Scott Clark

mitigation plan 1987

FINAL

ENVIRONMENTAL STATEMENT

LAROSE TO GOLDEN MEADOW, LOUISIANA, HURRICANE PROTECTION
(FORMERLY LAROSE TO VICINITY OF GOLDEN MEADOW HURRICANE PROTECTION)

ASSOCIATED WATER FEATURE
BAYOU LAFOURCHE, LOUISIANA

Prepared by

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS, NEW ORLEANS, LOUISIANA

November 1973

LAROSE TO GOLDEN MEADOW, LOUISIANA, HURRICANE PROTECTION
(FORMERLY GRAND ISLE, LOUISIANA, AND VICINITY HURRICANE PROTECTION)

STATEMENT OF FINDINGS

1. I have reviewed and evaluated, in light of the overall public interest, the documents concerning the proposed action, as well as the stated views of other interested agencies and the concerned public, relative to the various practicable alternatives for providing hurricane flood protection along both banks of Bayou Lafourche from Larose to a point 2 miles south of Golden Meadow, Louisiana. The project will provide hurricane flood protection for the people and property located in an area of approximately 32,400 acres, including the towns of Larose, Cut Off, Galliano, Belle Amie, and Golden Meadow, Louisiana. All of the project area except 2,710 acres of marsh south of Yankee Canal has been previously leveed and drained by local interests. The major action of the project will consist of enlarging 43 miles of these existing encircling levees, constructing 4 miles of new levees, and providing facilities for intercepted drainage and navigation. The project will serve to increase the degree of protection from tidal flooding presently afforded by the locally constructed works.

2. Public Law 71, approved 15 June 1955, by the 1st Session of the 89th Congress, authorized a survey to be made of the eastern and southern seaboard of the United States with respect to hurricanes. Such a survey was made and an interim Survey Report, Grand Isle, Louisiana, and vicinity, was published by the US Army Engineer District, New Orleans, on 11 July 1963. The specific project, Larose to Golden Meadow, Louisiana, Hurricane Protection, was authorized by Public Law 298, 89th Congress, approved 27 October 1965. This authorization recommended that the following improvements be constructed to prevent hurricane tidal damage and loss of life: a levee approximately 36 miles in length along both banks of Bayou Lafourche, enlargement of 3 miles of existing levees at Golden Meadow, floodgates on Bayou Lafourche (in the bayou at Larose and in a bypass channel at the Golden Meadow end), 8 miles of low interior levees for intercepted drainage, and seven drainage structures. Local interests were to provide right-of-way without cost, bear 30 percent of the total cost, and operate and maintain the work when completed.

3. Except for the addition of 4 miles of necessary new levees and minor changes and refinements in engineering and design of the project features, the proposed plan is essentially the same as that included in the authorizing document.

4. A thorough study has been made of the project and the project area using many different techniques. Basic data were available for the study from surveys and studies made in connection with previous reports and other existing projects in the area. These data consisted of topographic maps and aerial photographs, field and geological surveys, construction drawings, hurricane damage survey reports, census reports, development planning reports and records of hurricane damages from newspapers, periodicals, miscellaneous reports, and US Weather Bureau files. Specific studies for the project were conducted after authorization and included field surveys, soil investigations, tidal hydraulic studies, studies of interior drainage, design studies for construction, cost estimates for works and relocations, and economic studies for evaluating justification for recommended works. These studies were conducted by professional personnel of the Corps of Engineers and are presented in the project design memorandum. In the environmental analysis, a comprehensive literature search was conducted and field trips were made by environmental personnel of the New Orleans District to determine and verify existing flora and fauna. Various historical references and the National Register of Historic Places were consulted. A professional archeologist visited the area and archeological periodicals and maps of archeological sites were consulted. Data accumulated in these and other studies are presented in the project Interim Survey Report, 11 July 1963; Design Memorandum No. 1, General Design, May 1972; Draft Environmental Statement, September 1972; and Final Environmental Statement, July 1973. All of these documents are available for examination by the public. Alternatives to the proposed action are discussed in the draft environmental statement and in the final environmental statement.

5. A public hearing was held at Morgan City, Louisiana, on 15 March 1956 to determine the views of local interests on hurricane protection for southern Louisiana. Numerous informal meetings have been held, both in this office and in the project area with members of the Lafourche Parish Police Jury, the Louisiana Department of Public Works, the South Louisiana Tidal Water Control Levee District, and other interested and affected groups. Letters of endorsement for the project have been received from the Lockport Rotary Club, Golden Meadow Lions Club, and the South Lafourche Jaycees. In 1967 letters requesting comments were sent to the US Department of Interior (Fish and Wildlife Service and Federal Water Pollution Control Administration) and to the Louisiana Wild Life and Fisheries Commission. None of these agencies offered any adverse comments on the project. In accordance with the National Environmental Policy Act, a draft environmental statement was circulated in September 1972 to Federal, state, and local agencies and to the public for comment. Comments were subsequently received from seven Federal agencies, three state agencies, and the National Wildlife Federation. These comments are incorporated in the final environmental statement.

6. The following alternatives for accomplishing the objectives of the authorized project were considered. In addition, the alternative of no action was evaluated.

a. Elevate buildings. Building codes could be adopted which would require the elevation of future construction to be above the anticipated height of tidal surge. Few existing buildings in the area presently incorporate this feature.

b. Increase structural stability of buildings. Adopt building codes to require all buildings to have adequate structural stability to withstand anticipated wave and water forces from hurricane tides.

c. Other levee alinements. Construct along levee alinements other than that of the proposed plan.

7. The possible consequences of all alternatives have been studied for environmental, social well-being, and economic effects, including regional and national economic development and engineering feasibility. The salient consideration bearing on my review was the severity of the flood threat to existing and early prospective development in the area. In evaluating the selected and other viable alternatives, I considered the following points pertinent:

a. Environmental considerations. I consider the various alternatives to be, on balance, environmentally less desirable than the proposed plan. The alternatives of elevating future buildings, and/or increasing their structural stability, will not provide protection to people presently residing or working within the area. Since the protected area has, to all intents and purposes, been previously defined by construction of levees by local interests, the alternative of selecting other levee alinements would involve serious environmental and economic implications. The no-action alternative would preserve the present flora and fauna of the 2,710 acres of marsh south of Yankee Canal and would mean that the residents would not have to cope with the waste material and pollution created by an accelerated rate of economic development. On the other hand, no action would leave the area and the development therein subject to recurrent hurricane flooding. I recognize that if the proposed plan is adopted, a total of 2,710 acres of viable marsh south of Yankee Canal will be leveed and drained. The loss of this marsh will impact unfavorably on estuarine productivity because the marsh acts as a nursery area for many species of fish, two species of shrimp, and the blue crab. Turbidity during construction will have a temporary and localized adverse effect on water quality and aquatic life. I am also aware that the project will likely induce increased population and economic development in the area and that both tend to be associated with environmental stress. The project

will, however, provide protection for oil tank leases which are a possible source of pollution when flooded. It will, moreover, tend to concentrate growth of the area within the levees and thus operate to preserve the land outside the levees in its present state.

b. Social well-being considerations. The alternatives of elevating and strengthening future construction would leave extensive existing development subject to severe damage. Raising residential buildings might present hardships to elderly or infirm people. Neither these alternatives nor the no-action plan would impact on the social well-being of the area as favorably as the selected plan. Removing the threat of flooding by constructing the proposed project will clearly enhance social well-being and community cohesiveness in the project area. Construction of the project will facilitate evacuation from Grand Isle and other exposed outlying communities when hurricanes impend. The protected area will serve as a haven for boats and barges in times of hurricanes.

c. Engineering considerations. In considering all alternatives, it is my judgment that the proposed plan is, from an engineering viewpoint, the most feasible and efficient method of achieving the objectives of the authorized project.

d. Economic considerations. Economic trends of growth and development indicate that the proposed action will improve employment opportunities and personal income, further enhancing the social well-being of the protected communities.

8. I find that the proposed action is based on thorough analysis and evaluation of various practicable alternative courses of action for achieving the stated objectives; that wherever adverse effects are found to be involved, they cannot be avoided by following reasonable alternative courses of action which would achieve the congressionally specified purposes; that where the proposed action has an adverse effect, this effect is either ameliorated or substantially outweighed by other considerations of public health and safety; that the recommended action is consonant with national policy, statutes, and administrative directives; and that, on balance, the total public interest should best be served by construction of the hurricane protection project.

Richard L. Hunt

12 Dec 73
DATE

RICHARD L. HUNT
Colonel, CE
District Engineer

SUBJECT: Larose to Golden Meadow, Louisiana, Hurricane Protection
(Formerly Grand Isle, Louisiana, and Vicinity Hurricane Protection)

I concur in the preceding statement of findings.

7 Feb '74
DATE

CHARLES C. NOBLE
Major General, USA
Division Engineer

I concur in the preceding Statement of Findings.

FOR THE CHIEF OF ENGINEERS:

4 April
(Date)

J. W. MORRIS
Major General, USA
Director of Civil Works

2 Nov 76

SUPPLEMENTAL STATEMENT OF FINDINGS

Section 404 Federal Water Pollution Control Act Amendments of 1972
(PL 92-500)
Larose to Golden Meadow Hurricane Protection Project

PART I - INTRODUCTION

As District Engineer it is my duty to review all Federal projects to be performed by the New Orleans District Corps of Engineers which involve the disposal of dredged or fill material in navigable waters. My responsibilities for such a review of dredged material are prescribed in final regulations (33 CFR 209.145) dated 22 July 1974 concerning the policies, practices, and procedures to be followed by all Corps of Engineers' installations in assessing a Federal project as described above. These regulations were developed pursuant to Sections 313 and 404 of the Federal Water Pollution Control Act (FWPCA) (33 U.S.C. 1323 & 1344) and Section 103(e) of the Marine Protection, Research and Sanctuaries Act of 1972. My review of discharge of dredged and fill material into navigable waters is also in accordance with final regulation published in Federal Register, Volume 40, No. 144 - Friday, 25 July 1975, which governs the issuance of Department of the Army permits for activities in navigable waters. A Corps project involving a discharge of dredged or fill material into navigable waters has to be evaluated in accordance with interim final guidelines outlined in Federal Register, Volume 40, No. 173 - Friday, 5 September 1975. These guidelines were developed by the Administrator, Environmental Protection Agency (EPA), in conjunction with the Secretary of the Army pursuant to Section 404(b) of the FWPCA. In compliance with the above regulation (5 September 1975) pursuant to Section 404(b) of the FWPCA, I submit this Supplemental Statement of Findings (SOF) to the original SOF concerning this project executed by Colonel E. R. Heiberg III, then District Engineer, New Orleans District, on 20 December 1974.

PART II
APPLICABILITY OF CORPS' REGULATORY RESPONSIBILITIES TO LAROSE TO GOLDEN MEADOW, HURRICANE PROTECTION PROJECT

The Corps of Engineers civil works projects which come under Section 404 of the FWPCA are regulated by 33 CFR 209.145 and in accordance with final regulations published in Federal Register, Volume 40, No. 173, Friday, 5 September 1975. A public notice was issued on 1 November 1974. No request for a public hearing was received. Objections were received only from the Fish and Wildlife Service of the US Department of the Interior and the National Marine Fisheries Service, US Department of Commerce. Generally, the objections were made on issues which should have been addressed during the project's formulation.

PART III
CONSTRUCTION ACTIVITIES ASSOCIATED WITH LAROSE TO GOLDEN MEADOW HURRICANE PROTECTION PROJECT WHICH INVOLVE THE DISPOSAL OF DREDGED OR FILL MATERIAL IN NAVIGABLE WATERS

At the time the public notice was issued on 1 November 1974, the local police jury was planning to construct a new levee in the marsh to provide the initial protection for the first mile of section C above Bully Canal (near Belle Amie, Louisiana) which would complete the non-Federal levee system on the west bank of Bayou Lafourche. The National Marine Fisheries Service had already objected to that portion of the hurricane protection project which coincides with the proposed parish levee on the grounds that the Corps of Engineers' environmental impact statement did not adequately address the area as wetlands. Based upon this objection, the Corps of Engineers did not issue a permit for the parish project.

PART IV
EVALUATION PURSUANT TO 33 CFR 209.145 AND EPA GUIDELINES PUBLISHED IN FEDERAL REGISTER, VOLUME 40, NO. 173 DATED 5 SEPTEMBER 1975

According to applicable regulations, Federal projects involving the disposal of dredged or fill material into navigable waters at a specified disposal site will be evaluated by application of EPA's guidelines of 5 September 1975 as developed by the Administrator, EPA, in conjunction with the Secretary of the Army pursuant to Section 404(b) of the FWPCA.

The effects of discharges of dredged or fill material on aquatic organisms and human uses of navigable waters may range from insignificant disruption to irreversible change at the disposal site. Environmental impact from dredged or fill material discharges can be divided into two main categories: (a) physical effects and (b) chemical-biological interactive effects.

A. Physical Effects.

(1) Destruction of wetlands. As the 2,750 acres within the levees are drained, they will cease to play their vital biological role as wetlands. Marsh vegetation, wildlife, and aquatic organisms (including valuable sport and commercial fish and shellfish) will be destroyed. Marsh vegetation will no longer contribute detritus to adjacent waters. The marsh-pond complex will no longer serve as a nursery for estuarine organisms. Therefore, the loss of this complex will be reflected in a reduction in aquatic productivity, including commercial fisheries. Waterfowl will no longer be able to utilize the marshes as nesting and wintering habitat. The area available for trapping will be reduced.

(2) Effects on water column. Temporary turbidity engendered by the levee building operation will reduce light transmission in adjacent waters, thereby temporarily reducing plankton populations. Fish will be able to avoid such turbidity at will.

(3) Effects on benthos. The benthos of the wetlands to be drained will be destroyed as the area dries out. Benthic organisms in the area to be dredged for levee construction will also be destroyed. The borrow pits formed by this action will become populated by benthic organisms within approximately 1 year, but this canal system will not be connected with the wetlands outside the levees.

B. Chemical-Biological Interactive Effects. Evaluation of chemical-biological interactive effects is not required since materials to be dredged are exactly the same as the substrate on which it will be deposited.

PART V - WATER QUALITY

Analysis of sediment and water samples taken in May 1976 during construction of portions of the project revealed that the water quality in the project area is good but the material involved in the construction of the project was found to be laden with high concentrations of organics and heavy metals. Only one water sample had a mercury concentration exceeding EPA's proposed water quality criteria for freshwater aquatic life. All other water quality parameters tested were within EPA's criteria. The bottom sediments tested, however, contained several heavy metals and organics that exceeded EPA Region VI bottom sediment criteria: arsenic, zinc, volatile solids, chemical oxygen demand, and total Kjeldahl nitrogen. Other water quality parameters tested from a mixture of bottom sediment and water (Standard Elutriate Test) showed that the construction of the project will cause minor water quality contamination as all elutriates tested for mercury exceeded EPA proposed water quality mercury criteria for freshwater aquatic life.

PART VI
CONSIDERATIONS RELATING TO DEGRADATION OF WATER USES AT PROPOSED DISPOSAL SITES

A. Municipal Water Supplies. No disposal will occur in the proximity of a public water supply intake.

B. Shellfish. Although the wetlands to be drained do not contain concentrated shellfish populations, they do support limited populations of typical brackish and freshwater mollusks and gastropods. The wetlands in question serve as a nursery area for such shellfish as blue crabs, brown shrimp, and white shrimp.

C. Fisheries. The marsh-pond complex serves as a spawning/nursery/feeding area for sport and commercial fish and shellfish at the present time. After leveeing and draining, it will be inaccessible to aquatic organisms and therefore unable to fulfill these functions.

D. Wildlife. Habitat for wetland-associated wildlife will be destroyed inside the leveed areas. Commercial trapping activities will be curtailed. Animals that are able to move to adjacent wetlands will be subjected to unnecessary inter- and intraspecific competition and thereby be reduced in numbers.

E. Recreation Activities. The marsh ponds are utilized for sport fishing, crabbing, and waterfowl hunting. Draining these ponds will make them unavailable for these types of recreation.

F. Threatened or Endangered Species. The area in question provides habitat for such endangered species as the American alligator, brown pelican, peregrine falcon, and bald eagle. Destruction of the wetlands inside the leveed area will not jeopardize the continued existence of these species or modify habitat critical to these animals.

G. Effects on Benthos. The benthos of the wetlands to be drained will be destroyed as the area dries out. Benthic organisms in the area to be dredged for levee construction will also be destroyed. The borrow pits formed by this action will become populated by benthic organisms within approximately 1 year, but this canal system will not be connected with the wetlands outside the levees.

H. Destruction of Wetlands. As the 2,750 acres within the levees are drained, they will cease to play their vital biological role as wetlands. Marsh vegetation, wildlife, and aquatic organisms (including valuable sport and commercial fish and shellfish) will be destroyed. Marsh vegetation will no longer contribute detritus to adjacent waters. The marsh-pond complex will no longer serve as a nursery for estuarine organisms. Therefore, the loss of this complex will be reflected in a reduction in aquatic productivity, including commercial fisheries. Waterfowl will no longer be able to utilize the marshes as nesting and wintering habitat. The area available for trapping will be reduced.

I. Submerged Vegetation. Submerged vegetation, such as coontail and widgeongrass, is common in the marsh ponds. This vegetation will be destroyed when the ponds are drained and will no longer contribute detritus to the aquatic ecosystem or serve as food for waterfowl or other organisms.

PART VII
COMMENTS RECEIVED SUBSEQUENT TO SUBMITTAL OF STATEMENT OF FINDINGS, LAROSE TO GOLDEN MEADOW HURRICANE PROTECTION PROJECT, 20 DECEMBER 1974

In accordance with Federal regulations, title 33 CFR 209.145, a public notice for the project was issued on 1 November 1974 with comments required to be submitted on or before 3 December 1974. As a result of this public notice, we received comments from Fish and Wildlife Service, US Department of the Interior, and National Marine Fisheries Service, US Department of Commerce. These comments were covered in the original Statement of Findings

executed by Colonel Heiberg, in which it was stated that further coordination was required as a result of comments pertaining to the unleveed portions of sections A and C. This coordination has now been accomplished. Subsequent comments received from the National Marine Fisheries Service substantially coincided with the earlier comments of the US Fish and Wildlife Service.

In summary, both the US Fish and Wildlife Service and the National Marine Fisheries Service have requested the following:

A. That the levee south of Yankee Canal and east of Bayou Lafourche, section A east, be relocated to the natural levee along Bayou Lafourche or immediately adjacent thereto. They further recommended that the portion of levee in section C, associated with the undrained wetlands near Belle Amie, be relocated as close as possible to the nonwetlands adjacent to Belle Amie and should only protect inhabited dwellings and other existing structures. (See the inclosed project map.)

B. If the foregoing realinements could not be accomplished, that the installation of water control structures be incorporated into the project design for the levees for these segments, to permit continued tidal interchange in the wetlands included within the leveed areas, except during hurricanes.

C. If it is impracticable to accomplish fully either (a) or (b) above, a mitigation plan intended to provide permanent acquisition of lands for intensive management in lieu of those committed to project construction, should be developed.

The above recommendations were reviewed, and engineering and economic analyses were made. The results of these analyses are summarized below:

A. I have considered the various recommendations to realine the proposed levees onto, or near, the natural ridge of Bayou Lafourche in both section A east and in the unleveed portion of section C southwest of Belle Amie. In section A east an alternate levee alinement, as close to the bayou as feasible and which would reduce the commitment of wetlands by 800 acres, has been selected and design efforts have been initiated for this area. However, in section C, due to the increased project costs, the difficulties which would be incurred in the acquisition of rights-of-way, and the resulting probable delays caused by these acquisitions, I do not consider that the alternate alinement, as recommended, for the portion of levee southwest of Belle Amie is feasible.

B. The proposal for use of drainage structures in both of the presently unleveed areas has been considered. These drainage structures would negate the function of the pumping stations as planned by the assuring agency. Local sponsors plan to construct these pumping stations, at a considerable increased cost to themselves, in order to provide improved drainage consistent with the planned use of the area.

C. Due consideration was given to the above recommendations; however, after economic, environmental, and engineering analyses were concluded, it was determined that the recommended mitigation plan is the best overall proposal for those remaining wetlands to be committed by the current project alinement. The purchase of wetlands for mitigation purposes will require separate approval by Congress; therefore, a special mitigation report is being prepared by this office for submission to the Congress in June 1979.

PART VIII - FINDINGS

As District Engineer, I have evaluated the two unleveed reaches of the Larose to Golden Meadow hurricane protection project in regard to its environmental effects on the project area. My evaluation of these areas has taken into consideration the environmental impact statement prepared in November 1973, a review of the original project planning process, a review of the original Statement of Findings concerning this project prepared by my predecessor, and a review of the related correspondence concerning this project. In addition, I have reviewed revised reports on this project submitted by the US Fish and Wildlife Service. I have given due consideration to all comments in these reports and those received from the National Marine Fisheries Service, as well as available data and recommendations by New Orleans District personnel. Based upon the above, my findings are as follows:

A. All adverse effects cannot be avoided by following any other reasonable alternative course of action which would achieve the authorized purpose.

B. The alternative alinement as proposed for the reach of unleveed portion south of Yankee Canal and east of Bayou Lafourche, in addition to the alinement for the area associated with the undrained wetlands near Belle Amie, has some adverse effects; however, these effects are substantially outweighed by the fact that social well-being of the local inhabitants will be enhanced by benefits to be realized from the project purposes, and that local, regional, and national citizenry will share in the benefits generated by the project.

C. The mitigation plan, as proposed by the Fish and Wildlife Service, would provide intensive wildlife management and would serve to mitigate the project damages to wildlife resources in these areas.

D. The proposed action is consonant with national policy, statutes, and administrative directives.

E. On balance, the total public interest will be best served by construction and maintenance of these two reaches of the Larose to Golden Meadow hurricane protection project.

2 NOV 1976
Date

EARLY J. RUSH III
Colonel, CE
District Engineer

1 Incl
1. Project map

LAROSE TO GOLDEN MEADOW, LOUISIANA, HURRICANE PROTECTION
(FORMERLY GRAND ISLE, LOUISIANA, AND VICINITY HURRICANE PROTECTION)

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LAROSE TO GOLDEN MEADOW, LOUISIANA, HURRICANE PROTECTION
(FORMERLY GRAND ISLE, LOUISIANA, AND VICINITY HURRICANE PROTECTION)

( ) Draft (X) Final Environmental Statement

Responsible Office: U. S. Army Engineer District, New Orleans
New Orleans, Louisiana

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action: Enlarging of about 43 miles of exterior levees together with associated borrow pits, drainage structures, and other appurtenances to provide protection from hurricane floods along both banks of Bayou Lafourche from Larose to a point 2 miles south of Golden Meadow, Louisiana. This project is located entirely in Lafourche Parish, Louisiana.

3. a. Environmental Impacts: The proposed project will provide hurricane flood protection for the people and property of an approximate 32,400-acre area, including the towns of Larose, Cut Off, Galliano, Belle Amie, and Golden Meadow. The increased protection to life and property will stimulate economic activity in the project area. It will also facilitate evacuation from Grand Isle and other exposed outlying areas when hurricanes impend. The project will result in a haven for boats and barges in times of hurricanes. The project will also provide protection for oil tanks which are a possible source of pollution when flooded.

b. Adverse Environmental Effects: A total of 2,710 acres of viable marsh south of Yankee Canal will be leveed and drained and the loss of this marsh will impact unfavorably on estuarine production. Temporary turbidity resulting from construction will produce an unavoidable adverse impact on fish, wildlife, water quality, and recreational resources of contiguous water areas. This effect will be temporary and localized. The project will induce increased population growth and economic development; both of these tend to be associated with environmental stress.

4. Alternatives: The alternatives considered include:

a. Adopting building codes elevating all buildings above anticipated tidal surge heights.

b. Require all buildings to have the structural stability to withstand anticipated water and wave forces.

c. Select some other levee alinement.

d. Implementation of a "no action" plan to preserve the environmental setting.

5. Comments Received:

U. S. Department of Agriculture, Soil Conservation Service
U. S. Department of Commerce, Deputy Assistant Secretary for Environmental Affairs
U. S. Department of Health, Education, and Welfare
U. S. Department of the Interior, National Park Service
U. S. Department of the Interior, Southwest Region
U. S. Department of Transportation, Federal Highway Administration
Environmental Protection Agency, Regional Administration
Louisiana Department of Highways
Louisiana Department of Public Works
Louisiana Wild Life and Fisheries Commission
National Wildlife Federation

6. Draft statement to CEQ October 3 1972 .

Final statement to CEQ _____.

LAROSE TO GOLDEN MEADOW, LOUISIANA, HURRICANE PROTECTION
(FORMERLY GRAND ISLE, LOUISIANA, AND VICINITY HURRICANE PROTECTION

FINAL
ENVIRONMENTAL STATEMENT

SECTION I--PROJECT DESCRIPTION

1. AUTHORIZATION.

The Larose to Golden Meadow, Louisiana, hurricane protection project was authorized by the Flood Control Act of 27 October 1965, House Document No. 184, 89th Congress, Public Law 89-298.

2. DESCRIPTION OF PROJECT.

a. Levees. This project is to be located along both banks of Bayou Lafourche from Larose, Louisiana, to 2 miles south of Golden Meadow, Louisiana, in Lafourche Parish. The existing loop levee which will be enlarged into a hurricane protection levee will extend approximately 21 miles on the west bank of Bayou Lafourche, including about 3 miles of existing levee at Golden Meadow and 17 miles on the east bank of the bayou. About 5 miles of levee on the east side south of Yankee Canal will be new levee. The hurricane levee system will have a net grade of elevation 13.0 feet m.s.l. (mean sea level) at the south end and will vary to elevation 8.5 feet m.s.l. at the north end. Borrow material for levee construction will be taken from the area immediately adjacent to the proposed levee alinement (see plate III). Enlargement of the levee will be accomplished by dragline dredge.

b. Floodwalls. Floodwalls are proposed where levee construction is not possible because of the congested nature of improvements and limited available rights-of-way and at transitions from levees to road gates or floodgates. The types of floodwalls will be inverted T- or I-wall as dictated by their function and structural requirements.

c. Navigation. Navigation access into the protected waterway area will be provided by two floodgates to be constructed across Bayou Lafourche--one at the north end and one at the south end of the protected area. Each gate will have a navigation width of 56 feet. The sill elevations will be -10.0 feet m.l.g. (mean

low gulf)[1] and -13.0 feet m.l.g. at the Larose and Golden Meadow gates, respectively.

d. Land access. Land access into the protected area at the north end will be provided by Louisiana Highways 1 and 308[2] without modification, since the finished grades of both roadways are above the predicted flood level at that end.

e. Highway modification. At the south end, Highway 1 will be raised to elevation 5.0 feet above m.s.l. and a 44-foot wide gap will be provided in the levee through which the road will pass. A steel roller gate will be provided to close this gap during hurricanes. The gap will not be closed until the floodwaters approach elevation 5.0 feet m.s.l., at which time Highway 1 south of Golden Meadow will be impassable for ordinary vehicular traffic. However, to provide for possible emergencies, a shell-surfaced bypass ramp will provide access over the levee on the west side of the bayou. Six road crossings will be constructed: one to Clovelly Farms, four crossing the Golden Meadow Ring levee, and one crossing the west levee just north of Golden Meadow (see plate III). The crossings will grade crossings of the levee in conjunction with bridges across the borrow areas.

f. Roller gates. Two overhead roller type road gates will also be provided at gaps in the levee for access to oil installations west of the city of Golden Meadow. Both gates will have 16 feet of overhead clearance. The northernmost gate will be 28 feet wide with a skewed crossing. The other gate will be 20 feet wide.

g. Drainage. A drainage channel and eight culvert structures will provide gravity drainage of the protected area. Flap gates and sluice gates will be provided to prevent a backflow into the project area during periods of high water on the exterior of the inclosure. Local interests have expressed their desire to have pumping stations installed as part of the hurricane protection project. The types of pumping stations installed by local interests subsequent to completion of the survey report are not adaptable to the hurricane protection project. Authority to construct pumping stations as part of the hurricane protection project does not exist. However, it is possible that local interests could be given credit toward developing a pumping system provided that the pumping system fulfills the drainage requirements established for the gravity

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[1] m.s.l. (mean sea level) = 0.78 m.l.g. (mean low gulf)

[2] At the present time the bridge across the GIWW on 308 is out. A new high level bridge is being planned.

system. The amount of credit that could be allowed to local interests would be equal to the Federal costs of the gravity system. An existing pumping station at Golden Meadow now provides adequate drainage from the existing ring levee that protects the town, however, some alteration of the discharge pipelines will be required.

h. Relocations. Construction of the protection system will require the relocation of 14 overhead powerlines, 36 known oil and gas pipelines varying from 1 through 20 inches in diameter, local roadway relocations (ramps over the proposed levees), a permanent emergency road bypass at Louisiana Highway 1 road gate, and a temporary road location at each of the two roller gates west of Golden Meadow.

i. Towns and population. This project will provide protection from hurricane floods for the people and property located in the 32,400-acre project area. The towns of Larose, Cut Off, Belle Amie, Galliano, and Golden Meadow will all be inclosed by the protection system. Approximately 17,200 people live within the project area according to the 1970 census.

j. Benefit-cost ratio. The benefit-cost ratio for the project as presented in the approved design memorandum, with costs and benefits revised to 1 July 1973, is 3.6 to 1.

SECTION II--ENVIRONMENTAL SETTING WITHOUT THE PROJECT

1. PHYSIOGRAPHY.

a. General features. The project area is situated on the deltaic plain of the Mississippi River, which is a region of extremely low relief. Specifically, the area is situated on an ancient lobate delta of the Mississippi River known as the Lafourche delta. Principal physiographic features of the area are natural levee ridges which mark the position of ancient courses of the Mississippi River and its distributary channels and marshlands that lie between the natural levee ridges. Elevations of the crests of the natural levee ridges range from about 8.0 feet m.s.l. at the northern edge of the project area to about 3.0 feet m.s.l. at the southern extremity. The marshlands are generally at elevations 0.0 to 1.0 feet m.s.l.

b. Soils. The project area was created during the advance of the Lafourche delta between 1,800 and 1,000 years ago. As this delta built outward, complex formations of clay, silts, and sand were deposited along and at the mouths of the numerous distributary channels, and marsh deposits accumulated at the surface in the low areas between the channels. The present Bayou Lafourche built its natural levees during this period of activity as a natural distributary of the present Mississippi River. A predominance of sand and silt is found in the natural levees of the old channels. The subsurface of the marshlands consists of peat and soft organic clays underlain by a deep stratum of clay.

c. Subsidence. The project area is situated near the central portion of the axis of the Gulf Coast Geosyncline where downwarping and consolidation of the Quaternary sediments have been occurring concurrently with deposition of these sediments since the end of the Tertiary period. The present rate of subsidence is estimated to be slightly less than 1 foot per century.

2. CLIMATOLOGY.

The climate of this area is semitropical in nature. It is influenced by the proximity of the Gulf of Mexico with water temperatures along the Louisiana shore averaging 57° F. in February to 83° F. in August. Southerly winds produce afternoon thundershowers in summer while winter storms are of the frontal type. The monthly average temperatures of this area range from 82° F. in July and August to 57° F. in January. The maximum recorded

temperature of 104° F. occurred at Houma, Louisiana, on 22 June 1915 and a minimum of 5° F. was recorded on 13 February 1899 at the same location. Precipitation is generally heavy with greatest falls recorded during the summer months due to frequent afternoon thundershowers. The average annual rainfall for the area is 62.8 inches with monthly averages ranging from 3.5 inches in October to 7.5 inches in July.[1]

3. HYDROLOGY.

a. Tides. Normal tide along the Louisiana coast is diurnal and has an average range of approximately 1 foot, with a maximum range of about 1.5 feet. Normal tidal effects are observed as far inland as Golden Meadow in the bayou. Storm and hurricane tides have reached elevations in excess of 10 feet on the coast, and strong northerly winter winds have depressed gulf levels as much as 2 feet below m.l.g.

b. Closure of Bayou Lafourche. Bayou Lafourche, a former distributary of the Mississippi River, leaves the parent stream at Donaldsonville, Louisiana, and has a length of about 107 miles upon reaching the Gulf of Mexico at Belle Pass. Because of the natural ridges along its banks, it drains only about 300 square miles of adjoining land. After its permanent closure and separation from the Mississippi River at Donaldsonville in 1904, the major source of inflow into the bayou became rainfall runoff. A pumping station at Donaldsonville diverts water from the Mississippi River to the bayou at an average rate of 260 c.f.s. (cubic feet per second).

c. Local levees. Local interests constructed low levees generally along the same alinement as that of the authorized hurricane protection levees. These levees were constructed for the development of agricultural lands, not for hurricane protection. Six pumping stations consisting of low-lift pumps and gravity inflow provide the existing drainage in the project area.

4. BOTANY.[2] (See plate IV for Vegetation Map.)

a. Introduction. The wooded parts of the project area consist mainly of bottomland hardwoods with cypress-tupelo gum

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[1]National Weather Service "Climatological Data for Louisiana: pamphlets.

[2]Species names are taken from Botanical Appendixes, U. S. Corps of Engineers, New Orleans District, January 1973.

swamps in low areas. Much of the area has been drained and consists of weedy pastures dotted with eastern baccharis. The marshes within the area vary from brackish in the southern part to fresh in the northern. Marshes outside the area are brackish to intermediate.

b. Woods. Approximately 17 percent of the area is wooded. These wooded areas are found along the natural ridge of the bayou in the northwest corner of the project area as far south as Raccoon Bayou, about 3 miles south of Cut Off, and along a ridge extending from Larose to Galliano on the east side of the bayou. The overstory of the woods is composed of red maple, hackberry, sweetgum, live oak, black willow, water oak, Nuttall's oak, Chinese tallow tree, American elm, American sycamore, and chinaberry. The understory of the woods consists of palmetto, poison ivy, elderberry, Virginia creeper, buttonbush, swamp bay, beech fern, lizard's tail, and daisy fleabane. In wetter areas baldcypress, water locust, and tupelogum are common. The wooded areas are classified as shrub in the paragraph on Land Use, Section II, part 7, paragraph f.

c. Shrub and pasture. Nearly half of the area is shrub and pasture; this includes most of the west side of the project area south of the woods and the area on the east side of the bayou north of Yankee Canal which is not wooded or cultivated. Common plants in the pastures and along the roadside are the daisy fleabane, dewberry, butterweed, yellow dock, bur clover, cranesbill, spiny thistle, common vetch, and white clover. Other plants found in these areas are wild chervil, bedstraw, buttercups, black medic, common chickweed, broom sedge, henbit, plaintain, yellow flag, reverse clover, and hedge nettle. Higher areas or canal banks have shrub on them consisting mainly of eastern baccharus, roseau, black willow, and dewberry. Other plants found are prickly ash, giant ragweed, cranesbill, and common vetch.

d. Marsh. The largest amount of marsh in the project area is the 2,710 acres south of Yankee Canal and east of the bayou. This marsh has never been leveed and is basically brackish with the major species being oystergrass, salt grass, and wiregrass. Scattered patches of marsh are found in other parts of the area, but most of the original marsh has been drained by local interests since the construction of the levees in the 1960's. Toward the south end of the area the isolated marsh is of the intermediate to brackish type with wiregrass dominant and oystergrass, salt grass, water hyssop, soft rush, spike rush, and alligatorweed common. The latter three species are found near the ridges where the water is less saline. Scattered patches of fresh marsh are found in the central and northern parts of the project area. Species found in these marshes are coontail, narrow-leaved cat-tail, water hyacinth, alligatorweed, bulltongue, soft rush, pickerel weed, spike rush, duckweed, water pennywort, water fern, giant cutgrass,

and great bulrush, Walter's millet, pink hibiscus, Cyperus, camphorweed, giant foxtail, and swamp lily. Outside the project area, the marsh to the west is brackish as far north as Galliano and intermediate to fresh northward to LA 24. On the east side of the bayou brackish marsh is found outside the project area up to Golden Meadow. Intermediate to fresh marshes lie north of this.

e. Lower plants. Several species of benthic algae are found in the marsh; Enteromorpha, Ectocarpus, and Vaucheria are common along the banks of waterways while Ulva lactuca is occasionally found there. Ulvella, Ulothrix, Cladophora, and Rhizoclonium are found in quiet marsh pools. Blue green algae such as Lyngbya, Oscellatoria princeps, and Spirulina are also found in mats in the marsh. Other species of algae are epiphytic on oystergrass stems such as Bostrychia, Polysiphonia, Chaetomorpha, and the diatoms, Amphora, Cocconeis, Melosira, Nitzchia, and Denticula. Common generae of phytoplankton include Ceratium, Merismopedia, Actinophychus, Biddulphia, Chaetoceros, Coscinodiscus, and Dinophysis (Day et al. 1973). Fungi found in the brackish marsh include Fusarium, Phoma, and Nigrospora. Pichia and Kluveromyces are two species of yeast found in the marsh. Bacteria found in marsh sediment include Bacillus and Clostridium. Micrococcus and Bacillus are found on oystergrass stems and Vibrio, Pseudomonas, and Achromobacterium are found in the water (Day et al. 1973).

f. Value of marsh. The marshes south of Yankee Canal in the project area and the marshes and estuaries surrounding the area are extremely valuable. Marshes and estuaries are among the most productive natural ecosystems in the world.[1] There are three primary production units, the oystergrass, the benthic algae, and the phytoplankton. These occupy different zones which allow nutrients and light to be used effectively. The marsh has an abundant supply of nutrients which are turned over rapidly. Moderate temperatures allow primary producers to make organic matter all through the year. The tide carries nutrients and detritus (mostly decomposed oystergrass) in and out of the marsh so they can be utilized by other organisms in the marsh and in the adjacent open waters. The marsh is a valuable nursery area for brown shrimp, white shrimp, blue crabs, oysters, and menhaden. The livelihood of many residents along Bayou Lafourche is dependent on the first four species.

5. ZOOLOGY.

[1]The following information on marsh productivity is from Schelske and Odom (1962).

a. Invertebrates of the marsh.[1] The brackish to intermediate marshes support a large population of invertebrates. The most common animals in the submerged sediments are nematodes; harpacticoid copepods, and amphipods are also very common. Other benthic invertebrates are foraminifera, ostracods, bloodworm larvae, and polychaetes. The most common organisms in the marsh soil are nematodes, polychaetes, and oligochaetes; ribbed mussels, ciliate protozoans, and foraminifera are also found. There are many organisms living among or on the marsh grasses such as fiddler crabs, square-backed crabs, marsh periwinkles, smooth periwinkles, and Melampus snails.

b. Zooplankton.[2] The most common zooplankters in the brackish waters of the project area are copepods (Acartia tonsa, Labidocera aestiva, Tremora tremora), chaetognath larvae, and ctenophores. Cladocera, ostracods, other copepods, amphipods, urochordates, and cumaceans are also found. Zooplankton found in the fresher waters of the area include protozoans, cladocera, copepods, ostracods, amphipods, and rotifers.

c. Macroscopic invertebrates.[3] Macroscopic invertebrates found in brackish waters in the project area include blue crabs, mantis shrimp, brown shrimp, white shrimp, barnacles, and dragonfly larvae. The fresher waters have river shrimp, grass shrimp, crayfish, water scorpions, giant waterbugs, predaceous diving beetles, ramshorn snails, stonefly larvae, water boatmen, bloodworms, dragonfly larvae, damselfly larvae, mayfly larvae, oligochaetes, flatworms, leeches, bryozoans, caddis fly larvae, and mosquito larvae.

d. Flying invertebrates. Flying invertebrates in the project area include grasshoppers, dragonflies, damselflies, stoneflies, mayflies, caddis flies, and mosquitoes, bees, gnats, and midges.

e. Soil invertebrates. Invertebrates found in the soil include nematodes, sow bugs, earthworms, and numerous others.

f. Freshwater fish.[4] Fish in the fresher parts of the project area include several minnows that inhabit the shallows such as:

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[1]From Day 1973.

[2]From Day 1973 and Cooperative Gulf of Mexico Estuarine Inventory Study. 1971.

[3]From Day and Pennak 1953, Marlow 1959, Penn 1959, Bick 1947, and Hedgepeth 1936.

[4]Fish are those listed from Day (1973), Fox and Mock (1968), and from personal observations.

rainwater killifish, sailfin molly, mosquito fish, least killifish, and sheepshead minnow. In the deeper waters one finds the following sport and commercial fish: largemouth bass, crappie, blue catfish, channel catfish, freshwater drum, buffalo fish, bluefill, spotted sunfish, redear sunfish, orange-spotted sunfish, spotted gar, longnose gar, and alligator gar.

g. Brackish water fish. In the more brackish waters in and adjacent to the project area one finds the following sports and commercial fish: spotted seatrout, southern flounder, sheepshead, red and black drum, Atlantic croaker, spot, largescale menhaden, striped mullet, gafftopsail catfish, silver perch, southern kingfish, Atlantic spadefish, bay wiff, fringed flounder, blackcheek tonguefish, Atlantic cutlass fish, sand seatrout, and inshore lizard fish. Fish commonly found in brackish water in or near the project area are the ladyfish, gulf killifish, Atlantic bumper, leatherjacket, lookdown, banded drum, rough silverside, tidewater silverside, and southern puffer. Other less common brackish water fish include the skipjack herring, diamond killifish, gulf killifish, longnose killifish, marsh killifish, saltmarsh top minnow, pinfish, darter goby, sharptail goby, naked goby, lined sole, Atlantic needlefish, southern stingray, Atlantic thread herring, banded killifish, southern stargazer, harvest fish, skillet fish, and butter fish.

h. Amphibians.[1] Some salamanders and toads in the project area are partly terrestrial, living near water but spending most of their time on land: the spotted salamander, small-mouthed salamander, marbled salamander, mole salamander, eastern spadefoot toad, East Texas toad, and Gulf Coast toad. Three salamanders in the area are usually found in or near canals or bayous: Gulf Coast water dog, western lesser siren, and central dusky salamander. Amphibians found mainly in marshes are the central newt, dwarf salamander, eastern narrowmouth toad, upland chorus frog, bronze frog, and southern leopard frog. Some are found in all types of wet areas: the three-toed amphiuma, northern cricket frog, bullfrog, and pig frog. Some frogs are arboreal such as the spring peeper, green treefrog, eastern gray treefrog and squirrel treefrog.

i. Reptiles.[1] Most turtles in the project area are associated with water except the Gulf Coast box turtle, which is mainly terrestrial. Turtles inhabiting lakes and marshes include the common snapping turtle, stinkpot, Mississippi map turtle, western chicken turtle, and Mississippi diamondback terrapin. The alligator snapping turtle, razorbacked mud turtle, and Mississippi mud turtle

[1]Distribution from Conant (1958), names from Keiser and Wilson (1969).

are found in marshes, canals, and bayous. The Mississippi map turtle, Mobile cooter, smooth softshell turtle, the Gulf Coast softshell turtle are usually associated with canals and bayous. Some turtles are found in all types of aquatic habitats such as the southern painted turtle, the Mississippi slider, and the red-eared turtle. The American alligator, which is on the U.S.D.I. endangered species list, occurs in the project area, usually associated with marshes, canals, and bayous. Some reptiles found in the project area are partly arboreal such as the green anole, southern fence lizard, and broad-headed skink. Others burrow most of the time such as the scarlet snake and rough earth snake. "Water" snakes are common in the marshes and canals. These include the broad-banded water snake, gulf salt marsh snake, yellow-bellied water snake, Graham's water snake, diamond-backed water snake, green water snake, and glossy water snake. Other snakes are also common on these wet areas such as the western ribbon snake, western mud snake, southern copperhead, western cottonmouth, western pygmy rattlesnake, and canebrake rattlesnake. Some reptiles inhabit the fields and shrub such as the western slender glass lizard, six-lined race runner, eastern glass lizard, western earth snake, eastern longnose snake, Mississippi ring-necked snake, and eastern yellow-bellied racer. The following reptiles are usually to be found in woodland areas: ground shink, northern red-bellied snake, corn snake, and five-lined shink. Snakes that are found in nearly all habitats in the project area are the midland brown snake, eastern garter snake, eastern coachwhip, gray rat snake, speckled kingsnake, Louisiana milk snake, and Texas coral snake.

j. Water birds.[1] Many species of birds are found over open water in or near the project area. The lesser scaup is very abundant and the ring-billed gull is abundant. Game birds commonly found on water include the following species: American coot, American pintail, American widgeon, blue-winged teal, canvasback, gadwall, green-winged teal, mallard, redhead, and shoveler. The belted kingfisher, Forester's fern, and laughing gull are also common over water. The herring gull, horned grebe, and pied-billed grebe are frequently found near water. The brown pelican, an endangered species nests on Grand Terre near the project area.

k. Marsh birds. The marsh is the habitat of several species. The boat-tailed grackle, common grackle, and tree swallow are very abundant in the marsh. Species that are abundant in the marsh include the water pipet, common snipe, common egret, snowy egret, Louisiana heron, and swamp sparrow. Common birds of the marsh

[1]Bird species are from 1969 and 1970 Christmas counts and personal observation.

are the white ibis, white-faced ibis, brown-headed cowbird, greater yellowlegs, green heron, little blue heron, long and short-billed marsh wrens, and marsh hawk. Birds frequently found in the marsh are the black-necked stilt, great blue heron, and lesser yellowlegs. Clapper rails and common gallinules are seen occasionally.

l. Field birds. Several species are found in the fields. The American robin, cardinal, cattle egret, eastern meadowlark, mourning dove, and savannah sparrow are abundant. Common inhabitants of the fields include the American goldfinch, chimney swift, eastern bluebird, eastern kingbird, and loggerhead shrike. The red tailed hawk, red shouldered hawk, and sparrow hawk are frequently seen in the fields. Near human habitations one commonly sees house sparrows, house wrens, and occasionally a barn owl.

m. Shrub birds. The shrubby parts of the project area provide a habitat for many small birds. The white-throated sparrow is abundant; the catbird, rufous-sided towhee, and song sparrow are common; and the white-crowned sparrow and fur sparrow are frequent.

n. Wood birds. Many species inhabit the wooded areas. Common woodland species are the yellowthroat, blue-gray gnatcatcher, bluejay, brown thrasher, cardinal, Carolina chickadee, downy woodpecker, golden crested kinglet, hairy woodpecker, myrtle warbler, orange-crowned warbler, red-bellied woodpecker, ruby-crowned kinglet, tufted titmouse, yellow-bellied sapsucker, and yellow-shafted flicker. Several species are seen frequently such as the cedar waxwing, eastern phoebe, and white-eyed virio. The barred owl, great horned owl, and screech owl are occasionally seen.

o. Wide ranging birds. Some species range over the whole project area. The killdeer and red-winged blackbird are very abundant; the common crow, fish crows, mockingbird, rusty blackbird, and starling are abundant. The chipping sparrow, common nighthawk, and turkey vulture are seen commonly. The bald eagle, an endangered species, has been reported in the vicinity of the project area.

p. Mammals.[1] Many mammals are found in the woods such as the eastern pipestrel, the red, seminole, evening, and Florida yellow-tail bats, the nine-banded armadillo, southern flying squirrel, and cotton mouse. Some game mammals found in the woods are the gray and fox squirrels, white-tailed deer, and eastern cottontail.

[1]Species are from Lowry 1943 and 1936.

Other mammals are found in both woods and shrub such as the striped and spotted skunk and white-footed and fulvous harvest mice. The opossum is found in the wood fields and brush. The eastern mole and southeastern myotis are found in or near the fields. The least shrew, eastern harvest mouse, and hispid cotton rat are found in fields and marsh. Many mammals live in the marsh such as the bobcat, marsh rice rat, eastern wood rat, and swamp rabbit. Furbearers present in the marshes and harvested commercially include nutria, mink, otter, and muskrat. Some animals occupy all types of habitat in the area such as the short-tailed shrew, long-tailed weasel, and free-tailed bat. The following rodents are found mainly in buildings: the harvest mouse, Norway rat, and black rat.

6. ARCHEOLOGICAL/HISTORICAL/CULTURAL ELEMENTS.

a. Archeological elements.

(1) Sites within the project area. An archeological survey was conducted by personnel of the Louisiana State Museum of Anthropology. An aerial reconnaissance of the project area was flown and no new archeological sites were discovered. The one known site (LF1) was visited on foot. It is an Indian site east of Cut Off over 1/2 mile within the levee alinement so it will not be disturbed by the proposed construction. This site originally consisted of two conical mounds, the first 6 feet high, and the second 4 feet high. The first site has been destroyed and the second drastically disturbed by plowing. The site was apparently occupied during the Plaquemine period, and the following pottery types were found: Fatherland Incised, Fort Walton, Manchac Incised, Moundville, and Evangeline Interior Incised.

(2) Sites near the project area. Other sites exist near the project area; most are of the Plaquemine period and contain the following types of pottery: Fatherland Incised, Moundville, Evangeline Interior Incised, Maddox Incised, Fort Walton, Manchac Incised, and Plaquemine Brushed. The percentage of pottery types found at each of these sites is shown in table I. The sites are located in the following areas: LF7 on Belle Pass, LF10 on Cheniere Caminada, LF12 on the edge of Caminada Bay, LF31 on Bayou Blue, LF37 north of Leeville, and Tr32 west of Catfish Lake. East of Little Lake in Jefferson Parish there are three sites that were initially occupied in the Troyville period and that continued to be occupied through the Plaquemine period.[1]

[1]McIntyre (1958)

TABLE I
POTTERY TYPES

	LF1	LF7	LF10	LF12	LF31	LF37	TR32
Fatherland Incised	30	8	20	15	6	40	9
Moundville	10	22.5	10	15	8		28
Evangeline Interior Incised	10						
Maddox Incised				7.5			
Fort Walton	20	35	20	30	25		37
Manchac Incised	20		10			3	18
Plaquemine Brushed		15		15		30	

Number is percentage of sherds of each type found at each site.

b. Historical elements.

(1) Early explorers. Many of the early explorers of the Gulf of Mexico passed along the Louisiana coast. In 1519 Pinada reported a great river on the north gulf coast.[1] Narvaez and his men in 1529 sailed along the Louisiana coast in four small boats and drank fresh water from the Mississippi far out in the gulf (Shepherd 1970). DeSoto traveled through the southeast U. S. from 1539 to 1543, crossing the Mississippi in 1541. After his death, Moscoso led the expedition down the Mississippi and across the Louisiana coast to Mexico. In 1682 La Salle sailed down the Mississippi from Canada and claimed the land near the mouth for France.

(2) Colonization. Early colonists settled mainly along the Mississippi but some trappers, traders, and fishermen lived along the coast from Grand Terre to the Timbalier Islands. The latter supposedly received their name during the Natchez Indian Rebellion when a settler drove off the Indians by beating on a kettle drum.

(3) Acadians. At the start of the French and Indian War there were many people of French descent living in Nova Scotia. The English were worried about their loyalty and required them to take an oath of allegiance. When many refused they were deported and wandered to several countries. By 1765 many were arriving

[1]All facts not specifically referenced were taken from Davis, 1961, and Dethloff and Begnaud, 1968.

in Louisiana, and large numbers settled along Bayou Lafourche. Land was sold in arpents (193 feet) and most holdings were 1 arpent on the bayou and 40 arpents toward the back swamps. Many more came in the 1780's, 1500 in 1785 alone (Kane 1943). By 1800 there were 6,000 people along Bayou Lafourche. By 1814 there were 30 miles of continuous houses and 30 more miles that were less thickly settled.

(4) Sugarcane. In 1794 de Bore first successfully granulated sugar in Louisiana. Cane had been grown since it was introduced by the Jesuits in 1751 but was only used for home consumption because it was difficult to ship ungranulated. After de Bore's discovery, sugar plantations spread down Bayou Lafourche as far as Cut Off. When the plantations came, some Acadians sold out and moved to the back bayou while others stayed (Kane 1943).

(5) Grand Isle. In the 1770's Spain tried to develop Grand Isle. John Anfrey received a grant and tried to farm and raise cattle. Others came and attempted to raise cane. These attempts failed because of the salinity of the soil. Near the end of the decade Francisco Caminada received a grant on the cheniere west of Grand Isle and the colony that grew up there was named after him. The area attracted mostly trappers, traders, and fishermen (Kane 1943).

(6) Barataríans. Smuggling was common along the southeastern Louisiana coast during the Spanish regime. In 1804 Jean Lafitte arrived in Louisiana and organized the smugglers. They set up a regular delivery schedule and had warehouses at New Orleans, Donaldsonville, and throughout the Barataria area (Lafitte 1958). In 1808 they made Grand Terre their headquarters. The Barataríans had letters of marque from Cartagena which allowed them to prey on Spanish shipping but they were not always discriminating (Saxon 1930). By 1813 Lafitte had 4,000 men under him and was holding well attended auctions of goods and slaves near Barataria Bay. The U. S. declared them outlaws and in 1814 Grand Terre was burned by the U. S. Navy. When it became obvious that the British would attack Louisiana, the Barataríans offered their services to the United States. Their accurate artillery fire and supplies of ammunition and flints played an important role in the Battle of New Orleans in 1815 (de Grummond 1961). The privateers were pardoned by the United States. Lafitte set up another privateering colony in Galveston Bay but most of his men reformed and settled down to fish, farm, or trap on Cheniere Caminada. (Kane 1943.)

(7) Hurricane on Isle Dernier. The coastal islands were "discovered" by the wealthy in the mid 1800's. A large resort

hotel and several houses were erected on Isle Dernieres. In August of 1856 a severe hurricane struck the area at the height of the tourist season. Seas were high for several days before, but with no warning system, few people left. When the storm hit, 320 people were killed and 100 buildings, including the hotel, were destroyed (Kane 1943, Interim Survey Report 1963).

(8) Growth of Grand Isle. Grand Isle grew slowly after the smuggling was halted. Attempts were made to grow oranges and cane but they failed. In the 1840's summer homes were built on the island, and in the 80's and 90's several new hotels were erected. By 1905 there were 450 permanent residents (Howell 1969). John Ludwig was prominent on the Island in the early part of this century. He ran a terrapin farm, drained and leveed land and planted vegetables (Kane 1943). Today Grand Isle supports various seafood endeavors but its mainstay is tourism.

(9) Other hurricanes. September 30, 1893, a severe hurricane hit Cheniere Caminada and 1150 people were killed. The survivors moved to Leeville and built homes on the east bank. A storm in 1909 with 8-foot tides destroyed several homes and 12 people were killed. In September 1915 another hurricane hit the coast and 99 percent of the houses at Leeville were destroyed but loss of life was minimized by good hurricane warnings. After this disaster most of the people rebuilt in Golden Meadow (Howell 1969, Kane 1943, Interim Survey Report 1963).

(10) Closure of Bayou Lafourche. In 1903 there were severe floods along Bayou Lafourche. Plantation owners met in the winter of that year and petitioned the state to block the bayou at the Mississippi. The state did so in 1904 (Howell 1969). The area between Larose and Golden Meadow continued to grow after the bayou was closed. Northerners tried to farm near Golden Meadow but failed and the only reminder is Yankee Canal. Rum running was common during prohibition. In the 1930's oil was discovered at Leeville and the town boomed. Offshore oil was first drilled in 1947. Oil continues to play a vital role in the economy of the project area (Kane 1943).

c. National Register of Historic Places. The May 15, 1972 Federal Register was consulted as well as the Federal Register for the first Tuesday of each month from April 1972 through July 1973. No National Register properties are listed in the project area.

d. Cultural elements. Much of the project area was originally settled by the Acadians. Their descendents have retained much of the Gallic language, religous customs, food habits and other

culture. In 1970, 62 percent of the population of Lafourche Parish listed French as their mother tongue. When people first settled the area it was necessary to live on natural levees. Since then, back areas have been drained but people still prefer to live along the bayou. Because of this preference, housing is closely spaced along both banks of Bayou Lafourche from Donaldsonville to Golden Meadow. It has been called the "longest main street in the world" (Kane 1943). Before roads and bridges were built, travel across and up and down the bayou was by boat, and today people still use pirogues for transportation.

7. ECONOMIC ELEMENTS.

a. Introduction. The project area lies entirely within Lafourche Parish. Data in this section will be for the project area and not for the whole parish.

b. General economics. Bayou Lafourche serves as the principal commerce artery of Lafourche Parish. The principal tonnage items carried on the waterway are shells, sulphur, water, drilling mud, crude oil, cement, and steel. While the tonnage of shrimp and oysters is small, compared to other commodities the value of these commodities is appreciable and they require the employment of a large number of boats and fishermen, and are major factors in the economy of Lafourche Parish. The Gulf Intracoastal Waterway (GIWW) which crosses Bayou Lafourche at Larose, is the most important connecting waterway. Scully, Breton, and Yankee Canals connect Bayou Lafourche to the bays and inland marshes to the east but navigation is limited to small boats or is nonexistent due to low-level fixed bridges and pile barriers. Bayou Blue on the west side and numerous smaller channels along both sides of the bayou have no water connection with Bayou Lafourche but start at the natural ridge and traverse the adjacent marshland. At Leeville, Louisiana, south of the project area, the bayous are crossed by the Southwestern Louisiana Canal which provides access to Caminada and Barataria Bays to the east and to Timbalier and Terrebonne Bays to the west.

c. Highways. Louisiana Highways 1 and 308 (two-lane asphalt and concrete) are the mainland traffic facilities in the project area. At the present time the bridge across the Intercoastal Waterway on Highway 308 is out. A new high level bridge is planned for this crossing. Highway 308 parallels the bayou on the east side but terminates on the southern end at Golden Meadow. Highway 1 runs along the bayou on the west side and continues on to Grand Isle. Bridges across the bayou connect the two highways at Larose, Cut Off, Belle Amie, Breton Canal, Galliano, and Golden Meadow. Louisiana Highway 24 connects Larose with Houma to the west.

d. Utilities. Natural gas, electric power, and telephone service are available to developed portions of the project area. Water supply is provided to the Lafourche Parish Water District through water mains on both sides of the bayou.

e. Local levees. Local interests at Golden Meadow, Louisiana, have constructed a ring levee to protect the town from storm tides. This levee incloses an area of approximately 900 acres abutting Bayou Lafourche. This project is maintained at a grade of 7 feet m.s.l. and has a 230 c.f.s. pumping station for removing local rainfall. Local interests have also constructed low-level tidal levees with six pumping stations of various sizes generally along the same alinement of the proposed hurricane protection levee. These levee systems will be incorporated into the proposed plan.

f. Land use. Of the 32,400 acres in the project area, 3,340 acres are developed for residential, commercial, and industrial uses; 6,360 are cultivated; 19,990 are shrub and pasture; and the remaining 2,710 acres are marsh.

g. Population. The population within the project area along Bayou Lafourche from Larose to Golden Meadow was 17,200 according to the 1970 census.[1] This area lies within Ward 10 of Lafourche Parish and comprises about 96 percent of the population of the ward. The ward has experienced continuous population growth since the first recorded census in 1920 which showed 4,934 residents. Indications are that the population will continue to grow at a rate of 1 1/32 percent per year until the year 2020 (General Design Memorandum, May 1972). Some lands now being used for agriculture will be converted to residential and commercial uses. The per capita income in the parish was $2,149 in 1970 which was 53 percent of the national per capita income. The percentage of the national per capita income has dropped from 60 percent in 1965 and 1968 (see table 2). In 1966, 28 percent of the families in Lafourche Parish were classified as poor. The median number of school years completed for Lafourche Parish residents 25 years of age or older was 8.5 in 1970 and 31 percent of the same age group had completed high school.[2]

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[1]U. S. Department of Commerce, Bureau of the Census "1970 Census of Population."

[2]U. S. Department of Commerce, Bureau of Census, General Social and Economic Characteristics 1970.

TABLE 2
PER CAPITA INCOME[1]

	1965	1968	1970
Lafourche Parish	$1,653	$2,053	$2,149
United States	2,765	3,421	3,933
Percentage of United States	60	60	53

h. Industrial development. Industries established within the project area include shipyards for the manufacture and repair of shrimp and oyster fishing vessels and other workboats, ice, and cold storage plants, seafood processing plants, machine shop, companies which manufacture and lease marsh buggies for the oil industry, and oil storage and barge loading facilities. Extensive oil and gas fields exist in the marshlands in and adjacent to the study area and in the offshore areas in the Gulf of Mexico. Bayou Lafourche is one of the leading ports for shrimping vessels in Louisiana. Shrimp trawling is the most important fishing activity in the area and provides employment for some of the residents. When the project is completed, construction financing is expected to be more readily available and a general upgrading of residential and commercial construction will ensue. Completion of the project will also induce a greater concentration of industries engaged in seafood processing and preparation.[2]

i. Agricultural development. Sugarcane, corn, and Irish potatoes are the major crops grown on the 6,360 acres of cultivated land. Practically all of the row crops are grown upstream of the latitude of Galliano, Louisiana.

8. WILDLIFE MANAGEMENT AREAS.

Two wildlife management areas are located near the project area. The Pointe Au Chien Wildlife Management Area (28,000 acres) is a public waterfowl hunting area occupying the marshes immediately west of the project area between Cut Off and Galliano. The Wisner Wildlife Management Area (30,000 acres) is located in the saline marshes southeast of Leeville.

[1]U. S. Department of Commerce, Bureau of Economic Analysis, Per Capita Personal Income, SMSA's, Counties, Parishes, Lower Mississippi River Region and Adjacent States, 1929-1970.

[2]General Design Memorandum, May 1972.

SECTION III--ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

1. PRINCIPAL IMPACTS.

The principal impact of the proposed action will be the increased protection of human life and property provided by the levee system against the forces of hurricanes. Most loss of life and destruction of property associated with hurricanes is caused by flooding and tidal surges. Residential, industrial, and commercial establishments suffer structural damage, business and social activities are disrupted, lives are endangered, and hazards to health result from hurricanes. The proposed levee enclosure is designed to prevent inundation of the area by flood stages of hurricane occurring at a frequency of once in 100 years. Under the existing state of development, this will prevent an estimated average annual crop and noncrop flood damage of $2,541,100 based on 1972 design memorandum estimate.

2. ECONOMIC DEVELOPMENT.

The increased protection to life and property will stimulate economic activity and induce development of an adequate interior drainage system, making land inside the levee, now shrub or pasture, available for residential, commercial, or agricultural development. The number of personal service establishments and the employment in these establishments, and the number of people engaged in professional services will grow at a more rapid rate with the project. There will also be a greater concentration of industries engaged in seafood processing and preparation. This increased economic development will improve employment opportunities and personal income, thereby enhancing the social well-being of the citizenry. Future development, which will occur with or without the project, will further increase the average annual benefits realized by the prevention of hurricane damage.

3. EVACUATION ROUTES.

The proposed levee enclosure will provide a safer evacuation route above Golden Meadow for the people from Grand Isle and other outlying areas when threatened by hurricanes. The additional time for safe evacuation would also permit inhabitants to better protect and make secure their properties and possessions which would have to be left behind. It will also reduce the distance the evacuees will have to travel from their homes to find shelter. Without

the project, evacuees from Grand Isle must travel at least 45 miles to Larose to avoid hurricane tides. With the project levee in place, this distance would be reduced to 30 miles. No alternative routes are available.

4. PROTECTION FOR BOATS.

The planned improvement will also serve as a haven from hurricanes for boats and barges transiting the area or homeported in Bayou Lafourche. At present, this traffic must travel as far inland as Larose to avoid the hurricane tides if time permits or if not, ride out the storm with the impending risk of great damage or total loss. Creation of a safer foul weather haven for watercraft in a relatively populous area will have impacts of mixed qualities: Growth and improvement of marine and other service-oriented commercial activities can be expected, and greater congestion and potential for damage and injury can be expected in this heavily used reach of the bayou.

5. OIL LEASE TANK PROTECTION.

The project will provide greater protection for oil tanks which are a source of pollution in hurricanes and high water.

6. EFFECT OF LEVEE ON LANDSCAPE.

One of the adverse impacts caused by the proposed project will be the intrusion of the levee and associated borrow ditch on the natural landscape, obstructing the view of the surrounding marsh. This effect will only be noticed south of Yankee Canal and east of the bayou because in all other areas of the project the locally constructed levee obstructs the view of the marsh already.

7. LAND CONVERSION.

Construction of the levees will require conversion of about 220 acres of marsh to levee right-of-way and borrow area. The construction of the local levees has already converted about 1,780 acres of woodland and marsh to levee and borrow area. The raising of these levees will not cause conversion of much new land. The borrow areas are of some value to fish as a refuge during periods of low water. These borrow pits are or will be located inside the levee at all points except for 12,000 feet which is outside the levee along the farming area between Breton Canal and Yankee Canal. The borrow pits outside the levee are of more value as a refuge because fish that enter them can leave again when the water rises. The borrow pits inside the levee could conceivably be pumped nearly dry during low water.

8. DRAINAGE EFFECTS.

Whichever method is adopted for draining the project, pumping stations or flap and sluice gates, no tidal flow will exist. This flow has been cut off since 1965 in all the project areas except the marsh south of Yankee Canal. Inside the levee enclosure, land that is drained and cleared for agricultural and industrial use will be lost to wildlife and fishery production. Local interests have already leveed and partly drained all of the project area except the marsh south of Yankee Canal which is about 2,710 acres. Without the project this existing marsh would probably stay in its natural state because it is on the east side of the bayou and south of Golden Meadow where there is no highway paralleling the bayou.

9. EFFECT OF WASTE MATERIAL PRODUCTION.

Increased residential, industrial, and commercial development, which will occur with or without the project, will be accompanied by an increase in the production of waste materials. Septic tanks, the historical method of waste treatment along Bayou Lafourche, will no longer be adequate. Modern treatment facilities will have to be provided. Restriction of pollution to acceptable levels will be the responsibility of Federal, state, and local regulatory agencies.

10. TURBIDITY.

During construction, turbidity both inside and outside of the levee enclosure, will have a temporary adverse effect on water quality and sedimentation adjacent to the construction site. These effects will be localized. The result will be some loss of aquatic life which will be repopulated by natural replenishment. Placement of earth materials from initial project construction and maintenance repair will be controlled by dragline operation and subsequent shaping to produce a uniform levee.

11. EFFECT OF ACTUAL CONSTRUCTION AND MITIGATION.

Disposal of vegetation resulting from the clearing of rights-of-way will be in conformance with Federal, state, and local laws governing the prevention of environmental pollution. Project contractors will be required to exercise care in the handling and storage of hazardous materials to prevent accidental spillage or usage that would result in water pollution. They will not be allowed to pollute lakes, ditches, rivers, bayous, canals, or waterways within or adjacent to the project area with fuels, oils, bitumens, calcium, chloride, insecticides, herbicides, or other similar materials harmful to fish, shellfish, or wildlife,

or materials which may be a detriment to outdoor recreation. It will be a contractual responsibility of the contractor to investigate and comply with all applicable Federal, state, county, and municipal laws concerning pollution of rivers and streams, public health, and protection of shellfish, fish, and domestic animals. The contractual requirements also provide for sanitary facilities to adequately dispose of wastes in conformance with existing regulations. The methods and locations of disposal of materials, wastes, effluents, trash, garbage, oil, grease, chemicals, etc., within the rights-of-way limits will be such that harmful debris will not enter lakes, ditches, rivers, bayous, canals, or waterways.

12. EFFECTS ON ARCHEOLOGICAL SITES.

If any archeological sites are discovered prior to or during construction, investigation and salvage will be accomplished by appropriate archeological authorities. Contractors will be required to operate with caution and refrain from disturbing any such sites if found.

13. EFFECTS ON AQUATIC PLANTS.

Temporary or periodic intensification of aquatic growth control may be needed in the project area in consequence of upstream disgorgements of noxious aquatic plants and their seeds at a time when hurricane flood protection entraps them.

SECTION IV--ANY ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

1. LAND CONVERSION.

Another impact of the proposed action will be the leveeing and draining of the 2,710 acres of brackish marsh south of Yankee Canal and east of Bayou Lafourche. This marsh would probably stay in its natural state without the project because of its inaccessability since it is south of Golden Meadow where there is no highway on the east side of the bayou. At the present time it is of value as a nursery area for fish and shellfish. Since there are large areas of brackish marsh in coastal Louisiana, the 2,710 acres drained by this project will not have a large statewide impact. With the project this marsh will probably be used for agricultural or urban type developments. The adverse impacts on the main part of the area will be small because local interests have already leveed and partly drained all of the project area north of Yankee Canal. The new higher levees and larger pumps will drain the few isolated, remaining patches of marsh. The wooded parts of the area will be affected if they are cut and cleared for cultivation. This cutting will probably not occur until the land presently in shrub is cleared.

2. TURBIDITY.

During construction, turbidity both inside and outside of the levee enclosure will have a temporary adverse effect on water quality and sedimentation adjacent to the construction site. The result will be some loss of aquatic life which will be repopulated by natural replenishment.

3. INCREASE IN WASTE MATERIALS.

An adverse impact which cannot be avoided should the proposal be implemented will be an increase in the production of waste materials coincident with increased residential, industrial, and commercial development. Septic tanks, the historical method of waste treatment and disposal, will no longer be adequate. Modern treatment facilities will have to be provided. Cooperation among Federal, state, and local regulatory agencies will be required to restrict pollution to acceptable levels.

SECTION V--ALTERNATIVES TO THE PROPOSED ACTION

Other actions considered as alternatives to the proposed plan include the following:

1. ADOPT BUILDING CODES WHICH REQUIRE ELEVATING ALL BUILDINGS ABOVE THE ANTICIPATED HEIGHT OF THE TIDAL SURGE.

This solution may be practical in unimproved areas south of the proposed project where other protective structures are not provided. However, with so many structures already in existence in the project area without this provision, and the prohibitive cost of incorporating this feature in existing buildings, it is unlikely that modifications will be made. Consequently, economic losses will still be experienced in the event of future hurricane flooding. Additionally, this provision will not provide the other features of protection incorporated in the proposed plan. The evacuation route above Golden Meadow will not receive any additional protection. People in Grand Isle and other surrounding areas will continue to be forced to begin evacuation further in advance of hurricanes, reducing the time available to secure property and possessions. This alternative will not provide safe haven to boats, barges, and people transiting the area or homeported in Bayou Lafourche. Other property such as crops, livestock, and docks cannot be practically provided for by this plan and thus is subject to damage and loss. This alternative, in effect, would retain the existing environmental setting.

2. REQUIRE BUILDINGS BY LAW TO HAVE THE STRUCTURAL STABILITY TO WITHSTAND ANTICIPATED WATER AND WAVE FORCES.

The cost of this type of construction would be more than the cost of the proposed project. Existing buildings could not practically be reinforced to withstand this force. In addition to wave damage, much destruction is caused by waterborne missiles. Many structures would proably be lifted from their foundation in varying degrees of disintegration and, along with other objects, become missiles themselves. Again the benefits of the proposed plan would not be realized. The evacuation route above Golden Meadow would not be protected; no safe haven would be provided for boats, barges, and people of outlying areas. This alternative would also retain the existing environmental setting.

3. SELECT SOME OTHER LEVEE ALINEMENT.

Other levee alinements north of Yankee Canal were considered but rejected because local interests have already constructed low-level tidal levees generally along the same alinement as the proposed hurricane protection levee. Enlarging the existing levee will cost less than building along a new alinement because some of the levee structure is already in place and postconstruction subsidence will not be as great. Selecting the same alinement negates the need for converting unspoiled areas to levees or borrow ditches. Utilizing the current alinement will also eliminate the necessity of destroying the existing levee and borrow ditch where it would interfere with the functioning of the designed project. All in all, utilization of the existing alinement will result in the least environmental impact. Below Yankee Canal the alinement is essentially an extension of the 40 arpent line location of the existing levees and a minimum-distance tieback to the Bayou Lafourche floodgate. This alinement location was negotiated with the local sponsors of the project.

4. IMPLEMENTATION OF A "NO-ACTION" PLAN TO RETAIN THE EXISTING ENVIRONMENTAL SETTING.

The loss of wildlife habitat, if the proposed project is implemented, will not have widespread significance. Enhancement of conditions for residential, commercial, and agricultural development will result. No action will mean that people in the project area will forego the advantages of protection against hurricane waves that the improved levee enclosure would provide. They would, however, retain the present flora and fauna of the area, and would not have to cope with the pollution created by further economic development.

5. SUPPLEMENTS TO OTHER ALTERNATIVES.

The National Weather Service is making a continuous effort to achieve more accurate forecasting and more efficient warning to affected areas. This will aid in making suitable preparations and facilitating the timely evacuation of the area but does not itself provide any protection against the destructive forces of hurricanes. Improved forecasting will, however, augment the use of other protective measures available. Television and radio stations broadcast hurricane reports at regular and frequent intervals during times of hurricane watches and warning. These stations utilize National Weather Service reports; some also have their own weathermen who have been studying hurricanes for several years.

SECTION VI--THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

1. LEVEE CONSTRUCTION.

Construction of the proposed levee system will require conversion of about 220 acres of marsh to levees, borrow pits, drainage structures, and other appurtenances. The local levees have already so converted approximately 1,780 acres of woodland and marsh.

This is the most practical engineering method of providing the desired protection. However, due to alteration of the land form, this area will be lost to natural wildlife production. Because of the need for periodic maintenance, the normal succession of vegetation will be repeatedly interrupted along the levee and prevented from reaching the stage of development characteristic of good wildlife habitat. This loss will continue for the life of the project.

2. ADDITIONAL DEVELOPMENT.

The protection afforded by the levee enclosure against the risk of hurricane damage will encourage additional agricultural, commercial, and industrial development over and above that anticipated without the project. The trend toward such development already exists but the rate of such growth will be increased by the project. Most of the land that will be converted to these uses is presently shrub and pasture. A very small amount of the area is productive marsh of the type being lost both to human development and the natural recession and subsidence of Louisiana coastal area. The result is a small decrease in a valuable natural resource.

3. RESOURCES.

Increased development of residential, commercial, and industrial activities of the area will result in a more intensified demand for the nonrenewable resources of the area. Regulations will have to be enforced by state and local agencies to prevent the loss and destruction of such valuable assets as wildlife, fisheries, and mineral deposits. Increased development also creates the problem of increased production of waste products which, if permitted to go without regulation, would endanger the environment for succeeding generations.

SECTION VII--ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

The planned conversion of about 220 acres of marshland to levees, borrow pits, drainage structures, and other appurtenances and the past conversion of 1,780 acres of marsh and woodland to such structures is irreversible and irretrievable unless the levees are subsequently degraded and borrow pits refilled. The removal of material from marsh and deposit as levee structure results in permanent loss of former marsh habitat and the natural organisms indigenous to the area. New organisms will invade the area but there are no known plans of local interests to stock or manage the borrow ditch for sport fisheries. The protection provided against the destructive forces of hurricanes enhances the development of land within the levee enclosure for residential, commercial, and industrial uses. A small amount of this land is now good quality marsh for fish and wildlife production. These changes in land and water use will be made economically feasible by the project. Increased economic development is associated with increased production of waste products which can pollute air and water. Treatment and disposal of this waste will involve irreversible and irretrievable commitments of resources regardless of whether the proposed action is implemented or not. If these wastes are improperly treated and disposed of, the result could be unalterable disruptions in the ecosystem, and other effects that would curtail the diversity and range of benefical uses of the environment.

SECTION VIII--COORDINATION WITH OTHERS

1. PUBLIC PARTICIPATION.

During the preparation for the general design memorandum for the authorized hurricane protection project, extensive coordination was maintained with the Lafourche Parish Police Jury, the agency which furnished assurance on the project. In addition to the Police Jury, the project was coordinated with and has the support of the South Louisiana Tidal Water Control Levee District and the State of Louisiana, Department of Public Works, the engineering agency for the State of Louisiana. Letters of endorsement have been received from the Lockport Rotary Club, Golden Meadow Lions Club, Golden Meadow Rotary Club, and the South Lafourche Jaycees. All of these organizations are located in or near the project area. There have been numerous meetings in this district and in the project area with representatives of local governmental groups and local citizen groups to discuss the project. During these meetings local interests indicated a desire to cooperate in the project.

In 1967 letters requesting comments were also sent to the U. S. Department of Interior (Fisheries and Wildlife Service and Federal Water Pollution Control Board) and the State of Louisiana (Wildlife and Fisheries Commission) None of these agencies offered any adverse comments on the project.

2. GOVERNMENT AGENCIES.

In September 1972, the draft environmental statement was circulated to 46 Federal, state, and local agencies and organizations for their comments. Comments received as a result of this coordination are contained below along with responses.

a. Federal agencies.

(1) U. S. DEPARTMENT OF INTERIOR, OFFICE OF THE SECRETARY, SOUTHWEST REGION.

Comment No. 1. The draft statement adequately describes existing fish, wildlife, and recreational resources of the area and the effects that the proposed project will have on these resources. No significant adverse environmental impact of the project as related to the geology or the hydrologic aspects of the proposed work is anticipated. The proposed action will not adversely affect any existing, proposed, or known potential unit

of the National Park System, nor any known historic, natural, or environmental education site eligible or considered potentially eligible for the National Landmark Programs.

Response: Concur.

Comment No. 2: The American alligator is mentioned as being the only species on the list of endangered species that is present in the vicinity of the project area. The southern bald eagle, another endangered species, has also been reported in the vicinity of the project area.

Response: This information is included in this final statement in section II, part 5, paragraph o.

Comment No. 3: The draft environmental statement mentions the need for relocation of 96 oil and gas pipelines ranging up to 20 inches in diameter. A more detailed map showing these pipelines would be desirable.

Response: This final statement reflects the revised number of 36 gas and oil pipelines of up to 20 inches in diameter that will require relocation. This relocation will be accomplished by simply raising the pipelines to conform to the slope of the levee. The location of these pipelines is shown on plate III. The type of pipe and the number on plate III is given in the following table:

Descriptions	Number on Plate III
1-6" Oil pipeline	1
2-6" Oil pipelines	2
3-Overhead powerlines	3
1-20" Gas pipeline	4
1-16" Gas pipeline	5
1-3" Gas pipeline	6
1-4" Oil pipeline	7
1-3" Gas pipeline	7
1-6" Oil pipeline	8
1-8" Gas pipeline	9
1-3" Gas pipeline	9
6-Overhead powerlines	10
1-8" Gas pipeline	11
1-8" Oil pipeline	12
2-Overhead powerlines	13
1-12" Oil pipeline	14

Descriptions	Number on Plate III
1-4" Gas pipeline	15
1-8" Gas pipeline	15
3-Overhead powerlines	16
1-3" Gas pipeline	17
2-6" Gas pipelines	18
1-12" Gas pipeline	18
1-8" Gas pipeline	19
1-2" Gas pipeline	20
1-3" Gas pipeline	20
3-3" Gas pipelines	21
1-1" Gas pipelines	22
3-3" Gas pipelines	23
1-3" Gas pipeline	24
1-3" Gas pipeline	25
1-3" Gas pipeline	26
1-6" Oil pipeline	27
1-20" Gas pipeline	28
1-16" Gas pipeline	29

Comment No. 4: Future recovery of minerals probably would not be hindered by the project, but without a more detailed map or description of the mineral facilities in the project area, it is difficult to judge the impact of the proposal on these facilities.

Response: The U. S. Bureau of Mines has stated that the proposed construction would be beneficial to the numerous mineral industries in the project area. Oil and gas production are found in the project area, and future exploration and production may take place. It is anticipated that this project will not adversely affect existing or future exploration and production nor will this existing or future exploration and production adversely affect the project.

Comment No. 5: The proposed action will not adversely affect any existing, proposed, or known potential unit of the National Park System, nor any known historic, natural, or environmental education site eligible or considered potentially eligible for the National Landmark Programs.

Response: Concur.

Comment No. 6: Item g on page 12 indicates an airplane and foot assessment of the project area was conducted under the leadership

of the Louisiana State Curator of Anthropology. The survey should be complete if the area was flown and then covered completely on the ground. The final statement should describe the procedure followed and indicate whether or not the Louisiana State Museum considers a proper reconnaissance was made and also their views as to whether any sites will be disturbed.

Response: The procedure followed in the archeological reconnaissance is described in Section II, part 6, paragraph a(1). Mr. Robert W. Neuman, Curator of Anthropology, Louisiana State University, has stated that he considers this reconnaissance sufficient. No known sites will be disturbed and if any new sites are discovered, procedures to be followed are outlined in Section III, paragraph 12.

Comment No. 7: In the third paragraph of item g on page 13, the statement mentions consultation with the National Register of Historic Places, 1969. Your office has been furnished a copy of the February 1, 1972, listing of historic or archeological sites and the final statement should reflect consultation with this more current listing.

Response: The statement now reflects consultation of the latest listings.

Comment No. 8: We note the draft statement has been sent to the State Liaison Officer for Historic Preservation. His comments concerning the effect of the project upon nominations to the National Register of Historic Places being processed should be included in the final statement.

Response: No comments have been received from that office.

(2) U. S. DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE, SOUTHWEST REGION.

Comment No. 1: We noted in your draft environmental statement for Grand Isle, Louisiana, and Vicinity hurricane protection (Larose to vicinity of Golden Meadow) that your reference for historical features was the 1969 National Register of Historic Places.

Response: For this final statement, the May 15, 1972 Federal Register was consulted as well as the Federal Registers for the first Tuesday of each month from April 1972 through July 1973.

(3) U. S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION.

Comment No. 1: The proposed project is not expected to have any adverse affect on highways or bridges, existing or planned. You are, of course, aware of the Louisiana Department of Highways' plans for relocating Route 308 with a high level bridge across the Gulf Intracoastal Waterway at Larose. The location of your levee should be coordinated with the bridge phase in this area.

Response: Coordination has been conducted with the Louisiana Department of Highways and the proposed bridge will clear the levee.

(4) ASSISTANT SECRETARY OF COMMERCE.

Comment No. 1: In the section entitled Project Description, it should be noted that the benefit-cost ratio does not include fish and wildlife losses.

Response: The recommended project will cause major changes in 2,710 acres of brackish marsh and may be expected, in the long run, to reduce its fish and wildlife resources. The Fish and Wildlife Service did not quantify such losses during coordination, and no evaluation was attempted by the Corps of Engineers in the planning studies for the project. However, data upon which an evaluation of such losses can be based are available from a special study conducted by an interagency group chaired by the Corps of Engineers, "The Fish and Wildlife Study of Coastal Louisiana and the Atchafalaya Basin Floodway."

The project is located within Unit 4 of the above referenced study and basic data relating to that unit may be used in the evaluation. Unit 4 contains 732,900 acres of estuarine marsh. The project would modify 2,710 acres of this marsh or about 0.37 percent of the total marsh in this unit. The average annual harvest of commercial fish in this unit for the period 1963-1967 was 370 million pounds. While no definitive analysis of the relationship of marsh area to productivity in the fishery resource is available (and the complexity of the relationship is such that the relationship is unlikely to be defined with any precision in the foreseeable future), it is reasonable to assume that should there be no marsh at all, there would be no commercial harvest, since the productivity, while perhaps not zero, would nevertheless be so reduced as to make commercial harvest impracticable. Viewing the marsh as a sine qua non with respect to commercial fishery harvest, it is reasonable, if imprecise, to assume that each portion of the marsh contributes to that harvest in proportion to its areal extent.

On this basis, the loss of 2,710 acres of marsh occasioned by the proposed action would result in a loss of 1.4 million pounds of commercial fish per year.

The level of sports hunting pressure on the Louisiana coast is such that it is reasonable to assume that any reduction in productivity will be reflected in a corresponding reduction in recreational activity. The referenced study indicates that estuarine marshes in the project area are capable of producing wildlife to support 0.20 man-days of small game hunting per acre per year, 0.12 man-days of large game hunting per acre, and 0.47 man-days of wildlife-oriented recreation for a total of 0.79 man-days of sports hunting and wildlife-oriented recreation per acre per year. The modification of 2,710 acres of estuarine marsh will thus engender a loss of 2,140 man-days per year of such recreational opportunity.

The level of commercial trapping pressure on the Louisiana coast is such that it is reasonable to assume that any reduction in productivity will be reflected in a corresponding reduction in harvest. The study indicated that estuarine marsh in coastal Louisiana is capable of producing marketable wildlife at the rate of 0.86 pelts per acre per year. The modification of 2,710 acres of estuarine marsh will thus engender a loss in commercial wildlife of 2,710 acres by 0.86 pelts per acre equals 2,330 pelts per year, and 2,710 acres by 3 pounds per acre equals 8,130 pounds of meat per year.

The reduction in productivity in the fisheries resource has implications in the area of recreation. Reduced production of sports species may be reflected in reduced sports catches. However, since the size of the catch is only part of the attraction, and in view of the small percentage reduction that modification of one small part of the total available estuarine marsh would produce, and in view of the fact that a large surplus of sports fishing potential exists in the area, it is unlikely that any measurable reduction in the overall recreation potential of the area, insofar as sports fishing is concerned, would be engendered by the project.

The benefit-cost ratio has been revised and reduced, based on July 1973 price levels and inclusion of the unit average dollar values applicable to the above fish and wildlife losses. This ratio is 3.6 to 1.

Comment No. 2: With regard to the Environmental Setting Without the Project, SUBSECTION E. Zoology, the dicussion of the marshes being extremely valuable nursery areas should be expanded to include some of the observations made by many investigators, such as Odum (1961). Schelske and Odum (1962), and Teal and Teal (1969), that.

tidal marshes produce much more organic matter than any form of agriculture and that one of the factors contributing to this productive efficiency is the ebb and flow of the tides. Also, the role of tidal marshes in the nutrient support of adjacent open waters should be further discussed.

Response: Observations of Odum and Teal as to the value of marshes have been included in the Zoology section.

Comment No. 3: In the subsection f. Economics, it should be mentioned that a primary reason Bayou Lafourche is a leading port for shrimping vessels, is because of an abundance of shrimp due to the expansive nursery areas, such as those discussed in the previous subsection.

Response: A discussion of the importance of the marsh as a nursery area for shrimp is included in this statement under Botany in section II, part d, paragraph 6, since this is a more relevant context than that suggested in the comment. The economic importance of shrimping is discussed under Industrial Development in section II, part 7, paragraph h.

Comment No. 4: Under Environmental Impact of the Proposed Action and also under Any Adverse Environmental Effects Which Cannot Be Avoided Should the Proposal Be Implemented, the statement that "inside the levee enclosure, land that is drained for agricultural and industrial use, will be lost to wildlife production," should be changed to also indicate a loss of fish production both in the area being altered and the adjacent open waters previously supported by nutrients and detritus from the marshes.

Response: These comments have been included in describing the impacts on the marsh south of Yankee Canal. The remainder of the project area has been leveed and partly drained by local interests since 1965. There has been no significant nutrient exchange between these drained, leveed areas and adjacent marshes since that time, and they have already been lost to the wildlife and fishery resource. About 20 percent of these areas are wooded and are expected to remain available to wildlife with the project in place.

Comment No. 5: We question the accuracy of a subsequent statement that "the carrying capacity of the quality of marsh in the general area could be improved by proper management insofar as food production is concerned," since Odum (1962), Teal and Teal (1969), and others have noted that tidal marshes are extremely productive. Odum (1962) further noted that, because of this great production, management emphasis must be on utilization, rather

than production, i.e., utilization of existing production rather than converting to some other unadaptable system.

Response: The sentence in question has been deleted because it is irrelevant to this statement. It is, however, true that the carrying capacity and quality of the marsh in the general area could be improved. Such is being done in the Wisner Management Area to the south where weirs are being used to improve the habitat for fish and waterfowl. This type of management is based on utilization of existing resources.

Comment No. 6: In these sections, the impact that the flap and sluice gates, previously mentioned in the Project Description, will have on the productivity of the inclosed marshes should be thoroughly discussed in view of the importance of tidal action as emphasized by the previously cited investigators.

Response: As mentioned in the response to comment no. 4, much of the area has been leveed and pumped since 1965 and there has been no tidal interchange for several years. The proposed action will not alter this situation. Whichever method is used to drain the project - the flap and sluice gates suggested by the Corps or the pumping stations represented by local interests - there will be no tidal exchange.

Comment No. 7: In the section Alternatives to the Proposed Action, the alternative D. Select Some Other Levee Alinement, should suggest that the realigned levee exclude most of all of the undeveloped marshes, about 80 percent of the project area, so that only the presently inhabited areas would be protected. This alternative should be thoroughly discussed so as to compare its impacts on the estuarine production to those of the proposed project which would much more restrict the tidal ebb and flow. Since there are apparently no structures or persons to be protected in the undeveloped marshes, the exclusion of these marshes should have little effect on the benefit-cost ratio.

An alternative should be added that would have all drainage structures built and sills no higher than one foot below mean low water and would have all gates, flaps, etc. remain open at all times to permit tidal exchange except during hurricane warnings. The importance to estuarine production of maintaining this tidal ebb and flow should be reemphasized in discussing this alternative since four-fifths of the area to be leveed by the project is presently undeveloped coastal marsh.

Response: In the draft environmental statement the assertion was made that 24,600 acres of the project area was marsh

now. This was an error, only 2,710 acres of the area are now marsh. The proposed project has been leveed by local interests with the exception of that portion of the area below Yankee Canal. It is pointed out on pages 6, 12, and 20 of the draft environmental statement that local interests have constructed low-level tidal levees generally along the same alinement as that of the authorized hurricane protection levees. As stated on page 6 of the draft statement, pumping stations were installed by local interests. The pumping stations along with the levees have permitted local interests to drain and develop the land for agricultural purposes. To consider any levee alinement which would exclude these developed areas from the protective system and any drainage system which would allow free tidal exchange into these areas would be defeating the project purpose and would certainly meet strong local opposition.

(5) U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE.

Comment No. 1: Provisions for adequate control of erosion, sedimentation, and water management during construction should be pointed out in the statement.

Response: The project is divided into six separate sections. This will keep the soil area exposed to erosion at any one time relatively small. The exposed soil will be dressed, seeded, and fertilized as soon as possible after placing the material in order to prevent erosion and resulting siltation.

Comment No. 2: The statement should point out that permanent vegetative cover and other necessary land treatment measures will be installed on levees and other disturbed areas.

Vegetative measures could be a type which would be beneficial to existing wildlife species by furnishing cover and food, yet providing necessary erosion protection to works of improvement.

Response: Standard seeding and fertilizing specifications for levee construction will be followed in the project. The grass used will be a native vegetation such as found in the surrounding areas and will furnish cover and food for existing wildlife.

(6) ENVIRONMENTAL PROTECTION AGENCY.

Comment No. 1: Our only specific comment concerns the last paragraph on page 15. We partially agree that "Increased residential, industrial, and commercial development, with or without the project, will be accompanied by an increase in the production of waste materials." However, we believe that the project, if implemented, could encourage the rate of development of residential, industrial,

commercial, and recreational areas to a greater extent than if the area were allowed to develop without the plan. Therefore, the amount of waste materials (pollutants) produced over a given period of time would substantially increase. We suggest that land use planning for the project area, including building codes and pollution control and abatement measures, should also be considered in the Final Statement. Such measures should include waste-water management and solid waste disposal methods to be implemented prior to project construction, to alleviate possible adverse environmental effects on the surrounding marshlands and Bayou Lafourche from future commercial, industrial, residential, or recreational development.

Response: Ultimately, the area will develop to the same degree with or without the project, but the project may induce a higher rate of development in the early years of its life. Any development has the potential to cause environmental pollution of air, water, and land. The control of these types of pollution is vested in Federal, state, and local regulatory agencies. Controls exerted by these agencies under the developing network of Federal, state, and local statutes and regulations will operate to control and prevent such pollution.

Comment No. 2: Socio-economic impact of displaced people and businesses should be discussed in enough detail to permit an evaluation of the possible effect of the displacement and relocation on potential pollution.

Response: It is presently estimated that three or four homes in the vicinity of Golden Meadow are within the project right-of-way area. No businesses will be displaced.

Comment No. 3: Excavation and construction operations should be scheduled to prevent exposing large amount of soil at one time to erosion and resultant siltation of streams. It would be helpful to describe the soil erosion practices and measures to be used.

Response: See response to Soil Conservation Service, comment no. 1.

Comment No. 4: Methods of handling and applying herbicides and pesticides during future operation and maintenance activities should be discussed.

Response: A manual detailing requirements for operation and maintenance of the complete project will be prepared by the Corps of Engineers and furnished to the local sponsor. This manual will cover, inter alia, proper use of herbicides and pesticides

in operation and maintenance. Periodic inspections will be made to ensure that the project is being maintained in accordance with the manual.

Comment No. 5: Clearing and disposing of the brush and vegetation along the right-of-way of the proposed project should include provisions for prevention of adverse effects on the environment. Methods of disposal should be covered in the statement. Open, uncontrolled burning should not be permitted, in order to meet the requirements given in 40 CFR 76.8.

Response: The plans and specifications for construction of the project will include requirements that all brush and vegetation cleared along the right-of-way be disposed of in such a manner that adverse effects on the environment will not be sustained. Burning, if allowed, will be in accordance with title 40 Code of Federal Regulation, Part 76 and the revised regulations of the Louisiana Air Control Commission effective 30 January 1972.

Comment No. 6: If a public water supply source, treatment facility, or distribution system is to be adversely affected by the project, precautionary measures to prevent damage to, or contamination of, the public water supply should be described.

Response: There are no known public water supply sources, treatment facilities, or distribution systems which will be adversely affected by the project.

Comment No. 7: The construction and maintenance of the project must not create conditions which would violate the Water Quality Standards of Louisiana and the United States. Measures to prevent violation of these standards should be described. To protect the water quality during construction and to reduce the adverse effects caused by operation and maintenance of the project, the following guidelines should be followed:

a. Relocation of all pipelines, mains, and utilities should be accomplished in a manner to avoid contamination of potable water supplies and discharges of untreated waste water, directly or indirectly, into the surface or underground water resources.

b. Measures to prevent the effects of accidental spillages should be incorporated into the design features of the project.

c. Where appropriate, sanitary waste facilities should be provided and operated to treat and dispose of domestic wastes in conformance with state and Federal water pollution control

regulations. Provisions of the Federal Occupational Safety and Health Act of 1970 should be considered.

Response: The plans and specifications for construction of the project will incorporate an environmental section outlining water quality standards which shall be maintained. The operation and maintenance manual mentioned in response no. 4 will detail procedures to be followed by the local sponsor. The remedial and protective procedures outlined in section III, paragraph II, will be contained in the relocation contracts. These measures will avoid contamination of potable water supplies and discharge of untreated waste water. The authorizing act does not provide for construction of sanitary waste facilities as part of the project.

(7) U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE.

Comment No. 1: Accordingly, our review of the draft environmental statement for the project discerns no adverse health effects that might be of significance where our program responsibilities and standards pertain, provided that appropriate guides are followed in concert with state, county, and local environmental health laws and regulations.

We therefore have no objection to the authorization of this project insofar as our interests and responsibilities are concerned.

Response: Noted.

(8) No comment was received from the following Federal agencies:

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MID-CONTINENT DIRECTOR, NATIONAL OCEAN SURVEY

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SOUTHEAST REGIONAL DIRECTOR, NATIONAL MARINE FISHERIES SERVICE

U. S. DEPARTMENT OF TRANSPORTATION, COAST GUARD

U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, REGIONAL ADMINISTRATOR VI

OFFICE OF ECONOMIC OPPORTUNITY

GULF STATES MARINE FISHERIES COMMISSION

b. State agencies.

(1) LOUISIANA DEPARTMENT OF PUBLIC WORKS.

Comment No. 1: We have completed our review of your draft statement and have no objection to the general context, however, it does not portray a realistic viewpoint of the existing conditions as compared to the proposed conditions resulting from construction of the hurricane protection project.

The general comments indicate that there is virtually no existing production system and that construction of such a system will reduce the marsh area and increase inhabitation. Plate no. 1 does not indicate the extent of the existing levee and drainage system to be able to differentiate between existing and proposed facilities. It is not sufficiently brought out in the statement that there is an existing levee system and series of pumping stations that for all practical purposes contains the same protected area that will result from this proposed project. The difference is there will be a much higher degree of protection as a result of the Bayou Lafourche gates and higher back levees. Even though the area is subject to flooding from major storms, this has not stopped development of this area. Therefore, very little loss of marsh can be attributed to this project. The 2,000 acres referred to as being taken up by levees and borrow pits tends to relate a false impression that this is a direct and permanent loss. It is also not sufficiently clear that the proposed project will primarily enlarge an existing levee and borrow pit system.

We believe the impact statements should properly reflect all aspects of the environmental impacts to be expected as a result of constructing the project. In general, many of the losses referred to could best be termed changes and in this manner alleviate current general thinking that Louisiana's coastal area is being completely destroyed.

Response: Existing and proposed levee alinements are shown on plate III. The statement has been rewritten to clearly reflect the existing conditions in the area, particularly with regard to protective works now in place.

(2) LOUISIANA DEPARTMENT OF HIGHWAYS.

Comment No. 1: In reference the Department of Highways has reviewed the environmental statement and wishes to offer the following comment. The Department of Highways proposes to relocate La 1 within the limits of your proposed project. The Departments' plans will not conflict with your proposed project, except for that portion along La 24 at LaRose.

Response: At the time the statement was written, the Corps was not aware of the planned Highway 1 relocation. The

Corps will cooperate with the Highway Department in developing plans consistent with overall requirements.

(3) LOUISIANA WILD LIFE AND FISHERIES COMMISSION.

Comment No. 1: According to the draft environmental statement, the south end of Highway No. 1 should be raised to an elevation of 5.0 feet above m.s.l. with a 44-foot opening, and this gap would be closed when flood waters approached 5.0 feet m.s.l. The effectiveness of this plan would be hindered greatly by the flooding of the highway in several places from this point to 1/4 mile above Golden Meadow, and at the present time this flooding of Highway No. 1 occurs during every abnormally high tide. During a hurricane the extent of this flooding would be determined by when the flood gate on Lafourche Bayou was closed, but the criterion for its closing was not discussed in the statement.

Response: The floodgate on Bayou Lafourche will be closed when weather forecasts indicate that a hurricane is imminent; this will prevent flooding on Highway 1 inside the levee. The Corps will make specific recommendations for closing the floodgates at a future date.

Comment No. 2: The report also stated that the protected area was accessible to the north by Highways No. 1 and No. 308, yet there is only one bridge across the Intracoastal Canal (Highway No. 1) at this point.

Response: At the present time the bridge across the GIWW at Highway 308 is out. A high level bridge, however, is planned for the crossing.

Comment No. 3: If gravity draining of certain areas behind the levee is to be accomplished with floodgates with flaps, some provisions for constant maintenance will be necessary because these gates are easily made inoperative with debris and fouling organisms such as oysters or barnacles. Using gravity drains only will mean some flooding with heavy rains and severe flooding should the levee become overtopped during a hurricane.

If the levee system is affected, it is important that adequate pumping stations and sewage-waste systems be developed and installed for the benefit of the people living within the protected areas.

Response: Local interests have expressed their desire to have pumping stations installed instead of floodgates. Section 1 of this statement discusses the lack of Federal authority for construction of pumping stations and mentions a possible conditional

local interest participation remedy that may be available. New pumping stations could be constructed that would fulfill the drainage requirements for the gravity system. Sewage-waste systems will be installed by local interests.

Comment No. 4: In order to minimize the loss of wildlife habitats, the new levee should be built on existing levees wherever feasible. The existing levees were not noted in the statement.

Response: Concur. The existing levees are shown on plate 3.

Comment No. 5: Does the statement include the benefit-cost ratio of the municipal and industrial sewage treatment plants necessary with increased development of the area? In 1972 approximately 4 million acres of marshlands yielded Louisiana $72.6 million in commercial landings. The average would be about $18 per acre on a yearly basis. Twenty-five thousand acres which might be lost with this project would thereby produce $450,000 per year in commercial seafoods. Over a 10-year period this would mean approximately $4.5 million of production might be lost.

Response: The benefit-cost ratio does not include the cost of municipal and industrial sewage treatment plants because it is considered that the area will develop with or without the project, hence, the need for improvements for that purpose is not project-induced. The 24,600 acres of marsh mentioned in the statement were an error. In the Interim Survey Report, Grand Isle, Louisiana, and Vicinity dated 11 July 1963, 24,030 acres of marsh and woodland were reported to be involved. Subsequently, however, local interests constructed low levees and pumping stations to drain this land. Under the proposal as currently developed, a total of 2,710 acres of marshland will be modified. For an appraisal of the impact of this modification on the fish and wildlife resource, see the response to Department of Commerce comment no. 1.

Comment No. 6: Alternate plans A and B are not feasible or economical, and plan E is not relevant to our problems. Plan C noted that the National Weather Service is making an effort for better forecasting. However, more emphasis could be placed on the accuracy of information given by local news media during a hurricane.

Response: In section V, paragraph 5, of the final statement, more emphasis has been placed on the accuracy of local news media hurricane information.

(4) LOUISIANA DEPARTMENT OF CONSERVATION.

Comment No. 1: The Department of Conservation endorses this project because of the protection it affords not only to the people of the oil and associated industries but to the people of these communities.

Response: Noted.

Comment No. 2: One of the benefits not pointed out on your environmental statement would be the added protection for oil lease tanks which are a source of pollution in hurricanes and high water.

Response: This has been done in section III, paragraph 5, of this final statement.

Comment No. 3: The area of construction is traversed by a great number of oil and gas transmission lines. Adequate safety and pollution safeguards must be adhered to on the relocation of these facilities.

Response: See the response to comment no. 7 from the Environmental Protection Agency.

(5) No comments have been received from the following state agencies:

LOUISIANA STATE PARKS AND RECREATION COMMISSION

LOUISIANA STATE BOARD OF HEALTH

LOUISIANA COMMISSION ON INTERGOVERNMENTAL RELATIONS

LOUISIANA STREAM CONTROL COMMISSION

LOUISIANA PLANNING COMMISSION

LOUISIANA COASTAL COMMISSION

LOUISIANA LAND OFFICE

LOUISIANA PUBLIC SERVICE COMMISSION

LOUISIANA ADVISORY COMMISSION ON COASTAL AND MARINE RESOURCES

STATE OF LOUISIANA, DEPARTMENT OF COMMERCE AND INDUSTRY

LOUISIANA HISTORICAL PRESERVATION AND CULTURAL COMMISSION

c. Local government agencies:

No comments have been received from the following local government agencies:

GREATER LAFOURCHE PORT COMMISSION, GALLIANO, LOUISIANA

MAYOR OF LAROSE, LOUISIANA

MAYOR OF GOLDEN MEADOW, LOUISIANA

MAYOR OF CUT OFF, LOUISIANA

MAYOR OF GALLIANO, LOUISIANA

d. Citizen groups.

NATIONAL WILDLIFE FEDERATION.

Comment No. 1: We are in receipt of a draft environmental impact statement entitled, "Grand Isle, Louisiana, and Vicinity, Hurricane Protection (Larose to Vicinity of Golden Meadow) associated water feature Bayou Lafourche, Louisiana" and have the following comment. The statement specifies the natural environment to be destroyed by the project and states that it will be "lost to wildlife production." The statement continues "no effective remedial or mitigation measures are planned." Your agency has the duty under the Fish and Wildlife Coordination Act and the National Environmental Policy Act to mitigate these losses. I also understand from your headquarters that it is the policy of your agency to request authorization for mitigation where that authorization does not presently exist. An adequate environmental impact statement should indicate what mitigation, to include land acquisition, you believe to be necessary and what steps you will take to carry it out.

Response: The information in the draft statement to the effect that 24,600 acres of land would be modified by the project was in error. Subsequent to authorization of the project by Congress, local interests inclosed what was 24,030 acres of marsh and woodland. The amount of land likely to be modified as a result of the project will only be the 2,710 acres of marsh south of Yankee Canal. An appraisal of the impact of this modification on the fish and wildlife resource is included in the response to comment no. 1 by the Department of Commerce. There is no known practicable means for mitigating this impact.

b. No comments were received from the following citizen groups:

ORLEANS AUDUBON SOCIETY

ECOLOGY CENTER OF LOUISIANA, INC.

NATIONAL AUDUBON SOCIETY

SOUTHWEST REGION

NATIONAL SIERRA CLUB

NATIONAL SIERRA CLUB, NEW ORLEANS

NATIONAL SIERRA CLUB, BATON ROUGE

NATIONAL WILDLIFE FEDERATION

LOUISIANA WILDLIFE FEDERATION

WATER CONTROL PROJECTS COMMITTEE

LOUISIANA WILDLIFE FEDERATION, BATON ROUGE

LEAGUE OF WOMEN VOTERS, BATON ROUGE, LOUISIANA

SECRETARY OF THE TECHE DISTRICT CLEARINGHOUSE

United States Department of the Interior

OFFICE OF THE SECRETARY
SOUTHWEST REGION
Room 4030, 517 Gold Avenue SW.
Albuquerque, New Mexico 87101

November 16, 1972

ER-72/1114

District Engineer
U.S. Army Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

This is in response to your request for our comments concerning the draft environmental statement on the "Grande Isle, Louisiana, and Vicinity, Hurricane Protection Project."

The draft statement adequately describes existing fish, wildlife, and recreational resources of the area, and the effects that the proposed project will have on these resources.

No significant adverse environmental impact of the project as related to the geology or the hydrologic aspects of the proposed work is anticipated.

The American alligator is mentioned as being the only species on the list of endangered species that is present in the vicinity of the project area. The southern bald eagle, another endangered species, has also been reported in the vicinity of the project area.

The draft environmental statement mentions the need for relocation of 96 oil and gas pipelines ranging up to 20 inches in diameter. A more detailed map showing these pipelines would be desirable.

Future recovery of minerals probably would not be hindered by the project, but without a more detailed map or description of the mineral facilities in the project area, it is difficult to judge the impact of the proposal on these facilities.

The proposed action will not adversely affect any existing, proposed, or known potential unit of the National Park System, nor any known historic, natural or environmental education site eligible or considered potentially eligible for the National Landmark Programs.

Item g on Page 12 indicates an airplane and foot assessment of the project area was conducted under the leadership of the Louisiana State Curator of Anthropology. The survey should be complete if the area was flown and then covered completely on the ground. The final statement should describe the procedure followed and indicate whether or not the Louisiana State Museum considers a proper reconnaissance was made and also their views as to whether any sites will be disturbed.

In the third paragraph of item g on page 13, the statement mentions consultation with the National Register of Historic Places, 1969. Your office has been furnished a copy of the February 1, 1972, listing of historic or archeological sites and the final statement should reflect consultation with this more current listing.

We note the draft statement has been sent to the State Liaison Officer for Historic Preservation. His comments concerning the effect of the project upon nominations to the National Register of Historic Places being processed should be included in the final statement.

We appreciate the opportunity to comment on this draft statement.

Sincerely,

Raymond E. Cheuvront

for Copp Collins
Field Representative

United States Department of the Interior
NATIONAL PARK SERVICE
Southwest Region
P.O. Box 728
Santa Fe, New Mexico 87501

IN REPLY REFER TO:
L7619-C

OCT - 6 1972

District Engineer
U. S. Army Engineer District
District Headquarters
Foot Prytania
New Orleans, Louisiana 71109

Dear Sir:

We noted in your Draft Environmental Statement for Grand Isle, Louisiana and Vicinity Hurricane Protection (Larose to vicinity of Golden Meadow) that your reference for historical features was the 1969 National Register of Historic Places.

We are enclosing several copies of the March 15, 1972 Federal Register, Part II, which is the annual compilation of all National Register sites as of February 1st, each year.

The National Register is a continuing project and additions and/or deletions appear in the Federal Register the first Tuesday of each month. We hope you will find the enclosure useful in the preparation of future Draft Environmental Impact Statements.

Sincerely yours,

Theodore R. Thompson
Acting Director, Southwest Region

Enclosure

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION SIX
Room 239, Federal Building
750 Florida Street
Baton Rouge, Louisiana 70801

October 10, 1972

IN REPLY REFER TO

Department of the Army
New Orleans District
Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Gentlemen:

Your draft environmental statement for the proposed project "Grand Isle, Louisiana, and Vicinity Hurricane Protection (Larose to Vicinity of Golden Meadow)" dated September 1972 has been reviewed by this office.

The proposed project is not expected to have any adverse affect on highways or bridges existing or planned. You are, of course, aware of the Louisiana Department of Highways' plans for relocating Route 308 with a high level bridge across the Gulf Intercoastal Waterway at Larose. The location of your levee should be coordinated with the bridge phase in this area.

Sincerely yours,

M. C. Reinhardt
Division Engineer

THE ASSISTANT SECRETARY OF COMMERCE
Washington, D.C. 20230

November 6, 1972

Colonel Richard L. Hunt
District Engineer
New Orleans District, Corps of
Engineers
P.O. Box 60267
New Orleans, Louisiana 70160

Dear Colonel Hunt:

The draft environmental impact statement for Grand Isle, Louisiana and Vicinity Hurricane Protection, which accompanied your letter, has been received by the Department of Commerce for review and comment.

The Department of Commerce has reviewed the draft environmental statement and has the following comments to offer for your consideration.

In the section entitled Project Description, it should be noted that the benefit-cost ratio does not include fish and wildlife losses.

With regard to the Environmental Setting Without the Project subsection e. Zoology, the discussion of the marshes being extremely valuable nursery areas should be expanded to include some of the observations made by many investigators, such as Odum (1961), Schelske and Odum (1962) and Teal and Teal (1969), that tidal marshes produce much more organic matter than any form of agriculture and that one of the factors contributing to this productive efficiency is the ebb and flow of the tides. Also, the role of tidal marshes in the nutrient support of adjacent open waters should be further discussed.

In the subsection f. Economics, it should be mentioned that a primary reason Bayou Lafourche is a leading port for shrimping vessels, is because of an abundance of shrimp due to the expansive nursery areas, such as those discussed in the previous subsection.

Under Environmental Impact of the Proposed Action and also under Any Adverse Environmental Effects Which Cannot Be Avoided Should the Proposal Be Implemented, the statement that "inside the levee enclosure, land that is drained for agricultural and industrial use, will be lost to wildlife production," should be changed to also indicate a loss of fish production both in the area being altered and the adjacent open waters previously supported by nutrients and detritus from the marshes.

We question the accuracy of a subsequent statement that "the carrying capacity of the quality of marsh in the general area could be improved by proper management insofar as food production is concerned," since Odum (1962), Teal and Teal (1969), and others have noted that tidal marshes are extremely productive. Odum (1962) further noted that, because of this great production, management emphasis must be on utilization, rather than production, i.e. utilization of existing production rather than converting to some other unadaptable system.

In these sections, the impact that the flap and sluice gates, previously mentioned in the Project Description, will have on the productivity of the enclosed marshes should be thoroughly discussed in view of the importance of tidal action as emphasized by the previously cited investigators. Teal and Teal (1969) noted that "it is the tide that makes the high production possible and then removes half of it before animals of the marsh get a chance to use it. But what is denied the animals of the marsh, is given to the abundant animal life in the estuarine waters around the marsh."... "The tides continually wash a part of the marsh production into the creeks and bays where fish, shrimp and oysters lie in wait. Without the marsh, these animals would not survive in the numbers which are characteristic of the southern estuaries."

In the section Alternatives to the Proposed Action, the alternative d. Select Some Other Levee Alinement, should suggest that the realigned levee exclude most or all of the undeveloped

marshes, about 80% of the project area, so that only the presently inhabited areas would be protected. This alternative should be thoroughly discussed so as to compare its impacts on the estuarine production to those of the proposed project which would much more restrict the tidal ebb and flow. Since there are apparently no structures or persons to be protected in the undeveloped marshes, the exclusion of these marshes should have little effect on the benefit-cost ratio.

An alternative should be added that would have all drainage structures built and sills no higher than one foot below mean low water and would have all gates, flaps, etc. remain open at all times to permit tidal exchange except during hurricane warnings. The importance to estuarine production of maintaining this tidal ebb and flow should be reemphasized in discussing this alternative since four-fifths of the area to be leveed by the project is presently undeveloped coastal marsh.

The inclusion of these alternatives in the final statement should help provide sound bases for balanced decision making.

Literature Cited

Odum, E.P. 1961. The role of tidal marshes in estuarine production. New York State Conservationist, 4 p.

Schelske, C.L., and E.P. Odum. 1962. Mechanisms maintaining high productivity in Georgia estuaries. Proc. Gulf and Carribbean Fisheries Institute 14:75-80.

Teal, J., and M. Teal 1969. Life and death of the salt marsh. Little, Brown & Co. 278 p.

We hope these comments will be of assistance to you in the preparation of the final statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Post Office Box 1630, Alexandria, Louisiana 71301

LMNED-PC

October 10, 1972

Colonel Richard L. Hunt
District Engineer
U. S. Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160

Dear Colonel Hunt:

Reference is made to your letter, LMNED-PC, requesting comment on the draft environmental statement for the authorized project, "Grand Isle, Louisiana, and Vicinity, Hurricane Protection (Larose to Vicinity of Golden Meadow)". We have reviewed the referenced statement and offer the following:

1. Provisions for adequate control of erosion, sedimentation, and water management during construction should be pointed out in the statement.

2. The statement should point out that permanent vegetative cover and other necessary land treatment measures will be installed on levees and other disturbed areas.

3. Vegetative measures could be a type which would be beneficial to existing wildlife species by furnishing cover and food, yet providing necessary erosion protection to works of improvement.

We appreciate an opportunity to comment on this well prepared statement.

Sincerely yours,

Thomas G. Rockenbaugh
Acting State Conservationist

cc: Dr. T. C. Byerly
Kenneth E. Grant

ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1600 PATTERSON, SUITE 1100
DALLAS, TEXAS 75201

October 4, 1972

OFFICE OF THE
REGIONAL ADMINISTRATOR

Colonel Richard L. Hunt
Corps of Engineers, New Orleans District
P. O. Box 60267
New Orleans, Louisiana 70160

Re: 06-3-35-LA
Your Re: LMNED-PC

Dear Colonel Hunt:

We have reviewed the Draft Environmental Impact Statement on the Grand Isle, Louisiana, and Vicinity Hurricane Protection project located in Lafourche Parish, Louisiana. The proposed project involves the construction of approximately 43 miles of exterior levees with associated borrow pits, drainage structures and other appurtenances to provide protection from hurricane-caused floods. The levees will extend along both banks of Bayou Lafourche from Larose to a point two miles south of Golden Meadow, Louisiana.

Your agency's efforts in the preparation of the statement are to be commended, especially the objective manner in which the environmental impacts (both beneficial and adverse) were presented.

Our only specific comment concerns the last paragraph on page 15. We partially agree that "Increased residential, industrial, and commercial development, with or without the project, will be accompanied by an increase in the production of waste materials." However, we believe that the project, if implemented, could encourage the rate of development of residential, industrial, commercial and recreational areas to a greater extent than if the area were allowed to develop without the plan. Therefore, the amount of waste materials (pollutants) produced over a given period of time would substantially increase. We suggest that land use planning for the project area, including building codes and pollution control and abatement measures, should also be considered in the Final Statement. Such measures should include wastewater management and solid waste disposal methods to be implemented prior to project construction, to alleviate possible adverse environmental effects on the surrounding marshlands and Bayou Lafourche from future commercial, industrial, residential or recreational development.

In addition to the above suggestion, we hope that the following comments of a general nature will be helpful in developing the Final Statement:

1. Socio-economic impact of displaced people and businesses should be discussed in enough detail to permit an evaluation of the possible effect of the displacement and relocation on potential pollution.

2. Excavation and construction operations should be scheduled to prevent exposing large amounts of soil at one time to erosion and resultant siltation of streams. It would be helpful to describe the soil erosion practices and measures to be used.

3. Methods of handling and applying herbicides and pesticides during future operation and maintenance activities should be discussed.

4. Clearing and disposing of the brush and vegetation along the right-of-way of the proposed project should include provisions for prevention of adverse effects on the environment. Methods of disposal should be covered in the statement. Open, uncontrolled burning should not be permitted, in order to meet the requirements given in 40 CFR 76.8.

5. If a public water supply source, treatment facility, or distribution system is to be adversely affected by the project, precautionary measures to prevent damage to, or contamination of, the public water supply should be described.

6. The construction and maintenance of the project must not create conditions which would violate the Water Quality Standards of Louisiana and the United States. Measures to prevent violation of these standards should be described. To protect the water quality during construction and to reduce the adverse effects caused by operation and maintenance of the project, the following guidelines should be followed:

a. Relocation of all pipelines, mains, and utilities should be accomplished in a manner to avoid contamination of potable water supplies and discharges of untreated waste water, directly or indirectly, into the surface or underground water resources.

b. Measures to prevent the effects of accidental spillages should be incorporated into the design features of the project.

c. Where appropriate, sanitary waste facilities should be provided and operated to treat and dispose of domestic wastes in conformance with State and Federal water pollution control regulations. Provisions of the Federal Occupational Safety and Health Act of 1970 should be considered.

We appreciate the opportunity to review and comment on the draft statement and would like to receive two copies of the Final Environmental Statement when it is available.

Sincerely yours,

Arthur W. Busch
Regional Administrator

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGIONAL OFFICE
1114 COMMERCE STREET
DALLAS, TEXAS 75202

October 3, 1972

OFFICE OF
THE REGIONAL DIRECTOR

Our Reference: EI#0972-178

Mr. Richard L. Hunt
Colonel, CE
District Engineer
Department of the Army
New Orleans District
Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Re: Grand Isle, Louisiana and Vicinity Hurrican Protection (LaRose to Vicinity of Colden Meadow)

Dear Mr. Hunt:

Pursuant to your request, we have reviewed the Environmental Impact Statement for the above project proposal in accordance with Section 102(2)(C) of P. L. 91-190, and the Council on Environmental Quality Guidelines of April 23, 1971.

Environmental health program responsibilities and standards of the Department of Health, Education, and Welfare include those vested with the United States Public Health Service and the Facilities Engineering and Construction.Agency. The U. S. Public Health Service has those programs of the Federal Food and Drug Administration, which include the National Institute of Occupational Safety and Health and the Bureau of Community Environmental Management (housing, injury control, recreational ehalth and insect and rodent control).

Accordingly, our review of the Draft Environmental Statement for the project discerns no adverse health effects that might be of significance where our program responsibilities and standards pertain, provided that appropriate guides are followed in concert with State, County, and local environmental health laws and regulations.

We therefore have no objection to the authorization of this project insofar as our interests and responsibilities are concerned.

Very truly yours,

Jerry W. Stephens
Environmental Impact Coordinator

ORD-EI-1

I appreciate the opportunity to review and comment on your statement and request that you forward this department a copy of the final statement for our review and comments.

Sincerely yours,

ROY AGUILLARD
DIRECTOR

ART:mal

STATE OF LOUISIANA
DEPARTMENT OF HIGHWAYS
P. O. BOX 44245, CAPITOL STATION
BATON ROUGE, LA. 70804

OFFICE OF THE DIRECTOR

October 4, 1972

District Engineer
U. S. Army Engineer District, New Orleans
P. O. Box 60267
New Orleans, Louisiana 70160

RE: LMNED-PC

Dear Sir:

In reference the Department of Highways has reviewed the environmental statement and wishes to offer the following comment. The Department of Highways proposes to relocate La 1 within the limits of your proposed project. The Departments' plans will not conflict with your proposed project, except for that portion along La 24 at LaRose.

It is anticipated that the Corp of Engineers and the Department will cooperate in working out any conflict in this area.

Other than the above mentioned problem, the Department of Highways has no adverse comments concerning the environmental statement.

Yours very truly,

S. L. POLEYNARD
ASSISTANT DIRECTOR

JRR/cer
CC: W. T. Taylor
A. B. Ratcliff
G. A. Landry (w/attachment)
F. M. Heroy

LOUISIANA WILD LIFE AND FISHERIES COMMISSION

WILD LIFE AND FISHERIES BUILDING
400 ROYAL STREET
NEW ORLEANS, LOUISIANA 70130

November 13, 1972

Col. Richard L. Hunt, CE
District Engineer
New Orleans District, Corps of Engineers
U. S. Department of the Army
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Col. Hunt: YOUR RE.: LMNED-PC

Reference is made to your request for comments on the draft environmental statement for the authorized project "Grand Isle, Louisiana, and Vicinity, Hurricane Protection (Larose to Vicinity of Golden Meadow)."

According to the draft environmental statement, the south end of Highway No. 1 should be raised to an elevation of 5.0 feet above m.s.l. with a 44-foot opening, and this gap would be closed when flood waters approached 5.0 feet m.s.l. The effectiveness of this plan would be hindered greatly by the flooding of the highway in several places from this point to 1/4 mile above Golden Meadow, and at the present time this flooding of Highway No. 1 occurs during every abnormally high tide. During a hurricane the extent of this flooding would be determined by when the flood gate on Lafourche Bayou was closed, but the criterion for its closing was not discussed in the statement.

The report also stated that the protected area was accessible to the north by Highways No. 1 and No. 308, yet there is only one bridge across the Intracoastal Canal (Highway No. 1) at this point.

If gravity draining of certain areas behind the levee is to be accomplished with floodgates with flaps, some provisions for constant maintenance will be necessary because these gates are easily made inoperative with debris and fouling organisms such as oysters or barnacles. Using gravity drains only will mean some flooding with heavy rains and severe flooding should the levee become overtopped during a hurricane.

If the levee system is effected, it is important that adequate pumping stations and sewage-waste systems be developed and installed for the benefit of the people living within the protected area.

In order to minimize the loss of wildlife habitats, the new levee should be built on existing levees wherever feasible. The existing levees were not noted in the statement.

Does the statement include the benefit-cost ratio of the municipal and industrial sewage treatment plants necessary with increased development of the area? In 1972 approximately 4 million acres of marshlands yielded Louisiana $72.6 million in commercial landings. The average would be about $18 per acre on a yearly basis. Twenty five thousand acres which might be lost with this project would thereby produce $450,000 per year in commercial seafoods. Over a ten-year period this would mean approximately $4.5 million of production might be lost.

Alternate plans A and B are not feasible or economical, and plan E is not relevant to our problems. Plan C noted that the National Weather Service is making an effort for better forecasting. However, more emphasis could be placed on the accuracy of information given by local news media during a hurricane.

We thank you for affording us the opportunity to comment on this draft environmental statement.

Sincerely yours,

J. Burton Angelle

J. Burton Angelle
Director

JBA/lm

cc: Mr. Harry E. Schafer,Jr.,Chief
Oysters, Water Bottoms and Seafoods Division

Eng Dir

State of Louisiana

R. T. SUTTON
COMMISSIONER

DEPARTMENT OF CONSERVATION
BATON ROUGE 70804

P. O. BOX 44275

September 25, 1972

In Re: LMNED-PC

Department of the Army
New Orleans District
Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Attention: Colonel Richard L. Hunt

Dear Sir:

The Staff of the Department of Conservation has reviewed the environmental statement on the proposed LaRose-Golden Meadow, Louisiana, hurricane protection levee project. The Department of Conservation endorses this project because of the protection it affords not only to the people of the oil and associated industries, but to the people of these communities.

One of the benefits not pointed out in your environmental statement would be the added protection for oil lease tanks which are a source of pollution in hurricanes and high water.

The area of construction is traversed by a great number of oil and gas transmission lines. Adequate safety and pollution safeguards must be adhered to in the relocation of these facilities.

Yours very truly,

R. T. Sutton
Commissioner

FLSjr/lwh

National Wildlife Federation

1412 16TH ST., N.W., WASHINGTON, D.C. 20036 Phone: 202-483-1550

September 22, 1972

Colonel Richard L. Hunt
District Engineer
New Orleans District
Corps of Engineers
Department of the Army
P.O. Box 60267
New Orleans, Louisiana 70160

Dear Colonel Hunt:

We are in receipt of a draft environmental impact statement entitled, "Grand Isle, Louisiana and Vicinity, Hurricane Protection (Larose to Vicinity of Golden Meadow) associated water feature Bayou Lafourche, Louisiana" and have the following comment. The statement specifies the natural environment to be destroyed by the project and states that it will be "lost to wildlife production". The statement continues, "no effective remedial or mitigation measures are planned". Your agency has the duty under the Fish and Wildlife Coordination Act and the National Environmental Policy Act to mitigate these losses. I also understand from your headquarters that it is the policy of your agency to request authorization for mitigation where that authorization does not presently exist. An adequate environmental impact statement should indicate what mitigation, to include land acquisition, you believe to be necessary and what steps you will take to carry it out.

Sincerely,

Oliver A. Houck
Counsel

OAH/b

SECTION IX

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GRAND ISLE, LOUISIANA, AND VICINITY
HURRICANE PROTECTION
(LAROSE TO VICINITY OF GOLDEN MEADOW)

APPENDIX A

A LIST OF THE PLANTS
MENTIONED IN THIS STATEMENT

The plants are listed alphabetically by common name, followed by the scientific name.

HERBACEOUS PLANTS

Bedstraw*
Galium tinctorium

Black medic*
Medicago lupulina

Broomsedge*
Andropogon virginicus

Bulltongue*
Sagittaria falcata

Bur clover*
Medicago hispida

Buttercup*
Ranunculus muricatus

Buttercup*
Ranunculus pusillus

Butterweed*
Senecio glabellus

Camphorweed*
Pluchea camphorata

Common chickweed*
Stellaria media

Common vetch*
Vicia ludoviciana

Coontail*
Ceratophyllum demersum

Cranesbill*
Geranium carolinianum

Cyperus*
Cyperus erythrorhizos

Daisy fleabane*
Erigeron philadelphicus

Dewberry*
Rubus trivialis

Duckweed*
Lemna minor

Giant cutgrass*
Zizaniopsis miliaceae

Giant foxtail*
Setaria magna

Giant ragweed
Ambrosia trifida

*Starred species were seen or collected during trips to the project area 19-20 March 1973 and 11 September 1973.

HERBACEOUS PLANTS (Cont'd)

Glasswort*
Salicornia begelovii

Great bulrush*
Scirpus validus

Hedge nettle*
Stachys floridana

Henbit*
Lamium amplexicule

Lizard's tail*
Saururus cernuus

Narrow-leaved cat-tail*
Typha angustifolia

Oystergrass
Spartina alterniflora

Pickerel weed*
Pontoderia cordata

Pink hibiscus*
Kosteletzkya virginica

Plantain*
Plantago virginica

Reverse clover*
Trifolium resupinatum

Roseau
Phragmites communis

Salt grass*
Distichlis spicata

Sea-oxeye*
Borrichia frutescens

Soft rush*
Juncus effusus

Spanish moss*
Tillandsia usneoides

Spike-rush*
Eleocharis

Spiny thistle*
Cirsium horridulum

Swamp lily*
Crinum americanum

Walter's millet*
Echinochloa walteri

Water hyacinth*
Eichornia crassipes

Water hyssop*
Bacopa monnieri

Water pennywort*
Hydrocotyle ranunculoides

White clover*
Trifolium repens

Wild chervil*
Chaerophyllum tainturieri

Wiregrass*
Spartina patens

Yellow dock*
Rumex crispus

Yellow flag*
Iris pseudocorus

TREES, SHRUBS, AND VINES

American elm*
Ulmus americana

American sycamore*
Platanus occidentalis

Baldcypress*
Taxodium distichum

Black willow*
Salix nigra

Buttonbush*
Cephalanthus occidentalis

Chinaberry*
Melia azedarach

Chinese tallowtree*
Sapium sebiferum

Eastern baccharis*
Baccharis halimifolia

Elderberry*
Sambucus canadensis

Hackberry*
Celtis laevigata

Live oak*
Quercus virginiana

Nuttall oak*
Quercus nuttallii

Palmetto*
Sabal minor

Poison ivy*
Rhus radicans

Prickly ash*
Zanthoxylum clava-herculis

Red maple*
Acer rubrum

Swamp bay
Persea palustris

Sweetgum
Liquidamber syvraciflua

Tupelogum*
Nyssa aquatica

Virginia creeper*
Parthenocissus quinquefolia

Water locust
Gleditsia aquatica

Water oak*
Quercus nigra

FERNS

Beech fern*
Thelypteris kunthii

Water fern*
Azolla caroliniana

BACTERIA

Achromobacterium
Bacillus
Clostridium
Micrococcus
Pseudomonas
Vibrio

FUNGI

Fusarium
Kluveromyces
Pichia
Phoma
Nigrospora

ALGAE

Actinoptychus
Amphora
Biddulphia
Bostrychia
Ceratium
Chaetoceros
Chaetomorpha
Cladophora
Cocconeis
Coscinodiscus
Denticula
Dinophysis
Ectocarpus
*Entermorpha**
Lyngbya
Melosira
Merismopedia
Nitzchia
Oscellatoria princeps
Polysiphonia
Rhizoclonium
Spirula
Ulothrix
Ulva lactuca
Ulvella

GRAND ISLE, LOUISIANA, AND VICINITY
HURRICANE PROTECTION
(LAROSE TO VICINITY OF GOLDEN MEADOW)

APPENDIX B

A LIST OF THE ANIMALS
MENTIONED IN THIS STATEMENT

The animals are listed alphabetically by common name followed by specific name.

INVERTEBRATES

Protozoa
- *Ammotium*
- *Arenoparella*
- *Miliammina*
- *Paramecium*
- *Vorticella*

Annelida
- *Neanthes succinea*

Cladocera
- *Evadne tergestina*
- *Penilia avirostris*
- *Podon polyphemoides*

Copeoda
- *Acartia tonsa*
- *Canvella elongata*
- *Centropages* spp.
- *Corycaeus* spp.
- *Euchaeta marina*
- *Eurytemora hirundoides*
- *Halicyclops fosteri*
- *Labidocera aestiva*
- *Nitroca spinipes*
- *Paracalanus* spp.
- *Pseudosime* spp.
- *Tortanus* spp.
- *Temora temora*
- *Undinula vulgaris*

Amphipoda
- *Ampelisca*
- *Cerapus*
- *Corophium*
- *Hyallela azteca*

Cumacea
- *Leptocuma minor*

Decapoda
- *Acetes carolinae*
- Blue crab*
- *Callinectes sapidus*
- Brown shrimp
- *Penaeus aztecus*
- Crayfish
- *Cambarellus shufeldti*
- *Cambarus diogenes ludovicanus*
- *Orconectes lancifer*
- *Procambarus blandingi acutus*
- *Procambarus clarki**
- Fiddler crab
- *Uca pugnax*
- Grass shrimp
- *Palaemonetes*
- *Leander tenuicornis*
- *Lucifer*
- Mantis shrimp
- *Squilla ampusa*

INVERTEBRATES (Cont'd)

Decapoda (cont'd)
- Mud crab
  Rithropanopeus harrisii
- River shrimp
  Macrobrachium ohione
  Macrobrachium acanthurus
- Square-backed crab
  Sesarma reticulatum
- White shrimp
  Penaeus fluvatilis

Odonata
- *Anax junius*
- *Cannacria gravida*
- *Enallagma signatum*
- *Epiaeschna heros*
- *Erythemis simplicollis*
- *Erythrodiplax bernice*
- *Ischnura posita*
- *Ischnura ramburi*
- *Libellula needhami*
- *Libellula vibrans*
- *Pachydiplax longipennus*
- *Pantala flavescens*
- *Pantala hymenea*
- *Perithemis*

Hemiptera
- Giant water bug
  Belostoma
- Water scorpion
  Ranatra

Coleoptera
- Predaceous diving beetle
  Dytiscus

Gastropoda
- Marsh periwinkle
  Littorina irrorata
- Melampis snail
  Melampsis bidentata
- Smooth periwinkle
  Neritina reclivata

Pelecypoda
- Ribbed mussel
  Modiolus demissus

Ctenophora
- *Beroe avata*
- *Mnemiopsis mccradyi*

Chaetognatha
- *Saggita hispida*

Urochordata
- *Oikopleura*

FISH

Alligator gar*
Lepisosteus spatula

Atlantic bumper
Chloroscombrus chrysurus

Atlantic croaker*
Micropogon undulatus

Atlantic cutlass fish
Trichiurus lepturus

Atlantic needlefish
Strongylura marina

Atlantic spadefish
Chaetodipterus faber

FISH (Cont'd)

Atlantic thread herring
Opisthonema oglinum

Banded drum
Larimus fasciatus

Banded killifish
Fundulus diaphanus

Bay anchovy*
Anchoa mitchelli

Bay whiff
Citharichthys spilopterus

Blackcheek tongue fish
Symphurus plagiusa

Black drum
Pogonias cromis

Blue catfish
Ictalurus furcatus

Bluegill
Lepomis macrochirus

Buffalo fish
Ictiobus sp.

Butterfish
Peprilus triacanthus

Channel catfish
Ictalurus punctatus

Crappie
Pomoxis sp.

Darter goby
Gobinellus boleosoma

Diamond killifish
Adenia xenica

Freshwater drum
Aplodinotus grunniens

Fringed flounder
Etropus crossotus

Gafftopsail catfish
Bagre marinus

Gulf killifish*
Fundulus grandis

Gulf menhaden*
Brevoortia patronus

Harvest fish
Peprilus alepidotus

Inshore lizzard fish
Synodus foetens

Ladyfish
Elops saurus

Largemouth bass
Micropterus salmoides

Least killifish*
Heterandria formosa

Leatherjacket
Oligoplites saurus

Lined sole
Achirus lineatus

Longnose gar*
Lepisosteus osseus

Longnose killifish
Fundulus similis

Lookdown
Selene vomer

FISH (Cont'd)

Mosquito fish*
Gambusia affinis

Orange-spotted sunfish
Lepomis humilis

Pinfish
Lagodon rhomboides

Rainwater killifish
Lucania parva

Redear sunfish
Lepomis microlophus

Red drum
Scianops ocellata

Rough silversides
Membras martinica

Sailfin molly*
Poecilia latipinna

Saltmarsh top minnow
Fundulus jenkinsi

Sand seatrout
Cynoscion arenarius

Sea catfish
Arius felis

Sharptail goby
Gobinellus hastatus

Sheepshead
Archosargus probatocephalus

Sheepshead minnow*
Cyprinodon varigatus

Silver perch
Bairiella chrysura

Skilletfish
Gobiesox strumosus

Skipjack herring
Alosa chrysochloris

Southern flounder
Paralichthys lethostigma

Southern kingfish
Menticirrhus americans

Southern puffer
Sphaeroides nephalus

Southern stargazer
Astroscopus y-graecum

Southern stingray
Dasyatis americana

Spanish mackerel
Scomberomorus maculatus

Spot*
Leiostomus xanthurus

Spotted gar
Lepisosteus oculatus

Spotted seatrout
Cynoscion nebulosus

Spotted sunfish
Lepomis punctatus

Striped anchovy
Anchoa hepsetus

Striped mullet*
Mugil cephalis

Tidewater silversides*
Menidia beryllina

AMPHIBIANS AND REPTILES

Al ror snapping turtle*
Ma lemrs temmincki

Am an alligator
Al itor mississipiensis

Br -banded water snake
Na sipedon confluens

Br headed skink
Eu s laticeps

Bro e frog
Rana clamitans clamitans

Bullfrog
Rana catesbeiana

Canebrake rattlesnake
Crotalus horridus atricaudarus

Central newt
Notophthalmus viridescen louisianeosis

Corn snake
Elaphe guttata guttata

Diamond-backed water snake
Natrix rhombifera

Diamond-backed terrapin
Malaclemys terrapin

Dusky salamander
Desmognathus fuscus brimleyorum

Dwarf salamander
Manculus quadridigitatus

East Texas toad
Bufo woodhousei velatus

Eastern coachwhip
Masticophis flagellum flagellum

Eastern garter snake
Thamnophis sirtalis sirtalis

Eastern glass lizard
Ophiosaurus ventralis

Eastern gray treefrog
Hyla versicolor versicolor

Eastern hognose snake
Heterodon platyrhinos

Eastern narrowmouth toad
Gastrophyrne carolinensis

Eastern scarlet snake
Cemorpha coccinea copei

Eastern spadefoot toad
Scaphiopus holbrooki holbrooki

Eastern yellow bellied racer
Coluber constrictor flaviventris

Fivelined skink
Eumeces fasciatus

Glossy water snake
Regina rigida

Graham's water snake
Regina grahami

Gray rat snake
Elaphe obsoleta spiloides

Ground skink*
Scincella laterale

Gulf coast box turtle
Terrapene carolina major

Green anole*
Anolis carolinensis

Green tree frog
Hyla cinerea cinerea

Green water snake
Natrix cyclopion cyclopion

Gulf coast smooth softshell
Trionyx muticus calvatus

Gulf coast spiny softshell
Trionyx spinifer asper

Gulf coast toad
Bufo valliceps valliceps

Gulf coast water dog
Necturus beyeri beyeri

Gulf salt marsh snake*
Natrix fasciata clarki

Keelbacked musk turtle
Sternothaerus carinatus

Louisiana milk snake
Lampropeltis triangulum amaura

Marbled salamander
Ambystoma opacum

Midland brown snake
Storeria dekayi wrightorum

Mississippi map turtle
Graptemys kohni

Mississippi ringnecked snake
Diadophis punctatus stictogenys

Missouri slider
Chrysemys floridana hoyi

Mississippi mud turtle
Kinosternon subrubrum hippocrepis

Mobile cooter
Chrysemys concinna mobilensis

Mole salamander
Ambystoma talpoideum

Northern cricket frog
Acris crepitans crepitans

Northern red-bellied snake
Storeria occipitomaculata occipitomaculata

Pig frog
Rana grylio

Red eared turtle
Chrysemys scripta elegans

Rough earth snake
Virginia striatula

Rough green snake
Opheadrys aestivus

Six lined racerunner
Cnemidophorus sexlineatus

Small mouthed salamander
Ambystoma texanum

Snapping turtle
Chelydra serpentina

Southern copperhead
Agkistrodon contortrix contortrix

Southern fence lizard
Scaloporus undulatus undulatus

Southern leopard frog
Rana pipiens sphenocephala

Southern painted turtle
Chrysemys picta dorsalis

Speckled kingsnake
Lampropeltis getulus holbrooki

AMPHIBIANS AND REPTILES (Cont'd)

Spotted salamander
Ambystuma maculatum

Spring peeper
Hyla crucifer

Squirrel frog
Hyla squirella

Stinkpot
Sternothaerus odoratus

Texas coral snake
Micrurus fulvius tenere

Three-toed amphiuma
Amphiuma tridactylum

Western chicken turtle
Deirochelys ceticularia miaria

Western chorus frog
Pseudaoris triseriata feriarum

Western cottonmouth
Agkistrodon piscivorus leucostoma

Western lesser siren
Siren intermedia nettingi

Western mud snake
Farancia abacura reinwardti

Western pygmy rattlesnake
Sistrurus miliarius streckeri

Western ribbon snake*
Thamnophis proximus proximus

Western slender glass lizard
Ophisaurus attenuatus attenuatus

Western earth snake
Virginia valeriae elegans

Yellow bellied water snake
Natrix erythrogaster flavigaster

BIRDS

American coot*
Fulica americana

American goldfinch
Spinus tristis tristis

American pintail
Anas acuta tzitzihoa

American robin*
Turdus migratorius

American widgeon
Mareca americana

Bald eagle
Halioetus leucocephalus

Barn owl
Alba pratincola

Barred owl
Strix varia

Belted kingfisher*
Megaceryle alcyon alcyon

Black-necked stilt
Himantopus mexicanus

Blue-gray gnatcatcher
Polioprila caerula

Blue jay*
Cyanocitta cristata

Blue-winged teal*
Anas discors

Boat-tailed grackle*
Cassidix mexicanus

Brown-headed cowbird
Mdothrus ater ater

Brown pelican
Pelecanus occidentalis carolinensis

Brown thrasher
Toxostoma rufum rufum

Canvasback
Aythya valisineria

Cardinal*
Richmondena cardinalis

Carolina chickadee
Parus carolinensis

Catbird
Demetella carolinensis

Cattle egret*
Bubulicus ibis

Cedar waxwing
Bombycella cedrorum

Chimney swift
Chaetuta pelagica

Chipping sparrow
Spizella passerina passerina

Clapper rail
Rallus longirostris

Common crow*
Corvus brachyrhynchos

Common egret*
Casmerodius albus egretts

Common gallinule
Gallinula chloropus cachinnans

Common grackle*
Quiscalus quiscula

Common nighthawk
Chordeiles minor

Common snipe*
Capella gallinago delicata

Downy woodpecker*
Colymbus nigricollis

Eastern bluebird
Sialia sialis

Eastern kingbird
Tyrannus tyrannus

Eastern meadowlark*
Sturnella magna

Eastern phoebe
Sayornis phoebe

Fish crow*
Corvus assifragus

Forster's tern*
Sterna foresteri

Fox sparrow
Passerella iliaca iliaca

BIRDS (Cont'd)

Gadwall
Anas strepera

Golden-crested kinglet
Regulus satrapa satrapa

Great blue heron*
Ardea herodias

Great horned owl
Bubo virginianus

Greater yellowlegs*
Totanus melanoleucus

Green heron
Butorides virescens virescens

Green-winged teal
Anas discors

Hairy woodpecker
Dendrocopus pubescens

Herring gull*
Larus argentatus

Horned grebe
Colymbus auritus

House sparrow*
Passer domesticus domesticus

House wren
Troglodytes aedon

Killdeer*
Charadrius vociferus vociferus

Laughing gull*
Larus atricilla

Lesser scaup*
Aythya affinis

Lesser yellowlegs
Totanus flavipes

Little blue heron
Florida coerulea coerulea

Loggerhead shrike
Lanius ludovicianus

Long-billed marsh wren
Telmatodytes palustris

Louisiana heron*
Hydranassa tricdor ruficollis

Mallard
Anas platyrhynchos platyrhynchos

Marsh hawk*
Circus cyaneus hudsonius

Mockingbird*
Mimus polyglottos polyglottos

Mourning dove*
Zenaidura macroura

Myrtle warbler
Dendroica coronata coronata

Orange-crowned warbler
Vermivora celata celata

Pied-billed grebe
Podilymbus podiceps podiceps

Red-bellied woodpecker
Centurus carolinus

Redhead
Aythya americana

Red-shouldered hawk
Buteo lineatus

MAMMALS

Black rat
(White-bellied roof rat)
Rattus rattus frugivorus

Bobcat
Lynx rufus floridanus

Common opossum
Didelphis virginiana pigra

Cotton mouse
Peromyscus gossypinus gossypinus

Eastern cottontail
Sylvilagus floridanus alacer

Eastern harvest mouse
Reithrodontomys humulis merriami

Eastern mole
Scalopus aquaticus pulcher

Eastern pipistrelle
Pipistrellus subflavus subflavus

Eastern spotted skunk
Spilogale putorius indianola

Eastern wood rat
Neotoma floridana rubida

Evening bat
Nycticeius humeralis

Florida yellow bat
Lasiurus intermedius floridanus

Fox squirrel
Sciurus niger subauratus

Free-tailed bat
Tadarida brasilensis cynocephala

Fulvous harvest mouse
Reithrodontomys fulvescens aurantius

Gray squirrel
Sciurus carolinensis fuliginosis

Hispid cotton rat
Sigmodon hispidus hispidus

House mouse
Mus musculus

Least shrew
Cryptotis parva parva

Long-tailed weasel
Mustela frenata arthuri

Marsh rice rat
Oryzomys palustris texensis

Mink
Mustela vison vulgivaga

Muskrat
Ondatra zibethicus rivalicius

Nine-banded armadillo
Dasypus novemcinctus mexicanus

Norway rat
Rattus norvegicus

Nutria
Myocastor coypus

Otter
Lutra canadensis texensis

Raccoon
Procyon lotor megalodous

Red bat
Lasiurus borealis borealis

Seminole bat
Lasiurus seminolus

MAMMALS (Cont'd)

Short-tailed shrew
Blarina brevicauda minima

Southeastern myotis
Myotis austroriparius gatesi

Southern flying squirrel
Glaucomys volans saturatus

Striped skunk
Mephitis mephitis elongata

Swamp rabbit
Sylvilagus aquaticus aquaticus

White-footed mouse
Peromyscus leucopus leucopus

White-tailed deer
Odocoileus virginianus mcilhennyi

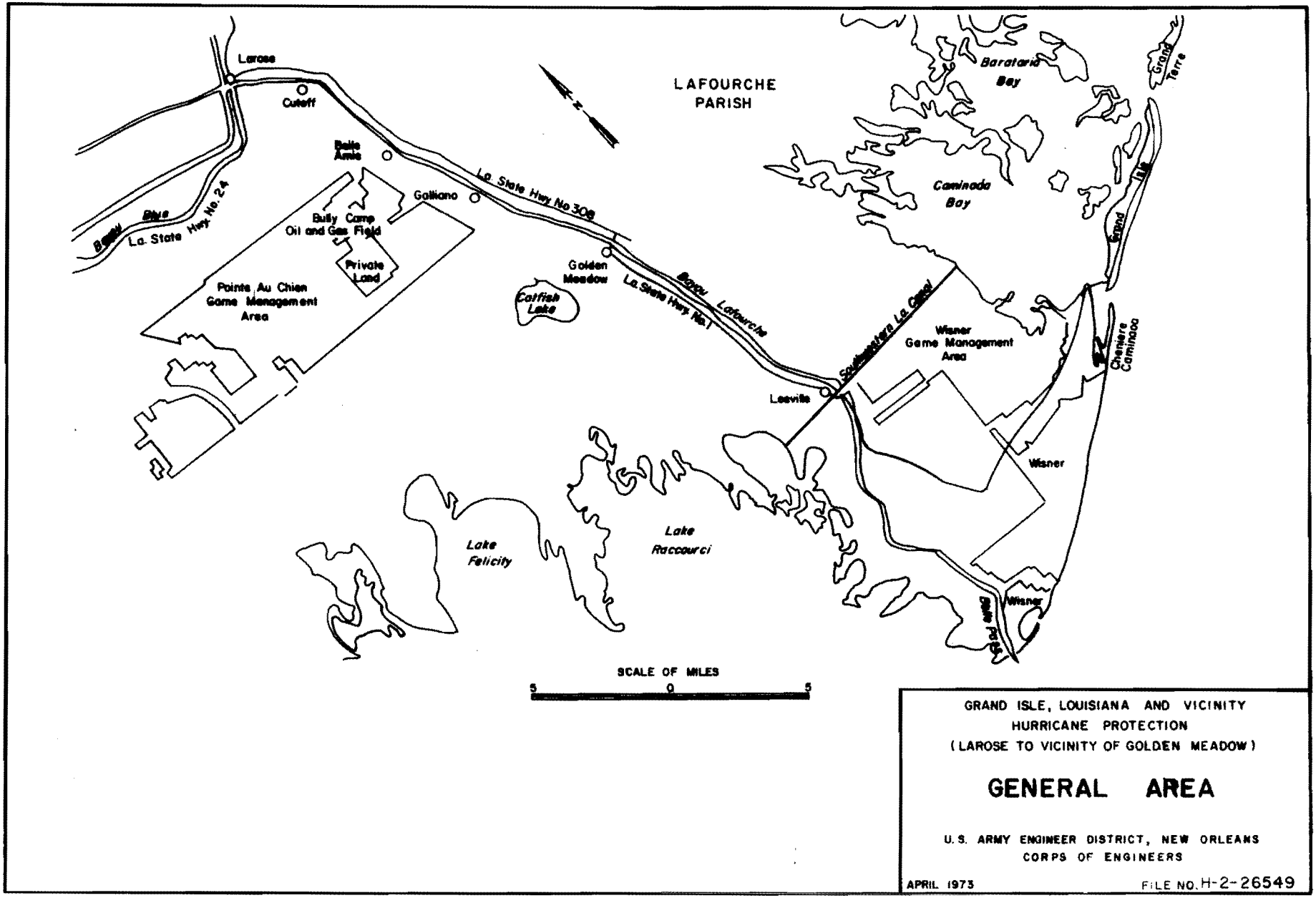
GRAND ISLE LOUISIANA AND VICINITY
HURRICANE PROTECTION
(LAROSE TO VICINITY OF GOLDEN MEADOW)

PROJECT LOCATION

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

APRIL 1973 FILE NO.

PLATE 1



GRAND ISLE, LOUISIANA AND VICINITY
HURRICANE PROTECTION
(LAROSE TO VICINITY OF GOLDEN MEADOW)

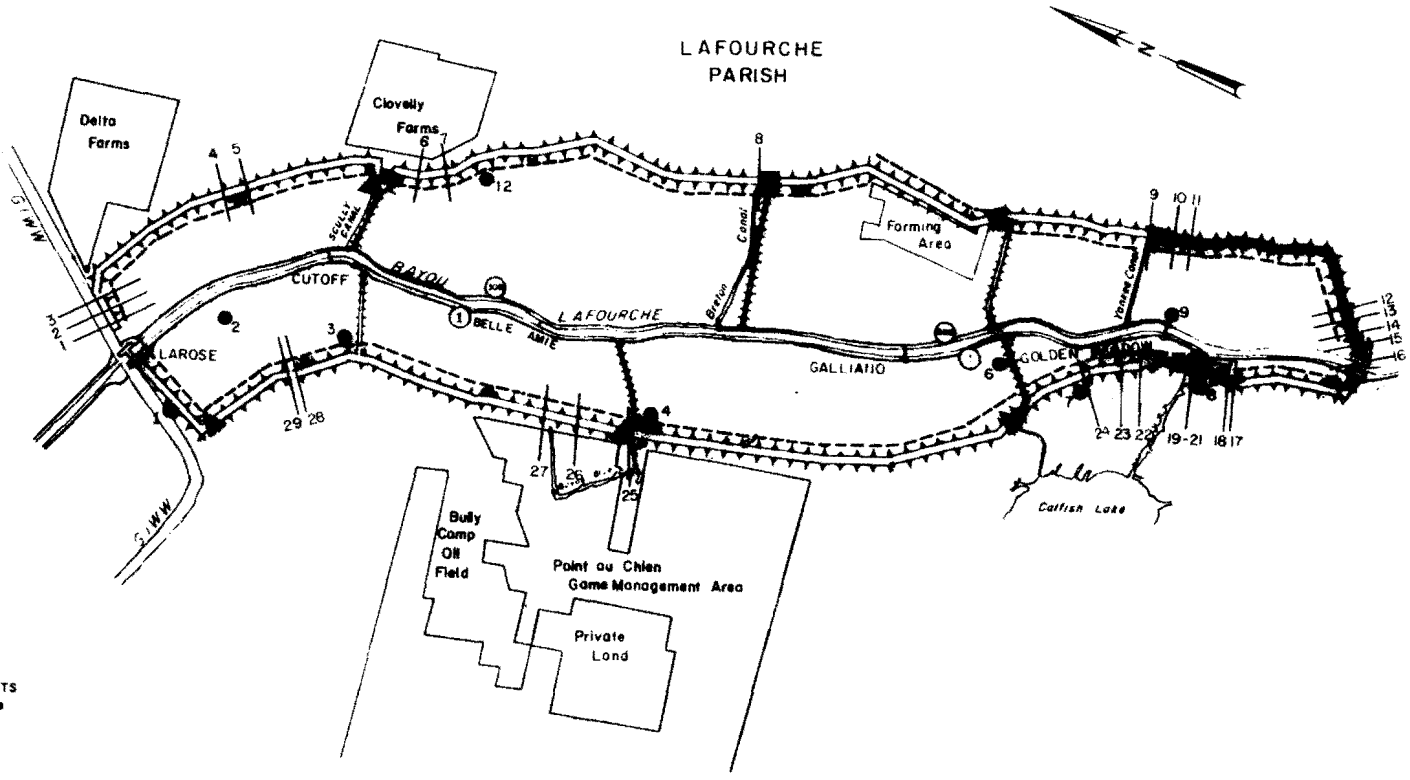
GENERAL AREA

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

APRIL 1973

FILE NO. H-2-26549

PLATE II



LEGEND

PROPOSED IMPROVEMENTS

- Drainage Structure
- Low Level Levee To Be Raised
- New Levee
- Flood Gate
- Borrow Area
- Interior Levee
- Pipeline Crossing
- Road Crossing
- Road Gate

EXISTING IMPROVEMENTS

- Pumping Station
- Channel
- Low Level Levee
- Zoological Collection Stations

SCALE IN FEET
4000 0 4000

GRAND ISLE, LOUISIANA AND VICINITY
HURRICANE PROTECTION
(LAROSE TO VICINITY OF GOLDEN MEADOW)

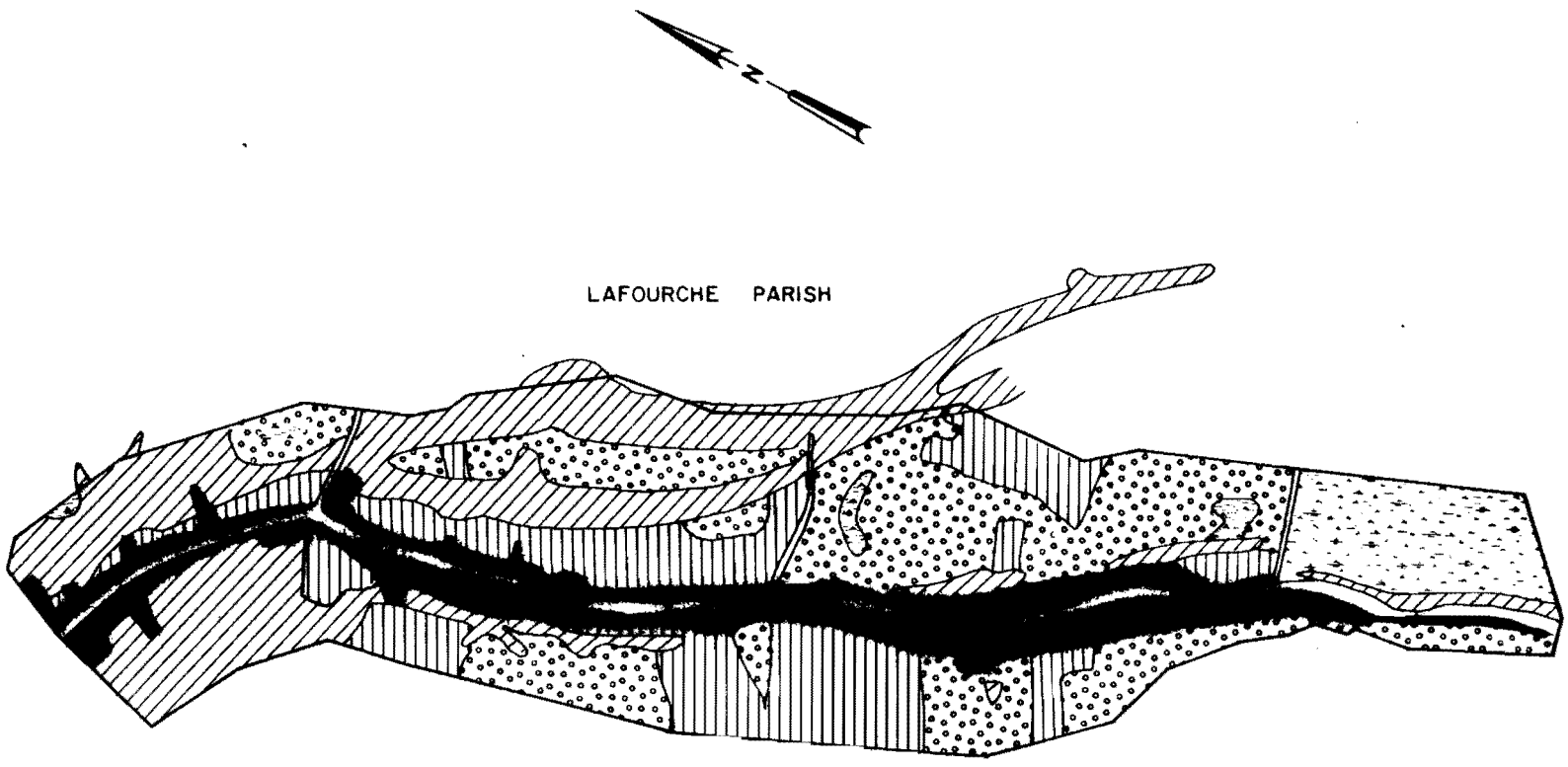
PROJECT AREA

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

APRIL 1973

FILE NO. H-2-26549

PLATE III



LEGEND

- Woods
- Fields & Pasture
- Shrubs & Small Trees
- Marsh
- Urban
- Waterway
- Levee

GRAND ISLE, LOUISIANA AND VICINITY
HURRICANE PROTECTION
(LAROSE TO VICINITY OF GOLDEN MEADOW)

VEGETATION MAP

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

APRIL 1973 FILE NO. H-2-26549

PLATE IV