace	Possible Montgomery Terrace	Montgomery Terrace	Possible Montgomery Terrace	Prairie Terrace	Possible Prairie Terrace	Prairie Terrace	Possible Prairie Terrace	Undiff. Alluvium	Possible Undiff. Alluvium
16 RR 61	X										X	
16 RR 64												
16 RR 65			X									
16 RR 66			X									
16 RR 67												
16 RR 68												
16 RR 69												
16 RR 70												
16 RR 71												
16 RR 72												
16 RR 73												
16 RR 74												
16 RR 75												
16 RR 76												
16 RR 77	X											
16 RR 78	X											
16 RR 79												
16 RR 80												
16 RR 82	X											
16 RR 85												
16 RR 86												
16 RR 87												
16 RR 92												
Total	4	0	2	0	0	13	1	3				

TABLE III-10

ARCHEOLOGICAL SITES WITHIN AND AROUND
THE PROPOSED GRAND BAYOU POOL
AND THEIR ASSOCIATED VEGETATION ZONES

(Based on a Sample Survey of the Proposed Project Area)

Site Number	Pine and Hardwoods	Agriculture	Dry Bottomland Hardwoods	Wet Bottomland Hardwoods
16 RR 61			X	
16 RR 64	X			
16 RR 65	X			
16 RR 66	X			
16 RR 67		X		
16 RR 68	X			
16 RR 69			X	
16 RR 70			X	
16 RR 71	X			
16 RR 72			X	
16 RR 73		X		
16 RR 74	X			
16 RR 75		X		
16 RR 76		X		
16 RR 77	X			
16 RR 78	X			
16 RR 79	X			
16 RR 80	X			
16 RR 82	X			
16 RR 85	X			
16 RR 86	X			
16 RR 87		X		
16 RR 92		X		
Total	13	6	4	0

3.06 DEMOGRAPHIC ELEMENTS

a. Population of Red River Parish, 1930-1977. The 1980 Census is not yet official, therefore, the latest official Census estimates for the population of Red River Parish are for the year 1977. Previous population projections do not take into account the impact of three major projects on Red River Parish as follows:

- construction of the Louisiana North-South Expressway (I-49), which is scheduled to traverse Red River Parish in the decade of the late 1980's or early 1990's.
- development of a navigable Red River waterway, scheduled to traverse Red River Parish, with completion dates established for the mid to late 1980's.
- mining and processing of lignite coal in the officially designated "Energy Impact Area" of four parishes of which Red River is centrally located. Activities associated with the lignite coal are in early stages now. Mining and processing, and the attendant economic and demographic impacts, will continue through the 1980's, 1990's, and into the 21st century. In the impact area are approximately one billion tons of lignite coal.

The Office of the Governor, State of Louisiana, submitted a report to the U.S. Department of Energy in 1979 (Designation Report, Public Law 95-620: the Powerplant and Industrial Fuel Use Act of 1978, dated June 30, 1979) which documented through the use of industry reports that 5,445 new industrial jobs will be created by ten known industries in the period from 1980-1986 (See Section 1). The report enumerated only known industries with announced plans. When family members are included in the estimates, an estimated 9,822 persons are expected to populate the area by 1984 (According to a report issued to the Federal Regional Council by Louisiana Governor David Treen in March of 1980). That untitled report is available from the Office of the Governor.

These projections do not break down expected population increase according to parishes, however. Instead the report concerns a four-parish area: Red River, Natchitoches, Sabine, and DeSoto.

In his report, the Governor of Louisiana stated on page 4, "The northwestern Louisiana Energy Triangle will be a boom area Because of the large energy infrastructure that will be developed there, opportunities beyond the decade of 2020 will be for an extended energy center which could utilize western coal and other energy sources including biomass. This will be true because the utilities will have invested more than \$3 billion for plant construction. Unless technology changes dramatically, those plants will have an extended life. The immediate concern, however, is coping with the stress-strain relationships that will be caused in the next ten years. Areas that will require special attention are listed, in part, below: water systems."

The highest recorded population of Red River Parish occurred in 1930 (Table III-11). From 1930 through 1970, the population decreased. Preliminary census estimates for 1977 indicate a slight increase in population.

TABLE III-11
POPULATION OF RED RIVER PARISH,
LOUISIANA, 1930-1977

<u>Year</u>	<u>Population</u>
1930	16,089
1940	15,881
1950	12,113
1960	9,978
1970	9,226
1977*	9,526

*Preliminary U.S. Census estimate.

SOURCE: Louisiana Almanac, 1970-1980
James Calhoun, Editor

b. Population Profile, 1970.

(1) Race. In 1950, the population of Red River Parish was equally divided between whites and nonwhites. Since then the proportion of whites has increased slightly, although the actual population of whites and nonwhites has declined (Table III-12).

TABLE III-12

RACIAL COMPOSITION OF POPULATION IN
RED RIVER PARISH, LOUISIANA, 1950-1970

Year	White		Nonwhite	
	Number	Percent	Number	Percent
1950	6,057	50.0	6,056	50.0
1960	5,232	52.4	4,746	47.6
1970	5,337	57.8	3,889	42.2

SOURCE: Statistical Profile of Red River Parish, 1973,
Public Affairs Research Council of Louisiana, Inc.
Baton Rouge, Louisiana

(2) Age and Sex. Females comprise a slightly larger proportion of the population of Red River Parish than do males. The proportion of persons 65 years of age and older has increased in the parish, while the younger age category (under 18) has steadily decreased (Table III-13).

TABLE III-13

AGE AND SEX CHARACTERISTICS OF
RED RIVER PARISH, LOUISIANA, 1950-1970

NUMBER							
YEAR	MALE			FEMALE			
	Under 18	18 to 64	65 and over	Under 18	18 to 64	65 and over	TOTAL
1950	2,597	2,833	534	2,535	3,097	517	12,113
1960	2,074	2,181	575	2,036	2,541	571	9,978
1970	1,759	2,043	562	1,727	2,459	676	9,226
PERCENT							
1950	21.4	23.4	4.4	20.9	25.6	4.3	100.0
1960	20.8	21.9	5.8	20.4	25.5	5.7	100.1*
1970	19.1	22.1	6.1	18.7	26.7	7.3	100.0

*Does not total to 100.0 due to rounding.

SOURCE: Statistical Profile of Red River Parish, 1973,
Public Affairs Research Council of Louisiana, Inc.,
Baton Rouge, Louisiana.

(3) Population Projections. Available projections show a continued decrease in the population of Red River Parish. Although census estimates of population show a slight increase, other projections show a continually declining population due to the fact that they were based on historical data which were available in the 1970's. None of the existing projections take into account the impact on population expected as a result of lignite mining and processing, development of the Red River waterway into a navigable body of water, and the construction of the Louisiana North-South Expressway (I-49). No new projections are available which take into account these developments. In order to take this growth into account a completely new set of projections are required.

For the purposes of this report, using figures developed by the Governor's Office indicating that 5,445 new industrial jobs will be created in the four-parish Energy Impact Area and making the assumption that for each job there will be a multiplying factor of three, it can be projected that the area's population will increase by 16,335 (including family members and support persons). What percentage of these people will actually locate residential quarters in Red River Parish is not known yet, although all the new major electricity generating plants will be located in Red River Parish, according to industry sources, specifically Cajun Electrical Cooperative, Central Louisiana Energy Company, and Southwest Electric Power Company. If one-quarter of the in-migrating population locate in Red River Parish, the population of that parish will increase by more than 4,000 persons, a conservative estimate, according to Coushatta Mayor Truman Crawford. Thus Table III-14 includes four sets of existing projections and one set of new projections which take into account the new population impacts.

TABLE III-14

**POPULATION PROJECTIONS,
RED RIVER PARISH, LOUISIANA**

YEAR	PROJECTION				
	A ¹	A ²	A ³	A ⁴	A ⁵
(6)					
1970	9,226	9,226	9,226	9,226	9,226
1975	9,439	9,018	--	8,743	9,439
1976	9,370	--	--	--	9,370
1985	--	8,810	9,153	8,255	13,370

A¹ = Estimates of the Louisiana Economy, Louisiana Tech University, Ruston, Louisiana

A² = Projections to the Year 2000 of Louisiana Population and Households, UNO, New Orleans, Segal, et al., 1976

A³ = Population Projections to 1980 and 1990, LSUNO, New Orleans; Christou and Segal, 1973

A⁴ = Population Projections by Age, Race, and Sex for Louisiana and its Parishes, 1970-1985, LSU, Baton Rouge; Burford and Murzyn, 1972

A⁵ = Column A¹ plus 4,000, beginning in 1984, per para, 3 above

6 = Actual 1970 Census

3.07 ECONOMIC ELEMENTS

a. Employment. No official Census employment data is available beyond 1970. In 1970, 2,715 residents of Red River Parish of a work force of 2,945 (excludes military personnel) were employed. The unemployment rate was 7.8 percent. The primary areas of employment were in agriculture, forestry, fisheries, and manufacturing as are shown in Table III-15. These figures do not include existing and projected new employment in the lignite-related mining and manufacturing areas.

TABLE III-15

EMPLOYMENT BY MAJOR INDUSTRY
RED RIVER PARISH, LOUISIANA

Employed by Major Industry	1950		1960		1970	
	Number	Percent	Number	Percent	Number	Percent
Total	3,345	100.0	2,552	100.0	2,715	100.0
Agriculture, forestry & fisheries	1,886	56.4	652	25.6	340	12.5
Mining	50	1.5	56	2.2	67	2.5
Construction	160	4.8	270	10.6	240	8.8
Manufacturing	128	3.8	252	9.9	574	21.1
Railroad	56	1.7	23	0.9	28	1.0
Trucking service	13	0.4	12	0.5	22	0.8
Other transport	24	0.7	40	1.6	46	1.7
Communications	10	0.3	12	0.5	13	0.5
Utilities & sanitary	31	0.9	29	1.1	34	1.2
Wholesale trade	27	0.8	51	2.0	108	4.0
Food & dairy	87	2.6	80	3.1	79	2.9
Eating & drinking	48	1.4	41	1.6	86	3.2
Other retail	175	5.2	244	9.6	183	6.7
Finance, ins. & real estate	24	0.7	42	1.6	24	0.9
Business and repair service	40	1.2	42	1.6	53	2.0
Private households	151	4.5	292	11.3	186	6.9
Other personal service	61	1.8	56	2.2	29	1.1
Entertainment	9	0.3	0		24	0.9
Hospitals	15	0.4	13	0.5	64	2.3
Education	167	5.0	160	6.3	206	7.6
Other prof. service	26	0.8	44	1.7	36	1.3
Public administration	74	2.2	109	4.3	72	2.7
Other	83	2.5	32	1.3	201	7.4

SOURCE: Statistical Profile of Red River Parish, 1973,
Public Affairs Research Council of Louisiana, Inc.,
Baton Rouge.

b. Income. The median annual family income in Red River Parish was \$4,563 in 1969. The median income for Louisiana was \$7,530. Forty percent of the families reported income below the poverty level. The median earnings for males was \$4,520; females had a median of \$1,804 (Table III-16).

TABLE III-16

MEDIAN EARNINGS OF SELECTED OCCUPATION GROUPS
RED RIVER PARISH, LOUISIANA, 1969

Male, Total	\$ 4,620
Professional, managers, & kindred	8,256
Craftsmen, foremen, & kindred	5,813
Operatives & kindred	4,647
Laborers, except farm	2,667
Female, Total	1,804
Clerical & kindred	3,000
Operatives, including transportation	2,238

SOURCE: Statistical Profile of Red River Parish, 1973
Public Affairs Research Council of Louisiana, Inc.
Baton Rouge

c. Agricultural and Forestry Production.

(1) Crops. Red River Parish had a total of 21,300 acres in the production of five major crops. These crops include cotton, corn, soybeans, wheat, and sorghums. Soybeans account for the most acreage with a total of 11,500 acres (Table III-17).

TABLE III-17

CROP YIELD AND PRODUCTION
RED RIVER PARISH, LOUISIANA, 1976

Crop	Acreage Harvested	Yield/Acre	Production
Cotton	5,100	439.0 pounds	4,660 bales
Corn	1,100	55.0 bushels	60,500 bushels
Soybeans	11,500	29.0 bushels	334,000 bushels
Wheat	1,100	33.0 bushels	36,300 bushels
Sorghums	2,500	31.0 bushels	77,500 bushels
TOTAL	21,300		

SOURCE: Agricultural Statistics for Louisiana, 1973-1976.
 Lonnie L. Fielder, Jr. and Sam L. Guy, Louisiana
 State University and Agricultural and Mechanical College.

(2) Timber and Pulpwood Production. During 1977 a total of 9,056,740 board feet of sawtimber and 45,021 cords of pine and hardwood pulpwood were severed in Red River Parish. The estimated value of this production was \$1,038,358 (Table III-18).

TABLE III-18

TIMBER SEVERED AND ESTIMATED STUMPAGE VALUE
RED RIVER PARISH, 1977

Species	Timber Severed	Stumpage Value (\$)
¹ <u>Sawtimber</u>		
Cypress	-	-
Oak	990,176	39,607
Ash	-	-
Pine	7,035,890	703,589

TABLE III-18 (Cont'd)

Species	Timber Severed	Stumpage Value (\$)
¹ <u>Sawtimber (Cont'd)</u>		
Gum	116,245	4,650
Cottonwood & Willow	2,003	90
Other Hardwoods	912,426	41,059
² <u>Pulpwood</u>		
Pine	32,656.55	212,268
Hardwood	12,364.87	37,095

¹Sawtimber in board feet, Doyle scale.

²Pulpwood in standard cords.

SOURCE: "1977 Timber and Pulpwood Production in Louisiana",
Louisiana Department of Natural Resources,
Office of Forestry, 1978.

d. Sales Tax Revenue. The Red River Parish School Board collects a one percent sales tax. These tax receipts provide a measure of economic activity in the parish in that the actual average monthly tax receipts from 1975 to 1978 increased from \$15,016 to \$25,123. When the collection is adjusted to 1967 dollars, the amounts are \$9,314 and \$12,858, respectively (Table III-19). When a new public water supply is developed for Red River Parish, coupled with expansion in the energy sector, attendant economic activities will cause an increase in tax receipts. The actual amount of future tax increases has not been projected and is not available for inclusion in this report.

TABLE III-19

AVERAGE MONTHLY SALES TAX RECEIPTS,
ACTUAL AND ADJUSTED TO 1967 DOLLARS
RED RIVER PARISH, LOUISIANA

Year	Monthly Average (\$)		Annual Percent Change ²	
	Actual ¹	Adjusted ²	Actual	Adjusted
1975	15,016	9,314	-	-
1976	17,782	10,429	18.42	11.97
1977	22,881	12,607	28.68	20.88
1978	25,123	12,858	9.80	1.99

SOURCE: ¹Louisiana Business Review. Louisiana State University, Division of Research, College of Business Administration. 1975-1978, Baton Rouge, Louisiana.

²SUNBELT RESEARCH CORPORATION.

3.08 LAND USE

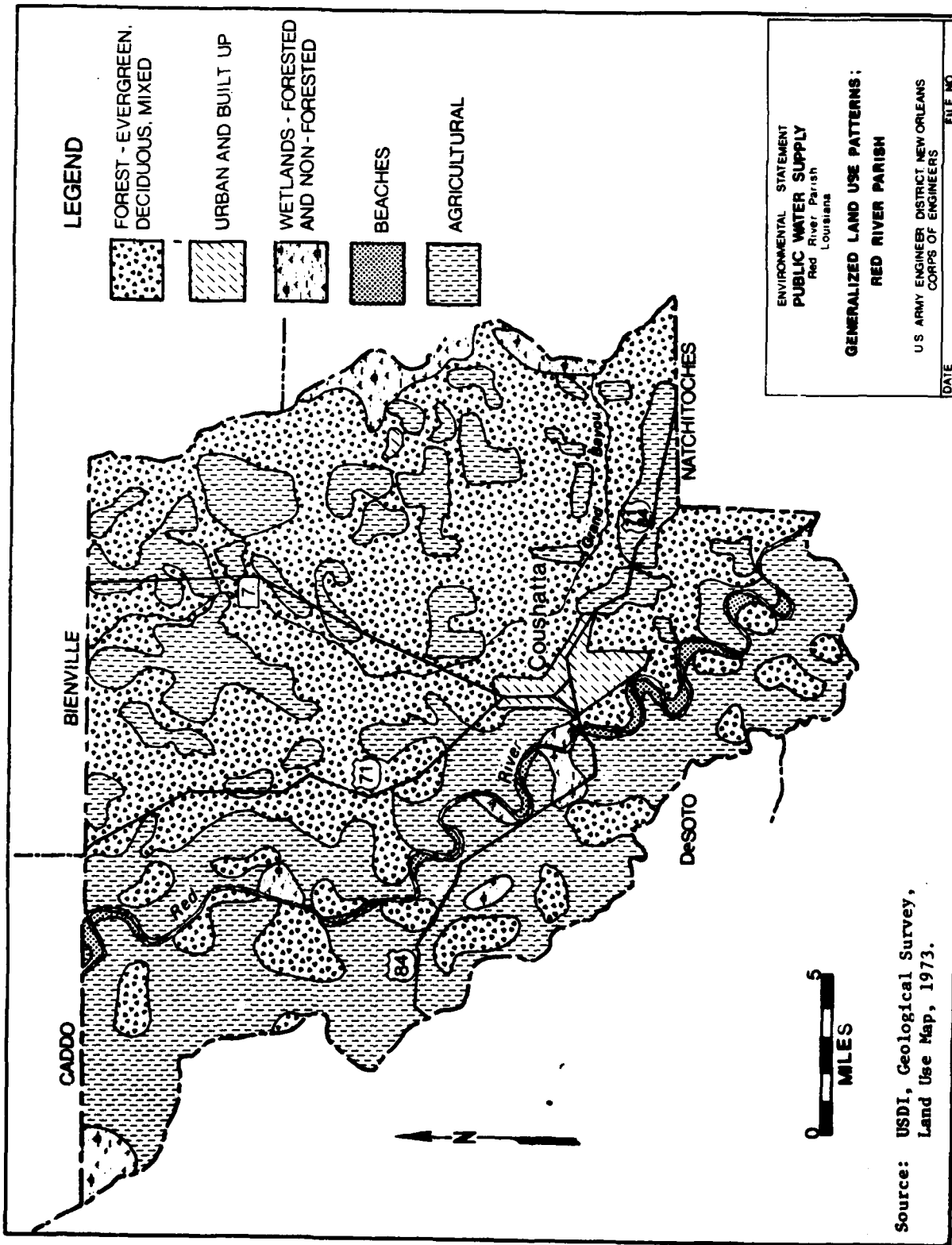
Red River Parish has a total of 253,203 acres. Of this total, 44 percent is used for agricultural purposes. Forested land comprises approximately 50 percent of the parish. Sixty percent of the forested land is considered evergreen forest, 22.6 percent is deciduous forest, and 17.4 percent is mixed. The remaining six percent of the total area is comprised of waterways, water bodies, and urban areas. Plate III-8 represents the land use patterns of Red River Parish (Please refer to Future Land Use, Red River Parish, 1978 for more details.)

The future land use of Red River Parish will be dramatically changed after lignite mining begins in the mid-1980s. It is now projected that mining will occur in the western and northern portions of the parish. It is also likely that a larger percentage of the land will be devoted to industrial and urban purposes.

3.09 DEVELOPMENTS

a. Water Resources.

(1) Red River Navigation. This project includes the construction and maintenance of a 9 by 200 foot navigation channel, with five locks and dams and related bank stabilization, from the Mississippi



River to Shreveport, Louisiana. Recreation is an integral part of the project and facilities will be developed at lock and dam sites, at selected sites along the navigation channel, and at oxbow lakes formed by channel realignment. (Refer to Final Supplement No. 1 to the Final Environmental Statement, Red River Waterway, Louisiana, Texas, Arkansas, and Oklahoma, and Related Projects; Mississippi River to Shreveport, Louisiana Reach; U.S. Army Engineer District, New Orleans, Louisiana, February, 1977, for further details.)

(2) Existing Reservoirs.

(a) Lake Bistineau. Lake Bistineau is an impoundment of Bayou Dorcheat in northwest Louisiana. The lake lies in three parishes (Webster, Bossier, and Bienville). The earthfill dam was completed in 1935 and enlarged in 1951. The reservoir is used for flood control and conservation. The dam contains a 1,200 foot concrete spillway equipped with twelve adjustable gates and a fish ladder (USDI, 1978).

(b) Black Lake. Black Lake is a 13,500 acre reservoir located approximately eighteen miles south of Coushatta in Natchitoches Parish, Louisiana. Construction was completed in 1934, but additional work was done in 1949. The lake is divided into two distinct sections by Louisiana Highway 9. The area west and north of Highway 9 is thickly populated with trees and other vegetation and is known as Black Lake. The area to the east and south of the highway is primarily open water and is known as Clear Lake. The reservoir is used primarily for recreation (Stokes, 1971).

b. Railways. The Kansas City Southern Railway (KCS) and the Texas Pacific Railway (TP) have trackage which roughly parallels the Red River. Both railroads operate between Shreveport and Alexandria. The KCS provides service on the east side of the Red River and TP on the west side.

c. Airports. The Coushatta-Red River Parish airport is a general aviation facility located 2.5 miles southeast of Coushatta. The runway is 5,000 feet long. Services and fuel are not available at the airport.

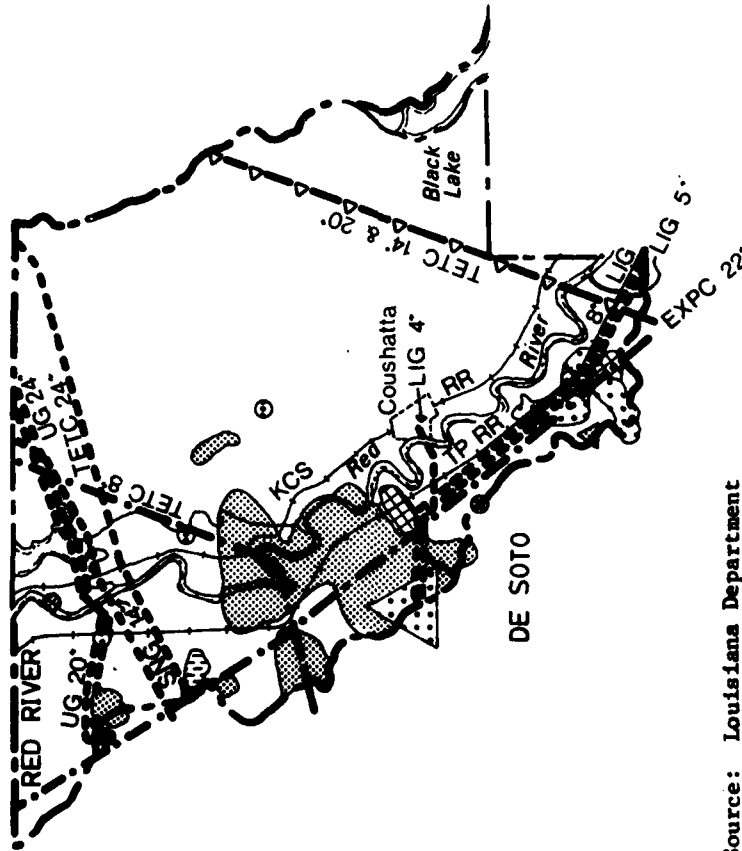
d. Highways. A total of seven state highways cross Red River Parish. Two federal highways, 71 and 84, also cross Red River Parish. Several parish roads connect these highways. (Refer to Plate II-3 for details of highway locations.)

e. Minerals.

(1) Oil and Gas. Only a limited number of oil and gas fields have been discovered in Red River Parish. Most of the fields are located along the western boundary and extend into DeSoto Parish (Plate III-9).

LEGEND

- STUDY AREA BOUNDARY
- GAS PIPELINE
- . - . OIL PIPELINE
- △--- PRODUCTS PIPELINE
- [Pattern] OIL PRODUCTION
- [Pattern] GAS PRODUCTION
- [Pattern] DEPLETED OIL AREA
- [Pattern] DEPLETED GAS AREA
- [Pattern] OIL PRODUCTION - AREA NOT DELINEATED
- [Pattern] GAS PRODUCTION - AREA NOT DELINEATED
- ONE WELL FIELD



ENVIRONMENTAL STATEMENT
PUBLIC WATER SUPPLY
Red River Parish
Louisiana

OIL AND GAS FIELDS AND PIPELINES

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE _____ FILE NO. _____

PLATE III-9

Source: Louisiana Department of Conservation, "Oil and Gas Map of Louisiana," 1973.

Still, Red River Parish produces more barrels of oil than 32 other parishes in the state. The natural gas production of Red River Parish is somewhat lower, producing more cubic feet of natural gas than only 25 of the 64 parishes in the state. The natural gas production in Red River Parish in 1974 was 2,511,849 thousand cubic feet. (Refer to Table III-20) (Louisiana Department of Conservation, 1974).

TABLE III-20
OIL AND GAS PRODUCTION, 1974

Parish	Crude Oil		Natural Gas	
	Barrels	% of Total Produced In Five Parishes	1000 cubic ft. @ 15,025# Abs.	% of Total Produced In Five Parishes
Bienville	57,509	0.87	58,595,629	34.94
Bossier	1,798,403	27.13	42,767,681	25.50
Natchi- toches	2,942,357	44.39	17,749,441	10.58
Red River	923,859	13.94	2,511,849	1.50
Webster	906,698	13.68	46,094,369	27.48
TOTALS	6,628,826	100.01*	167,718,969	100.00

*Not exactly 100 due to rounding.

SOURCE: "Louisiana Annual Oil and Gas Report, 1974"
Louisiana Department of Conservation

(2) Sand and Gravel. Sand is classified as being a naturally occurring mineral material ranging in size from 0.0029 inch to 0.187 inch. Gravel is the incoherent granular rock which is coarser than 0.187 inch. Several exposures of sand and gravel are located in Red River Parish. These exposures are a portion of the north-south Quaternary Alluvial Valleys of the tributaries of the Red River. No extensive commercial dredging is presently taking place on the Red River in Red River Parish. Most of the outcrops of Red River Parish occur along the Black Lake Bayou drainage system and are of either Bentley or Montgomery Age (Woodward and Gueno, 1941). Table III-21 lists the sand and gravel production of Red River Parish.

TABLE III-21

SAND AND GRAVEL PRODUCTION
RED RIVER PARISH, LOUISIANA
1974 & 1975

Year	No. of Mines	Production (1000 Short Tons)	Value (1000 Dollars)
1974	3	51	166
1975	2	W	71

W = Withheld to avoid disclosing confidential data.

SOURCE: The Mineral Industry of Louisiana, 1975,
 Ownes W. Jones and Leo W. Hough, Bureau of Mines,
 United States Department of the Interior and the
 Louisiana Geological Survey.

(3) Lignite. Lignite is classified as an immature coal at an intermediate stage between peat and bituminous coal. The lignite fields located within the study area are associated with the Wilcox Formation. The most extensive Louisiana lignite range is found in DeSoto Parish (in the Dolet Hills) which borders Red River Parish on the west. This field extends into Red River Parish. Separate lignite outcrops do occur on the east side of the Red River as well. An extensive study of the lignite outcrops found in Louisiana was conducted by the Department of Conservation, Louisiana Geological Survey, in 1942. Table III-22 lists the location and descriptions of the lignite fields which occur in three parishes of the study area as a result of the 1942 survey.

TABLE III-22

LIGNITE FIELDS WITHIN THE STUDY AREA

Parish	Township	Range	Thickness	Stratigraphic Position		
				Group	Formation	Member
Red River	14N	10W	3'6"	Midway	Hall Summit	Loggy Bayou
Red River	14N	9W	0'4"	Midway	Hall Summit	Loggy Bayou
Natchitoches	8N	9W	0'8"	Wilcox	Pendelton	Loggy Bayou
Natchitoches	10N	7W	2'5"	Wilcox	Pendelton	Loggy Bayou
Webster	19N	9W	1'8"	Claiborne	Sparta	Loggy Bayou

TABLE III-22 (cont'd)

SOURCE: Louisiana Lignite, D. Pope Meagher and L.C. Aycock
Geological Pamphlet No. 3
Department of Conservation
Louisiana Geological Survey, 1942

Seven companies have obtained exploratory drilling permits for lignite in areas which encompass all of Webster and Red River Parishes and the majority of Bossier, Bienville, and Natchitoches Parishes (Sunbelt Research Corporation, 1979).

f. Power Transmission Lines. Three electrical power transmission lines cross the study area. The three lines are owned by Gulf States Utilities, Central Louisiana Electric Company, and Louisiana Power and Light Company. The Gulf States Utilities line is a major transmission line that runs northeast from the hydroelectric plant located at the Toledo Bend Reservoir dam and has a voltage of 500 KV (U.S. Department of Energy, 1978).

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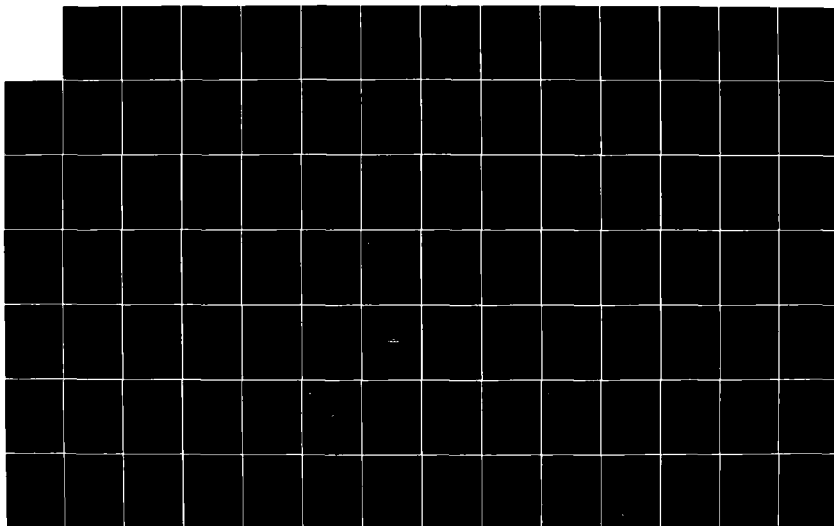
PUBLIC WATER SUPPLY RED RIVER PARISH LOUISIANA(U)
SUNBELT RESEARCH CORP BATON ROUGE LA C W DECKER MAR 81

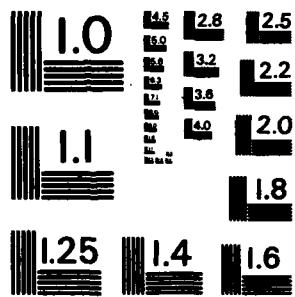
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SECTION 4.

ENVIRONMENTAL CONSEQUENCES

4.01 DIRECT EFFECTS AND THEIR SIGNIFICANCE

a. Beneficial effects.

(1) Meets purpose. Water availability is a primary consideration in determining whether or not an alternative meets the intended purpose. Each alternative under consideration is adequate in terms of water quantity except for the no action alternative.

(2) Potential habitat development.

(a) Fisheries. No direct beneficial impacts upon fisheries will result from a pipeline from Red River. Grand Bayou Reservoir would produce 2,700 surface acres of prime fisheries habitat that averages ten feet deep. The steep gradient of the intermittent and main stream channels would create structures around which fish would gather. The gentle slope along the north shore would create a spawning habitat if properly maintained. As was discussed in earlier sections, the plankton and macroscopic invertebrates are numerous and diversified enough to sufficiently sustain a food chain for game and commercial fish.

(b) Waterfowl. The creation of Grand Bayou Reservoir would produce a resting point for migratory waterfowl. Geese, diving ducks, and dabbling ducks would be found in the area as a result of the reservoir. Moreover, the large shallow areas found along the north shore of the proposed lake would provide feeding grounds for all types of waterfowl. Four to five hundred acres of shoreline waterfowl habitat are estimated to be produced as a result of implementation of the reservoir (USDI, 1979). Still, the majority of the lake would serve merely as a resting point for most game waterfowl.

(c) Forest edge. Pipeline right-of-ways from the Red River would create a strip along either side of the right-of-way which would be considered a forest edge community. This type of habitat is by far the most diversified of any found within the study area and would therefore serve as a niche for various species of wildlife. The total acreage of forest edge communities produced from a pipeline from Red River would be approximately 36 acres considering a 15 foot strip on either side of the right-of-way. Depending upon restrictions placed upon shoreline development, a forest edge community could be created

along the Grand Bayou Reservoir that would amount to a total of 62 acres.

b. Adverse effects.

(1) Land resources.

(a) Red River. Bossier City is the only known municipality located in Louisiana that withdraws water from the Red River. Bossier was required to construct a settling pond (2,000 acre feet) in order to allow a majority of the suspended materials in the Red River water to fall from suspension. This was accomplished by constructing a 100 acre pond which is 20 feet deep. This settling pond contains approximately a 100-day supply of water, based on Bossier City's average day consumption (Howell, 1979). An equivalent storage supply for Red River Parish, would require construction of a 1700 acre-feet pond. (85 surface acres by 20 foot depth.)

(b) Grand Bayou. A reservoir on Grand Bayou would result in the irretrievable loss of 2900 acres of land resources. Most of this land, however, is in the alluvial floodplain of Grand Bayou. Therefore, this land is not used for agricultural or timber production. This land does provide excellent habitat for various species of wildlife. The land consists of primarily bottomland hardwoods.

(2) Vegetational resources.

(a) Red River. Before treatment can begin on water from the Red River the water must first be pumped into a "holding" or "settling" pond in order to allow siltation of particulate matter from the water. Land will also be required for the treatment plant. A total of approximately 115 acres of terrestrial vegetation will be irreversibly lost. This includes 85 acres for a holding pond (20' depth) and 30 acres for the treatment plant and a "buffer" zone around the pond.

(b) Grand Bayou. The reservoir itself as proposed will require 2700 acres of terrestrial vegetation to be cleared. An additional 1.5 feet above mean pool level is proposed to be cleared. This will mean an additional 200 acres along the shoreline that will be cleared. Most of the vegetation which will be required to be cleared will consist of bottomland hardwoods (Plate III-8). A small percentage (10.2) of the basin is comprised of agricultural land. The pine-hardwoods which lie mostly around the periphery of the basin comprise 19.6 percent of the 2900 acres to be cleared. This is the portion of land which would be the only feasible area upon which to practice forest management, although presently none is being applied.

(3) Wildlife resources.

(a) Red River. A pipeline from Red River will have a

minimal impact on the wildlife of the area. However, as mentioned above, a "settling" pond will have to be constructed; thus, the terrestrial wildlife in the immediate area of construction will be displaced. Those animals which are too slow for displacement (turtles, salamanders, etc.) might be irretrievably lost.

(b) Grand Bayou. The 2036 acres of bottomland and the 568 acres of pine-hardwoods found within the project area is prime habitat for a diversity of animals (see Section 3.04b). Displacement and relocation of such an enormous number of animals would be detrimental to most. Those animals which did survive the displacement would then be in competition for food and cover with the other inhabitants in the relocation area. Several beaver ponds are located within the project area which have recently been described as providing valuable ecosystems for aquatic and non-aquatic, game and non-game wildlife (Hair, et al., 1978). The beaver ponds are especially important to the woodduck and mallard populations within the basin. According to the results of a Habitat Evaluation Procedure (HEP), the bottomland hardwoods found within the project area of the Grand Bayou Reservoir are of a high quality (U.S. Department of the Interior, 1979). Table IV-1 lists the values per acre of prime bottomland hardwoods. As a comparison, moderate and low quality bottomland hardwoods are also listed. From this table, the value of the bottomland hardwoods which would be lost as a result of the construction of the reservoir can be calculated. Man-days lost for small game hunting, large game hunting, and Wildlife Oriented Recreation (WOR) would be 773.68, 1221.6, and 1018, respectively. A total annual value of \$15,351.44 is calculated for the value of these bottomland hardwoods. When separated into the different categories this figure represents \$2,321.04 for small game hunting, \$10,994.40 for large game hunting, and \$2,036 for WOR. The most trapped furbearer in the bottomland hardwoods is the Northern Raccoon (*Procyon lotor*). The value per acre in this habitat type for the raccoon would be \$.191 (U.S. Army, 1977). This calculates to a total value of \$388.88 for the Grand Bayou project area. These figures are annual values.

TABLE IV-1

MAN DAYS AND VALUE PER ACRE OF BOTTOMLAND HARDWOODS

	HIGH QUALITY		MODERATE QUALITY		LOW QUALITY	
	Man-Days	\$	Man-Days	\$	Man-Days	\$
Small Game	.38	1.14	.32	.96	.17	.51
Large Game	.60	5.40	.48	4.32	.31	2.79
Wildlife Oriented Recreation (WOR)	.50	1.00	.50	1.00	.50	1.00

Source: "Value of Wetlands and Bottomland Hardwoods", New Orleans

Table IV-1, continued.

District, U.S. Army Corps of Engineers, Environmental Quality
Section, Table 23, July, 1977.

(4) Archeological/Cultural.

(a) Red River. Because this alternative involves only a pipeline, adverse impacts can be minimized by routing the line around any cultural resources. Table IV-2 indicates the possible adverse impacts of the alternatives.

(b) Grand Bayou. At least twenty-three sites are expected to suffer irreversible adverse impacts once the Grand Bayou Reservoir is created (see Table IV-2). Additional sites may be adversely effected since the twenty-three known sites were determined by a sample-based survey. The impacts will be caused by total inundation and/or erosion along the banks of the reservoir. Of the twenty-three known sites, impacts will be caused by total inundation of 14 sites and possible erosion of another nine sites along the reservoir banks.

TABLE IV-2
DIRECT ADVERSE IMPACTS ON CULTURAL RESOURCES

Alternative	Prehistoric Component	Historic Component
Red River	NONE	NONE
Grand Bayou	23	3*
No Action	NONE	NONE

*These three sites have both prehistoric and historic components.

(5) Modifications.

(a) Red River. No modifications of existing pipelines, powerlines, highways, railroads or bridges are expected to occur if water is to be withdrawn from Red River.

(b) Grand Bayou. Major modifications will be necessary if a reservoir is constructed on Grand Bayou. The following modifications will be necessary: (For further details refer to Feasibility and Development Plan, Vol. I, Grand Bayou Reservoir, Red River Parish, Louisiana.)

1. Highway Modifications.

a. Esperanza Road - This is a parish road which is located at the northern most area of the reservoir site. The proposed

modification is to eliminate the four (4) existing wooden bridges and to replace them with one 200 foot concrete bridge. In addition, the new bridge and approximately 2850 feet of the existing road will be raised to 148.0' MSL.

b. Louisiana Highway No. 748. This highway crosses the reservoir site approximately three miles upstream from the dam site. Two concrete deck bridges are proposed to be replaced with one concrete structure with a minimum length of 200 feet. Also another bridge located on this highway crosses a finger of the proposed reservoir on the northern edge. The concrete deck bridge at this point will be replaced with a 60 foot concrete deck bridge. Again, the new bridge and existing road will be raised to 148' MSL. The portion of the road to be raised at this bridge will be approximately 200 feet on either side of the bridge.

c. Louisiana Highway No. 155. The elevation and structure of the bridges on Highway No. 155 which crosses Grand Bayou are presently adequate, since this highway is located in an area which would be effected only in extreme backwater. However, it is proposed that work be done to improve the slope along the highway for protection against erosion.

2. Pipeline Modifications. One 20" products pipeline and one 14" products pipeline owned by the Texas Eastern Transmission Corporation bisect the proposed reservoir site near the damsite. The pipelines are not weighted, although, Texas Eastern was warned by the parish government to weight the pipelines because of the possibility of the construction of a reservoir. The approximate total length to be weighted is 8000' each. The parish is now requesting that Texas Eastern bear the cost of modification if the reservoir is constructed.

(6) Short-term construction impacts. During the construction of either alternative, the same basic inconveniences and impacts are going to occur. Some of these include dust, noise, and smoke production. These impacts would be greater at the reservoir site than at the pipeline construction site. Refer to the Feasibility and Development Plan Grand Bayou Reservoir, Red River Parish, Louisiana, Vol. IV 1976, for details of construction impacts which would be encountered.

(7) Long-term pollution impacts. The two alternative projects, namely the Red River Water Supply Project and Grand Bayou Reservoir, will attract industries, businesses and additional population into the service area. This development brings along additional pollutional problems related to water, air, land and noise.

The Red River project and the Grand Bayou project, which need long maintenance roads (ten miles and five miles respectively) along the force main rights-of-way, will create additional pollution associated

with the pipeline maintenance and other traffic on the road.

The roadways may induce land development along them. The Red River alternative effects will be more severe due to the longer force main. The intake structure-pump houses for both the projects will be sources of noise for any existing or future homes nearby. This may also disturb the nearby wildlife. The large volume of surplus earth created after construction of the Red River alternative holding pond might pose a long-term pollution problem for natural drainage ways. The two alternative projects require water treatment plants and the resultant waste chemical sludge disposal will be comparatively greater for the Red River project than the Grand Bayou project. It was estimated that the sludge to be disposed of by the Red River project would be in excess of 5 tons of solids per day. The treatment plant related noise would be more for the Red River alternative than the Grand Bayou alternative because of more complex treatment facilities.

Construction of a reservoir on Grand Bayou will result in the creation of many miles of new shoreline. This shoreline may be subject to wind induced wave erosion from the reservoir. Erosion can present a problem to property owners in terms of "lost" land and also increases the suspended solids level of the reservoir water which in turn can increase the rate of sedimentation.

The phenomenon of wave development is discussed in the following excerpts from Water Resources Engineering by Ray K. Linsley and Joseph B. Franzini (3rd Edition, McGraw Hill, 1979).

"When wind begins to blow over a smooth surface, small waves, called capillary waves, appear in response to the turbulent eddies in the wind stream. These waves grow in size and length as a result of the continuing push of the wind on the back of the waves and of the shearing or tangential force between the wind and the water. As the waves grow in size and length, their speed increases until they move at speeds approaching the speed of the wind. Because growth of a wave depends in part upon the difference between wind and wave speed, the growth rate approaches zero as the wave speed approaches the wind speed.

"Earth dams must have sufficient freeboard at the maximum pool level so that waves cannot wash over the top of the dam. Waves in reservoirs may also damage shoreline structures and embankments adjacent to the water and interfere with navigation. Part of the design of any reservoir is an estimate of wind set-up and wave height.

"Wind set-up is the tilting of the reservoir water surface caused by the movement of the surface water toward the leeward shore under the action of the wind. The current of surface water is a result of tangential stresses between the wind and the water and of differences in atmospheric pressure over the reservoir. The latter, however, is typically a smaller effect. As a consequence of wind set-up, the reservoir water surface is above normal still-water level on the leeward side and below the still-water level on the windward side. This results in hydrostatic unbalance and a return flow at some depth must occur. The water-surface slope which results is that necessary to sustain the return flow under conditions of bottom roughness and cross-sectional area of flow which exist. Wind set-up is generally larger in shallow reservoirs with rough bottoms."

Another possible effect of the reservoir construction is the creation of pools of stagnant water which provide breeding areas for mosquitoes. Mosquitoes lay a raft-like mass of eggs on or near water. Within a few days or weeks, depending on the species, the eggs hatch into larvae. Mosquitoes can transmit yellow fever, malaria and other diseases among humans and thus their spread must be controlled.

Construction of the pipeline for the Red River alternative will involve clearing of the corridor. Erosion will be induced by the alteration of existing drainage patterns and removal of vegetation. Wind erosion will also be possible in the areas of disturbed soil. These effects can be minimized by proper construction procedures such as sprinkling the loose soil and reseeding the construction area.

The water storage reservoir (holding pond) required for the Red River water supply alternative will involve similar problems with regard to mosquito breeding as the Grand Bayou Reservoir alternative. The size of the storage reservoir is much smaller than the Grand Bayou Reservoir, thus, control of mosquitoes under this alternative will be easier to accomplish than for the Grand Bayou Reservoir.

(8) Displacements. The following is a statement found in Part 2, Page 7 of Vol. 4 of the Feasibility and Development Plan, Grand Bayou Reservoir, Red River Parish, Louisiana concerning displacement of households as a result of construction of the reservoir:

"An investigation of the area to be flooded by the Reservoir reveals that only four, and possibly five, families will have to be relocated. Accessibility between families after the reservoir is constructed will not be seriously hampered, due to the absence of roads through the flooded area and the bridging of

the major road that will cross the Reservoir."

No churches or cemeteries will need to be relocated. As was mentioned before, a final alignment has not been made for the Red River pipeline; consequently, a definite number of households, churches, and cemeteries that would necessarily be relocated cannot be stated. However, because of the flexibility of the route a pipeline may take, there is reason to believe that these problems can be avoided.

4.02 INDIRECT EFFECTS AND THEIR SIGNIFICANCE

a. Beneficial effects.

(1) Population. Based on 1980 industry reports, an increased population is projected for Red River Parish in the decades of the 1980s and 1990s. Prior to announcements by Cajun Electrical Cooperatives, Central Louisiana Electric Company and Southwest Electrical Company regarding their plans to build facilities in the area, a series of statewide population projections were developed. Those projections are given in this report in Table III-14. But because this projection did not take account of new population growth expected to occur because of lignite mining and lignite processing, plus the fact that these projections did not anticipate the development of the large containerboard plant by International Paper Company between Coushatta and Mansfield, it was necessary to develop a new set of population projections. Further, when the engineering studies were done regarding the proposed Grand Bayou Reservoir, these developments were not known. Thus, all the population projections used as a basis for determining future water needs are conservative, i.e., more demand will be made for water than the engineers contemplated. Although the original research was based on a projected population of 9,200 to 9,400, the actual population of Red River Parish is expected to approximate 13,370 by 1985. Beyond 1985, the population is expected to continue to increase.

(2) Commercial development. Commercial developments associated with the Grand Bayou Reservoir alternative will be relatively unimportant statistically. Data in the feasibility study indicates that the number of commercial establishments in Red River Parish is increasing (Ozarks Regional Commission, 1976) (Table IV-3). These figures were compiled, however, before major announcements regarding the lignite industry in Red River Parish were announced. In the future the number of commercial establishments will be appreciably more than the number today.

TABLE IV-3

COMMERCIAL ESTABLISHMENTS, RED RIVER PARISH, LOUISIANA

YEAR	NO ACTION	GRAND BAYOU ALTERNATIVE
1970	357	-
1975	371	-
1980	399	399
1990	426	434
2000	450	465
2010	475	497

SOURCE: Feasibility and Development Plan, Grand Bayou Reservoir,
Ozarks Regional Commission, 1976.

(3) Employment. The availability of an adequate public water supply will stimulate employment in Red River Parish and will make it possible for the municipalities to develop water supplies that would enhance subdivision developments to accommodate new employees who will be working in the lignite and related employment centers in Red River Parish. The number of workers in the parish has steadily increased since 1960 (Table IV-4). The employment figures represent full-time jobs.

TABLE IV-4

EMPLOYMENT, RED RIVER PARISH, LOUISIANA

YEAR	ALTERNATIVE		
	NO ACTION	GRAND BAYOU	RED RIVER
1960	2,552	-	-
1970	2,715	-	-
1975	2,717	-	-
1980	2,844	2,844	2,844
1990	5,713	5,787	5,787
2000	5,888	6,046	6,046

NOTES:

- 1) Source: Feasibility and Development Plan, Grand Bayou Reservoir,
Ozarks Regional Commission, 1976; Designation Report, Public
Law 95-620; Powerplant and Industrial Fuel Use Act of 1978,
State of Louisiana, Office of the Governor, June 30, 1979.
- 2) Projections do not include impact of the Red River Waterway or the lignite related development.

(4) Projected total amount annual retail sales. Projected annual retail sales for Red River Parish have been calculated. These projections include the effects of assumed future price inflation at a rate of five percent per year as applied to the consumers price index. Sales in the parish are expected to increase (Table IV-5). The provision of an adequate public water supply will stimulate sales through the establishment of new commercial developments. Recreation related commercial enterprises associated with the Grand Bayou reservoir alternative is expected to contribute to an additional volume of retail sales. The annual recurring costs of amortizing, operating, and maintaining recreational facilities are not included in the numbers shown in Table IV-5.

TABLE IV-5

PROJECTED ANNUAL RETAIL SALES, RED RIVER PARISH, LOUISIANA
(SALES IN THOUSANDS)

YEAR	NO ACTION	PROJECT	
		RED RIVER ALTERNATIVE	GRAND BAYOU ALTERNATIVE
1975	\$12,100	\$12,100	\$12,100
1980	16,300	16,300	16,372
1990	29,000	29,800	30,054
2000	51,700	53,700	54,202
2010	92,100	96,400	97,363

NOTES:

- 1) Source: Feasibility and Development Plan, Grand Bayou Reservoir, Ozarks Regional Commission, 1976.
- 2) Estimation does not include data related to the Red River Waterway and lignite related development.

(5) Land Value. Implementation of the Grand Bayou Reservoir alternative will increase the value of land adjoining the reservoir. The valuation increase phenomena is evidenced from the three similar developments in north Louisiana (Table IV-6).

TABLE IV-6

UNIMPROVED LAKEFRONT PROPERTY VALUATION CHANGE
BEFORE AND AFTER RESERVOIR DEVELOPMENT
 (ALL FIGURES ADJUSTED TO 1967 DOLLARS)

<u>LOCATION/DATES¹</u>	<u>ADJUSTED 1967 \$</u> <u>PER ACRE²</u>
Lake Sibley, Natchitoches Parish:	\$
before (1963-64)	137
after (1974)	3,047
Lake D'Arbonne, Union Parish:	
before (1963)	1,317
after (1968) (5th year)	3,786
Lake Claiborne, Claiborne Parish:	
before (1955)	784
after (1968) (2nd year)	2,390

¹Feasibility and Development Plan, Grand Bayou Reservoir, Red River Parish, Louisiana. Ozarks Regional Commission, March, 1976.

²Sunbelt Research Corporation.

b. Adverse effects.

(1) Red River. Construction of over 50,000 L.F. of pipeline, and 85 acres of storage facility will have adverse environmental effects. These impacts can and will be minimized through environmentally sound operation procedures.

(2) Grand Bayou. Three major impacts could be created indirectly as a result of the reservoir. The three secondary impacts include (a) deterioration of wetlands below the dam site, (b) siltation and the resulting aquatic weeds, and (c) braiding of Grand Bayou near the headwaters of the reservoir. These impacts can and will be minimized through environmentally sound operations procedures.

(a) Wetlands. The majority of land within the confines of 140' MSL contours below the dam site is classified as bottomland hardwoods. During the late winter or early spring floods most of this area is inundated, at which time the several small beaver ponds existing in the basin are filled. The only major beaver pond (approximately 100 acres) located below the dam site is also recharged during these floods. However, this particular beaver pond is also fed by Robertson Branch, an intermittent stream that has a drainage area of 1.47 square miles (Plate III-4). The design of the dam as

described in the Feasibility and Development Plan is such that it incorporates an open, uncontrollable spillway. The spillway will be 200 feet wide and the crest will be at 138.5 feet MSL. Once the reservoir is filled, any excess water will escape via the spillway. The result would be similar to the naturally occurring floods. During extended periods of drought no water will be flowing over the spillway, however, a minimum flow of 3.75 cfs will be released from the reservoir. As Grand Bayou exists today, a "zero flow" situation occurs normally every year; so that the bottomland hardwoods will essentially remain in their existing state. Furthermore, the induced clearing upon these bottomland hardwoods has been estimated by the Soil Conservation Service to be zero (Slayton, 1979).

The Grand Bayou alternative will have minimal or no adverse effects on Black Lake, located downstream of the reservoir site, since it has been agreed, as a mitigation measure, to allow a minimum flow from the reservoir of 3.75 CFS of water (see Section 4.04-Mitigation). As can be seen from Table III-3, the present mean monthly flow on Grand Bayou frequently drops below this amount during the summer months. In addition, Grand Bayou comprises only 15 percent of the total drainage area of Black Lake.

(b) Siltation. Once the reservoir has reached its pool level, the silt carried by the Grand Bayou will be deposited as the waters enter the reservoir. The deposition of the silt will compound the problem of the already shallow areas of the upper end of the lake. The silt deposition will also, in turn, enhance the proliferation of aquatic plants such as cattails.

(c) Aquatic Weed. Grand Bayou Reservoir will constitute an ideal environment for the growth of plants such as cattails (*Typha latifolia*), alligator weed (*Alternanthera philoxeroides*), smartweed (*Polygonum spp.*), and water hyacinth (*Eichornia crassipes*). These and other species are normally considered a nuisance and must therefore be controlled by periodic drawdowns. The prescribed drawdown usually occurs every 3 to 5 years from September to January. This procedure has been shown to adequately control the problem of aquatic vegetation in many Louisiana lakes (Lantz, 1974; Manning and Sanders, 1975; Goldaby and Sanders, 1977).

(d) Archeological/Cultural impacts. Nine cultural resource sites are known to exist adjacent to the proposed reservoir. These sites are mostly atop hills on land presently containing scattered homesites and farms. If the reservoir is constructed, then recreational camps along with ramps and access roads will probably be built. The construction of such facilities will more than likely adversely impact both known and unrecorded archeological sites.

(3) Pollution. As no recreation is to be expected to occur along the pipeline (with the exception of hunting), solid waste pollution should not be a problem along the right-of-way site. The

only other activity which could take place along the pipeline right-of-way besides hunting, would be motorcycle riding. The particular sport of motorcross is ever increasing in popularity and could thus produce some solid waste and noise pollution along the pipeline. On the other hand, as mentioned above, a reservoir would attract many outdoor recreation enthusiasts that would participate in various activities such as skiing, fishing, and swimming. These activities will result in solid waste and other types of pollution. However, the effect of solid waste and sewage resulting from Grand Bayou Reservoir user activities can be minimized through State Board of Health approved disposal facilities and regulations. As an example, this could involve trash dumpsters for solid waste disposal which would be emptied in a satisfactory area landfill. Sewage could be treated by cesspool, package treatment plant or land treatment. Refer to Volume III of the Feasibility and Development Plan, Grand Bayou Reservoir, Red River Parish, Louisiana, 1976, for further details of the suggested sanitation facilities and regulations. Additional engineering work is required to quantify accurately the quantity of wastes and recommended disposal methods. The water treatment plant for either alternative would produce a sludge which must be disposed. Treatment plant sludge is generally dewatered by one of several methods and reduced to a stable, non-odorous cake which is transported to a sanitary landfill.

(4) Erosion. In the event that motorcross riding (as mentioned above) occurred along the pipeline, the tires of the motorcycles would disturb the herbaceous vegetation and topsoil, thus creating an erosion problem. The shoreline along the Grand Bayou Reservoir would be subjected to erosion also, as a result of the wave action, especially in high activity areas. Construction of the treatment plant (both alternatives) and the storage basin (Red River alternative) would create disruption of existing vegetation and would increase the likelihood of wind and water induced erosion.

4.03 POSSIBLE CONFLICTS

a. Compatibility with land use plans.

(1) Red River. The Master Plan for the Red River Waterway is currently being developed. The plan has several proposed parks with facility developments that could serve to satisfy much of the recreational needs of Red River Parish. Included in this proposed development is a city water front park in Coushatta and other major sites within 20 miles of Coushatta.

(2) Grand Bayou. Due to the level, poorly drained soils and periodic inundation of the Grand Bayou Basin, the immediate area is used only as woodlands. No forest management or agricultural practices are being applied. The future land use plan for this area includes the construction of the Grand Bayou Reservoir and the

adjacent parks (Coordinating and Development Council of Northwest Louisiana, 1976 and 1978).

b. Policies and controls.

(1) Red River. Any proposed water withdrawal from the Red River should be reviewed by the Corps of Engineers to allow coordination of these plans with the planned improvements associated with the Red River Waterway project.

(2) Grand Bayou. Since the proposed reservoir site is entirely within the boundaries of Red River Parish, there would not be any conflicts with other parish governmental departments. The Black Lake Bayou Recreation and Water Conservation District of Red River Parish has been appointed by the Red River Parish Police Jury to establish and govern the rules and regulations of the proposed Grand Bayou Reservoir.

c. General. The following possible conflicts are expected to arise during the course of implementation of any of the alternatives given below:

(1) Red River Alternative

- (1-a) Possible strong public reaction against the water quality and the associated public health hazards.
- (1-b) Possible complaints from land owners against land acquisition for pipeline right-of-way.
- (1-c) Possible land acquisition problems relative to a large parcel of land (115) acres near urbanized areas for locating the storage reservoir and water treatment plant.
- (1-d) Possible conflicts with other utility companies and the railroad company.
- (1-e) Possible objections by the environmental groups for any damage that might be caused to the environment.
- (1-f) Possible conflicts regarding possible changes in pool elevations.

(2) Grand Bayou Reservoir Alternative.

- (2-a) Possible conflicts with the five households that are likely to be displaced.
- (2-b) Possible conflicts with the concerned road authorities in

relocating the roads.

- (2-c) Possible conflicts with bridge authorities for relocating the bridges.
- (2-d) Conflict with various utility companies whose pipelines need to be relocated.
- (2-e) Conflict with power transmission line authorities for relocating their lines.
- (2-f) Conflicts with land owners for transmission pipeline right-of-way, reservoir dam construction and treatment plant location near an urbanized area.
- (2-g) Possible objections by environmental groups for any damage the project may cause to the environment.
- (3) No Action Alternative.
 - (3-a) Possible public dissatisfaction and health problems as existing aging water systems deteriorate further and are placed under higher demands as lignite coal associated activities attract more persons in to the area.
 - (3-b) Possible financial hardships on municipalities which are forced to upgrade water treatment and distribution facilities.
 - (3-c) Possible water shortages due to increased demand and lack of new supply sources.
 - (3-d) Possible loss of potential revenue and employment opportunities from lignite coal related development due to the fact that municipalities may not be able to supply adequate water to new working force and small industries that desire to locate in the vicinity.

4.04 MITIGATION

a. Constructional mitigation.

(1) Turbidity and sedimentation. Turbidity and possible sedimentation will occur periodically along the pipeline at any stream crossing. These problems will be minimal since most or all of the streams which will be crossed are intermittent streams. Thus, they are narrow and the construction will not disturb the water flow for any extended length of time. Also, there is the possibility that the streams will be dry during construction. On the other hand, turbidity and sedimentation could be a major impact during construction

of a reservoir on Grand Bayou. However, it has been proposed that clearing and other construction practices begin at the perimeter and work toward the middle of the basin so that siltation will be mitigated by the buffer zones (Ozarks Regional Commission, 1976). For further details of mitigating siltation during construction of the reservoir, refer to Vol. IV of the Feasibility and Development Plan, Grand Bayou Reservoir, Red River Parish, Louisiana, 1976.

(2) Pollution. In order to mitigate any pollution problems that might arise, it is recommended that the construction contractor for any of the alternatives be required to follow the EPA guidelines. These include strict enforcement of such regulations as petroleum products storage, run-off and sedimentation.

(3) Mitigation and Compensation Plans.

(a) General. Compensation land for either the Grand Bayou alternative or the Red River alternative will provide at least 11,093 Habitat Units and will be purchased and managed by the State of Louisiana. The applicant has secured an approval from the International Paper Company to buy approximately 6000 acres of mixed timber land near Sicily Island, Catahoula Parish, Louisiana. This tract of land will be a State of Louisiana Wildlife Management Area in perpetuity. In 1980, the Louisiana Legislature approved the purchase and allocated funds for same in the Capital Outlay Bill which was signed into law by Gov. David C. Treen. For the Grand Bayou Reservoir approximately 2700 acres of land will be cleared while the Red River alternative involves 115 acres for the storage facilities and treatment plant in addition to a corridor of approximately 9.8 miles long and 20 feet wide for the transmission line.

(b) Grand Bayou Reservoir. In May, 1979 a Habitat Evaluation Procedure (HEP) was performed in the proposed reservoir site. This HEP was formulated by the U.S. Fish and Wildlife Service and was performed by biologists from the U.S. Corps of Engineers, cooperating agencies and the contractor. The following is a list of mitigation measures which resulted from the HEP and which will be implemented upon initiation or completion of the reservoir.

Timber will be left in the shallow coves in the reservoir. This will provide habitat for woodducks, water snakes, raccoons, fish, and non-game waterfowl.

As stated previously, Grand Bayou normally floods every spring and remains in this state of inundation for several weeks. The Ogee Spillway which is incorporated into the design of the dam (Feasibility Study), will provide the overbank flooding below the reservoir during the late winter and early spring floods.

The applicant will provide a minimum flow of 3.75 cubic feet per second (c.f.s.) so that the stream fish population below the dam site can be maintained. This 3.75 c.f.s. is above the normal flow during the low flow period from July to September. A multi-level outlet extended from a 6' x 6' concrete drawdown chute (Ozarks Regional Commission, 1976) will provide the required minimum flow; and at the same time provide a mixed discharge of water so that a temperature difference can be reached.

The applicant will construct a marked access route to the stream on the downstream side of the dam. This will provide access for fishermen to the tailwater of the reservoir where sportfishes are expected to concentrate.

The applicant will have to incorporate into his regulations lake management planning practices. This should include fish and wildlife management planning and control of problematic aquatic vegetation. The recommended procedure would be to collect fish and aquatic vegetation samples every year during the month of July. Then, if the lake proved to have an excessive standing crop of forage fish or problematic aquatic plants, the lake would be drawdown. The drawdown would best be initiated in early September and continued until January when the late winter floods would refill the reservoir. This practice has been reported by many scientists to slow down the eutrophication process (Lantz, 1974; Manning and Sanders, 1975; Goldsby and Sanders, 1977; Richardson, 1975; Manning and Johnson, 1975; Lantz, 1974b).

The applicant will seek technical assistance from appropriate agencies, both state and federal, to insure optimum successes in the relocation of animals. The fact that the habitat will be modified and that animals must be relocated is evident, thus the less restrictive means available today will be used to insure proper location. A definite relocation plan will be developed in cooperation with the Louisiana Department of Wildlife and Fisheries.

Simultaneously, the applicant will seek technical assistance from appropriate agencies, both state and federal, in the development of a lake management plan. Because the proposed new reservoir will be primarily a public water supply and secondarily a recreational area, the plan must take cognizance of those particular objectives. A detailed plan will be developed for aquatic weed control and optimum fishery habitat provision.

(4) Relocation of wildlife to a new habitat.

(a) Red River. Relocation impact during construction of a pipeline and appurtenances from Red River will be negligible since the area impacted is expected to be very small.

(b) Grand Bayou. Approximately 2700 acres will be cleared if the proposed reservoir is constructed. Consequently, many wildlife species will be displaced creating a problem of competition and relocation. Trapping and transporting wildlife to new locations away from construction sites has proven to be a safe and reasonably economical method of relocation. However, because of the abundance of similar habitat adjacent to the study area, trapping would not be feasible. Because adjacent areas are at carrying capacity, loss of habitat will result in a corresponding loss of wildlife in the immediate area.

1. Relocation sites. The proposed reservoir site is bordered along the south by U.S. Highway 71-84. Along the highway and to the south of it the land is used for agricultural purposes and human habitation. To the east of the proposed site is the Black Lake Bayou drainage system. This stream is designated as a natural and scenic stream; thus the basin has been left virtually unchanged so that the majority of the basin is still bottomland hardwoods. The area to the north is very rural with sporadic private farms. The habitat in this area is mostly pine-hardwoods with scattered stream bottoms. Northwest of the proposed reservoir site is the upper reaches of the Grand Bayou drainage basin. This area is locally known as the Chicot Swamp. The area encompasses several thousands of acres and is comprised mostly of bottomland hardwoods. The areas to the north and northwest are the best locations due to close proximity, absence of physical barriers, and similarity of habitats. The area south and southwest of the proposed reservoir site would not be suitable because of the more dense human population.

2. Procedures. In order to "drive" the wildlife to the specified relocation sites and away from the southern area, harvesting and clearing operations need to begin in the middle along the southern edge of the proposed reservoir site. From this point, the harvesting and clearing would proceed to the center of the basin and thence to the east and to the west northwest, simultaneously. This will help to drive the animals in the direction toward the relocation sites. Consequently, the populations will be distributed somewhat evenly so that competition is lessened.

3. Environmental constraints. The harvesting and clearing operations will be performed during the late spring and summer months because the Grand Bayou basin is normally inundated during the winter and early spring months. Clearing during the summer will not be in conflict with the mating or nesting seasons. In addition, the competition for food and shelter in the relocation sites will not be as severe as it would be if clearing began in the fall or winter. Obviously, these procedures will not be one hundred percent effective, but this will definitely aid in a more even distribution.

4. Operational/administrative constraint. Approximately fifty percent of the land within the proposed reservoir site is owned by the International Paper Company (IPC). The remaining site is owned by private individuals or smaller timber companies. The timber companies and some individuals will like to harvest the merchantable timber before clearing begins. Therefore the applicant will necessarily have to maintain control over the schedule and procedures of the harvesting process; or the applicant can compensate the landowners for the marketable timber. The selective harvest will have a minimal effect in the relocation process; however, clearing will be the major factor and should thus follow the plans outlined in the above sections.

SECTION 5

PREPARERS AND COMMENTORS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

The persons whose names appear in Table V-1, and Table V-2 on the following pages are primarily responsible for the preparation of this draft environmental impact statement on the proposed Grand Bayou Reservoir. Table V-3 is a listing of the various agencies, groups and individuals to whom copies of the draft environmental impact statement have been mailed requesting their review and comments. Subsection 5.04 gives response information concerning the draft environmental impact statement.

TABLE V-1

5.01

LIST OF PREPARENS

SUNBELT RESEARCH CORPORATION

NAME	EXPERTISE/DISCIPLINE	EXPERIENCE	ROLE IN PREPARING EIS
Mr. Jerome Fournier	Geography	2 years Environmental Planning	Physical Geography, Geology
Dr. Sherwood Gagliano (consultant)	Geography, Anthropology	16 Years Environmental, Archeological, Cultural Studies	Geomorphology, Anthropology
Dr. Raymond Germany (consultant)	Aquatic Biology	1 Year Marine Biologist and Ichthyologist, Gulf Coast Research Laboratory; 3 Years Research Assistant, Texas Department of Wildlife and Fisheries; 1 Year Aquatic Biologist, Environmental Laboratories, Inc.	Aquatic Biologist
Mr. Jeff Harris	Civil Engineering	3 Years Civil/Environmental Engineering	Engineering Aspects
Mr. Chris Ingram	Ichthyology, Mammalogy	2 Years Lab Assistant, Southeastern Louisiana University	Wildlife Biologist
Dr. William J. Long	Planning, Economics	17 Years Urban Planning	Demographic, Economics, and Planning
Mr. Lawrence McKenzie, III (Project Director/Study Manager)	Physical Geography	9 Years Environmental Research	Geomorphology, Climatology
Dr. A. V. Peddada, P.E.	Civil Engineering	22 Years Civil/Environmental Engineering	Engineering Aspects
Mr. Alexander Weissman, P.E.	Civil Engineering	22 Years Civil/Environmental Engineering	Engineering Aspects

TABLE V-2

5.02

LIST OF CONTRIBUTORS
(REVIEWERS AND COMMENTORS OF EIS)
CORPS OF ENGINEERS

NAME	EXPERTISE/DISCIPLINE	EXPERIENCE	ROLE IN COORDINATING E.I.S.
Baehr, Lloyd F., Dr.	Botanist	4 years Environmental Studies, 2 years Regulatory Functions Studies, Corps of Engineers, New Orleans District	Regulatory Functions and Botanical Aspects
Bush, Rick, Mr.	Recreation Planner	2 years Recreation Planning, Corps of Engineers, New Orleans District	Recreation Aspects
Decker, Charles W., Mr.	Civil Engineer	11 years Chief, Regulatory Functions Branch, Corps of Engineers, New Orleans District	Regulatory Functions
Gilino, Gary D., Mr.	Civil Engineer	2 years Regulatory Functions- Waterways Protection, Corps of Engineers, New Orleans District	Regulatory Functions- Jurisdictional Determina- tion
Lacy, Robert D., Jr., Mr.	Economist	9 years Economics/Planning, Corps of Engineers, New Orleans District	Socio-Economics and Plan- ning Aspects
Montz, Glen N., Dr.	Botanist	5 years Environmental Studies, 3 years Aquatic Growth Control Studies, Corps of Engineers, New Orleans District	Aquatic Growth Control and Botanical Aspects
Reece, Dave, Mr.	Fishery Biologist	4 years, Florida Game and Fish Commission, 3 years with Corps of Engineers, New Orleans District	Effects on Fishery Resources, Environmental Impacts
Ryan, Thomas M., Mr.	Archaeologist	1 year, Chief, Cultural Resources Section and 2 years as archaeolo- gist, Corps of Engineers, New Orleans District	Cultural Resources Manage- ment
Shelton, Calvin W., Mr.	Engineer/Civil Engineer	28 years, Corps of Engineers, Little Rock and New Orleans District	Engineering Input, Project Manager, Red River Water- way Project

TABLE V-2 CONTINUED

LIST OF CONTRIBUTORS

CORPS OF ENGINEERS

NAME	EXPERTISE/DISCIPLINE	EXPERIENCE	ROLE IN COORDINATING EIS
Speed, Donald C., Mr. (Corps EIS Coordinator For Project)	Fishery & Wildlife Biologist/Environmental Specialist	4 1/2 years Fish and Wildlife Management Planning, 1 1/2 years Environmental Studies, Corps of Engineers; 12 years Fishery Biology Experience (other agencies)	EIS Coordination for Project, Effects on Biological and Environ- mental Resources, Botanical and Zoological Nomen- clature
Utes, Richard V., Mr.	Engineer/Civil Engineer	9 years Environmental Coordinator for EA's, EIS's, Corps of Engineers, New Orleans District	Environmental Coordination
Weber, John C., Mr.	Zoology	3 1/2 years Chemist, Texas Parks and Wildlife Department; 8 1/2 years Environmental Planning and Regulatory Functions, Corps of Engineers, New Orleans District	Chief, Environmental Analysis Branch
Zimny, Raymond E., Mr.	Engineer/Civil Engineer	3 years, Corps of Engineers, New Orleans District	Engineering Input, Effects on Water Quality, Study Manager, Red River Waterway Project

TABLE V-3

5.03

LIST OF ORGANIZATIONS FROM WHOM COMMENTS ARE REQUESTED

Federal

J. Bennett Johnston, US Senator
 Russell B. Long, US Senator
 Corinne C. Boggs, US Congresswoman
 John B. Breaux, US Congressman
 Jerry Huckaby, US Congressman
 Robert L. Livingston, US Congressman
 Gillis W. Long, US Congressman
 W. Henson Moore, US Congressman
 Charles Roemer III, US Congressman
 William "Billy" Tauzin, US Congressman
 US Department of Interior, Office of the
 Secretary, Washington, D.C.
 US Department of Interior, Assistant Secretary
 for Program Development and Budget, Office
 of Environmental Project Review, Washington, DC
 US Department of the Interior, Regional Director,
 National Park Service, Santa Fe, New Mexico
 US Department of the Interior, Director, Bureau
 of Outdoor Recreation, SC Region, Albuquerque,
 New Mexico
 Advisory Council on Historic Preservation,
 Lakewood, Colorado
 US Fish and Wildlife Service, Regional Director,
 Atlanta, Georgia
 US Fish and Wildlife Service, Area Manager,
 Jackson, Mississippi
 US Fish and Wildlife Service, Field Supervisor,
 Vicksburg, Mississippi
 US Fish and Wildlife Service, Field Supervisor,
 Lafayette, Louisiana
 Environmental Protection Agency, Administrator,
 Washington, DC
 Environmental Protection Agency, Regional
 Administrator, Region VI, Dallas, Texas
 Environmental Protection Agency, Permits and Enforcement
 Branch, Dallas, Texas
 US Department of Commerce, Deputy Assistant
 Secretary for Environmental Affairs,
 Washington, DC
 US Department of Commerce, Regional Director,
 National Marine Fisheries Service,
 St. Petersburg, Florida
 US Department of Commerce, Area Supervisor,
 National Marine Fisheries Service, Water
 Resource Division, Galveston, Texas
 US Department of Agriculture, Regional Forester, Forest Service
 Atlanta, Georgia
 US Department of Agriculture, State Conservationist,
 Soil Conservation Service, Alexandria, Louisiana
 US Department of Transportation, Division Engineer,
 Federal Highway Administration, Baton Rouge, Louisiana

TABLE V-3 CONTINUED

US Department of Commerce, National Oceanic and
Atmospheric Administration, Office of Ecology and
Conservation, Rockville, Maryland

US Department of Transportation, Commander, Second
Coast Guard District, St. Louis, Missouri

US Department of Health, Education and Welfare,
Regional Director, Public Health Service,
Region VI, Dallas, Texas

US Department of Health, Education and Welfare, Water
Resources Activity, Vector Biology and Control
Division, Atlanta, Georgia

US Department of Housing and Urban Development,
Regional Administrator, Region VI, Dallas, Texas

US Department of Energy, Director, Federal Energy
Administration, Environmental Impact Division, Office
of Environmental Programs, Washington, DC

US Department of Energy, Advisor on Environmental
Quality, Federal Power Commission, Washington, DC

US Army Engineer Division, Lower Mississippi Valley,
Attention: LMVCO-N, Vicksburg, Mississippi

US Army Engineers, Shreveport Area Office, Area
Engineer, Shreveport, Louisiana

Heritage Conservation and Recreation Service, South
Central Region, Albuquerque, New Mexico

Interagency Archeological Services -Atlanta-
Heritage Conservation and Recreation Service,
Atlanta, Georgia

State

Donald G. Kelly, Louisiana Senator

H. M. "Mutt" Fowler, Louisiana Representative

Office of the Governor, Baton Rouge, Louisiana

Office of the Lieutenant Governor, Baton Rouge, Louisiana

Office of the Attorney General, Baton Rouge, Louisiana

Office of Intergovernmental Relations, Office of the Governor,
Baton Rouge, Louisiana

Louisiana Department of Health and Human Resources, Office of
Health Services and Environmental Quality, New Orleans, Louisiana

Louisiana Department of Transportation and Development, Office
of Public Works, Baton Rouge, Louisiana

Louisiana Department of Transportation and Development
Office of Public Works, Alexandria, Louisiana

Louisiana Department of Transportation and Development, Office
of Highways, Impact Engineer, Baton Rouge, Louisiana

Louisiana Department of Transportation and Development, Office
of Management and Finance, Project Control Engineer,
Baton Rouge, Louisiana

Louisiana Department of Agriculture, Commissioner, Baton Rouge,
Louisiana

Louisiana Department of Commerce, Secretary, Baton Rouge, Louisiana

Louisiana Department of Wildlife and Fisheries, Secretary, New
Orleans, Louisiana

Louisiana Department of Wildlife and Fisheries, Refuge Division,
Chief, New Orleans, Louisiana

Louisiana Department of Wildlife and Fisheries, Game Division,
Chief, Baton Rouge, Louisiana

Louisiana Department of Wildlife and Fisheries, Fish Division,
Baton Rouge, Louisiana

TABLE V-3 CONTINUED

Louisiana Department of Wildlife and Fisheries, Coordinator,
Environmental Section, Baton Rouge, Louisiana
Louisiana Department of Wildlife and Fisheries, Supervisor
District Office Number 3, Tioga, Louisiana
Louisiana Department of Wildlife and Fisheries, Supervisor,
District Office Number 1, Minden, Louisiana
Louisiana State Parks and Recreation Commission, Baton Rouge,
Louisiana
Louisiana Archeological Survey and Antiquities Commission,
State Archeologist, Baton Rouge, Louisiana
Louisiana Air Control Commission, New Orleans, Louisiana
Louisiana Public Service Commission, Baton Rouge, Louisiana
Louisiana Department of Natural Resources, Office of Forestry
Baton Rouge, Louisiana
Louisiana Department of Natural Resources, Offices of Conservation,
Baton Rouge, Louisiana
Louisiana Department of Natural Resources, Office of State Lands,
Baton Rouge, Louisiana
Louisiana Department of Natural Resources, Office of Environmental
Affairs, Water Pollution Control Division, Baton Rouge, Louisiana
Louisiana Department of Culture, Recreation, and Tourism, Division of
Archaeology and Historic Preservation, State Historic Preservation
Officer, Baton Rouge, Louisiana
Louisiana Department of Justice, Environmental Section, New Orleans,
Louisiana
Louisiana Joint Legislative Committee on Environmental Quality, Louisiana
Legislature, Baton Rouge, Louisiana
Louisiana State Planning Office, Baton Rouge, Louisiana
Louisiana State Soil and Water Conservation Committee, Louisiana State
University, Baton Rouge, Louisiana
Louisiana State University, Associate Director, Sea Grant Program, Center
for Wetland Resources, Baton Rouge, Louisiana
Louisiana State University, Curator of Anthropology, Department of Geography
and Anthropology, Baton Rouge, Louisiana
University of New Orleans, Coordinator, Environmental Impact Section, Depart-
ment of Environmental Affairs, New Orleans, Louisiana
Saline Lake Game and Fish Preserve, Winnfield, Louisiana
Northwest Regional Clearinghouse, c/o Coordinating and Development Council
of Northwest Louisiana, Shreveport, Louisiana

Local

President, Red River Parish Police Jury, Coushatta, Louisiana
President, Winn Parish Police Jury, Winnfield, Louisiana
President, Natchitoches Parish Police Jury, Natchitoches, Louisiana
Mayor, Town of Coushatta, Coushatta, Louisiana
Mayor, Village of Hall Summit, Hall Summit, Louisiana
Board of Commissioners of Red River-Bayou Pierre Levee and
Drainage District, Coushatta, Louisiana
Black Lake Bayou Recreation and Water Conservation District of
Red River Parish, Coushatta, Louisiana
Coushatta-Red River Chamber of Commerce, Coushatta, Louisiana
Grand Bayou Reservoir Commission, Coushatta, Louisiana
Saline Soil and Water Conservation District, Ringgold, Louisiana

Environmental

Ecology Center of Louisiana, Inc., New Orleans, Louisiana
Orleans Audubon Society, New Orleans, Louisiana

TABLE V-3 CONTINUED

Ouisca Chitto Audubon, Kinder, Louisiana
National Audubon Society, Library, New York, New York
National Audubon Society, Southwestern Regional Office,
Regional Representative, Austin, Texas
Delta Chapter, Sierra Club, New Orleans, Louisiana
Delta Chapter, Sierra Club, Baton Rouge, Louisiana
National Sierra Club, San Francisco, California
National Wildlife Federation, Washington, DC
Louisiana Wildlife Federation, Baton Rouge, Louisiana
Louisiana Wildlife Federation, Water Control Projects Committee,
Chairman, New Iberia, Louisiana
Wildlife Management Institute, Washington, DC
Wildlife Management Institute, Southcentral Representative,
Dripping Springs, Texas
The Conservation Foundation, Washington, DC
Environmental Defense Fund, New York, New York
Trout Unlimited, San Antonio, Texas
Natural Resources Defense Council, Washington, DC
Environmental Information Center, Inc., New York, New York
League of Women Voters of the US, Baton Rouge, Louisiana
The Fund for Animals, Inc., Field Agent, Jefferson, Louisiana
Louisiana Environmental Professionals Association, Metairie, Louisiana

Others

Shreveport Area Council of Governments, Shreveport, Louisiana
The Coordinating and Development Corporation, Shreveport, Louisiana

5.04 Response Information

All responses must be directed to:

Colonel Thomas A. Sands
District Engineer
Corps of Engineers
Department of the Army
P.O. Box 60267
New Orleans, Louisiana 70160

As provided in Paragraph 17-b of ER 200-2-2, 25 August 1980, a forty-five (45) day review period has been established. The deadline for responses will be that established by the notice of availability published in the Federal Register.

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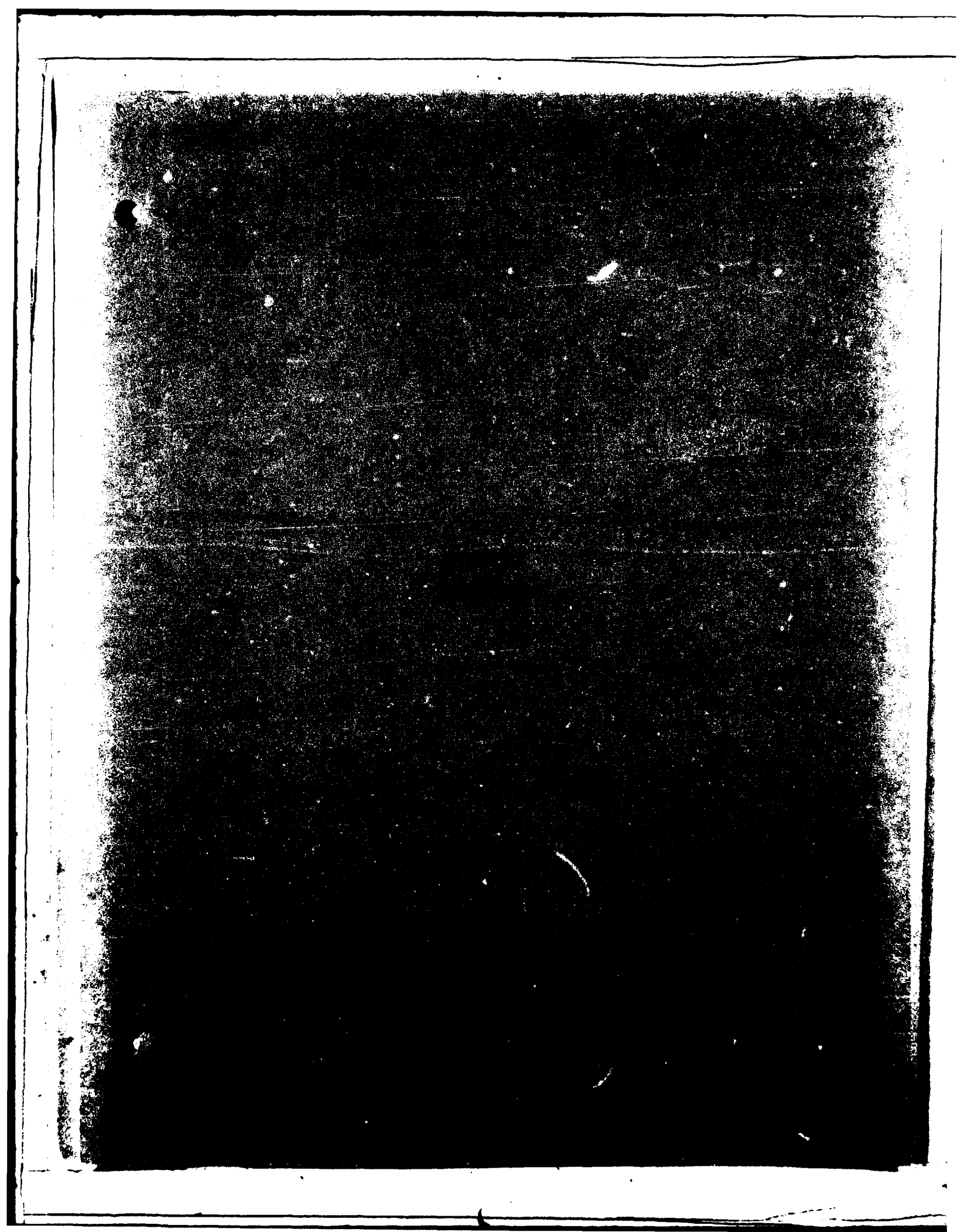
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Appendix A

METHODOLOGY

A. Botanical

(1) Terrestrial. The terrestrial vegetation of the Grand Bayou Reservoir area was sampled by means of plots located along transects. The transects were surveyed to lie perpendicular to the axis of the Grand Bayou basin and run from 140 foot to 140 foot MSL contour across the basin. Each transect was approximately one mile from the other. The first transect, Transect A, is located approximately one mile from the mouth of Grand Bayou. At some point along the transect, selected at random using Stockton's random number tables (Stockton, 1966), a "starting point" was established. At this "starting point", and every 700 feet along the transect thereafter, a 10 meter x 10 meter plot was established. These plots were the sample units in which the vegetation of the area was identified and counted for density values. When a plot happened to be located in a grassland, it was reduced to one square meter. To determine the density value, the plants were divided into groups according to size: one inch to one foot high; 1.1 foot to ten feet high; one inch to three inches in diameter at breast height (DBH); four inches to nine inches DBH; and ten inches and over DBH. Vegetational analysis of the other areas (Lake Bistineau, Black Lake, Red River) were determined using land use maps, aerial photographs and published literature.

(2) Aquatic. Phytoplankton counts for Grand Bayou were taken at four locations along the stream (Plate III-7). At each location whole water samples were taken at a depth of one foot below the surface of the water. The samples were then preserved in four percent formalin and transported back to the laboratory. Here the phytoplankton was identified utilizing a Sedgewick-Rafter cell. Thirty fields at 150x magnification were examined in each cell for phytoplankton. The phytoplankton communities of other alternatives were determined strictly through literature research.

B. Zoological

(1) Terrestrial

(a) Mammals. There was no mammal field survey per se; however, during every field trip into the project area, mammals were recorded by sight, sound, or signs. Literature and museum research also played a role in determining the mammals found within the study area.

(b) Birds. The birds within the Grand Bayou Reservoir project area were studied along the same transect lines established for the vegetational analysis. As well as recording bird sightings during other field trips into the area, a complete study was performed specifically for the birds. Every 200 feet along each transect, bird counts would be made. Each count lasted for five minutes and songs as well as sightings were recorded. Special care was taken to prevent a duplicate recording from previous counts along the transect.

(c) Reptiles and Amphibians. The herpetological counts were made along the same transect lines. Along each transect, a strip approximately 25 feet wide was thoroughly searched. Also, "herp" sightings were recorded during every field trip into the area. Museum and literature research also provided information concerning the reptiles and amphibians of the study area.

(2) Aquatic.

(a) Fish. Fish samples were taken at points where each transect crossed the Grand Bayou, with the exception of Transects "C" and "D" (Table III-6). At these points, three 30' drags were made with a 20' seine. Fish were identified, counted, recorded, and then released. Representatives of each species from each sampling point were collected and preserved in ten percent formaldehyde. Fishes that were not easily identifiable in the field were preserved and later identified in the laboratory. Museum and literature research also aided in providing information about the fishes in the drainage basins of all the alternatives.

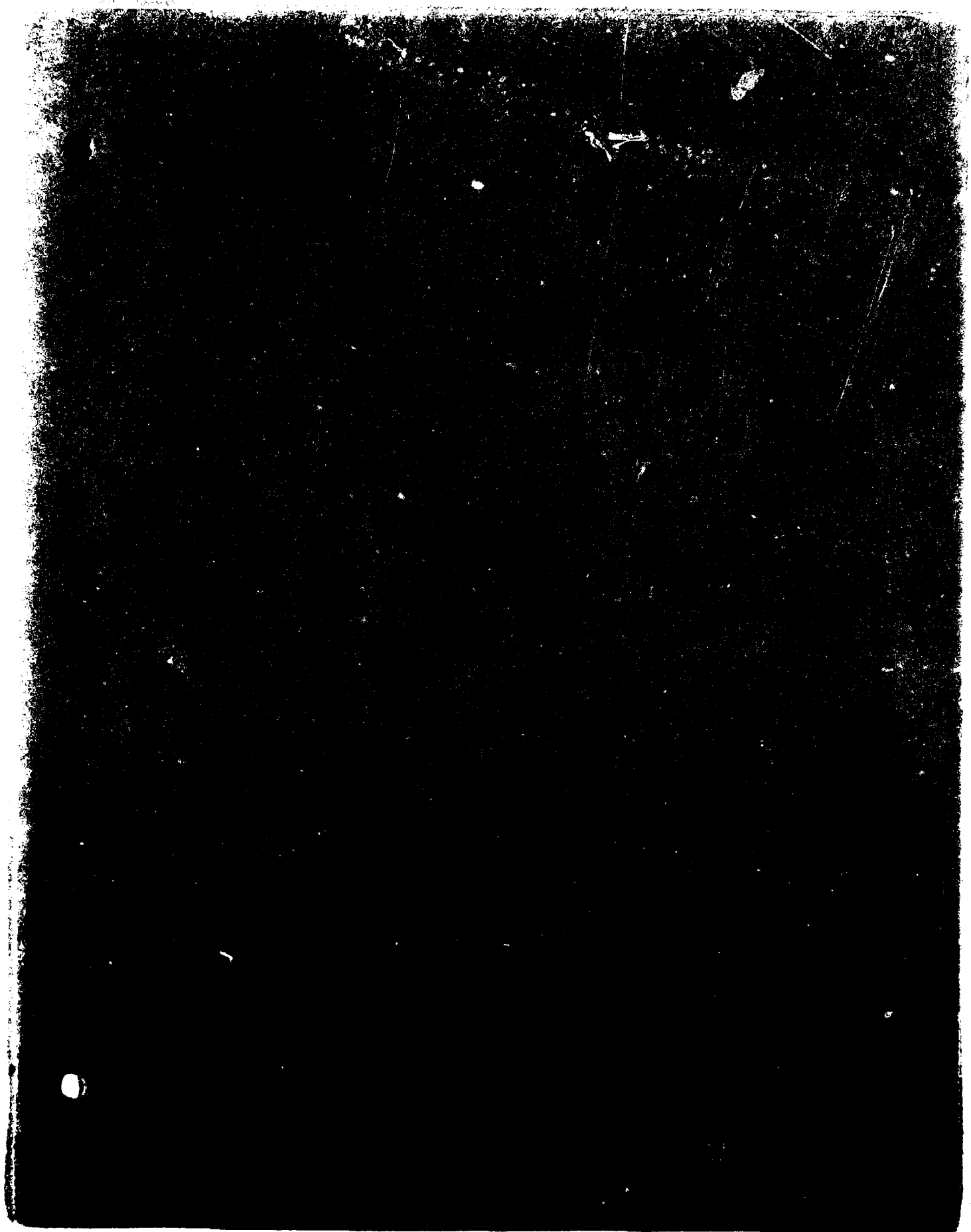
(b) Benthos. Samples to determine the diversity of the benthic communities were taken at the same locations along Grand Bayou as the plankton samples (Table III-8). Three samples were taken at each location. Each sample area measured 1/25 of a square meter and each sample was washed through a sieve which had a mesh size of .039 inches. The samples were preserved in 4 percent formaldehyde and brought back to the laboratory for identification.

(c) Zooplankton. The zooplankton samples were taken at the same sites as the phytoplankton samples (Table III-7). Three samples were collected at each site with a standard plankton net. Each sample consisted of a three minute sweep just below the surface of the water. The samples were then preserved in four percent formaldehyde and transferred back to the laboratory. Here the zooplankters were identified in the same manner as was the phytoplankton.

I

C. Water Quality

The test procedures used for determining water quality in Grand Bayou were either from the 14th edition of Standard Methods for the Examination of Water and Wastewater; Methods for Chemical Analysis of Water and Wastes, 1976 (EPA); or Annual Book of Standards, Part 23, Water Atmospheric Analysis, 1972.



STORMT System

TABLE B-1
WATER QUALITY

07/05/00 54882
12 PM 05.0 093 21 10.0 2
NEW RIVER AT COLUMBIA LA
25351 LOUISIANA

101691

LOCID	02111204	STPA/ANNT/STREAM	NOBS	AVE	MAX	MIN	BEG-DATE	END-DATE
INDEX 120045	DEPTH							
MILES 932.1	10.00							
10 WATER TEMP	CENT		105	20.3	31.0	3.5	69/10/29	75/10/29
70 TURB JKS	JTU		29	68.4	360.0	10.0	74/10/10	75/10/29
75 TURB HLGE	PPM 5102		18	77.9	368.0	10.0	73/07/25	74/08/25
76 TURB TRBDNTR	MACH FTU		11	58.6	170.0	10.0	75/03/12	75/08/23
80 COLOR PT-CO	UNITS		68	53	500	5	69/10/29	75/10/29
95 CONDUCTIV AT 25C	MICROMHO		105	514	1260	153	69/10/29	75/10/29
300 DO	MG/L		105	8.4	13.8	5.4	69/10/29	75/10/29
310 DOB	MG/L		84	3.4	8.8	0.3	69/10/29	75/10/29
330 COB MUD	MG/KG		1	6000	6000	6000	75/09/00	75/09/00
340 COB	MG/L		85	25	116	0	69/10/29	75/10/29
400 PH	SU		95	7.62	8.40	6.60	69/10/29	75/10/29
425 CO2	MG/L		28	6.1	23.0	1.5	72/01/16	75/10/29
410 TALK	MG/L		64	100	220	48	69/10/29	75/10/29
440 M03 TOM	MG/L		64	122	260	58	69/10/29	75/10/29
445 CO3 TOM	MG/L		22	0	0	0	69/10/29	75/10/29
495 LOSS ON	MG/KG		43	5560.00	5560.00	5560.00	75/09/00	75/09/00
550 OIL-GRSE	MG/L		1	12.0	12.0	0.0	74/02/28	75/09/00
553 OIL-GRSE	MG/KG		35	0.00	0.00	0.00	75/09/00	75/09/00
600 TOTAL N	MG/L		45	0.88	1.60	0.54	74/07/02	75/10/29
605 ORG N	MG/L		33	0.644	1.400	0.060	74/02/28	75/10/29
608 M03-N	MG/L		45	0.332	3.570	0.000	69/10/29	73/04/05
610 M03-N	MG/L		37	0.057	0.190	0.000	74/02/28	75/10/29
615 M03-N	MG/L		21	0.015	0.120	0.000	74/02/28	75/10/29
620 M03-N	MG/L		26	0.08	0.50	0.02	71/12/29	73/09/11
625 TOT CUEL	MG/L		36	0.082	0.410	0.000	74/02/28	75/10/29
630 ORGAM. N	MG/KG-N		1	0.002	1.500	0.440	74/07/02	75/09/00
635 M03NO3	MG/L		43	220.00	120.00	220.00	75/09/00	75/10/29
650 T PO4	MG/L		24	0.1	0.4	0.0	74/03/13	75/10/29
655 ORTHOPO4	MG/L		6	0.43	1.40	0.04	69/10/29	72/01/16
665 PHOS-TOT	MG/L P		54	0.68	0.95	0.15	72/10/18	73/04/05
668 PHOS-MUD	MG/KG-P		1	0.303	4.000	0.039	71/10/21	75/10/29
671 PHOS-BIS	MG/L P		6	510.0	510.0	510.0	75/09/00	75/09/00
680 T ORG C	MG/L		42	0.222	0.310	0.050	72/10/18	73/04/05
900 TOT HARD	MG/L		47	9.1	19.0	4.2	74/03/13	75/10/29
902 MC HARD	MG/L		47	133	300	60	69/10/29	73/09/11
915 CALCIUM	MG/L		47	39	132	3	69/10/29	73/09/11
916 CALCIUM	MG/L		47	38.6	80.0	19.0	69/10/29	73/09/11
925 MAGNESIUM	MG/L		6	40.7	60.0	28.0	74/07/16	75/10/02
927 MAGNESIUM	MG/L		47	8.9	25.0	1.4	69/10/29	73/09/11
929 SODIUM	MG/L		6	11.6	19.0	7.4	74/07/16	75/10/02
930 SODIUM	MG/L		5	48.40	80.00	22.00	74/10/10	75/10/02
931 SODIUM	MG/L		48	49.70	50.00	8.20	69/10/29	74/07/16
932 PERCENT	RATIO		47	1.8	4.0	0.5	69/10/29	74/07/16
935 PTSSILUM	MG/L		49	40	54	0.5	69/10/29	74/07/16
937 PTSSILUM	MG/L		5	3.30	6.50	1.30	69/10/29	74/07/16
940 CHLORIDE	MG/L		63	4.00	5.00	3.40	74/10/10	75/10/02
945 SULFATE	MG/L		63	230	230	11	69/10/29	75/10/02
950 FLUORIDE	MG/L		47	43	120	10	69/10/29	75/10/02
955 SILICA	MG/L		47	0.20	0.40	0.00	69/10/29	73/09/11
	DISOLVED		47	6.1	8.7	0.6	69/10/29	73/09/11

TABLE B-1 CONT.

0750500 54802
 12 00 45 0 003 21 10-0 2
 DEF RIVER AT COUSHATTA, LA
 23001 LOUISIANA

101691

ICURD	02111204	0	TYPE/ANNT/STREAM
INREV 340045	DEPTH		
FILE 932.11	10.00		
PARAMETER			
1000 ARSENIC	AS, DISS	UG/L	
1002 ARSENIC	AS, TOT	UG/L	
1003 ARSENIC	SEBAG-KG	DRY UGT	
1025 CADMIUM	CD, DISS	UG/L	
1027 CADMIUM	CD, TOT	UG/L	
1028 CD MUD	DRY UGT	MG/KG-CD	
1029 CHROMIUM	SEBAG-KG	DRY UGT	
1032 CHROMIUM	CH, VAL	UG/L	
1034 CHROMIUM	CH, TOT	UG/L	
1040 COPPER	CU, DISS	UG/L	
1045 IRON	FE, TOT	UG/L	
1046 IRON	FE, DISS	UG/L	
1048 LEAD	PB, DISS	UG/L	
1051 LEAD	PB, TOT	UG/L	
1052 LEAD	SEBAG-KG	DRY UGT	
1082 STRONTIUM	SR, TOT	UG/L	
1086 ZINC	ZN, DISS	UG/L	
1092 ZINC	ZN, TOT	UG/L	
1093 ZINC	SEBAG-KG	DRY UGT	
1170 FE MUD	DRY UGT	MG/KG-FE	
31801 TOT COLI	PFINDO	/100ML	
31810 INVALID	PAR	NUMBER	
31815 FEC COLI	MPN/100ML	/100ML	
31816 FEC COLI	MPN/100ML	/100ML	
31879 FECSTREP	MPN/100ML	/100ML	
32230 CHLORPHYL	A	MG/L	
32231 CHLORPHYL	B	MG/L	
70000 RES-SUSP	AT 100 C	MG/L	
70300 RES-SUSP	DISS-100 C	MG/L	
70301 DISS SOL	SUM	MG/L	
70303 DISS SOL	TONG PER	ACRE-FT	
71846 AMMONIA	DISS-NH4	MG/L	
71850 NITRATE	TOT-NO3	MG/L	
71851 NITRATE	FE	MG/L	
71885 IRON	AS TOTAL	MG/L	
71887 TOTAL N	MG TOTAL	MG/L	
71900 MERCURY	SEBAG-KG	DRY UGT	
71921 MERCURY	ENTER PAR CODE.		

ENTER PAR CODE. "NEXT STATION", OR "ALL"

TABLE B-1 CONT.

PARAMETER	UNIT	FROM	AT	DATE	MEAN	VARIANCE	STAN. DEV.	COEF. VAR.	STAND. ER.	MAXIMUM	MINIMUM	RES. DATE	END DATE
00001 M3MOL/LC	PT-CD	5 DAY	W/C	7/20/70	1.00000	.00000	.00000	.00000	.00000	1.00000	1.00000	7/20/70	7/20/70
00002 COLON	PT-CD	5 DAY	W/C	7/20/70	9.99999	.00000	.00000	.00000	.00000	10.00000	10.00000	7/20/70	7/20/70
00003 CONDUCTIV	AT 25C	5 DAY	W/C	7/20/70	185.500	612.500	24.750	.13235	.008735	10.00000	10.00000	7/20/70	7/20/70
00004 H2O	5 DAY	W/C	W/L	7/20/70	1.35000	3.25000	1.80000	.13235	.008735	10.00000	10.00000	7/20/70	7/20/70
00005 PH	5 DAY	W/C	W/L	7/20/70	6.40000	.00000	.00000	.00000	.00000	6.40000	6.40000	7/20/70	7/20/70
00006 T ALK	5 DAY	W/C	W/L	7/20/70	13.0000	18.0000	4.24254	.324357	.00000	16.0000	10.0000	7/20/70	7/20/70
00007 HCO3 ION	5 DAY	W/C	W/L	7/20/70	16.0000	32.0000	5.65685	.353554	.00000	20.0000	12.0000	7/20/70	7/20/70
00008 CO3 ION	5 DAY	W/C	W/L	7/20/70	.000000	.000000	.000000	.000000	.000000	.000000	.000000	7/20/70	7/20/70
00009 ORN N	5 DAY	W/C	W/L	7/20/70	.000000	.000000	.000000	.000000	.000000	.000000	.000000	7/20/70	7/20/70
00010 TOT HARD	5 DAY	W/C	W/L	7/20/70	16.0000	.000000	.000000	.000000	.000000	16.0000	16.0000	7/20/70	7/20/70
00011 MC HARD	5 DAY	W/C	W/L	7/20/70	3.00000	.000000	.000000	.000000	.000000	3.00000	3.00000	7/20/70	7/20/70
00012 CALCIUM	5 DAY	W/C	W/L	7/20/70	1.00000	.000000	.000000	.000000	.000000	1.00000	1.00000	7/20/70	7/20/70
00013 MAGNESIUM	5 DAY	W/C	W/L	7/20/70	1.00000	.000000	.000000	.000000	.000000	1.00000	1.00000	7/20/70	7/20/70
00014 SULFATE	5 DAY	W/C	W/L	7/20/70	13.5000	26.5000	5.15940	.380000	.000000	17.0000	10.0000	7/20/70	7/20/70
00015 CHLORIDE	5 DAY	W/C	W/L	7/20/70	1.45000	.25000	.50000	.343763	.000000	1.80000	1.10000	7/20/70	7/20/70
00016 PE-CENT	5 DAY	W/C	W/L	7/20/70	90.4000	46.5000	6.71939	.075335	.000000	67.0000	54.0000	7/20/70	7/20/70
00017 PHTHALATE	5 DAY	W/C	W/L	7/20/70	1.00000	.000000	.000000	.000000	.000000	1.00000	1.00000	7/20/70	7/20/70
00018 SULFATE	5 DAY	W/C	W/L	7/20/70	20.5000	40.5000	6.36395	.309111	.000000	26.0000	15.0000	7/20/70	7/20/70
00019 FLUORIDE	5 DAY	W/C	W/L	7/20/70	5.20000	11.5000	3.39111	.647434	.000000	6.00000	3.00000	7/20/70	7/20/70
00020 SILICA	5 DAY	W/C	W/L	7/20/70	1.00000	.000000	.000000	.000000	.000000	1.00000	1.00000	7/20/70	7/20/70
00021 DISSOLVED	5 DAY	W/C	W/L	7/20/70	6.90000	1.00000	1.41421	.204350	.000000	7.90000	5.90000	7/20/70	7/20/70
00022 DISSOLVED	5 DAY	W/C	W/L	7/20/70	72.5000	95.5000	9.79239	.132742	.000000	66.0000	66.0000	7/20/70	7/20/70
00023 DISSOLVED	5 DAY	W/C	W/L	7/20/70	63.4000	112.4000	10.6064	.167030	.000000	58.0000	58.0000	7/20/70	7/20/70
00024 DISSOLVED	5 DAY	W/C	W/L	7/20/70	1.00000	.000000	.000000	.000000	.000000	1.00000	1.00000	7/20/70	7/20/70
00025 NITRATE	5 DAY	W/C	W/L	7/20/70	.050000	.000000	.000000	.000000	.000000	.000000	.000000	7/20/70	7/20/70
00026 NITRATE	5 DAY	W/C	W/L	7/20/70	.000000	.000000	.000000	.000000	.000000	.000000	.000000	7/20/70	7/20/70

TABLE B-1 CONT.

STATION DATE 7/9/68/30													
221902													
31 59 00.0 093 06 00.0 *													
BLACK LAKE													
22017 LOUISIANA													
101601													
112PALES													
0005 CLASS 00													
ANALYZER													
NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	REG DATE	END DATE				
00000 LAB	25.79.3	312080	176.61	.093335	1019.95	27519.0	24459.0	7/6/53/30	7/6/68/23				
00010 WATER	26.4333	7.3520	2.65597	.094613	1.5323	30.0000	25.4000	7/6/53/30	7/6/68/23				
00021 INCDT LT	1.03000					1.00000	1.00000	7/6/53/30	7/6/68/23				
00031 WIND	45.7666	7.30281	2.71713	.031644	1.54074	69.0000	46.3000	7/6/53/30	7/6/68/23				
00077 TRAMP	42.0000	72.0000	8.49526	.202010	6.0000	48.0000	36.0000	7/6/53/30	7/6/68/23				
00085 SECCHI	131.667	1407.35	37.5240	.285623	21.4668	175.0000	110.0000	7/6/53/30	7/6/68/23				
00095 CHLOROPHY	124.733	810.182	28.6637	.230196	16.4395	157.0000	100.3000	7/6/53/30	7/6/68/23				
00300 PH	6.57000	2.52000	.55543	.35697	1.10000	5.60000	3.40000	7/6/53/30	7/6/68/23				
00400 DO	6.43333	1.3452	.604242	.236418	6.00000	6.20000	7/6/53/30	7/6/68/23					
00410 T CEL	11.4667	8.31350	2.88678	.257438	1.54668	15.0000	10.0000	7/6/53/30	7/6/68/23				
00418 DO-M	8.96667	10.1733	3.48336	.240337	1.20000	14.0000	7/6/53/30	7/6/68/23					
00625 TOT TCEL	533333	.003336	.057740	.004242	.071334	.400000	.500000	7/6/53/30	7/6/68/23				
00430 WATER	6.00000	.003900	.062450	.034089	.034056	.140000	.920000	7/6/53/30	7/6/68/23				
00431 WATER	6.96667	.001010	.031766	.350500	.014387	.127000	.060000	7/6/53/30	7/6/68/23				
00471 WATER	8.32333	.001929	.041924	.114545	.025326	.089000	.011000	7/6/53/30	7/6/68/23				
32217 CHLOROPHY	8.20000					8.20000	8.20000	7/6/53/30	7/6/68/23				
76223 DEPTH DO	5.00000	.001000	.000000	.000000	.000000	5.00000	5.00000	7/6/53/30	7/6/68/23				

STONET DATE 79/06/3A

11 58 00.0 093 03 00.0 4

BLACK LAKE

2017 LOUISIANA

101491

537031

0010 CLASS 00

PARAMETER	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAM	STAND EP	MAXIMUM	MINIMUM	REG DATE	END DATE
00000 LAB	4	25047.5	312152	1766.68	.067982	983.339	27518.0	24557.0	7/05/30	7/08/23
00010 WATER	2	20.8250	3.3251	1.52398	.052870	741.949	30.0000	24.5000	7/05/30	7/08/23
00031 MCOT LT	2	1.00000	.000000	.000000		.000000	1.00000	1.00000	7/05/30	7/08/23
00074 TUNB	4	88.3999	2.9917	1.57454	.017812	787266	89.6000	86.3000	7/05/30	7/08/23
00077 TRANS	1	50.0000								
00078 PRODUCTV	4	122.500	41.0000	6.40712	.052270	3.20156	27.0000	51.0000	7/05/30	7/08/23
00095 CONDUCTV	4	112.750	15.6281	1.95073	.034155	1.92537	117.700	104.300	7/05/30	7/08/23
00300 DO	3	5.64666	1.21345	1.10157	.036395	63.6691	9.60000	5.60000	7/05/30	7/08/23
00400 PH	4	6.87500	1.12264	1.23257	.045583	15.0126	7.10000	6.50000	7/05/30	7/08/23
00410 T ALK	4	12.7500	18.2300	3.20156	.055103	1.60678	16.0000	10.0000	7/05/30	7/08/23
00420 MH3-M	4	107008	9.62000	99.1552	.020919	99.0974	980000	.050000	7/05/30	7/08/23
00425 TOT CAL	4	172.000	1.74167	.356398	.049721	1.76649	1.20000	.400000	7/05/30	7/08/23
00430 M23-M03	4	86.3000	.001025	.032016	.074313	.016008	.080000	.020000	7/05/30	7/08/23
00445 M035-TOT	4	864750	.001335	.336537	.381546	.014266	1.34000	.400000	7/05/30	7/08/23
00471 PHOS-015	4	88.4250	.001360	.063552	.003458	821.746	985000	.910000	7/05/30	7/08/23
12317 CHLORAL	2	15.0000	32.1199	5.70626	.380551	.009499	19.1000	11.5000	7/05/30	7/08/23
12025 DEPTH OF	2	7.99090	2.30000	1.51421	.200030	1.00000	6.00000	4.00000	7/05/30	7/08/23

TABLE B-1 CONT.

SHEET DATE 7/08/30

0736250

LAKE WISTONEAU NEAR HINGGOLD, LA
22013 LOUISIANA

101601

TYPE/AMOUNT/STAGE

112000 0000 CLASS 00

PARAMETER	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND EP	MAXIMUM	MINIMUM	REG DATE	END DATE
00001 WATER	2	1.00000	.00000	.00000	.00000	.00000	1.00000	.00000	7/02/17	7/02/17
00010 WATER	10	19.1000	92.3222	9.60844	.503040	3.03844	30.0000	4.00000	6/12/09	7/05/01
00020 ST-EAM	10	721.199	1.76187	369.008	.511653	145.024	1100.00	300.000	7/01/21	7/05/01
00030 COLON	12	17.3033	38.4472	6.20058	.362961	1.74894	30.0000	5.00000	6/12/09	7/05/01
00045 CONDUCTIV	15	220.297	10458.8	102.415	.464954	25.4534	532.000	135.000	5/11/23	7/05/01
00050 SPO	2	7.00000	.975994	.987949	.141421	.700000	7.00000	.00000	7/02/17	7/02/17
00065 PH	16	6.63374	.073311	.278049	.043150	.069512	7.10000	6.00000	4/05/25	7/05/01
00075 CU2	6	10.4500	107.017	10.3449	.971351	5.17244	26.0000	3.00000	4/05/25	7/05/01
00085 T-AL4	16	15.2500	64.1865	6.69825	.439220	1.67454	30.0000	2.00000	4/05/25	7/05/01
00095 CU3 10M	16	18.5025	65.0314	8.06007	.434520	2.01052	36.0000	8.00000	4/05/25	7/05/01
00105 CO3 10M	12	12.6506	51.1513	7.294506	.562707	1.80907	20.0000	4.00000	6/12/09	7/05/01
00115 QMG N	1	.000000					.000000	.000000	7/02/17	7/02/17
00125 UISS	1	.000000					.000000	.000000	7/02/17	7/02/17
00135 TOT HARD	16	31.9459	125.273	11.2013	.350047	2.40037	62.0000	17.0000	4/05/25	7/05/01
00145 MC HARD	16	16.4135	83.2609	9.14450	.543035	2.24022	30.0000	6.00000	4/05/25	7/05/01
00155 CALCIUM	15	9.41333	5.94126	2.44771	.260025	.631995	16.0000	5.30000	5/11/23	7/05/01
00165 MAGNESIUM	15	1.75333	1.13125	1.08945	.619041	.249025	5.10000	.400000	5/11/23	7/05/01
00175 SODIUM	14	26.4571	261.211	16.1620	.601780	4.31944	78.0000	15.0000	5/11/23	7/05/01
00185 SODIUM	14	2.05000	.505014	.71372	.375279	.204158	3.30000	1.30000	5/11/23	7/05/01
00195 POTASSIUM	14	62.1428	26.1334	5.30406	.088353	1.41754	73.0000	53.0000	5/11/23	7/05/01
00205 POTASSIUM	16	2.25000	.224700	.471911	.209278	.124121	3.20000	1.50000	5/11/23	7/05/01
00215 CHLORIDE	16	54.3124	944.409	30.7394	.565374	7.48484	144.000	24.0000	4/05/25	7/05/01
00225 SULFATE	15	5.33333	3.33456	1.84650	.346219	.474744	10.0000	3.20000	5/11/23	7/05/01
00235 FLUORINE	13	1.60230	.033474	.252430	.156559	.070150	1.00000	.499000	5/11/23	7/05/01
00245 SILICA	15	7.47000	25.0211	5.00211	.630025	1.29154	23.0000	1.40000	5/11/23	7/05/01
00255 MANGANESE	1	.000000					.000000	.000000	5/11/23	7/05/01
00265 NITROGEN	11	12.4554	1012.64	31.4427	.253640	4.50492	30.0000	30.0000	6/12/09	7/05/01
00275 D155 SOL	15	11.7333	3084.21	54.7871	.469850	14.1615	290.000	87.0000	5/11/23	7/05/01
00285 D155 SOL	15	270.340	3201.13	174.849	.661719	80.0014	505.000	91.0000	7/01/21	7/05/01
00295 NITRATE	15	1.40000	.074497	.070091	.236193	.114252	3.00000	.110000	5/11/23	7/05/01
00305 NITRATE	12	3.04004	.033334	.284074	.787248	.144667	7.00000	.200000	5/11/23	7/05/01
00315 NITRATE	12	.645044	.011515	.266970	.404364	.044521	.900000	.100000	4/12/09	7/05/01
00325 NITRATE	1	.000000					.000000	.000000	7/02/17	7/02/17
00335 PHOS	12	19.1847	530.149	23.2430	.124746	7.01274	30.0000	.000000	5/11/23	7/05/01

TABLE B-1 CONT.

STATION DATE 7/20/70													
220304													
32 29 29.0 093 22.03.0 3													
LAKE BISTINEAU													
22119 LOUISIANA													
101691													
11EPALES													
0005 CLASS 00													
PARAMETER	IDENT.	NUMBER	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	REG DATE	END DATE	
00000 LAB	TEMP	TRANS	CENT	5	25932.4	1995.09	4465.59	171801	1997.12	30742.0	21950.0	7/20/72	7/21/71
00010 WATER	TEMP	TRANS	S	5	19.2920	17.6614	4.20254	217839	1.87943	26.7400	14.8100	7/20/72	7/21/71
00074 TURB	SECCHI	INCHES	S	5	80.2800	13.0035	3.68829	041544	1.44945	93.5000	85.0000	7/20/72	7/21/71
00077 TRANSP	FIELD	MICROMHU	INCHES	2	44.7000	207.000	14.1121	321112	10.0000	54.0000	34.0000	7/20/72	7/21/71
00094 CONDUCTIVITY	AT 25C	MICROMHU	MICROMHU	5	134.600	1204.81	34.7680	258306	15.5487	194.000	108.000	7/20/72	7/21/71
00095 CONDUCTIVITY	AT 25C	MICROMHU	MICROMHU	5	148.360	55.547	23.8637	159154	10.4933	186.100	124.800	7/20/72	7/21/71
00308 DO	DO	DO	DO	5	6.01400	1.19350	1.85053	177625	525215	7.00000	5.60000	7/20/72	7/21/71
00400 PH	PH	PH	PH	5	6.01400	3.19512	542676	094687	249581	6.80000	5.42000	7/20/72	7/21/71
00400 PH	PH	PH	PH	5	10.1800	3.20007	1.78837	165637	800009	15.0000	10.0000	7/20/72	7/21/71
00418 I ALA	CAC03	MG/L	MG/L	5	0.07000	0.00100	0.10000	166670	004472	0.07000	0.05000	7/20/72	7/21/71
00425 TOT KJEL	TOTAL	MG/L	MG/L	5	0.64000	0.13000	141660	293843	001241	800000	0.00000	7/20/72	7/21/71
00430 MO3C03	N-TOTAL	MG/L	MG/L	5	0.06000	0.01150	0.33912	565194	011164	100000	0.02000	7/20/72	7/21/71
00445 PHOS-TOT	PHOS-TOT	MG/L	MG/L	5	0.04200	0.00065	0.00044	090178	003597	103000	0.03000	7/20/72	7/21/71
00471 PHOS-013	PHOS-013	MG/L	MG/L	5	0.30800	0.00185	0.13541	441250	004678	046000	0.01000	7/20/72	7/21/71
32217 CHLORPHYL	CHLORPHYL	MG/L	MG/L	3	16.4000	464.750	21.6737	1.31356	12.5133	31.5000	3.00000	7/20/72	7/21/71
72225 DEPTH OF	DEPTH OF	FEET	FEET	3	6.33333	5.33333	2.30441	364664	1.33334	9.00000	5.00000	7/20/72	7/21/71

STOWAY DATE 79/08/30

220303

32 24 57.0 093 21 18.0 7

LAKE AISTINEAU

22119 LOUISIANA

101691

STYPA/AMANT/LAKE

5410631

001\$ C1A5 00

PARAMETER	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND ER	MAXIMUM	MINIMUM	REG DATE	END DATE
00001 LAB	1	25133.2	134508	366.63	.145967	1297.06	30748.0	2194.7	7/6/03/21	7/6/11/11
00010 WATER	2	21.1637	20.6636	4.5573	.214788	1.6716	16.6300	16.6300	7/6/03/21	7/6/11/11
00070 TUNA	3	88.3624	12.5117	3.53719	.039740	1.25059	92.9000	84.0000	7/6/03/21	7/6/11/11
00077 TUNA-SB	3	35.6667	66.3345	8.14460	.223453	4.74228	45.0000	30.0000	7/6/03/21	7/6/11/11
00095 CROACTIV	4	119.475	55.2678	7.43624	.062017	2.4788	130.000	111.000	7/6/03/21	7/6/11/11
00095 CROACTIV	4	20.4000	31.502	5.6638	.137472	6.30874	146.9000	106.300	7/6/03/21	7/6/11/11
00300 DO	4	2.99999	3.74202	1.93638	.350677	.787832	7.00000	1.40000	7/6/03/21	7/6/11/11
00400	5	6.21376	312633	576917	.092945	203971	7.00000	5.35000	7/6/03/21	7/6/11/11
00410	4	11.2500	3.64266	1.90463	.169646	.674901	15.0000	10.0000	7/6/03/21	7/6/11/11
00410 TOTAL	4	8.05000	.000057	.007559	.151149	.007673	.060000	.040000	7/6/03/21	7/6/11/11
00425 TOT KJEL	4	8.87500	.001250	.145775	.264128	.051539	.400000	.400000	7/6/03/21	7/6/11/11
00430 N224-NITEL	4	8.66250	.001227	.03026	.594685	.012383	.116000	.020000	7/6/03/21	7/6/11/11
00445 PHOS-TOT	4	6.06000	.000009	.00009	.136394	.003327	.065000	.060000	7/6/03/21	7/6/11/11
00501 PHOS-DIT5	4	0.11875	.601099	.00963	.527450	.003523	.031000	.005000	7/6/03/21	7/6/11/11
32217 CHL-NITEL	3	18.6667	590.043	24.2908	.130129	15.0243	46.6000	2.30000	7/6/03/21	7/6/11/11
72025 OCEAN OF	3	13.9333	8.33350	2.88678	.146664	1.50000	15.0000	10.0000	7/6/03/21	7/6/11/11

TABLE B-1 CONT.

STIMET DATE 12/08/30									
220302									
32 23 55.0 091 25 25.0 1									
LAKE BISTINEAU									
22015 LOUISIANA									
101401									
/TYPE/TEMP/LAKE									
11EGALES									
0015 CLASS 00									
PARAMETER	NUMBER	MEAN	VARIANCE	STAN DEV	COEF VAR	STAND EP	MAXIMUM	MINIMUM	BEG DATE END DATE
00002 LAR	8	251.05	134.008	3649.11	144002	1297.23	30738.0	21944.0	74/03/21 74/11/11
00010 WATER	8	21.3175	22.3516	4.72775	219717	1.67151	27.3300	17.0000	74/03/21 74/11/11
00074 TURB	8	99.4500	15.9905	3.98681	394905	1.51370	93.0000	86.0000	74/03/21 74/11/11
00077 TRANSP	3	37.1333	41.3340	6.42915	172209	3.71187	42.0000	30.0000	74/03/21 74/11/11
00094 CONDUCTIV	4	117.625	714.353	26.8054	227892	9.4773	169.000	95.0000	74/03/21 74/11/11
00095 CONDUCTIV	4	127.675	1541.55	39.5165	309025	13.9712	187.600	90.1000	74/03/21 74/11/11
00300 DO	6	6.53333	5.74721	0.662300	094931	2.70407	7.80000	5.00000	74/03/21 74/11/11
00300 PH	8	6.51750	2.49485	0.519600	076490	1.83704	7.20000	5.76000	74/03/21 74/11/11
00419 T ALK	8	10.2500	214.286	4562910	045142	163663	11.0000	10.0000	74/03/21 74/11/11
00419 W3-M	4	0.4750	0.00098	0.09910	203291	0.03504	0.6000	0.00000	74/03/21 74/11/11
00425 TOT ALK	4	562500	0.22479	150535	287724	053243	500000	0.00000	74/03/21 74/11/11
00430 W02403	8	0.4750	0.00098	0.09910	203291	0.03504	0.6000	0.00000	74/03/21 74/11/11
00445 PHOS-TOT	4	0.0000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	74/03/21 74/11/11
00471 PHOS-DIS	4	0.0000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	74/03/21 74/11/11
22217 CHLORYL	3	9.13333	31.5233	5.78184	633272	3.33933	15.5000	5.00000	74/03/21 74/11/11
22025 DEPTH UP	3	12.4067	9.13350	3.05504	241190	1.74385	16.0000	10.0000	74/03/21 74/11/11

TABLE B-1 CONT.

[illegible]

TABLE B-1 CONT.

WASTEWATER ANALYSES REPORT

Lawrie-Med Laboratories, Inc.

414 W. CALIFORNIA, BOSTON, LA. 71270 510 222-0000

1000 South St. and E. 10th St. Boston, La.

Service to _____
 Address _____
 Attention _____
 Title _____
 Sample No. _____ Sample Type GRAB
 Date Collected (1) 8-9-79 Time 1510
 Date Collected (2) _____ Time _____
 Date Received 8-9-79 Time 1845
 Collected by _____ Brought in EAB

File No. _____ Report No. 1
 Invoice No. C9085 Date 9-26-79
 P.O. No. _____ RPO _____

MISCELLANEOUS CHARGES:

1. Total Miles _____ at _____ /mile
 2. Labor Time _____ at _____ /hr
 3. Shipping Charges (last) _____
 Logged in by Amr Preserved ye

15462

RMP # and Source

GRAND BAYOU

SAMPLE NO. 1

SAMPLE NO. 2

PARAMETER	Pb	Rel	Conc.	Re per day	Date Begun	Time Begun	Date Completed	Time Completed	Analyst	Conc.	Re per day	Date Begun	Time Begun	Date Completed	Time Completed	Analyst	Conc.	Re per day	Date Begun	Time Begun	Date Completed	Time Completed	Analyst	Conc.	Re per day	Date Begun	Time Begun	Date Completed	Time Completed	Analyst	Conc.	Re per day
Acidity	273																															
Ammonia-Nitrogen	276																															
Calcium	278																															
Total	278																															
Chlorine Free	827																															
Total	835	22.18			8-9	1800	8-12	1700	10/10																							
Fecal Strap	842																															
SO ₄ S	843	4.3			8-9	1800	8-11	1800	10/10																							
Chloride	304	22.5			8-14	11:00	8-14	12:15	10/10																							
CO ₂	560	31.8			8-13	10:00	8-13	9:00	10/10																							
Urethane T	261																															
Org Oxygen	480	4.9			8-9	1515	8-9	1530	10/10																							
Firm (MGG)																																
Fluorides	201	0.06			8-14	2:00	8-14	2:45	10/10																							
Hardness	202																															
Nitrogen Ammonia	180	0.05			8-10	10:30	8-10	11:00	10/10																							
Nitrate	178	2.8			8-10	11:00	8-10	2:00	10/10																							
Nitrite	427	0.04			8-10	2:00	8-10	3:00	10/10																							
Organic	434																															
Total	437																															
Oil & Grease	515																															
Phosphate Chlorinated	70				8-10	0900	8-																									
Organic Phos	70																															
pH	480	2.1			8-9	1510	8-9	1515	10/10																							
Phosphorus	574																															
Phosphorus Total	481	0.08			8-08	11:00	8-08	13:00	10/10																							
Other	481																															
Solids Total	86																															
Total Diss	84	50.0			8-13	1900	8-14	0930	10/10																							
Total Susp	82																															
Volatile Diss	86																															
Volatile Susp	86																															
Fixed Diss	86																															

* Indicates out of permit substances (Regulation 1) which should be reported within 5 days of non-compliance conditions.

Charles Stratton

Dr. Robert W. Fleury, President

Unless otherwise stated, all data is reported in units of mg/l or ppm.

Analysis conducted in accordance with the List of Approved Test Procedures, published in Federal Register, vol. 41, no. 242, Wednesday, December 1, 1970. Test procedures are derived from the 1970 edition of Standard Methods for the Examination of Water and Wastewater, Methods for the Examination of Water and Wastewater, 1970 (APHA), or ASTM (American Society of Standards, Part 25, Water Chemistry Analysis, 1972).

The duplicate analysis and spread samples for 8-10 indicate all methodologies are in control.

Samples received for 1000 ppm.

TABLE B-1 CONT.ANALYTICAL REPORT
TRACE METALS

Enviro-Med Laboratories, Inc.

NEW CALIFORNIA RESTON VA 22270 SLN 259 0000
1010 S ALABAMA HIGHWAY RESTON ROULET VA 70000 S01 144 1114

Environmental, Molecular and Chemical Specialists

Name _____
Address _____
Attention _____
Title _____
Sample Type _____ Present _____
Group _____ Date _____
Date Collected (1) 8-5-79 Time 1510
Date Collected (2) _____ Time _____
Date Received 8-5-79 Time 1845
Collected By _____ Brought In _____

File No. _____ Report No. _____
Invoice No. C9085 Date 9-26-79
P.O. No. _____ RPD _____

MISCELLANEOUS CHARGES:

1. Total Miles _____ at _____ mile _____
2. Latent Time _____ at _____ /in _____
3. Shipping Charges (tax) _____

Logged In By hmo Comments _____

SAMPLE NO. 1

SAMPLE NO. 2

[illegible]

Chemists/Biologists

Dr. Robert W. Flourney, President

Analyses conducted in accordance with the list of approved Test Procedures, published in Federal Register, vol. 41, no. 23, Wednesday, October 1, 1976. Test procedures are either from the 14th Edition of Standard Methods for the Examination of Water and Wastewater, 1976 (SMA), or from Analyses of Water and Wastes, 1976 (AWA).

The duplicate analysis and initial sample for **8-10** were all methodologies are in control.

* Applications and all other documents (Regulatory agency) should be received within 5 days of non-competitive tenders.

weight 100 g/100 g for three years.

—**WENN DER VERWANDTE VERSTORBEN, SO WIRD IN FOLGENDEN ZEILEN ANGEZEIGT:**

TABLE B-1 CONT.

DRINKING WATER ANALYSES REPORT

Service to: Sunbelt Research Corp ENVIRO-MED LABORATORIES, INC.
 Address: 727 Spain St. 414 W. California
Baton Rouge, La. Ruston, LA 71270
 Attention: Lawrence McKensie 318-255-0060 or 255-0064
 Title: President

Sample Source: Grand Bayou File No. _____ Report No. _____

Sample No: 13462 Sample Type: Water/ grab Date _____ Invoice No. _____
 Date Collected: 8-9-79 Time: 1510
 Date Received: 8-9-79 Time: 1845
 Date Analyzed: 8-23-79
 Performed By: Ken Baughman
 Collected By: Arlene

INORGANIC

CONTAMINANT	MCL*	DETECTED LEVELS	CONTAMINANT	MCL*	DETECTED LEVELS
Arsenic, As	0.05	_____	Lead, Pb	0.05	_____
Barium, Ba	1.0	_____	Mercury, Hg	0.002	_____
Cadmium, Cd	0.01	_____	Nitrate, NO ₃ -N	10	_____
Chromium, Cr	0.05	_____	Selenium, Se	0.01	_____
Fluoride, F	1.4-2.4	_____	Silver, Ag	0.05	_____

Reanalysis 9-24-79

ORGANIC

Endrin	0.0002	< 0.0002	Toxaphene	0.005	< 0.005
Lindane	0.004	< 0.004	2, 4-D	0.1	< 0.1
Methoxychlor	0.1	< 0.1	2,4,5-TP(Silvex)	0.01	< 0.01

RESULTS EXPRESSED IN mg/l (ppm) UNLESS OTHERWISE DESIGNATED *MCL - MAXIMUM CONTAMINANT LEVELS

Respectfully submitted,
 ENVIRO-MED LABORATORIES, INC.

Turbidity _____ (NTU)

Total Coliform _____ (N/100ml)

Ken Baughman
 Analyst/Bioanalyst/Microbiologist

Robert W. Flourney
 Dr. Robert W. Flourney, President

Comments:

METHODS: Methods used for inorganic analyses are Environmental Protection Agency approved as specified in the 1976 Federal Register, Volume 41, No. 232. Organic analyses methods are according to the Environmental Protection Agency Manual "Analysis of Pesticide Residues in Human and Environmental Samples". Turbidity and Total Coliform procedures are from the 14th Edition of "Standard Methods for the Examination of Water and Wastewater".

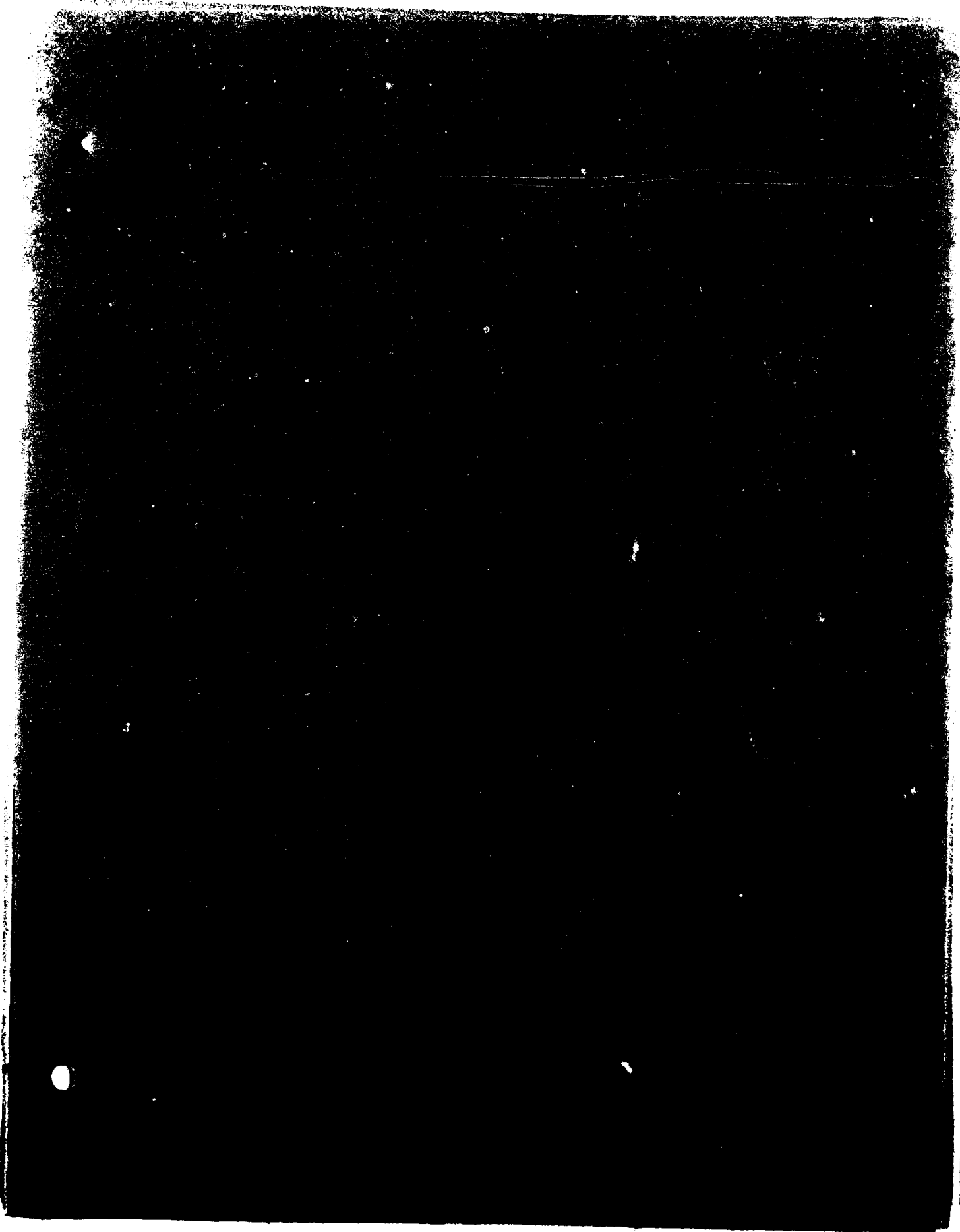


TABLE C-1
VEGETATIONAL SPECIES RECORDED
IN GRAND BAYOU AREA

Scientific Name Common Name	Habitat Found	Numbers Recorded in 50 Plots (Total)					
		Ground Cover	1'-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Acer rubrum</i> Red Maple	C,D,E		121	87	26	16	3
<i>Aesculus pavia</i> Red Buckeye	C		1				
<i>Alternanthera philoxeroides</i> Alligator weed	D,A	3					
<i>Amaranthus</i> spp. Pigweed	D		7				
<i>Ampleopsis arborea</i> Peppervine	B,C,D,E		22	37			
<i>Andropogon virginicus</i> Broomsedge	B		17				
<i>Apium leptophyllum</i> Marsh Parsley	C,D,E	1	5				
<i>Aralia spinosa</i> Hercules' Club	C,E		14	50	12		
<i>Arisaema dracontium</i> Green Dragon	D,E		28				
<i>Arisaema triphyllum</i> Jack-in-the-Pulpit	C,D,E		36				
<i>Arundinaria tecta</i> Switch Cane	C,D,E		129				
<i>Ascyrum hypericoides</i> St. Andrews' Cross	C,E		3	1			
<i>Baccharis halimifolia</i> Marsh Elder	A,D		3	2			

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Baptista leucantha</i> Indigo	C		2				
<i>Berchemia scandens</i> Rattan vine	B,C,D,E	2	8	39			
<i>Callicarpa americana</i> French Mulberry	C,E		11	34			
<i>Campsis radicans</i> Trumpet Creeper	B,C,D,E		26	8			
<i>Cardamine bulbosa</i> Bulb Bittercress	D,E		177				
<i>Carex</i> spp. Sedge	A,D	1					
<i>Carpinus caroliniana</i> Hornbeam	D,E		66	175	52	17	6
<i>Carya aquatica</i> Bitter Pecan	C,D,E			2			
<i>Carya tomentosa</i> Mockernut Hickory	C,E		2	2	6	1	1
<i>Carya</i> spp. Hickory	C,D,E		31	35	8	4	1
<i>Cassia fasciculata</i> Partridge Pea	A,B,C,D,E	1	5				
<i>Cassia</i> spp. Cassia	C,D	1	2				
<i>Chionanthus virginica</i> Fringetree	C		27	9			
<i>Cirsium florida</i> Sow Thistle	B		2				

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Cnidoscolus stimulosus</i> Bullnettle	B, C		22				
<i>Cornus florida</i> Flowering Dogwood	C, D		31	44	18	8	
<i>Coronopus didymus</i> Swinecress	C		12				
<i>Crataegus marshalli</i> Parsley Hawthorn	C, D, E		63	82	8		
<i>Crataegus viridis</i> Green Hawthorn	D, E			25		1	
<i>Crataegus</i> spp. Hawthorn	C, D, E		6				
<i>Croton capitatus</i> Wooly Croton	B		24				
<i>Cyperus esculentus</i> Yellow Nutsedge	B		2				
<i>Cyperus</i> spp. Nutsedge	B		15				
<i>Dichondra carolinensis</i> Dichondra	B	1	94				
<i>Diospyros virginiana</i> Persimmon	C		6	7			
<i>Eleocharis</i> spp. Spikerush	A, D	2	42				
<i>Erythrina herbacea</i> Coral Bean	C		22				
<i>Eupatorium capillifolium</i> Dogfennel	B		23				

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Eupatorium perfoliatum</i> Thoroughwort	C		8	83			
<i>Eupatorium</i> spp. Yankee Weed	B,C		11				
<i>Fagus grandifolia</i> Carolina Beech	C,E			3		1	
<i>Fraxinus carolina</i> Carouna Ash	D,E		10	12	2	3	1
<i>Fraxinus pennsylvanica</i> Green Ash	D,E		4	10	5		
<i>Fraxinus</i> spp. Ash	C,D,E		3	6	1		
<i>Forestiera accuminata</i> Swamp Privet	D			1			
<i>Gelsemium sempervirens</i> Yellow Jessamine	C,D,E		35				
<i>Georgia pellucida</i> Moss	D,E		2				
<i>Geranium carolinianum</i> Wild Geranium	B		2				
<i>Gleditsia triacanthos</i> Honey Locust	D,E			2			
<i>Gnaphalium obtusifolium</i> Rabbit Tobacco	B,C,E		44				
<i>Halesia carolina</i> Silverbell	C,D,E			47	3		
<i>Hamamelis virginiana</i> Witch Hazel	C,D,E		48	35	8		

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Heliantheum canadense</i> Rock Rose	A,D,E		17				
<i>Helianthus spp.</i> Sunflower	B,C,E		21	34			
<i>Hibiscus lasiocarpus</i> Wooly Rose-Mallow	D			33			
<i>Hydrocotyle ranunculoides</i> Water Pennywort	D		99				
<i>Hypericum cistifolium</i> St. John's Wort	C,E		4				
<i>Ilex decidua</i> Deciduous Holly	D,E			64	26		
<i>Ilex opaca</i> American Holly	C,D,E		22	9	15	1	
<i>Ilex vomitoria</i> Yaupon	C,E		33	47			
<i>Iris giganteaerulea</i> Giant Blue Iris	D			3			
<i>Itea virginica</i> Virginia Willow	D			4			
<i>Juncus effusus</i> Soft Rush	A,D		98				
<i>Juniperus virginiana</i> Southern Red Cedar	C			1			
<i>Lamium amplexicaule</i> Henbit	B,C		15				
<i>Leersia virginica</i> White Grass	D	3	161				

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Leersia lenticularis</i> Catchfly Grass	D	1	9				
<i>Lespedeza</i> sp. Lespedeza	B		67				
<i>Liquidambar styraciflua</i> Sweetgum	B,C,D,E		41	87	27	12	8
<i>Lolium perenne</i> Rye Grass	B	1					
<i>Lonicera japonica</i> Honeysuckle	B,C,D,E	3					
<i>Magnolia virginiana</i> Sweetbay	C,D,E			2	6	1	
<i>Mazus japonicus</i> Monkeyface	B		15				
<i>Mitchella repens</i> Partridge Berry	C,D,E	9	8				
<i>Mnium</i> spp. Moss	D	1					
<i>Morus rubra</i> Red Mulberry	D,E		2				
<i>Myrica cerifera</i> Wax Myrtle	C,E		97	49			
<i>Nyssa aquatica</i> Tupelogram	D,E		4	17	3	1	1
<i>Nyssa sylvatica</i> Blackgum	C,D,E		1	22	16	4	
<i>Osmunda cinnamomea</i> Cinnamon Fern	C		1				

TABL C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Ostrya virginiana</i> Hophornbeam	D				1		
<i>Oxalis stricta</i> Yellow Wood Sorrel	B,C,D,E		25				
<i>Panicum sphaerocarpon</i> Panic Grass	B,C,D,E	3	16				
<i>Panicum spp.</i> Panic Grass	B,C,D,E	3	13				
<i>Panicum virgatum</i> Switch Grass	B,E		22				
<i>Parthenocissus quinquefolia</i> Virginia Creeper	C,D,E	7	35				
<i>Paspalum notatum</i> Bahia Grass	B		2				
<i>Paspalum urvillei</i> * Vasey Grass	C		4				
<i>Peltandra virginica</i> Arrow Arum	D		32				
<i>Pinus elliotii</i> Slash Pine	C,E		1		1	4	5
<i>Pinus taeda</i> Loblolly Pine	C,E		11	12	12	17	20
<i>Plagiothecum striatellum</i> Moss	D,E	2					
<i>Planera aquatica</i> Water Elm	D			4			
<i>Plantago major</i> Plantain	B,C,E		24				

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Podophyllum peltatum</i> Mandrake	C		70				
<i>Polygonum spp.</i> Smartweed	A,D		133				
<i>Polypodium polypodioides</i> Resurrection Fern	C,D,E						
<i>Polytrichum sp.</i> Moss	C,D,E		107				
<i>Prunella vulgaris</i> Self-Heal	B,C,E		1				
<i>Prunus angustifolia</i> Chickasaw Plum	C,D,E		2	2	2		
<i>Prunus caroliniana</i> Cherry Laurel	C		6				
<i>Prunus mexicana</i> Mexican Plum	C,D,E			2	6	2	
<i>Prunus serotina</i> Black Cherry	C				1		
<i>Pteridium aquilinum</i> Bracken Fern	C		6				
<i>Quercus alba</i> White Oak	C,D,E		27	68	5	2	1
<i>Quercus lyrata</i> Overcup Oak	D,E		4	8	12	11	2
<i>Quercus marilandica</i> Blackjack Oak	C,E		8	5	3		
<i>Quercus michauxii</i> Cow Oak	D,E		8	19	4		

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Quercus nigra</i> Water Oak	C,D,E		9	36	21	15	13
<i>Quercus obtusa</i> Obtusa Oak	D,E			5	1	9	1
<i>Quercus phellos</i> Willow Oak	C,D,E		238	119	37	3	1
<i>Quercus rubra</i> Red Oak	C,E		1	7	10	8	
<i>Quercus spp.</i> Oak	C,D,E		148				
<i>Quercus stellata</i> Post Oak	C,E		4	1	9	9	
<i>Rhamnus caroliniana</i> Carolina Buckthorn	C		6	5			
<i>Rhododendron canescens</i> Wild Azalea	D,E		2	13			
<i>Rhus copallinum</i> Winged Sumac	C,E		16	16			
<i>Rhus glabra</i> Smooth Sumac	C,E			2			
<i>Rhus quercifolia</i> Poison Oak	C		12				
<i>Rhus radicans</i> Poison Ivy	C,D,E	21	43	5			
<i>Rubus spp.</i> Dewberry	B,C,D,E	3	179	53			
<i>Sabal minor</i> Palmetto	D			20			
<i>Salix nigra</i> Black Willow	D			9			

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Sassafras albidum</i> Sassafras	C,E		10	8		1	
<i>Saururus cernuus</i> Lizards' Tails	D	2	107				
<i>Scirpus</i> spp. Rush	A,D		10				
<i>Senecio glabella</i> Butterweed	C,D,E		58				
<i>Silphium perfoliatum</i> Rosinweed	C		1				
<i>Smilax bona-nox</i> Bona-Nox Greenbriar	C,E			15			
<i>Smilax glauca</i> Cat Briar	C		4				
<i>Smilax rotundifolia</i> Greenbriar	C,D,E		28	18			
<i>Smilax</i> spp. Greenbriar	C,D,E	3	79	44			
<i>Smilax walteri</i> Small Greenbriar	C	1					
<i>Solidago</i> spp. Goldenrod	B		45				
<i>Spartina cynosuroides</i> Hog Cane	D			26			
<i>Sphagnum cymbifolium</i> Sphagnum Moss	C	1					
<i>Stenotaphrum secundatum</i> St. Augustine Grass	B	137					

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1'-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Styrax grandifolia</i> Bigleaf Snowbell	C,D,E		2	11	2		
<i>Symplocos tinctoria</i> Horsesugar	C,E		3	17	1		
<i>Taxodium distichum</i> Baldcypress	D		1				
<i>Tradescantia</i> spp. Spiderwort	D,E	3	83				
<i>Trichostema dichotomum</i> Blue Curls	B		2				
<i>Trillium sessile</i> Wake Robin	C,E		16				
<i>Ulmus americana</i> American Elm	C,D,E		65	45	16	6	2
<i>Ulmus alata</i> Winged Elm	C,D,E		36	49	10	4	
<i>Vaccinium aboreum</i> Tree Huckleberry	C,D,E		13	26	8	1	
<i>Vaccinium</i> spp. Huckleberry	C		52	310			
<i>Verbascum</i> spp. Mullein	C		9				
<i>Viburnum dentatum</i> Arrowwood	C,D,E		33	34	4		
<i>Viburnum nudum</i> Possumhaw Viburnum	C,E		7	8	1	1	
<i>Viburnum</i> spp. Arrowwood	C,D,E		30	6			

TABLE C-1, VEGETATIONAL SPECIES, CONT.

Scientific Name Common Name	Habitat Found	Ground Cover	Numbers Recorded in 50 Plots (Total)				
			1"-1'	1.1'-10'	1"-3" DBH**	4"-9" DBH**	10"+ DBH**
<i>Viola rosacea</i> Violet	C,D,E	5	161				
<i>Viola spp.</i> Violet	C,D,E		13				
<i>Vitus labrusca</i> Fox Grape	C	1	2	1			
<i>Vitus rotundifolia</i> Muskadine	C,D,E	2	86	110	1		
<i>Vitis spp.</i> Grape Vines	C,D,E			137			
<i>Wisteria macrostachya</i> Wild Wisteria	D			4			

*Ground Cover- at least 100 individuals per 10 meter x 10 meter plot

**DBH- Diameter at breast height

A= Marsh

B= Agriculture

C= Pine Hardwoods

D= Wet Bottomland Hardwoods

E= Dry Bottomland Hardwoods

TABLE D-1
MAMMALS ANTICIPATED SPECIES WITHIN STUDY AREA

Scientific Name	Common Name	Parish Where Known To Exist (RR, N, S)
<i>Didelphidae</i>		
<i>Didelphis virginiana</i>	Virginia Opossum	RR, N, S
<i>Soricidae</i>		
<i>Blarina brevicauda</i>	Short-Tailed Shrew	RR, N, S
<i>Cryptotis parva</i>	Least Shrew	S
<i>Talpidae</i>		
<i>Scalopus aquaticus</i>	Eastern Mole	N, S
<i>Vespertilionidae</i>		
<i>Myotis austroriparius</i>	Southeastern Myotis	N
<i>Pipistrellus subflavus</i>	Eastern Pipistrelle	N
<i>Speotyto cunicularia</i>	Big Brown Bat	N
<i>Lasiurus borealis</i>	Red Bat	RR, N
<i>Lasiurus cinereus</i>	Hoary Bat	N
<i>Lasiurus sealinus</i>	Seminole Bat	N
<i>Myotis grisescens</i>	Evening Bat	N, S
<i>Plecotus rafinesquii</i>	Rafinesque's Big-Eared Bat	N
<i>Molossidae</i>		
<i>Tadarida brasiliensis</i>	Brazilian Free-Tailed Bat	N
<i>Dasypodidae</i>		
<i>Dasypus novemcinctus</i>	Nine-Banded Armadillo	RR, N, S
<i>Leporidae</i>		
<i>Sylvilagus floridanus</i>	Eastern Cottontail	RR, N, S
<i>Sylvilagus aquaticus</i>	Swamp Rabbit	RR, N, S
<i>Sciuridae</i>		
<i>Sciurus carolinensis</i>	Gray Squirrel	RR, N, S
<i>Sciurus niger</i>	Fox Squirrel	RR, N, S
<i>Glaucomys volans</i>	Southern Flying Squirrel	N, S
<i>Narmata monax</i>	Woodchuck	S

TABLE D-1
MAMMALS ANTICIPATED SPECIES WITHIN THE STUDY AREA

Scientific Name	Common Name	Parish Where Known To Exist (M, N, S) **
<i>Geomys</i>		
<i>Geomys burarius</i>	Plains-Pocket Gopher	M, N, S
<i>Citellus</i>		
<i>Citellus canadensis</i>	American Beaver	M, N, S
<i>Citellus</i>		
<i>Oryzomys palustris</i>	Marsh Rice Rat	M, S
<i>Reithrodontomys fulvescens</i>	Pulvose Harvest Mouse	M, N, S
<i>Reithrodontomys humilis</i>	Eastern Harvest Mouse	N
<i>Peromyscus leucopus</i>	White Footed Mouse	M, S
<i>Peromyscus gambelii</i>	Cotton Mouse	M, S
<i>Ochrotomys nuttalli</i>	Golden Mouse	M, S
<i>Sigmodon hispidus</i>	Hispid Cotton Rat	M, N, S
<i>Neotoma floridana</i>	Eastern Wood Rat	S
<i>Microtus pinetorum</i>	Woodland Vole	
<i>Rattus</i>		
<i>Rattus rattus</i>	Roof Rat	M, N, S
<i>Rattus norvegicus</i>	Norway Rat	M, S
<i>Rus musculus</i>	House Mouse	M, N, S
<i>Calomys</i>		
<i>Calomys callosus</i>	Whitish Rat	M, S
<i>Camelidae</i>		
<i>Camelus</i>		
<i>Camelus lotrovus</i>	Coyote	M, S
<i>Canis rufus</i>	Red Wolf	M, S
<i>Vulpes fulva</i>	Red Fox	M, S
<i>Urocyon cinereoargenteus</i>	Gray Fox	M, N, S
<i>Ursidae</i>		
<i>Ursus americanus</i>	American Black Bear	M, S
<i>Procyonidae</i>		
<i>Procyon lotor</i>	Northern Raccoon	M, N, S

TABLE D-1
MAMMALS ANTICIPATED SPECIES WITHIN STUDY AREA

Scientific Name	Common Name	Parish Where Known To Exist ^a (RR, N, B) or
<i>Mustelidae</i>		
<i>Mustela ermine</i>	Long-Tailed Weasel	
<i>Mustela vison</i>	North American Mink	N
<i>Neophelis nebulosa</i>	Striped Shunk	RR, N
<i>Lutra canadensis</i>	Nearctic River Otter	
<i>Felidae</i>		
<i>Lynx rufus</i>	Bobcat	RR, N
<i>Cervidae</i>		
<i>Odocoileus virginianus</i>	White-Tailed Deer	RR, N, B

^aPersonal Observations and/or Museum Documentation
along River, Natchitoches, Bossier (and/or Bienville) Parishes, respectively
Source for Museum Documentation: Lowery, George H., Jr., The Mammals of Louisiana and Its
Adjacent Waters. Louisiana State University Press, 1974.

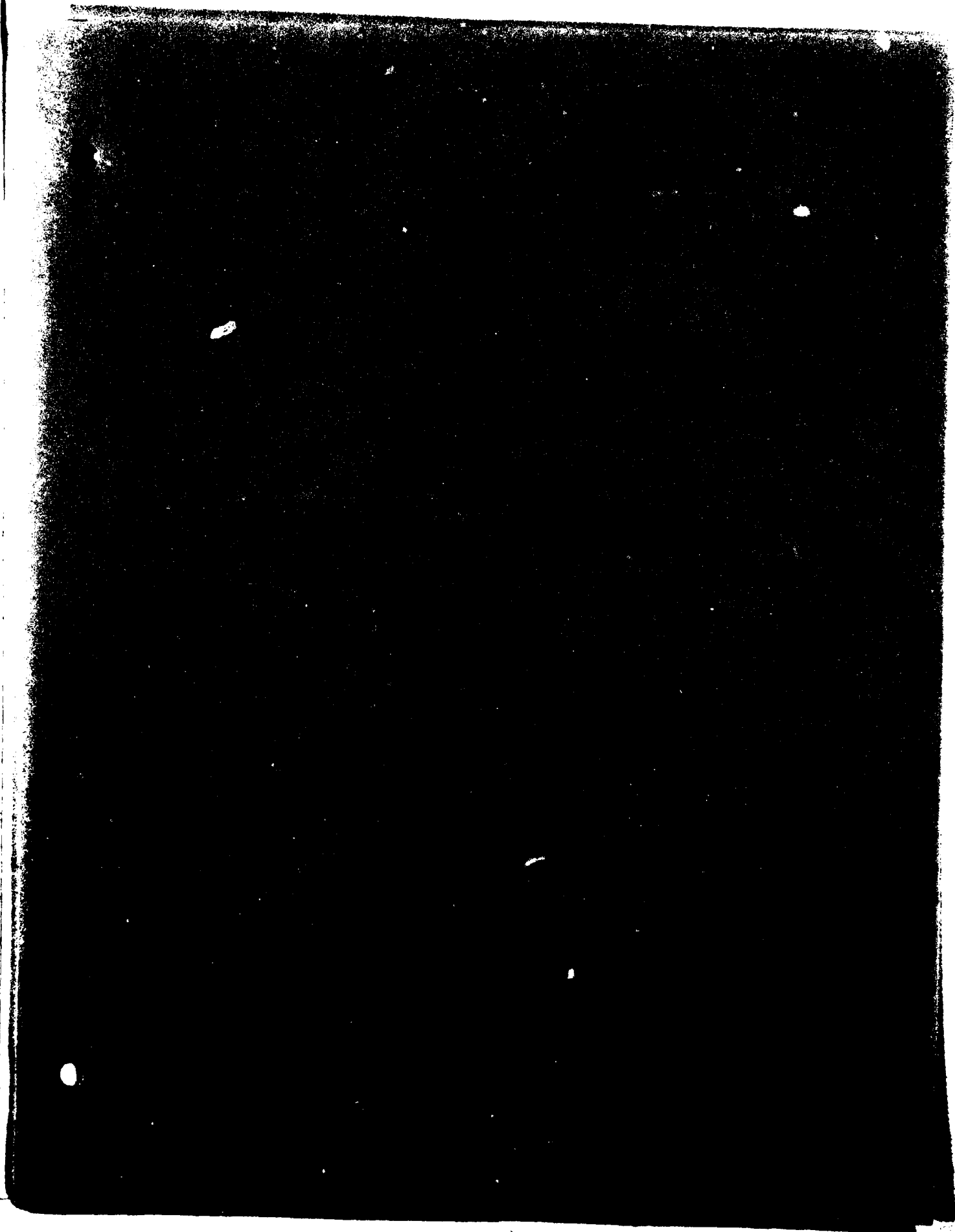


TABLE E-1
BIRDS KNOWN OR PRESUMED TO OCCUR IN THE GRAND BAYOU AREA

Family Name	Scientific Name	Common Name	Presumed or Known	Occurrence in Red River Parish	Winter	Summer
Anhimidae	<i>Anhinga anhinga</i>	American anhinga		X	X	
	<i>Chen caerulescens</i>	Snow goose			X	X
	<i>Anas platyrhynchos</i>	Mallard	P	X	X	X
	<i>Anas diaconus</i>	Blue-winged teal			X	
	<i>Anas boschas</i>	Wood duck			X	
Cathartidae	<i>Cathartes aura</i>	Turkey vulture		X		
Accipitridae	<i>Coragyps atratus</i>	Black vulture		X		
	<i>Accipiter cooperii</i>	Cooper's hawk		X	X	
	<i>Accipiter striatus</i>	Sharp-shinned hawk	P			
	<i>Buteo jamaicensis</i>	Red-tailed hawk		X	X	
	<i>Buteo lineatus</i>	Red-shouldered hawk		X	X	
	<i>Buteo platypterus</i>	Broad-winged hawk		X	X	X
	<i>Circus cyaneus</i>	Marsh hawk	P		X	
	<i>Aquila chrysaetos</i>	Golden eagle	P		X	
	<i>Haliaeetus leucorhynchus</i>	Bald eagle	P		X	
	<i>Falco sparverius</i>	American kestrel		X		
Falconidae	<i>Buteo borealis</i>	Wild turkey		X		
Phasianidae	<i>Colinus virginianus</i>	Bobwhite		X		
Ardeidae	<i>Ardea herodias</i>	Great egret		X		
	<i>Ardea herodias</i>	Cattle egret		X		
	<i>Ardea herodias</i>	Great blue heron		X		
	<i>Ardea herodias</i>	Green heron		X		
	<i>Ardea herodias</i>	Little blue heron		X		
	<i>Ardea herodias</i>	Black-crowned night heron		X		
	<i>Ardea herodias</i>	Yellow-crowned night heron		X		
	<i>Ardea herodias</i>	Least bittern		X		
	<i>Ardea herodias</i>	American bittern		X		
	<i>Ardea herodias</i>	Purple gallinule		X		
	<i>Ardea herodias</i>	Common gallinule		X		
	<i>Ardea herodias</i>			X		
	<i>Ardea herodias</i>			X		
	<i>Ardea herodias</i>			X		
	<i>Ardea herodias</i>			X		
Scolopacidae	<i>Spizella monticola</i>	Chipping sparrow		X		
	<i>Spizella monticola</i>	Chipping sparrow		X		

TABLE E-1

BIRDS KNOWN OR PRESUMED TO OCCUR IN THE GRAND BATOU AREA

Family Name	Scientific Name	Common Name	Presumed or Known	Occurrence in Red River Parish		
				Resident	Winter	Summer
Charadriidae	<i>Charadrius vociferus</i>	Killdeer		X		
Scelopacidae	<i>Phalaropus minor</i>	American woodcock		X		
Columbidae	<i>Columba palliaco</i>	Common snipe	P		X	
	<i>Columba livia</i>	Rock dove		X		
Coccyidae	<i>Coccyzus macroura</i>	Mourning dove		X		
	<i>Coccyzus americanus</i>	Yellow-billed cuckoo		X		
Oculidae	<i>Otocorys californiana</i>	Greater roadrunner		X		
Troglodytidae	<i>Tyrus alba</i>	Barn owl	P	X		
Strigidae	<i>Otus asio</i>	Common screech owl		X		
	<i>Bubo virginianus</i>	Great horned owl	P	X		
Caprimulgidae	<i>Strix varia</i>	Barn owl		X		
	<i>Caprimulgus carolinensis</i>	Whip-poor-will		X		
	<i>Caprimulgus vociferus</i>	Whip-poor-will	P			X
Apodidae	<i>Chordeiles minor</i>	Common nighthawk	P			X
Trochilidae	<i>Chondestes pelagicus</i>	Chimney swift		X		
Alcedinidae	<i>Archilochus colubris</i>	Ruby-throated hummingbird		X		
Picidae	<i>Meizoceryle alpeya</i>	Belted kingfisher		X		
	<i>Colaptes auratus</i>	Common flicker		X		
	<i>Myiophobus pileatus</i>	Pileated woodpecker		X		
	<i>Certhia carolinensis</i>	Red-bellied woodpecker		X		
	<i>Meizoceryle orthocephalus</i>	Red-headed woodpecker		X		
	<i>Sphyrapicus varius</i>	Yellow-bellied sapsucker		X		
	<i>Meizoceryle borealis</i>	Red-cockaded woodpecker	P	X		
	<i>Meizoceryle villosus</i>	Hairy woodpecker		X		
	<i>Meizoceryle pubescens</i>	Downy woodpecker		X		
Tyrannidae	<i>Amphispiza bilineata</i>	Scissor-tailed flycatcher	P			X
	<i>Tyrannus tyrannus</i>	Eastern kingbird		X		
	<i>Myiarchus cinerascens</i>	Great crested flycatcher		X		
	<i>Empidonax phoebe</i>	Eastern phoebe		X		
	<i>Empidonax traillii</i>	Willow flycatcher		X		
	<i>Empidonax virens</i>	Acadian flycatcher	P			X
	<i>Empidonax virens</i>	Eastern wood pewee		X		

TABLE 2-1
BIRDS KNOWN OR PRESUMED TO OCCUR IN THE GRAND BATOU AREA
CONT.

Family Name	Scientific Name	Common Name	Presumed or Known	Occurrence in Red River Parish	Summer
Alcedinidae	<i>Alcedo verticillata</i>	Bank swallow			X
	<i>Hirundo lunifrons</i>	Bank swallow	P		X
Corvidae	<i>Corvus corax</i>	Common crow			X
	<i>Corvus sinuatus</i>	Blue jay			X
Paridae	<i>Parus carolinensis</i>	Parula warbler	P		X
	<i>Parus bicolor</i>	Parula warbler	P		X
Sittidae	<i>Sitta carolinensis</i>	White-breasted nuthatch	P		X
	<i>Sitta pusilla</i>	Red-breasted nuthatch	P		X
Cathartidae	<i>Cathartes aura</i>	Brown-headed nuthatch	P		X
	<i>Cathartes aura</i>	Brown-headed nuthatch	P		X
Troglodytidae	<i>Troglodytes aedon</i>	Northern house wren	P		X
	<i>Troglodytes aedon</i>	Winter wren	P		X
Mniotiltidae	<i>Mniotiltus ludovicianus</i>	Bewick's wren	P		X
	<i>Mniotiltus ludovicianus</i>	Carolinian wren			X
Mniotiltidae	<i>Mniotiltus ludovicianus</i>	Marsh wren			X
	<i>Mniotiltus ludovicianus</i>	Northern mockingbird			X
Turdidae	<i>Turdus migratorius</i>	Gray catbird			X
	<i>Turdus migratorius</i>	Brown thrasher			X
Sylviidae	<i>Sylvia sialis</i>	American robin			X
	<i>Sylvia sialis</i>	Wood thrush			X
Sylviidae	<i>Sylvia sialis</i>	Hermit thrush			X
	<i>Sylvia sialis</i>	Eastern bluebird			X
Troglodytidae	<i>Troglodytes aedon</i>	Blue-gray gnatcatcher	P		X
	<i>Troglodytes aedon</i>	Golden-crowned kinglet			X
Troglodytidae	<i>Troglodytes aedon</i>	Red-crowned kinglet			X
	<i>Troglodytes aedon</i>	Water thrush			X
Troglodytidae	<i>Troglodytes aedon</i>	Cedar waxwing			X
	<i>Troglodytes aedon</i>	Least flycatcher			X
Troglodytidae	<i>Troglodytes aedon</i>	Least flycatcher			X
	<i>Troglodytes aedon</i>	European starling			X

TABLE 2-1
BIRDS KNOWN OR PRESUMED TO OCCUR IN THE GRAND BAYOU AREA

Family Name	Scientific Name	Common Name	Presumed or Known	Occurrence in Red River Parish		
				Resident	Winter	Summer
Vireonidae	<i>Vireo olivaceus</i>	Solitary vireo			X	
	<i>Vireo gilvus</i>	White-eyed vireo				X
	<i>Vireo huttoni</i>	Hutton's vireo				X
	<i>Vireo flavifrons</i>	Yellow-throated vireo	P			X
	<i>Vireo olivaceus</i>	Red-eyed vireo				X
	<i>Vireo gilvus</i>	Warbling vireo	P			X
	<i>Amelospiza carolinensis</i>	Black-and-white warbler				X
	<i>Protonotaria citrea</i>	Protonotary warbler				X
	<i>Limothlypis swainsonii</i>	Swainson's warbler	P			X
	<i>Hammonia bohemii</i>	Bachman's warbler	P			X
Parulidae	<i>Parula americana</i>	Blue-winged warbler	P			X
	<i>Parula americana</i>	Orange-crowned warbler	P			X
	<i>Parula americana</i>	Northern parula warbler	P			X
	<i>Parula americana</i>	Yellow warbler				X
	<i>Parula americana</i>	Yellow-rumped warbler				X
	<i>Parula americana</i>	Carolina warbler	P			X
	<i>Parula americana</i>	Yellow-throated warbler				X
	<i>Parula americana</i>	Pine warbler				X
	<i>Parula americana</i>	Ovenbird	P			X
	<i>Parula americana</i>	Louisiana waterthrush	P			X
	<i>Parula americana</i>	Common yellowthroat	P			X
	<i>Parula americana</i>	Kentucky warbler	P			X
	<i>Parula americana</i>	Yellow-breasted chat				X
	<i>Parula americana</i>	Wooded warbler				X
	<i>Parula americana</i>	American redstart				X
	<i>Parula americana</i>	House sparrow				X
	<i>Parula americana</i>	Eastern meadowlark				X
	<i>Parula americana</i>	Red-winged blackbird				X
	<i>Parula americana</i>	Belted blackbird				X
	<i>Parula americana</i>	Brewer's blackbird				X
Vireonidae	<i>Vireo gilvus</i>	Common grackle				X
	<i>Vireo gilvus</i>	Brown-headed cowbird				X
	<i>Vireo gilvus</i>	Orchard oriole				X
	<i>Vireo gilvus</i>	Northern Oriole				X
	<i>Vireo gilvus</i>	Northern Oriole				X

TABLE E-1
BIRDS KNOWN OR PRESUMED TO OCCUR IN THE GRAND BATON AREA
CONT.

Family Name	Scientific Name	Common Name	Presumed or Known	Occurrence in Red River Parish Resident	Winter	Summer
Thraupidae	<i>Piranga rubra</i>	Southern tanager				X
Fringillidae	<i>Cardinalis cardinalis</i>	Northern cardinal		X		X
	<i>Guiraca caerulea</i>	Blue grosbeak				X
	<i>Passerina cyanea</i>	Indigo bunting				X
	<i>Passerina ciris</i>	Painted bunting		X ⁺		X
	<i>Carpodacus purpureus</i>	Purple finch	P			
	<i>Spinus tristis</i>	American goldfinch			X	
	<i>Spiza americana</i>	Dickcissel	P	X ⁺		X
	<i>Pipilo erythrophthalmus</i>	Rufous-sided towhee		X		
	<i>Passerculus sandwichensis</i>	Savannah sparrow	P			
	<i>Ammodramus saviannus</i>	Grasshopper sparrow	P		X	
	<i>Ammodramus henslowii</i>	Henslow's sparrow	P		X	
	<i>Ammodramus leconteii</i>	Le Conte's sparrow	P		X	
	<i>Pooecetes gramineus</i>	Vesper sparrow	P		X	
	<i>Chondestes grammacus</i>	Lark sparrow	P			X
	<i>Junco hyemalis</i>	Dark-eyed junco				
	<i>Amphispiza aestivalis</i>	Bachman's sparrow		X		
	<i>Spizella passerina</i>	Chipping sparrow	P	X		
	<i>Spizella pusilla</i>	Field sparrow		X		
	<i>Zonotrichia leucophrys</i>	White-crowned sparrow	P			
	<i>Zonotrichia albicollis</i>	White-throated sparrow			X	
	<i>Passerella iliaca</i>	Fox sparrow	P		X	
	<i>Melospiza lincolni</i>	Lincoln's sparrow	P		X	
	<i>Melospiza georgiana</i>	Swamp sparrow			X	
	<i>Melospiza melodia</i>	Song sparrow	P		X	

¹Anticipated species from Louisiana Birds, George H. Lowery, Jr., 1974.
Louisiana State University Press, Baton Rouge, Louisiana.

²Were not recorded in field surveys.

³Threatened or endangered species.

⁴Species may set up residence in the area, but more probable in season mated.

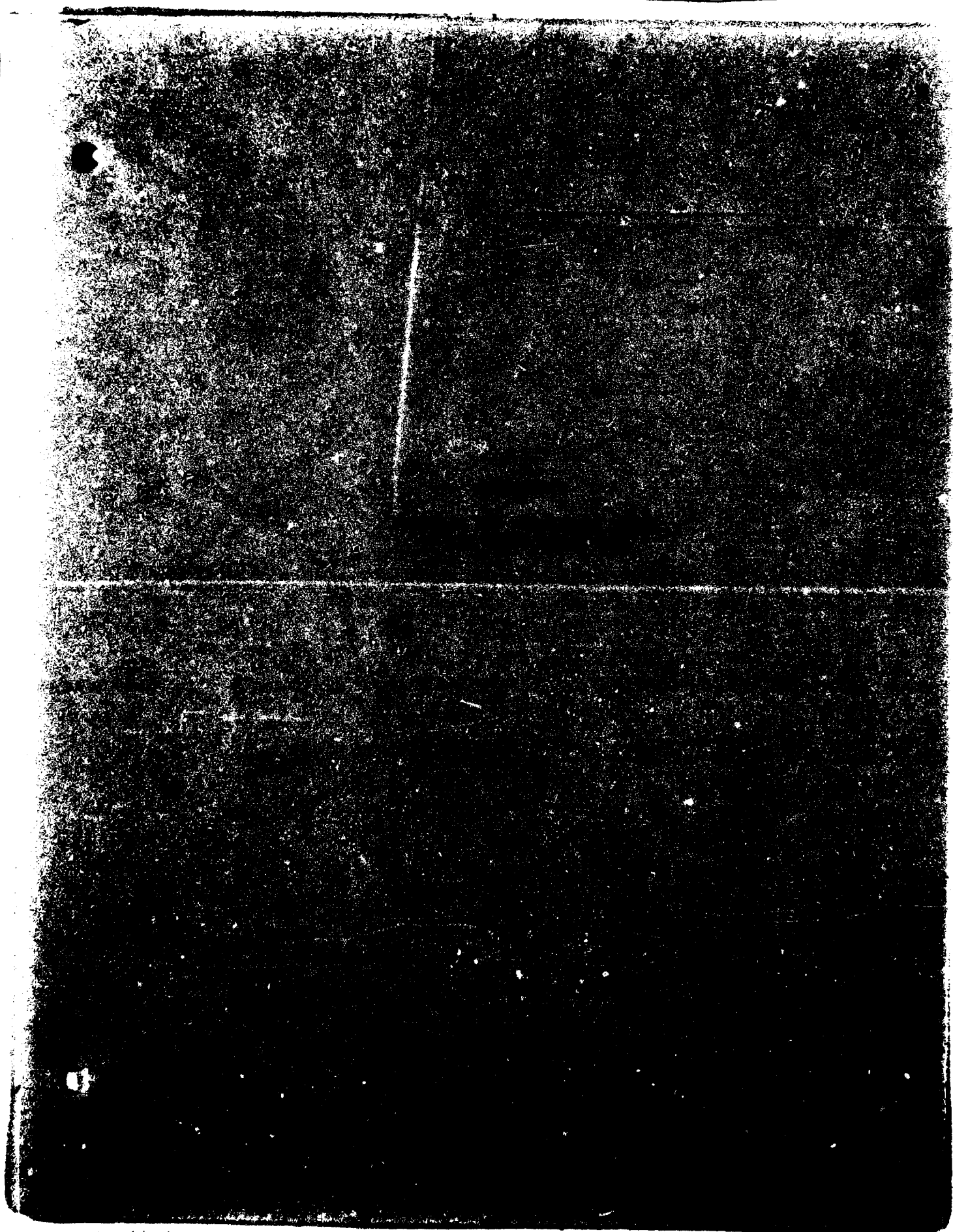


TABLE F-1

REPTILES AND AMPHIBIANS KNOWN
IN THE GRAND BAYOU AREA

Family Name	Scientific Name	Common Name	Abundance
Chelydridae	<i>Chelydra serpentina</i>	Common snapping turtle	C
	<i>Macroclemys temminicki</i>	Alligator snapping turtle	C
Kinosternidae	<i>Kinosternon subrubrum hipocrepis</i>	Mississippi mud turtle	A
	<i>Sternotherus carinatus</i>	Razor-backed musk turtle	V
	<i>Sternotherus odoratus</i>	Stinkpot	A
Emydidae	<i>Chrysemys concinna hieroglyphica</i>	Slider	C
	<i>Chrysemys floridana hoyi</i>	Missouri slider	C
	* <i>Chrysemys picta dorsalis</i>	Southern painted turtle	C
	<i>Chrysemys scripta elegans</i>	Red-eared turtle	A
	* <i>Deirochelys reticularia</i>	Chicken turtle	C
	<i>Gratemys kohni</i>	Mississippi map turtle	C
	<i>Gratemys pseudographica ouachitensis</i>	Ouachita map turtle	U
	<i>Terrapene carolina triunguis</i>	Three-toed box turtle	C
Trionychidae	* <i>Trionyx muticus</i>	Smooth softshell turtle	U
	* <i>Trionyx spiniferus pallidus</i>	Pallid spiny softshell	U
Iguanidae	<i>Anolis c. carolinensis</i>	Green anole	C
	<i>Sceloporus undulatus hyacinthinus</i>	Northern fence lizard	A
Telidae	<i>Cnemidophorus sexlineatus</i>	Six-lined racerunner	U
Scincidae	* <i>Eumeces anthracinus</i>	Southern coal skink	U
	<i>Eumeces fasciatus</i>	Five-lined skink	A
	<i>Eumeces laterale</i>	Ground skink	A
	<i>Eumeces laticeps</i>	Broad-headed skink	C
	<i>Eumeces septentrionalis obtusirostris</i>	Southern prairie skink	R
Anguidae	<i>Ophisaurus a. attenuatus</i>	Western slender glass lizard	U
Coluberidae	* <i>Cemophora coccinea</i>	Northern scarlet snake	R
	<i>Coluber constrictor anthicus</i>	Buttermilk snake	C
	<i>Diadophis punctatus</i>	Mississippi ringneck snake	U
	* <i>Elaphe guttata</i>	Corn snake	U
	<i>Elaphe obsoleta lindheimeri</i>	Texas rat snake	C
	<i>Elaphe o. obsoleta</i>	Black rat snake	V
	<i>Farancia abacura reinwardti</i>	Western mud snake	C
	<i>Heterodon platyrhinos</i>	Eastern hognose snake	C
	<i>Lampropeltis c. calligaster</i>	Prairie kingsnake	U
	<i>Lampropeltis getulus holbrooki</i>	Speckled kingsnake	C
	<i>Lampropeltis triangulum amaura</i>	Louisiana milk snake	U
	<i>Masticophis f. flagellum</i>	Eastern coachwhip	U
	<i>Natrix c. cyclopion</i>	Green water snake	C
	<i>Natrix erythrogaster flavigaster</i>	Yellow-bellied water snake	V
	<i>Natrix fasciata confluens</i>	Broad-banded water snake	V
	<i>Natrix r. rhombifera</i>	Diamond-backed water snake	V
	<i>Ophedryx aestivus</i>	Rough green snake	C

TABLE F-1, REPTILES AND AMPHIBIANS, CONT.

Family Name	Scientific Name	Common Name	Abundance
Coluberidae (Cont.)	* <i>Pituophus melanoleucus ruthveni</i>	Louisiana pine snake	R
	<i>Regina grahami</i>	Graham's water snake	C
	<i>Regina rigida</i>	Glossy water snake	U
	<i>Storeria dekayi wrightorum</i>	Midland brown snake	V
	* <i>Storeria occipitomaculata</i>	Red-bellied snake	U
	* <i>Tantilla gracilis</i>	Flat-headed snake	U
	<i>Thamnophis p. proximus</i>	Western ribbon snake	A
	<i>Thamnophis s. sirtalis</i>	Eastern garter snake	U
	<i>Virginia striatula</i>	Rough earth snake	C
	* <i>Virginia valeriae elegans</i>	Western smooth earth snake	U
Elapidae	<i>Micrurus fulvius tenere</i>	Texas coral snake	U
Viperidae	<i>Agkistrodon c. contortrix</i>	Southern copperhead	C
	<i>Agkistrodon piscivorus leucostoma</i>	Western cottonmouth	V
	<i>Crotalus horridus atricaudatus</i>	Canebrake rattlesnake	U
	* <i>Sistrurus miliarius streckeri</i>	Western pigmy rattlesnake	U
Sirenidae	<i>Siren intermedia nettingi</i>	Western lesser siren	C
Amphiumidae	<i>Amphiuma tridactylum</i>	Three-toed amphiuma	C
Ambystomatidae	<i>Ambystoma maculatum</i>	Spotted salamander	U
	<i>Ambystoma opacum</i>	Marbled salamander	C
	<i>Ambystoma talpoideum</i>	Mole salamander	U
	<i>Ambystoma texanum</i>	Small-mouthed salamander	C
Salamandridae	<i>Notophthalmus viridescens louisianensis</i>	Central newt	V
Plethodontidae	<i>Desmognathus fuscus brimleyorum</i>	Central dusky salamander	R
	* <i>Eurycea quadridigitata</i>	Dwarf salamander	R
Pelobatidae	<i>Scaphiopus holbrookii</i>	Hurter's spadefoot	U
Bufonidae	<i>Bufo woodhousei fowleri</i>	Fowler's toad	A
	<i>Bufo w. woodhousei</i>	Woodhouse's toad	V
Hylidae	<i>Acris c. crepitans</i>	Northern cricket frog	A
	<i>Hyla cinerea</i>	Green treefrog	V
	<i>Hyla crucifer</i>	Northern spring peeper	V
	<i>Hyla squirrela</i>	Squirrel treefrog	C
	<i>Hyla versicolor</i>	Gray treefrog	C
	<i>Pseudacris triseriata feriarum</i>	Upland chorus frog	V
Microhylidae	<i>Gastrophryne carolinensis</i>	Eastern narrow-mouthed toad	C
Ranidae	* <i>Rana areolata</i>	Southern crawfish frog	C
	<i>Rana catesbeiana</i>	Bullfrog	V
	<i>Rana c. clamitans</i>	Bronze frog	V
	<i>Rana palustris</i>	Pickeral frog	U
	<i>Rana utricularia</i>	Southern Leopard frog	V

Abundance Classes: A= Abundant; V= Very Common; C= Common; U= Uncommon;
R= Rare.

*Anticipated species from Feasibility and Development Plan, Ozarks Regional Commission.

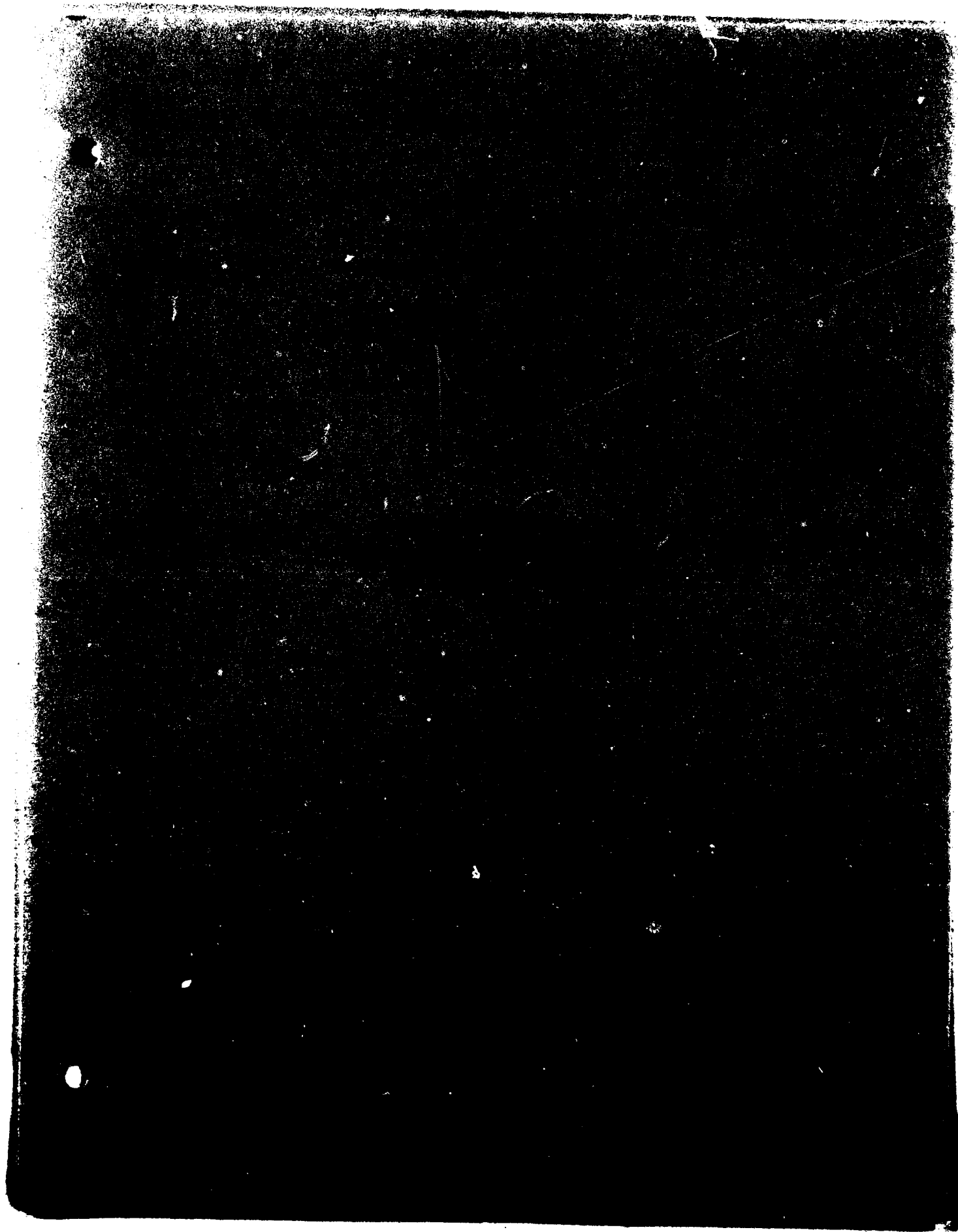


TABLE G-1

FISHES KNOWN OR ANTICIPATED TO OCCUR
IN THE GRAND BAYOU DRAINAGE AREA

Family Name	Scientific Name	Common Name	Abundance**
Petromyzontidae	* <i>Ichthyomyzon</i>	Chestnut Lamprey	U
Amiidae	<i>Amia calva</i>	Bowfin	C
Lepisosteidae	<i>Lepisosteus oculatus</i>	Spotted Gar	C
	<i>Lepisosteus osseus</i>	Longnose Gar	C
	* <i>Lepisosteus platostomus</i>	Shortnose Gar	C
	* <i>Lepisosteus spatula</i>	Alligator Gar	C
Hiodontidae	* <i>Hiodon alosoides</i>	Goldeneye	U
	* <i>Hiodon tergisus</i>	Mooneye	U
Clupeidae	* <i>Alosa chrysochloris</i>	Skipjack Herring	U
	<i>Dorosoma cepedianum</i>	Gizzard Shad	A
	<i>Dorosoma petenense</i>	Threadfin Shad	A
Esocidae	<i>Esox americanus vermiculatus</i>	Grass Pickerel	A
	<i>Esox niger</i>	Chain Pickerel	A
Catostomidae	<i>Carpionodes carpio</i>	River Carpsucker	C
	<i>Erimyzon oblongus</i>	Creek Chubsucker	V
	<i>Erimyzon sucetta</i>	Lake Chubsucker	V
	<i>Ictiobus bubalus</i>	Smallmouth Buffalo	C
	* <i>Ictiobus cyprinellus</i>	Bigmouth Buffalo	U
	* <i>Ictiobus niger</i>	Black Buffalo	U
	<i>Minytrema melanops</i>	Spotted Sucker	C
	<i>Moxostoma poecilurum</i>	Blacktail Redhorse	C
Cyprinidae	<i>Cyprinus carpio</i>	European Carp	C
	* <i>Hybognathus hayi</i>	Cypress Minnow	U
	<i>Hybognathus nuchalis</i>	Silvery Minnow	C
	<i>Notemigonus chrysoleucas</i>	Golden Shiner	V
	<i>Notropis atherinoides</i>	Emerald Shiner	V
	<i>Notropis atrocaudalis</i>	Blackspot Shiner	U
	<i>Notropis chalybaeus</i>	Ironcolor Shiner	U
	<i>Notropis chrysocephalus</i>	Southern Striped	C
	<i>isolepis</i>	Shiner	
	<i>Notropis fumeus</i>	Ribbon Shiner	U
	<i>Notropis lutrensis</i>	Red Shiner	C
	* <i>Notropis maculatus</i>	Taillight Shiner	U
	<i>Notropis texanus</i>	Weed Shiner	V
	<i>Notropis umbratilis</i>	Redfin Shiner	A
	<i>Notropis venustus</i>	Blacktail Shiner	A
	<i>Notropis volucellus</i>	Mimic Shiner	C
	<i>Notropis emiliae</i>	Pugnose Minnow	C
	<i>Pimephales vigilax</i>	Bullhead Minnow	A
	<i>Semotilus atromaculatus</i>	Creek Chub	U

TABLE G-1, FISHES, CONT.

Family Name	Scientific Name	Common Name	Abundance**
Ictaluridae	<i>Ictalurus melas</i>	Black Bullhead	C
	<i>Ictalurus natalis</i>	Yellow Bullhead	A
	<i>Ictalurus punctatus</i>	Channel Catfish	A
	<i>Noturus gyrinus</i>	Tadpole Madtom	U
	<i>Noturus nocturnus</i>	Freckled Madtom	U
	<i>Noturus phaeus</i>	Brown Madtom	R
	<i>Pylodictis olivaris</i>	Flathead Catfish	C
Anguillidae	<i>Anguilla rostrata</i>	American Eel	U
Cyprinodontidae	<i>Fundulus chrysotus</i>	Golden Topminnow	V
	<i>Fundulus notti</i>	Starhead Topminnow	C
	<i>Fundulus notatus</i>	Blackstripe Topminnow	U
	<i>Fundulus olivaceus</i>	Blackspotted Topminnow	A
Poeciliidae	<i>Gambusia affinis</i>	Mosquitofish	A
Aphredoderidae	<i>Aphredoderus sayanus</i>	Pirateperch	V
Percichthyidae	* <i>Morone chrysops</i>	White Bass	U
	* <i>Morone mississippiensis</i>	Yellow Bass	C
Centrarchidae	<i>Centrarchus macropterus</i>	Flier	V
	<i>Elassoma zonatum</i>	Banded Pigmy Sunfish	C
	<i>Lepomis cyanellus</i>	Green Sunfish	A
	<i>Lepomis gulosus</i>	Warmouth	A
	<i>Lepomis humilis</i>	Orangespotted Sunfish	U
	<i>Lepomis macrochirus</i>	Bluegill	A
	<i>Lepomis marginatus</i>	Dollar Sunfish	U
	<i>Lepomis megalotis</i>	Longear Sunfish	A
	<i>Lepomis microlophus</i>	Redear Sunfish	A
	<i>Lepomis punctatus</i>	Spotted Sunfish	U
	<i>Lepomis symmetricus</i>	Bantam Sunfish	C
	<i>Micropterus punctulatus</i>	Spotted Bass	A
	<i>Micropterus salmoides</i>	Largemouth Bass	A
	<i>Pomoxis annularis</i>	White Crappie	C
	<i>Pomoxis nigromaculatus</i>	Black Crappie	V
Percidae	* <i>Ammocrypta vivax</i>	Scaly Sand Darter	U
	<i>Etheostoma chlorosomum</i>	Bluntnose Darter	C
	<i>Etheostoma fusiforme</i>	Swamp Darter	U
	<i>Etheostoma gracile</i>	Slough Darter	C
	<i>Etheostoma histrio</i>	Harlequin Darter	R
	<i>Etheostoma parvipinne</i>	Goldstripe Darter	R
	<i>Etheostoma proeliare</i>	Cypress Darter	C
	<i>Etheostoma whipplei</i>	Redfin Darter	U
	<i>Percina caprodes</i>	Logperch	U
	<i>Percina maculata</i>	Blackside Darter	U
	<i>Percina sciera</i>	Dusky Darter	U

TABLE G-1, FISHES, CONT.

Family Name	Scientific Name	Common Name	Abundance**
Sciaenidae	<i>Aplodinotus grunniens</i>	Freshwater Drum	V
Atherinidae	<i>Labidesthes sicculus</i>	Brook Silverside	A

* Anticipated species.

** Abundance classes: A= Abundant; V= Very common; C= Common; U= Uncommon;
R= Rare

SOURCE: Feasibility and Development Plan, Grand Bayou Reservoir, Red
River Parish, Louisiana, Ozarks Regional Commission, March, 1976.



APPENDIX H

PERMIT REQUIREMENTS

The Federal Register of September 5, 1975 (Vol. 40, No. 173) discusses the discharge of dredged or fill material and the requirements for a Section 404 (b) permit. The Grand Bayou Reservoir requires a 404(b) permit primarily because of excavation and fill associated with the earthen dam.

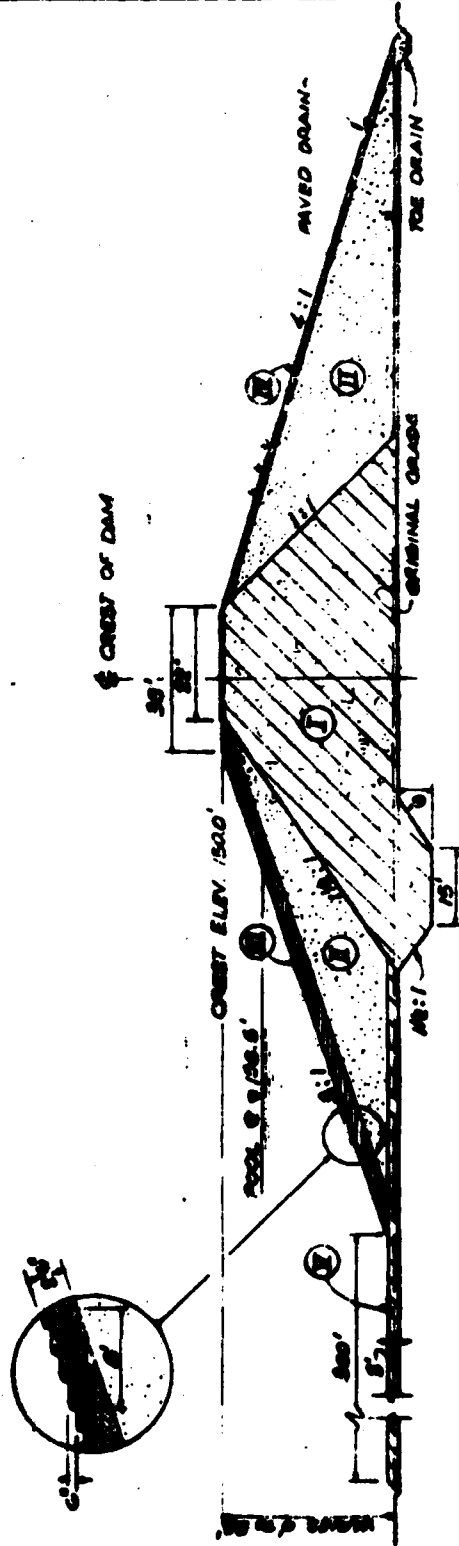
(1) Dam Construction- Plate H-1 reproduced from the Grand Bayou Reservoir Feasibility and Development Plan, shows a cross section of the proposed dam along with the types of soils required for the fill material. There are two types of "select" materials required: a sand-silt-clay impervious core and a select clay to be used as an impervious seepage blanket. Plate H-2 presents an analysis of soil samples taken near the dam site. From this exhibit it can be seen that several types of soils are available including soils with plasticity indexes of 15-20 which could be used for the impervious layers. The remainder of the common fill can be taken from the reservoir bottom.

Plate H-3 presents a chemical analysis of the soil samples taken near the dam site. The chemical interaction between the water and soil is not expected to create any problems. Note that Section 230.4-1(b)(1), p. 41294 of the aforementioned Federal Register states that, "the evaluation of chemical-biological interactive effects of dredge or fill material may be excluded if "the material proposed for discharge is substantially the same as the substrate at the proposed disposal site . . .". This condition applies to the proposed Grand Bayou Reservoir project.

ZONAL DESCRIPTION

- ZONE I - SELECT SAND, SILT CLAY; IMPERVIOUS CORE
- ZONE II - COMMON FILL; PERVIOUS EMBANKMENT
- ZONE III - LAYERED SOIL CEMENT; SLOPE PROTECTION
- ZONE IV - SALVAGED TOP SOIL; SLOPE PROTECTION
- ZONE V - SELECT CLAY; IMPERVIOUS SEEPAGE BLANKET

LAYERED SOIL-CEMENT
SLOPE PROTECTION



TYPICAL DAM CROSS-SECTION

NO. SCALE

ENVIRONMENTAL STATEMENT
PUBLIC WATER SUPPLY
Red River Parish
Louisiana

DAM DETAILS

ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

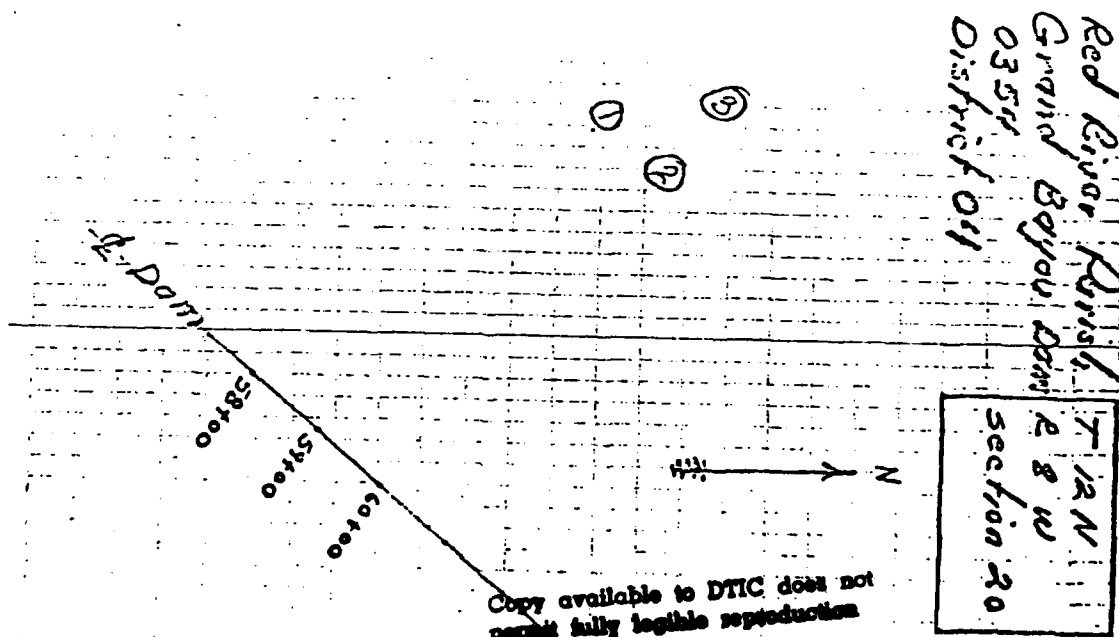
FILE NO.

PLATE H-1

Plate H-2

Hole 1	Hole 2	Hole 3	Sample	Description	PI
1	1	1	S-001	A-4(3) Sandy Loam	PI 0
2	7	12	S-002	A-4(4) Clay Loam	LL 26 PI 9
3	8	13	S-003	A-4(2) Sandy Loam	PI 0
4	9	14	S-004	A-4(3) Sandy Loam	PI 0
5	10	15	S-005	A-6(6) Clay Loam	LL 27 PI 12
6	11	16	S-006	A-6(7) Clay Loam	LL 27 PI 12
			S-007	A-6(5) Clay Loam	LL 28 PI 11
			* S-008	A-6(8) Clay Loam	LL 33 PI 16
			* S-009	A-6(9) Clay Loam	LL 34 PI 15
			S-010	A-6(8) Clay Loam	LL 28 PI 11
			S-011	A-4(8) Silty Loam	LL 26 PI 7
			S-012	A-6(4) Clay Loam	LL 26 PI 11
			* S-013	A-6(11) Lt silty clay	LL 39 PI 20
			* S-014	A-6(9) Lt silty clay	LL 34 PI 16
			S-015	A-6(6) Clay Loam	LL 28 PI 13
			* S-016	A-6(12) Silty clay	LL 39 PI 20

* samples 8, 9, 13, 14, 16 have a PI of 15 or more





575 GSR:RC - BATON ROUGE LA 70804

Rec'd 9/21/80

*George Cramer
DSTD 626
925-6763*

Plate H-3

Leachate Analyses on Soil Samples

for

Department of Transportation
Materials Laboratory
P.O. Box 44205
Capitol Station
Baton Rouge, LA. 70804

May 15, 1980

H-5

80-276

Department of Transportation
Materials Laboratory
May 15, 1980

Four soil samples were received on May 2, 1980 and analyzed for Fluoride, Metals, Nitrate, Organic Phosphorus and Pesticides. The samples were extracted according to the procedure listed in the Federal Register Volume 43, Number 243, on December 18, 1978. Hundred grams of sample was extracted into 2 liters of deionized water and pH was adjusted according to the procedure described by the Environmental Protection Agency. The water extracts were analyzed according to the Environmental Protection Agency approved methods listed in the Federal Register Volume 44, Number 244, on December 18, 1979. Results of the analyses are reported in Tables I, II, and III.

TABLE I

Sample	Arsenic	Barium	Cadmium	Chromium	Mercury
	-----mg/L of Extract-----				
1	<.005	<0.2	<.005	<.05	<.0005
2	<.005	<0.2	<.005	<.05	<.0005
3	<.005	<0.2	<.005	<.05	<.0005
4	<.005	<0.2	<.005	<.05	<.0005
Quality Assurance	.040	1.0	.025	.25	.002
Analysis	.041	1.0	.023	.23	.002

Sample	Lead	Selenium	Silver	Fluoride	Nitrate	Organic Phosphorus
	-----mg/L of Extract-----					
1	<.005	<.005	<.01	<0.1	<1	<.1
2	<.005	<.005	<.01	<0.1	<1	<.1
3	.006	<.005	<.01	<0.1	<1	<.1
4	<.005	<.005	<.01	<0.1	<1	<.1
Quality Assurance	.025	.052	.25	1.0	1.0	.25
Analysis	.024	.043	.26	1.0	1.1	.25

AD-A135 273

PUBLIC WATER SUPPLY RED RIVER PARISH LOUISIANA(U)
SUNBELT RESEARCH CORP BATON ROUGE LA C W DECKER MAR 81

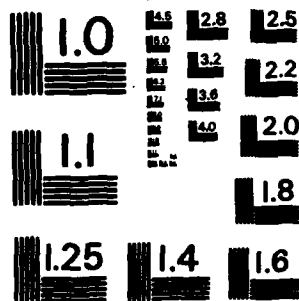
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



1315 GRIFFIN RD • BATON ROUGE, LA 70806

Department of Transportation
Materials Laboratory
May 15, 1980
Continued.....

TABLE II

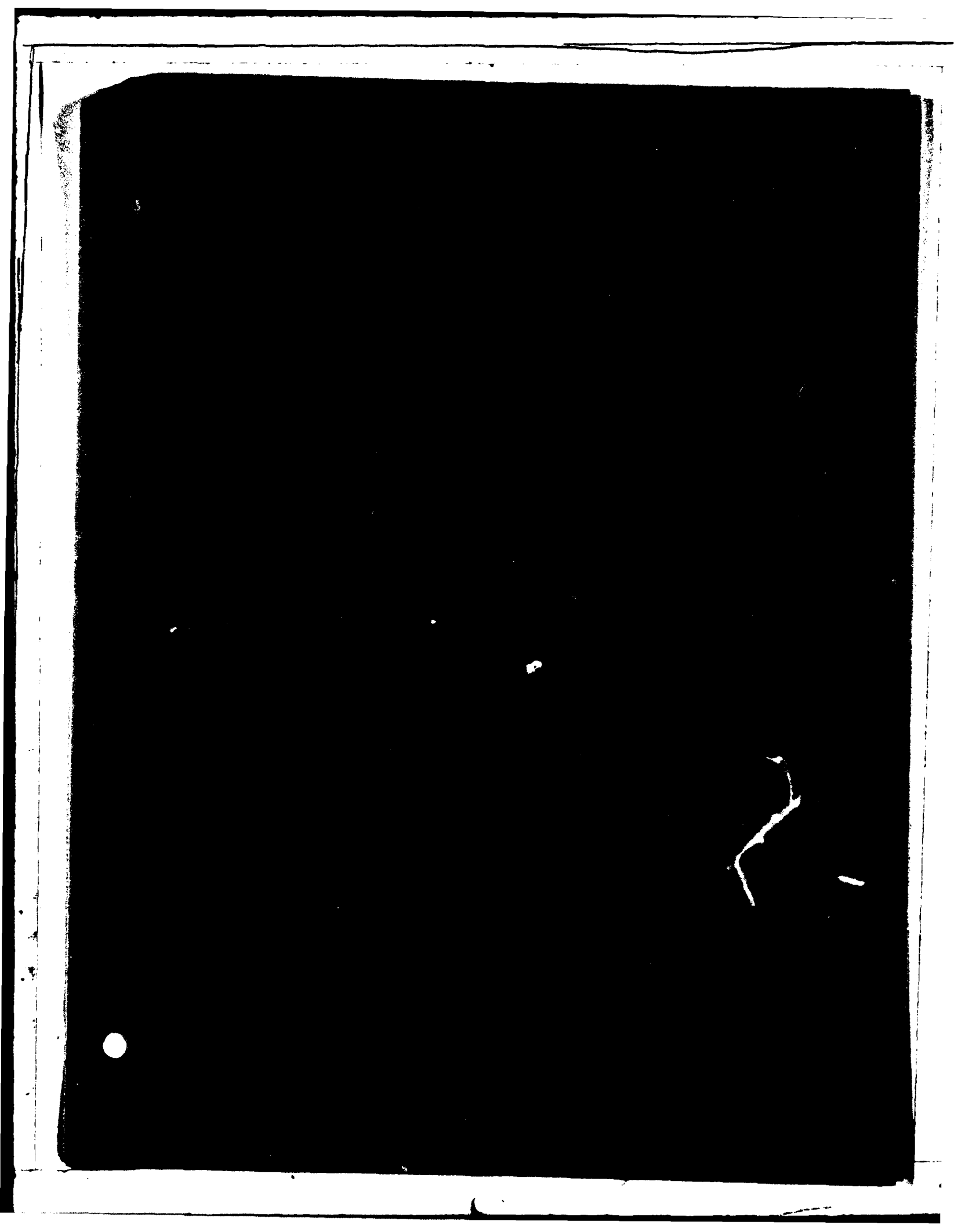
Sample	Endrin	Lindane	Methoxychlor	Toxaphene	2,4-D	2,4,5-TP
	-----µg/L of Extract-----					
1	<.001	<.0001	<.001	<.001	<.001	2.7
2	<.001	0.017	<.001	<.001	<.001	1.4
3	<.001	0.0003	<.001	<.001	<.001	1.7
4	<.001	<.0001	<.001	<.001	<.001	1.5

TABLE III

Sample	Total Chlorinated Hydrocarbons *
	-----µg/L of Extract-----
1	8.4
2	5.4
3	5.2
4	5.6

*Total Chlorinated Hydrocarbons were calculated in reference to Aldrin Standard.

Sham L. Sachdev
Sham L. Sachdev, Ph.D., C.I.H.
Executive Vice President



WITHDRAWAL OF WATER FROM THE RED RIVER

The Red River flows immediately adjacent to the Town of Coushatta and provides a readily available water supply source with adequate quantities. The quality of water from the Red River is not particularly good and thus requires considerable treatment before it can be used for potable purposes.

The most economical location for a raw water intake would be near the town. While investigating upstream discharges, however, it was determined that International Paper Company (IPC) is presently constructing a containerboard mill which is located near Mansfield, Louisiana, and which will discharge into the Red River at a point approximately 13 river miles upstream of Coushatta. The expected mill effluent characteristics are given in the Environmental Assessment prepared by Engineering-Science-Austin, Texas. (Refer to Table I-1).

Placing the intake for a public water supply a short distance downstream from a major waste discharge is undesirable. Several factors which require consideration are presented below.

- 1) As a general rule, surface waters such as the Red River are not preferred sources of public water supply (due to the variety and nature of organic and inorganic loads) unless other alternatives are not readily available.
- 2) The quality of the Red River varies substantially, even over relatively short periods of time. As an example, data taken from the Red River at Coushatta indicates fecal coliform levels ranging from 62 to 38,000 (number/100 ml), with a mean value of 4964 in 87 tests. Other parameters exhibit similar ranges of fluctuation. The variable quality characteristic complicates the treatment process. A related problem is that an upset in the process at the containerboard complex could cause a substantial change in the effluent quality. This would create a change in the chemical composition of the water taken in at the intake and could render the treatment process incapable of providing adequately treated drinking water.
- 3) The dissolved oxygen deficit calculation done in the Environmental Assessment indicates that the IPC effluent is projected to lower the dissolved oxygen (D.O.) concentration of the Red River from approximately 6.63 mg/l at the point of discharge to about 6.0 mg/l at a point about 8.5 miles downstream of the discharge. (The minimum

TABLE I-1

**ESTIMATED RAW WASTEWATER AND
ANTICIPATED TREATED EFFLUENT CHARACTERISTICS
FOR THE IPC-1 MILL**

PARAMETER	Concentration mg/l unless specified	
	RAW WASTE	TREATED EFFLUENT
Calcium (Ca)	31	Avg. yearly 30 Avg. summer 36
Sodium (Na)	476	Avg. yearly 430 Avg. summer 515
Potassium (K)	1.8	2.0
Sulfates (SO ₄)	76	Avg. 76 Max. 110
Chlorides	39	Avg. 39 Max. 60
Nitrate (NO ₃)	0.22	Negligible
Dissolved Solids	2,513	Avg. yearly 2,513 Max. 3,630
Hardness (as CaCO ₃)	92	Avg. 160 Max. 180
Sulfides	<10	<1
BOD	597	Avg. <45 Max. <89*
Color (units)	1,007	Avg. <290 Max. <436 *
Phenol	Unknown	Negligible
Surfactants	Unknown	Negligible
Aluminum	1.7	<1.0
Total Solids	2,635	Avg. yearly 2,538 Max. 4,050
Total Suspended Solids	122	Avg. <102 Max. <205*
pH (units)	7.5-11.0	~ 7.0
Temperature		Ambient

NOTE: Unless specified all values are best estimates.

* Based upon EPA's development document for Effluent Limitation Guidelines and New Source Performance Standards, for unbleached kraft and semichemical pulp segments of the pulp, paper, and paperboard mills Point Source Category, of 9,000 gal/ton. These values are not intended to represent limitations for permitting of the discharge. See the application for the NPDES permit filed with this document.

acceptable stream D.O. is 5.0 mg/l.) The point of minimum D.O. concentration occurs near the location of the proposed Coushatta water intake. (See Plate I-1). This shows that water taken from this point in the river is undergoing active degeneration (critical point has not been reached yet) and that the decomposition of organic wastes is not complete. This factor tends to make the water treatment plant handle additional chemical (organic/inorganic) load which increases the treatment cost.

4) The IPC plant intends to utilize an overland flow method of land treatment for wastewater treatment. The land treatment process has a number of advantages and has been used successfully in municipal and industrial applications. The projected effluent characteristics for the IPC containerboard complex were modeled using the Campbell Soup Company facility in Paris, Texas. This facility has been operational for over 15 years and has provided reliable treatment. The wastes from a containerboard complex differs greatly from food processing wastes. The actual quality of the IPC effluent will not be known until the plant becomes operational. However, the effluent quality is expected to comply with NPDES requirements to be issued by EPA. Anticipated BOD and TSS removal is 95% and 85% respectively. This removal level is predicated on the "design" performance of the system. Actual performance is sometimes less effective.

Proper treatment of the wastewater depends to a large extent on the soil characteristics. Two soil parameters at the proposed IPC land treatment site, pH and nutrient supply, are not suitable for the land treatment process and require augmentation. The soil pH is slightly acidic (5.0) and requires lime treatment to bring it to a neutral level. Nitrogen and phosphorus may also be added to provide proper nutrients for vegetation growth. These requirements become a maintenance problem over the life of a facility and are often neglected.

5) The Red River is currently being made navigable by a program involving bank stabilization, channel straightening, and a series of locks and dams. Navigation on the river is certainly desirable from an economic standpoint but it does create the possibility of oil spills and other pollutants from the boats and barges using the river. Such an accident upstream of the proposed water intake could force the shutdown of the pumping station until the condition is alleviated.

6) It is not desirable to locate an intake structure of a public water supply downstream of an effluent discharge point. Irrespective of the assurances of a high quality effluent from the IPC plant, public health risks however small, cannot be taken if an alternative take-off point or source exists.

MODEL CONDITIONS:

$K_d = 1.30/\text{day}$

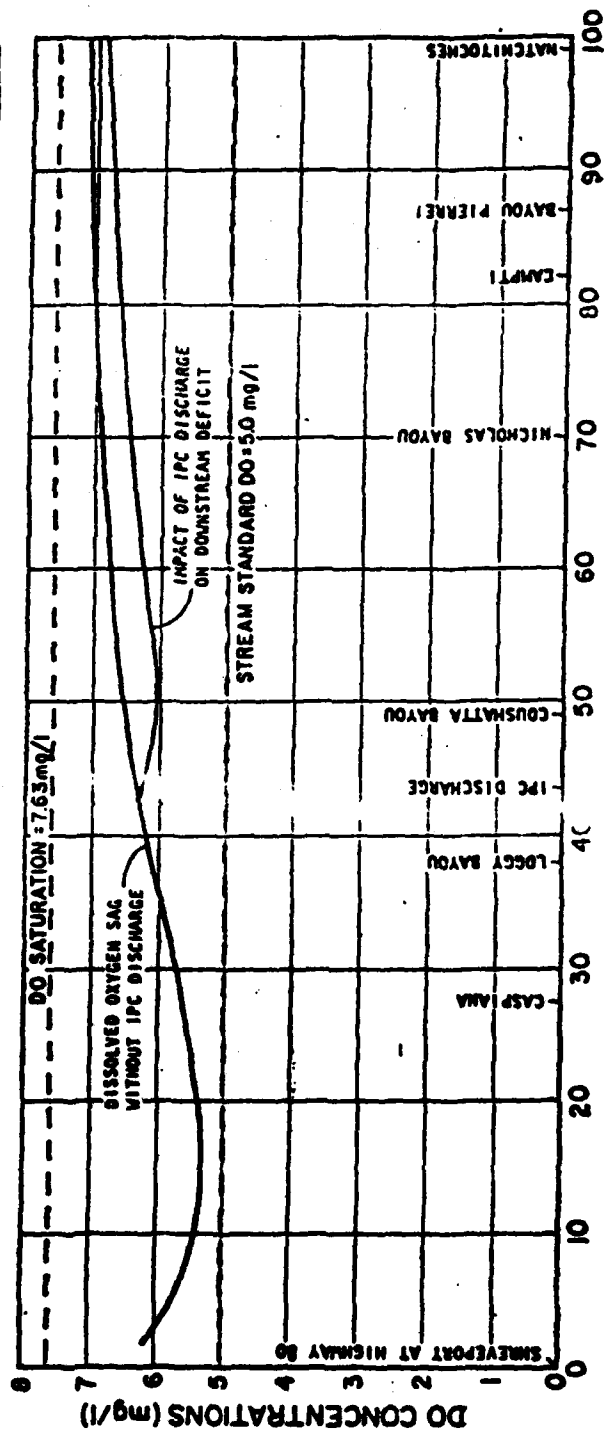
$K_r = 0.35/\text{day}$

TEMPERATURE = 30°C (SUMMER)

7-DAY 1-IN-10 YEAR LOW FLOW = 1,330 cfs

INITIAL DO = 6.63 mg/l AT MILE 0

*IPC LOADING EQUIVALENT NPS MAXIMUM DISCHARGE



ENVIRONMENTAL STATEMENT
PUBLIC WATER SUPPLY
Red River Parish
Louisiana

IMPACT OF IPB-I DISCHARGE
ON DISSOLVED OXYGEN DEFICIT
IN THE RED RIVER

U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

DATE FILE NO.

PLA-1-1

Public health considerations take precedence over other considerations.

7) The proposed water storage facility (100 days) should mitigate to a large extent, the possible upsets mentioned and will allow flexibility of operation for the treatment plant.

The preceding discussion enumerated several points which indicate that the raw water intake should not be located downstream of the IPC discharge. There exists a reasonable doubt regarding the quantity, quality, and consistency of the wastewater discharge. Since public health is at stake no assumptions or unnecessary risks should be made.

For the purpose of this preliminary design and for the reasons enumerated in paragraphs 1-7 above, the raw water intake will be located on the Red River north of the International Paper Company discharge point. Plate I-2 indicates the proposed intake location and pipeline alignment.

This alternative will involve an intake structure/pumping station located on the Red River, approximately 9.8 miles of transmission pipeline, a sedimentation/storage basin, treatment and distribution system. Each of these components will be briefly described below.

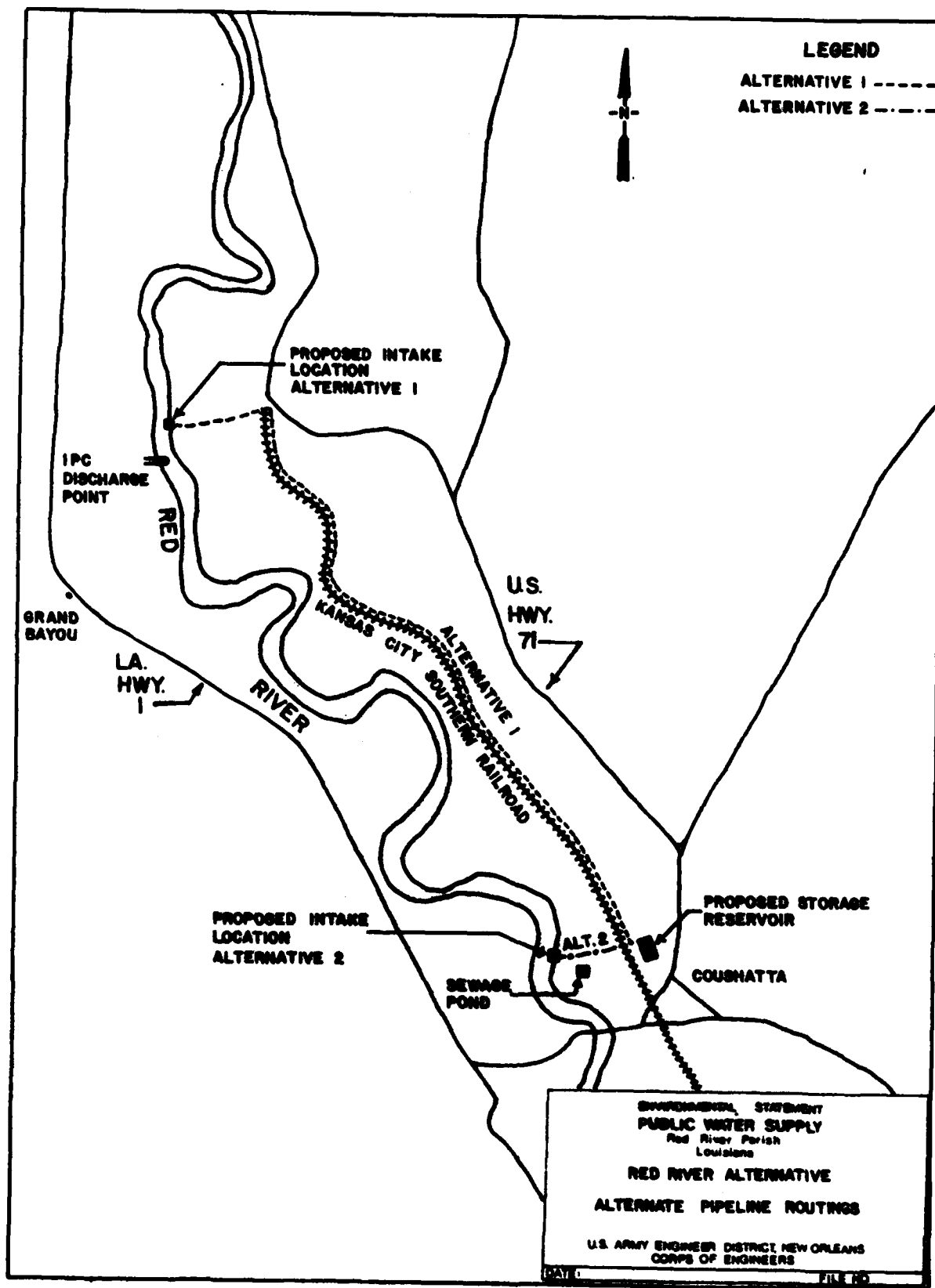
Intake Structure/Pumping Station - The intake structure must be located to operate within the range of stage elevations of the Red River. Suitable bar screens and trash racks are required. The structure must be designed to prevent interference with river traffic.

The pumping station must be capable of pumping an average flow of 5.57 MGD against a head of 85'. It is assumed for the purpose of this analysis that three equal capacity pumps (2 primary plus 1 spare) will be used.

Preliminary calculations are presented subsequently.

Transmission Pipeline - A 9.8 mile transmission pipeline is required to transport Red River water from the intake to a storage reservoir at Couthatta. The coefficient of pipeline roughness is taken as C-110. Normally, this would be somewhat low for a fresh water pipeline, however, it is felt that the composition of Red River water (high suspended solids, high iron content) justifies the use of a lower factor.

The pipeline alignment is shown paralleling the Kansas City Southern railroad right-of-way. The actual location may vary based on the availability of easements and the existence of natural and/or man-made obstacles.



Storage Basin - The highly variable quantity of the water in the Red River combined with the generally poor water quality suggests the necessity of a sedimentation/storage basin prior to the treatment process. A storage reservoir will allow sedimentation of suspended solids and will provide for natural attrition of pathogens present in the water. More than half of the pathogens in water will die within the first two days and 90 percent will die by the end of the week.

The relatively large size of the basin (100 day capacity) will also provide a great deal of flexibility of operation of the treatment plant during periods of drought, pollutant spills on the river, or any drastic changes of river quality caused by unexpected events. However, an early warning system may have to be built-in to shut down the intake promptly.

The required size of the storage reservoir can only be determined after a detailed analysis of the water characteristics and treatment requirements. Bossier City, Louisiana withdraws water from the Red River and stores it in a 2000 acre-foot (100 acres by 20 foot depth) basin. This is equivalent to approximately 100 days of usage at the average consumption. Using this same criteria for the sizing of the proposed storage reservoir at Coushatta the required volume becomes:

$$\text{Vol. Reg'd} = 5,600,000 \text{ gal/day} \times 100 \text{ days} \times \frac{1 \text{ ft}^3}{7.48} \text{ gal} \times 1/20' \text{ Depth}$$

$$\begin{aligned} \text{Vol. Reg'd} &= 3,723,262 \text{ ft}^3 \\ &= 85 \text{ acres} \end{aligned}$$

The reservoir will be located in the immediate vicinity of Coushatta for the purpose of this report. Although an alternative location would be near the proposed intake structure it is felt that this area would be remote and inconvenient for maintenance purposes.

Preliminary Calculation of Pumping Station Characteristics:

- Capacity, $Q = 5.57 \text{ mgd} = 3870 \text{ gpm}$
- Length of Force Main $L = 9.8 \text{ miles} = 51,744 \text{ Ft.}$
- Static Head = 43'
- Force Main diameter $D = 27''$
- Friction Losses (F.L.) at $c=110$ is 42' (from $F.L. = \frac{4.67}{D^{4.67}} \times \frac{Q^{1.85}}{(C)}$)
- Total Dynamic Head (TDH) = 43' + 42' = 85'
- Velocity (V) = 2.17 fps.

Using standard manufacturer's pump curves a preliminary selection of the required pumps has been made as follows:

Assume a three pump system (equal capacity, 2 primary, 1 spare

pump). Each pump should have a capacity of 1935 GPM @ 85' Head. Typical pump efficiency = 85%. Typical motor efficiency = 90%. Overall efficiency = .77 = 77%. Therefore, horsepower required for each pump =

$$\text{H.P.} = \frac{(1935 \text{ GPM}) (85')}{3960 (0.77)} \quad \text{from H.P.} = \frac{(\text{GPM}) (\text{TDH})}{3960 (\text{Eff.})}$$

H.P. = 54 - USE Standard 60 H.P. Motor.

Water Treatment Facility - A general description of the process units required to treat Red River water can be given but at this point a detailed design is not feasible. The major components and their primary functions are listed below.

Raw Water Storage Basin - Provides sedimentation and natural attrition of pathogens. The addition of Copper Sulfate will probably be required to prevent algae growth. Also acts as an equalization basin for water quantity and quality variations.

Prechlorination - Reduces fecal coliform concentration, tastes and odors, and chlorides.

Mixing, Coagulation, and Sedimentation - Effective for the removal of fecal coliform, turbidity, color, calcium carbonate, and iron.

Rapid Sand Filtration - Further reduction of items listed under Mixing, Coagulation, and Sedimentation.

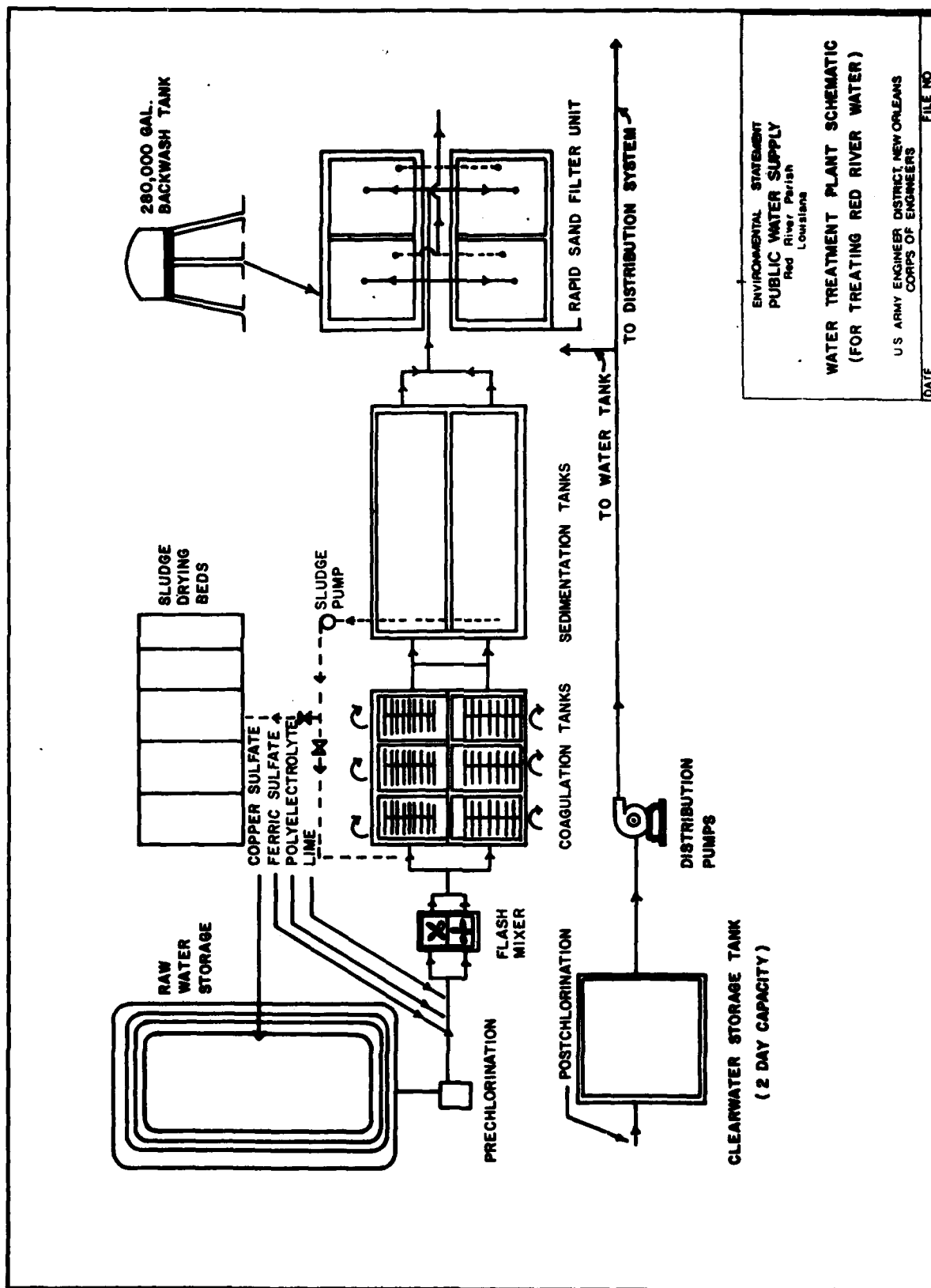
Chlorination - Final chlorination as required to provide a safe and potable water.

Treated water will be stored in a clear well prior to pumping into the distribution system.

Sludge Handling Facilities - A treatment plant capable of handling the projected design flows (5.6 MGD) will produce approximately 10,000 pounds per day of sludge (60,000 gpd at 2% concentration). Some method of sludge processing (dewatering and stabilization) and temporary storage (sand beds, sludge lagoons, etc.) will be required. Ultimate disposal facilities such as an approved landfill will also have to be provided.

Plate I-3 presents a flow schematic for the proposed water treatment.

Table I-2 gives an estimated cost of the project in terms of 1976 dollars.



ENVIRONMENTAL STATEMENT
PUBLIC WATER SUPPLY
Red River Parish
Louisiana

WATER TREATMENT PLANT SCHEMATIC
(FOR TREATING RED RIVER WATER)

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE _____ FILE NO. _____

PLATE I-3

Table I-3 presents a summary of the Grand Bayou Reservoir costs for comparison. All figures are taken from the Feasibility and Development Plan and are in terms of the 1976 dollars.

Table I-4 gives the present worth and estimated annual cost of operation and maintenance for the Red River Alternative and the Grand Bayou Reservoir Alternative.

Table I-5 presents a summary of project costs.

TABLE I-2

**RED RIVER WATER SUPPLY SYSTEM
COST ESTIMATES
(1976 \$)**

No.	ITEM	Qty.	Unit Cost	Total Cost
1	27 inch diameter R-C-P force main	51,744 L.F.	\$40/L.F.	\$2,069,760
2	Intake well, pump station, mech./electrical equip.	1 ea	lump sum	\$1,000,000
3	Excavation & embankment work for reservoir.	1,600,000c.y.	\$2.60/cy	\$4,160,000
4	Land clearance for the reservoir	115 acres	\$850/acre	\$ 97,750
	TOTAL:			<u>\$7,327,510</u>
5	Add for appurtenant works/structures for force main, reservoir, lift station, and misc. works and contingency			\$1,099,130
6	Land acquisition	115 acres	\$500/acre	\$ 57,500
7	Right-of-way for force main	35 acres	\$500/acre	\$ 17,500
8	Total item 4 thru 7			<u>\$8,501,640</u>
9	Add for Engineering Legal, Adm, etc. @ 15% of item 8			\$1,275,240
10	Total Project Cost items 8 & 9			<u>\$9,776,880</u>

All unit prices are the same as the ones used in the Feasibility Study Report for Grand Bayou Reservoir except for the cost of land which has been increased by \$100/acre due to its proximity to urbanized areas.

TABLE I-3

**GRAND BAYOU RESERVOIR
COST ESTIMATES
(YR 1976 \$)**

No.	ITEM	Qty.	Unit Cost	Total Cost
1	Reservoir Project Cost*	1 each	L.S.	\$11,750,000
2	Force Main to Treatment Works 24" Ø **	25,000 L.F.	\$36/L.F.	\$ 900,000
3	Lift Station Appurtenant Structures **	1 each	L.S.	\$ 500,000
4	Engineering, legal, adm. @ 15% of items 2 and 3			\$ 210,000
5	Total Project Cost			<u>\$13,360,000</u>

NOTES:

* Given in FDP. Vol. II-A, Schedule C-1.

** Costs added to make the two alternatives comparable.

TABLE I-4

PRESENT WORTH AND ESTIMATED ANNUAL COST
OF O&M REPAIR (1976 \$)

1. Red River Water Supply Reservoir & Pumping & Pipeline O & M and Repair @ 2½% of cost of items 1 thru 5, table I-2 =	\$ 210,670
2. Grand Bayou Reservoir Project O & M and Repair	
1. F.D.P. Vol II-A Schedule C-6=\$32,700	
2. Add for Vegetation Control, Dam Maintenance = \$10,000	
3. Transmission to treatment plant @ 2½% of items 2 & 3 of Table I-3 = \$35,000	
TOTAL: =	\$ 77,000
 COST DIFFERENTIAL O & M AND REPAIR FOR RED RIVER RESERVOIR PROJECT	 \$ 133,670
Average Annual Cost allowing 7% for 15 years =	\$ 133,670 x (2.05)
=	\$ 274,024
 Present worth of O & M @ 7% interest, 30 year period, P.W.F. = 12.409	 \$ 3,400,364

TABLE I-5

SUMMARY OF PROJECT COSTS
(ESTIMATED YR 1976 \$)

I. RED RIVER WATER SUPPLY SYSTEM
(Reservoir & Transmission to Treatment Plant)

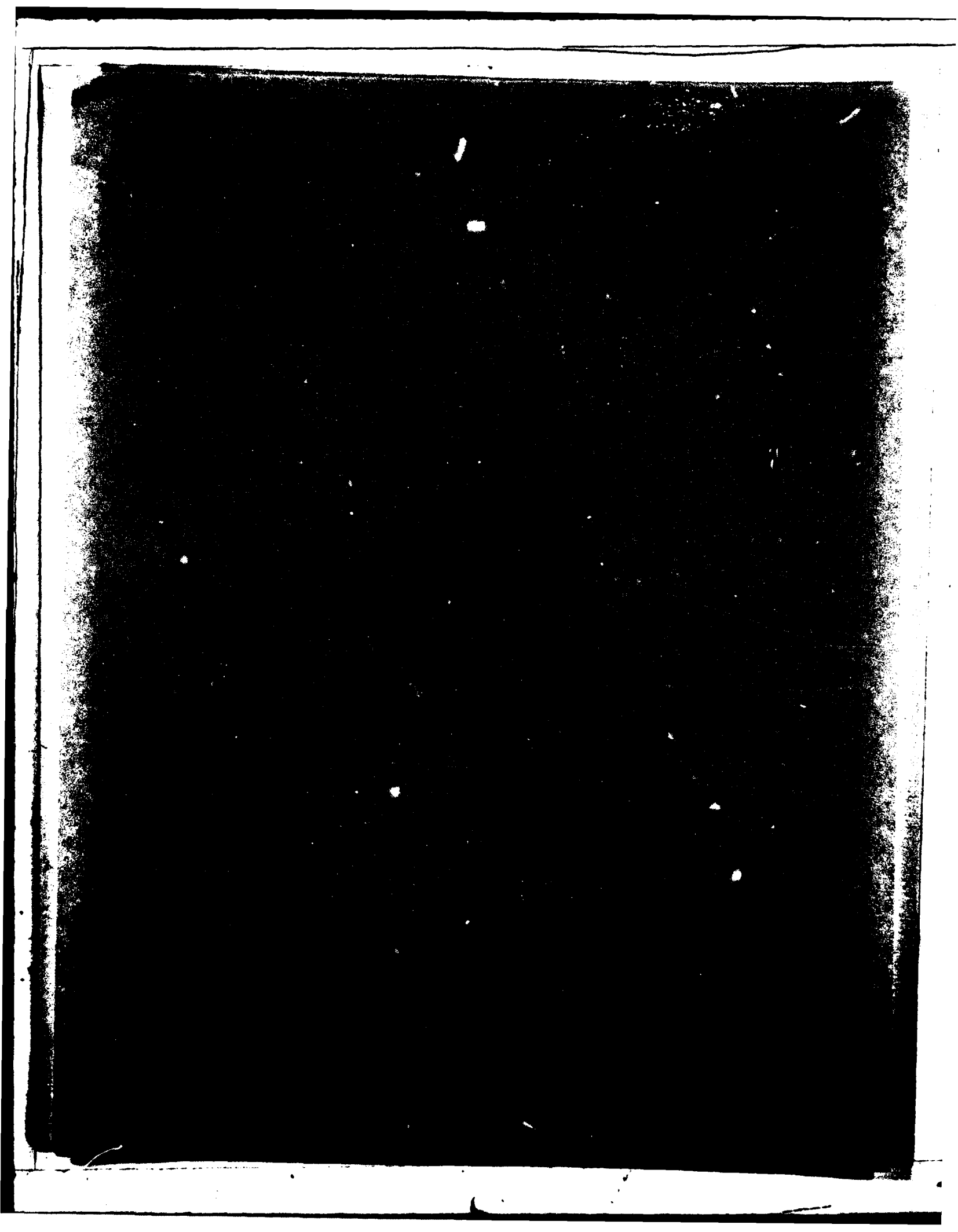
a. Project Construction Cost (Table I-2) = \$9,776,880

b. Present worth of Annual O & M and
Repair Cost differential (Table I-4) = \$3,400,364

TOTAL PRESENT WORTH OF PROJECT = \$13,177,244

II. GRAND BAYOU RESERVOIR PROJECT

Grand Bayou Dam and Reservoir Project Cost (Table I-3) \$13,360,000



February 29, 1980

Mr. Charles Whitehead, Sec.-Treas.
Northwest Louisiana Game and Fish Reserve
P.O. Box 697
Natchitoches, Louisiana 71457

Dear Mr. Whitehead:

For the past several years our commission has actively pursued a search for a reliable supply of good quality water for use by municipalities and industries in Red River Parish. Withdrawal of water from Black Lake is an alternative source which is currently being considered.

The supply of water selected for Red River Parish must meet demands for a period of thirty years. During project year one, approximately 1.5 to 2.0 million gallons per day will be required. By the fifteenth year the demand will be 3.5 to 4.0 million gallons per day and 7.5 to 8.0 million gallons per day by the thirtieth year.

Users would bear the responsibility for construction and maintenance of necessary intake treatment and transmission facilities.

In order to insure that these potential users will have a dependable water supply at a stated price for a 30 year period in the amounts listed above (3.5 mgd to 8.0 mgd), your agency is being asked if such quantity and quality of water is available and if a contract providing terms stated above can and will be entered into by your agency and our commission.

Your prompt attention to this request will be appreciated due to the urgent need of water in Red River Parish.

Cordially,

John K. Kelly
John Kelly, President
Grand Bayou Reservoir Commission

cc: Dr. Bill Long
Sunbelt Research

LAW OFFICES OF
WHITEHEAD AND MCCOY

CHARLES R. WHITEHEAD, JR.
KENNETH D. MCCOY, JR.
GREGORY N. WAMPLER

300 ST. DENIS STREET - P. O. BOX 697 - (504) 362-6401
NATCHITOCHES, LOUISIANA 71457

March 13, 1980

Mr. John Kelly, President
Grand Bayou Reservoir Commission
Coushatta, Louisiana 71019

Re: Northwest Louisiana Game & Fish Preserve
Commission

Dear Mr. Kelly:

Your letter of February 29, 1980 on behalf of the Grand Bayou Reservoirs Commission has been received.

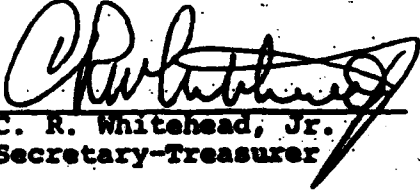
Your request concerning withdrawal of water from Black Lake as an alternative source for municipal and industrial uses has been discussed by the commission members.

Unfortunately, because of the current water demands within Natchitoches Parish by users and prospective need for the water from Black and Clear Lakes in the future, the Northwest Louisiana Game & Fish Preserve Commission, with regrets, will not be able to make any commitment to furnish any water to the Grand Bayou Reservoir Commission.

Yours very truly,

NORTHWEST LOUISIANA GAME &
FISH PRESERVE COMMISSION

By:


C. R. Whitehead, Jr.
Secretary-Treasurer

CRW/lh

February 29, 1980

Mr. Burton Angelle, Secretary
Department of Wild Life and Fisheries
400 Royal Street
New Orleans, Louisiana 70130

Dear Mr. Angelle:

For the past several years our commission has actively pursued a search for a reliable supply of good quality water for use by municipalities and industries in Red River Parish. Withdrawal of water from Lake Bistineau is an alternative source which is currently being considered.

The supply of water selected for Red River Parish must meet demands for a period of thirty years. During project year one, approximately 1.5 to 2.0 million gallons per day will be required. By the fifteenth year the demand will be 3.5 to 4.0 million gallons per day and 7.5 to 8.0 million gallons per day by the thirtieth year.

Users would bear the responsibility for construction and maintenance of necessary intake treatment and transmission facilities.

In order to insure that these potential users will have a dependable water supply at a stated price for a 30 year period in the amounts listed above (3.5 mgd to 8.0 mgd), your agency is being asked if such quantity and quality of water is available and if a contract providing terms stated above can and will be entered into by your agency and our commission.

Your prompt attention to this request will be appreciated due to the urgent need of water in Red River Parish.

Cordially,


John Kelly, President
Grand Bayou Reservoir Commission

cc: Dr. Bill Long
Sunbelt Research

State of Louisiana



J. BURTON ANGELLE
SECRETARY

DEPARTMENT OF WILDLIFE AND FISHERIES
400 ROYAL STREET
NEW ORLEANS 70130

EDWIN EDWARDS
GOVERNOR

March 27, 1980

Mr. John Kelly, President
Grand Bayou Reservoir Commission
P. O. Box 308
Coushatta, LA 71019

Dear Mr. Kelly:

I am in receipt of your recent letter pertaining to the request of the Grand Bayou Reservoir Commission to withdraw water from Lake Bistineau over a thirty year period for municipal and industrial use in Red River Parish. This lake provides very high quality recreation and the Louisiana Department of Wildlife and Fisheries can not allow the use of the lake in any manner which might jeopardize this activity. In view of the above, we find it necessary to deny withdrawal of water as requested.

If you need further justification for this denial, please let me know.

Sincerely yours,

J. Burton Angelle
J. Burton Angelle
Secretary

JBA:KCS:csg

cc:

Senator Don Kelly
Rep. H. M. Fowler

Copy

PINEVILLE KRAFT CORPORATION

P. O. BOX 870

PINEVILLE, LOUISIANA 71360

March 20, 1980

WOOD PRODUCTS



POST OFFICE BOX 142
COUSHATTA, LOUISIANA

Mr. Chris Ingram
SUNBELT RESEARCH CORP.
727 Spain Street
Baton Rouge, La. 70802

Dear Chris:

Attached is a water analysis report from our Boiler treatment vendor indicating test results from four samples taken over the past two years. The total water requirements for our plant are satisfied from three on-site water wells. The water hardness level is high and is a major expense for our Boiler operation to correctly-chemically treat the water.

I do not have a number for annual water usage as we do not meter from our wells, but certainly the quality of the water is not desirable, and, perhaps, we are on the same water table as is the town of Coushatta's current water supply.

Hopefully, this information will be of some benefit to you in proceeding in your endeavor to improve the area's long-range water requirements.

Sincerely yours,

PINEVILLE KRAFT CORPORATION

Henry Conly

Henry Conly
Plant Manager

HC/vl

Attachment

cc: John Kelly/Member Coushatta Town Council
file

JACKIE D. HUCKABAY, M. D.
RES. PHONE 932-525

FRED S. WILLIS, M. D.
RES. PHONE 932-525

L.S. Huckabay, M.D. Memorial Hospital

OFFICE PHONE 932-5786 -- POST OFFICE BOX 369

COUSHATTA, LOUISIANA 71019

April 3, 1980

Sunbelt Research Corporation
727 Spain Street
Baton Rouge, LA 70802

ATTENTION: Dr. Bill Long,
Chairman of the Board

Dear Mr. Long,

We are very much interested in the Grand Bayou Lake because of the severe problems associated with extremely poor water in the Coushatta, Red River Parish area.

I operate a hospital here, as well as living in the community, and use the city water which is very far below standards. For example, in corrosiveness, our hospital plumbing system has extreme problems. The circulating pump for the hot water system has to be replaced approximately every three months, at a cost of \$150.00. The hospital is less than ten years old and at the time of its construction the best possible copper piping was used because of the water problems, and we have still had to go into the slab on some three occasions because of the corrosiveness and the fact that the pipes have been eaten away. In addition, we have an x-ray developing machine which normally last about 8-10 years. We are now operating on our third x-ray developer and this is felt to be due primarily to the poor condition of the water.

There is, of course, from the medical aspect, a possibility of health hazards which are very great. There are definite foreign matters in the water which is higher than the desirable State standards, I am sure. I do not know of any specific infective episodes due to the city water but they do use very high levels of chlorine in an effort to keep the bacterial counts down, and to the point on occasions the chlorine is very objectionable.

Another point of the extreme corrosiveness and scale deposit associated with the water is the fact that hot water tanks rarely last over three years in this area. I know personally that most appliance centers will not sell

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in the area because of the problems with guarantees. They are unable to meet their guarantees because the hot water tanks as well as the ice making machines usually have severe repair problems before the normal guarantee time has expired.

It appears that the Grand Bayou Reservoir is probably the best source for the water we need in our area. I would appreciate your help and consideration in aiding us to obtain this water source.

Sincerely,

L.S.HUCKABAY, M.D. MEMORIAL HOSPITAL, INC.

Jackie D. Huckabay
Jackie D. Huckabay, M.D.

JDH:drb

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