



**US Army Corps  
of Engineers**  
New Orleans District

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# **LAKE PONTCHARTRAIN, LOUISIANA, AND VICINITY HURRICANE PROTECTION PROJECT**

*REEVALUATION STUDY*

**JULY 1984**

**VOLUME I**

**MAIN REPORT AND  
FINAL SUPPLEMENT I TO THE  
ENVIRONMENTAL IMPACT STATEMENT**



DEPARTMENT OF THE ARMY  
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS  
P. O. BOX 60267  
NEW ORLEANS, LOUISIANA 70160

# **LAKE PONTCHARTRAIN, LOUISIANA, AND VICINITY HURRICANE PROTECTION PROJECT**

## SYLLABUS

The purpose of this study is to review the ongoing Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection Project to determine if the plan of improvement originally proposed and currently being constructed is still the most feasible method to achieve hurricane protection for the Metropolitan New Orleans area, and if not, what modifications to the plan are necessary to provide the most feasible hurricane protection project.

This study was conducted in response to a 1977 Federal court injunction which stopped construction of portions of the project on the basis that the 1975 final environmental impact statement (EIS) for the project was inadequate. The court directed that the EIS be rectified to include adequate development and analysis of alternatives to the proposed action. The results of the studies presented herein are considered to be of sufficient scope and detail to adequately supplement the existing EIS.

Various solutions to the problems and needs relating to existing low level hurricane protection for the Metropolitan New Orleans area were analyzed. These solutions were developed using two basic design concepts. One design concept would provide barrier structures at Lake Pontchartrain's main tidal passes in conjunction with levee and flood-wall protection. The barrier structures would be closed during the approach of hurricanes from the Gulf of Mexico to reduce the build-up of lake levels, thereby reducing the extent of levee and floodwall construction which otherwise would be necessary. Plans incorporating the use of barrier structures in their designs were designated as barrier plans. The other design concept would provide hurricane protection solely by means of raising and strengthening levees and floodwalls; these plans were designated as high level plans.

As presented herein, the most feasible plan for providing hurricane protection was determined to be a high level plan. The plan would provide for improving the existing hurricane protection levee systems in Orleans Parish and the east bank of Jefferson Parish, improving existing levees and constructing new ones in St. Bernard Parish, repairing and rehabilitating the Mandeville Seawall in St. Tammany Parish, building a new mainline hurricane levee on the east bank of St. Charles Parish just north of US Highway 61 (Airline Highway), raising and strengthening the existing levee which extends along the Jefferson-St. Charles Parish boundary between Lake Pontchartrain and Airline Highway, and deferring construction of the proposed Seabrook lock until its feasibility as a feature of the Mississippi River-Gulf Outlet navigation project can be determined. Areas which would be inclosed by the proposed levee and floodwall construction would be provided protection against tidal surge flooding resulting from the Standard Project Hurricane (SPH). The SPH is defined as the most severe hurricane which can be reasonably expected to occur from a combination of meteorological and hydrologic events reasonably characteristic of the area. The first cost (completion cost) of the recommended plan is estimated at \$627,714,000 and annual costs would average \$22,769,000. Annual benefits (remaining benefits) which would accrue to the recommended plan are estimated at \$95,771,000, the bulk of which, \$88,430,000, relate to reduction of flood damages to existing development. The benefit-to-cost ratio is 4.2 to 1, and the average annual excess benefits over costs are \$73,002,000. These costs are at 1981 price levels and use an interest rate of 3 1/8 percent.

Implementation of the recommended plan would provide protection to the Metropolitan New Orleans area, but also would result in short term turbidity along the Jefferson Parish lakefront, require conversion of 54 acres of marsh and 411 acres of lake bottoms to project works, result in deep and potentially anoxic deep holes in Lake Pontchartrain, and temporarily disrupt esthetics and recreational values along the Orleans Parish and Jefferson Parish lakefronts.



LAKE PONTCHARTRAIN, LOUISIANA, AND VICINITY  
HURRICANE PROTECTION PROJECT  
REEVALUATION STUDY

ERRATA SHEET

COST UPDATE

Costs and benefits presented in the report have been updated to October 1983 price levels. The summary tables below present this information at the authorized interest rate of 3 1/8 percent and at the current interest rate of 8 1/8 percent. The plans are justified at either interest rate, and the High Level Plan remains the NED plan.

PLAN COMPARISON AT 3 1/8 PERCENT

October 1983 Price Levels  
(\$ 1,000,000s)

ITEM	High Level Plan	Barrier Plan	
	Base Year 1988	Base Year 1988	Base Year 1993
Total First Cost	680.0	806.0	806.0
Gross Investment	712.0	816.0	952.0
Annual Benefits	104.0	94.7	110.0
Annual Charges	24.8	28.4	33.2
Benefit-Cost Ratio	4.2 to 1	3.3 to 1	3.3 to 1
Excess Benefits	79.2	66.3	76.8

# PLAN COMPARISON AT 8 1/8 PERCENT

October 1983 Price Levels

(\$ 1,000,000s)

ITEM	High Level Plan	Barrier Plan	
	Base Year 1988	Base Year 1988	Base Year 1993
Total First Cost	680.0	806.0	806.0
Gross Investment	768.0	841.0	1,242.0
Annual Benefits	102.0	73.5	109.0
Annual Charges	63.9	69.7	103.0
Benefit-Cost Ratio	1.6 to 1	1.05 to 1	1.05 to 1
Excess Benefits	38.1	3.8	6.0

## OUTFALL CANALS

Since completion of this report, plans to provide protection at the three main outfall canals in New Orleans have been further investigated. It appears likely that protection could be provided at a cost of approximately \$60,000,000 for the Barrier Plan and about 2 percent greater for the High Level Plan. Although this figure is less than the estimate used in the reevaluation report (\$124,000,000), since it is substantially the same for either plan, it does not affect plan selection.

VOLUME 1

MAIN REPORT AND FINAL SUPPLEMENT I TO THE ENVIRONMENTAL IMPACT STATEMENT

VOLUME 2

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APPENDIX B - ECONOMIC ANALYSIS

APPENDIX C - ENVIRONMENTAL RESOURCES

VOLUME 3

APPENDIX D - PUBLIC VIEWS AND RESPONSES

**LAKE PONTCHARTRAIN, LOUISIANA,  
AND VICINITY HURRICANE PROTECTION PROJECT**

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## INTRODUCTION

This report has been arranged in three volumes. The first volume, the Main Report, is a nontechnical presentation of the study results, including the overall project formulation processes, the environmental impact statement (EIS), and study recommendations. The second volume, a set of technical appendixes, contains technical data in support of information presented in the Main Report. These appendixes are primarily an aid to the technical reviewer. Volume III is the Public Views and Responses appendix containing the comments received on the draft EIS.

## STUDY AUTHORITY

The Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection project, as presently being constructed, was authorized by Public Law 89-298, 27 October 1965, House Document 231, 89th Congress, 1st Session (the Flood Control Act of 1965) generally in accordance with recommendations contained within a report of the Chief of Engineers. Upon receipt of funds in 1966, construction of the hurricane protection project began.

In response to the National Environmental Policy Act of 1969, the US Army Corps of Engineers prepared an EIS in August 1974, and filed it with the Council on Environmental Quality in January 1975. Shortly thereafter, the adequacy of the EIS was challenged in court, and, on 30 December 1977, major portions of the project were enjoined from further construction by United States District Court, Eastern District of Louisiana, New Orleans Division. Subsequently, in March 1978, the injunction was modified to allow continued construction of all portions of the project, except the barrier complexes at Chef Menteur Pass and The Rigolets. Pertinent portions of the court's opinion are as follows.

"It is clear from the evidence in this case that the final environmental impact study for the Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection Project prepared by the United States Army Corps of Engineers dated August 1974 does not comply with the requirements of Title 43 United States Code Section 4332 which provides in pertinent part: ... all agencies in the federal government shall - utilize a systematic, interdisciplinary approach in decision making ... include in every recommendation or report or proposals for legislation ... a detailed statement by the responsible official on the environmental impact of the proposed action ... alternatives to the proposed action ... As written the EIS actually precludes both public and governmental parties from the opportunity to fairly and adequately analyze ... the proposed plan and any alternatives to it ... the court's opinion is limited strictly to the finding that the environmental impact statement of August, 1974 for the project was legally inadequate. Upon proper compliance with the law with regard to the impact statement this injunction will be dissolved and any hurricane plan thus properly presented will be allowed to proceed ..."

This report has been prepared as a response to that injunction.

## STUDY PURPOSE AND SCOPE

Upon issuance of the court injunction, studies which could adequately support a legally sufficient supplement to the EIS were initiated. The results of those studies are contained in this report.

Considered in the investigation were the immediate and future needs for providing hurricane protection to the Metropolitan New Orleans area;

and the economic, social, and environmental impacts and implications of the alternatives. This report is considered a final response to the requirements set forth in the court injunction.

## PRIOR STUDIES AND REPORTS

There have been numerous prior reports concerned with navigation and flood control in the area. A summary of pertinent reports is contained in this section.

House Document No. 90, 70th Congress, 1st Session, submitted 8 December 1927, is the basis for the Flood Control, Mississippi River and Tributaries project adopted by the Flood Control Act of 15 May 1928. The Mississippi River levee system is included in this general plan.

For over a century, the Corps of Engineers has conducted studies concerning deep-draft navigation on the Mississippi River below Baton Rouge, Louisiana. House Document No. 215, 76th Congress, 1st Session, submitted 15 March 1939, resulted in authorization by the River and Harbor Act of 2 March 1945 to combine and modify existing deep-draft projects on the river in a single project, "Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana." Subsequently modified by the River and Harbor Act of 23 October 1962, the project currently provides the following channel dimensions:

Baton Rouge to New Orleans	40 by 500 feet
Port of New Orleans	35 by 1,500 feet
New Orleans to Head of Passes	40 by 1,000 feet
Southwest Pass	40 by 800 feet
Southwest Pass Bar Channel	40 by 600 feet
South Pass	30 by 450 feet
South Pass Bar Channel	30 by 600 feet

A report entitled "Deep-Draft Access to the Ports of New Orleans and Baton Rouge, Louisiana," recently prepared by the New Orleans District, recommended enlarging the navigation channel from Baton Rouge to the Gulf of Mexico to dimensions of 55 by 750 feet. The Board of Engineers for Rivers and Harbors has approved the report, and it has been sent to the Secretary of the Army.

House Document No. 96, 79th Congress, 1st Session, submitted 19 May 1942, provides the basis for the existing project on the Gulf Intra-coastal Waterway (GIWW) east of New Orleans.

Senate Document No. 139, 81st Congress, 2nd Session, submitted 20 February 1950, provides the basis for the existing Lake Pontchartrain, Louisiana, levee project along the Jefferson Parish lakefront.

House Document No. 245, 82nd Congress, 1st Session, submitted 25 September 1951, resulted in authorization of the Mississippi River-Gulf Outlet (MR-GO) project by the River and Harbor Act of 29 March 1956. The project provides for a 36- by 500-foot ship channel between the Inner Harbor Navigation Canal (IHNC) in New Orleans and the Gulf of Mexico, a 1,000- by 2,000- by 36-foot deep turning basin and a high level bridge over the channel at Louisiana Highway 47. Project authorization also provides for a lock and connecting channel between the Mississippi River and the new ship channel when economically justified.

## PLAN FORMULATION

### PROBLEM IDENTIFICATION

To determine the problems and needs of the study area as related to hurricane protection, it is necessary to understand the present and projected future conditions. This section contains a summary of information related to human, economic, and environmental resources of the study area, thus providing a basis for determining the potential social and economic effect of hurricane-induced flooding.

### EXISTING CONDITIONS

LOCATION. The study area, shown on Plate 1, is located in southeastern Louisiana in the vicinity of New Orleans, and includes all or a portion of five parishes: Jefferson, Orleans, St. Bernard, St. Charles, and St. Tammany. It consists of the low land and water areas between the Mississippi River alluvial ridge and the Pleistocene escarpment to the north and west. The dominant topographic feature is Lake Pontchartrain, a shallow land-locked tidal basin approximately 640 square miles in area and averaging 12 feet in depth. It connects with Lake Maurepas to the west, through Pass Manchac and North Pass, and with the Gulf of Mexico to the east through Lake Borgne and Mississippi Sound. The lake drains approximately 4,700 square miles of tributary area.

The study area is bounded by water bodies posing potential flood threats. The Metropolitan New Orleans area is protected against riverine flooding by the project works of the Flood Control, Mississippi River and Tributaries project. On the east bank of the Mississippi River within this area, populated sections are threatened by flooding

resulting from hurricane-induced tidal surges from Lake Pontchartrain and/or the interconnected Lakes Borgne and Maurepas.

Residential and commercial development along the shores of Lake Pontchartrain is extensive, being most dense along the south shore, which is occupied by portions of Orleans, Jefferson, and St. Charles Parishes to the east of the Bonnet Carre' Spillway. The populated areas located within the portions of Orleans and St. Bernard Parishes, inclosed by the Chalmette Area Plan levee system, are concentrated along the Mississippi River to the south of the GIWW. Along the north shore of Lake Pontchartrain in St. Tammany Parish, population density is less, but the area is rapidly developing. Slidell, located to the northeast, is the major population center. Also, located along the north shore are the communities of Lacombe, Mandeville, and Madisonville.

HUMAN RESOURCES. Residential developments and population growth adjacent to the Central Business District of New Orleans historically have been dependent on the construction and maintenance of levees along the lakes and waterways of the area. The earliest developments took place along the natural ridges, with later residential growth occurring where the greatest levee protection was available. In recent years, residential development in the Lake Pontchartrain area has followed the pattern of many other urban centers with a growing number of multiple-family dwelling units and several mid-rise level apartment buildings.

Table 1 shows the significant population increases which occurred in the economic study area between 1950 to 1980. The 2.5 percent compound annual growth rate between 1950 to 1960 declined to 1.5 percent during the 1960's and 1.3 percent during the 1970's. Of special significance has been the changing distribution of the population. While the city of New Orleans experienced a net decline from 1950 to 1980, the total population of the surrounding parishes (Jefferson, St. Bernard, St. Tammany, and St. Charles) increased by more than

300 percent. The most dramatic growth has taken place in Jefferson Parish, on the East Bank of the Mississippi River, increasing from 19,000 in 1940 to 275,000 in 1980, or more than 1,300 percent. The west bank of the Mississippi River in Jefferson has grown rapidly as well, from 32,000 in 1940 to 180,000 in 1980--an increase of almost 500 percent.

TABLE 1  
POPULATION OF ECONOMIC STUDY AREA  
1950-1980

Parish	Land Area (Sq. Mi.)	Populations			
		1950	1960	1970	1980
Jefferson	372	103,873	208,769	338,229	454,592
Orleans	203	570,443	627,525	593,471	557,482
St. Bernard	521	11,087	32,186	51,185	64,097
St. Charles	291	13,363	21,219	29,550	37,259
St. Tammany	882	26,988	38,643	63,585	110,554
TOTALS	2,269	725,754	928,342	1,076,020	1,223,984

SOURCE: US Department of Commerce, Bureau of the Census,  
Census of Population, "Number of Inhabitants, Louisiana".

ECONOMIC RESOURCES. A period of extremely rapid growth occurred in the New Orleans area during the 1950's and mid-1960's, largely as a result of increased mineral production in surrounding areas, the development of petro-chemical industries, National Aeronautic and Space Administration programs, marine construction, the continued growth of the Port of New Orleans and, to a somewhat lesser degree, the continued development of the tourist industries. However, during the late 1960's and 1970's economic growth rates returned to those more in line with national trends.

While the competition of other ports appears to have increased, the total volume of tonnage reported for the Port of New Orleans has continued to grow, and by 1979, surpassed the total reported for the Port of New York, previously the Nation's most active port. Table 2 compares the traffic patterns of the Port of New Orleans with New York and several ports along the gulf coast. In addition to waterborne commerce, connecting truck and rail lines have helped maintain the Metropolitan New Orleans area as a major international as well as regional market. Based on figures reported by the Louisiana Department of Labor, transportation employment in the study area in 1979 accounted for 44 percent of the state's total.

TABLE 2  
COMPARATIVE TRAFFIC PATTERNS OF PORTS

Year	New Orleans	Total Volume of Tonnage Reported New York	Miami <sup>1/</sup>	Tampa	Mobile	Houston
1970	123,674	174,008	12,371	31,357	23,830	64,654
1971	120,067	181,025	12,709	34,975	24,919	68,424
1972	125,719	196,843	15,667	43,230	27,291	71,431
1973	136,104	216,896	18,111	41,923	30,518	88,518
1974	144,189	195,096	15,698	40,919	33,154	89,106
1975	140,409	177,815	14,107	39,858	32,453	83,674
1976	155,990	179,587	15,729	39,904	35,379	89,898
1977	162,992	185,292	15,333	45,620	35,944	104,291
1978	160,612	186,733	15,631	47,077	36,261	111,936
1979	167,135	163,621	16,607	47,885	35,245	117,551

<sup>1/</sup>Includes Port Everglades and Miami Harbors.

SOURCE: US Army Corps of Engineers, Waterborne Commerce of the United States, 1979.

Construction of the New Orleans Superdome, several large commercial buildings, and a number of major hotels have helped keep the area's



economy active. The changing skyline of the New Orleans Central Business District reflects this growth, as well as the significance which construction industries have had on the area's economic development in recent years.

Table 3 indicates business and manufacturing trends in the five-parish economic study area as reported by the Bureau of the Census. While the data indicate that commercial and manufacturing activities have increased in other areas of the state, the figures for wholesale trade and service industries exemplify New Orleans' continued strength as a regional commercial center. For example, the 1977 Census of Wholesale Trade shows that sales in the Lake Pontchartrain economic study area (Jefferson, Orleans, St. Bernard, St. Charles, and St. Tammany Parishes) accounted for 46 percent of the state total, while the area's population in 1977 was estimated at approximately 30 percent of the state total. The growing importance of tourism is reflected by the increasing number of hotels constructed in recent years and by hotel and motel receipts. In 1958, hotel and motel receipts in the Lake Pontchartrain economic study area accounted for 42 percent of the state total. By 1977 they made up 65 percent of the state total.

The fluctuation in manufacturing employment, on the other hand, could reflect the need for greater balance in the area's economy as suggested by some local analysts. Data for 1979, as reported by the State Department of Labor, indicated that manufacturing accounted for approximately 11 percent of total employment in the Lake Pontchartrain economic study area. Manufacturing accounted for 15 percent of the total employment reported for the rest of the state. City planners, in cooperation with the Board of Commissioners of the Port of New Orleans (Dock Board), are promoting port facilities and industrial expansion in the development of an Almonaster-Michoud Industrial District, a largely undeveloped 7,000-acre portion of the Citrus-New Orleans East area which will be protected by the plan. Developers hope to relocate certain port

TABLE 3

## ECONOMIC TRENDS IN THE STUDY AREA

	1958	1963	1967	1972	1977
<b>Retail Trade</b>					
Number of Establishments	8,134	6,342	7,958	8,703	8,121
Sales (\$1,000's)	1,001,527	1,133,089	1,591,015	2,395,141	3,985,704
Percent of State	34	33	33	33	32
<b>Wholesale Trade</b>					
Number of Establishments	1,749	1,816	1,935	2,103	2,250
Sales (\$1,000's)	2,371,046	2,673,483	3,606,681	4,768,954	9,065,065
Percent of State	60	58	54	49	46
<b>Selected Service Industries</b>					
Number of Establishments	4,731	4,408	5,938	8,593	9,172
Sales (\$1,000's)	186,032	228,389	323,897	718,982	1,282,818
Percent of State	48	48	47	48	44
<b>Manufacturing</b>					
Number of Establishments	963	924	921	955	1,056
Number of Employees	49,000	50,600	57,800	57,600	51,300
Percent of State	36	36	35	32	26
<b>Value Added by Manufacture</b>					
(\$1,000's)	513,503	618,363	976,700	1,218,700	2,368,500
Percent of State	36	32	35	28	25

SOURCE: US Department of Commerce, Bureau of the Census.

facilities and expand industrial development in this tidewater area, and eventually broaden the metropolitan area's economic base. Two related projects are currently under study; one would modify lockage capacity through the MR-GO and IHNC, and the other would enlarge the Mississippi River navigation channel from Baton Rouge, Louisiana, located upstream of New Orleans, to the Gulf of Mexico.

EMPLOYMENT AND INCOME. Table 4 illustrates establishment-based employment covered by the Louisiana Employment Security Law and per capita personal income in the study area for 1977, 1978, and 1979. The high employment and above average incomes generated in the study area reflect its historic economic growth.

TABLE 4  
EMPLOYMENT AND PER CAPITA PERSONAL INCOME

Parish	1977		1978		1979	
	Employment	Income	Employment	Income	Employment	Income
		(\$)		(\$)		(\$)
Jefferson	107,139	7,039	133,062	7,850	144,951	8,867
Orleans	275,687	6,987	300,439	7,744	303,973	8,707
St. Bernard	11,579	6,596	13,428	7,172	13,948	8,135
St. Charles	12,993	6,199	15,561	7,167	17,407	8,030
St. Tammany	12,395	5,576	17,812	6,440	20,111	7,191
Total/per capita	419,793	6,870	480,302	7,626	500,390	8,588
% of State	36	115	35	113	35	113

SOURCE: State of Louisiana, Department of Labor, Office of Management and Finance; Employment Wages, November 1980, US Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, April 1981.

Table 5 shows an employment distribution for 1979. Like a number of large metropolitan areas in recent years, New Orleans and the Lake

TABLE 5  
EMPLOYMENT BY INDUSTRY, 1979

	Mining	Construction	Transportation	Wholesale	Retail	Finance	Service	Public Administration
State of Louisiana	77,547	144,123	130,336	101,503	253,267	72,234	402,982	77,606
LAKE PONTCHARTRAIN ECONOMIC STUDY AREA								
Jefferson Parish	4,050	15,785	14,383	11,752	33,615	5,640	36,136	4,249
Orleans Parish	12,052	13,455	38,688	23,819	49,155	22,744	97,383	20,500
St. Bernard Parish	174	982	993	175	2,315	408	2,936	740
St. Charles Parish	202	5,364	1,684	1,294	1,215	252	2,488	176
St. Tammany Parish	211	2,288	971	638	4,366	1,091	7,163	761
TOTAL	16,689	37,874	56,719	37,678	90,666	30,135	146,106	26,426
Allocated to Parishes <sup>1/</sup>	71,516	135,746	127,802	91,937	248,799	70,799	399,340	76,612
Percent of State <sup>1/</sup>	23	28	44	41	36	42	37	34

<sup>1/</sup>Firms operating in two or more parishes with no available breakdown by area are included only in the totals; therefore, the percent of the state is computed using only the figures specifically allocated to the parishes in the study area.

SOURCE: State of Louisiana, Department of Labor, Office of Management and Finance, Employment wages, November 1980.

Pontchartrain economic study area in general have suffered from unemployment and underemployment problems. Some of these problems have been attributed to the immediate area's dependency on the port and tourist industries, the latter requiring labor intensive services but generating lower levels of income. However, information provided by the Louisiana Department of Labor indicates that other portions of the state have experienced more severe effects from the recent economic recession than the New Orleans area. Preliminary estimates indicate that unemployment in the New Orleans Standard Metropolitan Statistical Area (SMSA) was 10.6 percent in June of 1982, while the figure for the state was 11.5 percent.

Land Use. Land use in the five-parish study area ranges from 2.5 percent urban (St. Bernard Parish) to 34.3 percent urban (Orleans Parish). A summary of urban versus nonurban land use by parish is shown in Table 6. Considering the five-parish area as a unit, and not including Lakes Pontchartrain and Maurepas, approximately 12.7 percent is urban. A review of the data in Table 7 indicates that about 41 percent of the urbanized area is residential. Table 8 contains a breakdown of nonurban use into five categories. Over 70 percent of the nonurban land use is water and wetlands, and the depicted acreages do not include the areas of Lakes Pontchartrain and Maurepas. If the areas for these bodies of water are included in the land use calculations, over 98 percent of the study area would be water and wetlands, and only 0.6 percent would be considered urban. The extremely high amount of water and wetlands indicates the potential for damage from flooding due to storm-related high water.

ENVIRONMENTAL SETTING AND NATURAL RESOURCES. The project area, located in southeastern Louisiana, is of mostly low relief and characteristic of an alluvial plain. The area is within the Pontchartrain Basin, which is situated near the center of the Gulf Coastal Plain in the lower reaches of the Mississippi Embayment. The basin is in a shallow depression

TABLE 6  
SUMMARY OF LAND USE CATEGORIES  
(Acres)

PARISH	TOTAL <sup>1/</sup>	URBAN	PERCENT URBAN	NONURBAN	PERCENT NONURBAN
Jefferson	230,420	69,253	30.1	161,167	69.9
Orleans	134,036	45,937	34.3	88,099	65.7
St. Bernard	335,355	8,391	2.5	326,964	97.5
St. Charles	187,343	31,780	17.0	155,563	83.0
St. Tammany	<u>571,467</u>	<u>30,116</u>	5.3	<u>541,351</u>	94.7
TOTAL	1,458,621	185,477	12.7	1,273,144	72.8

<sup>1/</sup>Does not include Lakes Pontchartrain and Maurepas, parish boundaries are indefinite.

SOURCE: Land Use Maps published in the Inventory of Basic Environmental Data, New Orleans-Baton Rouge Metropolitan Area 1980.

TABLE 7  
URBAN LAND USE  
(Acres)

PARISH	RESIDENTIAL	COMMERCIAL SERVICES	INDUSTRIAL	EXTRACTIVE	TRANSPORTATION	INSTITUTIONAL	STRIP AND CLUSTERED SETTLEMENT	OPEN	TOTAL
Jefferson	23,616	4,237	4,659	27,917	576	865	2,980	4,403	69,253
Orleans	27,950	3,645	4,157	967	2,348	1,055	1,270	4,565	45,937
St. Bernard	5,079	376	1,300	402	230	159	666	179	8,391
St. Charles	3,592	223	3,556	21,660	26	166	2,007	550	31,780
St. Tammany	16,467	1,042	429	2,574	723	888	6,326	1,667	30,116
TOTAL	76,704	9,523	14,101	53,500	3,903	3,133	13,249	11,364	185,477

SOURCE: Land Use Maps published in the Inventory of Basic Environmental Data, New Orleans-Baton Rouge Metropolitan Area 1980.

TABLE 8  
NONURBAN LAND USE  
(Acres)

PARISH	AGRICULTURE	FOREST	WATER <sup>1/</sup>	WETLANDS	BARREN LANDS	TOTAL
Jefferson	3,354	3,415	79,851	74,342	205	161,167
Orleans	755	36	18,314	68,994	0	88,099
St. Bernard	18,691	0	53,942	254,331	0	326,964
St. Charles	22,436	535	11,261	120,942	389	155,563
St. Tammany	98,383	209,285	6,677	226,907	99	541,351
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
TOTAL	143,619	213,271	170,045	745,516	693	1,273,144

<sup>1/</sup> Does not include Lakes Pontchartrain and Maurepas, which are bordered by several parishes, where definite parish boundaries into these water bodies have not been defined. The total area of these lakes is about 720 square miles, or 31,363,200 acres.

SOURCE: Land Use Maps published in the Inventory of Basic Environmental Data, New Orleans-Baton Rouge Metropolitan Area 1980.



lying between the alluvial ridge of the Mississippi River to the south and sloping uplands to the north and west. Lake Pontchartrain, a brackish embayment of the Gulf of Mexico some 640 square miles in area, is connected to Lake Borgne to the east via The Rigolets, Chef Menteur Pass, and the IHNC. To the west, Lake Pontchartrain is connected by Pass Manchac and North Pass to Lake Maurepas, a freshwater lake about 90 square miles in area. The south shore area from the Bonnet Carre' Spillway to Lake Borgne is essentially uniform in topography. The land slopes gently downward from an average elevation of about 12 feet National Geodetic Vertical Datum (NGVD)<sup>1/</sup> along the natural banks of the Mississippi River to approximately sea level near the lake shores.

All of this area is protected from Mississippi River overflows by the mainline levee system. Minimum elevations as low as minus 9 feet are found in the artificially drained low-lying marsh and swamp areas (the area is subject to subsidence). A ridge at an elevation of approximately 4 feet, is located about 2 to 3 miles from the lake, and runs generally parallel to the lakeshore in eastern Jefferson Parish and throughout Orleans Parish. This ridge, known as the Metairie-Gentilly Ridge, is the remains of the natural levee of an ancient distributary of the Mississippi River, and forms a natural drainage divide between the river and the south shore of Lake Pontchartrain. US Highway 90 generally traverses this ridge in the eastern part of Orleans Parish.

The north shore of Lake Pontchartrain, located in St. Tammany Parish, is composed of low-lying marsh and swamp at an elevation of about 1.5 feet. The land rises inland to the adjacent higher Pleistocene escarpment forming the northern boundary of the study area, except in the vicinity of the town of Mandeville where the shoreline abuts the uplands.

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<sup>1/</sup>Unless otherwise noted, all elevations in this report are expressed in feet referenced to National Geodetic Vertical Datum, formerly referred to as mean sea level.

The portions of the physical study area to the west in Tangipahoa, Livingston, Ascension, St. James, and St. John the Baptist Parishes are essentially low-lying marsh and swamp with an average elevation of 1.5 feet. The feasibility of providing hurricane protection to this area is being investigated under the Lake Pontchartrain-West Shore, Louisiana project. Where the shoreline is not protected by erosion control works, a general shoreline retreat is the present dominant process within Lake Pontchartrain. A map of the physical study area, the area within the Standard Project Hurricane overflow limits, is shown on Plate 2. The designated study area for environmental analysis is delineated differently (Plate 11). The project study area boundaries are based on limits of flooding, while the study area for environmental land use analysis is based on habitats directly and indirectly impacted by construction activities associated with the project. The impacts of hurricane flooding are also discussed in the EIS.

Climate. The study area has a subtropical marine climate. Located in a subtropical latitude, its climate is influenced by the many water surfaces of the lake, streams, and the Gulf of Mexico. Throughout the year, these water areas modify the relative humidity and temperature conditions, decreasing the range between the extremes. When southern winds prevail, these effects are increased, imparting the characteristics of a marine climate.

The area has mild winters and hot, humid summers. During the summer, prevailing southerly winds produce conditions favorable for afternoon thundershowers. In the colder seasons, the area is subjected to frontal movements which produce squalls and sudden temperature drops. River fogs are prevalent in the winter and spring when the temperature of the Mississippi River is somewhat colder than the air temperature.

In the New Orleans area, the mean average temperature is about 70 degrees Fahrenheit (°F). The monthly mean temperatures vary from

53°F to 82°F. Record high temperatures of 102°F occurred in June 1954 and August 1951 at Belle Chasse and New Orleans, respectively. The record low temperatures of 7°F and 13°F occurred in January 1963 at Belle Chasse and New Orleans, respectively.

Precipitation generally is heavy in two fairly definite rainy periods. Summer showers last from about mid-June to mid-September, and heavy winter rains generally occur from mid-December to mid-March. The annual normal precipitation for New Orleans (Citrus station) is 58.22 inches, with annual variations of plus or minus 50 percent. Extreme monthly rainfalls exceeding 12 inches are not uncommon, and as much as 25 inches have been recorded in a single month. The greatest 24-hour amount of precipitation since 1871 was 14.01 inches on 15 and 16 April 1927. Snowfall amounts are generally insignificant, and hail of a damaging nature seldom occurs.

Average wind velocity is about 9 miles per hour (mph), based on historic anemometer coverage at the New Orleans International Airport. The predominant wind directions are south to southeast from March to June and north to northeast from September to February.

From early June until late November, the study area is subject to the threat of hurricanes. A hurricane is defined as a well-developed cyclonic storm, usually of tropical origin, that occurs in the North Atlantic Ocean, Gulf of Mexico, Caribbean Sea, and Eastern and Southern Pacific Oceans. Hurricane storm characteristics are violent winds, tremendous waves and surges, and torrential rainfall. (Average wind speeds must be at or above 75 mph in order for a storm to be classified as a hurricane.) Size and duration vary with each hurricane, but they generally extend over thousands of square miles, reach heights of 30,000 feet or more, and last from 9 to 12 days.

Hurricanes pose a dual threat to life and property because of high winds and associated flooding. Winds can be damaging in themselves, but it is also a matter of record that wind patterns may cause changes in lake levels. Hurricane winds in the study area can increase the volume of water in Lakes Pontchartrain and Maurepas, increasing the average still water lake elevations. Further, wind can "tilt" the water in the lakes towards shore, depending upon wind direction. The wave action generated by wind forces further increases surge elevations. Rainfall associated with hurricanes poses an additional flood threat.

The study area has experienced many severe hurricanes, as well as lesser tropical storms which caused loss of life and/or damage to property. Official meteorological records are not available prior to 1893, but historic accounts are available. Because a large portion of the study area was relatively uninhabited prior to 1893, the extent of the flooding often went unobserved.

Prior to 1800, New Orleans had little protection from flooding caused by lake waters entering the city. Bienville's newly established capital city of New Orleans was severely damaged by a hurricane in 1722. The church, crops, stores, and 35 huts were destroyed, and the city was reduced to a state of famine. A 1723 hurricane caused similar damage. Other storms in 1776, 1779, 1780, 1781, 1793, and 1794 struck the area. Severe crop damage was reported from some of these storms. The lack of storm reports during the mid-century is thought to be primarily a lack of records rather than the absence of storms.

Historic data indicate that storms struck the area in 1800, 1811, 1812, and 1821. A particularly severe storm in 1831 devastated the area near the gulf and caused considerable damage in the study area. Several lives were lost, and all the buildings fronting the lake in the vicinity of New Orleans were washed away. The hurricane of 1837 inundated the city of New Orleans for a distance of approximately 2 miles inland from

the shoreline of the lake, and several lives were lost. In 1860, another severe hurricane struck the area. Heavy damage was reported in Mandeville, and several deaths occurred in New Orleans where approximately two-thirds of the city was inundated. In 1887, a storm which had paralleled the entire coast of Texas passed inland near New Orleans. Flooding occurred in the portion of the city nearest Lake Pontchartrain, as well as in some interior localities through levee breaks along drainage canals. In October 1893, an extremely violent hurricane devastated the coastal region of Louisiana west of the Mississippi River. The loss of life was estimated to be 2,000 persons, and heavy damage in other areas in Louisiana are noted in most of the storm records. It was reported that the rate of forward motion of this storm decreased to nearly zero in the vicinity of the Mississippi River. As a result of this stalling, the winds in the area were of long duration, and great volumes of gulf waters were forced from Lake Borgne into Lake Pontchartrain. Other 19th century storms which resulted in lesser damage occurred in 1886, 1888, 1892, 1894, and 1897.

As development increased in the study area in the 20th century, the amount of damage from storms increased. Additionally, refinements in the procedures of damage assessments, improved communications, and better record keeping have provided much better information on the duration and impact of these storms. Hurricanes or tropical storms occurred in 1900, 1901, 1902, 1904, 1905, 1906, 1907, 1909, 1914, 1915, 1917, 1919, 1920, 1936, 1940, 1943, 1945, 1946, 1947, 1948, 1955, 1956, 1961, 1964, 1965, 1969, 1971, and 1974. Some of these were major hurricanes which caused extensive damage and loss of life.

The storm of 4-16 August 1901 passed just east of New Orleans causing considerable property damage and the loss of 10 lives. Approximately 3 square miles of the city were inundated to depths of 1 to 4 feet. The hurricane of 10-22 September 1909 caused damage exceeding \$6 million, and a loss of 353 lives. The railroad was washed

out between Frenier and Ruddock along the west shore of the lake, and the western portion of the city was flooded to depths of 1 to 2 feet.

From 22 September to 2 October 1915, a storm with winds of 75 mph at New Orleans caused considerable damage. Torrential rains accompanied the storm, causing severe flooding in the southeastern portion of Louisiana. New Orleans reported a total of 8.2 inches of rain with a maximum of 1.59 inches in 1 hour. Failure of the drainage pumps caused the impounded water to remain for several hours. In New Orleans, 25,000 buildings were destroyed or damaged, and the city was flooded to depths of 1 to 8 feet. Total property losses exceeded \$13 million and the death toll was 275.

The hurricane of 4-21 September 1947 ranked as one of the greatest on record. It struck the Louisiana coast south of Lake Borgne and continued westward south of Lake Pontchartrain. The path of the storm center in relation to the converging coasts of Mississippi and southeastern Louisiana was conducive to the generation of a very high tidal surge. Water flowed over the seawall at the New Orleans lakefront, inundating approximately 8.9 square miles of lakefront area, of which 2.7 square miles were covered by sheet flow 2 feet or more in depth. Flow over the low protective embankment along the lakeshore caused flooding of approximately 31 square miles in Jefferson Parish, making the drainage pumps inoperative for a considerable period of time. Water was 6 feet deep in some sections. New Orleans International Airport had 6 inches of water on the runways and could not operate. Wind speeds at the airport were reported as high as 98 mph with gusts to 112 mph. Total storm damage was estimated at \$110 million with 51 lives lost, 12 of which were in Louisiana.

Hurricane Flossy (21-30 September 1956), passed over the mouth of the Mississippi River on a northeasterly track. Heavy rains, varying from 4 to 10 inches, fell along the path of the storm from Florida to

Grand Isle. The seawall along the New Orleans lakefront was overtopped by waves, flooding an area of approximately 2.5 square miles in the eastern part of the city; however, Jefferson Parish was protected by a levee built after the 1947 storm. Total deaths reported on the coast were 15 and damage was estimated at \$20 million.

In late September 1964, Hurricane Hilda developed off the southern coast of western Cuba and attained a surface wind velocity of 150 mph on 1 October while the hurricane was located 350 miles south of New Orleans. Hilda crossed the Louisiana coast west of New Orleans during the evening of 3 October. At that time, maximum winds were 98 mph. Offshore and coastal oil installations suffered heavy damage and camps located along the south shore of Lake Pontchartrain in the Eastern New Orleans area were severely damaged by high waves in the lake. The hurricane resulted in the flooding of more than 3,000,000 acres of land, damages estimated in excess of \$53,000,000, and the death of 39 people.

The most destructive storm of record on the Louisiana coast, and one of the great hurricanes of this century, was Betsy, which entered the Gulf of Mexico on 8 September 1965. At that time, wind velocities were estimated at 150 mph. When the storm entered the Louisiana coast at Grand Isle on 9 September, winds were reported at 105 mph, with gusts to 160 mph. The eastern portion of New Orleans and the adjacent Chalmette area of St. Bernard Parish suffered severe damage from floodwaters and winds. The waters overtopped and poured through breaks in the IHNC levees and the Chalmette back levee. The Citrus and New Orleans East back levees, located along the GIWW, also were overtopped. Many camps and homes located along Chef Menteur, The Rigolets, Lake St. Catherine, and the south shore of Lake Pontchartrain in the Citrus-Little Woods area were completely demolished or heavily damaged by the combination of floodwaters, wind and waves. Serious flooding occurred in these areas with the depths ranging up to 9 feet. Waves caused overtopping of the New Orleans seawall on Lake

Pontchartrain, but a secondary levee constructed by the local levee board prevented serious overflow into the city. Damages and expenditures related to this hurricane were estimated at over \$2 billion. More than 2 1/2 million acres of land were flooded, approximately 300,000 persons were evacuated or changed living quarters, and more than 27,000 homes were destroyed or flooded. In addition, offshore and coastal oil installations and public utilities reported unprecedented damage. Fall crops were heavily damaged and much livestock drowned. Deaths in Louisiana resulting from Hurricane Betsy are listed at 81 persons, including over 50 deaths in the New Orleans area.

Hurricane Camille, which occurred in August 1969, was one of the most intense and destructive hurricanes ever recorded. By the 17th, Camille had winds estimated at 190 mph, and was located southeast of New Orleans and south of the gulf coast of Mississippi. Just before midnight, Camille hit the gulf coast with winds estimated at 160 mph and gusts up to 200 mph. Maximum tidal surges exceeded 20 feet. While Camille was in the Gulf of Mexico, a central barometric pressure of 26.61 inches was recorded, second only to the 26.35 inches recorded by the Labor Day hurricane of 1935. (Central barometric pressure is an important parameter affecting a storm's intensity.)

While the Mississippi coast received the brunt of Camille, the study area also suffered damages. Heavy damages were sustained by all types of facilities in and near The Rigolets/Chef Menteur/Lake St. Catherine area. Camps and homes located on both the north and south shores of Lake Pontchartrain were heavily damaged. Total monetary damages as a result of Camille exceeded \$1 billion, while at least 262 lives were lost.

The geographical location of the New Orleans area, combined with the low terrain and nearby bodies of water, make this densely populated section of the state highly susceptible to hurricane-induced damages.



Hydrology. The study area lies within the Lake Pontchartrain Basin. This drainage basin is bounded by the Pearl River Basin on the east, Mississippi Sound to the south (via Lake Borgne), and the Mississippi River to the west. The Pearl River Basin, whose western boundary generally follows the Louisiana-Mississippi state boundary in the vicinity of Lake Pontchartrain, does not directly interface with the Pontchartrain Basin. It does provide about one-half of the freshwater inflows to Lake Borgne.

Lake Borgne is an estuarine area which connects to the east with Mississippi Sound (an embayment of the Gulf of Mexico) and to the west with Lake Pontchartrain via Chef Menteur Pass and The Rigolets, two natural tidal passes.

The Mississippi River is separated from the study area by the left descending bank mainline levees, but is connected with the Pontchartrain system at two locations. The Bonnet Carre' Spillway, located on the east bank of the Mississippi River in St. Charles Parish about 26 miles north of New Orleans, is a feature of the Mississippi River and Tributaries Flood Control project. The spillway is designed to operate as a relief valve for the Mississippi River; that is, when floodflows on the Mississippi River below the spillway reach 1,250,000 cubic feet per second, a portion of the river's flows are diverted to Lake Pontchartrain. Studies indicate that previous operations of the spillway have produced only small lake variations, varying from 0.7 feet to 1.5 feet measured at or near the design diversion capacity of 250,000 cfs. Along the south shore, Lake Pontchartrain is connected with the Mississippi River, MR-GO, and GIWW via the IHNC, a manmade channel. The IHNC is connected to the Mississippi River via a lock. The Mississippi is a source of freshwater inflows for Lake Pontchartrain via the Industrial Lock and during limited periods when the Bonnet Carre' Spillway operates. Conversely, the MR-GO, which connects with the Gulf of Mexico, is a source of saline waters for Lake Pontchartrain.

Lake Pontchartrain is an oval-shaped low salinity estuary formed from a remnant of an arm of the Gulf of Mexico, which was impounded by deltaic deposits of the Mississippi River and gradually freshened. It is about 25 miles wide along its north-south axis and 40 miles long along its east-west axis. In addition to its tidal passes at Chef Menteur, The Rigolets, and at the IHNC (Seabrook), Lake Pontchartrain has two inland passes to the west, North Pass and Pass Manchac, which connect to Lake Maurepas. Lake Maurepas has a surface area of about 90 square miles and an average depth of 10 feet. The total drainage area having significant effect on the lake system covers approximately 4,700 square miles.

The northern portions of the Lake Pontchartrain Basin are drained by numerous streams and rivers which flow in a predominantly southerly direction to Lakes Maurepas and Pontchartrain. Portions of Ascension, St. James, St. John the Baptist, St. Charles, Orleans, and Jefferson Parishes which lie east of the Mississippi River and north of St. Bernard Parish, are all drained by a series of natural and manmade streams and canals which flow away from the Mississippi River to Lakes Maurepas and Pontchartrain. In Orleans, Jefferson, and St. Bernard Parishes, pumping stations are required to lift the water through the levees which protect the New Orleans metropolitan area from flooding to the lake level. Pumping station discharge locations include Lake Pontchartrain, the IHNC, the MR-GO, and Lake Borgne.

Within Lake Pontchartrain and adjoining Lake Maurepas, water circulation patterns and lake levels are controlled by tidal action at the tidal passes, freshwater inflows from upstream drainage areas, and the wind. The lake generally has diurnal tides, that is, one high tide and one low tide in a day. Records indicate that normal wave crests range from 0.1 to 5.3 feet; whereas, normal tides in Lake Pontchartrain average 0.6 feet. This indicates that wind effects usually mask diurnal tidal fluctuations. Estimation of wind energy effects indicates that

tidal effects predominate over wind at wind speeds less than 4.5 mph, winds and tides are about equal when wind speeds range between 4.5 and 6.5 mph, and wind effects predominant when they are greater than 6.5 mph. Since wind speeds average more than 6.5 mph, winds generally dominate tides in the lake. Maximum stages occur in Lake Pontchartrain during hurricane activity in the vicinity. A maximum recorded stage of 13.1 feet occurred at Frenier Beach on 29 September 1915, while a minimum recorded stage of minus 2.2 feet occurred at New Orleans on 26-27 January 1938.

Except in the immediate vicinity of the tidal passes, the direction and speed of water circulation in Lake Pontchartrain is controlled by winds. Currents average 0.4 feet per second (fps) in the lake, while mean flood current speeds in the tidal passes average 1.2 to 1.6 fps.

The bulk of inflows received by Lake Pontchartrain comes from its tidal passes. Headwater flows account for only 4.5 percent of Lake Pontchartrain's inflow, while The Rigolets, Chef Menteur Pass, and the IHNC contribute 57, 32, and 6.5 percent, respectively, of the lake's total inflow volume.

The salinities of Lakes Pontchartrain and Maurepas normally range from fresh to brackish [brackish waters have a salinity of 1.0 to 5.0 parts per thousand (ppt)]. At times of extreme low flows, Lake Maurepas can become brackish. Salinities average less than 0.2 ppt in Lake Maurepas while averaging about 1.5 ppt in Lake Pontchartrain. Lake Pontchartrain salinities range seasonally from a low of about 0.45 ppt in the late spring to a high of about 5.3 ppt in the late fall, reflecting seasonal variations in freshwater inflow. The salinity regime is subject to drastic change during hurricanes.

Because the lake system receives its salt input from the tidal passes located to the east, the salinity of the lake is fresher towards

the west. The lake system receives about half of its freshwater input from headwater inflows and about half from the tidal passes. The Rigolets transports freshwater from the Pearl River Basin, and the IHNC transports freshwater from the Mississippi River. Salt budget calculations indicate that The Rigolets supplies about 40 percent; the Chef Menteur Pass supplies about 40 percent; and the IHNC supplies about 20 percent of the total salt entering the lake.

Water Quality. Lake Pontchartrain, the IHNC, GIWW, and MR-GO are all classified as "water quality limited." The water quality limited classification is given a stream segment where it is known that water quality does not meet all applicable standards and/or is not expected to meet all applicable standards, even after application of the effluent limitations required by the Federal Water Pollution Control Act. Each of these surface waters is subjected to sewage contaminated storm water, and domestic and industrial wastewater discharges from the New Orleans metropolitan area.

Rivers and streams draining into Lake Pontchartrain along the north shore carry pollutants from the basin uplands. Residential development on the north shore, particularly in the Slidell and Mandeville areas, also has increased storm water runoff to the lake. Untreated domestic wastewater discharges from camps along the shoreline and on immediate tributaries are an additional source of pollution. Primary contact recreation (swimming, skiing, etc.) is one of the designated uses of the lake. However, a recent (1982) bacterial pollution survey prompted state health officials to recommend that primary contact recreation activities not be conducted within 1/4-mile of the shoreline along the south shore west of US Highway 11. State health officials also discourage primary contact activities along the north shore within a 200-yard radius of the mouth of streams which flow into the lake.

Urban storm water, industries, and vessels are sources of pollution in the IHNC, GIWW, and MR-GO. None of these waters has been designated as suitable for primary contact recreation. Because of the manufacture, handling, use, and transport of toxic materials in the project area, these water bodies are subject to periodic spills, some of which have caused acute environmental perturbations.

Heavy industrialization of the area ensures a generally low level, but essentially constant, input of known toxic and potentially toxic substances to local water bodies from atmospheric fallout, washout and direct discharges.

Botanical Resources. The vegetation north of Lake Pontchartrain consists of swamp and marshland, with pinewoods on the prairie terrace to the north and west. Within the area of study, there are various types of marshlands, cypress-tupelo swamps, bottomland hardwood forests, and submerged grass beds (see Plate 12). The marshes in the study area can be described as two basic types. Fresh-intermediate marshes contain a variety of plant species such as bulltongue, deerpea, maidencane, and wiregrass. The most common forms of vegetation associated with the brackish-saline marshes are wiregrass, oystergrass, and black rush.

The cypress-tupelo swamp is dominated by baldcypress, tupelogram, Drummond red maple, ash, and black willow. Most of this association is confined to St. Charles Parish. Bottomland hardwoods are located on higher, less frequently flooded areas. Common vegetation includes hackberry, various species of oaks, cottonwood, sycamore, and American elm. The dredged material disposal areas and levees located within the marsh system are vegetated with a scrub shrub type of plant association, consisting mainly of marsh elder and eastern baccharis.

The prairie terraces to the north and west of Lake Pontchartrain are covered primarily with longleaf, slash, spruce and loblolly pines,

oaks (several species), magnolias, tulip tree, flowering dogwood, and sweetgum.

The submerged vegetation within the lake and associated inlets (primarily wild celery, naiad, widgeongrass, and spikerush) provide cover, nursery, and spawning benefits to the local recreational and commercial fishery.

Zoological Resources. The biota of the study area can be divided into two categories: organisms having a land-based habitat and those utilizing aquatic habitat.

Lake Pontchartrain and the extensive marsh, swamplands, and bottomland in the project area contribute to an important seafood industry. The marsh and open waters provide varied and highly productive habitat for game and furbearing animals, as well as waterfowl. There are two wildlife management areas (Manchac and Joyce) and one refuge (St. Tammany) in the project area.

The aquatic life of Lake Pontchartrain is composed of typical brackish water species. The low salinity allows the invasion of freshwater species but excludes some of the typical high salinity forms. As is typical of the biota of estuaries, there is an abundance of a few species which can tolerate brackish conditions. Lake Pontchartrain is considered a nursery area for many marine species of the Gulf of Mexico, with the eastern portion being of exceptional importance to such species as menhaden and white shrimp.

The fishes of the lake are primarily marine and estuarine with the Atlantic croaker, gulf menhaden, anchovy, and silverside being particularly abundant. Other common species include spot, sand seatrout, sea catfish, and striped mullet. Freshwater species such as blue catfish, channel catfish, largemouth bass, and other sunfish occur in less saline water near incoming river mouths.

Lake Pontchartrain supports a sport and commercial fishery for many species including blue crab, white shrimp, spotted seatrout, black drum, red drum, sheepshead, and flounder. Western Lake Pontchartrain and the interconnecting Lake Maurepas also provide a sufficient density of brackish water clams to support a viable commercial shell harvesting industry.

The bald eagle is the only endangered or threatened species that might be impacted by a project alternative. For further discussion, see Appendix C, Section 1.

Additional information concerning zoological resources can be found in the EIS.

Cultural Resources. Located within the present and proposed levee system protecting Orleans, St. Bernard, Jefferson, and St. Charles Parishes are 104 historic properties and eight historic districts listed in the National Register of Historic Places. These properties include Big Oak and Little Oak Islands archeological sites, the Chalmette National Historical Park, Destrehan Plantation, Camp Parapet Powder Magazine, and the many historic buildings and districts in New Orleans.

The remainder of the Lake Pontchartrain study area also contains many significant cultural resources listed in the National Register. Forts Pike and Macomb are massive brick fortifications built in the early 1800's to guard the two natural passes into Lake Pontchartrain, The Rigolets, and Chef Menteur Pass. The historic town of Mandeville, which contains three structures listed in the Register and a proposed historic district, is located on the north shore of the lake. Three of the lighthouses which dot the lake's shoreline; Pass Manchac, New Canal, and Tchefuncte River Rear Range; have recently been listed in the National Register. Also listed in the Register are two archeological sites located in the marshes and swamps which constitute the lake's

shoreline. The Tchefuncte type site (16ST1) is composed of two Rangia shell middens in the marsh east of Mandeville. The Bayou Jasmine site (16SJB2) is a deeply buried cultural deposit dating to the Poverty Point period and is located in St. John the Baptist Parish between Lakes Maurepas and Pontchartrain. Plate 13 is a cultural resources location map.

Numerous other archeological sites are located throughout the study area. These sites are characteristically Rangia shell middens located on relict natural levee ridges, beaches, and shorelines. The archeological record of the Lake Pontchartrain Basin documents the presence of man from the late Archaic period [ca. 4,000 - 2,500 Before Present (B.P.)], with an economic strategy largely based on exploitation of Rangia.

Navigation through Lake Pontchartrain has existed since the early exploration of Louisiana. In fact, the shorter route to the gulf provided by the Bayou St. John/Lake Pontchartrain/Rigolets or Chef Menteur Pass route was a primary consideration in the founding of New Orleans. Commercial navigation in the lake continued throughout the 18th and 19th century first with extension of Bayou St. John by construction of the Carondelet Canal, and later by construction of the New Basin Canal into the growing city of New Orleans. Numerous historic shipwrecks are reported in Lake Pontchartrain.

Historic cultural resources in the study area also include approximately 150 recreational camps located along the Orleans Parish shoreline east of Lakefront Airport. Most of these structures are built on pilings some distance out in the lake with piers providing access to the shore. Some of the camps are reported to date from the late 19th century. Prior to the development of the New Orleans Lakefront between West End and the Lakefront Airport in the late 1920's, similar structures dotted the entire lakeshore of Orleans Parish from West End to South Point.



Recreational Resources. A linear recreational environment exists adjacent to the Lake Pontchartrain shoreline. Many recreational areas are currently existing and several are planned for future development. The Jefferson Parish Department of Recreation has developed a recreation master plan, dated March 1982, which encompasses all facilities to date and identifies additional area development. Increased demand for water-oriented recreation will continue until met via additional development such as that contained in the above mentioned master plan. Also contained in the Jefferson Parish Master Plan is a multi-million dollar recreational development which includes several boat launching areas, improvement of a 10.5-mile long National Recreation Trail, yacht harbors, marinas, private camps, and significant nodes of public/private neighborhood recreational developments with ancillary features. These recreational features are located exclusively on the narrow strip of land between the levee crown and the lakeshore. Activities occurring on existing facilities or in the vicinity of the project area include: boating, boat and bank fishing, crabbing, shrimping, skiing, sailing, picnicking, jogging, horseback riding, biking, walking for pleasure, field sports, sightseeing, and observation of wildlife. The existing facilities are adjacent to large residential areas, and attract heavy usage year round.

#### **AUTHORIZED AND EXISTING HURRICANE PROTECTION WORKS**

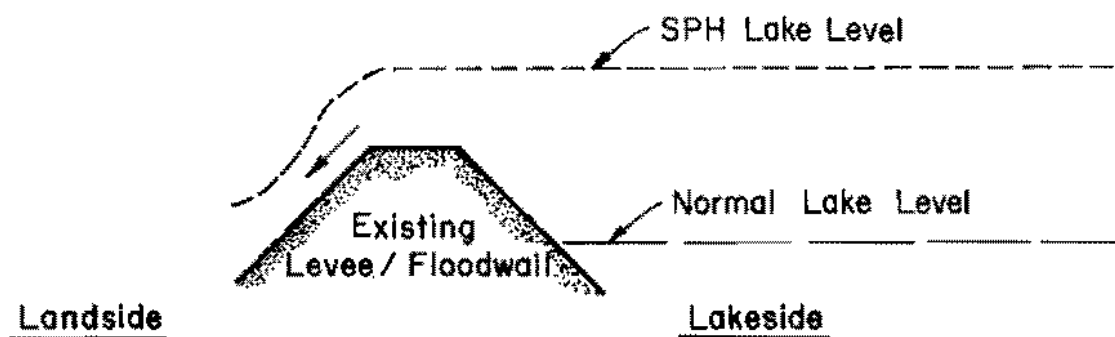
The Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection project has been under construction since 1966. Portions of the plan incorporate features which previously had been constructed under other Federal authorities (Jefferson Parish Lakefront Levee), an unconstructed feature of the MR-GO project (Seabrook lock), and several features constructed by local interests. The authorized plan consists of two basic elements; barrier complexes at Lake Pontchartrain's three main tidal entrances and levees/floodwalls. Features of the plan are shown on Plate 3. Completion of this plan would provide protection

against the Standard Project Hurricane (SPH), defined as the most severe hurricane which can be reasonably expected to occur from a combination of meteorological and hydrological events reasonably characteristic of the area.

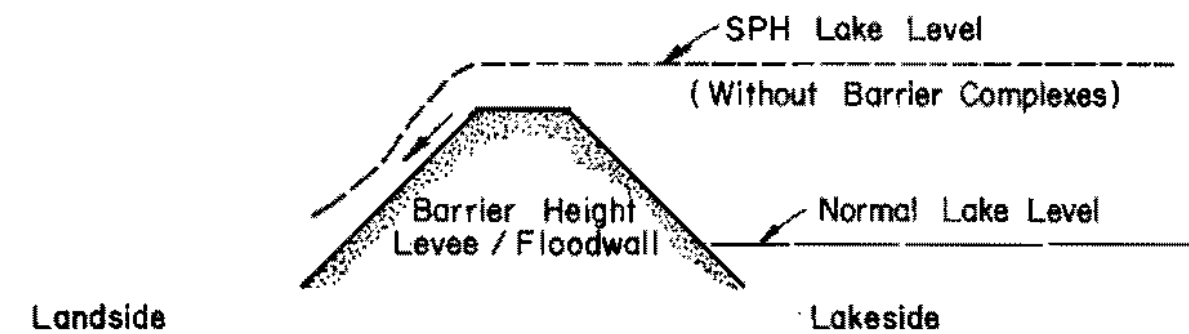
AUTHORIZED BARRIER COMPLEXES. The purpose of the barrier complexes is to allow closure of Lake Pontchartrain's main tidal passes during the approach of a hurricane from the Gulf of Mexico. The water levels in the lake thus can be kept at lower levels than that which normally would occur, thereby reducing required levees or floodwall heights. Figure 1 shows the planned effects of the barrier complexes upon Lake Pontchartrain's water levels during a hurricane occurrence. The proposed barrier complexes would be located at The Rigolets, Chef Menteur Pass, and at Seabrook (at the lakeside mouth of the IHNC). The only feature of any of these proposed complexes yet constructed is the GIWW navigation channel bypass feature of the Chef Menteur Pass complex. The modified 1977 court injunction precludes construction of either The Rigolets complex or Chef Menteur complex until such time a legally adequate supplement to the existing EIS is filed with the Environmental Protection Agency (EPA).

The Seabrook complex is a feature of the MR-GO navigation project, however, it also can serve as a barrier feature for hurricane protection. Thus, the authorization of the hurricane protection project provides for the construction costs of the Seabrook complex to be shared on a 50/50 basis between the MR-GO project and the hurricane protection project. The court injunction does not preclude work on the Seabrook complex, but physical construction of this feature has not been initiated.

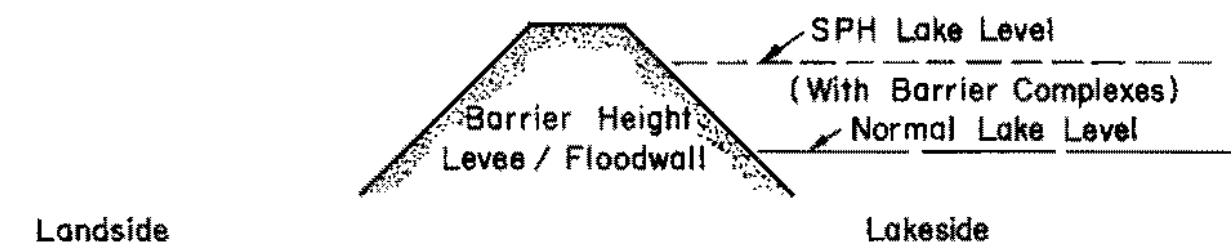
LEVEES/FLOODWALLS. The levee/floodwall features of the current plan of improvement (exclusive of the tie-in levees associated with the barrier complexes) encompass six distinct areas of protection: the Chalmette Area, the Citrus-New Orleans East Area, the New Orleans Area, the



EXISTING - WITHOUT PROJECT CONDITIONS



WITH LEVEES RAISED TO BARRIER PLAN HEIGHTS, NO BARRIERS



LEVEES RAISED TO BARRIER PLAN HEIGHTS WITH BARRIER COMPLEXES IN PLACE

EFFECTS OF BARRIER STRUCTURES ON LAKE LEVELS

FIGURE 1

Jefferson Parish Area, the St. Charles Parish Area, and the Mandeville Seawall, located on the north shore of Lake Pontchartrain along the lakefront of the town of Mandeville. Plate 4 shows the separable areas of protection.

Chalmette Area Plan. This ring levee system encompasses the populated area of St. Bernard Parish, a large portion of St. Bernard wetlands, and a portion of Orleans Parish located to the south of the GIWW. The levee system makes use of the existing Mississippi River levee to the west. The northern and eastern portions of the system utilize a dredged material disposal bank along the MR-GO as a levee base. There are navigable floodgates at Bayou Bienvenue and at Bayou Dupre, along the eastern portion of the levee system. These floodgates normally remain open and allow for navigation, gravity drainage, and tidal exchange to the inclosed wetlands. A gravity drainage structure is under construction at Creedmore Canal in the southern portion of the levee system. The levee system, designed to have net grades ranging from 17.5 feet to 14.0 feet, currently is under construction. The area protected by the Chalmette Area Plan is subject to a hurricane flood threat from Lake Borgne rather than Lake Pontchartrain; therefore, construction of the proposed barrier complexes are not related to this portion of the project.

Citrus-New Orleans East Area. The levee system follows an alignment of the levee system which was in place at the time of project authorization. The system encompasses two distinct areas, the Citrus area to the west and the New Orleans East area to the east. The line of demarkation between the two areas runs generally north from the Michoud Canal and along Paris Road, following an existing low level non-Federal levee. Comprised mostly of nonwetland areas, the Citrus area was partially developed at the time of project authorization and has experienced significant growth. Much of the New Orleans East area is wetlands and has remained basically undeveloped; however, there has been

increasing pressure for large scale development of the area in recent years.

To the west, preproject earthen levees along the IHNC, which had a grade of 8.6 feet, have been raised to 13-14 feet by floodwalls with some short sections of earthen levees. This floodwall work is essentially complete. Along the lakefront from the IHNC to South Point, preproject protection was provided by a floodwall built around the lakefront of the New Orleans Airport to an elevation of 10.5 feet. This floodwall ties into the Southern Railroad embankment which parallels the lakefront and has an elevation of 8.3 feet. Neither the airport floodwall nor the railroad embankment was adequate to meet the Corps design criteria.

Project protection along the lakefront consists of an earthen levee located just to the landside of the railroad embankment with net design grades ranging from 13.5 to 14 feet, with two exceptions; about 1/2-mile of floodwall in front (to the landside) of the airport, and about 1/4-mile of floodwall to an elevation of 11 feet on the landside of the area known as Lincoln Beach.

Along the eastern boundary of the Citrus-New Orleans East area, from the lakefront at South Point to the GIWW, project protection is provided by the South Point-to-GIWW levee which is built upon an existing locally constructed levee. The preproject grade of the levee was 10.6 feet and the project design grade varies from 12.5 to 14 feet. The southern portion of the Citrus-New Orleans East levee system is built upon a locally constructed levee paralleling the GIWW. The preproject grade of the levee varied from 8.6 to 13 feet. The grade of the project levee varies from 14 to 17.5 feet, with the exception of floodwalls surrounding the Michoud Canal which range in grade from 20 to 22 feet. The lakefront levees, South Point-to-GIWW levee and levees paralleling the GIWW (back levees) are nearing completion. It should be

noted that because the back levees and IHNC floodwalls do not front Lake Pontchartrain, their designs are not affected by construction of the barrier complexes.

New Orleans Area. This area is protected on the south by the existing Mississippi River levee, a feature of the Flood Control, Mississippi River and Tributaries project. To the east, the area is protected by levees and floodwalls on the west bank of the IHNC. The west bank of the IHNC originally had an earthen levee built to an elevation of 8.6 feet. Subsequently, this was raised to a design grade of 13 to 14 feet by means of a floodwall, with the exception of some short reaches consisting of levees.

Preproject protection along the New Orleans lakefront consisted of a seawall backed by a low levee from the Jefferson Parish line to the IHNC. The first 1/2-mile adjacent to Jefferson Parish is a seawall having a vertical crown of 6.5 feet protected by a breakwater at an elevation of 5.0 feet, forming the Orleans Marina. It is backed by a levee with an elevation of 9 feet. To the east of the harbor area, a stepped-type seawall with a crown elevation of 7.2 to 8.0 feet extended along the lakefront to the IHNC. Several hundred feet landward of the seawall, a small levee with a crown elevation of 8.6 feet provided secondary protection. The western boundary of the western New Orleans area was protected by a return levee paralleling the western bank of the Metairie (17th Street) Outfall Canal, and the lakefront protection system tied into the Jefferson Parish lakefront protection system.

The current plan of improvement would increase the net grade of the preproject earthen levee to 12 feet, with the exception of about 1,300 feet of floodwall built around the Orleans Marina and approximately 550 feet adjacent to the marina. This section would have a net grade of 10.5 feet, and would tie into the earthen levee system. The floodwall is complete, while the levee is presently at a net grade

of about 11.5 feet. Portions of the levee system have been raised to 16 feet by local authorities as a means of interim protection; however, the levee cross-section is not built to Corps criteria. Additionally, gaps in the levee system exist at road crossings.

New Orleans has three outfall canals for pumping stations at 17th Street (Metairie Outfall Canal), Orleans Avenue, and London Avenue which provide the major drainage for the city. These are shown on Plate 5. The pumping stations are set back 1 to 3 miles from the lakefront. Additionally, Bayou St. John, formerly a navigable channel, is now closed by floodgates about 1/2-mile inland from the lakefront. At the time of project authorization, the return levees paralleling the outfall canals to the pumping stations and Bayou St. John to its floodgates were considered adequate. Subsequently, they were determined to be inadequate in terms of grade and stability. Some of the return levees (of varying elevations) have been improved by local interests since the initial authorization, but still are considered inadequate under current design criteria. A number of solutions have been considered to correct these deficiencies in New Orleans' levee system, but no final decision has been reached.

The 17th Street Outfall Canal runs along the Jefferson/Orleans Parish line. It not only provides drainage for Orleans Parish, but also for a portion of Jefferson Parish. A return levee paralleling the west bank of the canal extends from the Mississippi River to Lake Pontchartrain. The return levee is considered inadequate in terms of preventing canal overflow during an SPH event, and there are two highway crossing gaps in the return levee; however, the levee is considered an effective enough barrier to prevent major flood exchange between East Jefferson Parish and the west New Orleans area to render the two areas independent when considering hurricane flood protection.

Jefferson Parish. This area lies on the east side of the Mississippi River, protected on the south by the existing Mississippi River levee. To the north, the area is protected by a lakefront levee constructed during the early 1950's under the authority of the Flood Control, Mississippi River and Tributaries project. The levee, with a net grade of 10 feet, is considered adequate to provide protection in tandem with barrier structures, with the exception of requiring additional foreshore protection (rip rap). The area is bounded on the east by the west bank return levee of the 17th Street Outfall Canal, and on the west by a return levee paralleling an outfall canal at the St. Charles Parish line.

There are four main pumping stations located along the Jefferson Parish lakefront levee which form an integral part of the mainline protection. The stability of the pumping stations was not considered to be either a problem or Federal responsibility at the time of project authorization; however, they were later determined to be structurally inadequate in terms of ability to withstand hurricane tidal surges from the lake. Local interests are in the process of providing adequate frontage protection for the four stations. It has been determined that this locally performed frontage protection work will meet Corps criteria, and that the work falls within the purview of the project, i.e., can be cost-shared as part of hurricane protection project related work. Local interests also have raised the lakefront levee by means of levee work and steel sheet piling to 14 feet for interim protection. Because the work did not affect the stability of the Federal levee, it was permitted; however, the Corps does not consider the parish to have design protection to 14 feet because the designs do not meet Corps criteria.

St. Charles Parish. From the standpoint of hurricane protection, the present condition of this area east of the Mississippi River is the same as it was prior to authorization of the hurricane protection project.



The area is bounded to the east by a levee along the St. Charles/Jefferson Parish line, to the south by the Mississippi River levee, and to the west by the east guide levee of the Bonnet Carre' Spillway. Although a small strip of St. Charles Parish is located just to the west of and parallel to the Bonnet Carre' Spillway, there is little development in that portion of the parish. The area to the north of US Highway 61 (known locally as the Airline Highway) is primarily wetlands, with most development being located south of the highway. No mainline levee to protect the area against flooding from Lake Pontchartrain exists. Drainage is by gravity, although some of the developments in the area are protected by a combination of ring levees and interior pumping.

It was originally planned to provide this portion of St. Charles Parish with hurricane protection by means of an earthen lakefront levee. The levee would connect the Jefferson Parish Lakefront levee to the east with the Bonnet Carre' Spillway east guide levee to the west. The levee would be built to a net grade of 12.5 feet and have a gravity drainage structure located at its approximate midpoint. Subsequent to detailed studies of the proposed St. Charles Lakefront levee (1973), the New Orleans District decided to defer indefinitely construction of the feature as it had been originally proposed.

The decision was based on environmental considerations. The levee would alter the existing hydrology (overflow patterns) of a large area of wetlands, and thus reduce the biological productivity of these areas. Subsequent to this decision, Bayou La Branche and Bayou Trepagnier were designated as natural and scenic streams by the State of Louisiana. (See Plate 11.) Construction of the levee as originally proposed would block these two streams and contravene the State's Natural and Scenic Rivers Act. It should be noted that construction of barrier structures would provide some degree of hurricane protection for the area even if no mainline levee is constructed in St. Charles Parish.

A Federal levee, actually part of the Jefferson Parish levee, extends along the St. Charles/Jefferson Parish line for a distance of 5.0 miles. The levee has a grade of 10 feet at the lakefront and 7 feet at its inland terminus. Since the levee does not tie into the Mississippi River levee, there presently exists a substantial gap in the levee system. Additionally, the levee itself is deficient in grade and section to withstand overtopping from an SPH event. Without additional work in St. Charles Parish, the boundary levee could be flanked around its southern terminus by floodwaters in St. Charles Parish, or topped--or both. This would result in flooding of the East Bank of Jefferson Parish. The deficiencies of the return levee are such that improvement of the levee must be considered in any plan for providing adequate hurricane protection for the eastern portion of Jefferson Parish.

Mandeville Seawall. The Mandeville seawall runs along the lakefront of the town of Mandeville, located on the north shore of Lake Pontchartrain, for a distance of 1.5 miles, and has a net grade of 6 feet. Rehabilitation of the seawall, which is in a poor state of repair, is a feature of the current plan of improvement. However, the Corps has never received satisfactory assurances of local cooperation, and further study is being held in abeyance pending resolution of this issue by the Corps and local officials. Mandeville, as well as the rest of the north shore of Lake Pontchartrain, would receive some protection from hurricanes by construction of the barrier structures.

It should be noted that many of the elevations given for preproject improvements are different from those quoted in the project's authorizing document. That is because an error in the vertical datum used to determine these elevations was discovered. The discrepancies between the quoted elevations of the authorizing document and this document reflect corrections acknowledging the datum error.

## CONDITIONS IF NO FEDERAL ACTION TAKEN

HUMAN RESOURCES. Based on historical trends, population growth in the Lake Pontchartrain economic study area probably will continue. Table 9 compares OBERS BEA Regional Projections for the New Orleans SMSA prepared by the Bureau of Economic Analysis with the most recent (1976) population projections published by the University of New Orleans (UNO).

The exact location of this population growth within the five-parish economic study area will be influenced by many factors, including the availability of land in other areas, construction costs, interest rates, flood protection, environmental concerns, the proximity of housing to the work place and commercial centers, differences in lifestyles, the rising cost of home ownership relative to incomes, and the construction of two new bridges--one paralleling the existing Greater New Orleans Bridge and a second further up river at Luling, Louisiana. As the figures for St. Tammany Parish illustrate, population in the eastern portion of the study area has increased somewhat more rapidly than projected in UNO's 1976 report. Much of the new residential development which has occurred since 1970 in Orleans Parish (coextensive with the city of New Orleans) has also taken place in the eastern part of the city.

In recent years, the largest volume of population growth in the study area has taken place in Jefferson Parish. This pattern is expected to continue in the near future. The Corps' latest analysis predicts the population of St. Charles Parish to increase from 39,000 in 1985 to 60,000 by the year 2035. However, the possibility of variation could be relatively high in view of the volume of economic activity in the parish. The amount of land on both sides of the Mississippi River and Lake Pontchartrain is probably sufficient to accommodate anticipated population growth over the theoretical life of the project.

TABLE 9

POPULATION PROJECTION: NEW ORLEANS SMSA  
AND LAKE PONTCHARTRAIN ECONOMIC STUDY AREA

	1980 <sup>1/</sup>	1985	1990	1995	2000	2030
1980 New Orleans SMSA	1,186,725					
No change in share <sup>2/</sup>	-	1,250,391	1,327,657	-	1,443,682	1,717,879
Low change in share <sup>2/</sup>	-	1,212,216	1,275,472	-	1,376,981	1,634,445
Moderate change in share <sup>2/</sup>	-	1,200,790	1,252,375	-	1,333,651	1,562,256
1976 Lake Pontchartrain Economic Study Area <sup>3/</sup>						
Jefferson Parish	454,592	539,249	606,121	658,628	702,729	-
Orleans Parish	557,482	541,964	529,939	528,632	523,026	-
St. Bernard Parish	64,097	76,986	85,438	92,260	98,267	-
St. Tammany Parish	110,554	94,455	106,760	119,732	132,917	-
SMSA	1,186,725	1,252,654	1,328,258	1,399,252	1,456,939	-
St. Charles Parish	37,259	40,206	44,271	48,378	52,003	-
TOTAL	1,223,984	1,292,860	1,372,529	1,447,630	1,508,942	-

<sup>1/</sup>US Department of Commerce, Bureau of the Census, 1980 Census of Population. "Number of Inhabitants, Louisiana."

<sup>2/</sup>US Water Resources Council, 1980 OBERS BEA Regional Projections, Vol. 8, July 1981. The Low- and Moderate- variations reflect changes in the SMSA's share of the state's total employment.

<sup>3/</sup>University of New Orleans, Projections to the year 2000 of Louisiana Population and Housing, Segal et al., 1976.

ECONOMIC RESOURCES. Some local analysts have suggested that the continued growth of labor-intensive service industries requiring domestic skills, without the concurrent growth of industries requiring more technical skills, could result in a less desirable occupational mix for the metropolitan area. One of the purposes of the Almonaster-Michoud Industrial District (A-MID) project, located in eastern New Orleans and within the authorized project levees, is to generate additional employment and broaden the area's occupational base. The A-MID project is supported by both the city of New Orleans and the Board of Commissioners of the Port of New Orleans. In addition to the construction of new port facilities along the MR-GO, the project hopes to attract industries requiring more technical skills in jobs paying higher salaries.

Failure to provide adequate hurricane protection could discourage further economic growth in some of the undeveloped areas, possibly diverting capital investments to other areas with a greater level of natural flood protection, but with fewer locational advantages. Lack of industrial expansion could inhibit future commercial activity as well, although mineral production would probably continue, depending on resource availability. The area's mild climate, natural resources, transportation access, and cultural and historical significance offer future development potential; however, it will also experience the threat of future hurricanes.

EMPLOYMENT AND INCOME. Income and employment projections for the New Orleans SMSA were contained in the 1980 OBERS BEA Regional Projections prepared by the US Department of Commerce for the US Water Resources Council. These projections, shown in Tables 10 and 11, contained three levels of projections (defined in the tables) related to the possible change in the areas share of Louisiana's total employment in various industries.

TABLE 10  
NEW ORLEANS SMSA POPULATION, PERSONAL INCOME,  
AND LABOR AND PROPRIETORS' INCOME, 1969 AND 1978, AND PROJECTED, 1985-2030

	HISTORICAL				POPULATION IN SHARE <sup>1/</sup>				LOW-CHANGE IN SHARE <sup>2/</sup>				MODERATE-CHANGE IN SHARE <sup>3/</sup>			
	1969 <sup>4/</sup>	1978 <sup>5/</sup>	1985	1990	2010	2030	1969	1985	1990	2010	2030	1969	1985	1990	2010	2030
POPULATION (JULY 1)	1,038,960	1,142,054	1,210,391	1,323,657	1,442,682	1,717,679	1,212,216	1,275,478	1,376,981	1,634,445	1,800,790	1,232,375	1,333,611	1,442,438	1,592,256	1,842,944
TOTAL PERSONAL INCOME (PLACE OF RESIDENCE)	4,100,435	5,818,709	6,180,186	10,010,573	14,034,381	30,653,367	7,799,931	9,503,049	13,202,478	20,764,671	27,729,201	9,281,292	12,660,921	16,409,262	21,350,944	27,350,944
BY PLACE OF WORK																
TOTAL LABOR AND PROPRIETORS' INCOME <sup>6/</sup>	3,442,227	4,711,935	5,652,740	8,210,179	11,539,426	23,235,511	6,389,616	7,785,097	10,869,366	23,669,461	31,204,112	7,600,846	10,413,297	13,313,044	17,313,044	21,313,044
AGRICULTURAL PRODUCTION	2,772	1,938	2,304	2,546	3,082	3,281	2,244	2,462	2,964	3,032	2,223	2,423	2,886	3,032	2,886	4,259
MONTANA	3,438,495	6,709,947	6,650,444	8,207,632	11,536,343	23,230,230	6,382,372	7,781,634	10,867,402	23,664,429	31,204,112	7,598,423	10,412,411	13,313,044	17,313,044	21,313,044
PRIVATE	2,985,008	4,076,884	5,810,439	7,195,710	10,161,908	22,235,414	5,543,395	6,785,782	9,463,293	20,731,736	27,729,201	6,381,877	9,016,352	11,409,262	15,409,262	19,409,262
AGRICULTURAL SERVICES, FORESTRY, FISHERIES, AND OTHER <sup>7/</sup>	7,000	14,357	19,054	23,997	32,446	66,383	19,784	23,646	32,156	65,786	19,428	23,861	32,016	65,080	19,428	65,080
MINING	200,768	276,897	342,854	349,617	381,569	410,713	209,123	305,428	300,437	267,936	246,097	244,983	246,411	243,785	243,785	243,785
CONSTRUCTION	244,716	391,883	482,823	586,057	690,709	1,336,931	680,707	537,115	866,045	1,286,928	478,761	516,888	648,522	1,289,864	1,289,864	1,289,864
MANUFACTURING	540,067	580,369	835,478	1,185,143	1,856,825	4,306,642	799,969	1,025,172	1,340,569	3,601,346	778,102	984,973	1,380,621	2,073,962	2,073,962	2,073,962
NONDURABLE GOODS	204,749	199,373	285,772	369,993	548,387	1,234,810	254,343	313,945	452,032	1,026,424	243,313	289,374	394,546	845,934	845,934	845,934
DURABLE GOODS	335,318	381,016	549,706	815,150	1,280,438	2,071,831	545,626	711,228	1,088,537	2,575,123	534,869	675,600	986,175	1,228,028	1,228,028	1,228,028
TRANSPORTATION AND PUBLIC UTILITIES	451,061	607,138	932,996	1,196,641	1,640,022	3,468,744	891,211	1,093,591	1,520,931	3,249,036	878,524	1,041,021	1,442,438	3,014,009	3,014,009	3,014,009
WHOLESALE TRADE	317,528	420,850	595,134	716,488	972,923	2,071,831	547,230	642,348	865,132	1,760,033	354,841	413,084	545,471	1,557,205	1,557,205	1,557,205
RETAIL TRADE	378,920	516,662	699,148	845,030	1,153,039	2,424,392	691,171	856,683	1,144,705	2,401,529	693,689	833,193	1,135,871	2,374,843	2,374,843	2,374,843
FINANCE, INSURANCE, AND REAL ESTATE	228,816	309,448	470,242	597,727	878,530	2,007,966	444,462	555,731	806,668	1,863,597	433,909	535,697	757,282	1,795,758	1,795,758	1,795,758
SERVICES	621,228	896,076	1,343,018	1,760,010	2,425,541	6,247,985	1,233,638	1,743,835	2,586,642	6,179,343	1,539,028	2,174,320	3,579,500	6,088,813	6,088,813	6,088,813
GOVERNMENT	651,457	891,283	1,343,018	1,760,010	2,425,541	6,247,985	1,233,638	1,743,835	2,586,642	6,179,343	1,539,028	2,174,320	3,579,500	6,088,813	6,088,813	6,088,813
FEDERAL CIVILIAN	132,791	189,761	251,084	303,372	416,464	636,916	254,411	309,426	422,397	676,004	253,437	310,589	427,084	886,883	886,883	886,883
FEDERAL MILITARY	17,067	20,257	33,232	39,034	48,223	89,570	37,238	39,574	48,523	89,570	37,238	39,574	48,523	89,570	89,570	89,570
STATE AND LOCAL	790,629	1,121,345	1,539,630	1,956,604	2,741,814	5,511,569	1,957,402	2,404,985	3,614,221	5,402,915	1,957,402	2,404,985	3,614,221	5,402,915	5,402,915	5,402,915

<sup>1/</sup>In the low-change-in-share procedure, for each industry, the substitute area's share of the State's employment was held constant throughout the projection period. A substitute area's projected share of total (all-industry) State employment, therefore, will change only to the extent that the substitute area has a disproportionate share of the State's fast- or slow-growth industries.

<sup>2/</sup>In the low-change-in-share procedure, for each industry, the substitute area's share of the State's employment was projected to change from 1978 to 1985 at an annual rate of change equal to 75 percent of the annual rate of change equal to the share from 1969 to 1978; from 1985 to 1990, at an annual rate equal to 1/2 of the projected annual rate for 1978 to 1985; and for each succeeding 5-year period, at 1/2 of the projected rate for the preceding 5-year period.

<sup>3/</sup>In the moderate-change-in-share procedure, for each industry, the substitute area's share of the State's employment was projected to change from 1978 to 1985 at an annual rate of change equal to 65 percent of the annual rate of change equal to the share from 1969 to 1978; from 1985 to 1990, at an annual rate equal to 2/3 of the projected annual rate for 1978 to 1985; and for each succeeding 5-year period, at 2/3 of the preceding 5-year period.

<sup>4/</sup>Estimates based on the 1987 Standard Industrial Classification (SIC).

<sup>5/</sup>Estimates based on the 1972 SIC.

<sup>6/</sup>Composites of wage and salary disbursements, other labor income, and proprietors' income.

<sup>7/</sup>Composite of wages and salaries paid to United States residents working for international organizations.

SOURCE: 1980 Census, Bureau of Economic Analysis.

TABLE 11  
NEW ORLEANS, SMSA  
EMPLOYMENT BY INDUSTRY  
BY PLACE OF BIRTH, 1969 AND 1976, AND PROJECTIONS, 1985-2030

	HISTORICAL				NO-CHANGE-18-YEAR <sup>2/</sup>				LOW-CHANGE-18-YEAR <sup>2/</sup>				MODERATE-CHANGE-18-YEAR <sup>2/</sup>			
	1969	1976	1985	1990	2000	2030	1985	1990	2000	2030	1985	1990	2000	2030		
TOTAL EMPLOYMENT	648,457	846,208	651,403	710,199	797,704	924,376	631,403	682,171	760,786	879,435	625,441	689,840	786,843	840,478		
AGRICULTURAL PRODUCTION	2,790	1,651	1,559	1,451	1,292	1,031	1,513	1,403	1,361	980	1,300	1,381	1,310	945		
MANUFACTURING	445,467	546,358	646,830	708,748	785,413	923,348	619,890	680,748	759,533	876,454	623,961	688,459	735,753	838,883		
PRIVATE	375,907	460,428	554,387	606,616	684,574	797,303	534,566	576,860	648,023	753,063	528,716	586,679	654,454	714,893		
AGRICULTURAL SERVICES, FORESTRY FISHERIES, AND OTHER	1,622	2,225	2,786	3,120	3,670	4,427	2,784	3,109	3,649	4,398	2,791	3,113	3,638	4,360		
MINING	15,667	17,652	17,608	18,771	12,493	7,506	15,433	13,745	10,430	6,236	15,157	12,807	14,606	1,324		
CONSTRUCTION	26,721	39,076	44,746	49,907	43,011	38,718	43,704	43,526	41,478	37,472	43,345	42,865	40,389	35,912		
MANUFACTURING	57,321	51,672	55,119	75,120	51,784	111,431	58,094	61,643	76,943	95,940	56,159	60,618	68,346	81,340		
NONDURABLE GOODS	25,285	21,455	25,997	29,291	34,866	43,513	22,854	24,817	28,777	35,908	21,664	22,835	24,525	29,114		
DURABLE GOODS	32,036	30,217	29,126	45,829	56,897	71,920	35,150	39,846	48,228	60,441	34,232	37,782	43,821	52,135		
TRANSPORTATION AND PUBLIC UTILITIES	47,807	51,416	58,354	62,501	68,513	76,340	55,583	58,678	63,610	70,613	56,642	56,780	60,060	65,118		
WHOLESALE TRADE	32,614	30,967	46,552	50,140	55,274	62,411	45,623	44,700	48,260	54,144	41,599	42,354	44,164	47,619		
RETAIL TRADE	46,773	59,363	114,901	126,649	143,020	163,917	113,952	125,845	141,918	164,580	113,742	124,793	142,995	162,944		
FINANCE, INSURANCE, AND REAL ESTATE	24,596	32,319	43,091	48,832	57,817	72,253	40,613	45,244	52,672	65,789	39,788	43,329	49,499	59,993		
SERVICES	101,844	131,756	151,596	180,150	208,934	254,581	161,449	178,922	208,612	253,981	161,265	179,603	207,746	253,374		
GOVERNMENT	65,560	83,930	95,463	109,136	111,813	125,744	95,704	101,908	111,531	127,391	95,245	101,760	111,278	131,908		
FEDERAL CIVILIAN	13,736	23,806	17,421	18,577	20,443	23,419	17,657	18,935	20,685	23,959	17,756	19,089	21,155	24,371		
FEDERAL MILITARY	6,909	7,370	7342	7,342	7,342	7,342	7,342	7,342	7,342	7,342	7,342	7,342	7,342	7,342		
STATE AND LOCAL	48,915	60,514	70,704	76,218	84,049	94,983	70,275	75,631	83,946	94,069	70,133	75,349	88,772	98,276		

1/In the no-change-in-share procedure, for each industry the substate area's share of the State's employment was held constant throughout the projections period. A substate area's projected share of total (all-industry) State employment, therefore, will change only to the extent that the substate area had a disproportionate share of the State's fast- or slow-growth industries.

2/In the low-change-in-share procedure, for each industry, the substate area's share of the State's employment was projected to change from 1976 to 1980 at an annual rate of change equal to 1/3 percent of the annual rate of change equal to the share from 1969 to 1976; from 1980 to 1985, at an annual rate equal to 1/2 of the projected annual rate for 1976 to 1980; and for each succeeding 5-year period, at 1/2 of the projected rate for the preceding 5-year period.

3/In the moderate-change-in-share procedure, for each industry, the substate area's share of the State's employment was projected to change from 1976 to 1980 at an annual rate of change equal to 85 percent of the annual rate of change in the share from 1969 to 1976; from 1980 to 1985, at an annual rate equal to 2/3 of the projected annual rate for 1976 to 1980; and for each succeeding 5-year period, at 2/3 of the projected 5-year period.

SOURCE: 1990 BUREAU OF ECONOMIC PROJECTIONS

At the present time, the low-change-in-share projections have been determined to represent the most likely growth trend for the New Orleans SMSA (Jefferson, Orleans, St. Bernard, and St. Tammany Parishes). The Corps' latest analysis of projected population growth in St. Charles Parish indicates a somewhat higher rate of increase than anticipated for the SMSA, based on historical trends. Population in St. Charles Parish is expected to increase from 39,000 in 1985 to 60,000 by the year 2035. The possibility for significant variations from these figures, however, seems relatively high because of their dependency on the factors discussed previously.

LAND USE. The same conditions which will influence future economic growth in the area will influence land use. If hurricane protection is not provided, land use densities probably will increase in the more protected areas of the project and stimulate growth in adjacent areas. Without additional protection, the demand for (and value of) the more protected adjacent lands within the economic study area would tend to increase. The higher land values would be reflected in the cost of home ownership, commercial property, and eventually the cost of goods, services, and overall cost-of-living.

#### **ENVIRONMENTAL RESOURCES**

WATER QUALITY. Projected future water quality conditions for the project area were modeled in conjunction with the New Orleans-Baton Rouge Metropolitan Area Water Resources Study, completed by the New Orleans District, Corps of Engineers in 1981. Data from that study, combined with additional information, provides an overview of future conditions.



Dissolved oxygen, pH, and fecal coliform violations are expected to continue along the southern shore of Lake Pontchartrain. Jefferson Parish has proposed to construct a regional wastewater treatment facility which will have an outfall in the Mississippi River rather than in a storm water drainage canal leading to the lake. The southern portion of Lake Pontchartrain has been identified as eutrophic, and the condition is expected to worsen.

In the IHNC and GIWW, a continuation of fecal coliform violations is expected, and occasional dissolved oxygen violations are anticipated. Fecal coliform violations can be reduced by disinfecting municipal waste and storm water from the New Orleans area. Occasional violations of dissolved oxygen, pH, and fecal coliform would occur in the MR-GO, caused by inadequate treatment of municipal wastes, urban storm water runoff, wastes from camps and individual homes, and/or solid wastes. Coliform violations are of particular concern because of the numerous connections with Lake Borgne. As with most other water bodies in the area, Lake Borgne is expected to have occasional dissolved oxygen, pH, and coliform violations. These are expected to continue until measures are taken to improve water quality in the MR-GO, Lake Pontchartrain, and Lake St. Catherine.

BOTANICAL AND ZOOLOGICAL RESOURCES. The most significant change in vegetation would be loss of marsh habitat, which would result in a decrease in the wildlife and fishing resources of the area. Most of this loss would be through the conversion of these productive marshes to less productive open water through subsidence and erosion. Marsh would also be converted to levees, disposal and developed areas, scrub shrub forest and upland developed habitat types. At the present time, there are 2,417 acres of brackish-saline marsh in the area subject to potential construction impact by the authorized plan or alternatives developed to that plan. By the year 2100, there would be only an estimated 857 acres remaining.

While the projected loss rate is numerically not as high as that associated with marshes, the forested habitats also will be decreased mainly at the expense of a gain in the upland developed habitat type through urban growth. These forested habitats, especially the bottomland hardwoods, are very important to wildlife due to the limited existence of such resources. The continued loss of these resources would result in a significant reduction of fish and wildlife resources in the study area. There are presently 41 acres of bottomland hardwoods and 213 acres of cypress tupelo in the area of potential construction impact. By the year 2100, these acreages are estimated to be 3 and 56, respectively. Additional information concerning biological and zoological resources can be found in the EIS.

If one or several hurricanes struck the project area, there would be some damage to the cypress-tupelo forests because of the saline waters that the hurricane would push inland. Fresh marsh could also be adversely impacted by saline waters; it might become a more brackish type or become open water. Some wildlife would be drowned by hurricane tides. Fisheries would probably not be impacted by hurricanes.

CULTURAL RESOURCES. The National Register properties and districts located within the present and proposed levee system would be vulnerable to hurricane-related flood damage. Other historic properties not presently listed in the National Register would be subject to the same effects.

The Mandeville seawall is subject to collapse during hurricane or other storm-generated wave action. Such a collapse could lead to erosion and flood damages to the historic town of Mandeville. In particular, the three National Register properties located on Lakeshore Drive and the proposed historic district would be adversely affected by failure of the seawall.

The many archeological sites located throughout the marshes and swamps of the study area would continue to be adversely affected, as a result of the urban growth, industrialization and related development which will continue to expand into presently undeveloped low-lying areas. The shoreline retreat and the destructive natural forces of subsidence and erosion also will continue.

RECREATIONAL RESOURCES. If no Federal action is taken, the proposed project area will continue to experience an increase in urban population. Current facilities are now being used extensively by residents of the Greater New Orleans area. Newly constructed boat launches and park areas along Lake Pontchartrain in Jefferson Parish are of ample size and quality to lessen the pressure on current needs; however, future expanded populations will require additional recreational facility development as well as improvement and expansion of existing facilities.

The Jefferson Parish Recreation Department has developed a Recreation Master Plan dated March 1982. Contained in this plan are four sites along the lakefront identified for future recreational development. These include the proposed Bucktown Park with marina, increased development of the linear park system, the proposed Causeway Center development, and a recreational development adjacent to the new Williams Boulevard boat launch.

Orleans Parish also will experience increased demand for recreational facilities, especially in the vicinity of Lake Pontchartrain. The existing green spaces and "pocket parks" adjacent to the existing levee on the batture side are at times utilized to their maximum capacity for activities such as picnicking, jogging, walking for pleasure, sightseeing, and field sports. Fishing, crabbing, and sightseeing are primary activities which occur close to the lake's edge.

St. Bernard and St. Charles Parishes do not have the intensity of recreational development existing in Jefferson or Orleans Parishes. Land- and water-related recreational activities coexist in this area, and are dominated by fishing and hunting. These areas will continue to provide an attractive base for future use, and an increasing demand will be placed on existing recreational facilities in the area. As the existing recreational areas will not satisfy the additional recreational demand, increased development of facilities will be required.

#### **PROBLEMS, NEEDS, AND OPPORTUNITIES**

The primary problems, needs, and opportunities identified in this study relate to the adequacy of the existing level of hurricane protection for the Metropolitan New Orleans area.

PROBLEMS CONCERNING IMPROVED HURRICANE PROTECTION. Because of the extent and types of existing development, limitations on the times for advance flood-forecasting, and limitations on the capacities of hurricane evacuation routes, development of strictly nonstructural measures would not be responsive to the problems and needs of the area related to the threat of hurricane flooding. Conversely, the nature of the area's natural environment and degree of existing development dictate that any feasible structural measures probably would result in some environmental losses and/or social disruptions. The projected decline in marsh acreage in the absence of additional Federal action could increase wave surge damages since the marshes would no longer be there to attenuate such surges.

NEEDS AND OPPORTUNITIES FOR IMPROVED HURRICANE PROTECTION. As it currently exists, the ongoing project provides varying degrees of protection to the populated areas of Jefferson, Orleans, and St. Bernard Parishes. As yet, no protection to St. Charles and St. Tammany Parishes has been accomplished under the project. However, there is a

recognizable potential for the occurrence of hurricane flooding events which would exceed the existing levels of protection. Projections indicate the population in the study area will continue to increase with an attendant increase in economic investments in the area. The potential loss of life and property damage from a hurricane will escalate accordingly. There is a need to provide adequate hurricane protection in the study area. The opportunity exists to increase the levels of protection to those areas which currently enjoy some degree of hurricane protection, and also to extend hurricane protection to surrounding areas which do not now enjoy any such protection.

The reevaluation study provides the opportunity to assess methods of reducing adverse environmental impacts. Measures such as levee realignments and alternative construction methods will be investigated.

IMPROVEMENTS DESIRED. The controversy surrounding the originally conceived project which culminated in the 1977 court injunction indicated that, while the general public and special interest groups are in support of urban hurricane protection for the study area, there is a widespread desire that potential adverse project impacts upon the natural and social environment be minimized. The input received at the 21 November 1981 and the 12 April 1984 meetings held in New Orleans confirmed these basic public concerns. In particular, environmental interests are opposed to the enclosure of wetland areas by levees and the use of hydraulic fill from Lake Pontchartrain. The project as conceived at the time of congressional authorization has legal assurances from local sponsors. The local sponsors still desire hurricane protection against SPH flooding; however, some of the sponsors have expressed concerns that modifications to the existing plan of improvement might increase their financial responsibilities.

## **PLANNING CONSTRAINTS**

Legislative and executive authorities have specified the range of impacts to be assessed, and have set forth the planning constraints and criteria which must be applied when evaluating alternative plans. Plans must be developed with due regard to the benefits and costs, both tangible and intangible, as well as associated effects on the ecological, social, and economic well-being of the region. Federal participation in developments also should insure that any plan is complete within itself, efficient and safe, economically feasible in terms of current prices, environmentally acceptable, and consistent with local, regional, and state plans. As far as practical, plans should be formulated to maximize the beneficial effects and minimize the adverse effects of the considered improvements. Adverse environmental impacts will be mitigated to the extent justified on a monetary and non-monetary basis.

The project, as originally conceived and authorized by Congress, is being built to provide SPH protection. Total flooding resulting from the occurrence of a SPH event in the New Orleans area would be potentially catastrophic in terms of loss of human life and in human suffering. Current Corps of Engineers planning criteria for urban flood protection states that when the potential for catastrophic loss of life exists SPH should be the minimum level of protection recommended unless there are other overriding considerations. Since no such considerations can be identified, provision for SPH protection as a minimum level of protection was assumed to be the primary planning constraint.

## **PLANNING OBJECTIVES**

The following planning objectives were established in response to the identified problems, needs, and opportunities.

- o provide more adequate hurricane protection for the east bank of the Metropolitan New Orleans area;

- o maximize the project's contribution to the Nation's economic development by reducing hurricane-related flood damages;

- o minimize adverse impacts to the natural environment and social well-being.

The following paragraphs present the planning rationale and the results of study efforts in delineating, combining, evaluating and assessing measures and plans, to meet the primary planning objective--improved hurricane protection for the New Orleans metropolitan area.

#### **MANAGEMENT MEASURES**

Management measures considered for providing improved hurricane protection for the New Orleans metropolitan area were limited to those such as levees, floodwalls, and floodgates to reduce flooding from hurricane-driven surges. These structural barrier measures include those which provide direct protection to developed areas and those which reduce flooding to developed areas along Lake Pontchartrain by preventing hurricane-driven surges from entering the lake.

Nonstructural measures such as flood-forecasting, combined with evacuation, and the national flood insurance program are currently employed in the study area and will continue to be employed over the period of analysis, with or without further Federal action. There are no other practicable nonstructural measures for improving hurricane protection to the study area.

## PLAN FORMULATION RATIONALE



Alternative plans for providing improved hurricane protection for the New Orleans metropolitan area were limited to those which would provide, as a minimum, SPH protection. The SPH is a theoretical event; that is, a design concept which represents a composite of storm parameters estimated from historic events. Alternatives were not designed to protect against a specific historic hurricane; instead, the hurricane(s) used in the design of alternative plans were based upon the estimated probabilities of various hurricanes occurring with given magnitudes of certain important storm parameters such as central barometric pressure, wind speeds, forward translation speeds, storm tracks, etc. The selection of the value(s) of the parameters are based on historic data and experience. The alternative plans are not based upon one theoretical SPH event, but upon several SPH events, each of which would be critical to a given project reach. Levees along the New Orleans lakefront were designed to protect against the worst probable hurricane likely to occur in terms of flood threat to that specific area. For example, levees along the Jefferson Parish lakefront were designed against a similar type event, but not necessarily the same event considered critical to the New Orleans lakefront. Thus, alternative comprehensive plans were designed to protect against several theoretical worst probable hurricanes. While a SPH event does not have a specific frequency, the design SPH storm for protection bordering Lake Pontchartrain has a return frequency of approximately 300 years. The return frequency of the design SPH critical to the Chalmette, Inner Harbor, Citrus Back, and New Orleans East Back Levees is approximately 200 years.

Protection from the SPH was the minimum level of protection considered appropriate for recommendation due to the catastrophic impacts which would result from the overtopping of levees and floodwalls protecting such a densely-populated urban area. Extensive property



damage and risk to human life would occur if structures providing lower levels of protection experienced significant overtopping during a hurricane more severe than the design storm.

There are two purposes of the studies presented herein. One purpose was to develop sufficient data to allow a rational decision on the best way to complete the project; that is, the economic costs and benefits and environmental impacts which already have been incurred as a result of prior project construction were not factors in plan formulation purposes, and are not reflected in the main report. The second purpose was to analyze previous impacts as well as those which might occur as a result of detailed plans. This data has been used to prepare the accompanying EIS supplement and to determine the amount of mitigation necessary. (A separate Mitigation Report/EIS is presently being prepared.)

As construction of the authorized hurricane protection project is ongoing, and the analyses required for this study are time consuming and cannot be continuously adjusted as construction progresses, it was necessary to freeze construction activities at some point in time. For purpose of economic analysis, existing conditions are defined as 1 October 1979 conditions. Accordingly, costs-to-complete reflect costs beginning 1 October 1979. Costs incurred before that date are the same for all plans, and do not affect plan selection. Costs reflect 1 October 1981 price levels, and the annual discount rate used for formulation was the rate in effect when construction funds for the project were first appropriated, 3 1/8 percent. The economic period of analysis (project life) used was 100 years beginning in 1993 for the barrier plan and 1988 for the high level plan. These years represent

the point of beneficial completion defined as achievement of 100-year level of protection. Environmental impacts which already have occurred or can be reasonably expected to occur in the near future, based upon current construction scheduling, can be quantified through 1983. Therefore, existing conditions for environmental analysis are defined as 1984 conditions.

Incremental analysis of the separable project areas and the sensitivities of variations in levels of protection, annual discount rates, and design methods will be discussed in the recommended plan section and in Appendix B, Economic Analysis.

#### **PLANS CONSIDERED IN PRELIMINARY PLANNING**

Two design concepts formed the basis for the formulation of all preliminary planning alternatives. One concept would utilize barrier structures at the lake's main tidal passes in conjunction with levee/floodwall works. Plans based upon this concept, which are similar to the authorized plan, are hereafter referred to as barrier plans. The other concept would depend solely upon raising levees and floodwalls. Plans based upon this design concept are hereafter referred to as high level plans.

Alternative levee alignments were considered for the New Orleans East and St. Charles Parish areas with both the barrier and high level design concepts. The other areas are completely developed and/or have existing levee systems developed to an extent that make alternative alignments impracticable. Work on levees and floodwalls for the authorized plan (the barrier design concept) has progressed to a stage that precludes alternative construction methods for these features. With the high level design concept, these levee and floodwalls would be significantly higher in some reaches and a sufficient amount of work remains to allow the development of alternative construction methods.

With the barrier design concept, the barrier control structures may need to be enlarged for environmental considerations.

BRIEF DESCRIPTION OF PLAN ELEMENTS. All plans were compared to the Future With No Additional Federal Action Condition. This condition assumes that hurricane protection improvements as they existed in October 1979 will continue to be operated and maintained over the project life. Actually, some additional work, such as some levee gap closures, would be completed to a degree of protection comparable to that of the rest of the levee. The various project reaches presently have different levels of protection as a result of being in various stages of construction.

Elements Common To All Plans. Some elements would be common to any barrier or high level plan developed. Some levees and floodwalls would follow the same alignment and have the same design under either type of plan as they would not be affected by the construction of the barriers. These levees and floodwalls include those in the Chalmette area, along either side of the IHNC, and along the Citrus-New Orleans East back levee between the IHNC and the point where the alternative Maxent Canal alignment intersects the levee. The Mandeville seawall feature does not provide hurricane protection; therefore, its design is not dependent on whether barriers are constructed. The alignment of the levees along the Citrus Lakefront, the New Orleans Lakefront and the Jefferson Parish Lakefront would be the same with or without barriers, although these levees would be significantly larger without the barriers. The advanced state of construction of existing levees and the extensive development in these areas make alternative alignments impracticable in these reaches.

BARRIER STRUCTURE(S) ALTERNATIVES. The barrier complexes included in the authorized plan and presented in the August 1974 EIS would be constructed at Lake Pontchartrain's three main tidal passes; Seabrook,

The Rigolets, and Chef Menteur Pass. Any barrier plan would require barrier complexes at all three locations; however, it is possible that the current designs would not be appropriate. Potential design modifications do not stem from any engineering deficiencies, but to the possible need to increase the size of the openings to minimize adverse effects upon the transport of biological, chemical, and physical constituents through The Rigolets and Chef Menteur Pass. (No modification for the Seabrook complex would be necessary.) The transport of such constituents is considered essential to the biological viability of the lake, and severe restrictions may have a significant adverse effect.

A number of complicated, time consuming, and expensive environmental-related studies would be required before a determination could be made as to the most suitable size of barrier complex. Cost estimates were developed for three sizes of complexes at The Rigolets and Chef Menteur Pass. These estimates, shown in Table 12, provide a means of assessing the costs involved in modifying the structures to any reasonable size. Because conduct of the necessary studies would have delayed this planning effort, the decision was made that, for preliminary plan formulation analysis, the costs of the smallest (and least expensive) complexes would be considered for the barrier plans. Selection of the least expensive complex would present the barrier plan from the most favorable economic standpoint. If necessary, the sensitivity of the results of the formulation analysis to barrier sizes and costs can be determined.

Figures 2, 3, and 4 depict artist's view of the conceptual designs of the Seabrook, Chef Menteur Pass, and The Rigolets complexes which were used in the development of cost estimates.

Levee Alinements. Because of the degree of existing development, there are practicable limits to levee alignment variations. There are

TABLE 12

ESTIMATES OF FIRST COSTS TO COMPLETE BARRIER COMPLEXES  
(1,000's of 1981 dollars)

COMPLEX	SIZE	COST
Seabrook	N/A	45,725 <sup>1/</sup>
Chef Menteur Pass	43% of Natural Opening <sup>2/</sup>	109,301
	50% of Natural Opening	119,192
	90% of Natural Opening	151,093
The Rigolets	35% of Natural Opening <sup>2/</sup>	195,501
	50% of Natural Opening	228,215
	90% of Natural Opening	325,006

<sup>1/</sup>Reflects only 50 percent of total first cost, which is hurricane protection project share, the other 50 percent is to be borne by the MR-GO navigation project.

<sup>2/</sup>1975 designs.

reasonable alternative alignments to the existing levee system only in two areas; the Citrus-New Orleans East area, and the East Bank of St. Charles Parish area.

Citrus-New Orleans East Levee Alignments. In the Citrus-New Orleans East area, the existing levee system incloses a large area of wetlands. Several groups and individuals are of the opinion that development of these wetlands would not be in the public interest. Further, the view has been expressed that the wetlands could be made much more productive if normal tidal exchange were reestablished. For these reasons, an alternate levee alignment was considered which would protect nonwetland areas which are presently developed or subject to development, but which would exclude wetland areas encompassed by the existing levee system. This alternative is called the Maxent Canal alignment, because a portion of it parallels a local drainage channel known as Maxent Canal. The alternative levee alignments in the New Orleans East area are shown on Plate 6.

St. Charles Parish Levee Alignments. The St. Charles Parish area east of the Mississippi River presently is not protected from hurricane tidal flooding from Lake Pontchartrain. A levee along the St. Charles Parish lakefront between the Jefferson Parish Lakefront levee on the east and the Bonnet Carre' Spillway on the west was a feature of the authorized plan; however, because of environmental concerns and considerations, its construction was indefinitely deferred in the early 1970's. Since the time the lakefront levee was proposed, the economic criteria which are applied to flood damage reduction projects to determine their economic feasibility has changed considerably, particularly with respect to the development of wetlands. Additionally, a suit was entered in the same court which enjoined construction of portions of the project to force construction of the St. Charles Lakefront levee. That suit is currently being held in abeyance pending submission of the final EIS.





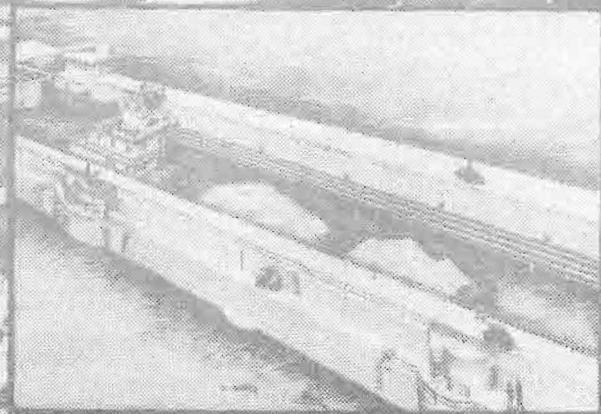
LAKE

PONTCHARTRAIN

PROPOSED

SEABROOK  
COMPLEX

FIGURE



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**Page 64**



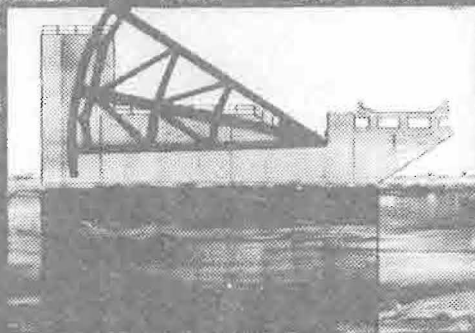
LAKE

PONTCHATRAIN

PROPOSED

CLOSURE OF EXISTING DRAINAGE  
NOT SHOWN

LAKE  
FORTUNE



CHIEF MENTEUR  
COMPLEX

TYPICAL GATE BAY

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**Page 66**

LAKE

PONTCHARTRAIN

PROPOSED

RIGOLETS COMPLEX



TYPICAL GATE BAY

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As a result of these environmental, economic, and legal concerns, three alternative levee alignments were developed for St. Charles Parish. The authorized lakefront alignment was retained for further study. A second considered alignment would lie just north of US Highway 61 (known locally as Airline Highway), and run east-west, paralleling Airline Highway from the Jefferson-St. Charles Parish line to the Bonnet Carre' Spillway. This North of Airline Highway alignment was selected because it essentially protects all the existing development in the area. The third alignment, called the South of Airline Highway alignment, was basically a modification of the North of Airline alignment, in that the alignment veers south of Airline Highway for a portion of its length to avoid inclosing about 3,000 acres of wetlands. In the event that the lakefront levee was not the most economically justified for St. Charles Parish, a Jefferson-St. Charles Parish Boundary levee would be necessary. This alternative would consist of strengthening and lengthening the existing return levee running along the St. Charles/Jefferson Parish line to prevent the existing mainline levee system from being flanked. Although the Jefferson-St. Charles Parish Boundary levee would be part of the Jefferson Parish protective work, it is considered in this section because it is dependent upon the alternative selected for St. Charles Parish, and thus is included as an alternative. The levee alignments developed for St. Charles Parish are shown on Plate 7.

Levee Construction Methods. Because of the advanced state of construction on the authorized (barrier) plan levees, no viable alternatives for levee work could be developed for barrier plans, except in St. Charles Parish. Levee work associated with barrier plans basically consists of either hauled clay levee construction or floodwall construction, depending upon relative feasibility. However, since levee heights for some project reaches would need to be significantly higher for a high level plan than for a barrier plan, alternate methods of levee construction were developed for certain levee reaches to attain the appropriate level of protection. Such methods of construction




include various permutations and combinations of hauled clay fill, hydraulic fill, or floodwall construction methods.


Outfall Canals at New Orleans Lakefront. One unresolved issue concerns three main outfall canals in New Orleans which empty into Lake Pontchartrain along the reach known as the New Orleans Lakefront (see Plate 5). Levees flank these gravity drainage canals for a considerable distance inland from the lake, tying into pumping stations at the head of the canals. Subsequent to project authorization, these levees were determined to be inadequate in terms of both grade and stability. Five basic alternatives were formulated to address the problem of deficient guide levees for both high level and barrier type plans. Since the economics of the alternatives are essentially the same for either plan and do not affect plan selection, only cost estimates for solutions compatible with the Barrier Plan were developed.

The first solution provides for raising and strengthening the guide levees to assure SPH protection, without concern for the number of house relocations necessary. At October 1981 price levels, this solution would cost about \$200,000,000.


The second solution would be identical to the first, except that all house relocations would be avoided. This solution would cost about \$250,000,000.

A third solution would provide for floodgates at the mouths of the outfall canals which could be closed when high lake levels threaten the integrity of the guide levees. During these times, pumps would be stopped and interior rainfall flooding would be increased. However, closure operations of the floodgates would occur infrequently and generally for short durations. Additionally, such operations would occur during times of high lake levels when the capacities of the existing pumping stations already would be greatly reduced. Therefore, in dollar terms, increased annualized residual flood damages due to

closure of the floodgates would be relatively minor. The costs of the floodgates is estimated to be about \$20,000,000. 

A fourth solution would be the same as the third, except that auxillary pumping stations would be provided at the lake to provide pumping capability when the floodgates were closed. The cost of these improvements is estimated to be \$124,000,000 (about \$20,000,000 for floodgates and \$104,000,000 for pumping stations). However, both the New Orleans Sewerage and Water Board and the engineering staff from the Corps of Engineers have serious reservations that this solution will work because of potential surging problems between stations. 

A fifth solution would involve relocating the existing pumping stations to the lake; however, the cost of improving gravity drainage to the relocated stations would be much more expensive than raising and strengthening the return levees. These costs in conjunction with the cost of pump station relocations were assumed to be prohibitive and estimates were not developed.

No specific solution has been developed for the guide levee problem at this time, therefore, for plan formulation purposes, it was decided to incorporate the costs of the fourth alternative (floodgates in conjunction with auxilliary pumping stations) into the costs of New Orleans Lakefront levee alternatives. The cost of this solution under the High Level Plan is estimated to be 3 to 5 percent higher than under the Barrier Plan (\$3.7 to \$6.2 million). Since this difference represents less than 1 percent of the total construction cost of the High Level Plan and will not affect plan selection, a separate cost estimate was not developed. The cost of the fourth alternative (about \$124,000,000) represents a reasonable upper limit of the range of probable alternatives to the outfall canals problem and will be used for both plans. 

BRIEF DESCRIPTION OF PLANS. The various plan elements were combined to form 16 basic preliminary plans. For the barrier concept, various combinations of levee alignment alternatives yielded eight plans (two levee alignment alternatives in New Orleans East and four levee alignment alternatives in St. Charles Parish equals eight levee alignment combinations). Each of the barrier plans assume the "minimum" sized structures at The Rigolets and at Chef Menteur Pass. For high level plans, eight levee alignment alternatives also were developed. For all these, a number of permutations were possible due to possible variations in levee construction methods by reach. Table 13 briefly lists and describes the 16 basic preliminary plans. Table 14 lists and displays costs for the various elements which can be combined to form plans.

INITIAL SCREENING OF PLANS. Economic, environmental, and social considerations were the factors used for screening the plans. All preliminary plans were presumed to be economically justified on an overall basis; all would result in some net adverse impacts to the environment; and all would have net positive social impacts, i.e., provide protection to human life and property. The plans were screened to determine those which minimized first cost and environmental impacts.

The alternatives initially were divided into two main groups, barrier plans and high level plans. Within each main group of plans, alternatives were subgrouped and compared by holding all other factors equal and comparing one varying element at a time. For instance, Plan 1 was the same as Plan 5 except for their levee alignments in the Citrus-New Orleans East area. This process was reiterated as necessary to consider other plan elements, such as levee construction methods.

Screening of Barrier Plans. With the barrier plans, alternative alignments in the Citrus-New Orleans East and St. Charles Parish areas were developed. The advanced state of construction on existing levees in other areas precluded alternative levee alignment or alternative methods of levee construction with the barrier plans.



TABLE 13

## DESCRIPTION OF PRELIMINARY PLANS

Plan	Barriers (yes/no)	New Orleans East Alinement	St. Charles Parish Alinement
1 <sup>1/</sup>	Yes	Existing	Lakefront
2 <sup>1/</sup>	Yes	Existing	North Airline
3 <sup>1/</sup>	Yes	Existing	South Airline
4 <sup>1/</sup>	Yes	Existing	Boundary Levee
5 <sup>1/</sup>	Yes	Maxent Canal	Lakefront
6 <sup>1/</sup>	Yes	Maxent Canal	North Airline
7 <sup>1/</sup>	Yes	Maxent Canal	South Airline
8 <sup>1/</sup>	Yes	Maxent Canal	Boundary Levee
9 <sup>2/</sup>	No	Existing	Lakefront
10 <sup>2/</sup>	No	Existing	North Airline
11 <sup>2/</sup>	No	Existing	South Airline
12 <sup>2/</sup>	No	Existing	Boundary Levee
13 <sup>2/</sup>	No	Maxent Canal	Lakefront
14 <sup>2/</sup>	No	Maxent Canal	North Airline
15 <sup>2/</sup>	No	Maxent Canal	South Airline
16 <sup>2/</sup>	No	Maxent Canal	Boundary Levee

<sup>1/</sup>Size of barrier structures may vary.

<sup>2/</sup>Methods of levee construction may vary.

TABLE 14

SUMMARY ESTIMATES OF FIRST COSTS TO COMPLETE<sup>1/</sup>

Description	COST	
	Barrier Plan	High Level Plan
	SPH Protection	SPH Protection
	(\$)	(\$)
ST. CHARLES PARISH		
Lakefront Alinement	123,072,000	143,559,000
Alinement North of Airline Hwy	37,498,000	55,721,000
JEFFERSON PARISH LAKEFRONT LEVEE		
All Earthen Levees:		
Hauled clay fill (astraddle)	N/A	524,467,000
Hauled clay fill	8,871,000	249,306,000
Hydraulic fill w/o ponding area	N/A	123,173,000
Hydraulic fill with ponding area	N/A	244,061,000
I-Wall on Levee with Barge Berm:		
Hauled clay fill	N/A	284,619,000
Hydraulic fill w/o ponding area	N/A	155,683,000
Hydraulic fill with ponding area	N/A	276,350,000
I-Wall on Levee:		
Hauled clay fill	N/A	167,708,000
T-Wall on Levee:		
Hauled clay fill	N/A	657,668,000
JEFFERSON-ST. CHARLES PARISH BOUNDARY LEVEE		
With St. Charles Parish Lakefront Levee	N/A	N/A
With St. Charles Parish North of Airline Highway Levee	9,248,000	14,095,000
With No Levee in St. Charles Parish	10,511,00	18,941,000
NEW ORLEANS LAKEFRONT LEVEE (West of IHNC)		
Hauled Clay Fill	188,150,000	224,311,000
I-Wall on Levee	N/A	220,861,000
I-Wall on Levee (w/ Barge Berm)	N/A	215,813,000

TABLE 14 (Continued)

SUMMARY ESTIMATES OF FIRST COSTS TO COMPLETE<sup>1/</sup>

Description	COST	
	Barrier Plan	High Level Plan
	SPH Protection	SPH Protection
	(\$)	(\$)
CITRUS LAKEFRONT LEVEE		
Hauled Clay Fill	8,571,000	60,156,000 <sup>2/</sup>
Hauled Clay Fill	N/A	109,470,000 <sup>3/</sup>
Hydraulic Clay Fill without Ponding Area	N/A	73,520,000 <sup>3/</sup>
Hydraulic Clay Fill with Ponding Area	N/A	105,194,000 <sup>3/</sup>
I-Wall on Levee	N/A	37,475,000 <sup>4/</sup>
I-Wall on Levee (w/ Barge Berm)	N/A	46,854,000 <sup>5/</sup>
NEW ORLEANS EAST LEVEES		
Maxent Canal Levee <sup>6/</sup>	79,920,000	120,772,000
New Orleans East Back Levee <sup>6/</sup> (Michoud Canal to Sta 1006+59) with Maxent Canal Levee	9,533,000	N/A
New Orleans East Back Levee <sup>6/</sup> (Michoud Canal to Maxent Canal) with Maxent Canal Levee	N/A	8,154,000
New Orleans East Lakefront Levee <sup>7/</sup>		
Hauled Clay Fill	12,185,000	34,843,000
I-Wall on Levee	N/A	32,022,000
South Point to GIWW Levee <sup>7/</sup>	585,000	5,182,000
New Orleans East Back Levee (Michoud <sup>7/</sup> Canal to Sta 1006+59) with NOE/S Point to GIWW Levees	17,087,000	17,087,000
CITRUS BACK LEVEE (IHNC TO MICHOD CANAL)	5,050,000	5,050,000
EAST BANK OF IHNC (MR-GO TO LAKE PONTCHARTRAIN)	3,423,000	3,423,000
WEST BANK OF IHNC	33,324,000	33,324,000

TABLE 14 (Continued)

SUMMARY ESTIMATES OF FIRST COSTS TO COMPLETE<sup>1/</sup>

Description	COST	
	Barrier Plan	High Level Plan
	SPH Protection	SPH Protection
	(\$)	(\$)
MANDEVILLE SEAWALL	2,378,000	2,378,000
CHALMETTE AREA PLAN	65,925,000	65,925,000
SEABROOK COMPLEX (50% OF TOTAL COST)	45,725,000	N/A
CHEF MENTEUR COMPLEX		
43% of Natural Opening	109,301,000	N/A
50% of Natural Opening	119,192,000	N/A
90% of Natural Opening	151,093,000	N/A
RIGOLETS COMPLEX		
35% of Natural Opening	195,501,000	N/A
50% of Natural Opening	228,215,000	N/A
90% of Natural Opening	325,006,000	N/A

<sup>1/</sup>October 1981 price levels.

<sup>2/</sup>Uses "existing" levee alignment, a retaining wall along Hayne Blvd., and a breakwater on the lakeside of railroad tracks.

<sup>3/</sup>In the lake alignment.

<sup>4/</sup>Uses "existing" levee embankment.

<sup>5/</sup>Uses "existing" levee alignment with a breakwater on the lakeside of railroad tracks.

<sup>6/</sup>With New Orleans East Maxent Canal Alignment only.

<sup>7/</sup>With New Orleans East existing alignment only.

Screening of Citrus-New Orleans East Levee Alinements. Plans 1, 2, 3, and 4 are similar to Plans 5, 6, 7, and 8, respectively, except for the alinement of the levees in the Citrus-New Orleans East area. With Plans 1, 2, 3, and 4, SPH protection would be provided via the existing alinement around New Orleans East, which extends eastward along the lakefront to South Point and thence generally southward to the GIWW and westward along the GIWW to the IHNC. With Plans 5, 6, 7, and 8, SPH protection would be provided by a new levee along the Maxent Canal alinement which excludes the eastern portion of the existing loop. These alinements are shown on Plate 6.

The portion of the existing loop in New Orleans East, which would be excluded from SPH protection if the Maxent Canal alinement were adopted, is essentially undeveloped. Therefore, the economic benefits foregone with the Maxent Canal alinement were relatively small, and the economic comparison of the two alinements was reduced to comparing the costs of alinements to determine the most economical plan for providing protection to the Citrus-New Orleans East area loop. Although the Maxent Canal alinement would be much shorter than the existing levee system, it would be a new levee, while the existing levee is in an advanced state of construction. The cost of the Maxent Canal levee, approximately \$89,000,000, is much higher than the cost of completing the existing levee system, approximately \$29,900,000. For this reason Plans 1, 2, 3, and 4, are better plans from an economic standpoint than Plans 5, 6, 7, and 8.

From an environmental standpoint, the difference in direct impacts between the two alinements were limited to direct construction impacts, that is, the conversion of wetlands to levee rights-of-way, and these impacts were insignificant due to the relatively small areas impacted.

With Plans 1, 2, 3, and 4, approximately 13,000 acres of land, most of which is wetlands, would be provided SPH protection that would be

excluded from such protection if the Maxent Canal alignment were adopted. The natural environment of this area would not be significantly affected by its inclosure by an SPH levee system. The area has been inclosed by a system of railroad embankments and levees since 1958, prior to authorization of the project. Four small, low-head gravity drainage structures were included in the levee system for draining the area, and these have been operated for that purpose since that time. The structures have been lengthened as the levees were enlarged and positive closures were added solely to assure the integrity of the system. The drainage structures normally remain in the "closed" position by means of flap gates. The wetlands would continue to be inclosed if the existing New Orleans East alignment were adopted and have been cut from normal tidal exchange for over 2 decades. This alteration of tidal hydrology is attributable to preproject conditions.

Although there is the potential for development of the 13,000 acres of wetlands inclosed by the existing levee system when raised to SPH level of protection, the development of these wetlands would be regulated under the permit authority of Section 404 of the Clean Water Act. Under this authority, a permit from the US Army Corps of Engineers is required for the discharge of dredge or fill materials in wetlands. Decisions on such operations are based on the overall public interest. (A request has been made by New Orleans East, Incorporated, for a permit to develop an area which would include 9,800 acres of wetlands in the New Orleans East area. This area is shown on Plate 6. An EIS is being prepared by the developer. That EIS, when finalized, will be used by the New Orleans District Engineer in making a final decision on whether to award the permit.)

The two levee alternatives for the Citrus-New Orleans East area are essentially the same in terms of direct environmental impacts due to construction. Completing the existing levee system is a more economically feasible alternative than the Maxent Canal levee

alternative, and is a more flexible alternative in that it protects, but does not preclude the future development, of wetlands. Future policies and needs may be such that development of these wetlands is desirable. This additional planning flexibility also is a factor in favor of completing the existing levee system.

When comparing the two levee alignment alternatives considered for the Citrus-New Orleans East area as part of the barrier plans, the completion of the existing levee system alternative was judged superior or equal to the Maxent Canal levee alternative based on all screening criteria. It is less costly (by \$59,000,000) and leaves additional planning options available. Therefore, Plans 5, 6, 7, and 8 were eliminated from further consideration.

Screening of St. Charles Parish Alignment. The remaining barrier plans (1, 2, 3, and 4) are similar except for the levee alignment in St. Charles Parish. A comparison of the plans was made to determine the most acceptable alternative.

Plan 1, the authorized Lakefront alignment, would extend from the Jefferson Parish Lakefront levee to the east Bonnet Carre' Spillway guide levee. This levee would protect that portion of St. Charles Parish east of the Mississippi River from hurricane-induced flooding. Plan 2, designated the North of Airline Highway alignment, would extend from the Jefferson-St. Charles Parish boundary to the Bonnet Carre' Spillway, and would be located immediately north of US Highway 61, known locally as Airline Highway. This plan would protect the developed portion of St. Charles Parish, but leave the wetland area adjacent to the lake open to normal interchange with the lake waters. Plan 3 is similar to Plan 2, except that the alignment veers south of Airline Highway in one section to avoid inclosing 3,000 acres of wetlands which would be inclosed by Plan 2.

Plan 4 is a no action alternative for St. Charles Parish; however, it would be required to provide complete hurricane protection to Jefferson Parish if the Lakefront alignment is not constructed. This alternative would be an extension and expansion of the existing return levee located along the Jefferson-St. Charles Parish boundary. Selection of either the North of Airline Highway or South of Airline Highway alignment would require construction of a portion of this boundary levee from the lake to Airline Highway. This alternative is addressed in this analysis because it is directly related to the selected alternative for St. Charles Parish; however, it would be part of the Jefferson Parish protection system.

For purposes of preliminary screening, the alternatives which would provide protection for St. Charles Parish were first compared (Plans 1 through 3). All three plans would have similar direct adverse environmental impacts, i.e., require a similar amount of wetlands be converted to levee rights-of-way. All three alignments were also considered sufficient to provide adequate protection for existing and future development. The trade-off analyses between plans thus reduced to comparing first costs against indirect environmental impacts. Indirect environmental impacts would relate to reductions of the biological productivity of inclosed wetlands due to alteration of the wetland's hydrology and/or induced urban development.

Since Plan 3, the South of Airline Highway alignment, was a variation of Plan 2, the North of Airline Highway alignment, these levee alternatives were first compared. As can be seen from Plate 7, Plan 3 differs from Plan 2 only in that its levee alignment veered south of Airline Highway for a short section to avoid encompassing about 3,000 acres of wetlands. These wetlands are subject to reduced tidal exchange, as they are connected to the wetlands north of Airline Highway only by culverts under the road. Thus, the difference in direct construction impacts between Plans 2 and 3 would be minimal; i.e.,



alteration of wetland hydrology under Plan 2 would be minimal, as drainage through the levee would be provided.

Differences in potential indirect environmental impacts between plans were next compared. Plan 2 would enhance the potential for development of the 4,000 acres of wetlands which Plan 3 would not. However, any development would be regulated under the Section 404 permit process. For purposes of analysis, it was apparent that both Plans 2 and 3 have similar indirect environmental impacts. Since Plan 3 would have a greater levee length and cost about 20 to 25 percent more than Plan 2, it was determined that Plan 3 did not merit further investigation.

Detailed designs and costs were developed for Plans 1, and 2, and 4. The latter is the no action alternative for St. Charles Parish, and would require construction of the Jefferson-St. Charles Parish Boundary Levee. First costs of these plans are presented in Table 15. Although part of the Jefferson Parish protection feature, the Boundary Levee is included because, as previously discussed, it is related to the selection of the St. Charles alternative.

TABLE 15

SUMMARY OF FIRST COSTS FOR ST. CHARLES PARISH LEVEE  
ALINEMENTS, BARRIER PLANS (\$1,000,000's October 1981 price levels)

Alinement	Costs
Lakefront (Plan 1)	123
North of Airline Highway (Plan 2) <sup>1/</sup>	37
No Action <sup>1/</sup> (Plan 4)	0

<sup>1/</sup>Would necessitate construction of Jefferson-St. Charles Parish Boundary Levee at a cost of \$9,248,000 with Plan 2 or \$10,511,000 with Plan 4.

Plans 1 and 2, both mainline levee plans, then were compared. Plan 1, the Lakefront alignment, would encompass all developed land on the east bank of St. Charles Parish and about 29,000 acres of undeveloped wetlands (26,000 acres north of Airline Highway and 3,000 acres south of Airline Highway). The estimated first cost of the plan would be \$123,000,000. Plan 2, the North of Airline Highway alignment, would encompass all developed land on the east bank of St. Charles Parish and about 3,000 acres of wetlands; and have a first cost of about \$37,000,000. The difference in the two plans amounted to 26,000 more acres of wetlands being inclosed by Plan 1 than by Plan 2, and Plan 1 costing an estimated \$86,000,000 more than Plan 2. Although both plans contain provisions for drainage structures which allow for tidal exchange during normal conditions, the natural regime of tidal sheet flow interchange would be reduced under Plan 1, tending to also reduce the biological productivity of the inclosed wetlands. Additionally, there is no discernable need to develop the wetlands north of Airline Highway in the foreseeable future. Plan 2, the North of Airline Highway alignment, was determined superior to Plan 1, the Lakefront alignment, in terms of both environmental and economic feasibility. Plan 1 was therefore eliminated from further consideration.

Finally, Plan 2, the North of Airline Highway alignment, was compared to the no action alternative for St. Charles Parish, the Jefferson Parish-St. Charles Parish Boundary Levee. Plan 2 would encompass 3,000 acres of wetlands, provide SPH protection for the St. Charles Parish area susceptible to hurricane-induced flooding from Lake Pontchartrain and cost about \$37,000,000. The Boundary Levee would provide SPH protection only for the western flank of the eastern portion of Jefferson Parish and cost about \$11,000,000. The environmental impacts of Plan 2 were considered minimal, so the trade-off analysis between Plan 2 and the no action alternative reduced to measuring the differences between the economic and social impacts of the two. Plan 2 would cost \$37,000,000 more than the no action alternative. However,

Plan 2 would provide SPH protection to the developed portion of the East Bank of St. Charles Parish, while the no action alternative would provide no protection for this area. (The area would receive some protection as a result of the barrier structures, even though no mainline levee work would be provided.) The investment of \$37,000,000 was determined to be justified on the basis of both tangible and intangible benefits, therefore the no action alternative was eliminated from further study. Plan 2 was the only barrier plan chosen for detailed study.

High Level Plans Considered in Preliminary Planning. Eight basic high level plans (based on alignment) were formulated for preliminary consideration. Permutations of each plan also were possible with regards to variations in levee construction methods. The basic high level alternatives thus can be defined in terms of levee alignments and construction methods. The initial screening of high level alternatives followed the same rationale as that applied to the screening of barrier alternative plans. Screening initially was done with regards to levee alignment, then performed relative to the levee alignment(s) selected; i.e., levee construction methods.

Plans 9 through 12, which were high level plans incorporating completion of the existing levee system in the New Orleans East area as plan features, initially were compared to Plans 13 through 16, high level plans incorporating construction of a Maxent Canal levee alignment as a plan feature. Closing the levee system in the New Orleans East area to a SPH level of protection was considered a given planning constraint. Completing the existing levee system was estimated to result in approximate first costs ranging from \$54,000,000 to \$57,000,000 (the range of costs reflects the fact that alternative levee construction methods were considered). The cost of a Maxent Canal levee alignment was estimated to have a first cost of about \$129,000,000. The trade-off analyses between plans reduced to the same type of analyses as

those applied to barrier plans including environmental considerations. Since completion of the existing levee system would be far less expensive (\$72,000,000 to \$75,000,000 in terms of first costs), that alternative was determined to be preferable for completing the project in the New Orleans East area. Therefore, Plans 13 through 16 were eliminated from further consideration.

Plans 9 through 12 then were compared with respect to differences in the impacts of the St. Charles Parish levee alignment feature. The same rationale which was applied to barrier plan alternatives with respect to the screening of St. Charles Parish levee alignments was applied to high level plan alternatives, with similar results. Detailed designs and costs were not developed for Plan 11, the South of Airline Highway alignment, as preliminary analysis indicated this alignment would cost considerably more than Plan 10, the North of Airline Highway alignment, and offer no significant advantages. Plan 11 was eliminated from further consideration at the preliminary screening stage. First costs for Plans 9, 10, and 12 are presented in Table 16.

TABLE 16

SUMMARY OF FIRST COSTS FOR ST. CHARLES  
PARISH LEVEE ALINEMENTS, HIGH LEVEL PLANS  
(\$1,000,000's October 1981 Price Levels)

ALINEMENT	COSTS
Lakefront (Plan 9)	144
North of Airline Highway (Plan 10) <sup>1/</sup>	56
No Action <sup>1/</sup> (Plan 12)	0

<sup>1/</sup>Would necessitate construction of Jefferson-St. Charles Parish Boundary Levee at a cost of \$14,095,000 with Plan 10 and \$18,941,000 with Plan 12.

When compared to Plan 10 (the North of Airline Highway alignment), Plan 9 (Lakefront alignment), would be much more expensive and have greater adverse environmental impacts, while offering no advantages. (This is essentially as previously discussed in screening of St. Charles alignments for the Barrier Plan.) Thus, Plan 9 was eliminated from further consideration. Plan 10 was compared to Plan 12, no action (Boundary Levee alignment for Jefferson Parish). The trade-off analysis reduced to determining if the cost of Plan 10 would be justified. The results of this analysis are presented in the section titled Sensitivity Analysis and in Appendix B. After consideration of the potential damage which could result to St. Charles Parish if no action were taken, Plan 12 was eliminated from further consideration. Plan 10 was thus the only high level plan chosen for detailed study. A portion of the Boundary Levee will remain in the overall plan as a part of the plan of protection for Jefferson Parish.

Although only one high level plan, Plan 10, was chosen for further study, there were a number of possible permutations of this plan depending upon the type of levee construction chosen for each of several levee reaches. The screening rationale used for selection of specific levee construction methods is presented in subsequent paragraphs. Alternative methods of levee construction for high level SPH protection were developed for all lakefront reaches of the existing levee system. From east to west, these reaches include: the New Orleans East Lakefront levee reach, the Citrus Lakefront levee reach, the New Orleans Lakefront levee reach, and the Jefferson Parish Lakefront levee reach.

Two levee construction methods were considered for completing the New Orleans East levee reach to a high level-SPH level of protection; hauled clay fill and I-type floodwall on levee. (The latter is hereafter referred to as I-wall on levee.) Table 17 presents a summary comparison of the costs and primary impacts of each of these two methods of levee construction.

TABLE 17

SUMMARY COMPARISON OF IMPACTS OF PRELIMINARY ALTERNATIVES  
TO COMPLETE THE NEW ORLEANS EAST LAKEFRONT LEVEE REACH  
FOR HIGH LEVEL PLANS

Type of Construction	First Cost (\$1,000,000's Oct 1981 Price Levels)	Acres of Wetlands Directly Affected
Hauled Clay Fill	35	210
I-Type Floodwall <sup>1/</sup>	32	143

<sup>1/</sup>Subject to potential barge impacts.

The hauled clay fill method of construction would consist of raising and strengthening the existing levee section by means of shaping and compacting hauled clay fill, and would cost about \$3,000,000 more to construct than the alternative method of construction. The I-type floodwall on levee would consist of improving the levee base by the same methods of construction as for the hauled clay fill alternative, except to a lesser elevation, and building a concrete-capped, steel sheet pile I-wall on top of the levee base to SPH grade. A comparison of these two levee construction methods revealed that the direct environmental impacts of either method would be small (indirect environmental impacts were judged to be identical). Based strictly upon economic and environmental data, it initially appeared that the I-wall on levee method of construction would be preferable to the hauled clay fill method of construction; however, it was determined that the two methods of construction were not comparable in terms of certainty of maintaining design protection. The I-wall would be subject to potential barge impact and breeching by loose (runaway) barges on Lake Pontchartrain during hurricane events. Although the I-wall design could be modified to include a berm to preclude barge impacts, such a modification would result in significant increases in cost and in environmental impacts.

While the potential for barge impact/breaching of an I-wall design would be difficult if not impossible to quantify in terms of potential frequency, it was considered a significant design consideration. Since the differences in environmental impacts were relatively small between construction method alternatives, the trade-off analysis reduced to comparing first costs against design integrities. The greater first cost of the hauled clay fill construction method over that of an I-wall-on-levee construction method (about \$3,000,000) was considered to be justified on the basis of assuring design protection integrity. Therefore, the hauled clay fill levee construction method was selected as the construction method for the New Orleans East Lakefront levee reach for Plan 10.

Alternative construction methods for the Citrus Lakefront levee reach were next screened. Six construction methods were developed for completing the levee reach to provide high level SPH protection. These methods include hauled fill and I-type floodwall (with and without barge berms), already discussed, and hydraulic fill, with and without ponding areas. These terms refer to the pumping of material from the bottom of Lake Pontchartrain, and using the material to form the levee. Since that material would be mixed with water, extensive runoff would occur (hydraulic fill without ponding areas). Various measures can be used to reduce this runoff (hydraulic fill with ponding areas). Such measures may range from silt curtains to dikes. The first costs for using each of these construction methods are displayed in Table 18.

The differences between the six alternative methods of levee construction to complete the Citrus Lakefront levee reach were related to costs, direct environmental impacts, and design integrities. Both alternatives using an I-wall feature were the least expensive in terms of economic cost, and would also result in the least adverse environmental impacts. In comparing these two alternatives, it was found that the I-wall on levee alternative would affect no natural habitat and cost

TABLE 18

SUMMARY COMPARISON OF FIRST COSTS OF PRELIMINARY ALTERNATIVES TO  
COMPLETE THE CITRUS LAKEFRONT LEVEE REACH FOR HIGH LEVEL PLANS  
(\$1,000,000's, October 1981 Price Levels)

TYPE OF CONSTRUCTION	FIRST COSTS
Hauled Clay Fill <sup>1/</sup>	60
Hauled Clay Fill <sup>2/</sup>	109
Hydraulic Clay Fill <sup>2/</sup> (without ponding area)	74
Hydraulic Clay Fill <sup>2/</sup> (with ponding area)	105
I-Wall on Levee <sup>3/</sup>	37
I-Wall on Levee <sup>4/</sup> (with barge berm)	47

<sup>1/</sup>Uses "existing" levee alignment, a retaining wall along Haynes Blvd. and a breakwater on the lakeside of railroad tracks.

<sup>2/</sup>In-the-Lake alignment.

<sup>3/</sup>Uses "existing" levee embankment.

<sup>4/</sup>Uses "existing" levee alignment with a breakwater on the lakeside of railroad tracks.

about \$37,000,000, while the I-wall on levee with barge berm would affect 35 acres of lake bottoms and cost \$47,000,000. The trade-off analysis between plans essentially was 35 acres of lake bottom and a \$10,000,000 difference in cost versus a difference in design integrity. As was the case for the New Orleans East levee I-Wall alternative, the Citrus Lakefront levee I-Wall alternative would be subject to potential breeching by barge impact while the I-wall with barge berm would not be subject to such breeching. The initial additional investment of \$10,000,000 and loss of 35 acres of lake bottom in this area were considered justified to assure the levee reach's design integrity. The I-Wall with barge berm alternative was selected as the preferred construction method to complete the Citrus Lakefront levee reach to high level SPH protection.



The next levee reach screened with respect to alternative methods of construction for Plan 10 was the New Orleans Lakefront. None of the three considered alternatives would affect any wetlands or lake bottoms, and indirect environmental impacts would be identical. All alternatives would be a modification of the existing levee, the alignment of which runs through an area which is heavily urbanized (primarily residential) to the landside and heavily used for recreational purposes (primarily green space) to the lakeside. Therefore, the social impacts of each of the three alternatives could vary and was a screening consideration. The estimated first costs of the three alternatives considered is displayed in Table 19.

TABLE 19

SUMMARY COMPARISON OF FIRST COSTS OF PRELIMINARY ALTERNATIVES TO COMPLETE THE NEW ORLEANS LAKEFRONT LEVEE REACH FOR HIGH LEVEL PLANS (\$1,000,000's, October 1981 Price Levels)

TYPE OF CONSTRUCTION	FIRST COSTS <sup>1/</sup>
Hauled Clay Fill	224
I-Wall on Levee	221
I-Wall on Levee with Barge Berm	216

<sup>1/</sup>Includes \$124,000,000 for a solution to deficient return levees along New Orleans' three main canal outfalls for cost comparison purposes.

The two factors which were used to screen the New Orleans Lakefront levee reach alternatives were first costs and social impacts. First costs for work not common to all alternatives (work not related to the outfall canals), would vary from \$92,000,000 to \$100,000,000 (first costs less \$124,000,000 for outfall canal work). Potential differences in social impacts would relate to levee configurations (heights and widths). Levee elevations would vary from 14.5 to 17.5 feet, and it was determined that differences between net levee elevations would have

minimal impacts with regards to affecting residents' view of the lakefront. Levee base widths would vary from about 140 to 230 feet, and increases would result in a reduction of green space. Of the three alternatives, the I-wall with barge berm would be the least expensive in terms of first cost. The width of the barge berm greatly reduces the required depth of the sheet piling. The reduction in steel sheet piling required offsets the increased fill costs thus, the I-wall with barge berm is less expensive than the I-wall without barge berm. In terms of levee rights-of-way, the two I-wall alternatives would be the least disruptive. A further consideration was that once construction was completed, the I-wall with barge berm feature would offer the greatest potential for recreational use and beautification. Considering all aspects, the I-wall with barge berm was chosen as the preferred method of construction for the New Orleans Lakefront levee reach.

The final levee reach to be considered with regard to construction method screening was the Jefferson Parish Lakefront levee reach. The existing Federal levee has a design grade of 10 feet. Work by local interests, not to Corps of Engineers standards for design integrity, has raised the levee grade to 14 feet. The high level plan design grade would be 14 feet, built to Corps standards. Nine alternatives were developed for completion of the levee to provide high level SPH protection. Table 20 presents the first costs associated with the nine alternatives.

Six of the nine alternatives were eliminated on the basis of first costs. The three alternatives not initially eliminated were the all earthen levee, hydraulic fill without ponding area (\$123,000,000); I-wall on levee with barge berm, hydraulic fill without ponding area (\$156,000,000); and I-wall on levee, hauled clay fill (\$167,000,000). All three alternatives would have similar direct environmental impacts in terms of acres of lake bottoms which would be converted to levee rights-of-way. Environmental impacts would vary, as the hydraulic fill

TABLE 20

SUMMARY COMPARISON OF FIRST COSTS OF PRELIMINARY ALTERNATIVES TO  
COMPLETE THE JEFFERSON PARISH LAKEFRONT REACH FOR HIGH LEVEL PLANS  
(\$1,000,000's, October 1981 Price Levels)

TYPE OF CONSTRUCTION	FIRST COSTS
All Earthen Levee	
Hauled Clay Fill (straddle)	524
Hauled Clay Fill	249
Hydraulic Fill without Ponding Area	123
Hydraulic Fill with Ponding Area	244
I-Wall on Levee With Barge Berm	
Hauled Clay Fill	285
Hydraulic Fill without Ponding Area	156
Hydraulic Fill with Ponding Area	276
I-Wall on Levee Without Barge Berm	
Hauled Clay Fill	167
T-Wall (hauled clay fill)	658

construction methods would result in short term turbidity during construction of the first lift(s). Alternatives also would vary in terms of design integrity, i.e., I-wall on levee without barge berm would be subject to potential barge impacts.

In comparing the three alternatives, the hydraulic fill methods were first compared. Both alternatives would be comparable in terms of design integrity. The I-wall alternative would result in slightly less short term turbidity during construction and take slightly less time to construct. These positive considerations were considered minor compared to the greater cost (\$33,000,000), and it was eliminated from further consideration.

Finally, the all earthen levee, hydraulic fill without ponding area alternative was compared to the I-wall on levee, hauled clay fill alternative. Of the two alternatives, the I-Wall alternative would cost \$44,000,000 more and have a lesser degree of design integrity; conversely, the I-wall alternative would not result in any short term turbidity during construction and would take less time to construct. In comparing differences between the two alternatives it was decided that the all earthen levee, hydraulic fill without ponding area was the preferred method of construction for completing the Jefferson Lakefront levee reach.

The selected method of construction would impact 573 acres of lake bottom through construction of borrow pits up to 60 feet deep. The adverse environmental impacts associated with these holes could be eliminated by the use of hauled material at a cost of at least \$249 million. The potential impacts are not severe enough to warrant the additional expenditure of \$126 million more than the selected alternative.

In summary, Plan 2 and a variation of Plan 10 were selected for more detailed evaluation and all other plans were eliminated. Both plans incorporate the same basic levee alignment. For ease of presentation, Plan 2 is henceforth referred to as the Barrier Plan, and Plan 10 is henceforth referred to as the High Level Plan. The Barrier Plan is shown on Plate 8 and the High Level Plan is shown on Plate 9.

## PLAN ASSESSMENT AND EVALUATION

Information presented in the following paragraphs describes in detail each of the two plans considered. Significant beneficial and adverse impacts and an evaluation also are discussed. Responsibilities for implementation are presented for each of the detailed plans.

## THE BARRIER PLAN

PLAN DESCRIPTION. This plan would provide SPH protection to the major urban areas in and immediately adjacent to New Orleans. The main features of the plan consist of barrier structures at Lake Pontchartrain's main tidal passes, improvement of the existing system of levees and floodwalls, and extension of the existing levee system to encompass the populated portion of the east bank of St. Charles Parish. The general location of the plan's proposed features are shown on Plate 8. Details of individual plan features are discussed in subsequent paragraphs.

Barrier Features. The primary features of this plan would be barrier complexes at Lake Pontchartrain's three main tidal passes: The Rigolets, Chef Menteur Pass, and Seabrook. The purpose of these complexes is to control inflows to the lake during times of approaching hurricanes to keep lake levels from rising, thereby reducing the need to raise levees and floodwalls.

The Rigolets complex would consist of barrier levees, a control structure, a navigation lock with approach channels, and a closure dam. The complex would provide a barrier against tidal influx through The Rigolets into Lake Pontchartrain under hurricane conditions, yet provide continuous tidal interchange and navigation movement under nonhurricane conditions. The cost estimate used in plan formulation is based upon a gated control structure, 1,088 feet long, which would provide a cross-sectional area of flow equal to approximately 35 percent of the natural cross-section, and allow for passage of over 90 percent of the natural tidal prism. As normal tidal interchange would occur through the control structure, and since tidal exchange is a critical factor to the ecology of the lake, costs for control structures with lengths of 1,564 feet and 2,856 feet, which would provide 50 percent and 90 percent, respectively, of the natural cross-section, also were

developed. (The costs of these alternate designs are presented in Tables 12 and 14.) Regardless of the size of the control structure, the navigation lock would be 110 by 800 feet. An artist's conceptual view of The Rigolets complex with the 35 percent opening is shown on Figure 4.

The Chef Menteur complex would consist of a closure dam astride the existing natural channel, barrier levees, a bypass channel for the GIWW channel (the only barrier complex feature which has been built), a control structure astride a new channel cut, and a navigation structure with approach channels. The complex would provide a barrier against tidal influx through Chef Menteur Pass into Lake Pontchartrain under hurricane conditions, and also provide for continuous tidal interchange and navigation movement during nonhurricane conditions. The cost estimate used for plan formulation purposes is based upon a gated control structure 612 feet long which would provide a cross-sectional area of flow equal to approximately 43 percent of the natural cross-sectional area of the pass, and allow for passage of over 90 percent of the natural tidal prism. Costs for control structures with lengths of 748 feet and 1,360 feet which would provide 50 percent and 90 percent, respectively, of the natural cross-section, also were developed. (The costs of these alternate designs also are presented in Tables 12 and 14.) The navigation structure would consist of a floodgate with guidewalls. An artist's conceptual view of the Chef Menteur complex with the 43 percent opening is shown on Figure 3.

The Seabrook complex would consist of a navigation lock, a control structure, and a closure dam. The complex would serve three functions: (1) during hurricane conditions, the lock and control structure would be closed to provide a barrier against tidal influx into Lake Pontchartrain; (2) during normal conditions the complex would provide a means for regulating salinity levels in Lake Pontchartrain which are affected by the MR-GO; and, (3) the lock would provide safe

passage in an area where currents are a hazard to navigation. Because of this multi-purpose nature, the 1965 authorizing legislation mandated that the first costs of the complex be apportioned equally between the hurricane protection project and the MR-GO navigation project. Therefore, only 50 percent of the first costs of the Seabrook complex are reflected in Tables 12 and 14. (Due to the nature of the Seabrook complex, alternative sizes of the control structure are not feasible.) An artist's conceptual view of the Seabrook complex is shown on Figure 2.

Chalmette Area Levee. The Barrier Plan includes an extensive levee system, which has been divided into logical reaches for analysis. One of these is a large ring levee system which would encompass and protect that portion of Orleans Parish located on the east bank of the Mississippi River, south of the GIWW and west of the MR-GO; the populated areas of St. Bernard Parish (located primarily along the east bank of the Mississippi River); and a large area of undeveloped wetlands in St. Bernard Parish. The levee system, known as the Chalmette Area Plan, is independent of the barrier structures, as the threat of tidal flooding to the area originates from Lake Borgne rather than Lake Pontchartrain, and the barrier structures would have little effect upon water levels in Lake Borgne. The levee system, which is under construction, makes use of the existing Mississippi River levee to the west. The northern and eastern portions of the system utilize existing dredged material disposal banks along the south bank of the GIWW and west bank of the MR-GO. The southern portion of the system is a new levee.

The northern levee reach, which fronts the GIWW, is an all earthen levee being constructed by means of hydraulic fill. The levee length is 5.6 miles and the final levee elevation and base width will be 14.0 feet and 500 feet, respectively. The eastern portion of the levee system, which fronts the MR-GO, is an all earthen levee also being constructed

by means of hydraulic fill. The length of this levee is 14.0 miles and the final levee elevation and bottom width will be 17.5 feet and 500 feet, respectively. There are two navigable floodgates in place at Bayou Bienvenue and at Bayou Dupre along the eastern portion of the levee system. These normally remain open and allow navigation, gravity drainage, and tidal exchange to the inclosed wetlands. The southern portion of the system is an all earthen levee being constructed by means of a combination of hydraulic fill and hauled clay fill. The levee is 10.1 miles long, the elevation will vary from 16.5 to 17.5 feet, and the base widths will vary from 250 to 500 feet. A gravity drainage structure is under construction at Creedmore Canal in the southern portion of the levee system.

Additional Independent Levee Reaches. There are four other levee reaches which are independent of the barrier structures: the IHNC East Bank Levee and IHNC West Bank Levee which parallel the IHNC, the Citrus Back Levee which runs along the northern bank of the GIWW and forms the southern boundary of the Citrus area, and the New Orleans East Back Levee which runs along the northern bank of the GIWW and forms the southern boundary of the New Orleans East Area. These levees protect against tidal surges originating from Lake Borgne and traveling via the MR-GO, GIWW, and/or IHNC.

The IHNC East Bank Levee, under construction and nearing completion, is basically I-type floodwalls driven into a hauled clay levee base, with some short sections of all earthen levee. The net grades of the levee/floodwall vary from 13 to 14 feet, and levee base widths vary from 50 to 55 feet. Total levee length is about 3.0 miles.

The IHNC West Bank Levee, near completion, also is basically I-type floodwalls driven into a hauled clay levee base with short sections of all earthen levee. The net grades of the levee/floodwall varies from 13 to 14 feet while levee base width is 20 feet. Total levee length is about 5.0 miles.



The Citrus Back Levee is built upon a locally constructed levee paralleling the GIWW. The all earthen levee is currently under construction by means of hydraulic fill and hauled clay fill. The levee is about 4.1 miles long, and will have a final grade of 14.0 feet and a base width of 300 feet.

The New Orleans East Back levee is also built upon a locally constructed levee paralleling the GIWW. This levee incorporates floodwalls surrounding the Michoud Canal which vary in net grade from 20 to 22 feet. With the exception of these floodwalls, the levee is all earthen and is currently under construction by means of hydraulic fill. Total levee length is 4.5 miles and the net design grade is 17.5 feet. The levee will have a final width of 500 feet for a length of 2.2 miles, and a final base width of 300 feet for a length of 2.5 miles.

South Point-to-GIWW Levee. The South Point-to-GIWW Levee is built upon a low locally constructed levee and is complete except for the Highway 90 crossing. The levee is an all earthen design built by means of hauled clay fill. Total levee length is 8.3 miles, and final net grades will vary from 12.5 to 14.0 feet. The base widths vary from 70 to 146 feet. There are four small gravity drainage structures located within the levee. These structures normally are controlled on the lakeside by flapgates which only allow drainage from the inclosed area to the lake. These flapgates are usually kept in the closed position. Each drainage structure has a vertical sluice gate to insure adequate control during times of hurricane occurrences.

Lakefront Levees. The New Orleans East Lakefront levee parallels the south shore of Lake Pontchartrain, connecting the South Point-to-GIWW levee with the Citrus Lakefront levee. It is located just to the landside of the Southern Railroad embankment. The levee, which is

complete except for foreshore protection, is an all earthen embankment constructed by the method of hydraulically placed sand core with a hauled clay fill cover. The levee length is 6.2 miles, the final net levee grade will be 14.0 feet and the final base width will be 190 feet.

The Citrus Lakefront levee parallels the south shore of Lake Pontchartrain between the New Orleans East Lakefront levee and the IHNC East levee. It also lies on the landside of the Southern Railroad embankment. The levee, which is complete except for foreshore protection, has a total length of 5.0 miles; about 0.7 miles of which consists of completed floodwalls and 4.3 miles of earthen levee embankment. The completed floodwall work consists of about 1/2-mile of floodwall located to the landside of the New Orleans Lakefront Airport, which is at the western terminus of the levee reach, and about 1/4 mile of floodwall located in front of Lincoln Beach, a once popular recreational area located near the eastern terminus of the levee reach. The net grade of the floodwalls (I-walls) is 11.0 feet. The remaining 4.3 miles of uncompleted earthen embankment will have a final design grade of 13.5 feet and a base width of 85 feet.

The New Orleans Lakefront levee extends from the IHNC West levee to the Jefferson/Orleans Parish line. This feature is a combination of earthen levee and floodwall (I-wall). Five sections of floodwall, ranging in length from 550 feet to 5,000 feet, would be constructed at various locations. The rest of the 6.9-mile long levee system, will consist of an all earthen section, having a final net design grade of 12 feet and a base width of 60 feet. Local interests have decided to raise portions of the levee to 16 feet as a means of interim protection. As previously discussed, the main outfall canals for New Orleans Parish constitute a weak link in the levee system. An acceptable solution to this problem has not been finalized; however, a solution representing the upper limit of reasonable cost (\$124,000,000) has been included in analysis of this levee reach.

The existing Jefferson Parish Lakefront levee, which extends from the Orleans Parish line to the St. Charles Parish line, is adequate in terms of height and section, if barrier structures are in place. Cost estimates for this item include the costs for frontage (rip rap) protection along the 10.3-mile levee reach. Local interests presently are correcting structural inadequacies at pumping stations located within the levee itself (frontage protection), and will be given cost-sharing credit for this work.

To complete the hurricane protection works for Jefferson Parish, it would be necessary to construct a levee along the Jefferson/ St. Charles Parish boundary. This levee would extend from the Jefferson Parish Lakefront levee to the North of Airline Highway levee in St. Charles Parish. This feature is necessary to protect highly developed Jefferson Parish from hurricane-induced flooding of the St. Charles Parish wetlands north of Airline Highway.

St. Charles Parish Levee. This plan includes providing protection to existing developed areas on the east bank of St. Charles Parish to the Bonnet Carre' Spillway. Protection would be accomplished by a combination of levees and floodwalls, which would extend from the Jefferson-St. Charles Parish boundary levee, and basically parallel the Airline Highway to the north, terminating at the east guide levee of the Bonnet Carre' Spillway. The levee/floodwall system will have an average elevation of about 11.5 feet, vary between 147 and 180 feet in base width, and be approximately 9.9 miles long.

Mandeville Seawall. The Mandeville seawall has a net grade of 6 feet, and runs along the lakefront of the town of Mandeville, located on the north shore of Lake Pontchartrain, for a distance of 1.5 miles. The seawall originally was constructed in 1915 and improved under a Works Progress Administration project in the late 1930's. Presently it is in a poor state of repair. Repair and rehabilitation of the seawall was

part of the original plan of protection, but no legal assurances of local cooperation ever have been executed. To insure proper consideration in the event such assurances are received, a cost for repair of the seawall is included in the cost estimate for the Barrier Plan.

OTHER CONSIDERATIONS. Although no construction is currently being performed on the barrier complexes, all other project features are being constructed to be compatible with those complexes. However, once it was determined that under present conditions a high level design might be competitive with a barrier design, a decision was made by the New Orleans District not to pursue any work which would not be compatible with either a barrier or high level plan. This policy will continue until a decision is made regarding final plan selection.

COST ESTIMATES OF PLAN FEATURES. Summary listings and cost estimates of the Barrier Plan's features are presented in Table 21. Detailed cost estimates of each feature are contained in Appendix A, Engineering Investigations.

ECONOMIC ANALYSIS. Details of the economic analysis of the Barrier Plan are contained in Appendix B, Economic Analysis, and only will be summarized herein. The gross investment necessary to complete construction of the plan is estimated to be \$874,238,000. Based on a 3 1/8 percent rate of return and a 100-year project life, the average annual charges for this amount are \$28,640,000. Estimated annual operation, maintenance, and replacement costs are \$1,764,000. Other costs which are included are annualized fish and wildlife losses estimated to be \$75,000. The total of these annual charges is \$30,479,000, with 1993 used as base year (the year the project is substantially completed).

TABLE 21

SUMMARY OF COSTS TO COMPLETE THE BARRIER PLAN  
 (\$1,000's, October 1981 Price Levels  
 3 1/8 Percent Annual Discount Rate and a 100-Year Project Life)<sup>1/</sup>

FEATURE	FIRST COST	ANNUAL OPERATION AND MAINTENANCE COSTS <sup>2/</sup>
CHALMETTE AREA PLAN	65,925	249
CITRUS-NEW ORLEANS EAST AREA		
Citrus Back Levee	5,050	27
New Orleans East Back Levee	17,087	17
South Point to GIWW levee	585	24
New Orleans East Lakefront Levee	12,185	15
Citrus Lakefront Levee	8,571	57
IHNC East Bank Levee	3,423	30
WEST NEW ORLEANS AREA		
IHNC West Bank Levee	33,324	30
New Orleans Lakefront Levee <sup>3/</sup>	188,150	256
EAST BANK OF JEFFERSON PARISH AREA		
Jefferson Parish Lakefront Levee	8,871	39
JEFFERSON-ST. CHARLES PARISH BOUNDARY LEVEE	9,248	8
EAST BANK OF ST. CHARLES PARISH AREA		
North of Airline Highway Levee	37,498	34
MANDEVILLE SEAWALL	2,378	1
BARRIER COMPLEXES		
Seabrook (50% of First Costs)	45,725	N/A
Chef Menteur Pass	109,301	135
The Rigolets	195,501	842
TOTAL CONSTRUCTION COST	742,822	1,764

TABLE 21 (Continued)

SUMMARY OF COSTS TO COMPLETE THE BARRIER PLAN

FEATURE	FIRST COST
GROSS INVESTMENT COST-BASE YEAR 1993 <sup>4/</sup>	874,238
Annual Costs (\$1,000's)	
Interest and Amortization on Investment Costs (I&A) =	
$\$874,238 \times 0.03276 = \$28,640$	
I&A	\$28,640
O&M	1,764
TOTAL	\$30,404

<sup>1/</sup>Costs to complete from 1 October 1979.

<sup>2/</sup>Includes annualized costs of replacements and O&M on completed work.

<sup>3/</sup>Includes \$124,000,000 for solution to outfall canals' problems.

<sup>4/</sup>Present worth of all expenditures expressed at the base year.

The benefits attributable to completion of the project under the Barrier Plan are estimated to average \$101,407,000 annually, and include benefits to existing and future development. Benefits also accrue from a reduction in the cost of emergency operations required during hurricane-induced flooding. A breakdown of these benefits shows \$93,303,000 would accrue to existing development, \$6,699,000 to future development, and \$1,405,000 to reduction in costs of emergency operations.

The average annual net benefits (benefits less costs) are \$70,928,000, and the ratio of average annual benefits to average annual

costs is 3.3 to 1. If only benefits to existing developments are considered, average annual net benefits are \$62,824,000 and the average annual benefits to average annual cost ratio is 3.1 to 1. Thus, the project is economically justified on the basis of protection to existing development.

IMPACT ASSESSMENT. This section summarizes the impacts projected to occur if this alternative is selected. More detailed discussions are contained in the EIS.

Environmental Impacts. The following paragraphs discuss impacts for various environmental concerns. These impacts are those projected to occur (or acreages of habitats affected) by completion of the Barrier Plan.

Biological Resources. Constructing the Barrier Plan would result in the direct loss or alteration of approximately 2,363 acres of brackish/saline marsh, 28 acres of lake bottom, 870 acres of river/canal bottoms, 41 acres of bottomland hardwoods, and 164 acres of cypress tupelo forest. The loss of this marsh area and lake and canal bottoms would result in a moderate reduction of fish and wildlife resources within the project area. The importance of these habitats as nursery and feeding areas for both fish and wildlife must not be overlooked or underrated.

The direct impact of the placement and operation of the barriers is difficult to quantify. Recent research has shown that the tidal passes are utilized as migration routes by many adult, juvenile, and larval estuarine and marine organisms. While it is difficult to quantify biological and nutrient transport through these passes, it can be reasonably assumed that some of this transport would be interrupted, altered or reduced through the placement of barrier structures. Changes in bottom hydrography due to sill heights, along with reduction in the

size of the natural opening of the passes, would be factors affecting such biological and nutrient transport.

The Seabrook outlet structure could be operated as a control structure to regulate salinities in certain portions of the lake or adjacent marshes, as appropriate to manage fish and wildlife resources. This would help mitigate the salinity effects of the MR-GO to Lake Pontchartrain.

If the Barrier Plan is implemented, the construction of proposed levees in St. Tammany Parish near White Kitchen could result in disturbance of endangered species habitat, i.e., eagle nesting areas.

In summary, conversion of natural habitats including marshes, swamps, and lake bottoms to levees, borrow sites, or structures would occur as a result of the project. Barrier construction in the tidal passes of Lake Pontchartrain would induce additional but unquantifiable impacts through reduction of detrital and biological transport into the lake from adjacent marshes and coastal waters. Additional discussion of impacts is given in Appendix C, Section V.

Cultural Resources. The Chef Menteur and Rigolets barrier structures, as designed in 1978, and associated levees in St. Tammany Parish have been surveyed to inventory cultural resources. No cultural resources listed on or eligible for inclusion on the National Register are located in the direct construction impact areas. However, Forts Pike and Macomb, properties listed on the National Register of Historic Places, are located adjacent to the Rigolets and Chef Menteur complexes, respectively, and visual impacts are therefore possible.

Numerous cultural resource surveys of the Chalmette area have revealed two archeological sites of possible National Register significance located near the levee rights-of-way. Both sites, 16OR40



and 160R41, were reported as deeply buried shell middens located during dredging operations. In conjunction with the proposed construction of a dock facility adjacent to the levee rights-of-way, the Port of New Orleans recently (1982) conducted a deep coring study in an attempt to locate site 160R40. No in situ cultural stratum was located, and it was concluded that the site probably was destroyed during construction of the MR-GO in 1960-1962. The New Orleans District undertook a similar study to assess the impacts of the project on site 160R41 in early 1983. Again, no in situ cultural stratum was located and it was calculated that the site was probably destroyed when dredged in 1964.

Except for the completed floodwalls along the IHNC, the Citrus-New Orleans East levee system has been covered by cultural resource surveys. The surveys included architectural evaluations of the pier camps and other standing structures located on and within 120 feet of the shoreline along the Citrus and New Orleans East Lakefront levees. The evaluations found none of the structures eligible for inclusion in the National Register. No other significant cultural resources were located in the area.

The New Orleans Lakefront levee is located almost entirely on post-1930 land fill and no cultural resources are affected. The possible impacts of the Bayou St. John closure on significant cultural resources were addressed through the permit process. No National Register or Register-eligible property will be adversely affected by the Bayou St. John closure. As no solution to the New Orleans outfall canal problems has been determined, possible impacts can not be fully addressed. However, no properties currently listed on the National Register or determined eligible for listing would be impacted by the alternative solutions under consideration. However, the three pumping stations associated with the outfall canals have the potential for National Register significance. A cultural resources survey of the Jefferson Parish Lakefront levee and the Jefferson Parish/St. Charles

Parish return levee was recently completed, and located no significant cultural resources.

As the tentatively recommended St. Charles Parish levee is only in a preliminary level of design, there has been no cultural resources survey conducted. There are no cultural resources presently recorded in the area of the proposed North of Airline Highway levee alignment.

The proposed renovation of the Mandeville seawall is presently under study to determine possible impacts to buried cultural remains and to the historic buildings and proposed district along the lakefront. Although the study is not yet complete, current data indicate no significant remains would be impacted.

A remote sensing survey of the Howze Beach offshore borrow area has been conducted. A magnetometer and sub-bottom profiler were used to locate possible historic shipwrecks and prehistoric sites which might be affected by the borrow area. Three anomaly clusters were located in the Howze Beach borrow area which may represent significant historic remains. The feasibility of avoiding project impacts to these clusters by delineation of avoidance areas in the proposed borrow area is under study. If avoidance is not feasible, the anomalies will be tested to determine whether they are significant and require further mitigative effort.

Recreational Resources. Implementation of the Barrier Plan would adversely affect water-oriented recreation in the vicinity of The Rigolets and Chef Menteur barrier complexes. Short term localized turbidity would be evident in the vicinity of each barrier complex during construction, adversely affecting the fisheries resource. Within the vicinity of the structures, recreational boaters would at times encounter a possible delay in passage due to narrow openings in the barrier structures and heavy boat traffic. These obstructions would

impact the ease of boat movement between Lake Pontchartrain and Lake Borgne. In addition, tidal exchange would be decreased. As a result, sport fishing, shrimping, and crabbing in Lake Pontchartrain would not maintain its current level. A reduction of 16,793 man-days of sport fishing valued at \$65,493 and of 922 man-days of sport hunting valued at \$9,526 would result from implementation of this plan. See the USFWS Final Coordination Act Report Volume II, Section XIV, Table 8.

Water Quality. The Barrier Plan's potential water quality impacts primarily relate to Lake Pontchartrain. Lake Pontchartrain's water quality is essentially controlled by three factors; input from tributary area runoff and municipal and industrial discharges, tidal flux, and water circulation primarily caused by wind. Some increased development could be expected to accompany the plan, resulting in increases in runoff and discharges. Conversely, it is anticipated that over the project life there would be improvements in wastewater treatment methods, continuation of the Clean Water Act, adoption of more stringent regulations, development of better enforcement procedures, and a resultant long term improvement of the quality of runoff and discharges received by Lake Pontchartrain.

Construction of The Rigolets closure dam feature would result in increased turbidity during its construction. The operation of both The Rigolets complex and Chef Menteur complex would result in a slight decrease in the normal tidal flux (prism) on the order of 5 percent. Operation of the Seabrook complex would be expected to decrease salinities in the lake. The large scale water circulation patterns within Lake Pontchartrain are primarily controlled by winds, and would not be affected by the project. However, operation of the barrier complexes would have localized effects on water velocities in the tidal passes, thereby affecting water quality in those areas. Operation of The Rigolets complex and the Chef Menteur complex would increase water velocities whereas operation of the Seabrook complex would decrease

water velocities. Water quality in the deep borrow pits remaining after construction generally would be poor.

Water Conservation. The implementation of the Barrier Plan would not have any significant effects on water conservation.

Social Impacts. A primary impact of the Barrier Plan on social well-being would be to assure adequate protection against SPH flooding to residents of the Metropolitan New Orleans area residing within the existing levee system, and residents living on the East Bank of St. Charles Parish south of Airline Highway. This plan would protect human lives and property and provide a sense of security. The plan also would provide a lesser degree of protection to populated areas along the north shore of Lake Pontchartrain. Some induced development throughout the study area would result in a minor increase in property values in the study area. No relocations of residences would be necessary. Project construction would result in minor short term reductions of land-based recreational and esthetic values, especially along the New Orleans Lakefront and Jefferson Lakefront levee reaches. Reductions in the long term environmental values of Lake Pontchartrain would result in a similar reduction of commercial and sports fisheries values in the lake. The barrier complexes at The Rigolets and Chef Menteur Pass would have some adverse impacts upon navigation interests, whereas the Seabrook complex would have beneficial impacts on navigation interests.

SUMMARY EVALUATION. This plan fulfills the primary planning objective of providing more adequate hurricane protection for the Metropolitan New Orleans area. The plan is complete for implementation and is not reversible. In terms of completion, the plan is estimated to have a cost of \$874,238,000, a benefit-to-cost ratio of 3.3 to 1 and would have annual excess benefits over costs of \$70,928,000.

The plan's net impacts on the environment would be negative. The potential adverse long term environmental impacts of the barrier complexes on Lake Pontchartrain are an area of widespread public concern.

IMPLEMENTATION RESPONSIBILITIES. This section sets forth the cost allocations and apportionment required assuming this plan is implemented.

Cost Allocation. With the exception of the Seabrook complex, all costs for the construction and operation and maintenance of the Barrier Plan would be allocated to hurricane protection. As set forth in the authorizing legislation, 50 percent of the first costs of the Seabrook complex are allocated to the hurricane protection project. Fifty percent of the first costs of the Seabrook complex and all of this feature's operation and maintenance costs are allocated to the MR-GO navigation project.

Cost Apportionment. Under the cost-sharing policies which apply to the project as a result of legislative authority, the estimated first cost (construction cost) of \$742,822,000 to complete the project would be apportioned \$519,976,000 to the Federal Government, and \$222,846,000 to non-Federal interests. All of the estimated average annual operation and maintenance costs of \$1,760,000 (including operation and maintenance costs for completed work) would be borne by non-Federal interests.

## **THE HIGH LEVEL PLAN**

PLAN DESCRIPTION. This plan would provide SPH protection for the major urban areas in and immediately adjacent to New Orleans. The main features of the plan would consist of improvement of the existing system of levees and floodwalls, and extension of the existing levee system to encompass the populated portion of the east bank of St. Charles

Parish. The general locations of the plan's proposed features are shown on Plate 9. Details of individual plan features are discussed in subsequent paragraphs.

Mutual Features of the High Level Plan and the Barrier Plan. The High Level Plan incorporates six features which are identical in design to those contained in the Barrier Plan. These are: the Chalmette Area Plan, the IHNC East Bank levee, the IHNC West Bank levee, the Citrus Back levee, the New Orleans East Back levee, and the Mandeville seawall. These features are identical under either plan because they would function independently of barrier structures. A description of each is found under the Plan Description discussion of the Barrier Plan.

Levees. Features of the High Level Plan which are not identical to those provided by the Barrier Plan are levee reaches which are similar in alinement, but not the same in terms of grade, section, or in some cases, construction method. These levee reaches include: the South Point-to-GIWW levee, the New Orleans East Lakefront levee, the Citrus Lakefront levee, the New Orleans Lakefront levee, the Jefferson Parish Lakefront levee, and the St. Charles Parish levee. Details of these individual features are discussed in subsequent paragraphs.

The South Point-to-GIWW levee is complete to barrier plan specifications except for the Highway 90 crossing. The levee design is an all earthen design built by means of hauled clay fill upon a locally constructed levee. The High Level Plan provides for completing the levee utilizing a similar type design as the Barrier Plan; however, the High Level Plan design calls for greater levee grades and widths. The 8.3 miles of levee would be increased to final elevations varying from 13.5 to 15.0 feet and final base widths varying from 130 to 176 feet. It is anticipated that only minimal modifications of the existing drainage structures would be necessary.

The New Orleans East Lakefront levee is complete to barrier plan specifications except for foreshore protection. The current levee design is an all earthen design built by means of hauled clay fill. The High Level Plan provides for completing the levee utilizing a similar type design as the Barrier Plan; however, the High Level Plan design calls for a greater levee elevation and width. The design requires improving the 6.2 miles of levee to attain a final levee elevation of 16.5 feet and a final base width of 272 feet.

The Citrus Lakefront levee is also complete to barrier plan specifications except for foreshore protection. The current levee design is 0.7 miles of I-wall (completed) and 4.3 miles of all earthen levee using hauled clay fill. The High Level Plan provides for completing the levee utilizing 0.7 miles of I-wall only, and 4.3 miles of I-wall driven atop the existing earthen levee, with a barge berm to the lakeside of the railroad embankment. The existing 0.7 miles of I-walls would not be overtopped during an SPH event with barrier structures in place, but some overtopping could be expected to occur during an SPH event without the barrier structures in place. While overtopping of the existing I-walls would not cause failure, they are not structurally sufficient to allow raising to prevent overtopping. The cost estimate for completing the Citrus Lakefront levee feature of the High Level Plan includes costs for removing the existing I-walls and replacing them with higher I-walls which would not be subject to overtopping or failure during SPH events. The existing I-wall elevations are 11.0 feet and the new I-wall elevations would be 13.5 feet. More detailed studies may show that overtopping of the existing I-walls would result in such small volumes of inflows to the protected area that the overtopping can be tolerated, and the I-walls would not be replaced. The remaining 4.3 miles of levee would be completed by building I-walls atop an earthen embankment having a net grade of 12.0 feet and base width of 70 feet. The net grade of the I-wall would be 15.0 feet. The levee would be located to the landside

of the Southern Railroad embankment. At the lakeside of the railroad embankment, paralleling the levee/floodwall section, a barge berm would be constructed to a net grade of 12.0 feet and a base width of 53 feet. The barge berm would be constructed with a shell core covered with derrick stone.

The proposed New Orleans Lakefront levee design provides for about 1,300 feet of I-wall floodwall to the landside of the Orleans Marina, which is located at the western terminus of the levee reach. The floodwall is completed to barrier plan specifications and has a net grade of 10.5 feet. The rest of the reach's basic design is an all earthen levee section (hailed clay) to be built upon an existing levee to a net grade of 12 feet. Local interests have raised portions of the levee to a grade of 16.0 feet as a means of higher interim protection. A similar situation exists for this feature as does for the existing I-wall section along the Citrus Lakefront levee reach. The cost estimate includes costs to remove the existing I-wall and replace it with an I-wall with a net grade of 13.5 feet, although there is the possibility that the existing I-wall might be left in place if potential overtopping is determined to be minor in terms of water (inflow) volume. The remainder of the 6.9-mile levee system basically would utilize a design section consisting of a hauled clay fill levee base with a 12.0-foot grade and 140-foot base width, and an I-wall driven into the levee base to a net grade of 14.5 feet. (Because the levee design section and barge berm are contiguous, the levee would have a very wide crown.) As is the case for the Barrier Plan cost estimate for this feature, the High Level Plan cost estimate includes \$124,000,000 for a solution to New Orleans's outfall canal problems. This amount is considered the upper limit of reasonable costs required for this feature.

Although the existing Jefferson Parish Lakefront levee is adequate in terms of grade and cross section for barrier designs, it is



inadequate for the High Level Plan. This plan would use hydraulic fill to raise and widen the existing 10.3 miles of earthen levee to a net grade of 14.0 feet and a base width of 686 feet. The existing Federal levee has a net design grade of 10.0 feet; however, work by local interests, not to Corps standards in terms of design integrity, has raised the levee grade to 14.0 feet. Frontage protection at four new pumping stations (two completed, two under construction) is being provided to high level design standards by local interests. Existing stations would need new frontage protection.

The High Level Plan provides for extending protection to existing developed areas on the east bank of St. Charles Parish to the Bonnet Carre' Spillway. Protection would be accomplished by a combination of levees and floodwalls which would extend from the St. Charles-Jefferson Parish line basically paralleling Airline Highway just to the north, terminating at the east guide levee of the Bonnet Carre' Spillway. The levee/floodwall system will average 13.5 to 14.0 feet in final elevation, vary between 188 and 238 feet in base width, and total 9.9 miles in length.

SUMMARY OF PLAN FEATURES. Summary listings and cost estimates of the High Level Plan's features are presented in Table 22. Detailed cost estimates of each feature are contained in Appendix A, Engineering Investigations.

ECONOMIC ANALYSIS. The economic analysis of the High Level Plan is discussed in detail in Appendix B, Economic Analysis, and only a summary of that data is contained in this section. Completion of construction to the level considered in this plan would require a gross investment of \$653,958,000. Using a project life of 100 years and a rate of return of 3 1/8 percent, the average annual charges for this amount would be \$21,423,000. Estimated annual operation, maintenance and replacement costs are \$964,000. Annual fish and wildlife losses and recreation

TABLE 22

SUMMARY OF COSTS TO COMPLETE THE HIGH LEVEL PLAN  
 (\$1,000's, October 1981 Price Levels,  
 3 1/8 Percent Annual Discount Rate and a 100-Year Project Life)<sup>1/</sup>

FEATURE	FIRST COST	ANNUAL OPERATION AND MAINTENANCE COSTS <sup>2/</sup>
CHALMETTE AREA PLAN	65,925	249
CITRUS-NEW ORLEANS EAST AREA		
Citrus Back Levee	5,050	27
New Orleans East Back Levee	17,087	17
South Point to GIWW levee	5,182	25
New Orleans East Lakefront Levee	34,843	22
Citrus Lakefront Levee	46,854	95
IHNC East Bank Levee	3,423	30
WEST NEW ORLEANS AREA		
IHNC West Bank Levee	33,324	30
New Orleans Lakefront Levee <sup>3/</sup>	215,813	324
EAST BANK OF JEFFERSON PARISH AREA		
Jefferson Parish Lakefront Levee	123,173	92
Jefferson-St. Charles Parish Boundary Levee	18,941	13
EAST BANK OF ST. CHARLES PARISH AREA		
North of Airline Highway Levee	55,721	39
MANDEVILLE SEAWALL	2,378	1
TOTAL	627,714 <sup>4/</sup>	964
GROSS INVESTMENT COST - BASE YEAR 1988 <sup>5/</sup>	653,958	

Annual Costs (\$1,000's)

Interest and Amortization on Investment Costs (I&A) =

\$653,958 X 0.03276 = \$21,423

I&A       \$21,423

O&M       964

TOTAL     \$22,387

<sup>1/</sup> Cost to complete from 1 October 1979.

<sup>2/</sup> Includes annualized costs of replacements and O&M on completed work.

<sup>3/</sup> Includes \$124,000,000 for solution to outfall canals' problems.

<sup>4/</sup> Does not include mitigation costs. Fish and wildlife mitigation will be addressed in a separate document.

<sup>5/</sup> Present worth of expenditures expressed at base year.

losses are estimated to be \$6,000 and \$376,000, respectively. These charges total \$22,769,000, with 1988 as the base year.

Annual benefits attributable to this plan are estimated to be \$95,771,000. Of this amount, \$88,430,000 would accrue to existing development, \$6,002,000 to future development, and \$1,339,000 to reduction in costs of emergency operations.

The average annual net benefits (benefits less costs) are \$73,002,000, and the ratio of average annual benefits to average annual costs is 4.2 to 1. Considering only benefits to existing developments, average annual net benefits are \$65,661,000, and the benefit to cost ratio is 3.9 to 1. This project is economically justified on the basis of protection to existing development.

#### IMPACT ASSESSMENT.

Environmental Impacts. The impacts discussed in the following paragraphs are those which occur as a result of completing the project.

Biological Resources. Construction of the High Level Plan would result in deposition of additional dredged or fill material on previously existing levee alignment. Thus, direct impacts to marsh are expected to be minimized. Primary impacts of this plan would be loss of water bottom within Lake Pontchartrain from dredged material deposition and hydraulic dredging. Approximately 573 acres of lake bottom would be impacted by the hydraulic dredging operations to obtain material for the Jefferson Parish Levee. The borrow sites would be located approximately 2,500 feet off the shoreline with an orientation basically parallel to the shore. The dimensions of the borrow site vary from approximately 500 feet at the top to 250 feet at the bottom. The extent of the borrow site would be about 9 miles paralleling the shoreline. The approximately 60-foot deep borrow area would not receive proper water

circulation, and even in this shallow, wind-controlled lake, could become an anoxic sump. These could chemically and/or physically stratify, rendering them unsuitable for benthic organisms for long periods of time. However, these borrow areas represent only about 0.2 percent of the offshore water in Lake Pontchartrian, and approximately 0.1 percent of the total lake bottom habitat. During the colder months of the year, the deep holes probably would act as fish attractors. It is highly unlikely that the unsuitable water at the bottom of the pits would mix with adjacent lake waters, even during hurricane events.

Direct loss or alteration of habitat as a result of implementing the High Level Plan would be as follows: 54 acres brackish/saline marsh, 984 acres of lake bottom (573 borrow and 411 levee), and 213 acres of cypress tupelo swamp and 88 acres of scrub-shrub. Implementation of the High Level Plan instead of the barrier structures would result in a savings of approximately 814 acres of brackish/ saline marsh by the end of project life (2100). No endangered species nor their habitat would be affected by the High Level Plan. Temporary interruption of commercial and recreational fishery could occur in portions of the project area during construction. Without barriers to prevent flooding of forests, the impacts of a hurricane would be similar to those discussed in the Environmental Resources section.

The major impact under the High Level Plan would be the loss of 984 acres of lake bottom through lakefront levee construction and associated borrow in Jefferson Parish. It is expected that the borrow sites would become more shallow with time and become repopulated by benthic organisms, although probably of different species.

Cultural Resources. The impacts are the same as the Barrier Plan with two exceptions. The Jefferson Parish offshore borrow area required for the High Level Plan increases the possibility of impacting historic shipwrecks. Remote sensing survey of the borrow area located four

anomaly clusters which may represent significant historic remains. The feasibility of avoiding project impacts to these clusters by delineation of avoidance areas in the proposed borrow area is under study. If avoidance is not feasible, the anomalies will be tested to determine whether they are significant and require further mitigative effort. Secondly, absence of the barrier complexes eliminates the possibility of visual impacts on Forts Pike and Macomb.

Recreational Resources. The High Level Plan would impact an area much larger in acreage than the Barrier Plan due to the nature of the project. The linear impact zone would disrupt land based recreational features in proximity to the shoreline. Short term localized turbidity would be evident during construction, impeding the fisheries resource within the work area. The entire lakefront areas of Orleans and Jefferson Parishes will experience some direct impacts due to construction of the High Level Plan. These impacts are not confined to any single recreational activity but will be widespread. Some construction impacts will be long term and others will be short term. Construction modifications are intended to minimize effects i.e., I-walls around Williams and Bonnabel boat launch complexes. Some esthetic losses would occur during construction due to the close proximity of trees and grass play fields to the work area. No known private recreational camps in New Orleans East would require relocation.

The High Level Plan will reduce the number of recreation man-days now present on the south shore of Lake Pontchartrain. Specific facilities impacted and their associated losses are:

<u>Facility</u>	<u>Man-Day Loss</u>
2-lane boat ramp (Kenner Race Track)	23,100
10.5-mile National Recreation Trail (Jefferson Parish)	75,799
3 children's play areas (Orleans Parish)	16,785
Hunting Small Game	77
Hunting Large Game	15
Hunting Waterfowl	173
Sport Fishing	1,712

These man-day losses are approximate and are conservative estimates. They do not include man-day estimates for passive recreation such as walking, driving for pleasure, bird watching, etc. Also not included in the estimates are the proposed recreation developments at Bucktown and Causeway Blvd. The National Recreation Trail and children's play areas will be replaced after construction. The Kenner Race Track boat ramp will not be replaced due to its limited use now and its current state of disrepair. Hunting and fishing man-day losses will not be replaced.

Water Quality. The High Level Plan's potential water quality impacts primarily relate to Lake Pontchartrain. During construction of the first two lifts of the Jefferson Parish Lakefront levee by means of hydraulic dredge and fill techniques, there would be a large amount of turbidity along the Jefferson Parish Lakefront. Some increased development could be expected to accompany the plan, resulting in increased runoff and discharges into Lake Pontchartrain. Conversely, it is anticipated that over the project life, there would be improvements in wastewater treatment methods, continuation of the Clean Water Act, adoption of more stringent regulations, development of better enforcement procedures, and a resultant long term improvement of water quality of runoff and discharges received by Lake Pontchartrain.

Water Conservation. The implementation of the High Level Plan would have no significant effects on water conservation.

Social Impacts. The primary social impact would be insuring adequate protection against hurricane flooding to residents of the Metropolitan New Orleans area residing within the existing levee system and residents living on the East Bank of St. Charles Parish south of Airline Highway. This plan would protect human lives and property and provide a sense of security. Some induced development throughout the study area would result in a minor increase in property values in the study area.

No relocations of residences would be necessary. During project construction, land-based recreational and esthetic values would be reduced, especially along the New Orleans Lakefront and Jefferson Parish Lakefront levee reaches.

SUMMARY EVALUATION. This plan fulfills the primary planning objective of providing more adequate hurricane protection for the Metropolitan New Orleans area. The plan is complete for implementation, and it is not reversible. In terms of completion, the plan is estimated to have a cost of \$653,958,000, a benefit-to-cost ratio of 4.2 to 1 and would have annual excess benefits over costs of \$73,009,000.

The plan's net impacts on the environment would be negative. However, the cumulative impacts would be less than those under the Barrier Plan.

IMPLEMENTATION RESPONSIBILITIES. This section provides information regarding the allocation and apportionment of costs required if this plan is selected.

Cost Allocation. All costs for the construction and operation and maintenance of the High Level Plan would be allocated to hurricane protection.

Cost Apportionment. Under the cost-sharing policies which apply to the project due to legislative authority, the first cost to complete the project of \$627,714,000 would be apportioned \$439,400,000 to the Federal Government and \$188,314,000 to non-Federal interests. All of the estimated average annual operation and maintenance costs of \$964,000 (including operation and maintenance costs for completed work) would be borne by non-Federal interests.

## MITIGATION PLANS

Project-induced losses of either the Barrier Plan or the High Level Plan would be mitigated. At the present time, various mitigation concepts have been developed. These include: aiding in implementation of St. Bernard Parish marsh management plans; provision of shoreline stabilization in St. Charles Parish lakefront, eastern Orleans Parish, and/or the Manchac Wildlife Management Area; wetland management in St. Charles Parish; restoration of tidal exchange in New Orleans East; and filling of the Chef Menteur By-Pass channel. For a more detailed description of these mitigation features, see paragraphs 4.4.2.3 to 4.4.2.7 in the EIS. Since impacts of the Barrier Plan are far more extensive than those for the High Level Plan, mitigation costs would be doubled or tripled for the Barrier Plan. A separate Mitigation Plan/EIS is being prepared. During mid-1984, a series of public meetings and workshops will be held to get input into the plan. The plan should be tentatively selected and ready for review within the Corps of Engineers by early 1985 and the Final EIS on mitigation should be filed with EPA early in 1986.



## COMPARISON OF DETAILED PLANS

### INTRODUCTION

Comparative information on the detailed plans is presented herein, along with the rationale for determining which of the plans is the national economic development (NED) plan and which is the recommended plan.

Both of the plans considered in detail fulfill the primary planning objective by providing more adequate hurricane protection for the east bank Metropolitan New Orleans area. Both are structural plans. Practical nonstructural measures such as zoning and building regulations, flood-forecasting and warning, and flood-fighting and evacuation plans, are currently in place within the study area and will remain in use as features of any plan, including the No Action Plan.

All of the plans are economically justified; however, the High Level Plan is the least costly plan and provides the highest annual excess benefits over costs. Although neither of the plans would result in net positive environmental quality benefits, the High Level Plan has the fewest environmental damages.

A summary comparison of the plans is shown in Table 23.

### NATIONAL ECONOMIC DEVELOPMENT

The NED plan is that plan which maximizes the difference between average annual benefits and average annual charges. A review of economic data related to the benefits accruing from completion of both plans shows the Barrier Plan would provide the maximum total benefits, as it would provide SPH protection to all areas benefited by the High Level Plan, as well as to additional areas along the north shore of Lake Pontchartrain (as shown on Plate 10). However, the Barrier Plan would be more expensive to construct, more than offsetting the increase in benefits.

TABLE 23  
SUMMARY COMPARISON OF PLANS

ITEM	THE BARRIER PLAN	THE HIGH LEVEL PLAN	NO ADDITIONAL FEDERAL ACTION
I. PLAN DESCRIPTION	Completion of the existing system of levees and floodwalls, construction of two new levees, one running generally north of and parallel to Airline Highway in St. Charles Parish between the Jefferson Parish line and the east guide levee of the Bonnet Carré Spillway, the other running along the Jefferson-St. Charles Parish boundary from Lake Pontchartrain to Airline Highway. This plan includes construction of barrier complexes at Lakeview, Gulf Meunier Pass, and The Sloughs such that all plan elements can be operated in tandem to provide 90% protection to those areas included by the system of levees and floodwalls and provide a lesser degree of protection to areas bordering the north shore of Lake Pontchartrain.	Completion of the existing system of levees and floodwalls, construction of two levees, one running generally north of and parallel to the Airline Highway in St. Charles Parish between the Jefferson Parish line and the east guide levee of the Bonnet Carré Spillway, the other running along the Jefferson-St. Charles Parish boundary from Lake Pontchartrain to Airline Highway such that the area included by the system of levees and floodwalls will enjoy 90% protection.	Maintenance of the existing system and its continued operation (construction funding through Fiscal Year (FY) 1979 and average annual impacts through FY84 were assumed).
II. SIGNIFICANT IMPACTS			
A. National Resources Development (NRD)			
a. Total Average Annual Benefits	\$161,407,000	\$ 94,771,000	Not applicable.
1) Floodation Reduction	\$100,632,600	\$ 94,432,000	
2) Employment Operations	\$ 1,405,000	\$ 1,379,000	
b. Total Average Annual Cost	\$ 30,441,000	\$ 32,787,000	
1) Interest and Amortization	\$ 18,640,000	\$ 21,475,000	
2) Operation and Maintenance	\$ 1,264,000	\$ 994,000	
3) Fish and Wildlife Losses	\$ 28,000	\$ 2,000	
4) Recreation Losses	\$ 9,000	\$ 372,000	
c. Total Cost	\$742,622,000	\$687,716,000	
d. Net Annual NRD Benefits	\$ 90,966,000	\$ 72,379,000	
e. Benefits/Cost Ratio	1:3 to 1	4:2 to 1	
B. Environmental Quality			
a. Aquatic and Terrestrial Habitat	Direct loss or alteration of an estimated 2,183 acres of brackish-marine marsh, 28 acres of lake bottom, 870 acres of bayou/marsh bottom, 41 acres of bottomland hardwood, and 82 acres of cypress-tupelo forest. By the year 2100, it is estimated that the following acreages would exist within the area of potential construction impacts: brackish-marine marsh, 20; lake bottom, 1,931; bayou/marsh, 467; bottomland hardwood, 0; cypress-tupelo, 0; scrub shrub, 2,180; and upland developed, 1,017.	Direct loss or alteration of an estimated 54 acres of brackish-marine marsh, 984 acres of lake bottom, 88 acres of scrub-shrub, and 107 acres of cypress-tupelo forest. By the year 2100, it is estimated that the following acreages would exist within the area of potential construction impacts: brackish-marine marsh, 834; lake bottom, 1,091; bayou/marsh, 932; bottomland hardwood, 1; cypress-tupelo, 0; scrub shrub, 706; and upland developed, 1,145.	Development activities, subsidence, and erosion actions are projected to continue and would result in a change in habitat types in wetlands within the study area over the project life. Shoreline retreat (erosion) could be expected to continue within Lake Pontchartrain resulting in an increase in lake bottom acreage. By the year 2100, it is estimated that the following acreages would exist within the area of potential construction impacts: brackish-marine marsh, 857; lake bottom, 1,931; bayou/marsh, 994; bottomland hardwood, 1; cypress-tupelo, 28; scrub shrub, 870; and upland developed, 641.
b. Aquatic Resources	The barrier structures would restrict the transport of fish through the tidal passes, resulting in a long term reduction of the biological productivity and quality of the Lake Pontchartrain system. Excavation for fill material would result in holes in the lake bed to 50 feet deep, creating a potential for aquatic conditions to develop as the holes resulting in localized areas deleterious to aquatic life. Operation of the Lakeview lock complex would reduce salinity levels in Lake Pontchartrain. Marsh loss due to construction would slightly reduce fisheries in the lake. Project construction would result in short term increases in turbidity in the vicinity of Lake Pontchartrain's three main tidal passes. The barrier complexes would alter water circulation and water quality in the immediate vicinity of the barrier complexes.	Excavation of material for lakefront levees would result in deep holes in the lake, 50 feet deep. Water stratification (physically and chemically) probably would occur. Aquatic conditions would probably develop in these holes, resulting in localized conditions deleterious to aquatic life. Project construction would result in increases in turbidity along the Jefferson Parish Lakefront levee during levee construction.	Development within the study area would continue and result in increased runoff and discharges into Lake Pontchartrain; however, improvements in wastewater treatment, continued implementation of the Clean Water Act, adoption of more stringent regulations, and development of better enforcement procedures would result in a net increase in water quality in the study area. (These impacts also are applicable to the Barrier Plan and the High Level Plan.)
c. Endangered Species	Potential disturbance of eagle nesting sites as a result of construction of a reach of the barrier closure levee system.	None.	None.
d. National Register of Historic Places	No impacts, with the exception that a Chalmette-area shell midden located near the Parish Road bridge where it crosses the Chalmette Area Flood levee system has not yet been excavated. Also, all studies are not yet completed.	Same as the Barrier Plan.	No impacts.
e. Natural and Scenic Rivers	No impacts.	No impacts.	No impacts.
3. Social Well-Being			
a. Community Cohesion	Community cohesion may be adversely affected to a minor extent during construction, but no businesses or residences near project construction sites would be physically affected. The impact is not considered significant.	Similar to the Barrier Plan, but slightly greater due to the greater amount of construction which would occur near populated areas. The impact is not considered significant.	No impacts.

TABLE 23 (continued)  
SUMMARY COMPARISON OF PLANS

ITEM	THE BARRIER PLAN	THE HIGH LEVEE PLAN	NO ADDITIONAL FEDERAL ACTION
b. Displacement of People	None.	None.	None.
c. Time	Residents near levee/floodwall construction would be adversely affected by construction activities.	Similar to, but slightly greater than the Barrier Plan.	No change.
d. Leisure Opportunities	A reduction of an estimated 256 man-days of hunting annually would result. This loss would not be mitigated and will be considered a loss due to this plan.	Would result in a reduction of an estimated 115,979 man-days of recreation usage annually. Included in the 115,979 man-days lost are 275 annual man-days of hunting. Recreation facility losses of 115,000 man-days will be replaced in kind as a project mitigation feature, however, 775 man-days of sport hunting will not be mitigated and will be considered a loss due to this plan.	No impact.
e. Security of Life, Health, Safety	Standard Project hurricane protection would be provided to areas within the levee system; lesser degrees of hurricane protection would be provided to residents of the North Shore Area of Lake Pontchartrain. The Seabrook Complex features would reduce the possibility of navigation accidents for traffic between Lake Pontchartrain and the RMC.	Similar to the Barrier Plan, except that there would be an additional hurricane protection provided to the North Shore Area.	No change.
f. Property Values	Minor increase in property values in areas experiencing protection from project completion.	Similar to but slightly less than the Barrier Plan because no protection is provided to the North Shore Area.	No impact.
4. Regional Development			
a. Effects on Employment and Income	The induced development caused by the Barrier Plan would result in a minor increase in employment opportunities. Project construction would provide increases in real income and income distribution. Although not included in the benefit analysis, average annual employment benefits attributable to project construction are estimated at \$5,900,000.	Similar to but slightly less than the Barrier Plan. Although not included in the benefit analysis, average annual employment benefits attributable to project construction are estimated at \$4,240,000.	Unsignificant.
b. Land Use	There would be no increase in induced development (industrial and residential) as a result of project construction.	Similar to but slightly less than the Barrier Plan.	Continued urban growth.
III. OTHER FACTORS IN PLAN EVALUATION			
a. Plan Response to Associated Evaluation Criteria			
1. Acceptability	Widespread environmental opposition to plan as a result of concerns about potential adverse long term impacts to Lake Pontchartrain and the potential development of the New Orleans East Area. North Shore Area residents are concerned that part of the plan might add to the existing potential for hurricane flooding. Navigation interests oppose the plan because of potential adverse impacts to navigation at Chief Boudro Pass and at The Sigoules. The State of Louisiana, Office of Public Works, is of the opinion that the Barrier Plan offers the greatest opportunity for future regional development.	The plan is generally acceptable on all parties, however, environmental groups are concerned about potential future development of the New Orleans East Area. Some opposition from residents immediately adjacent to future levee work along the New Orleans East Area and Jefferson Lakefront levee reaches may be expected during construction.	Greater protection against hurricane flooding is desired by residents of the Metropolitan New Orleans Area.
2. Efficiency (based on level and areal extent of hurricane protection provided)	Most efficient plan.	Slightly less efficient, as no protection is provided to North Shore Area.	Least efficient.
3. Reversibility	Irreversible.	Irreversible.	Not applicable.
4. Ranking of Plans			
a. Red Objective	(2)	(1) HB Plan	
b. EQ Objective	(2)	(1) LB Plan	
c. Social Well-Being	(1)	(2)	
d. Regional Development	(1)	(2)	
IV. IMPLEMENTATION RESPONSIBILITIES			
1. First Cost			
a. Federal	\$520,000,000	\$479,400,000	
b. Non-Federal	\$227,800,000	\$188,300,000	
c. Total	\$747,800,000	\$667,700,000	
2. Annual Cost			
a. Federal	\$ 17,100,000	\$ 16,600,000	
b. Non-Federal	\$ 3,000,000	\$ 2,100,000	
c. Total	\$ 20,100,000	\$ 18,700,000	

Table 24 shows a comparison of average annual benefits and charges for both plans providing SPH protection. A review of that data shows the Barrier Plan would have net benefits of \$60,813,000 while the net benefits attributable to the High Level Plan are \$73,002,000. Of the two, the High Level Plan is more acceptable considering national economic development.

A High Level Plan providing a 100-year level of protection was then compared to that providing protection from the SPH. Net benefits from the levees/floodwalls providing a 100-year level of protection were \$68,173,000, or \$4,829,0000 less than would accrue under SPH levels. Thus, the High Level Plan providing SPH level of protection was designated the NED plan.

TABLE 24  
PLAN COMPARISON<sup>1/</sup>  
NATIONAL ECONOMIC DEVELOPMENT DETERMINATION

ITEM	BARRIER PLAN SPH	HIGH LEVEL PLAN	
		SPH	100-YEAR
Annual Benefits	\$86,946	\$95,771	\$87,134
Annual Charges	26,132	22,769	18,961
Net Benefits	60,813	73,002	68,173
Benefit-Cost Ratio	3.3 to 1	4.2 to 1	4.6 to 1

<sup>1/</sup>1981 Price levels; values in \$1,000's; comparison at base year of 1988.

## **DETERMINATION OF RECOMMENDED PLAN**

The recommended plan was determined after a review of economic, environmental, social, engineering, and public interest considerations. A summary of effects on various specific items of concern is shown on Table 23, and a comparison of major effects of the plans considered in detail is contained in this section.

ECONOMIC CONSIDERATIONS. As discussed in the section regarding designation of the NED plan, the High Level Plan providing protection against the SPH provided the maximum net benefits. The difference in net benefits of this plan over the Barrier Plan is \$12,189,000.

ENVIRONMENTAL CONSIDERATIONS. Construction of the features included in either of the plans considered in detail would result in net adverse environmental impacts. The Barrier Plan would cause extensive but unquantifiable adverse impacts to the biology of Lake Pontchartrain and destroy 2,363 acres of marsh. The impact to the lake primarily results from the reduction in the lake's productivity, and a reduction in export to other systems. The Barrier Plan also would directly impact 164 acres of cypress tupelo swamp, 28 acres of lake bottom, 870 acres of bayou/canal, and 41 acres of bottomland hardwoods. Additionally, it would have potential adverse impacts on an endangered species, the bald eagle.

Completion of the project as considered in the High Level Plan would directly impact 213 acres of cypress tupelo swamp, 54 acres of brackish/saline marsh and 984 acres of lake bottom. The additional 49 acres of cypress tupelo swamp impacted by the High Level Plan would be more than offset by the 41 acres of bottomland hardwoods impacted by the Barrier Plan. The High Level Plan would immediately impact 2,309 less acres of brackish/saline marsh, and no river/canal or bottomland hardwood areas. It would directly impact 956 more acres of lake bottom.

This increase in lake bottom acreage impact results primarily from the area of lake bottom required by borrow and construction of levees along the lakefront, especially in Jefferson Parish. Raising and strengthening the levee would require the excavation of a borrow trench approximately 60 feet below the existing lake bottom. The water in this trench could chemically and physically stratify, and probably would become anoxic. Comparing this loss of lake bottom (about 0.1 percent of the total) with the potential impact to the lake from the barrier complexes, the High Level Plan was considered to be significantly less detrimental.

Of the two plans, the High Level Plan is considered to have the least environmental damage. Additional discussions on environmental impacts are contained in the EIS supplement, which is contained in this volume.

SOCIAL CONSIDERATIONS. There are short and long term social impacts associated with both plans. Short term impacts of the two plans relate primarily to construction activities within or immediately adjacent to highly developed, urbanized areas. During construction, social disruptions would be caused by noise, dust, and movement of equipment. Because the amount of levee construction in urban areas would be greater for the High Level Plan, the short term social impacts also would be greater.

Long term social impacts associated with the plans relate to permanent changes in land use as a result of constructing project works. During construction of the High Level Plan's Jefferson Parish Lakefront levee and New Orleans Lakefront levee features, recreational and esthetic values would be significantly reduced, whereas construction of the same features under the Barrier Plan would have fewer impacts upon these values. However, once construction is complete, the High Level Plan's Jefferson Parish Lakefront levee would provide a wide, sloping grassy berm suitable for landscaping and recreational redevelopment at a relatively modest cost. The High Level Plan's New

Orleans Lakefront levee feature includes a barge berm which will have a wide flat crown. Upon completion, this berm would offer an improvement over existing conditions, because it would be a long clear continuous green space which could be utilized for high-demand recreational activities such as jogging and walking. The barge berm also offers the potential for landscaping and recreational development at a relatively modest cost. Landscaping recommendations are considered embellishments and are not intended to be mitigation features of the plan.

The Barrier Plan's barrier features at The Rigolets and at Chef Menteur Pass would cause some long term reductions to the fisheries values of Lake Pontchartrain, and adversely affect recreational as well as commercial fishing activities. Additionally, these two features would increase water velocities in the tidal passes, adversely affecting navigation in those areas. In particular, recreational craft such as small fishing boats and sail boats would be affected.

Neither plan would require any business or residential relocations, nor cause any job relocations. The temporary relocation of walkways leading to camps located to the lake side of the Southern Railroad would be required during construction of the Citrus Lakefront levee and New Orleans East Lakefront levee. The social impacts of the two plans vary enough in terms of type and extent to make direct comparisons of plan impacts difficult; however, comparison of some aspects can be made. In general, the short term construction impacts of the High Level Plan are greater than for the Barrier Plan. Long term impacts are considered to be greater for the Barrier Plan.

ENGINEERING CONSIDERATIONS. Both plans are engineeringly feasible and would provide more adequate hurricane protection to the Metropolitan New Orleans area. Both fulfill the primary planning objective of providing hurricane protection to urban areas subject to catastrophic flooding. Neither of the plans considered in detail would be readily reversible because of the massive scope and areal extent of the individual project features.

PUBLIC INTEREST CONSIDERATIONS. Considering the sensitivity, risks, and uncertainty associated with analyses of the plans, and the constraint to recommend SPH protection to urban areas subject to catastrophic flooding, the High Level Plan was identified as the plan being in the best overall national interest. Additionally, the High Level Plan was considered to be more acceptable by various interest groups.

RECOMMENDED PLAN. A review of all aspects and effects of the two plans considered in detail resulted in the selection of the High Level Plan as the recommended plan. The High Level Plan has greater net benefits, is less damaging to the environment, and is more acceptable to the public. Analysis of social considerations indicate it has more short-term adverse social impacts than the Barrier Plan, but probably has fewer long term impacts. Both plans are engineeringly feasible. Thus, the High Level Plan was determined to be the most desirable of any of the practicable alternatives considered for providing more adequate hurricane protection for the Metropolitan New Orleans area.

## SENSITIVITY ANALYSIS

As with all water resources planning projects, there are elements of risk and uncertainty associated with the analyses which resulted in choosing the recommended plan. A detailed sensitivity analysis is contained in Appendix B, Economic Analysis; however, a summary of pertinent aspects which contain an element of risk and uncertainty is contained herein.

Selection of a design storm is based on a statistical analysis of storm-related data, and involves a certain amount of risk and uncertainty. Because of the potential for catastrophic destruction in the area, the SPH was selected as the design storm. To insure that all sections of the study area would be provided some level of protection, several SPH storms were evaluated, each of which would be critical to a given project reach. By considering several project historic events, risks and uncertainty were minimized.



The sensitivity of the economic analysis to errors which would change the economic feasibility was considered to be low. Unit prices used in project costing were based on unit cost of similar work conducted in the New Orleans District, and a contingency factor of 25 percent was added to insure the total cost was not undervalued. Population projections and projections of future development were not a consideration in the determination of economic feasibility, as the project is justified on the basis of protection to existing development. With a ratio of average annual benefits to average annual costs of 4.2 to 1, the feasibility would be relatively insensitive to any errors in benefit calculation.

When construction funds for this project were first appropriated, the interest rate in effect was 3 1/8 percent. Section 80 of the 1974 Water Resources Development Act allows the use of that discount rate for this project reevaluation; however, the same legislation also requires analysis of the project using the current Federal discount rate (7 7/8 percent). Using that rate, average annual benefits for the High Level plan were calculated as \$93,889,000 and average annual charges \$56,660,000. The benefit-to-cost ratio is 1.6 to 1, with net benefits of \$37,229,000.

The economic justification of each separable portion of the project was investigated independently. The project is composed of four separable areas as shown in Table 25. The Chalmette and New Orleans East areas are closed loop systems easily separated from the remainder of the project. The St. Charles levee reach can also be considered independently. This section represents an extension of the hurricane protection levees to an area not currently provided any protection.

TABLE 25  
SEPARABLE AREAS FOR INCREMENTAL ANALYSIS

AREA	COMPONENT LEVEE REACHES
Chalmette	Chalmette Area Plan
New Orleans East	Citrus Lakefront New Orleans East Lakefront South Point to GIWW New Orleans East Back Citrus Back IHNC East Bank
Orleans-Jefferson	IHNC West Bank Orleans Lakefront Jefferson Lakefront Jefferson-St. Charles Boundary
St. Charles	St. Charles North of Airline Highway

The remainder of the project area, the Orleans-Jefferson area, was considered as one unit. This area cannot logically be broken down into smaller components. If either parish were implemented separately a return levee approximately 5 miles long would be required along the parish line from Lake Pontchartrain to the Mississippi River levee. The cost of this levee with the associated relocations required would be very expensive and could approach the cost of providing protection to the adjacent area while providing no additional benefits.

The results of the incremental analysis reveal that each separable portion of the tentatively selected plan does have a benefit-cost ratio greater than one at the project interest rate of 3 1/8 percent. Table 26 summarizes the analysis results.

TABLE 26

INCREMENTAL ANALYSIS OF SEPARABLE AREAS FOR  
THE HIGH LEVEL PLAN  
(Oct 81 price levels; 3 1/8 percent Annual Discount Rate)

AREA	FIRST COST (\$000)	ANNUAL COST (\$000)	ANNUAL BENEFITS (\$000)	BENEFIT- COST RATIO
St. Charles	55,721	1,879	2,902	1.5:1
Chalmette	65,925	2,518	4,924	2.0:1
Orleans-Jefferson	391,251	13,970	70,024	5.0:1
New Orleans East	112,439	4,307	17,921	4.2:1

Projections of future with and without project land use assumed land use trends would continue at the observed 1956-1978 rate for the life of the project. For purposes of plan selection, it does not matter significantly whether the ratio is geometric as assumed, or logarithmic, because the Barrier Plan would impact far more habitat and would significantly impact the lake itself. Mitigation plans will be sensitive to analysis of future conditions because needs will be based on project-induced habitat losses. Selection of mitigation features will be determined by the efficiency of proposed management measures in preventing without project losses. Projections of future shoreline erosion should be approximately as accurate as land use projections, thus, the uncertainty associated with various mitigation features should be equal.

## DESCRIPTION OF RECOMMENDED PLAN

The recommended plan provides for the modification of the Lake Pontchartrain, Louisiana, and Vicinity project to provide SPH protection to urban areas in the New Orleans metropolitan area that are located generally between the Mississippi River and Lake Pontchartrain. The most significant difference between the authorized plan and the recommended plan is that the barrier design concept of the authorized plan is abandoned in favor of the high level design concept of the recommended plan.

### PLAN FEATURES

The specific features of the recommended plan are described below and are presented on Plate 9.

#### ST. CHARLES PARISH AREA

This feature provides for the construction of a new levee parallel to and immediately north of US Highway 61 (Airline Highway), between the levee along Jefferson-St. Charles Parishes boundary and the east Bonnet Carre' Spillway guide levee. The levee would be earthen with a crown elevation of 13.5 feet, except for short reaches where there are width restrictions. In these reaches the levee would have an earthen base topped by a floodwall with a top elevation of 14 feet. Four drainage structures would be provided through the levee at locations where there is drainage through Airline Highway. The drainage structures would remain open to maintain existing drainage patterns and would be closed only during a threat of a hurricane. (This feature is significantly different from the St. Charles Parish levee included in the authorized plan. The authorized levee extended along the Lake Pontchartrain shoreline of St. Charles Parish.)

## **JEFFERSON PARISH AREA**

This feature would provide for the improvement of the existing protective works along the Jefferson-St. Charles Parish boundary and along the Jefferson Parish Lakefront. The existing Federal levee along the Jefferson-St. Charles Parish boundary would be raised and topped with a floodwall. The elevation of the floodwall cap would range from 14 feet at the lake to 13.5 feet at the St. Charles Parish levee. The existing levee along the Jefferson Parish Lakefront would be increased in section and raised to an elevation of 14 feet. Floodwalls would provide frontage protection at the four existing pumping stations and tie into new floodgates across the traffic lanes of the Lake Pontchartrain Causeway. (This feature is significantly different from the authorized plan. With the authorized plan, the existing Jefferson Parish Lakefront levee would require only frontage protection work.)

## **NEW ORLEANS AREA**

This feature provides for the enlargement of earthen levees and the construction of floodwalls along the New Orleans Lakefront between the Jefferson Parish Lakefront levee and the existing floodwall along the west bank of the IHNC and for the construction of measures to prevent overtopping of the outfall canals for the three pumping stations which are setback from the lakefront. The earthen levees would be topped by a floodwall with an elevation of 14.5 feet. Floodwalls would be provided in four reaches where rights-of-way are limited: around the marinas near the Orleans-Jefferson Parish line, at the Pontchartrain Beach Amusement Park, at the Seabrook Bridge, and at the American Standard manufacturing plant immediately east of the amusement park. Floodwall elevation at the marinas and at Pontchartrain Beach would be 13.5 feet. (The existing floodwall, at the marinas, which has an elevation of 11.0 feet, may be determined to be adequate in more detailed studies.) The floodwall at the American Standard plant would have an elevation of 19.5 feet or greater. Floodgates or road ramps

would be provided at streets crossed by the levees and floodwalls. (The levees and floodwalls along the lakefront are much higher than the authorized plan; the floodwall system along the west bank of the IHNC is similar to the authorized plan.)

#### **CITRUS-NEW ORLEANS EAST AREA**

This feature provides for the enlargement of the existing levee and floodwall system surrounding the Citrus-New Orleans East area. Reaches of levee included in this feature are the Citrus Lakefront levee, the New Orleans East Lakefront levee, the South Point to GIWW levee, the New Orleans East back levee, the Citrus back levee, and the IHNC east levee. The Citrus Lakefront levee would consist of 0.7-miles of floodwall and 4.3 miles of earthen levee topped by a floodwall with a barge berm. The 0.7-miles of floodwall, which are completed to a grade of 11.0 feet would have a top elevation of 13.5 feet and the floodwall on the earthen levee would have an elevation of 15.0. The New Orleans East Lakefront would be an all earthen levee enlarged and raised to an elevation of 16.5 over its 6.2-mile length. The 8.3-mile long South Point to GIWW levee, also an all earthen levee, would be enlarged and raised to elevations ranging from 13.5 to 15 feet. Minor modifications could be required to the four drainage structures. The New Orleans East back levee would be an all earthen levee enlarged and raised to an elevation of 17.5 feet. The Citrus Back levee would be an all earthen levee enlarged and raised to an elevation of 14 feet, except around the Michoud Canal where a floodwall with elevations ranging from 18 to 22 feet would be provided because of restrictive rights-of-way. The IHNC east bank reach is a floodwall system with an elevation ranging from 13 to 14 feet. (The Citrus Lakefront, New Orleans East Lakefront, and South Point to GIWW reaches are significantly larger than the authorized plan; the New Orleans East Back levee, the Citrus back levee, and the IHNC East levee reaches are similar to those features with the authorized plan.)

### **CHALMETTE AREA PLAN**

This feature provides for completing the levees around the Chalmette area to elevations ranging from 14 to 17.5 feet. (This feature is similar to the authorized plan feature.)

### **MANDEVILLE SEAWALL**

This feature provides for a rehabilitation of a 1.5-mile seawall along the lakeshore of Mandeville. The improvements would have an elevation of 6 feet. (This feature is similar to the authorized plan feature.)

## **DESIGN AND COST CONSIDERATIONS**

Some features and segments of features of the recommended plan would be similar to those for the authorized plan. This includes the Chalmette area plan feature; the Mandeville Seawall feature; the Citrus back levee, New Orleans East back levee, and the IHNC East levee reaches of the Citrus-New Orleans East feature; and the IHNC west levee reach of the New Orleans feature. The design of the remaining features of the recommended plan has changed significantly. General information on the design of these remaining features is discussed below; detailed information is presented in Appendix A, Engineering Investigations.

### **ST. CHARLES PARISH AREA**

This levee along the north side of Airline Highway between the Jefferson-St. Charles Parish boundary levee and the east Bonnet Carre guide levee, would be constructed of hauled clay fill. The levee would be constructed in three lifts (two fill lifts and one shaping lift). In areas of restricted rights-of-way the levee would be smaller with a floodwall driven atop the levee to obtain the design elevation.

## **JEFFERSON PARISH AREA**

The Jefferson Parish lakefront would be raised and widened to the lakeside of the existing Federal levee. Construction would be in four lifts--two hydraulic fill lifts and two shaping lifts. Floodwalls would provide frontage protection at the four pumping stations in this reach. Floodwalls would also be utilized in areas where existing facilities would preclude the use of levees.

The Jefferson-St. Charles boundary levee would be constructed of hauled clay fill with a floodwall driven into the levee. The new levee would be an enlargement of the existing Federal levee.

## **NEW ORLEANS AREA**

The New Orleans Lakefront levee would be completed by hauled clay fill with a wide flat barge berm (which would also act as a wave breaker) and an I-wall driven into the crown of the design levee section. In addition to the basic design section, the cost estimate for this feature includes about \$124,000,000 for rectifying deficiencies of return levees paralleling New Orleans' main outfall canals. The mouths of these canals break the levee line at the lakefront.

## **CITRUS-NEW ORLEANS EAST AREA**

The Citrus Lakefront, New Orleans East Lakefront, and South Point to GIWW reaches of this feature would require significant modification with the recommended plan.

The Citrus Lakefront levee is complete to barrier specifications except for foreshore protection. The current levee design provides for 0.7-miles of I-wall (completed) and 4.3 miles of all earthen levee using hauled clay fill. The recommended plan provides for completing the



levee utilizing the 0.7-miles of I-wall, and 4.3 miles of I-wall driven atop the existing earthen levee, with a barge berm to the lake side of the levee. It should be noted that the existing 0.7 miles of I-walls would not be overtopped during an SPH event with barrier structures in place, but some overtopping of the I-walls could be expected to occur during an SPH event with the recommended plan (without the barriers). While overtopping of the existing I-walls would not cause failure, they are not structurally sufficient to allow raising to prevent overtopping.

The cost estimate for completing the Citrus Lakefront levee feature of the recommended plan includes costs for removing the existing I-walls and replacing them with higher I-walls which would not be subject to overtopping or failure during SPH events without barrier structures (the existing I-wall elevation is 11.0 feet and the new I-wall elevations would be between 13.5 and 19.5 feet); however, it may be determined during the course of future studies that overtopping of the existing I-walls will result in small enough volumes of inflows to the protected area that overtopping can be tolerated, i.e., I-walls won't be replaced. The remaining 4.3 miles of levee would be completed by driving I-walls atop an earthen embankment with a net grade of 12.0 feet and width of 70 feet. The net grade of the I-wall would be 15.0 feet. The levee is located to the land side of the Southern Railroad embankment. Just at the lake side of the railroad embankment, paralleling the levee/floodwall section, a barge berm would be constructed to a net grade of 12.0 feet and a width of 53 feet. The barge berm would be constructed with a shell core covered with derrick stone.

The New Orleans East Lakefront levee is complete to barrier plan specifications except for foreshore protection. The levee design provides for an all earthen design of hauled clay fill. With the recommended plan the levee would be enlarged by the same method. The design calls for improving the 6.2 miles of levee to attain a final levee elevation of 16.5 feet and a final levee width of 272 feet.

The South Point to GIWW levee is complete to authorized plan specifications except for some work at drainage structures and a road crossing at Highway 90. The levee design provides for an all earthen levee of hauled clay fill upon a locally constructed levee. The recommended plan provides for utilizing a similar type design; however, the design calls for greater levee heights and widths. The design provides for improving the 8.3 miles of levee to attain final elevations of varying from 13.5 to 15.0 feet and final widths varying from 130 to 176 feet. It is anticipated that only minimal modifications of the existing drainage structures will be necessary.

#### **RELOCATIONS**

No relocations of businesses or residences would be required due to plan construction. Temporary relocations of walkways leading to camps located to the lakeside of the Citrus Lakefront and New Orleans East Lakefront levee reaches would be necessary during construction. Recreational facilities along the Jefferson Parish Lakefront and New Orleans Lakefront would be destroyed and/or disrupted during levee construction. These would require replacement. Other relocation requirements such as road ramps, etc., would be minimal.

#### **OPERATION AND MAINTENANCE CONSIDERATIONS**

Operation and maintenance of the recommended plan would include mowing and periodic inspection and repair of levees and operation and maintenance of structures, such as floodgates and drainage structures. Construction, operation, maintenance and replacement costs are summarized in Table 27. Replacement costs are the costs of periodic replacement of operating machinery and equipment for such items as floodgates and drainage structures. Detailed construction cost estimates are presented in Appendix A, Section 4.

## PLAN ACCOMPLISHMENTS

The recommended plan would provide SPH protection for the developed urban areas located generally between the Mississippi River and Lake Pontchartrain. These include the following separable protection areas which are delineated on Plate 4: St. Charles Parish, Jefferson Parish, New Orleans, Citrus, New Orleans East, and Chalmette. Average annual benefits are estimated at \$95,771,000, which would result from the prevention of flood damages to existing and future development and savings in emergency costs.

## SUMMARY OF ECONOMIC, ENVIRONMENTAL, AND SOCIAL EFFECTS

A summary of the economic, environmental, and social effects of the recommended plan is presented in the following paragraphs.

### **ECONOMIC EFFECTS**

The total cost to complete the recommended plan is estimated at \$627,714,000, and average annual costs are estimated at \$22,769,000 including \$21,423,000 for interest and amortization, \$964,000 for operation and maintenance and replacements, \$376,000 for recreation losses, and \$6,000 for fish and wildlife losses. Average annual benefits are estimated at \$95,771,000 including \$88,430,000 for hurricane flood damages prevented to existing development, \$6,002,000 for damages prevented to future development, and \$1,339,000 for savings in emergency costs. The benefit-to-cost ratio is 4.2 and net benefits, the difference in annual benefits and annual cost, would average \$73,002,000.

TABLE 27

SUMMARY OF COSTS TO COMPLETE THE HIGH LEVEL PLAN  
 (\$1,000's, October 1981 Price Levels,  
 3 1/8 Percent Annual Discount Rate and a 100-Year Project Life)<sup>1/</sup>

FEATURE	FIRST COST	ANNUAL OPERATION AND MAINTENANCE COSTS <sup>2/</sup>
CHALMETTE AREA PLAN	65,925	249
CITRUS-NEW ORLEANS EAST AREA		
Citrus Back Levee	5,050	27
New Orleans East Back Levee	17,087	17
South Point to GIWW Levee	5,182	25
New Orleans East Lakefront Levee	34,843	22
Citrus Lakefront Levee	46,854	95
IHNC East Bank Levee	3,423	30
Total	112,439	246
WEST NEW ORLEANS AREA		
IHNC West Bank Levee	33,324	30
New Orleans Lakefront Levee <sup>3/</sup>	215,813	324
Total	249,137	354
EAST BANK OF JEFFERSON PARISH AREA		
Jefferson Parish Lakefront Levee	123,173	92
Jefferson-St. Charles Parish Boundary Levee	18,941	13
Total	142,114	105
EAST BANK OF ST. CHARLES PARISH AREA		
North of Airline Highway Levee	55,721	39
MANDEVILLE SEAWALL	2,378	1
TOTAL	627,714	964

<sup>1/</sup> Cost to complete from 1 October 1979.

<sup>2/</sup> Includes annualized costs of replacements and O&M on completed work.

<sup>3/</sup> Includes \$124,000,000 for solution to outfall canals' problems.

## **ENVIRONMENTAL EFFECTS**

Implementation of the recommended plan would directly impact 213 acres of cypress-tupelogum swamp, 54 acres of brackish-saline marsh, 984 acres of lake bottoms, 88 acres of scrub-shrub, and 351 acres of developed uplands which are primarily existing levees. The 213 acres of swamp and 54 acres of marsh would be converted to levees and borrow areas. Of the 984 acres of lake bottoms affected, 573 acres would be deepened for borrow for the construction of the Jefferson Parish Lakefront levee and 411 acres would be converted to levee. The construction of the Jefferson Parish Lakefront levee would also create temporary turbidity during construction in the vicinity of the levee.

The north of Airline Highway alignment would provide some opportunity for development due to an additional increment of protection from the 100-year flood. However, the area has been and presently is being developed without the increased flood protection afforded by the proposed levee. The levee as proposed is designed with flow through culverts which would maintain the existing exchange of nutrients, water and organisms between the wetlands north and south of Airline Highway. These culverts are to be gated so they can be closed during times of potential hurricane flooding.

No economic benefits were claimed for this area due to its wetland status. Similarly, the additional levee height to be added to the New Orleans East levee would provide increased flood protection to a wetland area. Any development in either of these wetlands would necessitate a permit from the Corps of Engineers and mitigation, if necessary, would be determined on a case by case basis.

## **SOCIAL EFFECTS**

The implementation of the recommended plan would result in improved hurricane protection to approximately 160,000 residences in the study area and in minor increases in property values. There would be minor, temporary degradation of air quality and there would be temporary noise pollution during construction. Esthetic values along the Lake Pontchartrain south shore in Orleans and Jefferson Parishes would be greatly reduced during construction. After construction, more open space would exist.

## **PLAN IMPLEMENTATION**

### **INTRODUCTION**

The purpose of this section is to present the division of responsibilities between the Federal and non-Federal interests in connection with the development of the proposed undertaking and documentation of the intention of non-Federal interests to fulfill their responsibilities.

### **DIVISION OF RESPONSIBILITIES**

#### **FEDERAL RESPONSIBILITIES**

Contingent upon the approval of this document by the Chief of Engineers, filing of the final EIS with EPA, receipt of supplemental assurances from non-Federal interests to carry out provisions of the project, the Federal Government will be responsible for preparing additional detailed designs and plans and bearing 70 percent of the first cost.

#### **NON-FEDERAL RESPONSIBILITIES**

In accordance with Public Law 89-298, which authorized the Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection project, non-Federal interests must, prior to initiation of construction of major design changes, assure the Secretary of the Army, with respect to the major design changes, that they will without cost to the United States:

a. Provide all lands, easements, and rights-of-way, including borrow and spoil-disposal areas necessary for construction, operation, and maintenance of the project; 1/

b. Accomplish all necessary alterations and relocations to roads, railroads, pipelines, cables, wharves, drainage structures, and other facilities required by the construction of the project;

c. Hold and save the United States free from damages due to the construction works;

d. Bear 30 percent of the first cost, to consist of the fair market value of the items listed in subparagraphs (a) and (b) above and a cash contribution as presently estimated below, to be paid either in a lump sum prior to initiation of construction or in installments at least annually in proportion to the Federal appropriation prior to start of pertinent work items, in accordance with construction schedules as required by the Chief of Engineers, or, as a substitute for any part of the cash contribution, accomplish in accordance with approved construction schedules items of work of equivalent value as determined by the Chief of Engineers, the final apportionment of costs to be made

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1/ Local interests are also required to comply with the requirements of the Uniform Relocation and Real Property Acquisition Policies Act of 1970 (PL 91-646), in acquiring real property. A constitutional amendment was provided by the Louisiana Legislature on 1 February 1972 allowing local interests to comply.



after actual costs and values have been determined; <sup>2/</sup> (A summary of the estimated remaining cost for each local sponsor is presented in Table 26.)

e. Provide all interior drainage and pumping plants required for reclamation and development of the protected areas;

f. Maintain and operate all features of the project in accordance with regulations prescribed by the Secretary of the Army, including levees, floodgates and approach channels, drainage structures, drainage ditches or canals, floodwalls, and stoplog structures; and

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<sup>2/</sup>This requirement has been modified by section 92 of Public Law 93-251, which is also commonly referred to as "The Hebert Bill." Basically, this law provides that for 24 years following the initiation of construction for the Lake Pontchartrain project (fiscal year 1967) local sponsors have the option of either paying each year's share in full down to the following amount:

One twenty-fifth of total cash owed in a given year (local share) and one twenty-fifth of the cumulative unpaid balance from previous years and an interest payment on the cumulative unpaid balance computed at an annual interest rate of 3.225 percent.

Interest is paid only on money owed from previous years, not on the current year's contribution.

In the project's twenty-fifth year, fiscal year 1991, local sponsors must pay that year's share and the unpaid balance from prior years and interest on the unpaid balance.

Interest payments are not treated as project monies, they are turned over to the Treasury Department.

Section 221 of Public Law 91-611, which requires that construction not begin until each non-Federal sponsor has entered into a written agreement to furnish the required cooperation, also applies to this deferred payment plan.

g. Acquire adequate easements or other interest in land to prevent encroachment on existing ponding areas unless substitute storage capacity or equivalent pumping capacity is provided promptly. (see footnote 1 on page 144).

CURRENT STATUS OF ASSURANCES. The basic assurances for the Chalmette Area Plan have been accepted. Joint assurances of the St. Bernard Parish Police Jury and the Lake Borgne Basin Levee District were accepted on 28 September 1966. The Lake Borgne Basin Levee District and St. Bernard Parish Police Jury executed, on 20 April 1976, a new joint agreement of assurance covering all requirements of local cooperation and a deferred payment plan as authorized by Public Law 93-251. These assurances were approved on behalf of the United States on 7 December 1977. Assurances from the Board of Commissioners of the Orleans Levee District were accepted on 10 October 1966. The assurances were amended on 16 September 1971 to reflect an increase in cost participation. These amended assurances, which supersede the 10 October 1966 assurances, were approved on behalf of the United States on 29 March 1974. Subsequent to this approval, it became evident that problems would exist in obtaining acceptable assurances from two agencies for the Barrier Plan. For this reason, the original assurances from the Orleans Levee District dated 10 October 1966 are considered in full effect. This 1966 assurance (for Chalmette Plan only) was supplemented to include Public Law 91-646 on 29 May 1975, and approved on behalf of the United States on 8 July 1975. The Orleans Levee District executed a new agreement of assurances covering all requirements of local cooperation and a deferred payment plan as authorized by Public Law 93-251 on 30 March 1976. These assurances were approved on behalf of the United States on 7 December 1977.

Supplemental assurances were required to insure compliance with the provisions of Public Law 91-646. The Louisiana Office of Public Works, designated as the coordinating agency by the Governor on 5 March 1971,

TABLE 28  
SUMMARY OF LOCAL COSTS  
(\$1,000,000's)

	FIRST COST <sup>1/</sup>	LOCAL SHARE
TOWN OF MANDEVILLE		
Mandeville Seawall	2.4	0.7
ORLEANS LEVEE DISTRICT		
Citrus New Orleans East	112.5	33.8
New Orleans	249.1	74.7
Chalmette	21.6	6.5
Total	<u>383.2</u>	<u>115.0</u>
ST. BERNARD PARISH/LAKE BORGNE BASIN LEVEE DISTRICT		
Chalmette	44.3	13.3
PONTCHARTRAIN LEVEE DISTRICT		
Jefferson	142.1	42.6
St. Charles	55.7	16.7
Total	<u>197.8</u>	<u>59.3</u>
TOTAL	627.7	188.3

<sup>1/</sup>Cost to complete after October 1979; October 1981 price levels.

was requested to have the St. Bernard Parish Police Jury and the Lake Borgne Levee District execute supplemental assurances. A joint supplemental assurance dated 26 February 1975 was received from those agencies, and approved on behalf of the United States on 17 March 1975.

LAKE PONTCHARTRAIN BARRIER PLAN. Basic assurances for the current Barrier Plan (exclusive of the Chalmette Area Plan) were obtained from the Board of Commissioners of the Orleans Levee District and accepted on 10 October 1966. The Orleans Levee District requested assistance in carrying out the assurances due to the rising non-Federal cost of participation and the widespread benefits to be derived by the

surrounding parishes. The Governor of the State of Louisiana, by Executive Order (5 March 1971), designated the Louisiana Office of Public Works as the local coordinating agency. Through this procedure, the Pontchartrain Levee District, the St. Tammany Parish Police Jury, and the Orleans Levee District have provided assurances for the Barrier Plan. Amended assurances to provide for an increase in cost participation were executed by the Orleans Levee District on 16 September 1971, and approved on behalf of the United States on 29 March 1974. The amended assurances supersede the 10 October 1966 assurances. Subsequent to the approval of the 1971 assurance, it became evident that problems existed in obtaining acceptable assurances from two agencies for this plan. For this reason, the original 10 October 1966 assurances from the Orleans Levee District are considered in full effect. On 30 March 1976, the Orleans Levee District executed a new agreement of assurance covering all requirements of local cooperation and a deferred payment plan as authorized by Public Law 93-251. These assurances were approved on behalf of the United States on 7 December 1977. Assurances providing for participation pursuant to the action of the Governor have been obtained from the Pontchartrain Levee District. Assurances on behalf of the St. Tammany Parish Police Jury were executed by the Governor on 8 May 1982 under Section 81, Title 38, Louisiana Revised Statutes of 1950, as amended. Neither of the latter two assurances has been accepted for lack of supporting documents. However, on 20 September 1976, the Pontchartrain Levee District executed a new agreement of assurance covering all requirements of local cooperation and a deferred payment plan as authorized by Public Law 93-251. On 19 October 1976, Governor Edwards executed an instrument designating the Louisiana Office of Public Works to lend financial assistance in connection with this project. The Louisiana Office of Public Works executed an act of assurance dated 8 November 1976 agreeing: to fulfill all local cooperation requirements for that portion of the project in St. Tammany Parish; and to lend financial assistance after the Pontchartrain Levee District has contributed \$100,000 in cash toward

that portion of the Barrier Plan which is the responsibility of that levee district. These assurances were approved on behalf of the United States on 7 December 1977. Supplemental assurances required by Public Law 91-646 were received as follows:

a. Orleans Levee District: supplemental assurances were executed on 21 September 1973.

b. Pontchartrain Levee District: supplemental assurances were executed on 15 October 1973.

c. St. Tammany Parish Police Jury: the assurances executed by the Governor on 8 May 1972 included Public Law 91-646 requirements.

The Mandeville Seawall portion of the project is not covered by any existing assurances.

The assurances listed as items b and c above have not been accepted on behalf of the Government due to lack of supporting data; however, substitute assurances incorporating the deferred payment plan authorized by Public Law 93-251 and Public Law 91-646 have been executed by these levee districts. These assurances were approved on behalf of the United States on 7 December 1977.

The Water Resources Development Act of 1974 (Public Law 93-251) enacted 7 March 1974, provided that local assuring agencies for this project (both plans) could, if they so chose, repay their cash obligation using a deferred payment plan. New assurances have been executed by local interests incorporating such a deferred payment plan. These assurances were approved by the Secretary of the Army on 7 December 1977. Local interests have been making payments under this plan since fiscal year 1977 and are current in payment.

Local interests have cooperated in all efforts to date and have given assurances that all requests for additional cooperation will be expedited. However, they have delayed granting rights-of-way as scheduled on certain items due to lawsuits brought by landowners and challenges made in court by environmental concerns. Some local interests are constructing items of flood protection works at vulnerable locations as work in-kind in lieu of cash contribution. They will be given credit only for the portion meeting project requirements. This work has been closely coordinated with the New Orleans District.

All negotiations for relocations are the responsibility of local interests and are on schedule.

On 1 January 1979, the State of Louisiana formed the Jefferson Levee District and assigned to it the responsibility of the Pontchartrain levees on the east bank of the Mississippi River. (These levees previously were the responsibility of the Pontchartrain Levee District.) Revised assurances are being sought from the Pontchartrain Levee District to cover the St. Charles portion of the project, and new assurances are being sought from the Jefferson Levee District for the Jefferson Parish segment of the project.

## STUDY PARTICIPANTS AND COORDINATION

The District Engineer, New Orleans District, Corps of Engineers, had the responsibility for conducting and coordinating the study, consolidating information from other agencies and interested parties, formulating the plan and associated recommendations, and preparing the report. Coordination was maintained with the US Environmental Protection Agency, US Fish and Wildlife Service, National Marine Fisheries Service, Louisiana Department of Transportation and Development (Office of Public Works), Jefferson Levee District, Lake Borgne Basin Levee District, Orleans Levee District, Pontchartrain Levee District, St. Bernard Parish Police Jury, and other Federal, state, and local agencies.

A public meeting for this study was held on 21 November 1981 in New Orleans, Louisiana, to discuss the plans under consideration. Attendees included representatives of Federal, state, and local agencies, the state legislature, parish offices, special interest groups, and the news media, as well as members of the affected public. Most testimony at the meeting was in favor of the High Level Plan. A representative of the Jefferson Levee District expressed concern about the high cost of the Jefferson Parish protection under the High Level Plan. The executive attorney of Save Our Wetlands Inc., an environmental interest group, expressed support for the High Level Plan but was opposed to the protection of any wetland areas which might be developed in the future. As a general conclusion, the testimony at the meeting supported the High Level Plan.

A second public meeting was held on 12 April 1984 in New Orleans, Louisiana, to present the tentatively selected plan to the public.

Representatives from various government agencies, special interest groups, the news media, and the general public attended. Attendees clearly preferred the High Level Plan to the Barrier Plan, but reservations over environmental issues were also expressed. In addition to the opposition expressed at the first meeting to the protection of wetland areas, concern was expressed over the size of the proposed borrow pits in Lake Pontchartrain required to construct the Jefferson Parish lakefront Levee. Comments also addressed the quantity and timing of mitigation.

A draft of this report was transmitted to all agencies, groups and individuals who normally receive such documents, and to additional agencies, groups and individuals who have expressed an interest in the project. Their comments were considered in the preparation of the final report.



# FINAL SUPPLEMENT I TO THE ENVIRONMENTAL IMPACT STATEMENT

## LAKE PONTCHARTRAIN, LOUISIANA, & VICINITY HURRICANE PROTECTION PROJECT

### PARISHES

ST. BERNARD  
ORLEANS  
JEFFERSON  
ST. CHARLES  
ST. JOHN  
THE BAPTIST  
TANGIPAHOA  
ST. TAMMANY

### ABSTRACT

New Orleans and adjacent municipalities are located in southeastern Louisiana. The New Orleans District has investigated public concerns relating to the needs and opportunities to provide hurricane flood protection. Of the 16 plans considered, two were selected for detailed study. The Barrier Plan provides for barriers to control inflows to Lake Pontchartrain and levees and floodwalls around developed areas. Inflows to the lake would be regulated by control structures and associated barriers and locks in the main tidal passes of the lake: the Inner Harbor Navigation Canal, The Rigolets, and Chef Menteur Pass. The resulting lower lake levels would reduce the height and cost of levees along the south shore of the lake. A new levee system would be constructed in St. Charles Parish. The Barrier Plan would provide a high level of hurricane protection for those urban areas located generally between the Mississippi River and Lake Pontchartrain. Completion of this plan would destroy 2,363 acres of highly productive marsh and result in an unquantified reduction in tidal transport of nutrients and biota which could affect fisheries. The High Level Plan proposes to provide basically the same hurricane flood protection as the Barrier Plan but no barriers would be built; instead,

existing levees would be raised, new levees would be built in St. Charles Parish and floodwalls provided where necessary. Completion of the High Level Plan would cause the loss of approximately 54 acres of marsh and would be less costly to implement than the Barrier Plan. This plan is the most efficient from the viewpoint of national economic development and would be the least environmentally damaging. Because of strong opposition to the Barrier Plan and no known significant opposition to the High Level Plan, implementation of this plan is more feasible. The High Level Plan more nearly meets all planning objectives. Thus, the High Level Plan has been selected as the Recommended Plan.

Send your comments to OCE, ATTN:  
DAEN-CWP by

If you would like further information on this statement, please contact Mr. Larry Hartzog, U. S. Army Corps of Engineers, New Orleans, P. O. Box 60267, New Orleans, Louisiana. 70160.  
Commercial telephone: (504) 838-2524

JULY 1984

LEAD AGENCY U.S. ARMY CORPS OF ENGINEERS DISTRICT  
NEW ORLEANS, LOUISIANA

NOTE *Information, displays, maps, etc. discussed in the Main Report and Appendixes are incorporated by reference in the EIS.*

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## **1. SUMMARY**

### **1.1. INTRODUCTION**

1.1.1. New Orleans and its suburbs are bordered by water on three sides: Lake Pontchartrain lies to the north, Lake Borgne to the east, and the Mississippi River to the south (see Plate 1). This densely populated low-lying area is susceptible to heavy damage and faces high risk to human life from hurricane-induced flooding. In 1965, Congress authorized the US Army Corps of Engineers (Corps) to construct a hurricane protection system for the New Orleans metropolitan area. Part of the authorized plan included features to prevent an increase in water levels in Lake Pontchartrain as a hurricane approached. This was to have been accomplished by placing barrier structures in the Rigolets and Chef Menteur tidal passes and the Inner Harbor Navigation Canal. The structures at Chef Menteur and the Rigolets would remain open except immediately prior to, and during, hurricanes. In addition to the barrier complexes, levees would be built along the entire lakefront from the Bonnet Carre' Spillway to South Point, with back levees around the Citrus and New Orleans East areas and a ring levee in the Chalmette area (see Plate 3).

1.1.2. A final Environmental Impact Statement (EIS) on the authorized plan (Barrier Plan) was filed with the Council on Environmental Quality in 1975. In 1977, the EIS was ruled inadequate and a court injunction was issued to stop all construction of the Chef Menteur and Rigolets barrier structures, pending preparation of a legally adequate EIS. In the interim, the court allowed construction of the levee portion of the plan to continue. Project reevaluation studies pursuant to the court-ordered revision of the EIS have led to the selection of an alternative to the Barrier Plan. This alternative, called the High Level Plan, would provide hurricane protection by raising and strengthening levees and floodwalls to a higher elevation than required by the Barrier Plan and would have no requirements for the barriers. Since the 1975 final EIS was considered to be adequate in terms of describing impacts of the levees, this EIS supplement will analyze only post-1984 impacts; i.e., the additional impacts that would be incurred by completing either the Barrier or High Level Plan. Construction impacts prior to 1984 are addressed only to determine the amount of mitigation necessary.

### **1.2. MAJOR CONCLUSIONS AND FINDINGS**

#### **1.2.1. RATIONALE FOR THE NATIONAL ECONOMIC DEVELOPMENT (NED) PLAN**

The Barrier Plan would provide maximum total benefits because it would protect not only all areas protected by the High Level Plan, but also some populated areas along the north shore of Lake Pontchartrain. However, the High Level Plan is the least expensive and would provide maximum excess benefits over costs and was designated the NED Plan.

## 1.2.2. RATIONALE FOR THE RECOMMENDED PLAN

1.2.2.1. The High Level Plan would result in the least environmental damage in terms of direct construction impacts. It would destroy 54 acres of marsh as opposed to 2,363 acres impacted by the Barrier Plan. Although the High Level Plan would have wider based levees, the Barrier Plan would require more miles of levees to connect the barrier structures. Raising the Jefferson Parish Lakefront levees to the height necessary for the High Level Plan would create short-term turbidity in the lake adjacent to the levee. The short-term turbidity caused by construction of the barrier structures (especially the damming of Chef Menteur Pass) would be more significant, because it would occur in areas more valuable to the ecosystem. Construction of the Barrier Plan would necessitate dredging approximately 512 acres to a depth of 20 to 40 feet below existing bottoms. The High Level Plan would entail deepening 573 acres of lake bottoms to 60 feet below existing bottoms. Although this facet of the High Level Plan may be more environmentally damaging than the Barrier Plan, the other environmental impacts of the Barrier Plan are far more significant. The Barrier Plan also would have potential adverse impacts on an endangered species, the bald eagle. Additionally, the Barrier Plan would restrict the transport of biota and nutrients through the tidal passes and result in a long-term reduction in the productivity of Lake Pontchartrain and reduce its export to other systems.

1.2.2.2. In terms of social impacts, however, the High Level Plan is the least acceptable. During raising of the levees for the High Level Plan along the Orleans and Jefferson Parish lakefronts, esthetic values would be greatly reduced because of noise, dust, and movement of equipment. Recreational values would be diminished as the existing linear recreational green spaces in Jefferson and Orleans Parishes are destroyed; however, levees would be designed to preserve and protect the recently developed Williams Boulevard and Bonabel Boulevard boat launch complexes. Once construction is complete, the new levees would provide continuous green spaces that could be landscaped and redeveloped for recreation. The barriers in The Rigolets and Chef Menteur Pass would increase water velocities, and thereby adversely affect navigation (including small fishing boats and sail boats). The barriers also would reduce the biological productivity of Lake Pontchartrain, which would decrease the harvest of sport and commercial fish and shellfish. In terms of implementation, the Barrier Plan would be strongly opposed by a broad spectrum of interests. Opposition to the High Level Plan is much less. In summary, the High Level Plan comes closest to meeting all planning objectives. It provides adequate hurricane protection to the east bank of the New Orleans metropolitan area, is most effective in terms of NED, minimizes adverse impacts on the natural environment and social well-being, and exploits some project-related opportunities to enhance social well-being. Thus, the High Level Plan was selected as the Recommended Plan.

### **1.2.3. CONCLUSIONS OF THE SECTION 404 EVALUATION PROCESS**

Concerns involving Section 404 of the Clean Water Act initially were discussed in public notices dated 29 November 1974 and 22 January 1975, in a 22 February 1975 public meeting, and in a 25 August 1975 Statement of Findings. Only the barrier complexes, New Orleans East levees, and Chalmette area levees were considered in this process. Three new Section 404(b)(1) Evaluations were prepared in 1982. They document findings specified in the Revised Guidelines for Specification of Disposal Sites for Dredged or Fill Material published in the "Federal Register" on 24 December 1980. These evaluations concluded: that no practicable alternative to the High Level Plan exists which would have less adverse impacts to the aquatic ecosystem, that applicable state and Federal water quality standards would not be violated, that the discharge would not contribute to a significant degradation of the waters of the United States, and that appropriate and practicable steps have been taken to minimize adverse impacts to the aquatic ecosystem. A Section 404 Public Notice was sent to the agencies and the public at the same time that the draft of this EIS supplement was released. A State Water Quality Certificate was received on 29 June 1984. All Section 404(b)(1) Evaluations are included in Appendix C, Sections VII to IX.

### **1.2.4. FINDINGS RELATING TO EXECUTIVE ORDER 11990 (PROTECTION OF WETLANDS)**

1.2.4.1. This Executive Order states that Federal agencies should not alter wetlands unless there is no practicable alternative. Of the two plans considered, the High Level Plan would destroy the fewest acres of wetlands. The South Point to Gulf Intracoastal Waterway (GIWW) levee alignment in New Orleans (see Plate 6) incloses 13,000 acres of wetlands; however, as a result of levees constructed by local authorities, these wetlands have been inclosed and removed from tidal exchange with Lake Pontchartrain since 1958. Raising the levees would increase the developmental potential; however, no development in these wetlands can occur without a Section 404 Permit from the Corps of Engineers. An application for a permit to develop 9,800 acres of this area has been made (see Plate 6), and the applicant is preparing an EIS on his proposal. Since the fate of these wetlands is dependent upon regulatory decisions, their potential loss is not attributed to this hurricane protection project. Mitigation for any loss of these wetlands will be addressed at the time the permit is processed.

1.2.4.2. In St. Charles Parish, a somewhat similar situation exists concerning the wetlands south of Airline Highway. Approximately 4,000 acres of cypress tupelo swamp are presently partially isolated from the wetlands north of Airline Highway by locally constructed railroad and highway embankments. The proposed hurricane protection levee would preserve the existing hydraulic connections between the wetlands south of Airline Highway and the area outside the levee.

1.2.4.3. Although the tentatively selected plan would provide an additional level of flood protection, the 4,000 acres would remain wetlands. No development in these wetlands could occur under Federal regulations without a Section 404 permit from the Corps of Engineers. Thus, development of these wetlands would be determined by the permit process and not by levee placement. Mitigation for any fish and wildlife losses incurred through development would be addressed at the time a specific permit is processed.

#### **1.2.5. FINDINGS RELATING TO EXECUTIVE ORDER 11988 (FLOOD PLAINS)**

The proposed action would occur within a flood plain. Practicable alternatives have been identified and are discussed in Section 4 of the EIS, and no reasonable nonflood plain alternatives exist. Section 6 of the EIS describes the beneficial and adverse impacts of each alternative and describes any expected losses of flood plain benefits. Views of the general public have been obtained at several public meetings, the most recent on 12 April 1984. The Recommended Plan preserves the most flood plain benefits derived from socioeconomic and environmental values and still provides flood protection.

#### **1.2.6. FINDINGS OF THE ENDANGERED SPECIES ASSESSMENT**

A 1982 Endangered Species Assessment concluded that the High Level Plan would not adversely impact any endangered species nor their critical habitat. The US Fish and Wildlife Service (FWS) concurred with this assessment. Subsequently, an eagle nest was discovered near the levee alignment in St. Charles Parish. We have determined that the High Level Plan would not impact this nest. This information is contained in a revised assessment. The revised assessment and correspondence with FWS is contained in Appendix C, Section I.

#### **1.2.7. COASTAL ZONE MANAGEMENT CONSISTENCY DETERMINATION**

A Consistency Determination was prepared to determine if the High Level Plan is consistent with the Louisiana Coastal Zone Management Act. It determined that the plan is consistent with all applicable guidelines to the maximum extent practicable. This Determination was sent to the Louisiana Department of Natural Resources (DNR) who stated in a 19 June 1984 letter that all features are consistent with the Louisiana Coastal Resources Program to the maximum extent practicable, except the alignment in New Orleans East. The DNR maintains that the New Orleans East alignment may not be consistent, while the Corps believes that our alignment is consistent to the maximum extent practicable. We are pursuing informal consultation with DNR and believe the conflict can be resolved. The Consistency Determination is contained in Appendix C, Section X. Correspondence with DNR is contained in Appendix D, Public Views and Responses.



### 1.3. AREAS OF RESOLVED CONTROVERSY

The major resolved controversy involves the Barrier Plan. This plan was opposed by several Federal agencies, environmental groups, and some citizens of the north shore of Lake Pontchartrain because of unquantifiable, but significant, impacts on the biology and hydrology of the lake, and the potential to increase north shore flooding. Detailed investigations for this study indicated that the High Level Plan was more feasible considering both environmental and economic aspects. Thus, the High Level Plan is the Recommended Plan.

### 1.4. UNRESOLVED ISSUES

1.4.1. The plan described in the 1975 EIS included a levee alignment along the lakefront in St. Charles Parish. There was extensive environmental opposition to such an alignment because it would inclose 25,000 acres of wetlands north of Airline Highway and impact another 1,000 acres of wetland by construction (see Plate 3). Because of environmental considerations, this alignment was put in an indefinitely deferred status in the early 1970's. A suit to force construction of the levee was entered in the same court which enjoined construction of the barrier features. This suit is being held in abeyance pending submission of the final EIS supplement for this project.

1.4.2. The FWS recommends that the St. Charles Parish levee segment be eliminated; but if it is determined that the levee is in the public interest, they recommend a levee alignment immediately adjacent to Airline Highway. They suggest that the exact location be determined jointly by the New Orleans District (NOD), FWS, National Marine Fisheries Service (NMFS), and the Louisiana Department of Wildlife & Fisheries (LDWF) during the advance engineering and design stage. In addition, it was recommended that the Corps should maintain complete control of the gated water control structures to be incorporated in the alignment. The Corps has determined that the levee is in the public interest and the Recommended Plan includes an alignment just north of Airline Highway. The aforementioned agencies will be consulted during preparation of the General Design Memorandum for this levee segment.

1.4.3. A second unresolved issue involves the levee alignments in the New Orleans East area described in paragraph 1.2.5. above. Environmental groups claim that raising the South Point-to-GIWW levee to high level specifications would make development of the inclosed wetlands more attractive. These wetlands have been inclosed for more than 2 decades. Although raising the levee to Standard Project Hurricane (SPH) level of protection would increase potential for development of the 13,000 acres of wetland, any filling operations would be regulated under the permit authority of Section 404. Decisions on such operations are based on public interest and the District Engineer will make an independent decision on the matter.

1.4.4. Another unresolved issue, ancillary to that discussed in paragraph 1.4.3., concerns tidal exchange between the inclosed wetlands and Lake Pontchartrain. Since 1958, the only exchange has been drainage through four flapgates in the South Point to GIWW levee. These remain in the closed position except after a heavy rain. Environmental groups and natural resource agencies desire that tidal exchange be reestablished to preserve the viability of the marsh, to allow it to again function as an estuarine nursery area for fish and shellfish, and to again export nutrients and detritus to the adjacent estuary. Such a resumption of tidal exchange is considered to be infeasible for several reasons; the most significant is that such an action would necessitate purchase of flooding easements and could require the elevation of Interstate 10. Easements would require Congressional authorization and incur additional costs to the local sponsors, who are opposed to such action. (For further discussion of this matter, see paragraphs 4.2.10. and 4.2.11.)

1.4.5. The FWS recommends that nondevelopment easements be purchased over the 9,700-acre wetland area in New Orleans East and that the water control structures in the South Point to GIWW levee be modified to reestablish tidal exchange. It is NOD's position that the proper solution to the problem of development in New Orleans East is via the permit process. However, one alternative we are studying in our preliminary mitigation plan is to restore tidal exchange to New Orleans East and purchase perpetual flowage easements where appropriate.

1.4.6. There still remains some disagreement over the source of fill material for the high level levee along the Jefferson Parish lakefront. The most economical method of obtaining and placing the fill material is by the proposed hydraulic dredging of the lake bottom adjacent to the lakefront alignment. This method would result in creation of a submarine borrow pit approximately 60 feet in depth and 500 feet in width for a distance of approximately 9 miles. The FWS objects to this method of obtaining fill material and recommends either utilization of hauled fill or development of a method of dredging that would alleviate water quality and biological productivity problems. The Corps has analyzed various other methods of obtaining fill material including hauled fill (including barge transport) and a combination of hauled fill and hydraulic fill. None of these methods was found to be cost effective. Further discussion of this analysis is contained in the main report on pages 90 to 92.

1.4.7. No agreement has been reached with the numerous environmental interests concerning the issue of concurrent mitigation. The Corps has agreed to mitigate for all construction impacts from project initiation to project completion. However, to finalize detailed mitigation plans and costs, further scoping, evaluation, and interagency coordination are required. Therefore, the mitigation plan will be prepared as a separate report which will be accompanied by an EIS and Fish and Wildlife Coordination Act Report. Environmental interests and the FWS would like



the finalized mitigation plan to accompany the present EIS. The draft mitigation report is scheduled for public release in the summer of 1985 and should be finalized by early 1986. Project construction will not be completed by this date and mitigation plans will be initiated upon approval to obtain mitigation as concurrently as practicable with the remaining construction.

## 1.5. RELATIONSHIP OF PLANS TO ENVIRONMENTAL REQUIREMENTS

Table 1.5 indicates the relationship of each plan to Federal and state environmental protection statutes and other environmental requirements.

FC = Full Compliance  
PC = Partial Compliance  
N/A = Not Applicable

Table 1.5

RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION STATUTES OR  
OTHER ENVIRONMENTAL REQUIREMENTS

	HIGH LEVEL	BARRIER
<u>FEDERAL STATUTES</u>		
1. <u>Preservation of Historical Archeological Data Act of 1974.</u> Completion of the ongoing and planned cultural resource studies will bring project into full compliance.	PC	PC
2. <u>Clean Air Act, as Amended.</u>	FC	FC
3. <u>Clean Water Act of 1977.</u>	FC	F
4. <u>Coastal Zone Management Act of 1972, as Amended.</u>	FC <sup>1/</sup>	PC
5. <u>Endangered Species Act of 1973, as Amended.</u> Compliance will be achieved upon receipt of a Biological Opinion from FWS regarding our ammended Biological Assessment.	PC	PC
6. <u>Estuary Protection Act.</u>	FC	FC
7. <u>Federal Water Project Recreation Act.</u>	FC	FC
8. <u>Fish and Wildlife Coordination Act.</u>	FC	FC
9. <u>Land and Water Conservation Fund Act.</u>	FC	FC
10. <u>Marine Protection Research and Sanctuaries Act of 1972, as Amended.</u>	N/A	N/A
11. <u>National Historic Preservation Act.</u> Completion of ongoing and planned cultural resource studies will bring the project into full compliance.	PC	PC

<sup>1/</sup> The Corps considers inself to be in full compliance with this feature, DNR does not concur.

Table 1.5 (Continued)

RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION STATUTES OR  
OTHER ENVIRONMENTAL REQUIREMENTS

	HIGH LEVEL	BARRIER
12. <u>National Environmental Policy Act.</u> Compliance requires signature of the Record of Decision.	PC	PC
13. <u>River and Harbor Act.</u>	FC	FC
14. <u>Watershed Protection and Flood Prevention Act.</u>	N/A	N/A
15. <u>Wild and Scenic Rivers Act.</u>	FC	FC
<u>EXECUTIVE ORDERS</u>		
1. <u>Executive Order 11988, Floodplain Management.</u>	FC	FC
2. <u>Executive Order 11990, Protection of Wetlands.</u>	FC	FC
3. <u>Executive Order 12114, Environmental Effects Abroad of Major Federal Action.</u>	N/A	N/A
4. <u>Executive Memorandum, Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA.</u>	FC	FC
5. <u>Executive Order 11593, Protection and Enhancement of the Cultural Environment.</u> Completion of ongoing and planned cultural resource studies will bring the project into full compliance.	PC	PC
<u>STATE AND LOCAL POLICIES</u>		
1. <u>Air Control Law.</u>	FC	FC
2. <u>Archaeological Treasure Act.</u>	FC	FC
3. <u>Historic Preservation Districts Act.</u>	N/A	N/A
4. <u>Louisiana Natural and Scenic Streams Act.</u>	FC	FC

Table 1.5 (Continued)

RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION STATUTES OR  
OTHER ENVIRONMENTAL REQUIREMENTS

	HIGH LEVEL	BARRIER
5. <u>Protection of Cypress Trees (EO 1980-3).</u>	FC	FC
6. <u>Water Control Law.</u>	FC	FC
<u>LAND USE PLANS</u>		
1. <u>Louisiana Coastal Zone Management Plan.</u>	FC <u>1/</u>	FC
2. <u>Land Use Element of the Area-Wide Comprehensive Plan (Jefferson, Orleans, St. Bernard, and St. Tammany Parishes).</u>	FC	FC
<u>REQUIRED FEDERAL ENTITLEMENTS</u>		
None are required.		

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### 3. NEED FOR AND OBJECTIVES OF ACTION

#### 3.1. STUDY AUTHORITY

3.1.1. The ongoing hurricane protection project was authorized by Public Law 89-298, 27 October 1965, House Document 231, 89th Congress, 1st Session (the Flood Control Act of 1965) generally in accord with recommendations contained in a report from the Chief of Engineers. Upon receipt of funds in 1966, construction of the hurricane protection project began.

3.1.2. In response to the National Environmental Policy Act of 1969, the US Army Corps of Engineers prepared an Environmental Impact Statement (EIS) and filed it with the Council on Environmental Quality in January 1975. Shortly thereafter, the adequacy of the EIS was challenged in court. On 30 December 1977, major portions of the project were enjoined from further construction by United States District Court, Eastern District of Louisiana, New Orleans Division. Subsequently, in March 1978, the injunction was modified to allow construction to continue on all portions of the project except the barrier complexes at Chef Menteur Pass and The Rigolets. Studies to support a legally adequate EIS have been in progress since the injunction.

#### 3.2. PUBLIC CONCERNS

The primary public concern relates to the adequacy of the existing hurricane protection in the New Orleans metropolitan area. Although varying levels of protection exist, there remains a potential for significant hurricane-induced flooding to exceed present low levels of protection. Such flooding could result in extensive property damage and loss of human life. The controversy surrounding the originally conceived project indicates that, while the public supports hurricane protection, there is widespread concern about possible adverse environmental and social impacts from the project.

#### 3.3. PLANNING OBJECTIVES

The following planning objectives were established in response to the identified problems, needs, and opportunities: provide more adequate hurricane protection for the east bank New Orleans area; maximize the project's contribution to the Nation's economic development; minimize adverse impacts on the environment and social well-being; and exploit project-related opportunities to enhance the environment and social well-being.

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## 4. ALTERNATIVES

### 4.1. DEVELOPMENT OF ALTERNATIVES

4.1.1. Alternative plans were limited to structural measures because all feasible nonstructural measures are in use, but do not provide adequate hurricane protection. Two basic design concepts were considered--high level and barrier. Under each concept, various levee alignments in New Orleans East and St. Charles Parish were possible. Using combinations of these elements, 16 alternative plans were formulated (see Table 4.1).

TABLE 4.1

#### ALTERNATIVE PLANS

PLAN	BARRIERS	NEW ORLEANS EAST ALINEMENT	ST. CHARLES PARISH ALINEMENT
1	Yes	Existing	Lakefront
2	Yes	Existing	North Airline
3	Yes	Existing	South Airline
4	Yes	Existing	Boundary Levee
5	Yes	Maxent Canal	Lakefront
6	Yes	Maxent Canal	North Airline
7	Yes	Maxent Canal	South Airline
8	Yes	Maxent Canal	Boundary Levee
9	No	Existing	Lakefront
10	No	Existing	North Airline
11	No	Existing	South Airline
12	No	Existing	Boundary Levee
13	No	Maxent Canal	Lakefront
14	No	Maxent Canal	North Airline
15	No	Maxent Canal	South Airline
16	No	Maxent Canal	Boundary Levee

4.1.2. The barrier concept involves controlling inflows to Lake Pontchartrain during approaching hurricanes, thus reducing the required heights of levees and floodwalls which would protect the New Orleans area. Inflow would be controlled by construction of barrier complexes at Lake Pontchartrain's three main tidal passes: the Inner Harbor Navigation Canal (IHNC), The Rigolets, and Chef Menteur. Each barrier complex would consist of a gated control structure, a closure dam, a navigational structure and approach channels, and any necessary tie-ins to adjacent levees (see Figures 2, 3, and 4). The high level concept proposes to provide hurricane protection by raising existing levees and constructing new levees in St. Charles Parish.

4.1.3. The New Orleans East area levees inclose 13,000 acres of wetlands (see Plate 6). Concerns have been expressed that development of these wetlands would not be in the public interest. Thus, an alternative alignment along the Maxent Canal was formulated to protect developed lands, but exclude these wetlands.

4.1.4. The east bank of St. Charles Parish is not protected from tidal flooding from Lake Pontchartrain. A levee along the lakefront was part of the original plan; however, because of environmental considerations, a decision was made in the early 1970's to indefinitely defer construction of this feature. Three alternative levee alignments have been developed. The North of Airline alignment would extend along the existing return levee at the St. Charles-Jefferson Parish line to just north of Airline Highway, then turn west and parallel the highway to the Bonnet Carre' Spillway (see Plate 7). The South of Airline alignment is a modification of the previous alignment that would veer south of the highway to avoid inclosing about 3,000 acres of wetlands. The St. Charles-Jefferson Parish Boundary alignment would consist of strengthening and lengthening the existing return levee, along the St. Charles-Jefferson Parish line. This would provide protection to Jefferson Parish from high water caused by flooding of the St. Charles Parish wetlands, but would not provide any protection to developed areas of St. Charles Parish.

## 4.2. PLANS ELIMINATED FROM FURTHER STUDY

4.2.1. For a detailed rationale of the process of screening alternative plans, see pages 72 to 92 of the Main Report.

4.2.2. **PLAN 1** consists of the barrier complexes, the existing alignment in New Orleans East, and the Lakefront alignment in St. Charles Parish (see Table 4.1). This plan would inclose 28,000 acres of wetlands in St. Charles Parish, but would allow for limited tidal exchange between these wetlands and the lake during normal conditions. An additional 1,000 acres of wetland would be lost to levee and borrow. However, sheet flow interchange would be eliminated, reducing the biological productivity of the wetlands and the lake. Further analysis indicated there was no discernable need to develop these wetlands during

the project life. Cost analyses showed the Lakefront alignment had the highest first cost to protect St. Charles Parish. For both environmental and economic reasons, Plan 1 was eliminated.

4.2.3. **PLAN 3** consists of the barrier complexes, the existing New Orleans East levee, and the South of Airline alignment in St. Charles Parish. This plan avoids inclosing approximately 3,000 acres of wetlands south of Airline Highway. However, these forested wetlands are subject to tidal exchange only through culverts under Airline Highway. The North of Airline alignment would include similar culverts; thus, when these two alignments are compared, neither would alter the existing hydrology as long as the culverts remain open. Since the South of Airline alignment is approximately 2.5 miles longer, it would cost substantially more. Thus, Plan 3 was eliminated, mainly for economic reasons.

4.2.4. **PLAN 4** consists of the barrier complexes, the existing New Orleans East levee, and the Boundary Levee alignment for St. Charles Parish. This plan would provide no hurricane protection to the east bank of St. Charles Parish, but would serve to complete hurricane protection for highly developed Jefferson Parish. Since analysis showed that there was a potential for extensive damage and loss of life from hurricane-induced flooding in the developed portion of the east bank of St. Charles Parish, Plan 4 was eliminated.

4.2.5. **PLAN 5** consists of the barrier complexes, the Maxent Canal alignment in New Orleans East, and the Lakefront alignment in St. Charles Parish. The Maxent Canal alignment would avoid increasing the height of levees which now inclose approximately 13,000 acres of wetlands. (These wetlands have been inclosed since 1958 by a system of railroad embankments and levees.)

4.2.6. The Maxent Canal alignment is much shorter than the existing levee system to the east; however, it would be a new levee on a poor foundation as opposed to an existing levee in an advanced stage of construction. Thus, it would cost \$70,000,000 more to build the Maxent Canal alignment than to complete the existing levee alignment, and, in addition, costs and plans must be developed to prevent flooding of Interstate 10. The number of acres of land required to build the Maxent Canal alignment is approximately equal to the number needed to finish the existing levee.

4.2.7. At the time of project authorization, it was assumed that the 13,000 acres of wetlands would be developed and project benefits for urban expansion were claimed. Subsequently, national policy changed to support preservation of wetlands. In this study, no benefits are claimed for future urban development in these wetlands.

4.2.8. Recently, the New Orleans District received a permit request (under authority of Section 404 of the Clean Water Act of 1977) from a

private developer. New Orleans East, Inc., proposes to develop approximately 9,800 of the 13,000 acres, and is preparing an Environmental Impact Statement on the proposed development. Subsequent to submittal of the EIS, the District Engineer will make a decision to approve or deny the permit. This decision will be based on national interest.

4.2.9. A consideration related to the Maxent Canal alignment is the possibility of tidal exchange between the 13,000 acres of wetlands and Lake Pontchartrain. To drain the area to the west of the South Point to GIWW levee, local authorities built four small gravity drainage structures with flap gates in the late 1950's. These structures have been improved and floodgates added as a part of Federal work on the project. At the present time, the floodgates are open, but the drainage structures remain closed because of the flap gates. Thus, there has been no tidal exchange between these wetlands and Lake Pontchartrain in over 2 decades.

4.2.10. Environmental groups, the NMFS, and the FWS have suggested that tidal exchange be reestablished to increase the productivity of the wetlands for waterfowl, furbearers, and estuarine fish and shellfish. By rejoining these wetlands and the lake, the normal exchange of nutrients and detritus could occur and the marsh would be available as a nursery area for fish and shellfish. This reconnection is opposed by several interests. The local levee board claims that landowners granted rights-of-way for the preproject levee system with the understanding that the inclosed area would be drained and developed. The levee board is concerned that implementing a plan counter to the original goals would open them to legal liability. They also claim that reopening the area to tidal exchange would require acquisition of expensive flowage easements. This is beyond the original authority of the project, and a purpose for which they did not agree to provide assurances. Further, it could increase their financial burden. Therefore, they do not wish to participate in such an action. The local authority responsible for operating and maintaining drainage in an adjacent housing development fears that increased water levels would lead to further infiltration into the forced drainage system and raise costs. The local mosquito control authority is concerned that tidal interchange might increase breeding habitat for mosquitoes near populated areas. In addition, reestablishment of tidal exchange could cause flooding of Interstate 10, a major route through the area; therefore, costs and plans must be developed to prevent such flooding. Restoration of tidal interchange to all or part of New Orleans East will be further investigated during mitigation studies.

4.2.11. The Maxent Canal alignment does not increase the existing hurricane protection to the wetland area between Maxent Canal and the existing South Point to GIWW levee, but would preclude development of that area. Future national or local policies and needs may make such development desirable, and project completion using the existing levee

could accomodate such policy changes without future additional costs for hurricane protection. Because of this consideration and the excessive costs of the Maxent Canal alinement compared to the existing alinement, Plan 5 was eliminated.

4.2.12. **PLANS 6, 7, AND 8** consist of barrier complexes, the Maxent Canal alinement, and various alinements in St. Charles Parish. The Maxent Canal alinement was determined to be infeasible for reasons discussed in paragraphs 4.2.5. through 4.2.11. above. Plans 6, 7, and 8 were eliminated from further study.

4.2.13. **PLAN 9** utilizes the high level concept with the existing alinement in New Orleans East and the Lakefront alinement in St. Charles Parish. The Lakefront alinement is undesirable from both environmental and economic viewpoints as described in paragraph 4.2.2, so Plan 9 was eliminated.

4.2.14. **PLAN 11** utilizes the high level concept with the existing levee alinement in New Orleans East and the South of Airline alinement. Because of the undesirability of the South of Airline alinement as described in paragraph 4.2.3., Plan 11 was eliminated.

4.2.15. **PLAN 12** has the high level concept, the existing levee in New Orleans East, and the Jefferson-Orleans Parish Boundary levee alinement in St. Charles Parish. Plan 12 was eliminated for reasons discussed in paragraph 4.2.4. In this case, the trade-off analysis indicated the incremental cost of Plan 10 over Plan 12 (about \$56,000,000) was justified.

4.2.16. **PLANS 13, 14, 15, AND 16** all include the high level concept, the Maxent Canal alinement, and varying alinements in St. Charles Parish. They were eliminated mainly because of the undesirability of the Maxent Canal alinement, as discussed in paragraphs 4.2.5. through 4.2.11.

#### 4.3. FUTURE WITHOUT ADDITIONAL FEDERAL ACTION

4.3.1. This project is ongoing and this EIS supplement includes only work from 1984 to 2100. In a strict sense, no future without-project exists; instead it is the future with no additional Federal action.

4.3.2. Significant improvement in the overall quality of project area surface waters is not anticipated. The water quality of Lake Pontchartrain is expected to improve slightly as a result of the planned cessation of municipal wastewater discharge from the south shore. However, pumping of bacteria-laden storm waters into the lake will continue, and the growth of the Port of New Orleans will increase opportunities for hazardous material spills. Much of the remaining marsh of the study area will convert to water, scrub shrub, or upland developed habitat (see Tables 4.3 and 6.3). Forested areas will be cleared and

developed. The continued loss of these habitats will decrease the fish and wildlife resources of the area. Recreational development will continue, especially in Orleans and Jefferson Parishes.

4.3.3. Hurricane-induced flooding could also affect numerous acres of wildlife habitat by increasing salinities.

4.3.4. The rising floodwaters could additionally cause drowning of terrestrial wildlife or isolation of these animals from their food base or feeding areas.

4.3.5. Population growth in the economic area will continue. In recent years, the largest volume of growth has taken place in Jefferson Parish. Most of the new residential expansion in Orleans Parish has occurred in the eastern part of the city. The east bank section of St. Charles Parish also is projected to grow at a rapid rate. People, dwellings, and businesses in the New Orleans metropolitan area will continue to be threatened with loss of life and property from hurricanes. This could discourage future economic growth in undeveloped areas and could delay construction of such proposed developments as the Almonaster-Michoud Industrial Development. In addition, land-use density in the more protected portions of the area will increase, raising the costs of such valuable lands.

#### 4.4. PLANS CONSIDERED IN DETAIL

##### 4.4.1. **BARRIER PLAN**

4.4.1.1. This plan would provide barrier complexes at the three tidal passes. Levees would protect the east banks of St. Charles and Jefferson Parishes, Orleans Parish, and portions of St. Bernard Parish. (For a detailed description of plan features, see the Plan Assessment and Evaluation Section in the Main Report.) The Rigolets complex would consist of barrier levees, a 110- by 800-foot navigational lock, a closure dam, and a gated control structure 1,088 feet long with riprapped approach channels and a sill at present bottom depth (see Figure 4). The complex would provide a cross-sectional area of flow equal to about 35 percent of the natural cross section and would allow for passage of over 90 percent of the natural tidal prism. The Chef Menteur complex would consist of an earthen closure dam across the existing channel, barrier levees, a bypass channel for the GIWW, a navigational floodgate on a new channel, and a 612-foot gated control structure astride another new channel (see Figure 3). The sill of the control structure would be 10 feet above the floor of the approaches. The control structure would provide a cross-sectional area of flow equal to approximately 43 percent of the natural cross section of the pass and would allow for passage of over 90 percent of the natural tidal prism. The Seabrook complex would consist of a navigational lock, a control structure, and a closure dam (see Figure 2). The only work that has been accomplished on the barrier complexes is the GIWW bypass channel.

4.4.1.2. The Chalmette Area Plan is a levee system which would protect the populated areas of St. Bernard Parish and inclose 16,312 acres of marsh (see Plate 4). All first lifts of this levee system have been completed except a short portion near Florida Avenue which is under construction. Table 4.2 shows the height and width of the various levee reaches and describes the method of construction. There are existing navigable floodgates in Bayous Bienvenue and Dupre which normally remain in the open position to allow navigation, gravity drainage, and tidal exchange to the inclosed marshes. A gravity drainage structure is planned at Creedmore Canal. Borrow material for construction would be taken from the Mississippi River-Gulf Outlet (MR-GO), the GIWW, and existing pits along the south reach of the levee.

4.4.1.3. The levees protecting the IHNC are described in Table 4.2. All first lifts have been completed.

4.4.1.4. The New Orleans East area, shown on Plate 6, would be protected by levees with dimensions described in Table 4.2. This system inclosed 13,000 acres of marsh. All first lifts are completed. There are four small gravity drainage structures with both flap and sluice gates in the South Point to GIWW reach of this levee system. The flap gates are normally closed and only allow drainage out of the inclosed marsh during and immediately after heavy rains. Borrow material for the back levee would be taken from existing pits. Hauled clay probably would come from pits in the Slidell area.

4.4.1.5. The Citrus Back and Lakefront, New Orleans Lakefront, Jefferson Lakefront, and St. Charles levee systems are shown on Plate 8 and described in Table 4.2. "Riprap" foreshore protection will be provided between the IHNC and Paris Road segment of the Citrus lakefront levee and along the Citrus Back. This will require the excavation of shallow, lakeside floatation channels to enable the "riprap" material to be barged in.

4.4.1.6. In Orleans Parish, there are three major outfall canals flanked by return levees which tie into pumping stations at the heads of the canals. These return levees are inadequate in terms of grade and stability. Several alternatives are being considered; however, no specific solution has been finalized with the local agencies.

4.4.1.7. The existing seawall in front of the town of Mandeville would be renovated and strengthened (see Plate 8).

4.4.1.8. IMPLEMENTATION RESPONSIBILITIES. Since the Seabrook complex would not only be part of the hurricane protection project, but is also an authorized feature of the MR-GO navigation project, 50 percent of its first costs and all operation and maintenance costs are allocated to MR-GO. All other features of the Barrier Plan are allocated to the hurricane protection project. The Federal Government would pay 70 percent of the first costs and non-Federal interests would be

TABLE 4.2  
LEVEE DIMENSIONS AND TYPE

REACH	BARRIER PLAN		HIGH LEVEL PLAN		TYPE OF LEVEE AND PREPROJECT CONDITION OF LAND
	Height (feet)	Width (feet)	Height (feet)	Width (feet)	
Chalmette North	14	500	14	500	Hydraulic fill on existing GIWW dredged material.
Chalmette East	17.5	500	17.5	500	Hydraulic fill on existing MR-GO dredged material.
Chalmette South	16.5-17.5	250-500	16.5-17.5	250-500	Hydraulic and hauled clay fill on existing levee first built for this project.
IHNC East and West	13-14	20-55	13-14	20-55	I-wall on hauled clay base; some hauled clay levee only. Both on IHNC dredged material.
New Orleans East Back	17.5	300-500	17.5	300-500	Hydraulic fill on locally built levee.
South Point-GIWW	12.5-14	70-146	13.5-15	130-176	Hauled clay fill on locally built levee.
New Orleans East Lakefront	14	190	16.5	272	Hauled clay fill on locally built levee.
Citrus Lakefront	13.5	85	13.5-15	85	Hauled clay fill on locally built levee. I-wall on hauled clay base with barge berm. <sup>1/</sup> Floodwall at Lincoln Beach. Foreshore protection.
Citrus Back	14	300	14	300	Hydraulic fill on existing levee. Foreshore protection.
New Orleans Lakefront	12	60	14.5		Hauled clay fill on existing levee. I-wall on levee with barge berm. <sup>1/</sup> Floodwall at Lakefront Airport, Seabrook Beach, American Standard, Pontchartrain Beach, and Orleans Marina.
Jefferson Lakefront	10	180-240	14	686	Hydraulic fill on existing Federal levee.
Jefferson-St. Charles Boundary	9-11		14	686	Hydraulic fill on existing Federal levee.
St. Charles at Airline Highway	11.5	180	13.5	238	Hauled clay fill with floodwall in restricted areas.

<sup>1/</sup> The most recent engineering studies indicate that hauled clay may be less costly than an I-wall with barge berm. If such a design change is made, a Supplemental Information Report will be prepared.



responsible for the remaining 30 percent. All the annual operation and maintenance costs would be borne by non-Federal interests.

4.4.1.9. MITIGATION. Project impacts are being minimized to the greatest degree possible through the following actions: use of existing levee alignments to the maximum extent feasible; use of I-wall, T-wall, or other floodwall type design to minimize levee widths in sensitive areas where feasible; use of silt curtains, turbidity diapers, retainment dikes or other turbidity control devices where possible; and provision of erosion control to intermediate levee lifts. Unavoidable environmental impacts would have to be mitigated by various compensation measures.

#### 4.4.2. HIGH LEVEL PLAN DESCRIPTION

4.4.2.1. This plan would raise levees and floodwalls to a height sufficient to protect against hurricane surges from Lakes Pontchartrain and Borgne. The design for some features (Chalmette Area Plan, IHNC East and West Levees, Citrus Back levee, New Orleans East Back levee, and Mandeville Seawall) is identical to that under the Barrier Plan because these features function independently of barrier structures. All other levee reaches for the High Level Plan are similar in alignment to the Barrier Plan, but are higher and wider because the water levels in Lake Pontchartrain would be higher without the barriers. Table 4.2 indicates the elevation, width, and method of construction of each reach. Plate 9 shows the location of the reaches. Only minimal modification of the four existing structures in the South Point-to-GIWW reach is expected. The same problems involving the grade and stability of the outfall canal return levees as described in paragraph 4.4.1.6. would exist. The hydraulic fill for the Jefferson Parish levee would be obtained from an in-lake borrow pit to be located approximately 2,500 feet offshore and parallel to the shoreline. These borrow sites would be discontinuous and approximately 9 miles in length, 500 feet in width, and 60 feet in depth National Geodetic Vertical Datum (NGVD).<sup>1/</sup> Recent hydraulic analysis of water movements in Lake Pontchartrain have indicated that, even during extreme weather conditions (hurricanes), the bottom waters of a 60-foot borrow pit would not mix with adjacent Lake Pontchartrain waters. Further consideration will be given to physical configuration, orientation and side slope pitch of the proposed borrow pits in order to expedite filling of the pits and, thereby, reduce the probability of sustained water quality impacts.

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<sup>1/</sup>Unless otherwise noted, all elevations in this report herein are expressed in feet referenced to National Geodetic Vertical Datum, formerly referred to as mean sea level.

4.4.2.2. IMPLEMENTATION RESPONSIBILITY. The legislative authority for this project specifies that the costs be shared, with the Federal Government bearing 70 percent of the first costs and non-Federal interests paying 30 percent. All annual operation and maintenance costs would be the responsibility of non-Federal interests.

4.4.2.3. MITIGATION. As previously noted, to properly estimate mitigation needs, all construction impacts associated with the project (from start to completion) have been considered.

4.4.2.4. The impacts associated with the post-1984 completion of both the Barrier Plan and the High Level Plan are noted in Tables 6.1, 6.2, and 6.3. On an annualized basis, approximately 32 acres of brackish/saline marsh and 106 acres of cypress-tupelo swamp would be lost due to completion of the High Level Plan. Comparable numbers for completion of the Barrier Plan would be 1,283 acres of brackish/saline marsh and 92 acres of swamp. Annualized losses of 740 acres of brackish/saline marsh and 81 acres of fresh/intermediate marsh have already occurred between 1979 and 1984. Thus, to fully mitigate for the Barrier Plan, it would be necessary to mitigate for an annualized loss of 81 acres of fresh/intermediate marsh, 2,023 acres of brackish/saline marsh, and 92 acres of swamp. The High Level Plan would be fully mitigated by replacing the habitat units associated with an annualized loss of 81 acres of fresh/intermediate marsh, 772 acres of brackish/saline marsh, and 106 acres of swamp. In addition, it would be necessary to mitigate for the annualized loss of 431 acres of lake bottoms with the High Level Plan or 279 acres with the Barrier Plan.

4.4.2.5. In order to mitigate these wetland losses, various plans are being developed. One plan would be to manage various marshes in St. Bernard Parish (see Plate 12). Without management, these marshes would deteriorate over time. Mitigation measures would include the construction of a series of shallow water distribution ditches, low-level dikes and water-control structures.

4.4.2.6. Another concept would involve providing protection to marsh immediately adjacent to Lake Pontchartrain in St. Charles Parish, Orleans Parish, and in the Manchac Wildlife Management Area through shoreline stabilization. Management of wetlands in St. Charles Parish will also be considered (see Plate 12). Reestablishment of tidal exchange to all or part of the area of New Orleans East east of the Maxent Canal alignment will be considered. Filling of the Chef Menteur Bypass Channel or similar work in that area will also be studied.

4.4.2.7. While still building the Barrier Plan in 1976, extensive marsh areas near Chef Menteur Pass were diked for future disposal. After the court injunction, these dikes were breached reestablishing tidal exchange. Many of the borrow canals were plugged to prevent erosion. Thus, these areas have been restored to a great extent. In addition, a borrow pit near Yscloskey utilized for levee construction has been

modified to act as a controlled release reservoir to benefit fish and wildlife production when water levels are normally low in the adjacent marshes (see Plate 12).

4.4.2.8. A separate Mitigation Plan/EIS is being prepared. During the summer and early fall of 1984, a series of meetings and workshops will be held with interested parties. The plan should be completed and ready for review by higher authority within the Corps of Engineers by early 1985. Public review is scheduled for the summer of 1985 and filing of the final EIS on mitigation should occur early in 1986. Our goal is to fully mitigate for all construction impacts of the project. One manner in which mitigation needs will be determined is through the Habitat Evaluation Procedure of the USFWS.

#### 4.5. COMPARATIVE IMPACTS OF ALTERNATIVES

The following Table 4.3., Comparative Impacts of Alternatives, describes in a comparative form the base and without condition, the impacts of the detailed plans on significant resources, and plan economic characteristics. More detailed information on the impacts described in this table are described in Section 6, Environmental Effects.

9.3 TABLE - COMPARATIVE IMPACTS OF ALTERNATIVES

ITEM	BASE (1978)	FUTURE WITH NO ADDITIONAL FEDERAL ACTION (2100)	FUTURE WITH HIGH LEVEL PLAN (2100)	FUTURE WITH BARKER PLAN (2100)
CRUSTACEANS-DEVELOP	Present in area of potential construction impact: 21.3 acres.	Remaining: 56 acres. 157-acre loss from base due to nonproject-induced conversion to upland developed.	Remaining: 0 acres. 211-acre loss from base due to term construction and nonproject-induced conversion to upland developed. 38-acre loss from future with no additional Federal action due to levee construction.	Remaining: 7 acres. 206-acre loss from base due to levee construction and nonproject-induced conversion to upland developed. 49-acre loss from future with no additional Federal action due to levee construction.
ORITHYRAN INSECTS	Present in area of potential construction impact: 41 acres.	Remaining: 3 acres. 38-acre loss from base due to nonproject-induced conversion to upland developed.	Same as future with no additional Federal action.	Remaining: 0 acres. 41-acre loss from base due to levee construction. Thereafter loss from future with no additional Federal action due to levee construction.
AGRICULTURAL LANDS	Present in area of potential construction impact: 0 acres.	No impact.	No impact.	No impact.
WILDLIFE	Present in area of potential construction impact: 2,417 acres.	Remaining: 854 acres. 1,563-acre loss from base due to nonproject-induced conversion to upland developed, 70-acre loss from future with no additional Federal action due to conversion to project levees.	Remaining: 1,129 acres. 1,288-acre loss from base due to nonproject-induced conversion to upland developed, 156-acre loss from future with no additional Federal action due to conversion to project levees.	Remaining: 20 acres. 2,397-acre loss from base due to project levees and disposal areas and 1,178 acres to nonproject-induced conversion to upland developed, 457-acre loss from future with no additional Federal action due to project disposal and levees.
LAKE PORTCHARTRAIN AND ADJACENT WATERS	Present in area of potential construction impact: 870 acres of bayou/canal and 1,012 acres of lake bottom. Lake Portchartrain, NE-OW, DMO, and GDM are all hydraulically connected and experience similar water quality problems. Each is subject to sewage contaminated stormwater and domestic and industrial wastewater discharges from the New Orleans metropolitan area. Each is subject to low-level impacts of toxic contamination from atmospheric sulphur dioxide and periodic mechanical spills of nonpetroleum wastes.	Present in 2100: 905 acres of bayou/canal and 1,226 acres of lake bottom. 12-acre gain in bayou/canal from base due to fill and 94 acres gain in lake bottom due to nonproject-induced marsh erosion and subsidence. Water quality same as base.	Present in 2100: 983 acres of bayou/canal and 1,591 acres of lake bottom. 124-acre gain in bayou/canal and 75-acre gain in lake bottom from base due to nonproject-induced marsh erosion and subsidence. Water quality same as base.	Present in 2100: 467 acres of bayou/canal and 1,701 acres of lake bottom. 203-acre loss of bayou/canal from base due to project-induced disposal and lack of marsh to convert to this habitat type. 29-acre gain of lake bottom from base. 37-acre loss of lake bottom from future with no additional Federal action. Marshes that would have been created without the barrier were used for disposal. Short-term increased suspended solids and turbidity levels in the tidal basins and vicinity likely to be beneficial for dispersion of any contaminants. In the long term, the material, potential for long-term impacts due to leaching of contaminants from the levees and the closure of Gulf Mainline Pass. Modification of circulation and flow patterns in the Pass could produce daily produce volumes of localized poor water circulation and reduced flushing.
FISHERIES	Fisheries resources are commensurate with the extent of marsh, bottomland hardwood, cypress swamps, scrub shrub, and open water habitat in the area of potential construction impacts. Wildlife fish and wildlife in study area.	Marsh loss would reduce catch to 139,063 pounds valued at \$66,341 by 2100.	Marsh remaining would produce 212,702 pounds of fish valued at \$66,710. Approximately 9.1 percent of the lake bottom would become 80-foot holes which would significantly reduce the area from benthic productivity.	Remaining marsh acreage would produce 5,669 pounds of catch valued at \$9,434.
WILDLIFE	The wildlife resources are commensurate with the extent of marsh, bottomland hardwood, cypress swamps, scrub shrub, and open water habitat in the area of potential construction impacts. Wildlife fish and wildlife in study area.	Wildlife populations would decline due to reduced amount of habitat available.	This plan would result in the average annual loss of 935 habitat units which would reduce habitats for waterfowl, wading birds, shorebirds, deer, public ducks, and diving ducks.	This plan would result in the average annual loss of 2,117 habitat units.

4.3 TABLE - (CONTINUED)

ITEM	BASE (1964)	FUTURE WITH NO ADDITIONAL FEDERAL ACTION (2100)		FUTURE WITH HIGH LEVEL PLAN (2100)		FUTURE WITH BARRIER PLAN (2100)	
		ENDANGERED SPECIES	WILDLIFE	RECREATION	NATIONAL REGISTER OF HISTORIC PLACES	MINERALS	AIR QUALITY
ENDANGERED SPECIES		The only endangered species likely to occur in the project area is the bald eagle.	About 13 of the 20 "blue listed" species are relatively common in the project area.	The principal recreational activities existing in the base condition are swimming, bicycling, jogging, boating, picnicking, field sports, hunting, and fishing. It is estimated that 783,421 annual man-days of recreation exist valued at \$2,532,799 annually. Included in the 783,421 man-days are 2,038 man-days of sport hunting and 13,122 man-days of sport fishing valued at \$15,581 and \$74,516, respectively. Three wildlife management areas are in the project area, none are in areas of potential obstruction impact.	Numerous study area historic properties and districts, as well as significant cultural resources, are listed in the National Register of Historic Places.	Minimal production of petroleum and natural gas and, to a lesser extent, extractable clay and sand fill materials are found within the project area.	Air quality is relatively good. No violations of National Ambient Air Quality Standards except ozone in urban New Orleans area.
WILDLIFE							
RECREATION							
NATIONAL REGISTER OF HISTORIC PLACES							
MINERALS							
AIR QUALITY							
NOISE							
FLOOD CONTROL							
PROPERTY VALUES							

4.3 TABLE - (CONTINUED)

ITEM	BASE (1978)	FUTURE WITH NO ADDITIONAL FEDERAL ACTION (2100)			FUTURE WITH HIGH LEVEL PLAN (2100)		FUTURE WITH BARRIER PLAN (2100)	
		BUSINESS AND INDUSTRIAL ACTIVITY			EMPLOYMENT		HOUSING	
BUSINESS AND INDUSTRIAL ACTIVITY	The economic base is centered around the port, transportation, and related commercial activities.	The economic base of the area would probably remain the same, with an increasing trend toward tourist trade, and industrial development in the Almonaster-Michoud Industrial District (A-MID).			Additional flood protection provided to business and industry, A-MID development accelerated.		Inspects would be similar to future with High Level Plan with possible additional development incentive on the north shore. Some perceive that this plan would potentially foreclose water-based development on the north shore.	
		Employment conditions would generally follow recent trends.			Completion of the project would generate an estimated \$4,240,000 in benefits.		Construction-related employment benefits are estimated at \$5,360,000.	
EMPLOYMENT	More than 65 percent of the total employment of the economic area is in services, retail trade, manufacturing, transportation, communications and utilities, and construction.	The without-project condition would probably follow existing trends.			Additional flood protection would benefit approximately 160,000 dwelling units.		About 187,000 dwelling units would receive additional flood protection.	
		The limited amount of protected land in the New Orleans area has resulted in relatively high housing densities. Pockets of low quality housing, renovation in older neighborhoods. Rapid construction in suburbs.			Esthetics would generally continue to be high.		Esthetics in passes would be temporarily altered during construction.	
HOUSING	The esthetics of the study area are generally high.	Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Community cohesion would be adversely affected to a minor extent during construction. Environmental opposition to plan is strong.	
		Community generally support plans for improved flood protection.			Community cohesion would be adversely affected to a minor extent during construction. Environmental opposition to plan is strong.		Community cohesion would be adversely affected to a minor extent during construction. Environmental opposition to plan is strong.	
ESTHETICS	The esthetics of the study area are generally high.	Community generally support plans for improved flood protection.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
		Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
COMMUNITY COHESION	Community generally support plans for improved flood protection.	Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
		Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
FIRST COSTS	N/A	Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
		Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
AVERAGE ANNUAL COSTS	N/A	Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
		Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
BENEFIT-COST RATIO	N/A	Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
		Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
NET BENEFITS	N/A	Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	
		Without completion of the project, social stresses created by a project hurricane could be more significant.			During construction, esthetics along lake-front would be greatly reduced. After construction, more open spaces would exist.		Esthetics in passes would be temporarily altered during construction.	

1/For the purpose of the EIS, only environmental impacts to complete the project will be assessed. 1978 is the base year since this is the year for which habitat acreage losses were computed. The earliest construction could be initiated to complete the project is 1984. Since some Federal action has taken place, the without-project condition is referred to future with no additional Federal action. The area of potential construction impact is the 4,921 acres that would be directly impacted by any project feature.

2/Remaining refers to the number of acres of a particular habitat remaining in the area of potential construction impact at the end of project life (2100).

3/Open water is classified into two categories: bayou/canal and lake bottoms.

4/It is assumed, based on recent studies, that the estuarine dependent fisheries resources are currently being produced and harvested at maximum rate and any loss in marsh habitat would cause a corresponding loss in fishery products. Basis for fishery economics is the average exvessel price of the landings (as provided by National Marine Fisheries Service) for the 16-year period 1963-1978. The net profit to the fisherman was calculated from exvessel prices adjusted for the cost of harvest.

## 5. AFFECTED ENVIRONMENT

### 5.1. ENVIRONMENTAL CONDITIONS

5.1.1. The project area is located in southeastern Louisiana in the vicinity of New Orleans. It encompasses Lake Pontchartrain and adjacent wetlands to the north and west, the western third of Lake Borgne, and the wetland areas between Lakes Pontchartrain and Borgne (see Plate 11). Climatic conditions within the area are subtropical marine. The dominant topographic feature is Lake Pontchartrain, a shallow body of water (average depth 12 feet) with an area of approximately 640 square miles, lying in the middle of a large estuarine complex with a diurnal tidal regime. The lake drains approximately 4,700 square miles of tributary area. The area to be inclosed by the proposed levee includes all of the east bank of Orleans Parish and portions of St. Bernard, Jefferson, and St. Charles Parishes. The area of potential construction impact includes those acres directly affected by post-1984 project features for either plan. These acreages will be utilized in the impact analysis in the subsequent section.

5.1.2. The major vegetative communities in the study area are fresh-intermediate marsh, brackish-saline marsh, bottomland hardwoods, and cypress-tupelo swamp. These vegetative communities comprise valuable habitat for wildlife including waterfowl, small game, commercially-utilized furbearers, and the American alligator. The waters of Lakes Pontchartrain and Borgne, their shallow shorelines, embayments, and associated marshes provide valuable nursery, spawning, and feeding areas for various species of marine, estuarine, and freshwater fish and shellfish. These open water areas and associated tidal passes are heavily utilized for sport and commercial fishing. Lake Pontchartrain also supports large populations of bottom dwellers and free-floating planktonic forms that are important in the aquatic food chain. Detritus and nutrients from surrounding areas also are important components of this aquatic food web.

5.1.3. The human population of the project area is multi-ethnic and urban. Extensive residential and commercial development exists along the shores of Lake Pontchartrain. Highest population densities are located along the south shore in portions of Orleans, Jefferson, and St. Charles Parishes. Employment in the area is primarily in the manufacturing and transportation industries while communications, utilities, and construction jobs are becoming increasingly important.

5.1.4. Numerous archeological sites and historic districts and properties are located within the present and proposed protective levee system. Because of the heavy utilization of Lake Pontchartrain for transportation by early settlers, numerous shipwrecks are located in the lake.

5.1.5. Many recreational areas currently exist and several are planned for future development. Increasing population will place a heavy demand on such facilities.

5.1.6. Water quality problems within the project area are similar to those experienced in most urban centers. Discharges of process and storm waters from industries, and sanitary waste and storm waters from municipalities have occasionally resulted in degradation of local surface waters used for recreation.

5.1.7. Under future with no additional Federal action conditions, the project area would undergo various changes. Land loss resulting from subsidence and erosion would effectively change or reduce vegetative types along with their associated wildlife habitats. Cultural resources within the levee system would be more vulnerable to hurricane-related flood damage. Archeological sites in the marshes would continue to be adversely affected. Demand for recreational resources would continue to increase. Should the project not be completed, land-use densities would probably increase in the more protected areas of the project and growth would be stimulated in adjacent areas.

## 5.2. SIGNIFICANT RESOURCES

### 5.2.1. GENERAL

A resource is considered to be significant if it is identified in the laws, regulations, guidelines, or other institutional standards of national, regional, and local public agencies; it is specifically identified as a concern by local public interests; or it is judged by the responsible Federal agency to be of sufficient importance to be designated as significant (see Table 5.1). This section discusses each significant resource previously listed in Table 4.3. Appendix C-XIII describes the land-use methodology used in calculating the future with no additional Federal action acreage discussed below.

### 5.2.2. CYPRESS-TUPELO SWAMP

This habitat is typically found at slightly lower elevations than the bottomland hardwoods, and is located primarily in St. Charles Parish. The common vegetation in the wooded swamps includes baldcypress, tupelogum, pumpkin ash, red maple, swamp privet, water hyacinth, and duckweed. This habitat is of moderate value to both wildlife and fish. Fish and crawfish spawn in the swamps and utilize them as a nursery. A total of 181,608 acres of cypress-tupelo swamp occurs in the entire project area, while only 213 acres are in the area of potential construction impact. Under the future with no additional Federal action condition, drainage and subsequent development would reduce this habitat by an estimated 157 acres in the area of potential construction impact. Projections of future gains and losses in habitat were calculated by projecting into the future the actual habitat changes



## 5-11 • LEARNING RESOURCES

RESOURCE	ECOLOGICAL ATTRIBUTES	CULTURAL ATTRIBUTES	ESTHETIC ATTRIBUTES	INTERNATIONAL RECOGNITION	TECHNICAL RECOGNITION	PUBLIC AWARENESS	ENVIRONMENTAL QUALITY TO BE PROTECTED	REASON FOR DESIGNATION
WATERWAYS	Variable habitat for fish and wildlife, especially nesting birds and waterfowl. Many areas are for fish.	Supports the traditional extractive economy of the Penobscot River basin. Also protects archaeological and historical sites located within these areas.	Typical Louisiana river-very includes non-sedimentary systems.	General Zoning Act of 1972, La. State Dept. Local Governmental Resources Act of 1978, EO 11906, EO 11907, EO 11908, EO 11909, EO 11910, EO 11911, EO 11912, EO 11913, EO 11914, EO 11915, EO 11916, EO 11917, EO 11918, EO 11919, EO 11920, EO 11921, EO 11922, EO 11923, EO 11924, EO 11925, EO 11926, EO 11927, EO 11928, EO 11929, EO 11930, EO 11931, EO 11932, EO 11933, EO 11934, EO 11935, EO 11936, EO 11937, EO 11938, EO 11939, EO 11940, EO 11941, EO 11942, EO 11943, EO 11944, EO 11945, EO 11946, EO 11947, EO 11948, EO 11949, EO 11950, EO 11951, EO 11952, EO 11953, EO 11954, EO 11955, EO 11956, EO 11957, EO 11958, EO 11959, EO 11960, EO 11961, EO 11962, EO 11963, EO 11964, EO 11965, EO 11966, EO 11967, EO 11968, EO 11969, EO 11970, EO 11971, EO 11972, EO 11973, EO 11974, EO 11975, EO 11976, EO 11977, EO 11978, EO 11979, EO 11980, EO 11981, EO 11982, EO 11983, EO 11984, EO 11985, EO 11986, EO 11987, EO 11988, EO 11989, EO 11990, EO 11991, EO 11992, EO 11993, EO 11994, EO 11995, EO 11996, EO 11997, EO 11998, EO 11999, EO 12000, EO 12001, EO 12002, EO 12003, EO 12004, EO 12005, EO 12006, EO 12007, EO 12008, EO 12009, EO 12010, EO 12011, EO 12012, EO 12013, EO 12014, EO 12015, EO 12016, EO 12017, EO 12018, EO 12019, EO 12020, EO 12021, EO 12022, EO 12023, EO 12024, EO 12025, EO 12026, EO 12027, EO 12028, EO 12029, EO 12030, EO 12031, EO 12032, EO 12033, EO 12034, EO 12035, EO 12036, EO 12037, EO 12038, EO 12039, EO 12040, EO 12041, EO 12042, EO 12043, EO 12044, EO 12045, EO 12046, EO 12047, EO 12048, EO 12049, EO 12050, EO 12051, EO 12052, EO 12053, EO 12054, EO 12055, EO 12056, EO 12057, EO 12058, EO 12059, EO 12060, EO 12061, EO 12062, EO 12063, EO 12064, EO 12065, EO 12066, EO 12067, EO 12068, EO 12069, EO 12070, EO 12071, EO 12072, EO 12073, EO 12074, EO 12075, EO 12076, EO 12077, EO 12078, EO 12079, EO 12080, EO 12081, EO 12082, EO 12083, EO 12084, EO 12085, EO 12086, EO 12087, EO 12088, EO 12089, EO 12090, EO 12091, EO 12092, EO 12093, EO 12094, EO 12095, EO 12096, EO 12097, EO 12098, EO 12099, EO 12100, EO 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that occurred in the 1956-1978 period. It was assumed that the 1956-1978 change rates would remain constant for the project life. These rates were applied to the area of potential construction impact to determine the loss therein. See Appendix C, Section XIII, for more details. All these assumptions are speculative at best, but do allow comparison of impacts. Hurricane flooding will increase salinities in the swamps to a point that impacts from slight damage to mortality could occur depending on range of salinity and duration of flooding.

#### 5.2.3. **BOTTOMLAND HARDWOODS**

The bottomland hardwoods are located on the higher, less frequently flooded areas generally found on the natural levees. Common vegetation includes black willow, bitter pecan, hackberry, American elm, Drummond red maple, sycamore, cottonwood, water oak, and Nuttall oak. This habitat is one of the most productive for game animals, and is equally important for numerous nongame birds. Bottomland hardwoods are being lost at a steadily increasing rate, thus reducing the recreational opportunities this habitat provides. A total of 29,082 acres of bottomland hardwood forest occurs in the project area, of which approximately 41 acres are in the area of potential construction impact. Under the future with no additional Federal action condition, bottomland hardwoods would be reduced by an estimated 38 acres in the area of potential construction impact, primarily as a result of urban development. Based on the expected limits of hurricane induced overflow (Plate 2), there would be a substantial portion of bottomland hardwood inundated north and west of Lakes Pontchartrain and Maurepas. Depending on the salinity of floodwaters and duration of flooding, these habitats could sustain significant damage or at least reduction in growth. Aside from these impacts, the area would be isolated from most wildlife uses until floodwaters have subsided.

#### 5.2.4. **MARSH**

5.2.4.1. The marshes of the study area are classified according to the salinity regime and vegetation. Fresh-intermediate marsh has salinity ranging from 0 to 6.7 parts per thousand (ppt). Brackish-saline marsh has salinity ranging from 8.1 to 15.9 ppt. For the purposes of this study, marsh types are combined because the habitat values of these marsh types are similar in the project area.

5.2.4.2. The predominant vegetation in the fresh-intermediate marshes is bulitongue, deerpea, maidencane, and wiregrass. This fresh-intermediate marsh type covers approximately 64,469 acres in the project area. None of this type of marsh exists in the area of potential construction impact.

5.2.4.3. The most common vegetation associated with the brackish-saline marsh type is wiregrass, oystergrass, blackrush, saltwort, leafy three-square, and saltgrasses. A total of 260,377 acres of brackish-saline

marsh occurs in the study area while approximately 2,417 acres are located in the area of potential construction impact.

5.2.4.4. These marshes provide habitats for fish and wildlife, act as storm buffers between the Gulf of Mexico and developed areas of the coastal zone, have the capacity to absorb water pollutants, and provide nutrients and detritus to the productive inland coastal waters.

5.2.4.5. The fresher marsh types function as valuable habitat for waterfowl, furbearers, and the American alligator. Migratory waterfowl heavily utilize the more vegetatively diverse fresher marshes for food, cover, and nesting. The higher salinity marshes provide spawning, feeding, and nursery areas for many commercial and sport fish and shellfish species. Most of the fishery (offshore as well as inshore) is linked to these marshes at some point through dependency on the food base or spawning habitat. In general, the brackish-saline marshes surrounding Lake Pontchartrain exhibit higher biomass and lower species diversity than do the fresh-intermediate marshes (Stone et al., 1980). Nutrient levels are generally higher in the marshes of St. Charles Parish and the impounded marsh of New Orleans East than in other marsh areas surrounding Lake Pontchartrain (Stone et al., 1980). Under the future with no additional Federal action condition, brackish-saline marsh in the area of potential construction impact would be reduced by an estimated 1,560 acres through subsidence, erosion, urban development, and oil exploration activities. Of this lost marsh, approximately 50 percent would become scrub shrub; 33 percent, lake bottoms; 8 percent, bayou/canal; and 9 percent, developed. It is possible that continued subsidence and erosion could cause a higher percentage of the marsh to become aquatic habitat and less to convert to scrub shrub than indicated above. Hurricane flooding could produce either beneficial or detrimental effects on marshes depending on marsh type and duration and salinity of flood waters. It could be expected that moderately saline water (18 ppt) flooding a fresh marsh for a week could probably significantly impact the marsh. The marshes most likely to be affected by an SPH storm surge would be the fresh marshes around the western shore of Lake Pontchartrain and Lake Maurepas.

#### 5.2.5. LAKE PONTCHARTRAIN AND ADJACENT WATERS

5.2.5.1. Many saline, brackish, and freshwater bodies of various sizes, depths, and morphology are located within the project area. These include lakes, ponds, canals, and bayous. All are warm, shallow, turbid systems, normally high in nutrients. The major open-water bodies within the project area are Lakes Pontchartrain, Borgne, and Maurepas, which comprise 1,526,807 acres of lake bottom habitat. However, only 1,012 of these acres are located in the area of potential construction impact. The remainder of the water bodies are bayous and man-made canals which are interspersed within the adjacent marshes and have salinities which correspond to the salinities associated with these marshes. Approximately 21,470 acres of these water bodies occur in the study area and 870 acres are in the area of potential construction impact.

5.2.5.2. Lake Pontchartrain is a shallow saucer-shaped estuary which covers approximately 640 square miles and has a natural maximum depth of 15 feet. Depths of up to 90 feet occur in localized areas as a result of man's activities. Dredging to depths greater than 15 feet for Federal levee construction has occurred as follows:

<u>Date</u>	<u>Location</u>	<u>Area (acres)</u>
1950	Jefferson Parish	67
1956	Jefferson Parish	230
1974	New Orleans East Lakefront	48

Extensive quantities of borrow have been taken from the lake in the New Orleans Lakefront area for land reclamation in the 1930's and for the recent New Orleans Airport runway extension. The acreage of lake bottom affected is not known, and recent surveys indicate that the borrow holes have almost completely filled in.

5.2.5.3. Salinity within the lake increases from west to east, varying from less than 0.5 ppt to nearly 18 ppt near Lake Borgne. The majority of the freshwater input is from the Tickfaw, Amite-Comite, and Tangipahoa Rivers located in the western portion. Lake temperatures closely follow the air temperature throughout the year (Stone et al., 1980). Circulation and tidal influences are wind-induced.

5.2.5.4. The principal submerged aquatics in these lakes consist of wild celery, spikerush, widgeongrass, water primrose, and naiad. These plants are important as a food source for wintering waterfowl. Lake Pontchartrain has approximately 2,000 areas of grass bed dominated by wild celery and widgeon grass. The lake, with its associated grass beds, marshes, food base, and access to the open gulf, provides a crucial link in sustaining the coastal fishery of Louisiana. Important commercial and recreational species dependent on the Pontchartrain complex include shrimp, crab, redfish, spotted sea trout, menhaden, and the brackish water clam. Nutrient transport through the tidal passes assists in providing the input needed to sustain the food base in the deeper, nearshore gulf waters.

5.2.5.5. In addition to being an important natural resource, the lake is a significant recreational resource. It provides flat-water recreation such as swimming, water skiing, pleasure boating, sailing, and fishing for the New Orleans metropolitan area, as well as for many other communities adjacent to the lake.

5.2.5.6. Lake Pontchartrain is an important source of clam shells which are used mainly in road construction. Shell dredging has been, and is still, permitted over approximately one-half of the 403,000-acre area of the lake. Dredging leaves a strip approximately 2 feet deep and 4 to 5 feet wide. This hole generally fills with sediments having a low bulk density. It is possible that shell dredging releases heavy metals to

the water column. It is estimated that dredging could affect approximately 54,000 acres of the lake annually.

5.2.5.7. The future with no additional Federal action condition would result in an estimated 516-acre increase in lake bottom habitat in the area of potential construction impact due to marsh subsidence and erosion. Additionally, an estimated 124-acre increase in the bayou/canal habitat in the area of potential construction impact would occur as a result of oil exploration activity.

5.2.5.8. Major surface waters which might be impacted by construction include Lake Pontchartrain, the Inner Harbor Navigation Canal (IHNC), Mississippi River-Gulf Outlet, and the Gulf Intracoastal Waterway. The significance of these water bodies is generally reflected by the designated uses assigned to them by the Louisiana Department of Natural Resources (LDNR). Designated use classifications, based on present and anticipated future uses, are shown in Table 5.2. Water quality in Lake Pontchartrain, the MR-GO, GIWW, and IHNC must be protected because of high actual and potential recreational use, and the important role of these waters in fish and shellfish productivity. General criteria (desirable attributes) and numerical standards (enforceable limits) applicable to the ambient quality of state waters have been published by the Water Pollution Control Division of the LDNR. The general criteria and numerical standards are designed to protect surface waters from degradation resulting from nonquality-dependent beneficial uses. Numerical standards applicable to the ambient quality of water bodies potentially affected by the project are shown in Table 5.3.

TABLE 5.2

DESIGNATED USES FOR SURFACE WATERS  
POTENTIALLY IMPACTED BY THE PROJECT

SEGMENT DESCRIPTION	WATER USES		
	A Primary Contact Recreation	B Secondary Contact Recreation	C Propagation of Fish and Wildlife
MR-GO/IHNC (Tidal)		X	X
IHNC (Tidal)		X	X
Lake Pontchartrain (Tidal)	X	X	X

SOURCE: Louisiana Stream Control Commission (1977)

TABLE EIS-5.3

## NUMERICAL WATER QUALITY CRITERIA

	Chloride mg/l	Sulfate mg/l	DO mg/l	pH Range S.U.	Bacterial Standard <sup>1/</sup>	Temperature °C	Total Dissolved Solids mg/l
Lake Pontchartrain-West of Highway 11	-	-	4.0	6.5-9.0	#1	35	-
Lake Pontchartrain-East of Highway 11	-	-	4.0	6.5-9.0	#4	35	-
MR-GO	-	-	4.0	6.5-9.0	#4	35	-
IHNC/GIWW	-	-	4.0	6.5-9.0	#1	35	-

<sup>1/</sup> #1 = Primary Contact Recreation - Based on a minimum of five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100 ml nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml.

#4 = Shellfish Propagation - The monthly total coliform median most probably number shall not exceed 70/100 ml and not more than 10 percent of the samples ordinarily exceed a MPN of 230/100 ml.

SOURCE: Louisiana Stream Control Commission (1977)

5.2.5.9. Occasional water quality problems in the project area have been dramatically signalled by fish kills, and by measurements of high concentrations of heavy metals, pesticides, and fecal coliform bacteria. Indications of acute environmental perturbations such as the reported existence of "dead zones" in Lake Pontchartrain have been noted. Inferences of potential water quality problems also have arisen from reports of toxic chemical spills and detection of toxic substances in some project area waters.

5.2.5.10. Beneficial uses of project area water bodies such as navigation, shell dredging, and oil and gas exploration and production often have produced side effects which clash with quality-dependent uses. Recently (1982), notable conflicting beneficial uses, waste and storm water disposal versus primary contact recreation, were brought to public attention through publication of a bacteriological survey of Lake Pontchartrain. This survey prompted state health officials to recommend that primary contact recreational activities not be conducted within 1/4-mile of the lake's southern shoreline, west of US Highway 11. The high bacteria levels noted in the lake were attributed by state health officials to discharges of storm and municipal wastewater. In spite of this and other known exceptions, the quality of the project area waters has generally remained adequate to sustain quality-dependent uses while supporting nonquality-dependent uses as well. Additional discussions of ambient surface water quality are contained in Appendix C, Sections VI through IX.

5.2.5.11. Groundwaters in the project area are a significant source of good quality water for some industries, municipalities, and individual consumers. Groundwaters will not be impacted by the project and are not addressed in this study.

5.2.5.12. Under future with no additional Federal action conditions, significant improvement in the overall quality of project area surface waters is not anticipated. Some reduction in the concentration of conventional pollutants (COD, BOD, suspended and dissolved solids, nitrogen, and phosphorus) might result from increased efficiencies of upgraded and new wastewater treatment facilities. However, industrialization of the area will continue, and total mass loading of conventional and nonconventional pollutants to area surface waters is likely to increase. Significant efforts toward treatment of urban and industrial stormwater discharges are unlikely to be initiated in the foreseeable future. Transport of hazardous materials and the attendant inevitable occasional toxic material spills will continue.

5.2.5.13. Hurricane tides would elevate salinities of inland waters and could result in depressed dissolved oxygen levels due to the increased nutrient loads and suspended solids in the incoming waters. Prolonged ponding of storm water and the associated street drainage could result in further deterioration of water quality due to increased levels of coliforms and other bacteria.

#### 5.2.6. FISHERIES

5.2.6.1. Lake Pontchartrain, with its varying habitats and adjacent marshes, is used at various times by numerous species of fish and crustaceans. At least part of this diversity is due to the availability of submerged vegetation and varying ranges of salinity available in the lake. Habitats consist of the open lake, grass beds, and beach areas. The fish fauna is comprised of 85 known species, 55 of which are lake species, 22 marsh species, and eight species resident to both areas (Stone et al., 1980). Four species dominate the fish population: anchovy, croaker, menhaden, and silverside. Eight of the most abundant species are primarily marsh dwellers: sheepshead minnow, rainwater killifish, sailfin molly, mosquitofish, spotted sunfish, bluegill, redear sunfish, and least killifish. The fish populations within the lake are very seasonal, with the largest number of fish occurring during spring/summer with a peak in July, followed by gradual decreases during late summer and fall. Anchovies do not follow the seasonal patterns and are found within the lake and surrounding marsh throughout the year. Young croaker heavily utilize the open water of the lake and avoid vegetated areas. Juvenile menhaden use inshore beach and marsh as their primary habitat; but as they reach subadult to adult size, they use the open water in the lake (Stone et al., 1980). Juvenile spot utilize the shoreline grass beds as primary habitat during summer months and move to the open water of the lake as they become adults.

5.2.6.2. The Lake Pontchartrain/Borgne estuarine complex supports a significant commercial fishery. Preliminary 1981 estimates prepared by the National Marine Fisheries Service (NMFS) show that the commercial catch from Lakes Borgne and Pontchartrain was 3,351,621 pounds with an exvessel value of \$3,271,372 (see Appendix C-III, pages 7 through 12 for discussion of historical data). This represents 16 percent of the total value of the 1981 commercial fishery for the State of Louisiana. In Lake Pontchartrain, blue crab dominates the commercial fishery and comprises two-thirds of the value and four-fifths of the total volume (Thompson and Stone, et al., 1980). Brown and white shrimp, catfish, and seatrout account for about 33 percent of the total catch value. Estimates of shrimp catches are conservative because they do not reflect the harvest of the recreational shrimper. A moderate amount of recreational crabbing is also done in the lake which is not noted in the above figures. It has been estimated by the USFWS that the shrimp and crab poundages reported (400,000 pounds and 2,700,000 pounds, respectively) should be increased by a factor of two to account for this recreational fishing. While no commercial fishing for menhaden is allowed in Lake Pontchartrain, the lake is vital as nursery and feeding habitat for this species. Based on personal communication (Chapoton, 1982) with NMFS, approximately 63,000 metric tons of menhaden were attributable to the Lakes Borgne-Pontchartrain estuarine complex during a 5-year period (1977-1981). Of this amount, approximately 47,250 metric tons (\$4,167,400) were attributable to Lake Pontchartrain.



5.2.6.3. Sportfishing in Lake Pontchartrain is very important. The lake is utilized by the densely populated areas of Metropolitan New Orleans, Baton Rouge, and the adjacent north shore communities of Slidell, Covington, and Mandeville and provides an estimated 227 man-days of sportfishing (U. S. Fish and Wildlife Service, 1962). Most of the sport fish are euryhaline species and are dependent on the entire estuarine complex to complete their life cycle. This explains the transient, migratory behavior of most sport species in the lake. Because of this behavior, some sportfishing occurs in the lake throughout the year. The most sought after species include seatrout, croaker, black drum, red drum, largemouth bass, various sunfish, sheepshead, southern flounder and crevalle fish. The sportfish standing crop is estimated to be 11,084,393 pounds. Approximately 83 pounds/acre are estimated for areas less than 8 feet in depth (approximately 76,066 acres) and 14.57 pounds/acre for areas over 8 feet deep (approximately 318,061 acres) (Rogillio and Brassette, 1977). Fifty-seven percent of the sport fish standing crop is attributable to water less than 8 feet in depth.

5.2.6.4. The fishes of Lake Pontchartrain feed primarily within a benthic or planktonic-nektonic food web nourished by numerous detritivores. Mullet and menhaden feed directly on detritus. The phytoplankton population of Lake Pontchartrain is seasonal in its species composition. Variations in habitat preferences also occur. Some species prefer marsh habitat, while others occur primarily or solely in the lake (Stone et al., 1980).

5.2.6.5. Lake Pontchartrain has a substantial resident population of nonmotile bottom-dwelling organisms. Bahr et al. (1980) found 24 macrobenthic species in Lake Pontchartrain. Of these, the six dominant species were chironomids which comprised 93 percent of the total abundance. The various groups of macrobenthic organisms were found in different habitats due to salinity regime and sediment characteristics influenced by urban runoff and dredging activities. While oysters are present in Lake Pontchartrain, they presently are not harvestable due to excessive fecal coliform counts found in the oyster producing areas of the lake. The brackish water clam, (Rangia cuneata), is the most economically important benthic species in Lake Pontchartrain, and the oyster is most important in Lake Borgne. The larger size Rangia populations were found to be restricted to the shallow waters along the north shore, with smaller individuals in the open lake. Under future with no additional Federal action conditions, an approximate 58,736,965-pound reduction in fisheries is estimated in the Lakes Pontchartrain/Borgne area based on pounds per acre from Appendix C, Section 3, and acres from Table 6.3. This would be a result of marsh loss.

5.2.6.6. Since most of the fish populations in Lake Pontchartrain are euryhaline, any hurricane-induced salinity changes should not significantly affect them. However, since the limit of flooding (Plate 2)

would reach a large portion of the freshwater fish community in Lake Maurepas and the surrounding wetlands, much of this freshwater fishery could potentially be adversely affected by the higher salinity floodwaters. Some of the less salt tolerant species could be killed by the incoming floodwaters. Further impacts would be associated with the destruction of spawning habitat, loss of shoreline and marsh vegetation as well as displacement of various species. Severe changes in salinities could alter the production of certain benthos such as the Rangia clam utilized as a food base in the lake. For some species, the flooded marshes would expand spawning habitat temporarily, depending on time and duration of flooding.

#### 5.2.7. WILDLIFE

5.2.7.1. Because of extensive marshes and moderate amount of forested habitat, the project area supports a variety of wildlife. There are few deer in the area; however, small game such as squirrels and rabbits are common. Furbearers occur in fairly large numbers in the marshes, especially muskrat, nutria, and raccoons. Nongame animals such as rats and mice are also common.

5.2.7.2. Migratory waterfowl are present in large numbers in the area. Large concentrations of dabbling ducks such as the mallard, blue- and green-winged teal, gadwall, American widgeon, and pintail are often common in the marshes of New Orleans East in the winter. An estimated 500,000 lesser scaup winter on Lakes Pontchartrain and Maurepas. The mottled duck nests in the marshes and the wood duck in wooded swamps. Other common game birds in the area include rails, coots, and common snipes. Wading birds such as great, snowy, and cattle egrets; great blue, green, and Louisiana herons; and white-faced and white ibis are abundant in the wooded swamps and marshes. Seabirds present include the white pelican; ring-billed, herring and laughing gulls; Forrester's, common, and least terns; and the black skimmer. Numerous active seabird and wading bird nesting concentrations occur in the project area. Shorebirds such as willets, killdeers, and greater and lesser yellowlegs are common. Several species of raptors present include the marsh hawk, red-tailed hawk, Mississippi kite, and turkey vulture. Song birds such as cardinals, wrens, blackbirds, sparrows, warblers, and mockingbirds are present in various habitats. Blue jays and various woodpeckers also occur.

5.2.7.3. Amphibians are generally restricted to freshwater habitats in the project area; frogs, toads, and salamanders are present. Reptiles common in the marshes and swamps include the American alligator, turtles, anoles, water snakes, and the cottonmouth.

5.2.7.4. Numerous terrestrial and aquatic insects are present in the project area. Some, such as mosquitoes, gnats, and deer flies, are nuisances and/or carriers of disease.

5.2.7.5. Under future with no additional Federal action conditions, there would be a significant decline in wildlife species and abundance throughout the project area. This would result from natural and man-induced deterioration of marshes, and clearing of bottomland hardwoods and wooded swamps for residential, industrial, and agricultural purposes. Hurricane-induced flooding could not only drown animals but isolate their food sources. In addition, increased salinities could damage cypress trees and thereby adversely affect wildlife.

#### 5.2.8. **ENDANGERED SPECIES**

The only endangered species that potentially could be impacted would be the bald eagle. There are two nests in the project area, one at White Kitchen in St. Tammany Parish and another in St. Charles Parish (see Plate 12). For more information, see the Endangered Species Assessment in Appendix C, Section I. Under future with no additional Federal action conditions, the cypress-tupelo assemblages that could possibly be utilized as nesting habitat in St. Charles Parish could undergo a transition to urban development. This would reduce possible nesting areas. The cypress-tupelo habitat near the eagle nest in St. Tammany Parish would remain because the nest is near the Pearl River Wildlife Management Area. Hurricane-induced flooding could result in some vegetation changes that may limit habitat of prey species.

#### 5.2.9. **BLUE LIST**

5.2.9.1. This is a listing of birds that are not yet considered threatened by the US Fish and Wildlife Service, but that are showing a noncyclical decline in numbers or a significant decrease in range. This is basically an "early warning system." Table 5.4 lists such birds, describes their numbers in the project area, and indicates the habitats each utilizes.

5.2.9.2. Under future with no additional Federal action conditions, there would be a decline in abundance of most of these species as marsh and forested habitat declines.

#### 5.2.10. **RECREATION**

5.2.10.1. The south shoreline of Lake Pontchartrain offers many open parkland areas and numerous associated public recreational developments which are used extensively by residents of the New Orleans metropolitan area. The types of existing recreational facilities along the linear configuration of the lakefront area provide for a variety of urban day-use activities.

TABLE 5.4

## AUDUBON SOCIETY BLUE LIST (1982)

BIRD	OCCURRENCE <sup>1/</sup>		HABITAT <sup>2/</sup>
	Study Area	State	
Western Grebe	e	e	6
American Bittern	c	c	5
Sharp-shinned Hawk	c	c	1,2
Red-shouldered Hawk	c	c	1,2,3,4,5
Swainson's Hawk	u	e	5
Marsh Hawk	c	c	4,5
King Rail	c	c	5
Piping Plover	c	r	8,10
Snowy Plover	r	r	8
Long-billed Curlew	r	r	4,5,9,10
Upland Sandpiper	c	c	4
Least Tern	c	c	6,8,9
Black Tern	c	c	5,6,8,9
Short-eared Owl	u	r	5
Ruby-throated Hummingbird	c	c	1,2,3
Hairy Woodpecker	c	c	1,2
Willow Flycatcher	u	r	3,4
Bewick's Wren	r	r	3,4
Eastern Bluebird	r	r	1
Loggerhead Shrike	c	c	4
Bell's Vireo	u	r	2,3
Golden-winged Warbler	r	r	1,2,3
Yellow Warbler	r	c	1,2,3,9
Dickcissel	c	c	4
Grasshopper Sparrow	r	r	3,4
Bachman's Sparrow	r	c	4

<sup>1/</sup>c = relatively common      r = rare      e = extremely rare  
u = unknown

<sup>2/</sup>1 = Upland forest      6 = Bays or ponds  
2 = Bottomland hardwood      7 = Buildings  
3 = Brush      8 = Beaches  
4 = Fields      9 = Islands  
5 = Marsh      10 = Mudflats

5.2.10.2. In general, there are three categories of recreational use areas along the urbanized portions of Lake Pontchartrain: (1) open maintained areas which provide for unstructured outdoor games and passive recreational use; (2) developed facilities for individual and group activities; and (3) developed facilities for water access. Unurbanized areas, such as the St. Charles Parish marsh and areas in the vicinity of Chef Menteur Pass and The Rigolets, attract sport hunters and sport fisherman.

5.2.10.3. There are five public boat launch sites, two fishing piers, a marina, a yacht harbor, and two potential swimming areas located along the lakefront. Swimmers also may use other parts of the lakefront at their own discretion. Pollution caused by storm water runoff and leakage from sewer lines often forces the closure of swimming areas.

5.2.10.4. The Orleans Parish lakefront area contains three children's playgrounds. These areas include: swings, see-saws, slides, and merry-go-rounds; four group picnic shelters; and restroom facilities. Additional park furniture includes portable picnic tables, portable trash cans, and drinking fountains. Public telephones and fountains, including the Mardi Gras Fountain, are also located along Lakefront Drive. At times, existing restroom facilities do not adequately serve the number of people using the lakefront. Portable toilets have been placed along the lakefront by the Levee Board to provide additional sanitation.

5.2.10.5. Many private recreational and fishing camps are located in eastern Orleans Parish. Most of these structures serve as recreational second homes for residents living in the metropolitan areas of New Orleans.

5.2.10.6. In Jefferson Parish, the lakeshore recreational development is more clustered than that of Orleans Parish. Jefferson Parish contains several major recreational developments along its linear lakefront park, which extends along the entire parish. The major feature of the park is a 10.5-mile National Recreation Trail which provides an area for walking, jogging, biking, and horseback riding. Bank and wade fishing are common activities along the linear park, and several areas are used as bird sanctuaries. Water access facilities have been developed in three locations. Two of these locations, Williams and Bonnabel, have undergone extensive facility expansions with each currently providing eight-lane boat launches with courtesy docks, fishing piers, slack-water harbor areas, sailboat launches and moorings, rest areas, parking areas, sanitation facilities and graded open areas with plans for future developments. Walter's Park, an informal park of unusual character, is located at one point along the linear system. This park was constructed over a period of many years by a local resident. It is primarily used as a resting area for those using the National Recreation Trail.

5.2.10.7. A significant fishing and waterfowl hunting resource exists along the Lake Pontchartrain portion of St. Charles Parish. This area is primarily a brackish marsh/cypress-tupelo swamp environment used by private clubs for waterfowl hunting, and, to some degree, for deer and alligator hunting. Fishing also is popular in this area. Numerous canals bisecting the area provide excellent access for fisherman and hunters. Within the study area, several scattered primitive hunting and fishing camps have been erected in prime user locations. Recreational fishing currently satisfies 19,122 man-days valued at \$74,576 and sport hunting satisfies 2,039 man-days valued at \$18,991. Consult the US Fish and Wildlife Coordination Act Report, Volume II, Section XIV, Table 8.

5.2.10.8. Recreational usage along the south shore of the lake during the summer season is substantial due to the lake's ease of access to large adjacent populations. There are no substitutes for lakefront water-oriented outdoor recreation in the area. The Lake Pontchartrain shoreline is unique in itself; and the activities which are intensely pursued in its vicinity are indicative of the current demand for water-oriented outdoor recreation in highly urbanized areas.

5.2.10.9. Recreational use along the south shore of the Lake Pontchartrain area would not be impaired under future with no additional Federal action conditions. Existing recreational facilities would not be affected; demands on these facilities would continue to increase as the population of the metropolitan area grows. Hunting would decrease due to habitat loss. The Jefferson Parish Department of Recreation has prepared a Master Plan for recreational development along the shoreline, which contains proposals for future additional recreational areas at the Bucktown lakeshore and Causeway Boulevard lakeshore, as well as for increased development of the National Recreation Trail. These proposals, if developed, would assist in filling increased recreational demands. As the water quality of the lake deteriorates, the associated water-based recreational resources would be reduced.

5.2.10.10. There are three sites in the project area designated as either a Wildlife Management Area (WMA) or refuge. Manchac WMA, located in the northeastern corner of St. John the Baptist Parish, is an 8,325-acre area owned and operated by the Louisiana Department of Wildlife and Fisheries (LDWF). Habitat types include intermediate marsh and cypress tupelo swamp. This area is open to the public for deer, small game, and waterfowl hunting, but receives its highest usage from waterfowl hunters. The 13,659-acre Joyce WMA is located in Tangipahoa Parish to the north of the Manchac WMA. It is owned and operated by the LDWF and is heavily utilized by waterfowl hunters. The St. Tammany Refuge is in St. Tammany Parish and consists of 1,300 acres of brackish marsh habitat; it is also managed by the LDWF. No hunting is allowed on this refuge. No Federal refuges are located in the project area; however, a large tract of marsh and wooded swamp in St. Charles Parish has been considered for inclusion into the National Wildlife Refuge System. Under future with no additional Federal action conditions, the

quality of these areas would decrease as a result of habitat degradation. The Manchac State Wildlife Management Area would encounter at least temporary flooding from hurricane winds, and, depending on salinity and duration of flood waters, irreversible habitat and vegetative changes could occur.

#### 5.2.11. NATIONAL REGISTER OF HISTORIC PLACES

5.2.11.1. The National Register of Historic Places, as published in the "Federal Register" through 1 May 1984, was reviewed for sites within the project area. Located within the present and proposed levee system protecting Orleans, St. Bernard, Jefferson, and St. Charles Parishes are 104 historic properties and eight historic districts listed in the National Register of Historic Places. These properties include Big Oak and Little Oak Islands archeological sites, the Chalmette National Historical Park, Destrehan Plantation, Camp Parapet Powder Magazine, and the many historic buildings and districts in New Orleans. Of these historic properties and districts, 20 are further recognized by being designated as National Historic Landmarks.

5.2.11.2. The area outside the levee system also contains many significant cultural resources listed in the National Register. Forts Pike and Macomb are massive brick fortifications built in the early 1800's to protect the two natural passes into Lake Pontchartrain--The Rigolets and Chef Menteur Pass. The historic Town of Mandeville, including three structures listed in the Register and a proposed historic district facing the lake, is located on the north shore of the lake. Three lighthouses located on the lake's shoreline (Pass Manchac, New Canal, and Tchefuncte River Range Rear) have recently been listed in the National Register. Also listed in the Register are two archeological sites located in the marshes and swamps which constitute the lake's shoreline. The Tchefuncte type site (16ST1) is composed of two Rangia shell middens in the marsh east of Mandeville. The Bayou Jasmine site (16SJB2), a deeply buried cultural deposit dating to the Poverty Point period, is located in St. John the Baptist Parish between Lakes Maurepas and Pontchartrain.

5.2.11.3. Cultural resources studies, designed to identify National Register and Register-eligible properties in the project area, have been completed for the majority of the project's impact area. These surveys have identified two National Register properties in the potential impact area of the project. These two properties are Forts Pike and Macomb located immediately adjacent to the Rigolets and Chef Menteur Complexes, respectively, of the Barrier Plan. Potential visual impacts have not yet been fully addressed. In addition, a remote sensing survey of the offshore borrow areas in Lake Pontchartrain located numerous magnetic anomalies which could represent significant historic shipwrecks.

5.2.11.4. Cultural resource studies have not yet been completed for the Mandeville seawall, the St. Charles Parish levee, and the New Orleans

Outfall Canals alternative. No known properties currently listed in, or determined eligible for, the National Register are located in the possible impact areas of these project features.

5.2.11.5. Under future with no additional Federal action conditions, the National Register properties and districts located within and outside of the present and proposed levee system would be vulnerable to hurricane-related flood damage. Other historic properties not presently listed in the National Register would be subject to the same effects. The Mandeville seawall would be subject to collapse during hurricane or other storm-generated wave action. Such a collapse would lead to erosion and flood damages to the historic Town of Mandeville. In particular, the three National Register properties located on Lakeshore Drive and the proposed National Register district would be adversely affected by failure of the seawall. The many archeological sites located throughout the marshes and swamps of the project area will continue to be adversely affected. This results from urban growth, industrialization, and related development which will continue to expand into presently undeveloped low-lying areas. The destructive natural forces of marsh subsidence and shoreline erosion will continue also.

### 5.3. SECTION 122 ITEMS

The following are those Section 122 items deemed to be significantly impacted by the project. For a discussion of all Section 122 items, see Appendix B, Exhibit 2, Socioeconomic Assessment.

#### 5.3.1. MINERALS

The mineral resources of the area consist primarily of petroleum which represented 96 percent of mineral production in 1975. There are also several active gas wells located in Lakes Pontchartrain and Borgne. Several submarine gas pipelines are located in the various levee reaches. These pipelines are primarily used to transport gas from well sites to users. Clay deposits are located on the north shore of Lake Pontchartrain at Howze Beach. Under the future with no additional Federal action conditions, the extraction of oil, gas, and minerals would continue, but eventually would decrease in importance as resources dwindle.

#### 5.3.2. AIR QUALITY

Air quality is relatively good compared to other urban areas. Of the six pollutants for which the US Environmental Protection Agency has set National Ambient Air Quality Standards, New Orleans violates only one, ozone (Office of Analysis and Planning, City of New Orleans, 1981). The Clean Air Act also provides for maintaining or improving existing air quality in areas already meeting current standards. For this purpose, various classes of areas have been designated with certain allowable levels of emissions. Under this classification, New Orleans



areas would be in the Class II category, which allows moderate emissions for some economic growth. Under future with no additional Federal action conditions, air quality in the area would change to some degree due to continual development of residential, commercial, and light industrial development.

#### **5.3.3. NOISE**

The project area ranges from urban to isolated, sparsely populated out-lying coastal communities. The urban portion of the project is subjected to traffic noise and ongoing construction works. The rural, isolated areas are relatively noise free. However, noise caused by the activities of the oil and gas industry, shipping, and sport and commercial fishing occurs throughout the area. Under future with no additional Federal action conditions, the noise levels would increase due to continuing urban and industrial development.

#### **5.3.4. FLOOD CONTROL**

Historically, land development in the New Orleans area has involved the construction of levees with drainage through a system of pumps. Local officials recognize these procedures as a trade-off, balancing the needs for hurricane protection and land development against reducing a certain amount of the adjacent wetland acreage which is also considered a valuable resource. Flood control programs have been involved in the development of a multiplicity of the area's water, land, mineral, and human resources. Under future with no additional Federal action conditions, some local flood protection possibly could be implemented, but probably not to the extent needed to protect developing areas.

#### **5.3.5. PROPERTY VALUES**

The value of protected property is relatively high compared to unprotected property. Under future with no additional Federal action conditions, properties without adequate protection would be of less value.

#### **5.3.6. BUSINESS AND INDUSTRIAL ACTIVITY**

The economic base of the New Orleans area is centered around transportation and related commercial activities. Port operations at New Orleans are among the world's most active. Consequently, related businesses and industries in the area are heavily dependent on port activities. Existing facilities along the riverfront have become dated by current standards. At the same time, other commercial interests, including tourism and convention activities, have been attracted to the riverfront. A number of commercial and light industrial establishments are located along the IHNC. Under future with no additional Federal action conditions, trends would be toward increasing tourist trade and commercial development, with industrial activities increasing in the Almonaster-Michoud Industrial District.

#### 5.3.7. EMPLOYMENT

Historically, over 65 percent of the people employed in the project area have been engaged in services, retail trade, manufacturing, transportation, communications and utilities, and construction. Under future with no additional Federal action conditions, employment would be expected to increase, but not as much as if the area were protected.

#### 5.3.8. HOUSING

The limited amount of protected land in the New Orleans area has resulted in relatively high density housing. As in other urban centers, low incomes in the inner city have resulted in pockets of low quality housing. Construction has grown rapidly in suburban areas. A gradual pattern of renovation is occurring in older neighborhoods. Under future with no additional Federal action conditions, protected land available for housing would be reduced, which would result in the construction of more high density housing.

#### 5.3.9. ESTHETICS

Esthetic values are high in many parts of the study area, although poorly planned urban and commercial expansion has caused a decrease in some areas. Lake Pontchartrain, the shoreline and associated parks, the marshes of St. Bernard and St. Charles Parishes, historic sites and parks all contribute to these values. Under future with no additional Federal action conditions, esthetics probably would remain similar to the present.

#### 5.3.10. COMMUNITY COHESION

Community opinion generally favors additional flood protection. Under future with no additional Federal action conditions, public opinion would continue to favor a solution to the problem of hurricane-induced flooding.

## 6. ENVIRONMENTAL EFFECTS

### 6.1. SIGNIFICANT RESOURCES

This section discusses the impacts projected to result from completion of the project by utilizing either the High Level (Plan 10) or Barrier (Plan 2) Plans. Impacts addressed in the existing EIS that have or will have occurred up to 1984 and are considered common to both plans will not be discussed in this section, but will be addressed for mitigation purposes only. (See Paragraph 4.4.2.4.) Habitat conversion (by feature) due to direct construction is shown in Table 6.1. Habitat acreages impacted by direct construction of the two plans are presented in Table 6.2. The area of potential construction impact referred to in the table is the total acres impacted by either plan. This area is then analyzed to compute future scenarios. Table 6.3 compares acres available in 1978 with acres expected to be available in 2100 for three scenarios: future with no additional Federal action, future with Barrier Plan, and future with High Level Plan. The methodology for calculating these projections is explained in Appendix C, Section XIII. These projections are rough estimates and are only of value in comparing plans. In the following paragraphs, the acres lost to direct construction will be stated. Then the net increase or decrease in habitat type will be discussed. This net change is the difference between the future with no additional Federal action and the future with the plan.

#### 6.1.1. CYPRESS-TUPELO SWAMPS

6.1.1.1. HIGH LEVEL PLAN. Levee construction would destroy 213 acres of swamp. By 2100, the net decrease in the area of potential construction impact would be 56 acres. Cypress tupelo habitat is more abundant in the study area and is generally of less value to wildlife than bottomland hardwoods. Approximately 4,000 acres of swamp in St. Charles Parish would be impounded by the levee, but culverts would maintain the existing water exchange.

6.1.1.2. BARRIER PLAN. Approximately 164 acres would be lost due to levee construction. By 2100, the net decrease in the area of potential construction impact would be 49 acres. The operation of the barrier structure could provide protection to the cypress-tupelo habitats along the northwestern shoreline of Lake Pontchartrain. With the gates of the barrier structure closed, the amount of floodwater reaching the cypress tupelo habitat would be minimized along with the adverse effects of elevated salinities.

#### 6.1.2. BOTTOMLAND HARDWOOD

6.1.2.1. HIGH LEVEL PLAN. This habitat type would not be impacted by direct construction. Thus, there would be no net loss by 2100.

TABLE 6.1

HABITAT CONVERSION DUE TO POST-1984 CONSTRUCTION BY FEATURE  
(acres)

BARRIER PLAN					
Feature	Habitat Impacted	Habitat Converted to			
		Scrub Shrub	Levee and Structure	Bayou/Canal	Lake Bottoms
Chef Menteur Area	1,943 marsh	1,681	146	116	
	28 lake bottoms	28			
	359 bayou/canal		120	239	
Rigolets Area	420 marsh	331	61	28	
	37 levee		37		
	41 bottomland hardwood		29	12	
	511 bayou/canal		238	273	
St. Charles Area	164 cypress-tupelo		164		
TOTALS	3,503	2,040	795	668	

HIGH LEVEL PLAN					
GIWW to South Point	28 marsh		28		
	36 levee		36		
New Orleans East-Back	3 lake bottoms		3		
New Orleans East-Lakefront	26 marsh		26		
	50 levee		50		
Jefferson Parish Lakefront	88 scrub shrub		88		
	408 lake bottoms		408		
	265 levee		265		
	573 lake bottoms				573
St. Charles	213 cypress-tupelo		213		
TOTALS	1,690		1,117		573

TABLE 6.2

ACRES IMPACTED IN AREAS OF POTENTIAL CONSTRUCTION IMPACT (BY HABITAT)  
IN 1978

HABITAT TYPE	BARRIER PLAN	HIGH LEVEL PLAN	AREA OF POTENTIAL <sup>1/</sup> CONSTRUCTION IMPACT
Cypress-tupelo	164	213	213
Brackish/saline marsh	2,363	54	2,417
Lake bottoms	28	984	1,012
Bayou/canal	870	0	870
Bottomland hardwoods	41	0	41
Levee	37	351	388
Scrub shrub		88	88
TOTAL	3,503	1,690	5,029

<sup>1/</sup>The area of potential construction impacts consists of the total construction right-of-way which would be either totally or partially affected by project construction.

TABLE 6.3

## FUTURE ACREAGE WITHIN AREA OF POTENTIAL CONSTRUCTION IMPACT

Habitat Type	Base Conditions (1978)	Future with no additional Fed- eral action <sup>1/</sup>	Future with High Level Plan <sup>1/</sup>	Future with Barrier Plan <sup>1/</sup>
Cypress-tupelo	213	56	0	7
Brackish/saline marsh	2,417	857	834	20
Lake bottoms	1,012	1,528	1,091	1,051
Bayou/canal	870	994	992	667
Bottomland hardwoods	41	3	3	0
Scrub shrub	88	870	706	2,160
Levee	388	641	1,295	1,017
TOTAL	5,029	4,949	4,921	4,922

<sup>1/</sup>Future is year 2100.

6.1.2.2. BARRIER PLAN. The entire 41 acres in the area of direct impact would be converted to levee or borrow. By 2100, the net decrease in the area of potential construction impact would be 4 acres.

6.1.3. MARSHES

6.1.3.1. HIGH LEVEL PLAN. Levee construction would destroy 54 acres of marsh. By 2100, there would be a net decrease of 23 acres in the area of potential construction impact. Levee construction would result in the burial of existing marsh; the higher ground elevations would preclude repopulation by marsh plants.

6.1.3.2. BARRIER PLAN. Construction of levees would destroy 2,363 acres of brackish-saline marsh. By 2100, there would be a net decrease of 837 acres in the area of potential construction impact. The majority of the marsh loss is the result of burial by dredged material associated with the barrier complexes. This material raises ground elevations and encourages succession to scrub shrub habitat. Some marsh would become levee and some would become bayou/canal.

6.1.4. LAKE PONTCHARTRAIN AND ADJACENT WATERS

6.1.4.1. HIGH LEVEL PLAN. Approximately 411 acres of lake bottom would be filled for levee construction (mostly in Jefferson Parish) and an additional 573 acres of lake bottom (0.1 percent of the total lake bottoms) off Jefferson Parish would be deepened. By 2100, there would be approximately 1,091 acres of lake bottom in the area of direct impact. This would be 437 acres less than would exist under future with no additional Federal action conditions. No bayou/canal habitat would be impacted by this plan.

6.1.4.2. Both short- and long-term water quality impacts could result from construction of the Jefferson Parish levee with hydraulic fill. Short-term impacts, primarily related to solids lost to adjacent waters, would occur during the multi-lift levee construction periods, each approximately 18 months long. Data from analyses of the proposed borrow material, and elutriates prepared from that material indicate relatively low to moderate potential for release of contaminants from dredged materials. However, localized dissolved oxygen depletion due to chemical and biochemical oxygen demands might occur. Minor modification of local water chemistry might result from the fill material discharges. Generally, sufficient mixing and dilution should be available to retard radical changes in water chemistry in the immediate discharge area. Since these levees would be built in successive lifts, it is probable that leaching of the fill material would occur between each lift. These leachates could contain contaminants along with the mineral solids which would enter Lake Pontchartrain through the runoff. Although the quality of runoff could be very poor at times, the quantities of runoff would generally be insignificant in relation to the dilution potential of the receiving waters; however, during the

placement of the first lift, erosion control measures would be implemented, and therefore, the leaching of the fill material would be moderated.

6.1.4.3. To obtain fill for Jefferson Parish Lakefront levees, dredging to depths approaching 60 feet below existing lake bottom levels would be required. Evaluation of water quality in deep borrow pits located in the New Orleans District indicates that the quality of the upper oxygenated waters generally reflects conditions in adjacent waters. However, the deeper waters are subjected to oxygen depletion by bacterial action on accumulated organic matter. Deprived of atmospheric reaeration, they become anoxic during a portion of the year. Anoxic conditions tend to increase the rate of release of some bound contaminants from the bottom muds. However, current research (Gambrell, Khalid, Verloo, and Patrick, 1977) indicates that low pH and redox-potential in sediment-water systems tend to favor formation of soluble species of metals; whereas, in oxidized non-acid systems, slightly soluble or insoluble forms tend to predominate. Thus, a reducing environment may immobilize metals. Based on available literature and limited data from an existing 65-foot hole in Lake Pontchartrain, it does not appear that conditions conducive to toxic material release would exist in the holes because of the neutral pH water and reduced sediments which will exist in the holes. Dense highly saline water tends to occupy the lower depths of the deep borrow pits. Consequently, deep borrow pits often exhibit strong density gradients due to dissolved solids differentials between the surface and deep waters. If toxic materials were released from bottom sediments, the density gradient that would be established would not permit mixing with the adjacent water of Lake Pontchartrain. The mild climate of the project area generally precludes thermally-induced seasonal exchange (overturn) of surface and bottom waters. In addition, hydraulic analyses of water movements in Lake Pontchartrain, as related to horizontal and vertical displacement in deep water for typical and extreme tidal occurrences, indicate that, even during extreme conditions (hurricanes), the bottom waters of a 60-foot borrow pit would not mix with adjacent Lake Pontchartrain waters.

6.1.4.4. Most of the water quality impacts attributable to constructing levees which follow existing levee alignments would result from solids contained in runoff from levee-fill areas. Such impacts are normally intermittent, highly localized, and relatively short-term. The quality of runoff could be very poor at times, but runoff quantities generally would be insignificant in relation to the quantity of water available for mixing and dilution.

6.1.4.5. Fill-material discharges associated with constructing the new St. Charles Parish levee would also cause intermittent and relatively short-term water quality impacts. This levee reach would be constructed using dry-hauled fill. Dissolved oxygen depletion could occur in shallow marsh waters at the fringes of the levee-fill areas. Also,

locally intensified nitrogen and phosphorus levels might occur as a result of the fill-material discharges.

6.1.4.6. Water quality impacts attributable to fill-material discharges are addressed in detail in the Section 404(b)(1) Evaluation Reports (Appendix C).

6.1.4.7. BARRIER PLAN. Levee construction would fill approximately 28 acres of lake bottoms. By 2100, an estimated 1,051 acres would exist in the area of potential construction impact. This is approximately 477 acres less than would accrue through normal marsh loss in the future with no additional Federal action. This is because the marsh that would become lake bottom without the barriers would be utilized for disposal.

6.1.4.8. Construction of the barrier complex would cause 359 acres of bayou/canal habitat to be converted to levee/structure; an additional 512 acres (0.1 percent of the total lake bottoms) would be deepened to 20-40 feet below existing bottoms. By 2100, an estimated 467 acres of this habitat would remain in the area of direct impact. This is 327 acres less than would occur under future with no additional Federal action conditions.

6.1.4.9. Hydraulic dredging to depths approaching 40-50 feet below existing lake bottom levels would be required to obtain fill for construction relating to the barrier complexes. Consequently, essentially permanent water quality impacts related to deep borrow pits, as discussed for the High Level Plan, also are applicable to this plan. For additional information on effects of barrier construction on water quality, refer to report entitled "Effects of Flood Control Barriers in Passes of Lake Pontchartrain, Louisiana," included in the Environmental Resources Appendix of this report. Further, water quality impacts associated with constructing the St. Charles Parish levee would be the same as described for the High Level Plan.

6.1.4.10. Constructing the barrier complexes could result in both short- and long-term water quality impacts. The most readily identifiable effects relate to hydraulic dredging to obtain an estimated 36 million cubic yards for in-place construction fill. Excess dredged material in an amount approximately equal to the required in-place quantity could be lost to adjacent surface waters. Contaminants bound to hydraulically-dredged sediments could be dispersed over a relatively large area adjacent to the construction sites. Potentially, long-term contaminant leaching from the earthen structures could occur, producing trace levels of pollutants in adjacent waters. Subtle, essentially permanent, modification of local current and flow patterns near the barrier structures could potentially cause areas of poor water circulation and reduced flushing with attendant water quality problems.



#### 6.1.5. FISHERIES

6.1.5.1. HIGH LEVEL PLAN. The reduction in marsh acreage discussed in paragraph 6.1.3.1. would result in the loss of productive nursery habitat for shrimp, menhaden, and other commercial species including blue crab, red drum, seatrout, Atlantic croaker, and spot. Turner (1979) reported that the Louisiana commercial inshore shrimp catch is directly proportional to the area of intertidal wetlands, and that the area of inshore water does not seem to be associated with the average shrimp yields. An analysis by Cavit (1979) determined that yields of menhaden increase in proportion to the ratio of marsh to open water. Marshes contribute vast amounts of organic detritus to adjacent estuarine water (Odum et al., 1973).

6.1.5.2. As shown in Table 6.4, the annual commercial catch attributable to Lakes Pontchartrain and Borgne in the year 2100 under the High Level Plan would be an estimated 10,296 pounds less than the expected catch under the future with no additional Federal action condition. This would be approximately \$2,644 less compared to the future with no additional Federal action. The greatest losses would be to the commercial catches of menhaden and shrimp. The data in Table 6.4 was computed by using commercial landing data for Hydrologic Unit I collected by the NMFS to estimate the average annual estuarine-dependent commercial fishery harvest from the period 1963 to 1978. The estimates were based on the following assumptions: (1) fish and shellfish production is attributable to the marshes in the project area currently being harvested at or near maximum sustained yield, and (2) that marsh losses associated with project construction would cause a proportional loss in fisheries production.

TABLE 6.4

ESTIMATED HARVEST (POUNDS) PRODUCED FROM AREA OF POTENTIAL  
CONSTRUCTION IMPACT AND HARVESTED FROM LAKES PONTCHARTRAIN AND BORGNE  
AND OFFSHORE OF VARIOUS COMMERCIAL SPECIES IN 2100

FUTURE WITH NO ADDITIONAL FEDERAL ACTION	HIGH LEVEL PLAN	BARRIER PLAN
442,103	431,807	53,295

Additional information concerning commercial fishery benefits can be found in Appendix C, Natural Resources, and Appendix B, Economics.

6.1.5.3. In the 573 acres along the Jefferson Parish lakefront where hydraulic dredging is to be utilized, existing benthic populations would be destroyed. An additional 411 acres of lake bottoms would be permanently removed from benthic production by burial during fill placement for levee construction. During fill placement, epibenthic organisms such as shrimp and crab would be able to escape burial, while most sessile or slow-moving organisms such as molluscs would be lost. Turbidities would be increased in the vicinity of the fill, and the major impact would be a reduction in primary production. The various estuarine fish species inhabiting these water bodies would be mobile enough to avoid direct adverse impacts; however, the localized benthic and planktonic food supplies would be reduced or lost. Due to construction of levees in successive lifts, the impacts could persist for as long as 12 months in some locations. As explained in paragraph 6.1.4.4., erosion control measures would be implemented to reduce leaching of the fill material.

6.1.5.4. The proposed 60-foot NGVD depths of the Jefferson Parish borrow areas would create areas that would not receive proper circulation and could become anoxic nutrient sumps. These could chemically or physically stratify, rendering them unsuitable for benthic organisms for an extremely long time. These deep holes would possibly attract fish due to the cooler or warmer temperatures, (depending on seasons) and, as a result of these anoxic conditions, could cause fish kills (Pisapia, 1974).

6.1.5.5. While this deeply dredged lake bottom would be removed from benthic production for an extended period of time, it represents only 0.2 percent of the offshore water in Lake Pontchartrain and approximately 0.1 percent of the total lake bottom habitat. The total abundance of benthic macrofauna in this area is moderate (see benthic distribution map, Appendix C); however, numbers and species diversity is low in comparison to more productive areas in the lake (Bahr and Sikora, 1980). Levine (in Stone et al., 1980) noted the benthic food web is composed primarily of worms, molluscs, crabs, insect larvae, amphipods and isopods, each of which is utilized by at least 10 fish species within Lake Pontchartrain. However, this benthic food source is utilized directly by only 12 percent of the fish species in Lake Pontchartrain. Because the types of benthic macrofauna found in the area of impact are not heavily utilized by the majority of the fish species, and because the area comprises a small amount of the habitat available, the lake bottom excavation is not expected to significantly affect long-term fishery resources; however, localized short-term effects would occur as described in paragraph 6.1.5.4.

6.1.5.6. The construction activity would cause some decline in the freshwater sport and commercial fishery. Since the area of suitable freshwater habitat within the area of direct impact is small and usage difficult to reliably quantify, no numeric estimate of impacts on freshwater fish populations or fisherman usage was attempted.

6.1.5.7. The USFWS estimates that the marsh and swamp lost due to the High Level Plan would cause an annual loss of 200 man-days of sport fishing valued at \$2,800 (see Appendix C, Section XIV). The most likely sportfish habitat subject to direct construction impact would be found in the nearshore areas where fill activity would occur. As reported by Rogillio and Brassette (1977), the standing crop for sportfish in the nearshore area averaged approximately 83 pounds per acre. However, the eastern stations around Highway 11, South Shore, and Bayou Lacombe produced approximately three times as many fish per acre as the western portion of the lake where the fill would occur. The loss of 408 acres of lake bottom and 54 acres of marsh would slightly decrease the sport fishery. Aside from the long-term impacts associated with direct loss of lake bottoms, there are the less persistent impacts associated with turbidity and runoff. In some locations where levee construction is done in successive lifts, the turbidity and runoff are minimal but constant due to leaching until the last lift is in place and erosion control measures are implemented. Foreshore protection and associated floatation channels could result in temporary degradation of water quality, displacement or elimination of benthic organisms and changes in composition of nearshore fish species. There could be a slight reduction of bottom feeders and an increase in hard surface feeders (sheepshead). The benthic organisms which prefer hard surface and wave wash zones would be provided additional habitat by the riprap placement.

6.1.5.8. BARRIER PLAN. The Barrier Plan would have much more severe impact on the fishery resources as a result of the loss of 2,363 acres of marsh and 870 acres of bayou/canal habitat due to construction. The fishery value of the impacted marsh is much higher than that affected by the High Level Plan. The peripheral location of these marshes makes them easily accessible to migratory species.

6.1.5.9. The importance of the loss of these marshes can be shown by the projected decline in commercial catch by the year 2100. While the High Level Plan reduces the estimated commercial catch for the year 2100 by 10,300 pounds, this plan would reduce this catch by an estimated 388,800 pounds and \$100,000 compared to the future with no additional Federal action conditions.

6.1.5.10. The USFWS estimates that loss of marsh and swamp attributed to the Barrier Plan would cause an annual reduction of 16,793 man-days of sport fishing valued at \$65,493. In a survey of the sportfishing of Lake Pontchartrain, Rogillio and Brassett (1977) noted that the most productive areas were located near Highway 11 and Bayou Lacombe, with production ranging from 127 to 88 pounds per acre, respectively. The large amount of turbidity associated with dredging and fill placement which would occur in the construction areas would result in a potential for significant impact on this fishery. In addition, access to some of the area might be limited to some fishermen for the short term. More detailed estimates of commercial and sport fishery values can be found in "Effects of Flood Control Barriers in Passes of Lake Pontchartrain,

Louisiana," Appendix C, Environmental Resources. Other than these economic impacts, various unquantifiable biological impacts would also result from the implementation of this plan. The creation of 20- to 50-foot deep holes by dredging would have impacts similar to those discussed in paragraph 6.1.5.4. New benthic substrates would be created on the riprap on the pass approaches, rock dikes at Seabrook, and unconsolidated sediments. All of these would support some type of benthic fauna, but might cause changes in fish species in the area as a result of this change in food base. Reductions would occur in biological, detrital, and nutrient transport through the passes and would limit the populations of pass-dependent commercial and sportfish utilizing Lake Pontchartrain. Approximately 96 percent of the commercial species are pass dependent (Thompson and Verret, 1980). Approximately 80 percent of the commercial harvest poundage for Lake Pontchartrain is blue crab, which is pass dependent. Shoal areas of value to various fish and shellfish might be lost by channel deepening or construction of the closure dam. Migration routes for species limited to the shallow water areas would be blocked by the dam (Davis et al., 1970). While the quantity cannot be accurately estimated, active migration of fresh crabs, shrimp, and other macro-organisms might also be reduced. There could be potential adverse fishery impacts associated with the actual operation of the gated barrier structures. While these impacts cannot be readily quantified, it is probable that they would result in short-term, localized changes in the fishery. During closure, marine and estuarine species would be isolated from their feeding and nursery areas within the lake. A drop in lake salinity would be initiated by structure closure (Tallant and Simmons, 1963). This salinity change could displace those less adaptable fish species which have preferences for higher salinities. The more freshwater tolerant species could expand their foraging range, and as a result, an overlap of feeding niches could occur; thus, this would increase competition for the existing food base. This impact should be only short-term unless the structures are closed for long periods of time. Additionally, some anadromous fish species utilizing the lake during structure closure would be trapped in the lake and migratory runs would be delayed.

6.1.5.11. Generally, there would be reductions in the standing crops of forage fish, thus reducing quantity of food available for predator species. Nursery support for planktonic feeders, such as menhaden, and food for ocean spawners like croaker, seatrout, and drum would be reduced. Resulting lower salinities in the lake might be less favorable to some molluscs dependent on brackish water. Opportunistic feeders who feed in waters of higher salinity would find their range compressed within the lake.

#### 6.1.6. WILDLIFE

6.1.6.1. HIGH LEVEL PLAN. By 2100, there would be essentially no bottomland hardwoods and very little wooded swamp remaining in the area

of potential construction impact under the future with no additional Federal action conditions, the High Level Plan, or the Barrier Plan; therefore, wildlife dependent on these forested areas would decline, but very little of the decline would be project-induced. Various habitats (54 acres of marsh and 213 acres of cypress-tupelo) would be immediately lost due to construction, instead of slowly disappearing as they would under future with no additional Federal action conditions. Therefore, the decrease in wildlife numbers and diversity would be slightly more rapid under the High Level Plan than it would with no additional Federal action.

6.1.6.2. Construction activities would kill some young or slow-moving wildlife and would force other animals to move to adjacent areas. The majority of these displaced animals would die because of competition with existing residents of the nearby areas.

6.1.6.3. BARRIER PLAN. The Barrier Plan would have a moderate adverse impact on marsh wildlife because of the net loss of 837 acres of marsh. The marsh that would be impacted is extremely valuable for muskrat and waterfowl. Approximately 41 acres of bottomland hardwoods and 164 acres of cypress-tupelo would be lost immediately due to construction. As discussed above, this would cause the minor project-induced wildlife decline to occur slightly more rapidly. Other impacts would occur as discussed in paragraph 6.1.6.2. above. In terms of hurricane-induced flooding, the Barrier Plan would prevent some drowning of wildlife and isolation from feeding areas.

#### 6.1.7. ENDANGERED SPECIES

6.1.7.1. HIGH LEVEL PLAN. As described in Appendix C, Section I, there would be no impact on the St. Charles Parish eagle nest since it is 1.5 miles from the nearest levee construction. The loss of 213 acres of cypress-tupelo would not adversely impact the eagle.

6.1.7.2. BARRIER PLAN. This plan, as presently constituted, would disturb or possibly destroy active bald eagle nesting sites as a result of associated levee construction. For a further discussion, see Appendix C, Section I.

#### 6.1.8. "BLUE LIST"

6.1.8.1. HIGH LEVEL PLAN. Species that utilize the marsh (see Table 5.4) would lose some habitat, but the net loss of 55 acres of marsh by year 2100 would not significantly impact these marsh utilizing species. The timing of the marsh loss could have minor impacts on species numbers. With the High Level Plan, several acres of marsh would be immediately lost due to construction; without the project, there would be a steady decline in marsh acres due to natural and man-made uses. By the end of project life, there would be very little forested habitat left in the project area with the High Level Plan, the Barrier

Plan, or under future with no additional Federal action conditions. Thus, the High Level Plan should not impact any blue list species that utilize forested areas; although by 2100, most such species would be gone from the area of potential construction impact, due to lack of habitat.

6.1.8.2. BARRIER PLAN. Blue list species that use marsh habitat could be moderately impacted by the net loss of 837 more acres of marsh. As described above, species utilizing forested habitat would not be affected by the Barrier Plan.

#### 6.1.9. RECREATION

6.1.9.1. HIGH LEVEL PLAN. Implementation of the High Level Plan would adversely impact more lakeshore recreation than the Barrier Plan. The linear impact zone would disrupt land-based recreational features in proximity to the shoreline. Some hunting land would also be affected. Localized turbidity would impact the sport fishing resource in the vicinity of work during construction. The Jefferson Parish lakefront area would lose the 10.5-mile Jefferson Parish National Recreational Trail and its associated uses. Potential project impacts to the Williams and Bonnabel boat launch complexes would be eliminated with design modifications, such as constructing a floodwall around the site. The existing boat launch in the vicinity of the Jefferson Downs Race Track would be lost due to construction. This two-lane boat ramp is in a state of disrepair and does not justify costly levee alterations.

6.1.9.2. Development of the proposed Bucktown and Causeway sites has not been initiated. Both sites would be affected by the High Level Plan, and it can be assumed that the proposed developments would not be implemented as originally intended unless additional modification to the levee design is made.

6.1.9.3. The project would not impact most of the recreational activities on the New Orleans Lakefront; however, facilities existing in close proximity to the levee work either would be destroyed or avoided by design modification of the levee. There is concern over the future of one covered picnic shelter in the vicinity of Beauregard Avenue and Lakeshore Drive. This facility is located near the existing levee, and design modification to the levee would be necessary. Three children's play areas, two of which are located in an area of tall pine trees, would be lost due to sloping and grading of the new levee. The 72 picnic tables are not permanent structures and could be individually relocated. The 18 boat launching lanes located at the Seabrook bridge would not be affected. In Orleans Parish, activities that occur between the roadway and the lake's edge, such as picnicking and fishing, would not be impacted by levee work. Casual walking on the levee and access across the crown would be disturbed during construction and circulation restricted after construction due to the placement of an I-wall in the

levee crown. Many trees in the vicinity of work which have an esthetic value would be lost. The proposed levee in this area includes a barge berm which would have a wide flat crown. Upon completion, the levee crown would have a recreational potential as a jogging or hiking trail. The barge berms offer the potential for landscaping and recreational development. Facilities and unique areas lost due to construction would be restored to their preproject condition.

6.1.9.4. The numerous private summer camps in the Citrus Lakefront area are not located within the levee construction right-of-way and should only be affected by possible restricted access at times. The project would impact the minimal fishing and crabbing in the area during construction (see Volume II, Appendix C, Section XI, Figure 1 for location of existing and proposed recreational facilities).

6.1.9.5. Turbidity due to construction of levees would be minimal and would not significantly impact the fishing experience. The High Level Plan would have a negative impact on potential man-days attributed to recreational fishing. The USFWS has estimated 712 man-days valued at \$2,776 and 265 man-days of hunting valued at \$2,894 would be lost due to project construction. Consult the USFWS Final Coordination Act report, Volume II, Section XIV, Table 8.

6.1.9.6. Sport hunting and waterfowl hunting would be adversely affected under this plan. In the year 2100, compared with future with no additional Federal action, 86 man-days of small game hunting and 209 man-days of large game hunting, which includes waterfowl hunting, would be lost.

6.1.9.7. Project-induced impacts on recreational man-days would predominately occur in the St. Charles, Jefferson, and Orleans Parishes lakefront areas. Annual man-days of recreation currently total 765,207. Projected annual use for the project life is assumed to remain constant. If no design modifications are made to the levee design, 317,852 annual man-days of recreation would be lost by the year 2100. Design modifications of the levee at Williams Boulevard and Bonnabel Boulevard in Jefferson Parish, and in the vicinity of one picnic shelter in Orleans Parish being investigated would save 201,813 annual man-days. A detailed analysis showing the calculations of these affected man-days is provided in the Environmental Resources Appendix, Section IX.

6.1.9.8. There would be no impact to wildlife management areas or refuges.

6.1.9.9. BARRIER PLAN. Implementation of the Barrier Plan would adversely affect water-oriented recreation in close proximity to the barrier complexes. Construction of navigable structures at the two passes would reduce the channel width, at times creating a bottleneck effect for recreational boats. Depending upon the size of vessels

passing through, it might not be possible for two or more sailboats to pass at the same time.

6.1.9.10. Short-term localized turbidity would be evident in the vicinity of each barrier complex during and shortly after construction, adversely affecting recreational fishing. As discussed in paragraph 6.1.5.10., sportfishing, shrimping, and crabbing would not maintain their current levels. A reduction in the number of man-days attributed to sportfishing and related activities would result. The Barrier Plan would have a negative impact on potential man-days attributed to recreational fishing. USFWS has estimated that 16,793 man-days of sportfishing valued at \$65,493 and 922 man-days of hunting valued at \$9,526 (total 17,715 man-days and \$75,019) would be lost due to project construction. Consult the USFWS Coordination Act Report, Volume II, Section XIV, Table 8.

6.1.9.11. Small and large game hunting, including waterfowl hunting, would be adversely affected under this plan. In the year 2100, compared with future with no additional Federal action, 111 man-days of small game hunting would be gained; however, 375 man-days of large game, which includes waterfowl hunting, would be lost. Additional information dealing with quantification and comparison of plans can be found in the Recreation Section of the Environmental Resources Appendix.

6.1.9.12. There would be no impact on wildlife management areas or refuges.

#### 6.1.10. **NATIONAL REGISTER OF HISTORIC PLACES**

6.1.10.1. HIGH LEVEL PLAN. Implementation of this plan would have a positive effect on the numerous National Register properties located within the existing and proposed levee system by protecting them from hurricane-related flood damage. The renovation of the Mandeville seawall would protect it from failure during hurricane or other storm generated wave action and, thus, protect the three National Register properties located on Lakeshore Drive and the proposed National Register district from erosion and flood damages.

6.1.10.2. The plan would not adversely impact any resource currently listed in or determined eligible for listing in the National Register. Most of the project impact areas have been covered by cultural resources surveys. The remote sensing survey of offshore borrow areas located three anomaly clusters which may represent significant historic remains in the Howze Beach area and four such anomaly clusters in the Jefferson borrow area. We are studying the feasibility of avoiding project impacts on these clusters. If avoidance is not feasible, the anomalies would be tested to determine their significance, and appropriate mitigative steps, if required, would be taken.



6.1.10.3. BARRIER PLAN. Construction of this plan would also have a positive effect on National Register properties located within the levee system by protection from hurricane-related flood damage. Additionally, this plan would reduce flood heights in Lake Pontchartrain and, thus, provide some measure of protection for the numerous National Register properties located along the fringes of the lake. These include the three lighthouses, Forts Pike and Macomb, archeological sites 16ST1 and 16SJB2, and the three properties and proposed district in Mandeville. Protection to Mandeville would also be provided by renovation of the seawall which would protect it from failure during hurricane wave action. The possible adverse effects of this plan would include impacts on the three anomaly clusters located by remote sensing surveys in the Howze Beach borrow area and possible visual impacts of the Rigolets and Chef Menteur barrier complexes on Forts Pike and Macomb, respectively.

## 6.2. SECTION 122 ITEMS

Section 122 of the River and Harbor and Flood Control Act (Public Law 91-611) provides a broad outline of the basic and minimum social, economic, and environmental factors to be considered in evaluating the impacts of water resource development. In addition to natural resources, these impacts include such things as property values, employment, and businesses, esthetic values, and community cohesion. For an additional discussion see Appendix B, Exhibit 2, Socioeconomic Assessment.

### 6.2.1. MINERALS

6.2.1.1. HIGH LEVEL PLAN. Gas pipelines would be relocated to provide passage through hurricane protection levees. This would mean temporary disruption in transport of gas or oil during relocations.

6.2.1.2. BARRIER PLAN. Similar to the High Level Plan.

### 6.2.2. AIR QUALITY

6.2.2.1. HIGH LEVEL PLAN. Emissions from machinery and dust created during construction would slightly degrade air quality from intermittent construction activities during the first quarter of the project. This impact would be minor and temporary.

6.2.2.2. BARRIER PLAN. Direct construction impacts would be similar for this plan.

### 6.2.3. NOISE

6.2.3.1. HIGH LEVEL PLAN. This plan would increase noise levels within the area during construction. Levee construction would take place in segments. Noise impacts would therefore last no longer than a month at any one location. Because most residences are more than 100 feet from

the construction sites, construction noise levels would be decreased by at least 26 decibels inside the houses (Bolt, et al., 1971).

6.2.3.2. BARRIER PLAN. Same as impacts noted above.

6.2.4. **FLOOD CONTROL**

6.2.4.1. HIGH LEVEL PLAN. Completion of the project would facilitate the flood protection of existing developments, as well as currently undeveloped areas which have been planned for development by both public and private interest. In addition, protection would be afforded the east bank of St. Charles Parish south of Airline Highway. No additional hurricane protection would be provided to the north shore area of Lake Pontchartrain.

6.2.4.2. BARRIER PLAN. Similar to the High Level Plan, except some degree of protection would be provided to the north shore area of Lake Pontchartrain.

6.2.5. **PROPERTY VALUES**

6.2.5.1. HIGH LEVEL PLAN. The additional amount of flood protection that would be provided by the project would increase property values within the study area.

6.2.5.2. BARRIER PLAN. Impacts would be similar to the High Level Plan; however, additional benefits could be realized from the protection afforded the north shore.

6.2.6. **BUSINESS AND INDUSTRIAL ACTIVITY**

6.2.6.1. HIGH LEVEL PLAN. This plan would provide additional flood protection for existing and anticipated business and industrial activities. More incentive would exist to accelerate development of the Almonaster-Michoud Industrial District.

6.2.6.2. BARRIER PLAN. These impacts would be similar to those for the High Level Plan with additional development incentive for the protected area of the north shore. Conversely, this plan is perceived by some as foreclosing certain water-based development opportunities on the north shore.

6.2.7. **EMPLOYMENT**

6.2.7.1. HIGH LEVEL PLAN. Construction of the project would generate additional employment, resulting in some employment benefits. Although such benefits were not included in the economic analysis of the project, they were estimated to provide an indication of this impact on the local economy. The average annual employment benefits attributable to project construction are estimated at \$4,240,000. Long-term employment benefits are expected to be minor.

6.2.7.2. BARRIER PLAN. Benefits to employment would be similar to the High Level Plan but for a slightly longer term. These construction related employment benefits are estimated on an average annual basis to be \$5,360,000.

#### 6.2.8. **HOUSING**

6.2.8.1. HIGH LEVEL PLAN. The level of hurricane and flood protection to the New Orleans metropolitan area would be increased. This would result in benefits to approximately 160,000 dwellings. Future housing developments would receive benefits from hurricane protection. For further detail refer to Appendix B, Economics.

6.2.8.2. BARRIER PLAN. This plan would have similar impacts on housing; however, 167,000 units (including some on the north shore) would receive flood protection benefits.

#### 6.2.9. **ESTHETIC VALUES**

6.2.9.1. HIGH LEVEL PLAN. During construction of this plan, esthetics along the New Orleans and Jefferson Parish lakefronts would be impaired. The scenic vistas along the lakefront as well as greenspaces, parks, and other recreational areas along the shoreline would be temporarily degraded. The esthetics of these areas would be greatly reduced due to unsightly stockpiling of fill material, excavation activities, and other construction activities associated with levee building. Most of these impacts would be temporary and, upon completion of construction and landscaping, should result in additional greenspaces, recreational areas, and scenic vistas.

6.2.9.2. BARRIER PLAN. The esthetics of the natural coastal passes would be temporarily altered through construction activity and permanently affected by the placement of barriers. The bypass channels, borrow, and disposal areas associated with barrier construction would contribute to the degradation of the naturalness of the marsh vistas. The barriers themselves would detract from the natural openness of the passes as well as hinder their navigability. The disposal sites would be greatly elevated above the normal marsh level and would be void of vegetation, resulting in an unpleasing disruption of the panoramic view normally afforded in a marsh vista. However, within a year these areas should become revegetated with plants indicative of more upland areas; therefore, these areas would culminate in a somewhat reduced long-term visual impact.

#### 6.2.10. **COMMUNITY COHESION**

6.2.10.1. HIGH LEVEL PLAN. The environmental community is concerned over the potential project-induced development in New Orleans East beyond the Maxent Canal. The fact that the community generally favors this plan, plus the additional flood protection and eventual increased

recreational space along the lakefront provided by this plan, minimizes the impact on community cohesion.

6.2.10.2. BARRIER PLAN. Community cohesion would be increased because of additional flood protection. Environmental opposition to the Barrier Plan is strong.

## 7. LIST OF PREPARERS

The following people were primarily responsible for preparing this Environmental Impact Statement:

NAME	DISCIPLINE/EXPERTISE	EXPERIENCE	ROLE IN EIS PREPARATION
Joseph L. Dykes	Civil Engineer	15 years, planning studies, New Orleans District	Project Manager
Lynn Devaul	Civil Engineer	5 years, planning studies, New Orleans District; 2 years, engineering studies, Metcalf & Eddy	Project Manager
Larry Hartzog	Fisheries Biologist	5 years, environmental studies, New Orleans District; 4 years, fisheries research, Florida Game and Freshwater Fish Commission; 2 years, water quality analyst, Hercules Chemical	EIS Coordinator, Sections 5, 6, and 9 of EIS.
Robert U. Lacy	Regional Economist	13 years, economic studies, New Orleans District	Preparation of general descriptions of socio-economic conditions and socioeconomic assessments of items required by Section 122 of the River and Harbor and Flood Control Act of 1970.
Nicholas G. Constan	Regional Economist	15 years, economic studies, New Orleans District	Compiled and completed the economic analysis.
Everett K. Johnson, Jr.	Regional Economist	34 years, economic studies, New Orleans District	Overall preparation of economics portion.
Suzanne K. Hawes	Marsh Ecologist	12 years, environmental studies, New Orleans District	Sections 1, 3, 4, 7, and 8 of EIS, Review of EIS, Land Use projections.
E. Scott Clark	Wildlife Biologist	4 years, environmental studies, New Orleans District	Endangered Species Assessment, Coastal Zone Management Consistency Determination
James Warren	Environmental Engineer	6 years, environmental engineer, New Orleans District	Effects on water quality
Stephen F. Finnegan	Landscape Architect	7 years, landscape architect, New Orleans	Effects on recreation
Michael E. Stout	Archeologist	7 years, archeologist, New Orleans District	Effects on cultural resources
Henry P. Glaviano	Technical Writer/Editor	13 years, Technical writer/editor, New Orleans District; 4 years, technical writer/editor, Boeing Company	Review and Editing

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**Page EIS - 70**

## 8. PUBLIC INVOLVEMENT

### 8.1. PUBLIC INVOLVEMENT PROGRAM

8.1.1. There has been a long history of public involvement in this project. A formal public meeting was held in New Orleans on 15 March 1956 during formulation of the original plan. Subsequently, the US Army Corps of Engineers has participated in numerous public affairs of various types at which project purposes, features, and impacts have been exposed to widespread public scrutiny and analysis. In 1972, a draft Environmental Impact Statement (EIS) was released to Federal, state, and local agencies, and to the interested public for review and comment. Responses to all comments were published in the 1975 final EIS. When the court enjoined construction of the barriers until impacts were better described, several Federal agencies (the US Fish and Wildlife Service, National Marine Fisheries Services, Louisiana Department of Wildlife and Fisheries, and US Environmental Protection Agency) provided input into the Scope of Work for a baseline study of Lake Pontchartrain and its passes. This study was completed in 1980 by the Louisiana State University (LSU) Center for Wetlands Resources. An environmental consultant for the Corps, Dr. Eugene Cronin, prepared a Scope of Work for a study to characterize the passes to assess barrier impacts. The same agencies approved this Scope of Work. Once the contract was awarded, a Technical Advisory Group composed of these same agencies was formed to help oversee the work of the contractor (LSU Center for Wetlands Resources). In 1981, when the tentative decision was made to choose the High Level Plan instead of the Barrier Plan, the contract was cancelled.

8.1.2. Public meetings to discuss the tentatively selected High Level Plan were held in New Orleans, Louisiana, on 21 November 1981 and 12 April 1984. The four major issues raised at the public meetings concerned the levee alignment in New Orleans East, the levee alignment in St. Charles Parish, the proposed borrow pits in Lake Pontchartrain for the Jefferson Parish Lakefront levee, and mitigation plans.

8.1.3. A number of people stated that they preferred the Maxent Canal alignment to the authorized alignment selected for New Orleans East. Choosing the Maxent Canal alignment would exclude 13,000 acres of wetlands from the protected area at an additional cost of \$70 million. The Corps does not feel this additional expenditure is justified. These wetlands have been excluded from normal tidal exchange by a levee system for over 20 years and the proposed levee would not change the existing drainage patterns.

8.1.4. Concern over the levee alignment in St. Charles centered around the exact location of the levee and the choice of alignments. Some preferred the south of Airline Highway alignment because no wetlands would be inclosed. The south alignment is more costly than the north alignment, however. In addition, the proposed levee north of Airline

Highway would have culverts to maintain the existing flow patterns. The levee alignment north of and parallel to the Airline Highway would be more precisely determined in the design stage. Requests to locate the levee as close to the highway as possible will be considered.

8.1.5. The third item concerned the possible adverse environmental impacts of the borrow pits for the Jefferson Parish levee. Alternative methods of construction and levee designs were considered but were ruled out as too costly or as being of lesser design integrity. The New Orleans District is continuing to investigate ways of minimizing the impacts and will implement measures of reasonable cost.

8.1.6. Many agencies and individuals were concerned that no mitigation plan had been developed to accompany this supplemental EIS. The plan is being developed and an additional public meeting was held in June of 1984; the mitigation report and an accompanying EIS will be complete by early 1986.

## 8.2. REQUIRED COORDINATION

Circulation of the draft supplement to the EIS in December 1983 accomplished the remaining required coordination with the National Park Service and State Historic Preservation Officer. Circulation to the list of agencies, groups, and individuals mentioned in the following paragraph will satisfy requirements of the National Environmental Policy Act.

## 8.3. STATEMENT RECIPIENTS

All members of Congress, Federal, state, and local agencies, environmental groups, and libraries listed below have been furnished copies of the draft supplemental main report/EIS (Volume 1) and appendixes. A notice of availability of the draft supplemental main report/EIS has been sent to all others thought to have an interest in the study.

### FEDERAL

Honorable J. Bennett Johnston, US Senator

Honorable Russell B. Long, US Senator

Honorable Lindy (Mrs. Hale) Boggs, US Congresswoman

Honorable Robert L. Livingston, US Congressman

Honorable William "Billy" Tauzin, US Congressman

Department of the Interior, Office of Environmental Project Review

US Environmental Protection Agency, The Administrator



US Environmental Protection Agency, Regional EIS Coordinator, Region VI

US Department of Commerce, Director, Office of Ecology and Conservation

US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Region

National Marine Fisheries Service, Environmental Assessment Branch

US Department of Agriculture, Washington, DC

US Department of Agriculture, Southern Region, Regional Forester, Forest Service

US Department of Energy, Director, Office of Environmental Compliance, Washington, DC

Federal Emergency Management Administration, Washington, DC

Soil Conservation Service, State Conservationist

US Department of Transportation, Deputy Director of Environmental and Policy Review

Federal Highway Administration, Division Administrator

US Department of Health and Human Services, Washington, DC

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

Advisory Council on Historic Preservation, Washington, DC

Advisory Council on Historic Preservation, Golden, Colorado

#### **STATE**

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

Louisiana Department of Transportation and Development, Office of Public Works, Assistant Secretary

Louisiana Department of Highways, Public Hearings and Environmental Impact Engineer

Louisiana Department of Wildlife and Fisheries, Ecological Studies Section

Louisiana Department of Wildlife and Fisheries, Secretary

Louisiana Department of Natural Resources, Coastal Resources Program

Louisiana Department of Natural Resources, Office of Environmental Affairs, Water Pollution Control Division

Louisiana Department of Natural Resources, Division of State Lands

Louisiana Department of Commerce, Research Division

Louisiana Department of Culture, Recreation, and Tourism, State Historic Preservation Officer

Louisiana Department of Culture, Recreation, and Tourism, Office of State Parks

Louisiana Department of Natural Resources, Office of Environmental Affairs

Louisiana Department of Natural Resources, Office of Forestry

Louisiana State Planning Office, Policy Planner

Louisiana State University, Department of Geography and Anthropology, Curator of Anthropology

Louisiana State University, Center for Wetland Resources

Louisiana State University, Coastal Studies Institute, Library

Department of Natural Resources, Division of State Lands

Governors Coastal Protection Task Force

Jefferson Levee District

Orleans Levee District

Lake Borgne Levee District

Pontchartrain Levee District

#### **LOCAL AGENCIES**

Metropolitan Regional Clearinghouse, New Orleans

President, Plaquemines Parish Commission Council

President, St. Bernard Parish Police Jury

St. Tammany Parish Police Jury

Mayor, City of New Orleans

Mayor, Town of Mandeville

Regional Planning Commission

Ad Hoc Committee on Lake Pontchartrain

**ORGANIZATIONS**

Ecology Center of Louisiana, Inc., President

Orleans Audubon Society, Mr. Barry Kohl

Environmental Defense Fund

Save Our Wetlands, Inc.

Dr. Oliver Houck, Tulane Law School

**ACADEMIC LIBRARIES**

Delgado Junior College

Dillard University

Louisiana State University

Loyola University

Tulane University

University of New Orleans

**PUBLIC LIBRARIES**

Ascension Parish Library

Jefferson Parish Library

Orleans Parish Library

St. Charles Parish Library

St. James Parish Library

St. John the Baptist Parish Library

St. Tammany Parish Library

Tangipahoa Parish Library

## 8.4. PUBLIC VIEWS AND RESPONSES

8.4.1. The major public view that influenced this study was opposition to the Barrier Plan. Several Federal agencies, environmental groups, and some citizens on the north shore opposed the barriers because they either feared the impacts on the biology and hydrology of Lake Pontchartrain or feared increased flooding on the north shore. These views were incorporated into the decision making process which resulted in eliminating consideration of the Barrier Plan and choosing the High Level Plan as the Recommended Plan.

8.4.2. Another public view that influenced alternative selection was the opposition to the St. Charles Parish Lakefront levee which would have impacted 26,000 acres of wetlands north of Airline Highway. Environmental groups and the US Fish and Wildlife Service were the major proponents of preservation of this marsh. The selected alignment in the High Level Plan leaves these wetlands in their natural state.

## 8.5. STATEMENT COMMENTATORS

### FEDERAL

Department of Commerce, National Oceanic and Atmospheric Administration,  
National Ocean Service (24 February 1984)

Department of Commerce, National Oceanic and Atmospheric Administration,  
National Marine Fisheries Service (16 February 1984)

Department of Commerce, National Oceanic and Atmospheric Administration,  
National Marine Fisheries Service (24 February 1984)

Department of Commerce, National Oceanic and Atmospheric Administration,  
National Weather Service (26 January 1984)

Environmental Protection Agency, Region VI

Gulf of Mexico Fishery Management Council

Department of Housing and Urban Development, Fort Worth Regional Office

Department of the Interior, Office of the Secretary, Office of  
Environmental Project Review (29 February 1984)

Department of the Interior, Fish and Wildlife Service (8 March 1984)

Department of Transportation, Federal Highway Administration  
(18 March 1984)

Department of Transportation, Federal Highway Administration  
(22 March 1984)

## **STATE**

Department of Culture, Recreation and Tourism (16 February 1984)

Department of Culture, Recreation and Tourism (20 February 1984)

Department of Environmental Quality

Department of Natural Resources (28 February 1984)

Department of Natural Resources (19 June 1984)

Department of Transportation and Development, Office of Public Works

Wildlife & Fisheries Statement

## **ORGANIZATIONS**

Audubon Society, New Orleans Chapter

Board of Levee Commissioners of the Orleans Levee District

City of New Orleans

Environmental Defense Fund (9 February 1984)

Environmental Defense Fund (6 March 1984)

Geodata Inc.

League of Women Voters of Louisiana

Louisiana Wildlife Federation Inc. (27 February 1984)

Louisiana Wildlife Federation Inc. (1 March 1984)

Regional Planning Commission, Jefferson, Orleans, St. Bernard, St. Tammany Parishes

St. Charles Parish

Sierra Club, Delta Chapter

## INDIVIDUALS

Mr. Milton Cambre

Ms. Juanita Grimes

Ms. Moira Ford

Mr. Michael Halle

Dr. Oliver Houck

## 8.6. PUBLIC VIEWS AND RESPONSES

Public views expressed to this agency concerning the Lake Pontchartrain Hurricane Protection Project were considered in the preparation of the Draft and Final Supplement to the Environmental Impact Statement for Lake Pontchartrain, Louisiana, and Vicinity, Hurricane Protection Project. As discussed in Section 1.4 of the EIS, several controversial issues may require resolution prior to project implementation. These issues were brought forth at the public meeting. Public views and responses are presented in Appendix D.

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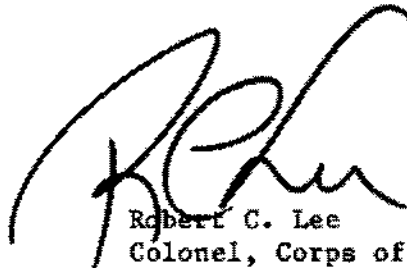


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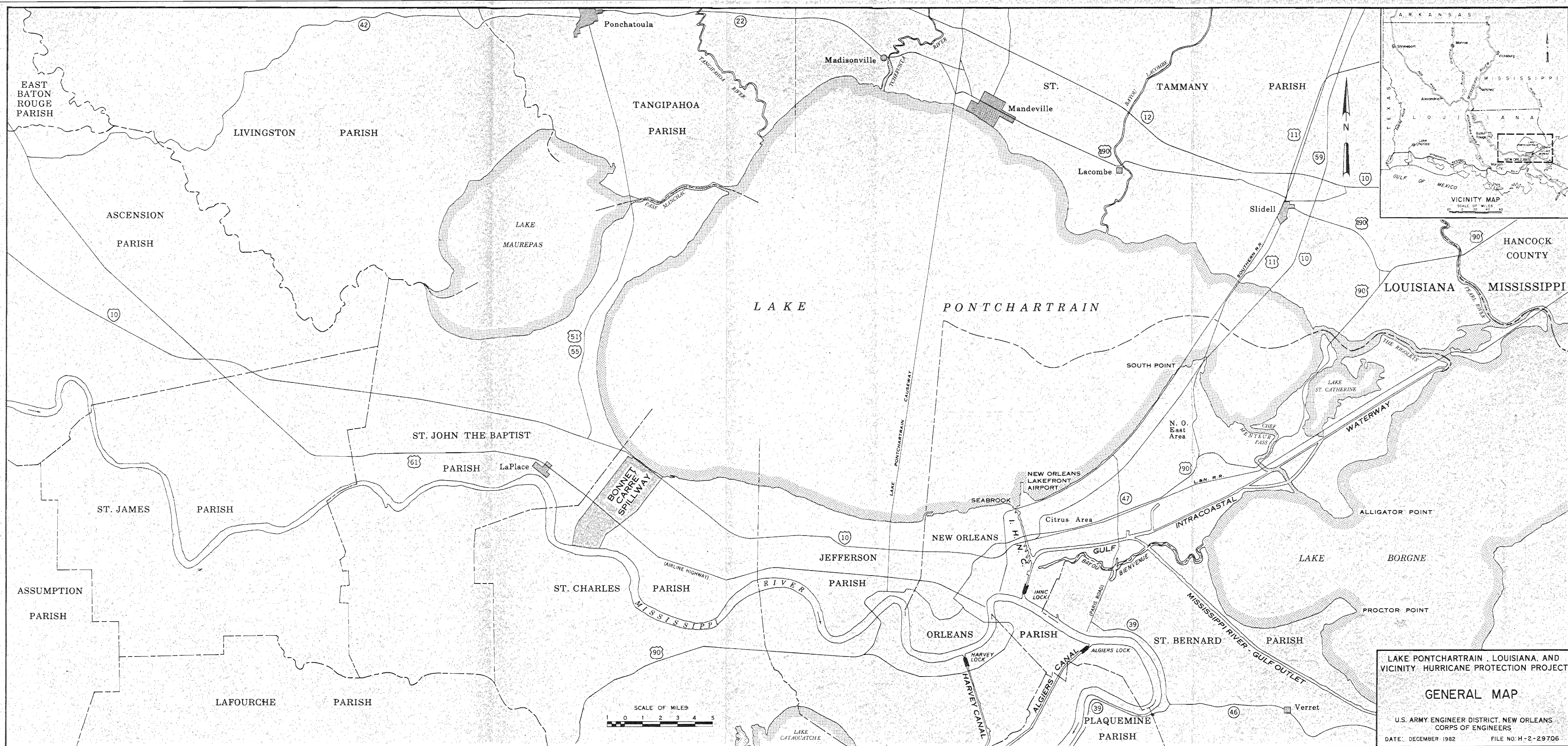
US Army Engineer Waterways Experiment Station, CE, Vicksburg, Mississippi. Effects on Lake Pontchartrain, La., of Hurricane Surge Control Structures and Mississippi River-Gulf Outlet Channel; Hydraulic Model Investigation, by I. C. Tallant and H. B. Simmons. November 1963, viii, 43 pp. and appendix - illus - table. (Technical Report No. 2-636)

## RECOMMENDATIONS

I recommend that the existing project plan for hurricane protection for Lake Pontchartrain, Louisiana, and Vicinity, authorized by Public Law 89-298 on 27 October 1965, be modified to provide for the implementation of a Federal project for hurricane protection, in accordance with the plan tentatively selected herein, with such further modifications thereto as in the discretion of the Chief of Engineers may be advisable. These tentative recommendations are made with the provision that, prior to proceeding with redirecting or initiating construction of plan features which vary from that which is provided for by the current plan of improvement, local interests provide adequate supplements to current assurances.

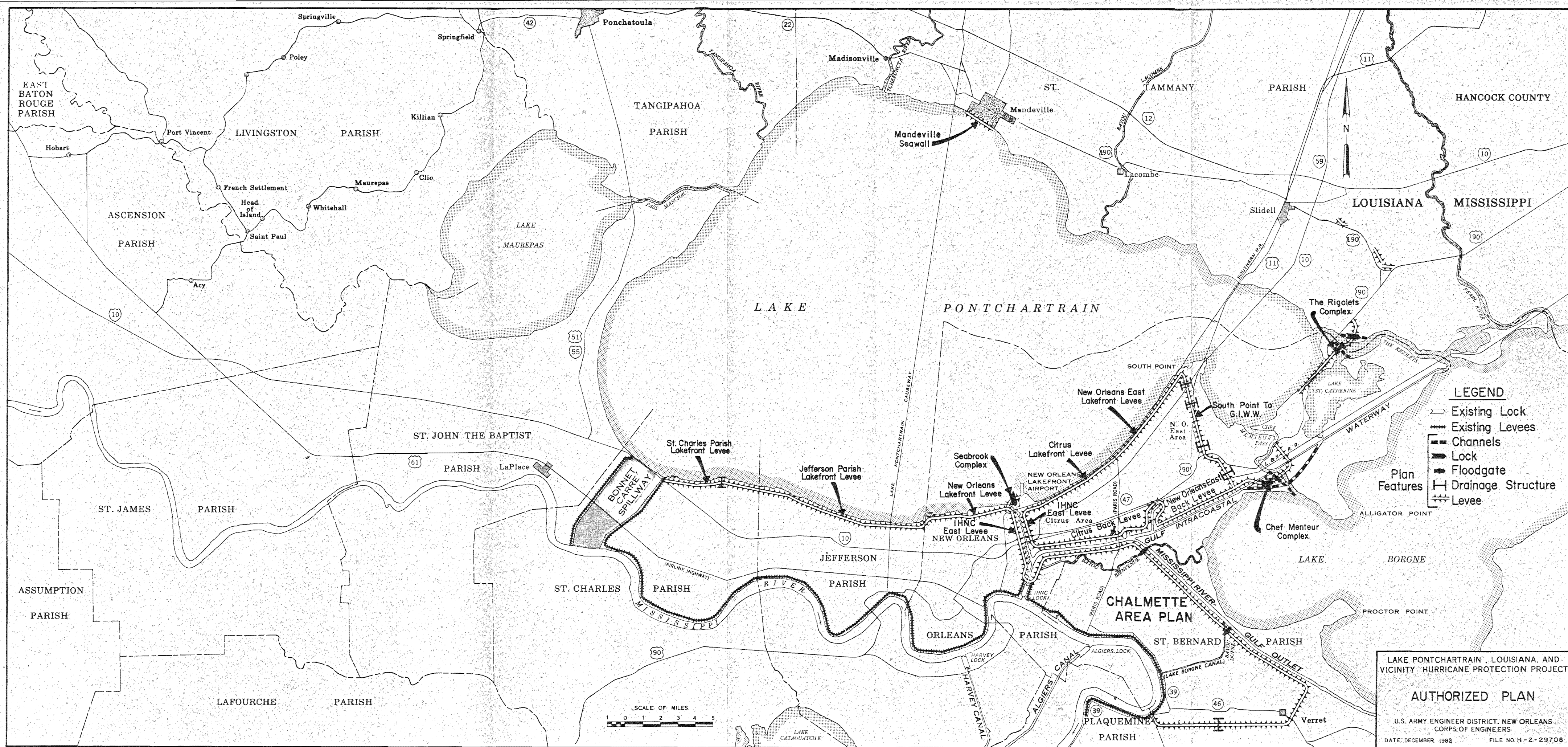
A large, stylized handwritten signature in black ink, appearing to read 'R. Lee'.

Robert C. Lee  
Colonel, Corps of Engineers  
District Engineer



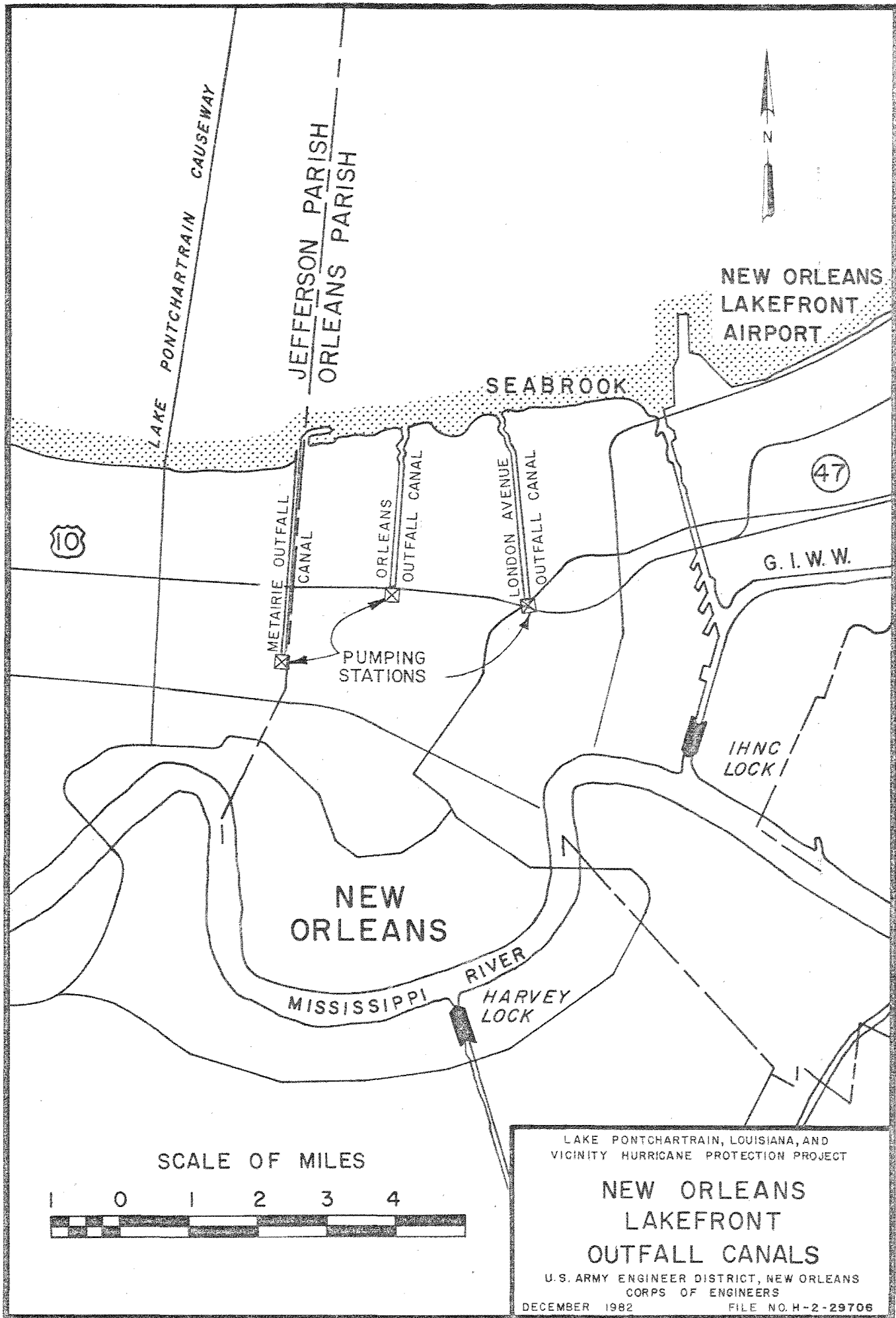




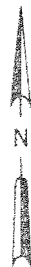
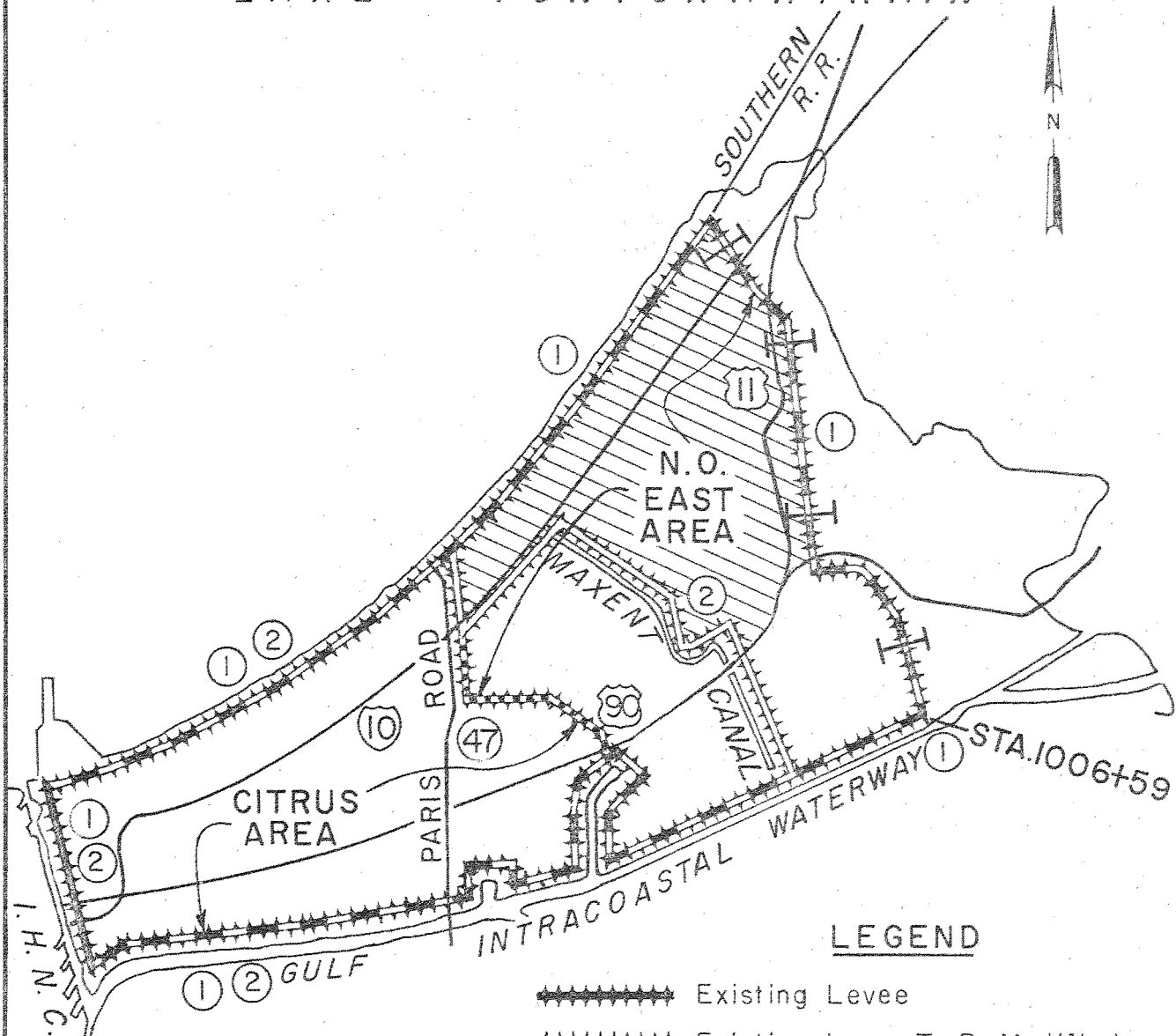








# LAKE PONTCHARTRAIN



## LEGEND

- Existing Levee
- Existing Levee To Be Modified
- New Levee
- Secondary Levee
- Drainage Structure
- Existing Alinement
- Maxent Canal Alinement
- New Orleans East, Inc. Permit Area

SCALE OF MILES

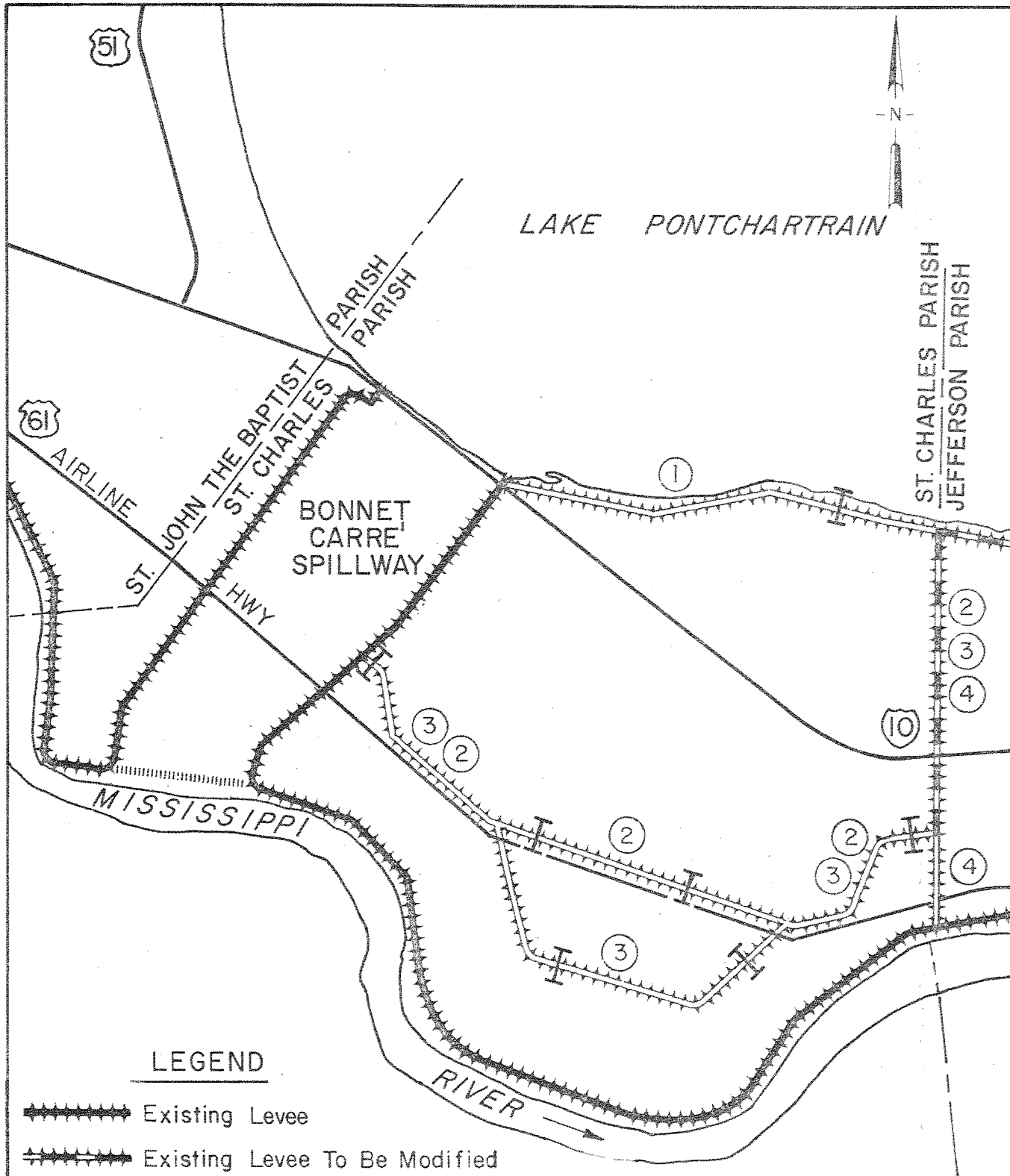


LAKE PONTCHARTRAIN, LOUISIANA, AND  
VICINITY HURRICANE PROTECTION PROJECT

## ALTERNATIVE NEW ORLEANS EAST ALINEMENT

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS  
CORPS OF ENGINEERS  
DECEMBER 1982 FILE NO. H-2-29706

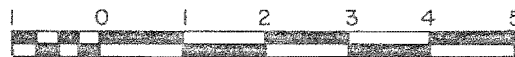




### LEGEND

- Existing Levee
- Existing Levee To Be Modified
- New Levee
- ① Lakefront Alinement
- ② N. Airline Hwy
- ③ S. Airline Hwy
- ④ Return Levee Only
- Drainage Structure

SCALE OF MILES



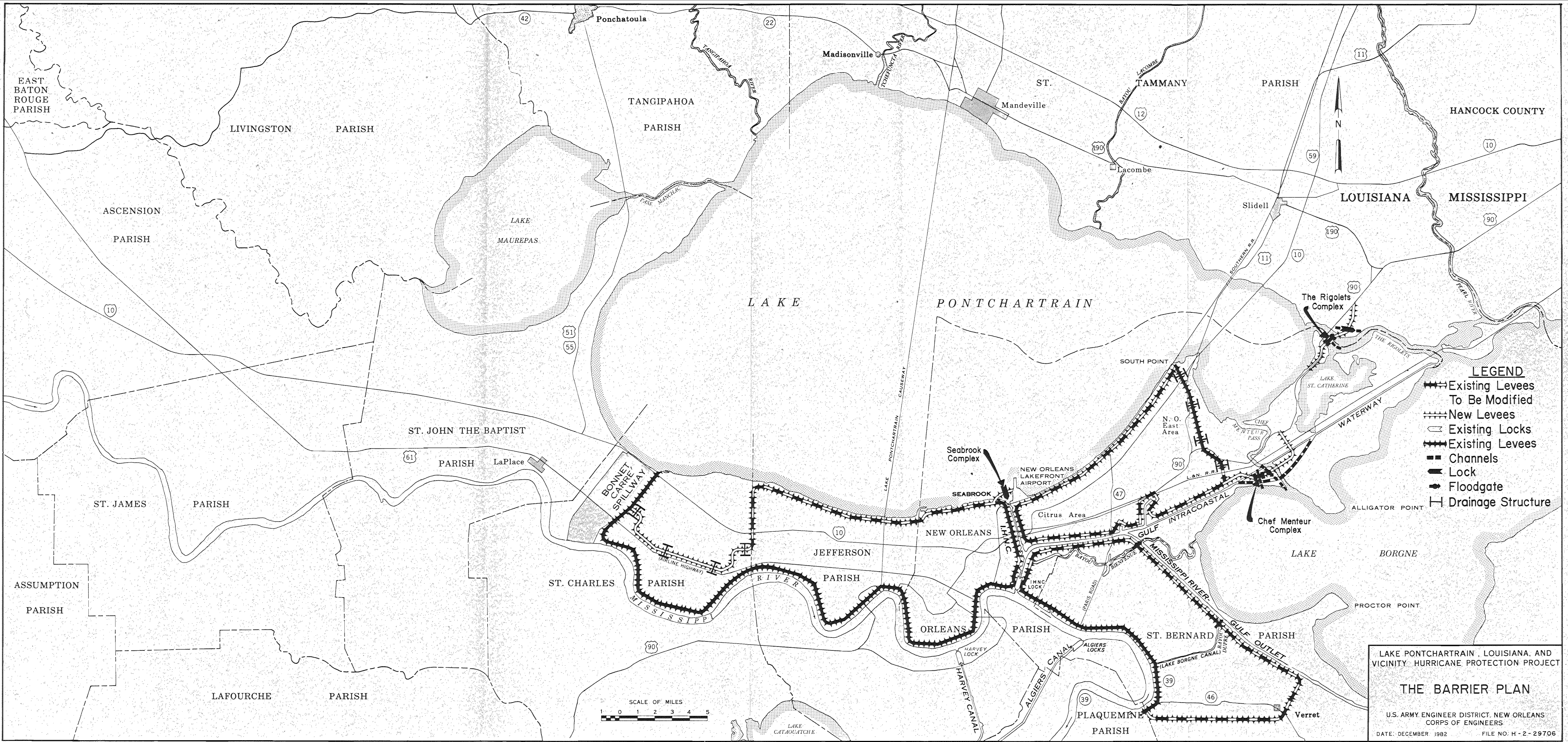
LAKE PONTCHARTRAIN, LOUISIANA, AND  
VICINITY HURRICANE PROTECTION PROJECT

## ST. CHARLES PARISH ALINEMENTS

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

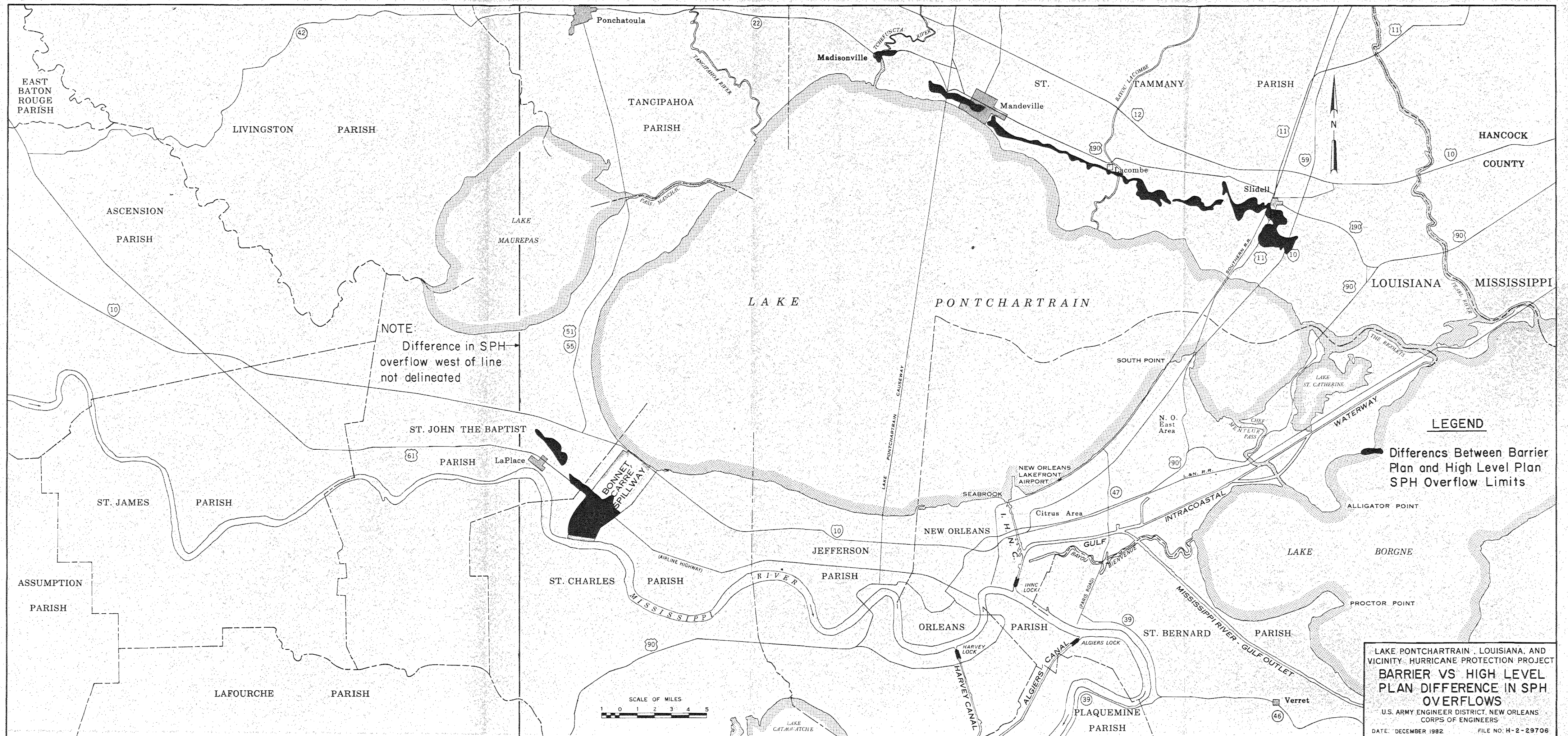
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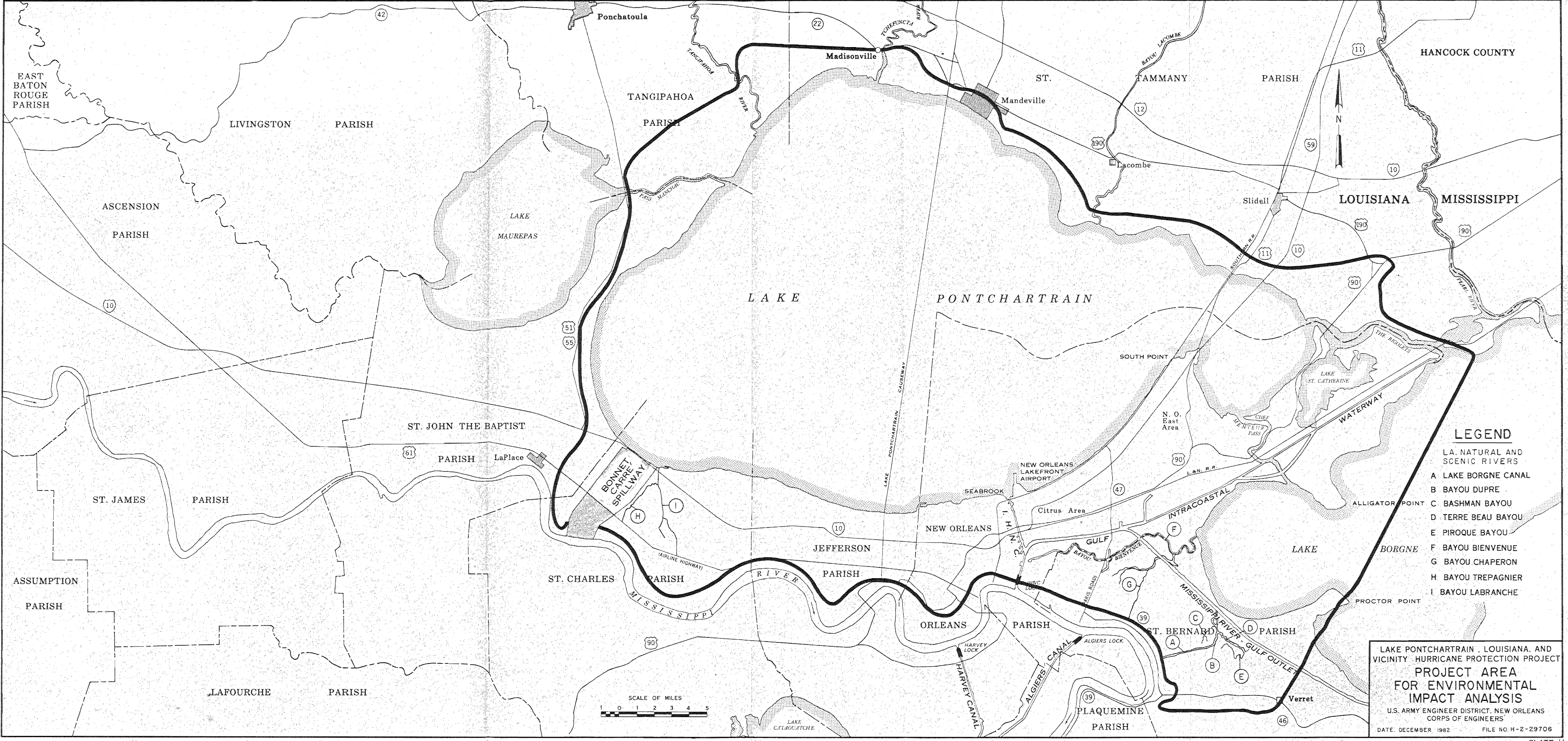
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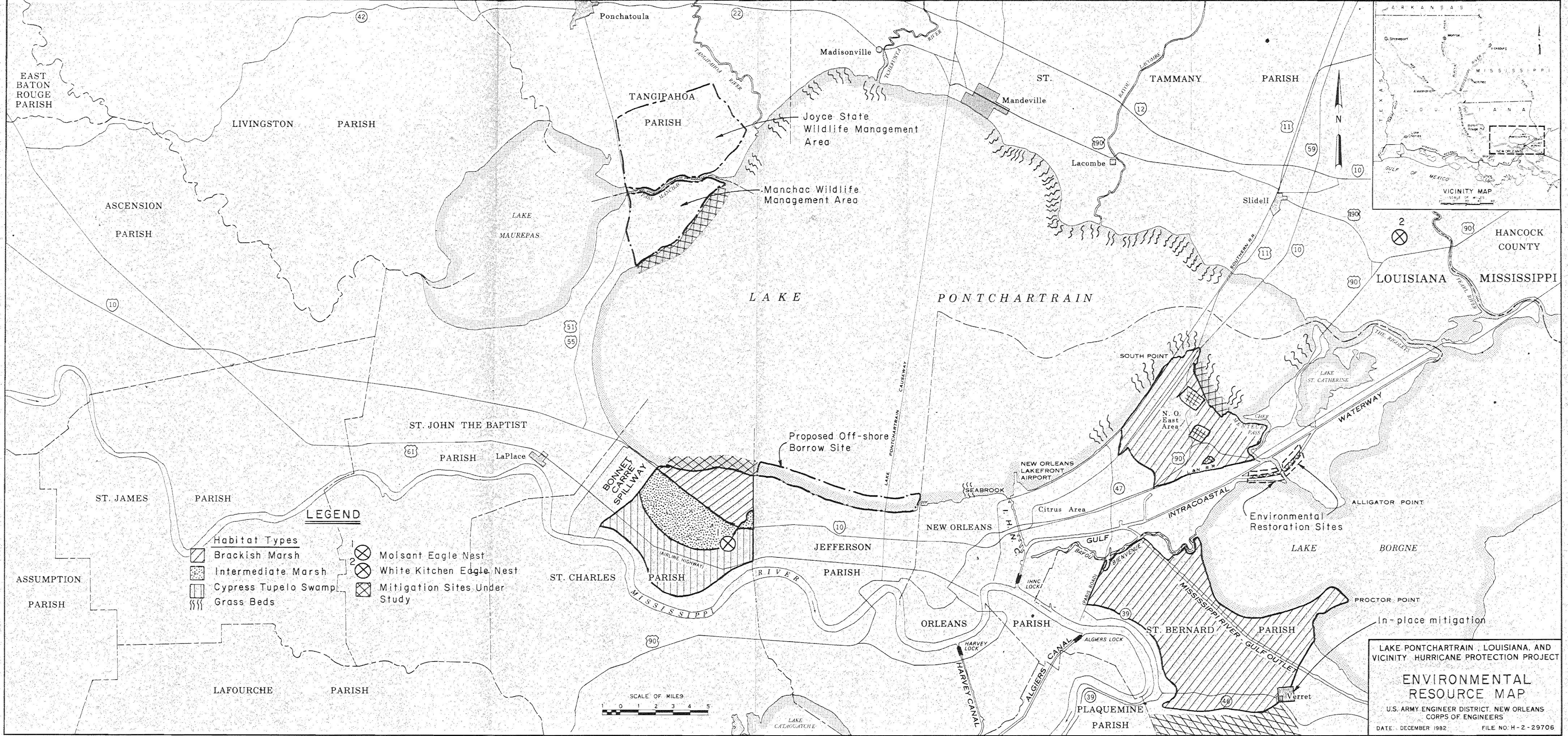






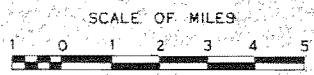
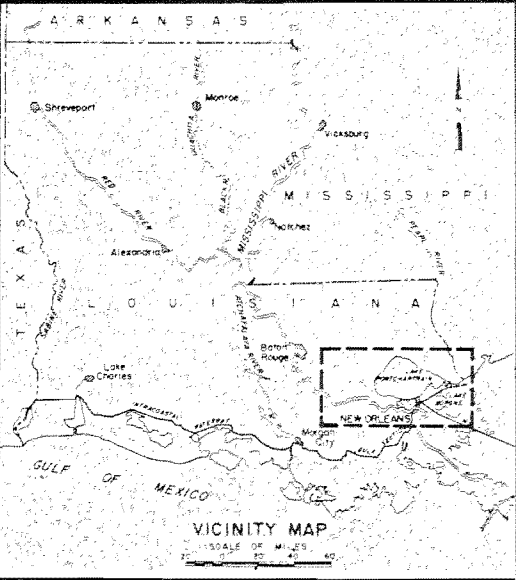






**LEGEND**

Brackish Marsh	Molsant Eagle Nest
Intermediate Marsh	White Kitchen Eagle Nest
Cypress Tupelo Swamp	Mitigation Sites Under Study
Grass Beds	



LAKE PONTCHARTRAIN, LOUISIANA, AND VICINITY HURRICANE PROTECTION PROJECT

**ENVIRONMENTAL RESOURCE MAP**

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

DATE: DECEMBER 1982 FILE NO: H-2-29706

